

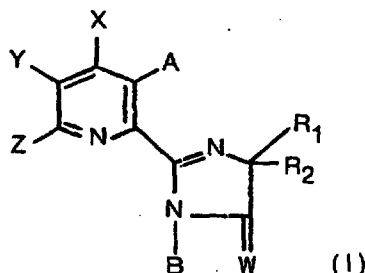
Description

Summary of the Invention

The present invention relates to novel 2-(2-imidazolin-2-yl)pyridine and quinoline compounds, a process and intermediates for the preparation of said pyridine and quinoline compounds and a method for controlling undesirable annual and perennial plant species therewith.

The U.S. Patents 4,188,487; 3,940,419 and 4,017,510 disclose substituted imidazolinyl benzoic acids, esters and salts; some of which show herbicidal activity. The British Patent 1,573,576 discloses phthalamic and nicotinic acids and their use as growth promoters. Our European Patent No. 41,624 discloses the compounds of this invention but as useful to beneficially influence and alter the development and life cycle of agronomic and horticultural crops. However, these prior patents do not teach or suggest this invention.

More particularly, this invention relates to 2-(2-imidazolin-2-yl)pyridine and quinoline compounds having the structure:

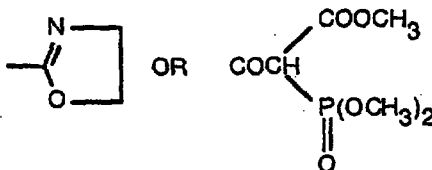


wherein

R_1 is C_1-C_4 alkyl;

R_2 is C_1-C_4 alkyl or C_3-C_6 cycloalkyl; and when R_1 and R_2 are taken together with the carbon to which they are attached they may represent C_3-C_6 cycloalkyl optionally substituted with methyl.

A is $COOR_3$, $CONHR_6$, CHO , CH_2OH , $COCH_3$, COC_6H_5 , CN , CH_3 , $CH=NOH$, CH_2COOH , $CONHOH$, CHR_8OH , CH_2CH_2COOH ,



R_3 is hydrogen, di(loweralkyl)(C_1-C_4)imino

C_1-C_{12} alkyl optionally substituted with one of the following groups: C_1-C_3 alkoxy, halogen, hydroxy, C_3-C_6 cycloalkyl, benzyloxy, furyl, phenyl, halophenyl, (C_1-C_4)loweralkylphenyl, (C_1-C_4)loweralkoxyphenyl, nitrophenyl, carboxyl, (C_1-C_4)loweralkoxycarbonyl, cyano or (C_1-C_4)triloweralkylammonium;

C_3-C_{12} alkenyl optionally substituted with one of the following groups: C_1-C_3 alkoxy, phenyl, halogen or (C_1-C_4)loweralkoxycarbonyl or with two C_1-C_3 alkoxy groups or two halogen groups;

C_3-C_6 cycloalkyl optionally substituted with one or two C_1-C_3 alkyl groups;

C_3-C_{10} alkynyl optionally substituted with one or two C_1-C_3 alkyl groups; or,

a cation selected from alkali metals, alkaline earth metals, manganese, copper, iron, zinc, cobalt, lead, silver, nickel, ammonium and organic ammonium;

R_6 is hydrogen, hydroxyl, C_3 -alkenyl, C_3 -alkynyl or C_1-C_4 alkyl optionally substituted with one hydroxyl or one chlorine atom;

B is H, COR_4 or SO_2R_5 ; provided that when B is COR_4 or SO_2R_5 ; A is $COOR_3$ in which R_3 is other than H, or a salt-forming cation, CH_3 or CN ; W is O; and Y and Z are not alkylamino, hydroxyl; or (C_1-C_4)hydroxyloweralkyl;

R_4 is C_1-C_{11} alkyl, chloromethyl or phenyl optionally substituted with one chloro, one nitro or one methoxy group;

R_5 is C_1-C_4 alkyl or phenyl optionally substituted with one methyl group;

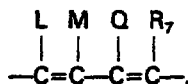
W is O or S;

R_8 is C_1-C_4 -alkyl or phenyl;

X is hydrogen, halogen, hydroxyl or methyl, with the proviso that when Y and Z are taken together to form a ring and YZ is represented by the structure: $-(CH_2)_n-$, where n is 3 or 4, X is hydrogen;

Y and Z each represent hydrogen, halogen, C_1-C_6 alkyl, C_1-C_4 hydroxyloweralkyl, C_1-C_6 alkoxy, C_1-C_4 alkylthio, phenoxy, C_1-C_4 -haloalkyl, nitro, cyano, C_1-C_4 alkylamino, di(C_1-C_4)loweralkylamino C_1-C_4 alkylsulfonyl group, or phenyl optionally substituted with one C_1-C_4 alkyl, C_1-C_4 alkoxy or

halogen; and, when taken together, Y and Z may form a ring in which YZ are represented by the structure: $-(CH_2)_n-$, where n is an integer selected from 3 and 4, provided that X is hydrogen; or

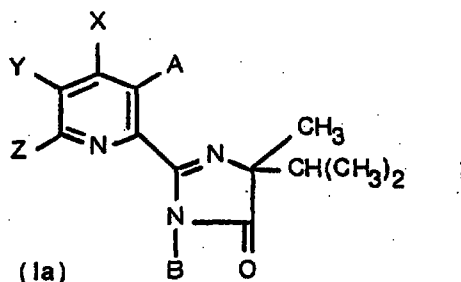


where L, M, Q and R_7 each represent hydrogen, halogen, C_1-C_4 alkyl, C_1-C_4 alkoxy, C_1-C_4 alkylthio, C_1-C_4 alkylsulfonyl, C_1-C_4 haloalkyl, NO_2 , CN, phenyl, phenoxy, amino, C_1-C_4 alkylamino, di(C_1-C_4)loweralkylamino, chlorophenyl, methylphenyl, or phenoxy substituted with one Cl, CF_3 , NO_2 or CH_3 group, with the proviso that only one of L, M, Q or R_7 , may represent a substituent other than hydrogen, halogen, C_1-C_4 alkyl or C_1-C_4 -alkoxy.

and when W is O and A is CN, CH_3 or $COOR_3$, provided that R_3 cannot be unsaturated alkyl and Y and Z cannot be alkylamino, dialkylamino or alkylthio, and the N-oxides thereof, and when R_1 and R_2 are not the same, the optical isomers thereof, and, except when R_3 is a salt-forming cation, the acid addition salts thereof.

A preferred group of 2-(2-imidazolin-2-yl)pyridine compounds have the formula shown as I above, wherein R_1 is methyl; R_2 is methyl, ethyl, isopropyl or cyclopropyl; W is oxygen; B is hydrogen, CO-alkyl C_1-C_6 or CO-phenyl optionally substituted with chloro, nitro or methoxy; A is $COOR_3$, CH_2OH or CHO where R_3 is as described in formula I above, X is hydrogen, Y and Z are each selected from hydrogen, C_1-C_6 alkyl, C_1-C_6 alkoxy, halo, phenyl, nitro, cyano, trifluoromethyl or methylsulfonyl; and when Y and Z are taken together, YZ is $-(CH_2)_6$.

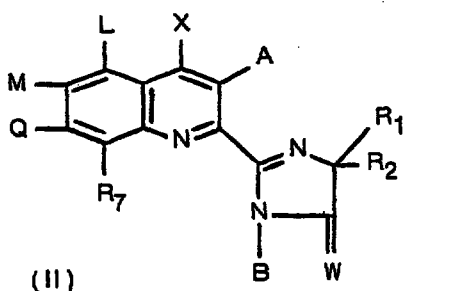
A more preferred group of these 2-(2-imidazolin-2-yl)pyridines may be illustrated by the formula (Ia):



wherein B is hydrogen, CO-alkyl C_1-C_6 or CO-phenyl; A is $COOR_3$ where R_3 is as described in formula (I) above; X is hydrogen and Y and Z each represent hydrogen, C_1-C_6 alkyl, C_1-C_4 -alkoxy, halo, C_1-C_4 -haloalkyl, or phenyl and, when taken together, YZ represent $-(CH_2)_4-$.

The most preferred formula (Ia), 2-(2-imidazolin-2-yl)pyridine compounds are those wherein B, X, Y and Z are each hydrogen; A is $COOR_3$ and R_3 is as described in formula (I) above.

The 2-(2-imidazolin-2-yl)quinoline compounds are illustrated by formula (II) below:



wherein R_1 , R_2 , W, B, A, X, L, M, Q and R_7 are as defined in reference to formula (I) above.

Formula (II) 2-(2-imidazolin-2-yl)quinoline compounds which are preferred herbicidal agents are those wherein R_1 is methyl; R_2 is methyl, ethyl, isopropyl or cyclopropyl; W is oxygen; B is hydrogen, CO-alkyl C_1-C_6 , CO-phenyl optionally substituted with one chloro, nitro or methoxy group; A is $COOR_3$, CH_2OH or CHO; R_3 is as defined in formula (I); X is hydrogen and L, M, Q and R_7 are each selected from the group consisting of hydrogen, halogen, methoxy, nitro, alkyl C_1-C_4 , CF_3 , CN, $N(CH_3)_2$, NH_2 , SCH_3 , or SO_2CH_3 , provided that only one of L, M, Q or R_7 may be nitro, CF_3 , CN, $N(CH_3)_2$, NH_2 , SCH_3 or SO_2CH_3 .

A more preferred group of formula (II) 2-(2-imidazolin-2-yl)quinoline compounds are those wherein X, L and R_7 are each hydrogen; R_1 is methyl; R_2 is methyl, ethyl, isopropyl or cyclopropyl; B is hydrogen or $COCH_3$; A is $COOR_3$, CH_2OH or CHO and R_3 is as defined in formula (I); W is oxygen and M and Q each represent a member selected from hydrogen, halogen, methyl, methoxy, nitro, CF_3 , CN, $N(CH_3)_2$, NH_2 , SCH_3

or SO_2CH_3 , provided that only one of M or Q may be a substituent other than hydrogen, halogen, methyl or methoxy.

A still more preferred group of formula (II) 2-(2-imidazolin-2-yl)quinolines are those in which R_1 is methyl; R_2 is isopropyl; W is oxygen; B, X, L, M, Q and R_7 are hydrogen; A is COOR_3 where R_3 is $\text{C}_1\text{--C}_8$ alkyl, hydrogen, $\text{C}_3\text{--C}_8$ alkenyl, $\text{C}_3\text{--C}_8$ alkynyl, $\text{C}_3\text{--C}_8$ cycloalkyl or a cation selected from alkali metals, alkaline earth metals, manganese, copper, iron, zinc, cobalt, lead, silver, nickel, ammonium and aliphatic ammonium.

In formulas I, Ia and II above, alkali metals include: sodium, potassium and lithium, but sodium is generally preferred. Further, the term "organic ammonium," is defined as a group consisting of a positively charged nitrogen atom joined to from one to four aliphatic groups, each containing from one to 20 carbon atoms. Among the organic ammonium groups which are illustrative for the preparation of the aliphatic ammonium salts of the formula (I) imidazolyl nicotinic acids and esters herein are: monoalkylammonium, dialkylammonium, trialkylammonium, tetraalkylammonium, monoalkenylammonium, dialkenylammonium, trialkenylammonium, monoalkynylammonium, dialkynylammonium, trialkynylammonium, monoalkanolammonium, dialkanolammonium, trialkanolammonium, $\text{C}_6\text{--C}_8$ -cycloalkylammonium, piperidinium, morpholinium, pyrrolidinium, benzylammonium and equivalents thereof. Exemplary of halogen hereinabove are chlorine, fluorine, bromine, and iodine, but chlorine and bromine are preferred.

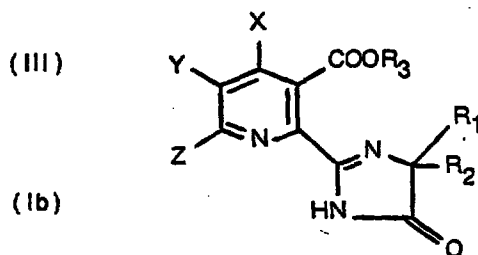
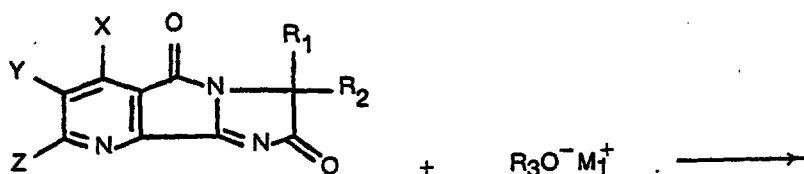
As indicated above, the present invention relates to 2-(2-imidazolin-2-yl)pyridine and 2-(2-imidazolin-2-yl)quinoline compounds and their use as herbicidal agents. These novel pyridine and quinoline compounds are represented by formula (I) which is generic to both compound groups. Formula (II) is more specific and is directed to the 2-(2-imidazolin-2-yl)quinolines.

While many process steps, hereinafter described, are common to the preparation of both the pyridine and quinoline derivatives of this invention, for convenience, process steps limited to the preparation of quinoline derivatives will be discussed separately following the discussion relating to the preparation of the pyridine derivatives.

In accordance with the process of the present invention, formula (I), 2-(2-imidazolin-2-yl)pyridine esters, wherein A is COOR_3 and R_3 represents a substituent other than hydrogen or a salt-forming cation, and R_1 , R_2 , X, Y and Z are as described above, can be prepared by reacting an imidazopyrrolopyridinedione, represented by formula (III), hereinbelow, with an appropriate alcohol and corresponding alkali metal alkoxide at a temperature ranging between about 20°C and about 50°C .

In these reactions, the alcohol can function both as reactant and solvent. As such, a secondary solvent is not required. However, when an expensive alcohol is employed in the reaction, a less expensive secondary solvent, such as dioxane, tetrahydrofuran or other non-protic solvent, may be added to the reaction mixture. The amount of non-protic solvent added to the reaction mixture may be widely varied.

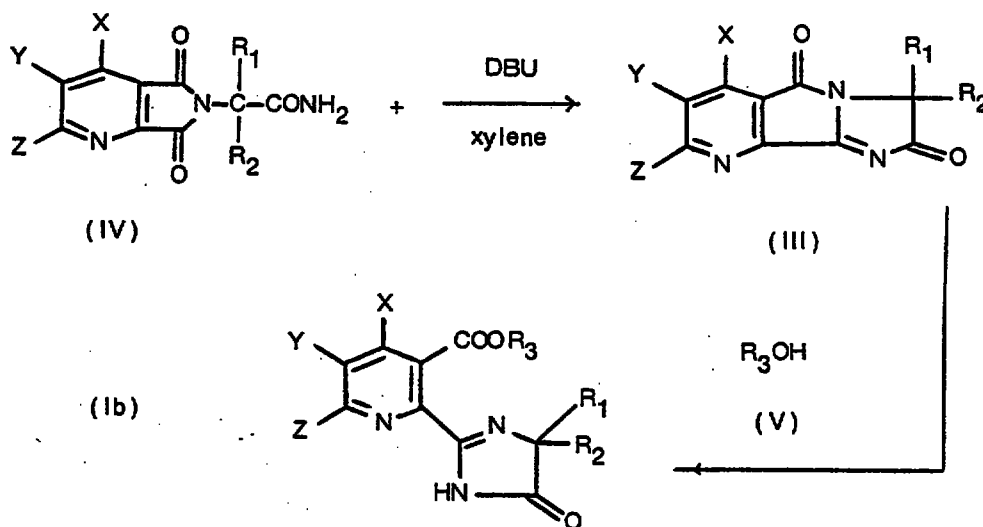
The overall reaction can be graphically illustrated as follows:



where M_1 is an alkali metal, and X, Y, Z, R_1 , R_2 and R_3 are as above defined.

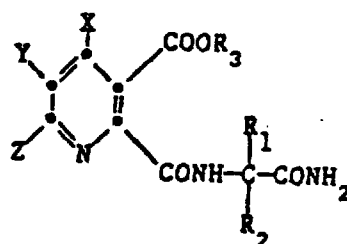
Advantageously, the formula (Ib) 2-(2-imidazolin-2-yl)pyridine esters can also be prepared from a formula (IV) dioxopyrrolopyridine acetamide, wherein R_1 , R_2 , X, Y and Z are as described above, by cyclization thereof with a strong base, such as 1,5-diazabicyclo [5.4.0] undec-5-ene (DBU), in the presence of an inert organic solvent such as xylene or toluene to give the crude imidazopyrrolopyridine of formula (III). The reaction mixture is heated to a temperature between 100°C and 150°C , and water is removed from the reaction mixture during the reaction using any convenient means, e.g., a Dean-Stark water separator. At least one equivalent of alcohol, represented by the formula (V) $R_3\text{OH}$, wherein R_3 represents a member other than hydrogen or a salt-forming cation, and R_1 , R_2 , X, Y and Z are as hereinabove described, is then

added to the reaction mixture and the thus prepared mixture heated to reflux at a temperature between 100°C and 150°C to yield the formula (Ib) 2-(2-imidazolin-2-yl)pyridine ester. The overall reaction can be graphically illustrated as follows:



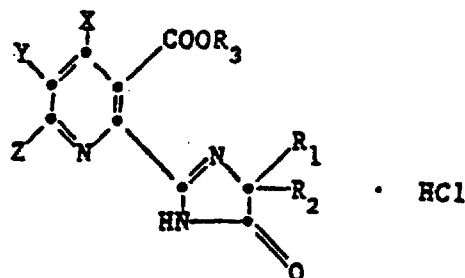
wherein X, Y, Z, R₁, R₂ and R₃ are as described above.

In still another embodiment relating to the preparation of the formula (Ib) 2-(2-imidazolin-2-yl)pyridine esters, the cyclization of a carbamoyl nicotinic acid ester, represented by formula (VI), with phosphorus pentachloride at an elevated temperature, generally between about 60°C and 100°C occurs. The reaction is preferably conducted in the presence of an inert organic solvent, such as toluene or benzene. Good yields of the hydrochloride salt of the desired formula (Ib) ester are attained. The hydrochloride salt is then readily converted to the formula (Ib) ester by dissolution of the acid addition salt in water and neutralization of the thus-prepared solution with base, such as sodium or potassium carbonate. The overall reactions can be illustrated as follows:

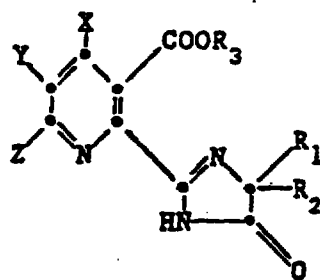


(VI)

PCl_5
 toluene



Base

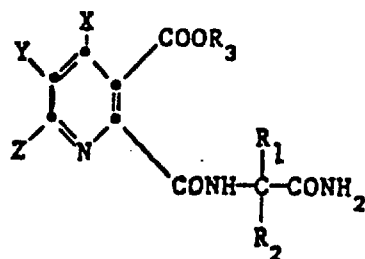


(Ib)

wherein A is COOR_3 and R_3 is a substituent other than hydrogen or a salt-forming cation, and R_1 , R_2 , X, Y and Z are as hereinabove described.

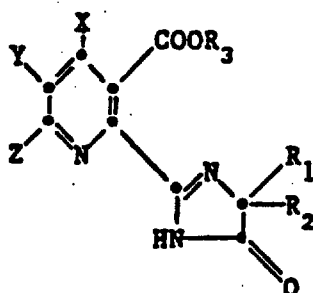
In still another embodiment for the preparation of the formula (Ib) 2-(2-imidazolin-2-yl)pyridines esters of the present invention, the cyclization of a carbamoyl nicotinic acid ester represented by formula (VI) using a mixture of phosphorus pentachloride and phosphorus oxychloride is accomplished. The reaction mixture is stirred at room temperature from about four to eight hours and then the POCl_3 removed *in vacuo*. The remaining residue is dispersed in an organic solvent such as toluene. The solvent is removed and the residue dispersed in water and heated to between 80°C and 100°C . After cooling, the pH of the aqueous mixture is adjusted to 5—6 with sodium bicarbonate, and the product extracted into methylene chloride to give the desired formula (Ib) 2-(2-imidazolin-2-yl)pyridine ester. The reaction can be graphically illustrated as follows:

0 041 623



(VI)

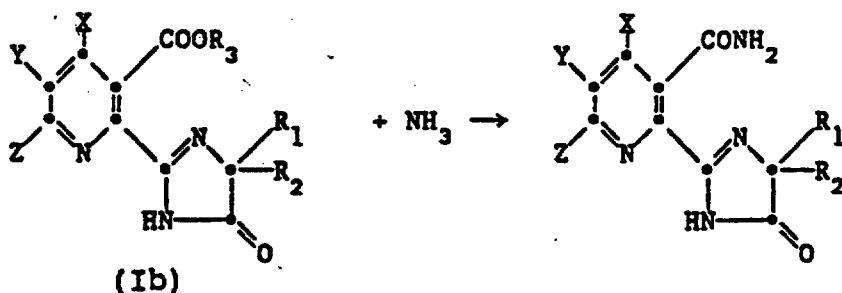
1. $\text{PCl}_5 / \text{POCl}_3$
2. H_2O



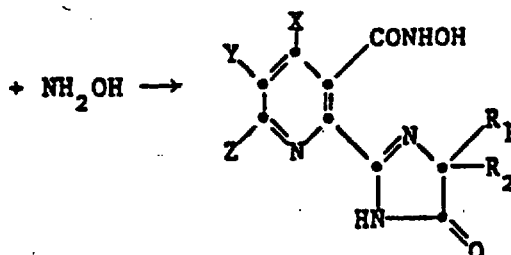
(Ib)

where A is COOR_3 and R_3 is a substituent other than hydrogen or a salt-forming cation, and R_1 , R_2 , X, Y and Z are as described above.

The formula (Ib) 2-(2-imidazolin-2-yl)pyridine ester in which A is COOR_3 and R_3 is alkyl $\text{C}_1\text{--C}_{12}$, alkenyl $\text{C}_3\text{--C}_{12}$, alkynyl $\text{C}_3\text{--C}_{10}$, cycloalkyl $\text{C}_3\text{--C}_6$ or the substituted derivatives of these groups and X, Y, Z, R_1 and R_2 are as described above, may be converted to the corresponding amide where A is CONH_2 by reaction with ammonia under superatmospheric pressure at a temperature between about 25°C and 125°C . This reaction can be conducted in a protic solvent such as a lower alkanol or an aprotic solvent such as tetrahydrofuran or dioxane. Likewise, using similar conditions but substituting hydroxylamine for ammonia in the above reaction yields the hydroxamic acid. These reactions may be graphically illustrated as follows:

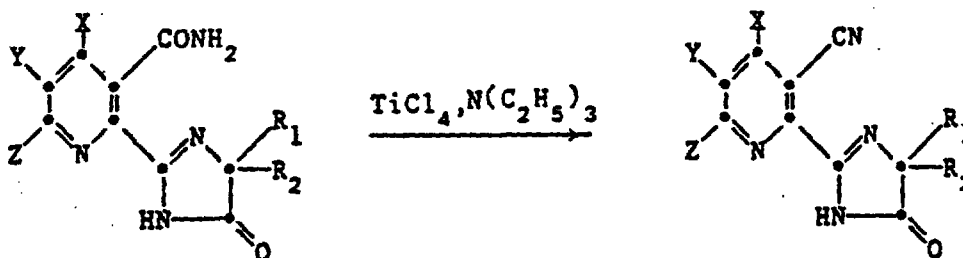


(Ib)



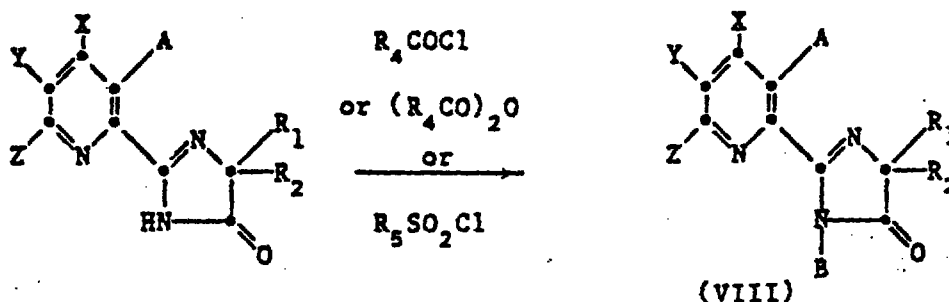
Treatment of the thus prepared primary amide described above with titanium tetrachloride and triethylamine, preferably in the presence of an inert aprotic solvent, such as tetrahydrofuran yields the

corresponding nitrile. The reaction is generally conducted under a blanket of inert gas, such as nitrogen, at a temperature between about 0°C and 10°C. The reaction may be illustrated as follows:



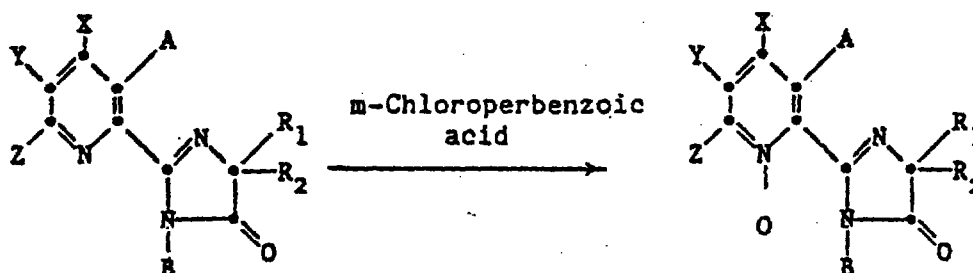
where X, Y, Z, R₁ and R₂ are as described above.

Preparation of the formula (VIII) N-substituted imidazolinone derivatives, wherein B is COR₄ or SO₂R₅; and A is CH₃, CN or COOR₃; and W is O; and R₁, R₂, R₃, X, Y and Z are as described above, excepting that Y and Z cannot be alkylamino, hydroxy or hydroxyloweralkyl; can be achieved by reaction of the appropriately substituted formula (I) 2-(2-imidazolin-2-yl)pyridine with an excess of acyl halide, acyl anhydride, or sulfonyl halide, alone or in a solvent such as pyridine or toluene at an elevated temperature between about 50°C and 125°C. The reaction can be graphically illustrated as follows:



where A is CH₃, CN or COOR₃; R₁, R₂, R₃, R₄, R₅, X, Y and Z are as described above excepting that Y and/or Z cannot be alkylamino, hydroxyl, hydroxyloweralkyl.

Reaction of either the formula (I) 2-(2-imidazolin-2-yl)pyridine of the formula (VIII) N-substituted imidazolinone derivatives, described and illustrated immediately above, wherein A is CH₃, CN or COOR₃, provided that R₃ is as described above, excepting that it cannot be an unsaturated alkyl group, B is R₄CO or R₅SO₂ and Y or Z cannot be alkylamino, alkylthio or dialkylamino; with an excess of m-chloroperbenzoic acid in the presence of an inert solvent such as methylene chloride, at refluxing temperature, yields the N-oxide corresponding to the pyridine derivative utilized as starting material. The reaction may be illustrated as follows:

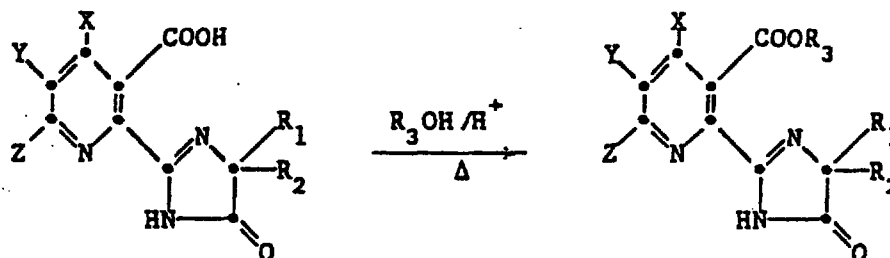


wherein A is CH₃, CN or COOR₃ is as described above excepting that R₃ cannot be an unsaturated alkyl group; B is COR₄ or SO₂R₅, R₁, R₂, R₄, R₅, X, Y and Z are as described above excepting that Y and Z cannot be alkylamino, alkylthio or dialkylamino.

Hydrolysis of the thus prepared N-oxide using a strong base such as sodium hydroxide in a lower alcohol yields the corresponding N-oxide in which B is H.

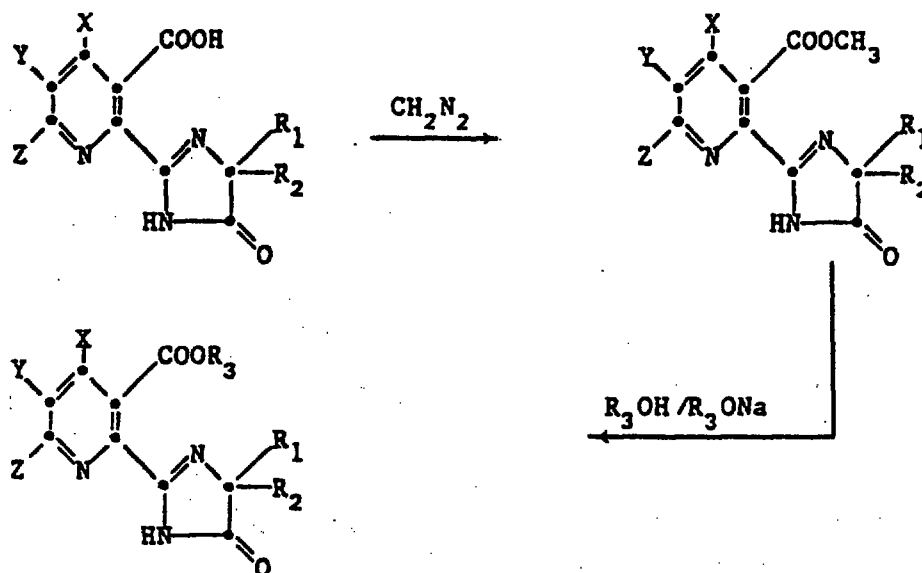
Advantageously, formula (I) esters in which B is hydrogen; W is oxygen and A is COOR₃ wherein R₃ is a saturated C₁-C₁₂ alkyl, C₃-C₆ cycloalkyl or benzyl substituent, and R₁, R₂, X, Y and Z are as defined above; can be prepared by reaction of the corresponding acid, i.e., where A is COOH, with an appropriate alcohol

in the presence of a catalytic amount of a strong mineral acid such as hydrochloric acid or sulfuric acid, at a temperature between about 50°C and 100°C. The reaction may be illustrated as follows:



wherein R_3 is C_1 – C_{12} alkyl, C_3 – C_6 cycloalkyl or benzyl; and R_1 , R_2 , X, Y and Z are as defined above.

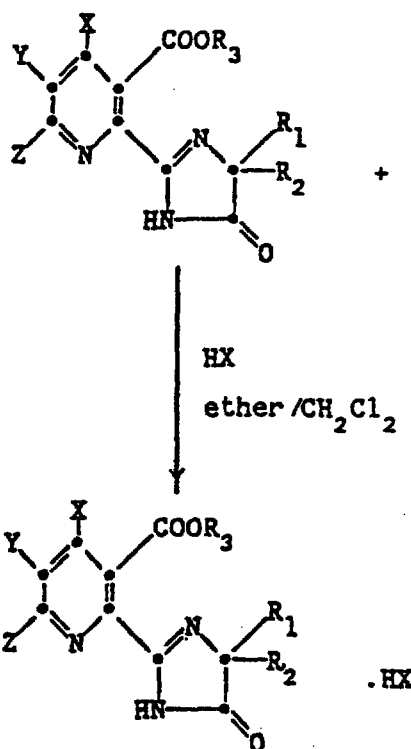
The formula (I) acid as shown immediately above where A is COOH; B is hydrogen; W is oxygen and R_1 , R_2 , X, Y and Z are as defined above, is also readily converted to the corresponding methyl ester by reaction with diazomethane at a temperature between about 0°C and 25°C. The thus prepared methyl ester may then be reacted with an alkali metal alkoxide such as a sodium or potassium alkoxide, for convenience shown as R_3ONa , and an appropriate alcohol represented by the structure R_3OH , wherein R_3 is C_1 – C_{12} alkyl optionally substituted with one C_1 – C_3 alkoxy, C_3 – C_6 cycloalkyl, benzyloxy, furyl, phenyl, halophenyl, loweralkylphenyl, loweralkoxyphenyl, nitrophenyl or cyano; C_3 – C_{12} alkenyl optionally substituted with one or two C_1 – C_3 alkoxy, phenyl or halogen groups; C_3 – C_6 cycloalkyl optionally substituted with one or two C_1 – C_3 alkyl groups or with C_3 – C_{10} alkynyl optionally substituted with one or two C_1 – C_3 alkyl groups. The above reactions may be illustrated as follows:



wherein R_1 , R_2 , R_3 , X, Y and Z are as defined above.

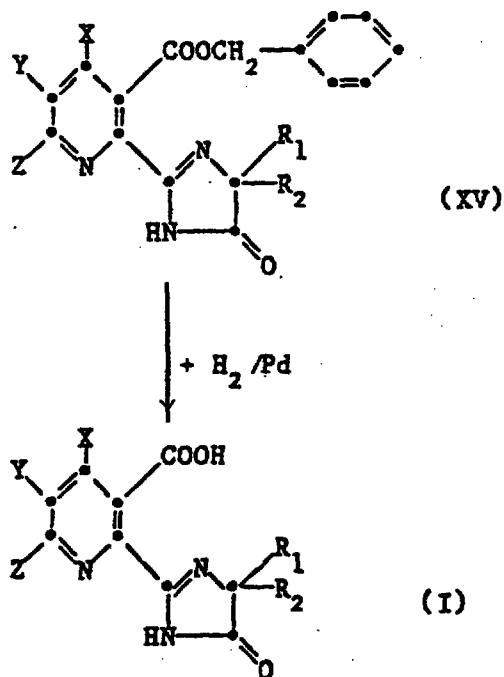
Conversion of the above-identified formula (I) esters to their corresponding acid addition salts is readily achieved by treatment of said esters with strong acids, particularly strong mineral acids such as hydrochloric acid, sulfuric acid or hydrobromic acid.

Where the hydrohalide acid addition salts are desired, the formula (I) ester, wherein A is $COOR_3$ and R_3 is other than hydrogen or a salt-forming cation, and R_1 , R_2 , X, Y and Z are as described above, is dissolved in an organic solvent such as methylene chloride, chloroform or ether. Addition of at least one equivalent of acid to the thus-prepared solution then yields the desired acid addition salt. The reaction may be illustrated as follows:

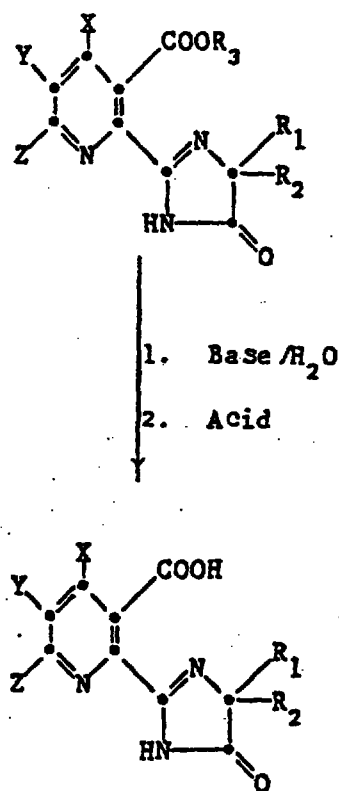


When the sulfuric acid salt of the ester is desired, the formula (I) ester is generally dissolved in a lower aliphatic alcohol such as methanol, ethanol, isopropanol or mixtures of the above with water. Treatment of the mixture with at least one equivalent of sulfuric acid yields the sulfuric acid addition salt of the formula (I) ester.

In a further embodiment of the invention, the formula (I) compounds, wherein A is COOR₃ and R₃ is hydrogen and R₁, R₂, X, Y and Z, are as defined above, except that X, Y and Z cannot be NO₂ or halogen, can be prepared by hydrogenolysis of the benzyl ester of the imidazoliny pyridine shown in formula (XV), wherein R₁, R₂, X, Y and Z, are as above-defined employing a palladium or platinum catalyst. In this reaction, the formula (XV) benzyl ester is dissolved or dispersed in an organic solvent, such as lower alcohol, an ether such as dioxane or tetrahydrofuran, toluene or xylene. The catalyst, preferably palladium on a carbon carrier, is added to the mixture and the mixture heated to between 20°C and 50°C. The heated mixture is then treated with hydrogen gas to yield the desired acid. The reaction may be graphically illustrated as follows:

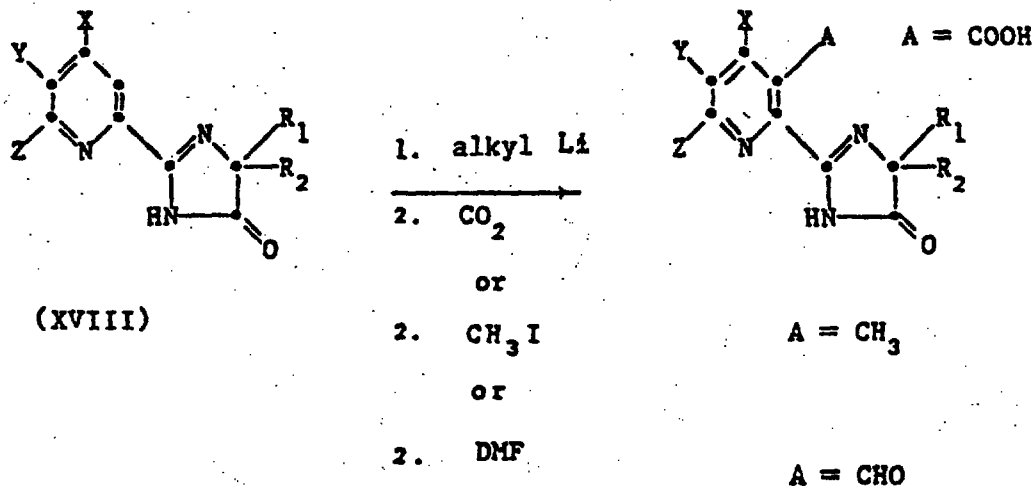


Alternatively, the formula (I) acids where A is COOH may be prepared by treatment of an aqueous solution of the formula (I) ester with a strong base. In practice the formula (I) ester is generally treated with one equivalent of base in aqueous solution, and the mixture heated to between 20°C and 50°C. The mixture is then cooled and adjusted to pH 6.5 to 7.5 and preferably pH 7, with a strong mineral acid. Such treatment yields the desired acid. The reaction can be illustrated as follows:

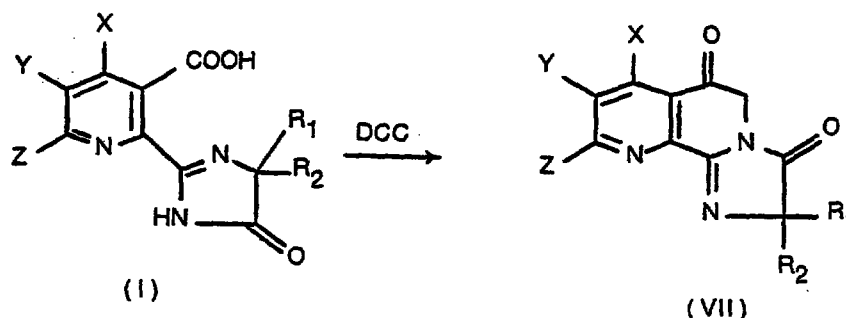


where R_3 is other than hydrogen or a salt-forming cation, and R_1 , R_2 , X, Y and Z are as described with reference to formula (I).

The formula (I) acids wherein A is COOH; B is hydrogen; W is oxygen and X, Y, Z, R_1 and R_2 are as described, can be prepared by reaction of the appropriately substituted formula (XVIII) imidazolinone with alkyl lithium, preferably in the presence of an inert solvent such as tetrahydrofuran under a blanket of nitrogen at a temperature between about -70°C and -80°C. The thus-formed mixture is then treated with hexamethylphosphoramide and carbon dioxide preferably in an inert solvent such as tetrahydrofuran, to yield the desired product. Where it is desirable to obtain the formula (I) pyridine derivatives in which A is CH_3 and X, Y, Z, R_1 and R_2 are as stated above, the formula (XVIII) imidazolinone is treated in the same manner as described for the preparation of the acid, excepting that methyl iodide is substituted for the carbon dioxide. If dimethylformamide is substituted for the methyl iodide, the corresponding formyl derivatives are obtained. These reactions may be illustrated as follows:

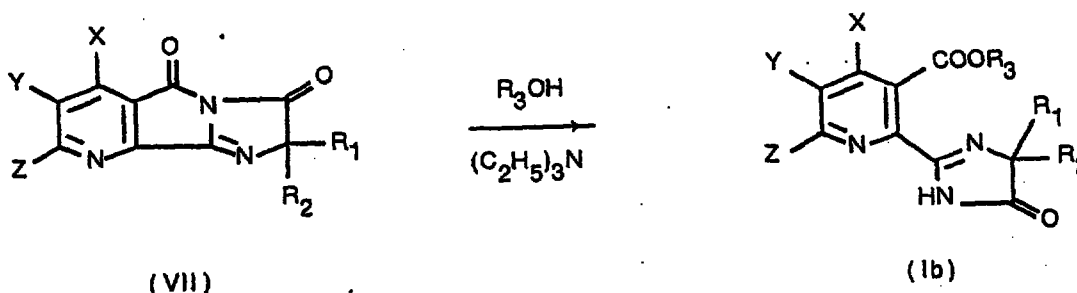


Advantageously, the formula (I) acids may be converted to the formula (VII) 5-H-imidazo[1', 2':1,2]pyrrolo[3,4-b]pyridine-3(2H),5-diones by reaction with dicyclohexylcarbodiimide (DCC). The reaction is preferably conducted using approximately an equimolar amount of the carbodiimide in the presence of a chlorinated hydrocarbon solvent at a temperature between about 20°C to 32°C. The reaction may be graphically illustrated as follows:



The formula (VII) 5H-imidazo[1', 2':1,2]pyrrolo[3,4-b]pyridine-3(2H),5-diones are isomers of the formula (III) imidazopyrrolopyridinediones referred to above, and are especially useful in the preparation of a variety of the formula (I) 2-(2-imidazolin-2-yl)pyridine derivatives of the present invention, as will become apparent from the following discussion.

In practice, it is found that the formula (VII) 3(2H),5-diones can be reacted with at least one equivalent of an appropriate formula (V), R_3OH alcohol in the presence of its alkali metal alkoxide or in the presence of triethylamine as catalyst to yield the formula (I) pyridine ester corresponding to the alcohol used. The reaction is preferably conducted at a temperature between about 20°C and 50°C in the presence of an inert aprotic solvent, such as tetrahydrofuran or dioxane. The reaction may be illustrated as follows:



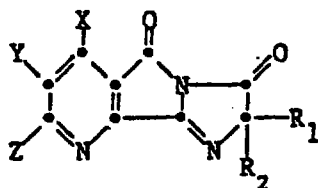
wherein R_3 represents a substituent as described above, excepting that hydrogen and salt-forming cations are excluded, and R_1 , R_2 , X, Y and Z, are as described above.

Further the compound of formula (VII) may be reacted with at least one equivalent of an amine of formula R_6NH_2 , in the presence of a lower alkyl alcohol or an aprotic solvent at a temperature between about 80°C and 125°C, whereby the corresponding pyridine acid amide is obtained.

The formula (VII) 3(2H),5-diones are also readily converted to the formula (Ib) 2-(2-imidazolin-2-yl)pyridine derivatives wherein R_1 , R_2 , X, Y and Z, are as described above; W is oxygen; B is hydrogen, and A is acetyl, benzoyl, trimethylphosphonoacetate or hydroxymethyl; by reaction thereof with methyl magnesium bromide, phenyl lithium, sodium trimethyl phosphonoacetate or sodium borohydride; respectively. The methyl magnesium bromide, phenyl lithium and sodium trimethylphosphonoacetate reactions are preferably carried out at a temperature between about -50°C and -80°C, in the presence of an inert solvent such as tetrahydrofuran or dioxane under a blanket of inert gas, such as nitrogen. Reaction of the above-said formula (VII) diones with sodium borohydride is relatively mild. The reaction does not require a blanket of inert gas and can be conducted at temperatures between about -10°C and +15°C.

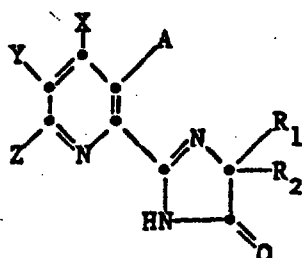
Reaction of the formula (VII) diones with at least one equivalent of acetone oxime yields the acetone oxime ester of the formula (I) 2-(2-imidazolin-2-yl)pyridine where A is $COON=C(CH_3)_2$, B is hydrogen and R_1 , R_2 , X, Y and Z, are as described for formula (I) pyridine derivatives. The above reaction is generally conducted in the presence of an inert organic solvent such as toluene, benzene or xylene at a temperature between about 40°C and 80°C.

The above reactions are graphically illustrated below:



Reactants

1. CH_3MgBr
2. Phenyl lithium
3. Sodium trimethyl phosphonoacetate
4. NaBH_4
5. $\text{HON}=\text{C}(\text{CH}_3)$



A in Formula I

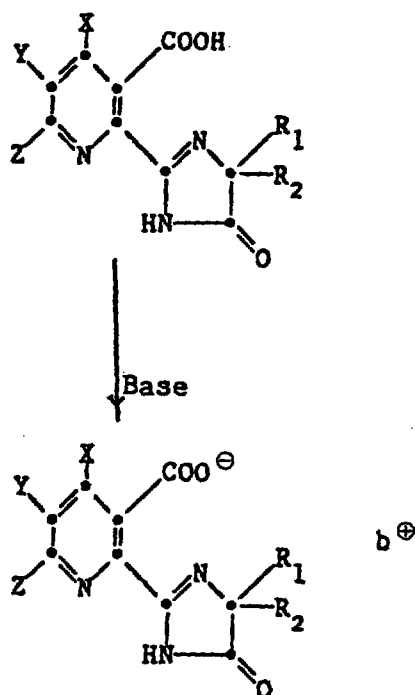
1. COCH_3
2. COC_6H_5
3. $\text{COCH}(\text{COOCH}_3)\text{P}(\text{OCH}_3)_2$
4. CH_2OH
5. $\text{COON}=\text{C}(\text{CH}_3)_2$

wherein R_1 , R_2 , X, Y and Z are as described above.

Formula (I) compounds, wherein A is COOR_3 and R_3 represents a salt-forming cation such as an alkali metal, alkaline earth metal, ammonium or aliphatic ammonium and R_1 , R_2 , X, Y and Z are as described above, can be prepared by dissolving the formula (I) 2-(2-imidazolin-2-yl)pyridine acid in an appropriate solvent and, thereafter, treating the solution of the acid with one equivalent of salt-forming cation. For compounds in which the salt-forming cation is an inorganic salt such as sodium, potassium, calcium, barium or the like, the formula (I) acid may be dissolved or dispersed in water or a lower alcohol or mixtures thereof. One equivalent of the salt-forming cation generally in the form of the hydroxide, carbonate, bicarbonate or the like, but preferably as the hydroxide, is admixed with the solution of the formula (I) acid. After several minutes, the formula (I) compound, wherein R_3 is the inorganic salt-forming cation, generally precipitates and can be recovered from the mixture by either filtration or through azeotropic distillation with an organic solvent such as dioxane.

To prepare the formula (I) compound in which A is COOR_3 and R_3 is ammonium or organic ammonium, the formula (I) acid is dissolved or dispersed in an organic solvent such as dioxane or tetrahydrofuran, and the mixture treated with one equivalent of ammonia or the amine or the tetraalkylammonium hydroxide. Among the amines which may be used in the above-said reaction are: methylamine, ethylamine, *n*-propylamine, isopropylamine, *n*-butylamine, isobutylamine, *sec*-butylamine, *n*-amylamine, *iso*-amylamine, hexylamine, heptylamine, octylamine, nonylamine, decylamine, undecylamine, dodecylamine, tridecylamine, tetradecylamine, pentadecylamine, hexadecylamine, heptadecylamine, octadecylamine, methylethylamine, methylisopropylamine, methylhexylamine, methylnonylamine, methylpentadecylamine, methyloctadecylamine, ethylbutylamine, ethylheptylamine, ethyloctylamine, hexylheptylamine, hexyloctylamine, dimethylamine, diethylamine, di-*n*-propylamine, diisopropylamine, di-*n*-amylamine, diisomylamine, dihexylamine, diheptylamine, dioctylamine, trimethylamine, triethylamine, tri-*n*-propylamine, triisopropylamine, tri-*n*-butylamine, triisobutylamine, tri-*sec*-butylamine, tri-*n*-amylamine, ethanolamine, *n*-propanolamine, isopropanolamine, diethanolamine, N,N-diethylethanolamine, N-ethylpropanolamine, N-butylethanolamine, allylamine, *n*-butenyl-2-amine, *n*-pentenyl-2-amine, 2,3-dimethylbutenyl-2-amine, dibutenyl-2-amine, *n*-hexenyl-2-amine, propylenediamine, tallowamine, cyclopentylamine, cyclohexylamine, dicyclohexylamine, piperidine, morpholine, and pyrrolidine. Among

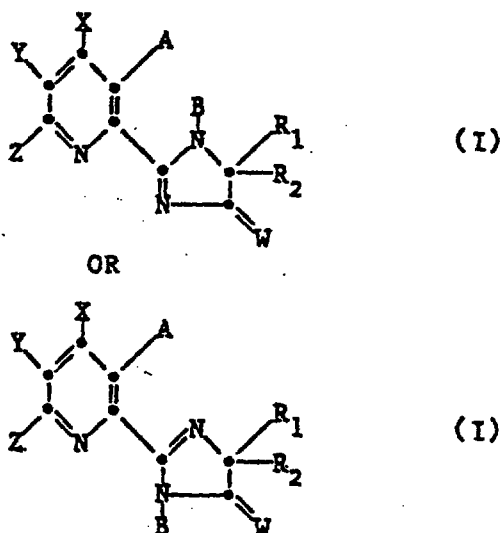
tetraalkylammonium hydroxides contemplated methyl, tetraethyl, trimethylbenzylammonium hydroxides. In practice, after several minutes, the ammonium or organic ammonium salt precipitates and can be separated from the solution by any convenient means, as by filtration or centrifugation. Additionally, the reaction mixture may be concentrated, and the remaining solvent removed with hexane, and the residue then dried to recover the ammonium or organic ammonium formula (I) salt. The above reactions may be graphically illustrated as follows:



wherein R_1 , R_2 , X , Y and Z are as described above, and b is the salt forming cation.

When R_1 and R_2 represent different substituents, the carbon to which R_1 and R_2 are attached is an asymmetric center, and the products (as well as their intermediates) exist in *d*- and *l*- forms as well as *dl*-forms.

It should also be understood that the 2-(2-imidazolin-2-yl)pyridines and quinolines represented by formula (I) in which $B = H$ may be tautomeric, while for convenience, they are depicted by a single structure identified as formula (I), they may exist in either of the isomeric forms illustrated as follows:



wherein A , W , X , Y , Z , R_1 and R_2 are as hereinabove defined and B is H . As such, both isomeric forms of the 2-(imidazolin-2-yl)pyridines and 2-(2-imidazolin-2-yl)quinolines are meant to be included under the formula (I) definitions.

One general method for the preparation of the formula (I) compounds involves the reaction of a quinolinic anhydride of formula (XVI) hereinbelow, with an appropriately substituted α -aminocarbonitrile of formula (XVII), hereinbelow, to yield a mixture of the monoamides of quinolinic acid of formula (IX) and formula (X).

This reaction is carried out at a temperature between about 20°C and 70°C and preferably between about 35°C and 40°C in an inert solvent, such as tetrahydrofuran, methylene chloride, ether, chloroform or toluene. The thus-formed acids are then cyclized to the corresponding pyrrolopyridine acetonitrile, depicted by formula (XI), by heating the reaction mixture with an excess of acetic anhydride in the presence of a catalytic amount of sodium acetate or potassium acetate.

In general, the above reaction is carried out by treating the reaction mixture with acetic anhydride, acetyl chloride, thionyl chloride or the like and heating said mixture to a temperature between about 20°C and 100°C. Hydration of the thus-formed pyrrolopyridine acetonitrile formula (XI) is carried out by treating said acetonitrile with a strong acid such as sulfuric acid. This reaction yields the formula (XII) pyrrolopyridine acetamide. Although the addition of a non-miscible solvent such as methylene chloride or chloroform is not essential to the conduct of the above described reaction, addition of such a solvent to the reaction mixture is generally preferred. Said reaction is usually carried out at a temperature between about 10°C to 70°C.

The cyclization of the formula (XII), hereinbelow, pyrrolopyridine acetamide yields the tricyclic formula (III) imidazopyrrolopyridinediones which are intermediates for the imidazolyl nicotinic acids and esters of the present invention referred to above and represented by formula (Ib).

The product of this reaction is predominantly the desired imidazopyrrolopyridinedione (85%) together with the isomer of formula (IIIa). Mixtures of this ratio of the two isomers generally give substantially isomerically pure nicotinate product.

The cyclization reaction is preferably conducted at a temperature of from 80°C to 150°C in the presence of a base such as sodium or potassium hydride or an acid such as an aromatic sulfonic acid and a solvent which will form an azeotropic mixture with water, permitting virtually immediate removal thereof from the reaction mixture as it is formed. Among the solvents which may be employed are toluene, benzene, xylenes and cyclohexane. Bases which may be used include alkali metal hydroxides, alkali metal hydrides, alkali metal oxides, tertiary amines such as diisopropyl ethylamine, 1,5-diazabicyclo[3.4]nonene-5,1,5-diazobicyclo[5.4.0]undecene-5,1,4-diazabicyclo[2.2.2]octane, tetramethylguanidine, potassium fluoride and quaternary ammonium hydroxide, such as trimethylbenzyl ammonium hydroxide and strongly basic ion exchange resins.

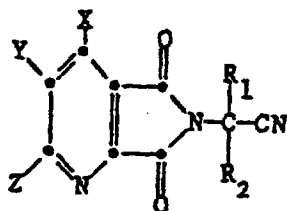
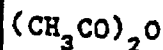
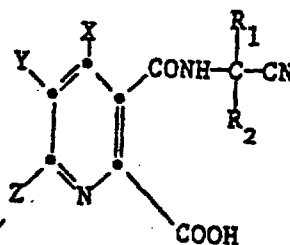
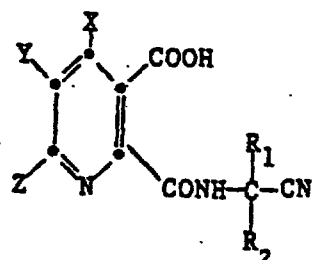
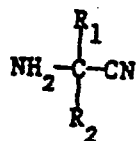
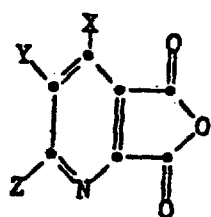
Finally, acidic reagents which can be employed herein include aromatic sulfonic acids, such as *p*-toluenesulfonic acid, β -naphthalenesulfonic acid or naphthalenedisulfonic acid.

The mixture of compounds of formula (III) and formula (IIIa) is then converted to formula (Ib), as discussed above, with an alkali metal alkoxide and alcohol.

The above reactions are graphically illustrated on Flow Diagram I below, when X, Y, Z, R₁, R₂ and R₃ are as defined above.

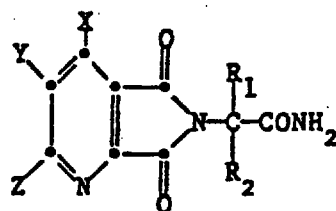
FLOW DIAGRAM I

50



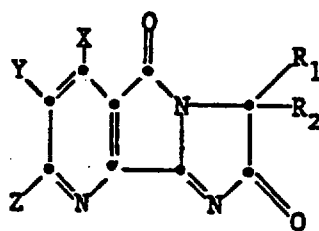
0 041 623

FLOW DIAGRAM I (CONTINUED)



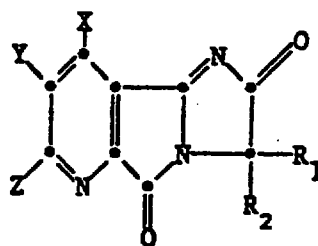
(XII)

Base



(III)

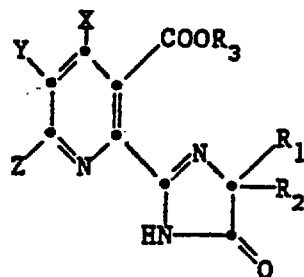
+



(IIIa)

R_3OH

R_3O —alkali metal

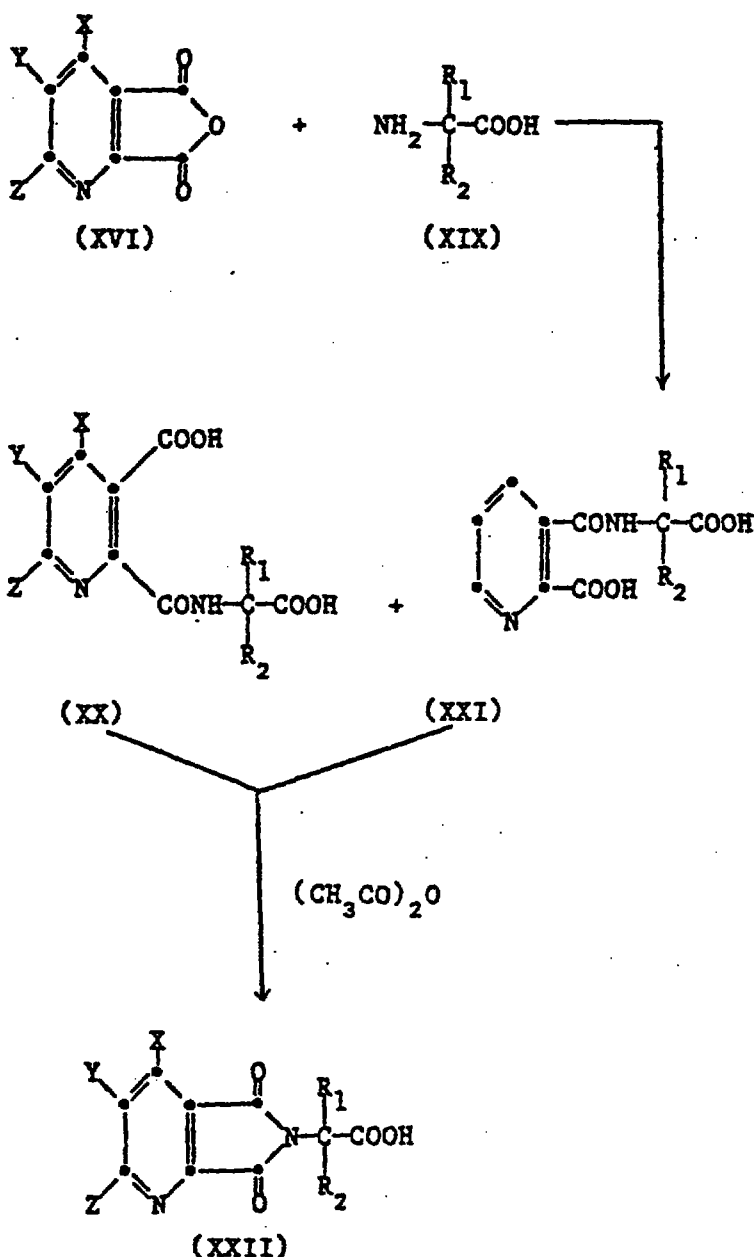


(Ib)

Another general method for the preparation of the formula (I) pyridine derivatives involves the reaction of a quinolinic anhydride of formula (XVI), with an appropriately substituted α -aminocarboxylic acid such as α -methylvaline represented by formula (XIX), preferably in a ketonic solvent such as acetone under a blanket of nitrogen to yield an isomeric mixture of the formula (XX) and formula (XXI) acids. The mixture is then treated with acetic anhydride and a catalytic amount of sodium acetate at an elevated temperature to give the dihydrodioxopyrrolopyridine acid formula (XXII). Reaction of the thus-formed acid with a thionyl halide, such as thionyl chloride or thionyl bromide, in the presence of an organic solvent such as toluene, xylene or benzene, at an elevated temperature, i.e., 80°C to 150°C, gives the formula (XXIII) acid halide corresponding to the formula (XXII) acid. Treatment of this acid halide with excess ammonia then yields the formula (IV) dihydrodioxopyrrolopyridine acetamide. The reaction is preferably carried out in the presence of an aprotic solvent.

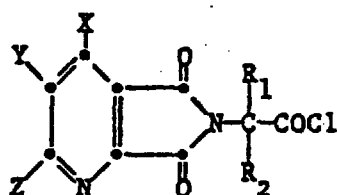
Reaction of the formula (IV) acetamide with 1,8-diazabicyclo[5,4,0]undec-7-ene in an inert organic solvent such as toluene or xylene at an elevated temperature between about 80°C and 125°C gives the formula (III) imidazopyrrolopyridinedione which may be heated with morpholine or an appropriate NH_2R_6 amine alone or in the presence of an aprotic solvent at a temperature of 80°C to 125°C to yield the 2-(2-imidazolin-2-yl)nicotinamides. These reactions are illustrated as Flow Diagram II.

FLOW DIAGRAM II

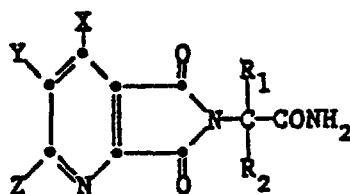


FLOW DIAGRAM II (CONTINUED)

23

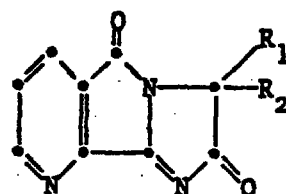
 SOCl_2 

(XXIII)

 NH_3 

(IV)

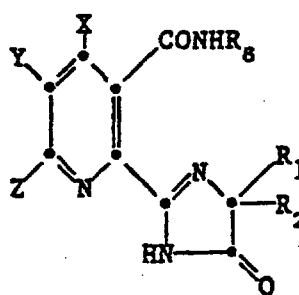
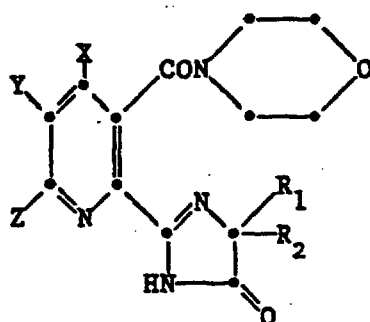
DBU



(III)

+ isomer

Morpholine

 NH_2R_6 

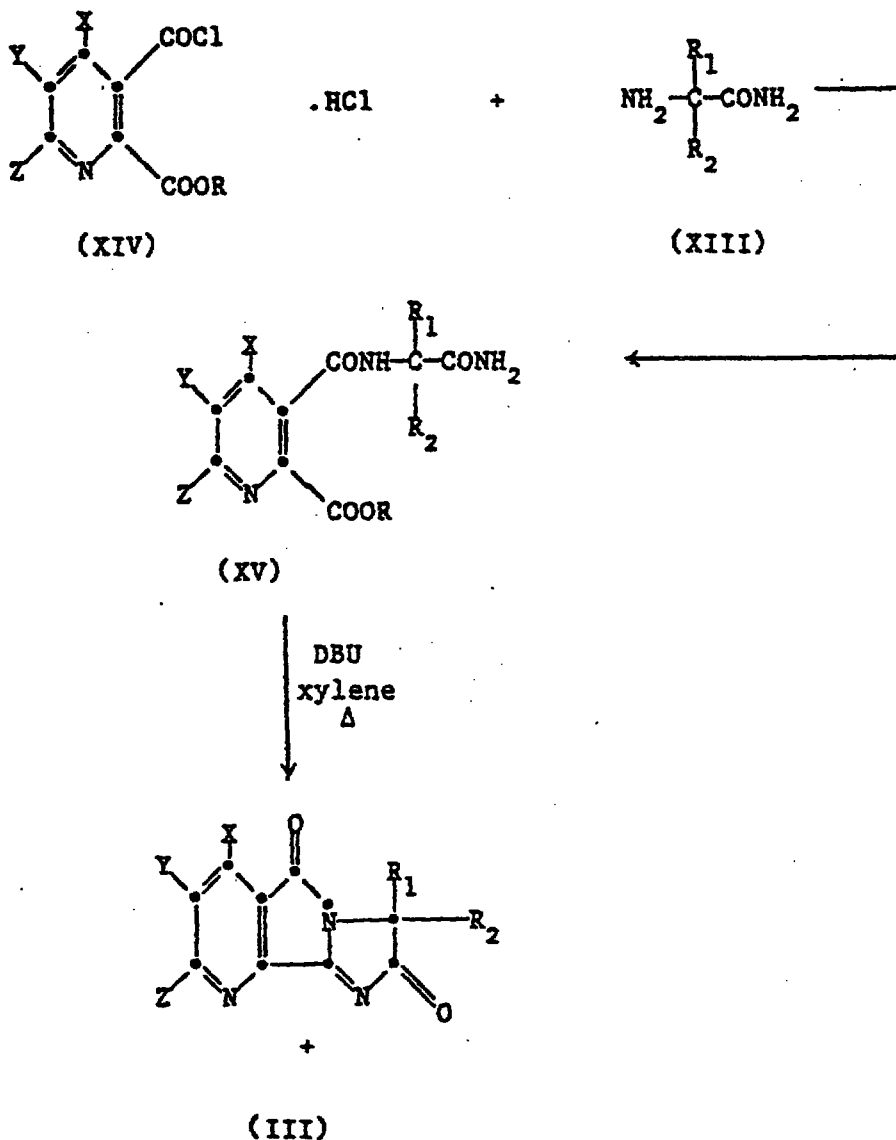
In another general procedure, the 2-(2-imidazolin-2-yl)pyridine acids and esters of formula (I), can be prepared by reacting the 2-carboalkoxynicotinoyl chloride of formula (XIV), hereinbelow, preferably as the methyl ester and preferably in the form of the hydrochloride salt, with the appropriate aminocarboxamide depicted by formula (XIII). The reaction yields the carbamoyl picolinate, formula (XV), and is preferably carried out in an inert blanket of gas such as nitrogen. The reaction mixture is generally maintained at a temperature below 30°C during the reaction period.

The thus-formed carbamoyl picolinate, formula (XV), hereinbelow, can then be dispersed in an inert non-protic solvent such as xylene or toluene and heated to about 50°C to 130°C with 1,5-diazabicyclo-[5.4.0]undec-5-ene. The reaction yields a mixture of the formula (III) and formula (IIIa), imidazopyrrolopyridinedione isomers which can be used without separation in the following reaction, wherein the reaction mixture is treated with an alkali metal alkoxide, in the presence of an alcohol to yield a mixture of the imidazolinyl nicotinate and the imidazolinyl picolinate. The desired formula (Ib) nicotinate can be readily separated from the picolinate by neutralizing the reaction mixture, preferably with glacial acetic acid, concentrating the neutralized solution and chromatographing the resulting residue on silica gel in ether.

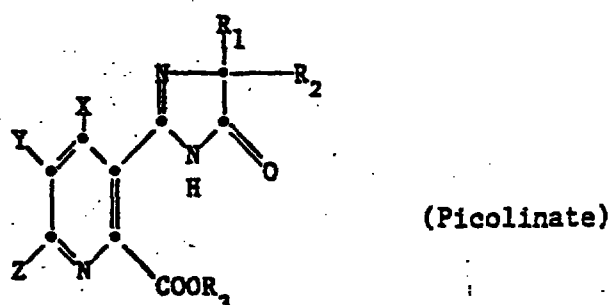
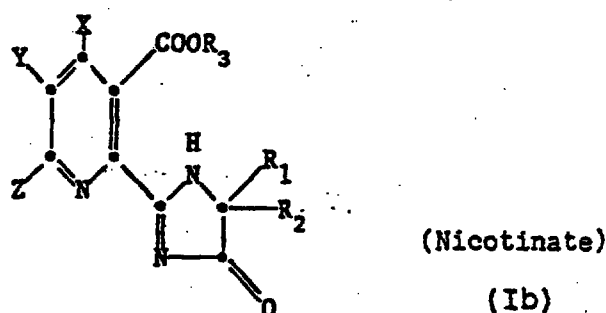
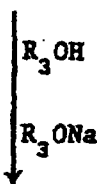
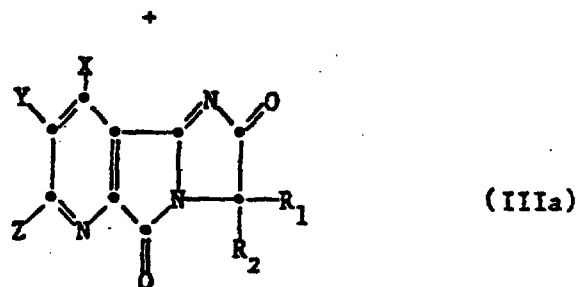
Conversion of the imidazolinyl nicotinate esters to the corresponding acids or acid addition salts can be readily achieved by the methods previously described. Similarly, the imidazolinyl nicotinic acids can be converted to the corresponding alkali metal, ammonium, or organic ammonium salts by the methods previously described.

Preparation of the formula (I) acids and esters, by the route described above, is graphically illustrated in Flow Diagram III below.

FLOW DIAGRAM III

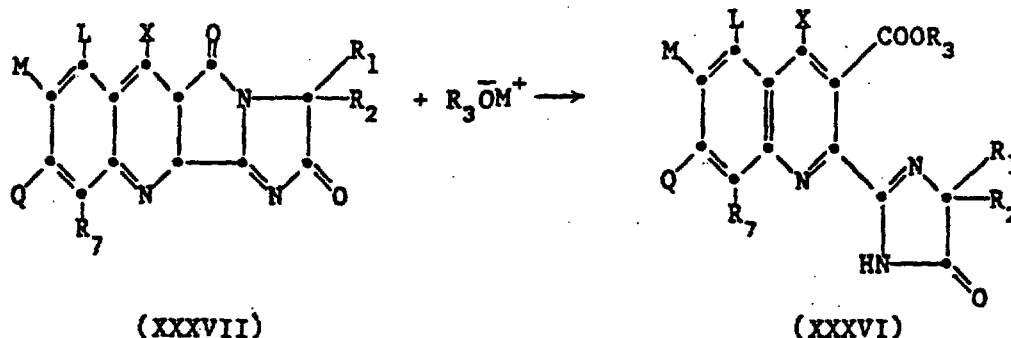


FLOW DIAGRAM III (CONTINUED)



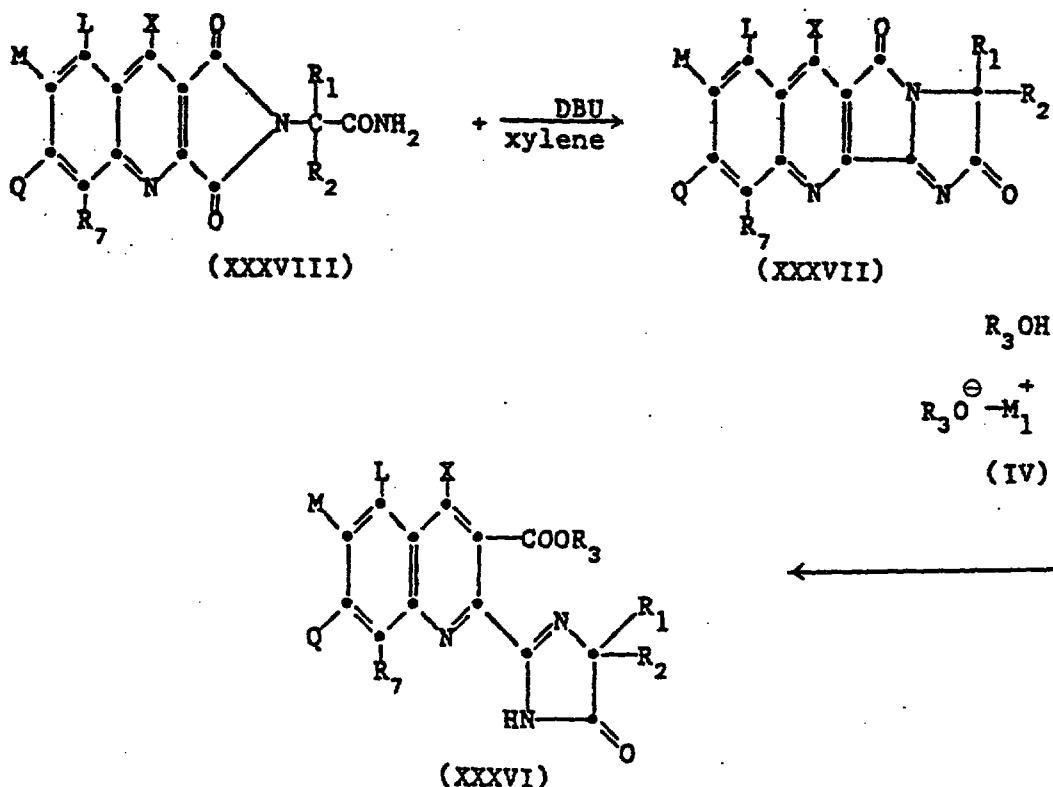
Advantageously, many of the formula (II) 2-(2-imidazolin-2-yl)quinoline derivatives of the present invention can be prepared by the procedures described above for the preparation of the formula (I) 2-(2-imidazolin-2-yl)pyridine compounds. For example, the formula (XXXVI) 2-(2-imidazolin-2-yl)quinolinecarboxylate esters, wherein R_3 represents a substituent other than hydrogen or a salt-forming cation, and R_1 , R_2 , X , L , M , Q and R_7 are as described above, can be prepared by reacting the formula (XXXVII) dione, with an appropriate alcohol and alkali metal alkoxide at a temperature between about 20°C and 50°C. In these reactions, as with similar reactions in which the formula (I) pyridines are prepared, the alcohol can function both as a reactant and a solvent. As such, a secondary solvent is not required, but can

be employed if so desired. When a secondary solvent is used, it is preferable to employ a non-protic solvent such as tetrahydrofuran or dioxane. The reaction may be illustrated as follows:



where M is an alkali metal; X is hydrogen, halogen, hydroxyl or methyl, with the proviso that when one of L, M, Q or R₇ is a substituent other than hydrogen; halogen, C₁–C₆ alkyl, or C₁–C₄ alkoxy, X is hydrogen; L, M, Q and R₇ each represent members selected from the group consisting of hydrogen, halogen, C₁–C₄ alkyl, C₁–C₄ alkoxy, C₁–C₄ alkylthio, C₁–C₄ alkylsulfonyl, C₁–C₄ haloalkyl, NO₂, CN, phenyl, phenoxy, amino, C₁–C₄ alkylamino, diloweralkylamino, chlorophenyl, methylphenyl or phenoxy substituted with one Cl, CF₃, NO₂ or CH₃ group, with the proviso that only one of L, M, Q, or R₇ may represent a substituent other than hydrogen, halogen, C₁–C₄ alkyl or C₁–C₄ alkoxy, and R₁, R₂ and R₃ are as described above.

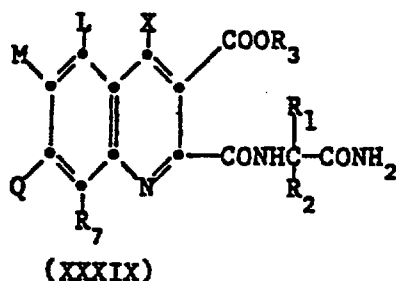
The formula (XXXVI) 2-(2-imidazolin-2-yl)quinolinecarboxylate esters can also be prepared from a formula (XXXVIII) dioxopyrroloquinoline acetamide, wherein R₁, R₂, X, L, M, Q and R₇ are as described above, by cyclization thereof with a strong base, such as 1,5-diazabicyclo[5.4.0]undec-5-ene (DBU) in the presence of an inert organic solvent such as xylene or toluene to give the crude imidazopyrroloquinolinedione of formula (XXXVII). The reaction mixture is heated to a temperature between 100°C and 150°C, and water removed from the reaction mixture using a Dean-Stark water separator. At least one equivalent of alcohol R₃OH represented by formula (V); wherein R₃ is a substituent as described above, but excluding hydrogen and salt-forming cations, is then added to the reaction mixture, and the thus prepared mixture heated to reflux at a temperature between 100°C and 150°C to yield the formula (XXXVI) ester. The reaction may be graphically illustrated as follows:



wherein R₁, R₂, R₃, X, L, M, Q and R₇ are as described above.

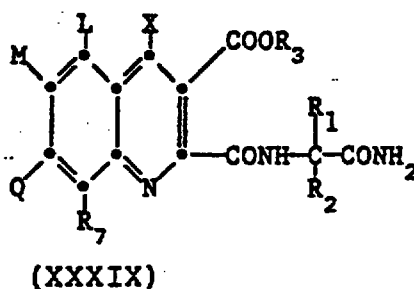
27

The formula (XXXVI) 2-(2-imidazolin-2-yl)quinoline-carboxylate esters can also be prepared by cyclization of a carbamoyl quinolinecarboxylate ester, represented by formula (XXXIX), with phosphorus pentachloride at an elevated temperature between about 60°C and 100°C. The reaction is generally conducted in the presence of an inert organic solvent, such as toluene or benzene, and yields the hydrochloride salt of the formula (XXXVI) 2-(2-imidazolin-2-yl)quinolinecarboxylate ester. Treatment of the thus formed hydrohalide salt with base, such as sodium or potassium carbonate, then yields the formula (XXXVI) 2-(2-imidazolin-2-yl)quinolinecarboxylate ester. The carbamoyl quinolinecarboxylate ester, formula (XXXIX), used in the above reaction may be shown as follows:



wherein R_3 is a substituent as described above, but excluding hydrogen or a salt-forming cation and R_1 , R_2 , X , L , M , Q and R_7 are as described above.

The 2-(2-imidazolin-2-yl)quinolinecarboxylate esters of formula (XXXVI) are also formed by cyclization of the carbamoyl quinolinecarboxylate esters represented by formula (XXXIX), and having the structure:



wherein R_3 is as described above excepting that hydrogen and salt-forming cations are excluded and R_1 , R_2 , X , L , M , Q and R_7 are as described above. Cyclization of the carbamoyl quinolinecarboxylate ester is achieved by reaction thereof with a mixture of phosphorus pentachloride and phosphorus oxychloride. The reaction mixture is stirred for several hours at a temperature between about 15°C and 35°C, and the $POCl_3$ then removed *in vacuo*. The residue from this treatment is dispersed in an organic solvent such as toluene. The solvent is then separated from the resulting mixture, and the remaining residue dispersed in water heated to between 80°C and 100°C. After cooling, the pH of the aqueous mixture is adjusted to 5–6 with sodium or potassium bicarbonate, and the product extracted into methylene chloride to give the 2-(2-imidazolin-2-yl)quinolinecarboxylate ester, formula (XXXVI).

The formula (XXXVI) quinoline ester in which R_3 is as described above, but excluding hydrogen or salt-forming cations, and R_1 , R_2 , X , L , M , Q and R_7 are as described above, is readily converted to its corresponding acid addition salt by reaction of said ester with at least one equivalent of a strong acid. Strong mineral acids such as hydrochloric acid, sulfuric acid, and hydrobromic acid are employed although organic acids may also be used. In practice, it is also found that the reaction proceeds most satisfactorily when conducted in the presence of an inert organic solvent such as ether, chloroform, methylene chloride, or mixtures thereof. Sulfuric acid salts are generally prepared by this procedure, but substituting a lower aliphatic alcohol for the above-mentioned solvents.

Preparation of the formula (II) 2-(2-imidazolin-2-yl)quinoline derivatives wherein A is $COOH$: B is hydrogen; W is oxygen and R_1 , R_2 , X , L , M , Q and R_7 are as defined, with the proviso that X , L , M , Q and R_7 are not halogen or nitro, can be achieved by hydrogenolysis of the benzyl ester of the formula (XXXVI) 2-(2-imidazolin-2-yl)quinolinecarboxylate. The reaction involves dispersion of the benzyl ester in an organic solvent, such as described above for the hydrogenolysis of the formula (XV) benzyl ester in the 2-(2-imidazolin-2-yl)pyridine series, and treatment of the thus-prepared reaction mixture with hydrogen gas in the presence of a catalyst such as palladium or platinum on a carbon carrier. The hydrogenolysis is generally carried out at a temperature between about 20°C and 50°C.

The acids of the formula (II) 2-(2-imidazolin-2-yl)quinoline derivatives in which A is $COOH$; B is hydrogen; W is oxygen and R_1 , R_2 , X , L , M , Q and R_7 are as described above, are also prepared by reaction of a formula (XXXVI) ester, in which R_3 is a substituent as described above, but excluding hydrogen and

salt-forming cations and R_1 , R_2 , X, L, M, Q and R_7 are as described, with at least one equivalent of strong aqueous base, such as an aqueous solution of an alkali metal hydroxide, at a temperature between 20°C and 50°C. The mixture is cooled and then adjusted to pH 6.5 to 7.5 with a strong mineral acid. Such treatment yields the desired acid.

Preparation of the formula (II) 2-(2-imidazolin-2-yl)quinoline derivatives in which A is COOR_3 ; R_3 is a salt-forming cation; B is hydrogen; W is oxygen and R_1 , R_2 , L, M, Q and R_7 are as described above, can be prepared by dissolving an acid, represented by formula (II) wherein A is COOH ; B is hydrogen; W is oxygen and R_1 , R_2 , L, M, Q and R_7 are as described above, in an appropriate solvent and treating the thus prepared mixture with at least one equivalent of a salt-forming cation. The reaction is essentially the same as described for the preparation of the formula (I) pyridines in which A is COOR_3 and R_3 is a salt-forming cation.

It should also be understood that the imidazoliny quinolinecarboxylic acids and esters depicted by formula (II) in which B is H may be tautomeric.

It should also be understood that when R_1 and R_2 represent different substituents on the formula (II) 2-(2-imidazolin-2-yl)quinoline derivatives and the formula (XXXVII) imidazopyrroloquinolinediones, the carbon to which R_1 and R_2 are attached is an asymmetric center, and the products (as well as their intermediates) exist in *d*- and *l*- forms as well as *d*/*l* forms.

Cyclization of the formula (XXXVIII) imidazopyrroloquinoline acetamide yields the tetacyclic formula (XXXVII) and the formula (XXXVIIa) imidazopyrroloquinolinediones which are intermediates for the formula (II) 2-(2-imidazolin-2-yl)quinolinecarboxylate acids and esters.

The product of this reaction is predominately the desired imidazopyrroloquinolinedione together with a small amount of the formula (XXXVIIa) isomer. Treatment of the isomeric mixture with an alkali metal alkoxide gives substantially isomerically pure quinolinecarboxylate product.

The cyclization reaction is preferably conducted at a temperature of from 80°C to 150°C in the presence of a base such as sodium or potassium hydride or an acid such as an aromatic sulfonic acid and a solvent which will form an azeotropic mixture with water, permitting virtually immediate removal thereof from the reaction mixture as it is formed. Among the solvents which may be employed are toluene, benzene, xylenes and cyclohexane. Bases which may be used include alkali metal hydroxides, alkali metal hydrides, alkali metal oxides, tertiary amines such as diisopropyl ethylamine, 1,5-diazabicyclo[3.4]nonene-5,1,5-diazobicyclo[5.4.0]undecene-5,1,4-diazabicyclo[2.2.2]octane, tetramethylguanidine, potassium fluoride and quaternary ammonium hydroxide, such as trimethylbenzyl ammonium hydroxide and strongly basic ion exchange resins.

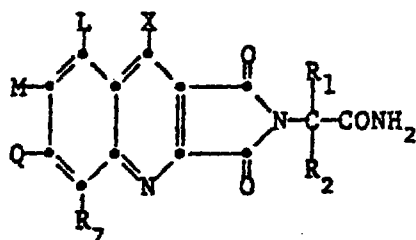
Finally, acidic reagents which can be employed herein include aromatic sulfonic acids, such as *p*-toluenesulfonic acid, β -naphthalenesulfonic acid and naphthalenedisulfonic acid.

The reactions are graphically illustrated in Flow Diagram IV.

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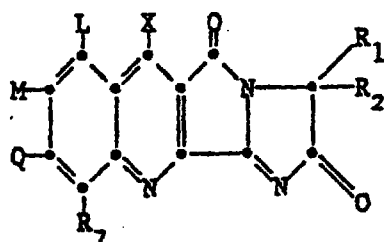
FLOW DIAGRAM IV

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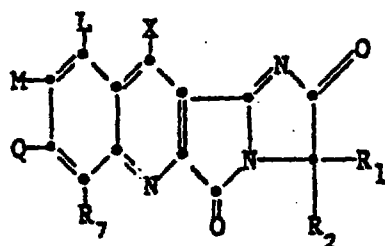
(XXXVIII)

Base or Acid



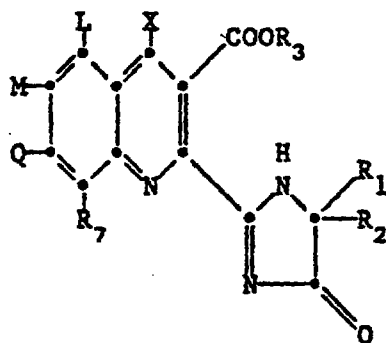
(XXXVII)

+



(XXXVIIa)

R₃O—alkali metal

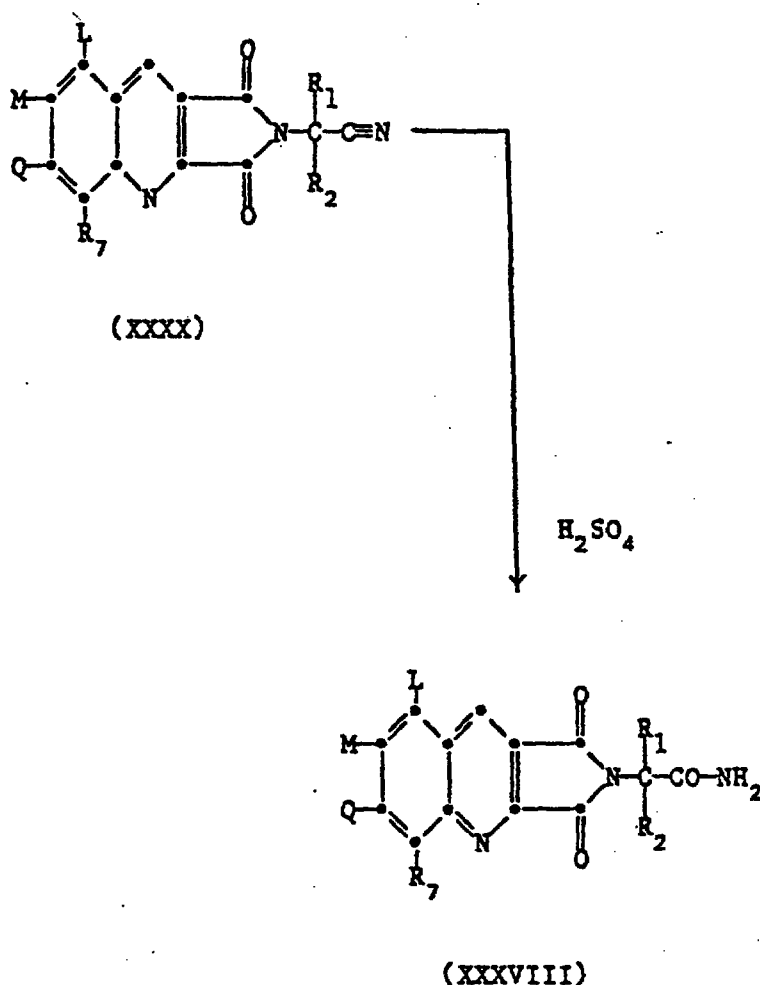


(XXXVI)

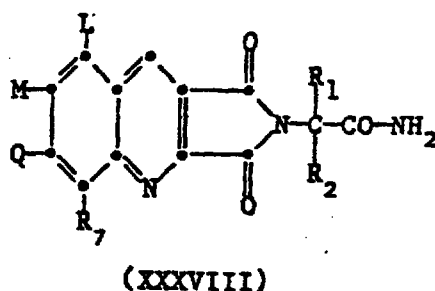
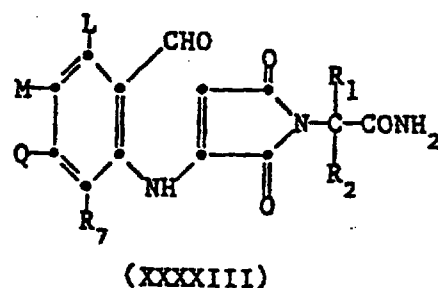
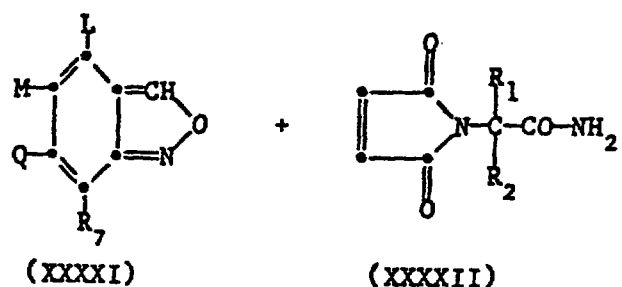
Several routes are employed to prepare pyrroloquinoline acetamides represented by formula (XXXVIII). Preferably hydration of the pyrroloquinoline acetonitrile of formula (XXXX) is accomplished by treatment with a strong acid such as sulfuric acid. This reaction yields the formula (XXXVIII) pyrroloquinoline acetamide. Although the addition of a non-miscible solvent such as methylene chloride or chloroform is not essential to the conduct of the above described reaction, addition of such a solvent to the reaction mixture may be preferred. Said reaction is usually carried out at a temperature between 10°C to 70°C.

Alternatively, the pyrroloquinoline acetamide of formula (XXXVIII) may be obtained by the Diels-Alder cycloaddition reaction between substituted anthranils of formula (XXXXI) and the dioxopyrroline acetamide of formula (XXXXII). These reactions are carried out in a wide temperature range: below 130°C significant amounts of the intermediate aldehyde of formula (XXXXIII) are obtained, but at 130°C — 200°C the pyrroloquinoline acetamide of formula (XXXVIII) is formed. Alternatively, the intermediate aldehyde of formula (XXXXIII) may be isolated and cyclized in refluxing xylene in the presence of an acid catalyst, such as *p*-toluene sulfonic acid. This reaction yields the desired formula (XXXVIII) pyrroloquinoline acetamide. These reactions may be graphically illustrated as shown below on Flow Diagram V.

FLOW DIAGRAM V



FLOW DIAGRAM V (CONTINUED)



A variety of routes may also be employed to obtain the formula (XXXX) pyrroloquinoline acetonitriles depending on the nature of L, M, Q and R₇ substituents.

The formula (XXXX) pyrroloquinoline acetonitriles may be prepared by reacting the appropriately substituted anhydride (XXXXIV) with an appropriately substituted α-aminocarbonitrile of formula (XVII), to yield a mixture of the monoamides of the formula (XXXXVa) and formula (XXXXV b) acids.

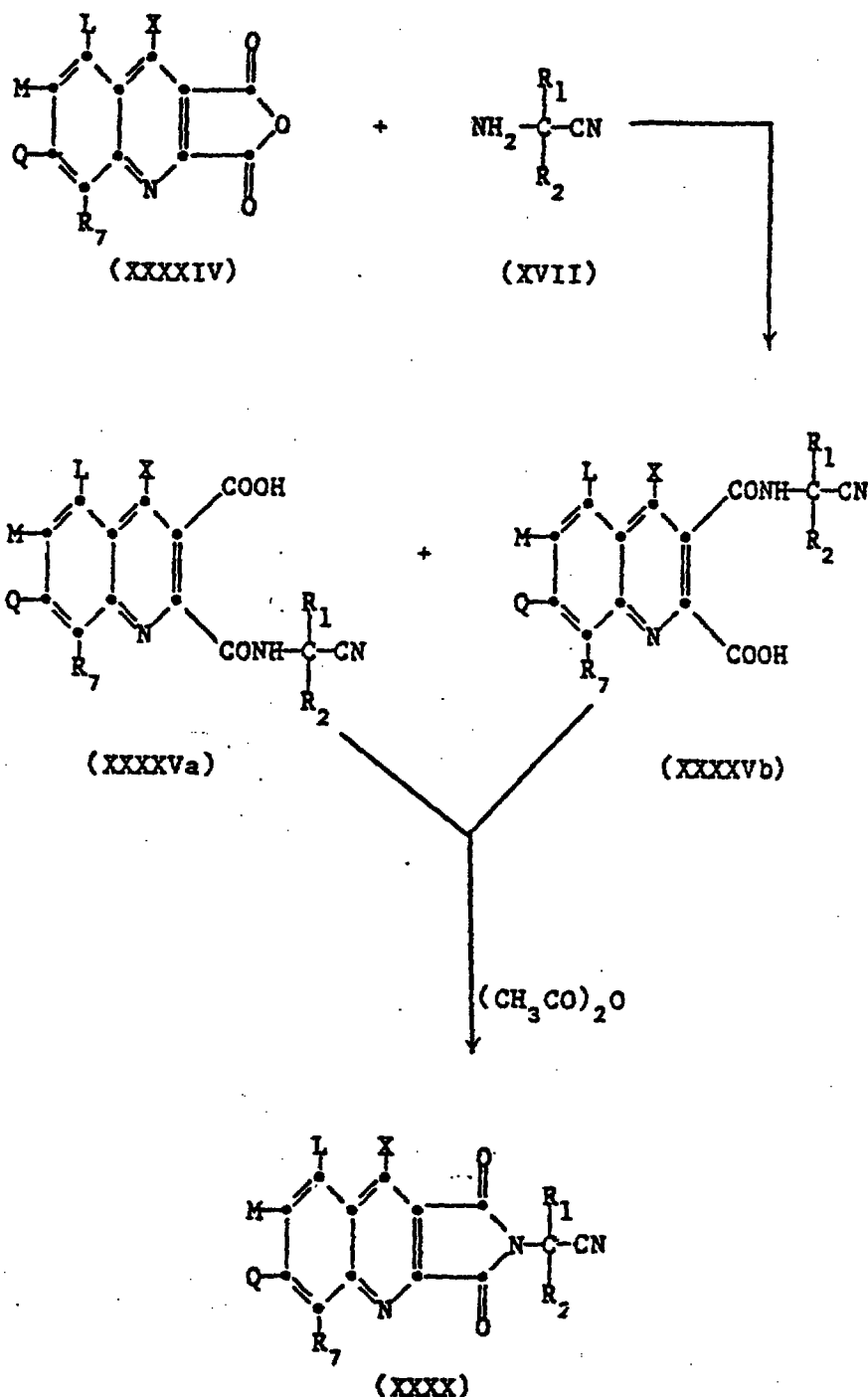
This reaction is carried out at a temperature between 20°C and 70°C and preferably between about 35°C and 40°C in an inert solvent, such as tetrahydrofuran, methylene chloride, ether, chloroform or toluene. The thus-formed acids are then cyclized to the corresponding pyrroloquinoline acetonitrile, depicted by formula (XXXX). This is accomplished by heating the reaction mixture to a temperature between about 75°C and 150°C with an excess of acetic anhydride in the presence of a catalytic amount of sodium acetate or potassium acetate.

In general, the above reaction is carried out by treating the reaction mixture with acetic anhydride, acetyl chloride, thionyl chloride or the like, and heating said mixture to a temperature between about 20°C and

(32)

100°C. The above reactions are illustrated graphically on Flow Diagram VI below, wherein R_1 , R_2 , X, L, M, Q and R_7 are as defined above.

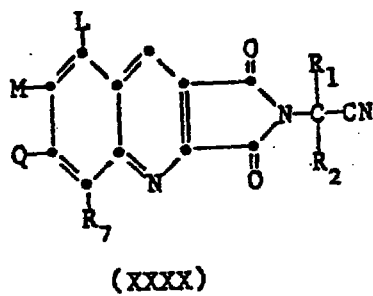
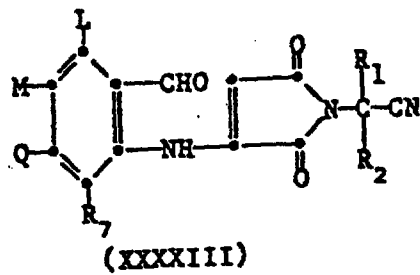
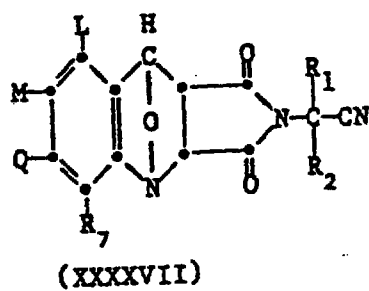
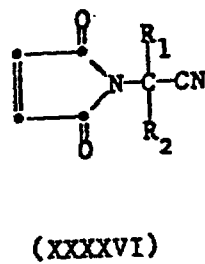
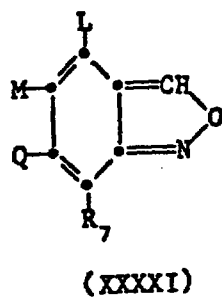
FLOW DIAGRAM VI



A preferred route to pyrroloquinoline acetonitrile of formula (XXXX) is the Diels-Alder thermal cycloaddition reaction of an appropriately substituted maleimide of formula (XXXXVI) with an appropriately substituted anthranil. In this route X must be hydrogen.

The outcome of this reaction is dependent upon the reaction temperature. Intermediate of formula (XXXXVII) is obtained at ~55°C. As the reaction mixture is heated further, to temperatures between 55°C and 130°C, the intermediate of formula (XXXXVIII) aldehyde is obtained. If the reaction is conducted in the presence of an aprotic solvent such as *o*-dichlorobenzene, and the reaction mixture heated to between 140°C and 200°C, the reaction yields the pyrroloquinoline acetonitrile of formula (XXXX). The reaction is illustrated on Flow Diagram VII below.

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FLOW DIAGRAM VII



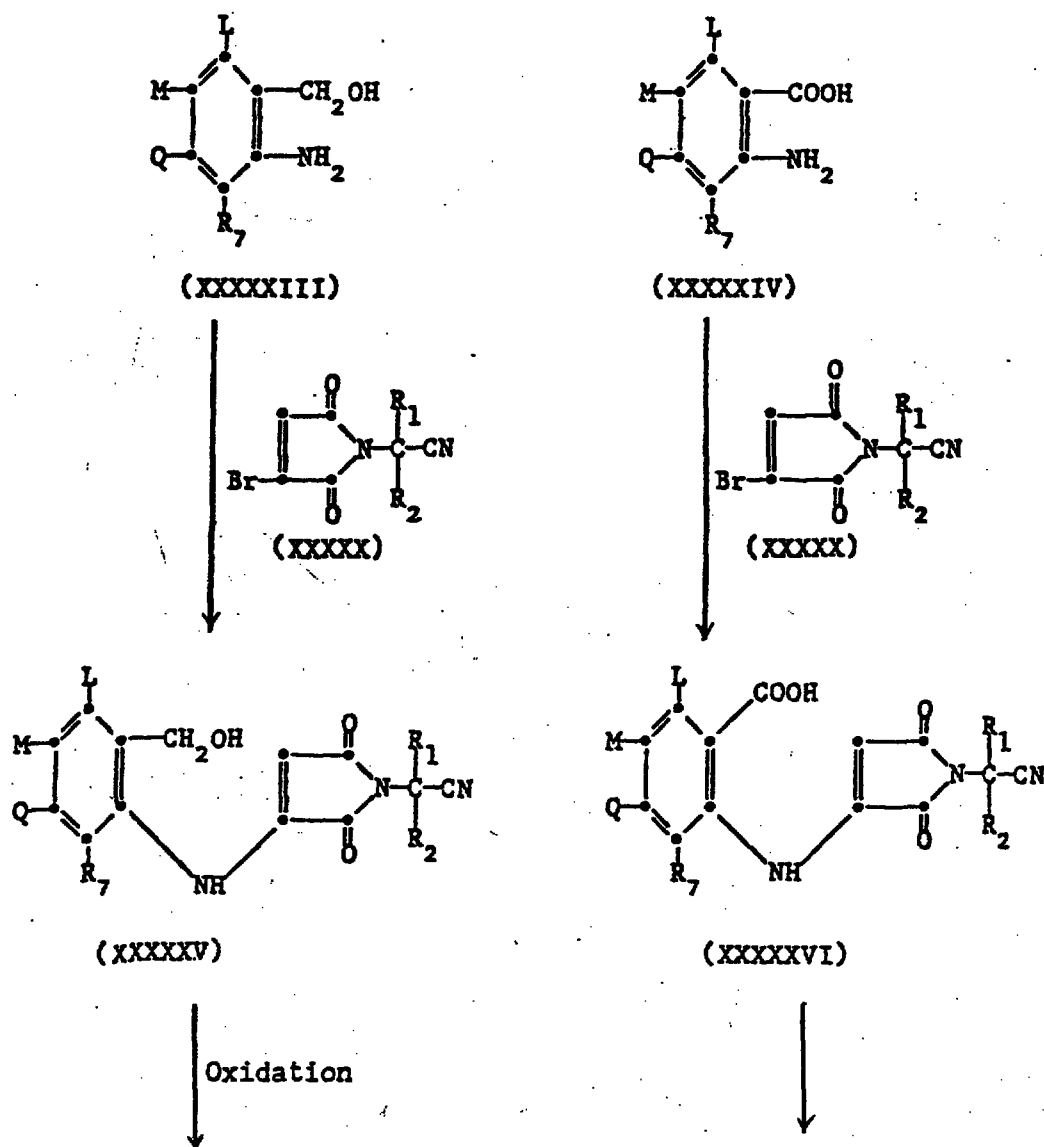
Compounds of formula (XXXX) bearing electron donor substitution on the L, M, Q and R₇ positions, such as alkyl, alkoxy, alkylthio, dialkylamino, hydroxy and a single halogen may be prepared by reaction of an appropriately substituted *o*-aminobenzyl alcohol of formula (XXXXXIII) or anthranilic acid of formula (XXXXXIV) with a bromo (or chloro) maleimide of formula (XXXXX).

This reaction is conducted in the presence of aprotic solvent, such as isopropyl or *t*-butylalcohol at 0°C to 30°C to yield respectively, the hydroxymethylanilinomaleimide of formula (XXXXXV) or dioxopyrrolinyl anthranilic acid of formula (XXXXXVI). A variety of base acceptors can be employed in the above reactions, e.g., alkaline earth metal hydroxides, such as Ba(OH)₂, BaO or sodium acetate. However, the reactions in many instances proceed satisfactorily without the aid of the base acceptor.

Oxidation of the formula (XXXXXV) alcohol to the formula (XXXXXIII) aldehyde may be accomplished using a wide variety of oxidizing agents exemplified by pyridiniumchlorochromate in methylene chloride or activated manganese dioxide in *t*-butanol. Cyclization of the aldehyde of formula (XXXXXIII) to the pyrroloquinoline acetonitrile of formula (XXXX) is achieved by one of the methods described above, such as heating said aldehyde to between 140°C and 200°C in the presence of an aprotic solvent.

Cyclization of the *o*-anilino-carboxylic acid of formula (XXXXXVI) the acetoxypyridine of formula (XXXXXVII) is accomplished with acetic anhydride, triethylamine and 4-dimethylaminopyridine at ambient temperatures. Mild reductive elimination gives the pyrroloquinoline acetonitrile of formula (XXXX). Hydrolysis in warm aqueous acetic acid gives formula (XXXX) where X=OH, further reaction with phosphorus oxychloride and pyridine affords compounds where X is chlorine. These reactions are illustrated in Flow Diagram VIII below.

FLOW DIAGRAM VIII



FLOW DIAGRAM VIII (CONTINUED)

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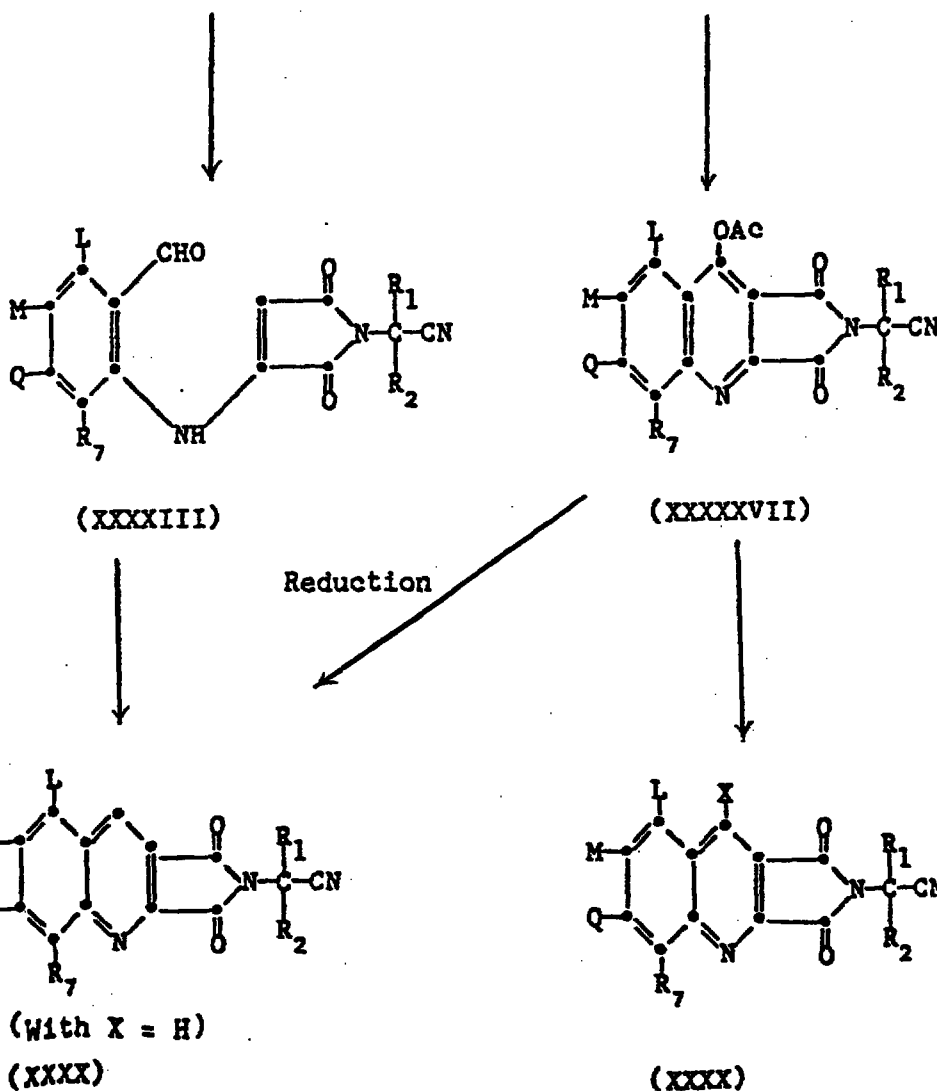
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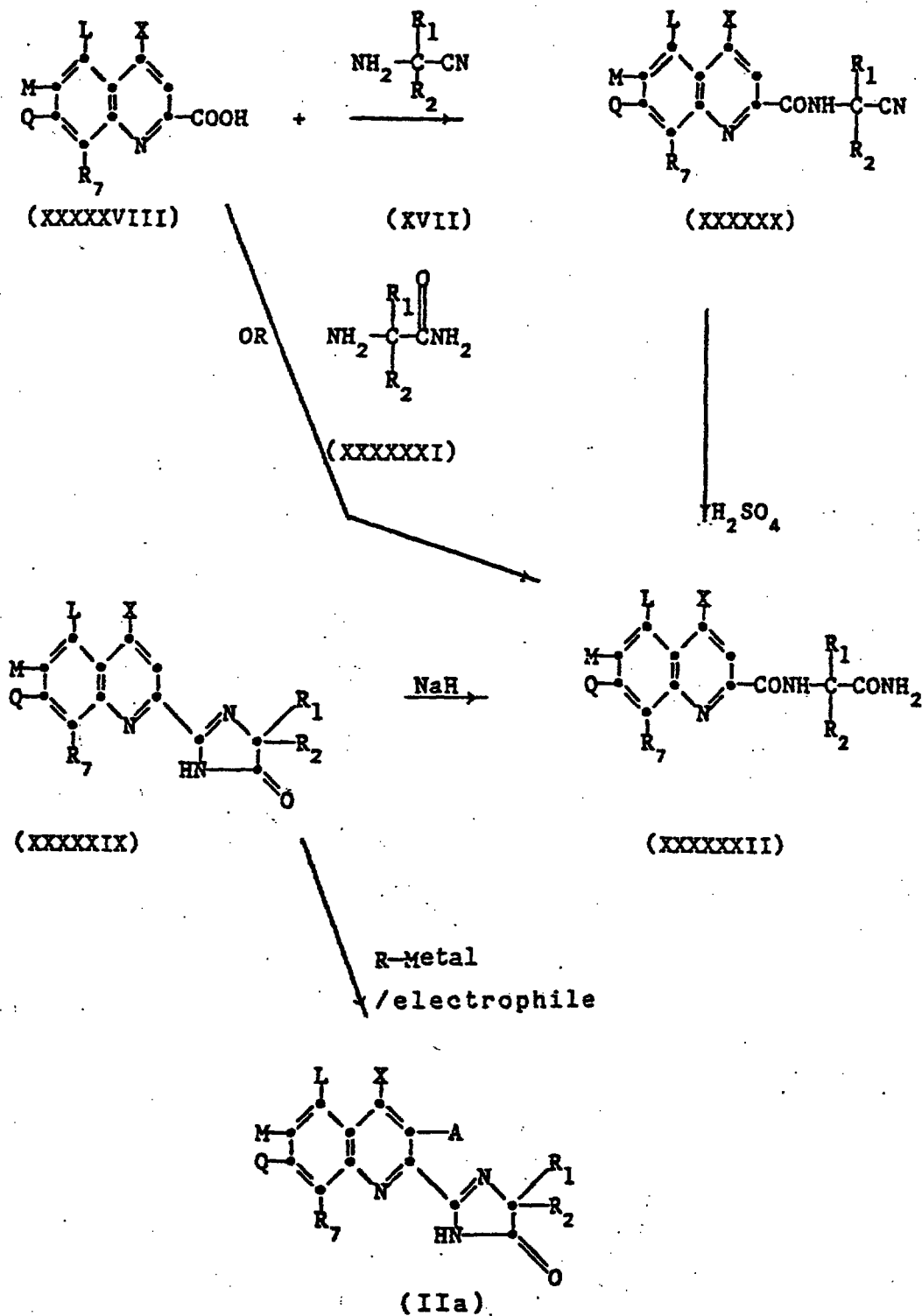
Another route to the 2-(2-imidazolin-2-yl)quinoline compounds of formula (II), particularly useful in synthesizing analogs in which the A group is varied, employs the 2-(2-imidazolin-2-yl)quinoline of formula (XXXXXIX). This intermediate is prepared from quinolinecarboxylic acid of formula (XXXXXVIII) which is converted to the acid chloride or anhydride and then reacted with either an appropriately substituted α -aminocarbonitrile of formula (XVII) to give the formula (XXXXXX) nitrile, or with the aminoamide of formula (XXXXXXI) to give the carboxamidoamide of formula (XXXXXXII). Cyclization of said carboxamidoamide is accomplished by the previously discussed procedures, although cyclization with sodium hydride in the presence of xylene is preferred. Introduction of a variety of groups, A, is made possible by treatment of the 2-(2-imidazolin-2-yl)quinoline of formula (XXXXXIX) with metallating reagents. Most organo metallic agents have some effect when two moles are used with the formation of a dianion, but the yield and reaction composition is dependent upon the nature of the organometallic reagent, reaction solvent, reaction temperature and the electrophile used to quench the reaction. In practice organometallic reagents such as alkyl lithiums are preferred and anion formation is obtained with methyl, *n*-butyl, *sec*-butyl and *tert*-butyl lithium. Phenyl lithium and lithium diisopropylamide may also be employed. Solvents must be aprotic and diethylether is preferred. Reaction temperatures employed to form the dianion range from -78°C to 0°C with -30°C to -10°C preferred. Quenching with an electrophile is usually accomplished at -78°C to $+20^{\circ}\text{C}$. If necessary, this is followed by acid treatment. All reactions are run under an inert atmosphere. Examples of reactive electrophiles include: CO_2 , ClCO_2CH_3 , $(\text{CH}_3)_2\text{NCHO}$, CH_3HCO , $\text{C}_6\text{H}_5\text{CHO}$, CH_3I . The corresponding values for A in formula (IIa) are COOH , COOCH_3 , CHO , $\text{CH}(\text{OH})\text{CH}_3$, $\text{CH}(\text{OH})\text{C}_6\text{H}_5$, CH_3 . Furthermore, following the quenching of the electrophile, the products may be modified. Thus the aldehyde ($\text{A}=\text{CHO}$) prepared from a DMF quench, reacts with hydroxylamine to afford an oxime. The above route is also useful for the synthesis of $\text{A}=\text{COOH}$ compounds by treatment of the dianion with carbon dioxide.

Not all X, L, M, Q and R₇ substituents are compatible with this organometallic process. Thus, if the above mentioned substituents are Br, I or sometimes fluorine, competitive loss of these groups occurs as well as replacement of the 3-proton of quinoline. Chlorine, however, is compatible with this process. When L, M, Q or R₇ is methoxy competitive anion formation can occur ortho to the methoxy group.

When X, L, M, Q and R₇ end with an hydroxyl group this can be protected by first forming a blocking group by reacting the compound with for example *t*-butyldimethylsilyl chloride.

The above-described reactions are graphically illustrated on Flow Diagram IX below.

FLOW DIAGRAM IX



Several functional groups, A, are prepared by an alternative approach. Thus reaction of the imidazopyrroloquinolinedione of formula (XXXVII) with R_3OM^+ affords the 2-(2-imidazolin-2-yl)quinoline esters of formula (XXXVI). In the case of formula (II) compounds in which A is the $CONHCH_2CH_2OH$ group, this may be cyclized to the oxazoline group via reaction of the above-identified compound with triethylphosphite in refluxing xylene. Formula (II) derivatives, in which A is $-CONH_2$, may be converted to the corresponding cyano derivative, i.e., $A=CN$, by dehydration of the $-CONH_2$ function.

The majority of compounds containing L, M, Q and R_7 , substituents may be prepared by the procedures previously outlined; however, amino, alkylamino, and dialkylamino compounds are conveniently formed by reductive alkylation of the appropriate nitro substituent in the L, M, Q or R_7 position. Alkylsulfonyl compounds are most readily formed by mild oxidation of the alkylsulfonyl group in the L, M, Q or R_7 position at $0^\circ C-20^\circ C$ using *m*-chloroperbenzoic acid. Under these conditions, N-oxidation of the quinoline nitrogen is minimized.

Oxidation of the quinoline to the N-oxide can be accomplished by prior N-protection of the imidazolone ring with, e.g., a $COCH_3$ group; N-oxidation can now be accomplished with peracetic acid or trifluoroperacetic acid, at elevated temperatures, if necessary.

The formula (I) and formula (II) 2-(2-imidazolin-2-yl)pyridines and 2-(2-imidazolin-2-yl)quinolines and the formula (III), formula IV and formula (XXXVII) imidazopyrrolopyridinediones and imidazopyrroloquinolinediones of the present invention are exceedingly effective herbicidal agents useful for the control of an exceptionally wide variety of herbaceous and woody annual and perennial monocotyledonous and dicotyledonous plants. Moreover, these compounds are herbicidally effective for controlling weeds indigenous to both dry land and wet land areas. They are also useful as aquatic herbicides and are unique in their effectiveness in controlling the above-said plants when applied to the foliage thereof or to soil or water containing seeds or other propagating organs of said plants such as tubers, rhizomes or stolons, at rates of from about 0.016 to 4.0 kg/ha, and preferably at rates from about 0.032 to 2.0 kg/ha.

It is of course, obvious that rates of application above the 4.0 kg/ha level can also be used to effectively kill undesirable plants species; however, rates of application of toxicant above the level necessary to kill the undesirable plants should be avoided since application of excessive amounts of toxicant is costly and serves no useful function in the environment.

Among the plants which may be controlled with the compounds of this invention are: *Elatine triandra*, *Sagittaria pygmaea*, *Scirpus hotarui*, *Cyperus serotinus*, *Elcipta alba*, *Cyperus difformis*, *Rotala indica*, *Lindernia pyridoria*, *Echinochloa crus-galli*, *Digitaria sanguinalis*, *Setaria viridis*, *Cyperus rotundus*, *Convolvulus arvensis*, *Agropyron repens*, *Datura stramonium*, *Alopecurus myosuroides*, *Ipomoea spp.*, *Sidda spinosa*, *Ambrosia artemisiifolia*, *Eichhornia crassipes*, *Xanthium pensylvanicum*, *Sesbania exaltata*, *Avena fatua*, *Abutilon theophrasti*, *Bromus tectorum*, *Sorghum halepense*, *Lolium spp.*, *Panicum dichotomiflorum*, *Matricaria spp.*, *Amaranthus retroflexus*, *Cirsium arvense*, and *Rumex japonicus*.

Surprisingly, it has now been found that some of the formula (I) and formula (II) compounds of the invention are selective herbicides when applied to the foliage of plants or to soil containing seeds of said plants at relatively low rates of application, i.e., at from 0.016 to about 2.0 kg per hectare, depending on the compound used and crop treated.

In practice, it has been found that generally the formula (I) 2-(2-imidazolin-2-yl)pyridines are best suited for use as broad spectrum herbicides, whether employed preemergence or post-emergence to the locus in which weed control is desired. This is not to say, however, that all of the formula (I) pyridines are non-selective. Actually, some of the 2-(2-imidazolin-2-yl)pyridines, particularly the five substituted formula (I) and formula (Ia), pyridines are selective in leguminous crops, particularly crops such as soybeans. Similarly, it has been found that the formula (I) and (II) 2-(2-imidazolin-2-yl)quinolines are generally selective herbicides, particularly effective for controlling undesirable weeds in the presence of leguminous crops such as soybeans. However, certain of the formula (I) and formula (II) compounds are less selective than others in this series.

It has also been found that several of the formula (I) and formula (II) 2-(2-imidazolin-2-yl)pyridines and 2-(2-imidazolin-2-yl)quinolines are effective as defoliants for cotton when applied at rates of application between about 0.016 to 4.0 kg/hectare. The compound is applied approximately 5 to 15 days prior to the anticipated harvest. At rates of application not exceeding about 0.01 kg per hectare, it has also been found that certain of the formula (I) and formula (II) pyridines and quinolines are effective for increasing branching of leguminous crops and affecting early maturation of grains.

The formula (XI) pyrrolopyridine acetonitriles, formula (IV) pyrrolopyridine acetamides formula (XXXX) pyrroloquinoline acetonitriles and formula (XXXVIII) pyrroloquinoline acetamides are useful as intermediates for the preparation of the above-mentioned herbicidal formula (I) and formula (II) 2-(2-imidazolin-2-yl)pyridines and quinolines and the herbicidal formula (III) and formula (XXXVII) imidazopyrrolopyridinediones and imidazopyrroloquinolinediones.

Since the formula (I) and formula (II) imidazolinylpyridine and quinoline derivatives, wherein R_3 is a salt-forming cation, are water soluble, these compounds can simply be dispersed in water and applied as a dilute aqueous spray to the foliage of plants or to soil containing propagating organs thereof. These salts also lend themselves to formulation as flowable concentrates.

The formula (I) and formula (II) 2-(2-imidazolin-2-yl)pyridines and quinolines and the formula (III) and

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formula (XXXVII) imidazopyrrolopyridinediones and imidazopyrroloquinolinediones, can also be formulated as wettable powders, flow concentrates, emulsifiable concentrates, granular formulations and the like.

Wettable powders can be prepared by grinding together about 20% to 45% by weight of a finely divided solid inert carrier such as kaolin, bentonite, diatomaceous earth or attapulgite, 45% to 80% by weight of the active compound of structures a, b, c, d, e of claim 1, 2% to 5% by weight of a dispersing agent such as sodium lignosulfonate, and 2% to 5% by weight of a surface active agent, notably a nonionic surfactant, such as octylphenoxy polyethoxy ethanol, nonylphenoxy polyethoxy ethanol or the like.

10 A typical flowable liquid can be prepared by admixing about 40% by weight of a active ingredient with about 2% by weight of a gelling agent such as bentonite, 3% by weight of a dispersing agent such as sodium lignosulfonate, 1% by weight of polyethylene glycol and 54% by weight of water.

15 A typical emulsifiable concentrate can be prepared by dissolving about 5% to 25% by weight of the active ingredient of structures a, b, c, d, e of claim 1 in about 65% to 90% by weight of an inert organic solvent, notably N-methylpyrrolidone, isophorone, butyl cellosolv, methylacetate or the like and dispersing therein about 5% to 10% by weight of a surface active agent, notably a nonionic surfactant such as an alkylphenoxy polyethoxy alcohol. This concentrate is dispersed in water for application as a liquid spray.

20 When the compounds of the invention are to be used as herbicides where soil treatments are involved, the compounds may be prepared and applied as granular products. Preparation of the granular product can be achieved by dissolving the active compound in a solvent such as methylene chloride, N-methylpyrrolidone or the like and spraying the thus prepared solution on a granular carrier such as corncob grits, sand, attapulgite or kaolin.

The granular product thus prepared generally comprises about 3% to 20% by weight of the active ingredient of structures a, b, c, d, e of claim 1 and about 97% to 80% by weight of an inert granular carrier.

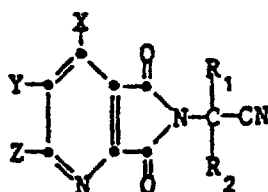
25 In order to facilitate a further understanding of the invention, the following examples are presented primarily for the purpose of illustrating certain more specific details thereof. Unless otherwise noted, all parts are by weight.

Example 1

Preparation of 5,7-Dihydro- α -isopropyl- α -methyl-5,7-dioxo-6H-pyrrolo[3,4-b]pyridine-6-acetonitrile

30 To a stirred solution containing 212 g quinolinic anhydride in 950 ml methylene chloride is added at a moderate rate 167 g of 2-amino-2,3-dimethylbutyronitrile. The mixture had reached the boiling point of the solution after about one quarter of the aminonitrile had been added and the rate of addition is adjusted to maintain this temperature. After the addition the solution is heated under reflux for a further 4 hours. The solution is cooled, filtered and concentrated to a thick oil. This oil is dissolved in 950 ml acetic anhydride, 35 6 g anhydrous sodium acetate added and the mixture distilled until the vapor temperature reached 118°C when the heating was continued under reflux for 3 hours. The mixture is concentrated *in vacuo* the residue dissolved in 500 ml toluene and again concentrated. This is repeated. The residue is slurried with a mixture of ether and hexane and the crude product which crystallizes collected (349 g). This is dissolved in 700 ml methylene chloride and filtered through a column containing 700 g silica gel and the product eluted with 40 methylene chloride. Concentration of the eluant gave 258 g of the desired product. An analytically pure sample with mp 95—96°C can be obtained by the recrystallization of the product from ether-methylene chloride.

Using the appropriate amino nitrile and quinolinic anhydride in the above procedure, the following pyrrolopyridines are prepared:



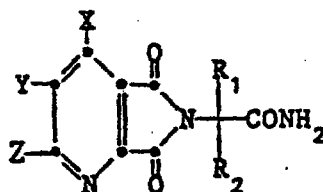
	R ₁	R ₂	X	Y	Z	mp°C
15	CH ₃	CH ₃	H	H	H	119—123
	CH ₃	C ₂ H ₅	H	H	H	95—97
	CH ₃		H	H	H	69—73
20	CH ₃	CH ₂ CH(CH(CH ₃) ₂)	H	H	H	oil
	—(CH ₂) ₅ —		H	H	H	85—87
25	C ₂ H ₅	C ₂ H ₅	H	H	H	71—72.5
	CH ₃	CH(CH ₃) ₂	CH ₃	H	H	129.5—131.3
	CH ₃	CH(CH ₃) ₂	H	H	OCH ₃	108—110
30	CH ₃	CH(CH ₃) ₂	H	H	Cl	94—96

Example 2

35 Preparation of 5,7-Dihydro- α -isopropyl- α -methyl-5,7-dioxo-6H-pyrrolo[3,4-b]pyridine-6-acetamide

To 330 ml concentrated sulfuric acid is added portion wise with thorough stirring 298 g finely divided nitrile so that the temperature did not go about 72°C. After the addition the temperature is adjusted to 60—65°C and maintained there for 1 1/2 hours. The mixture is cooled, quenched with ice and finally diluted with approximately 4 liters. After adding 454 g sodium acetate and cooling at 0°C for 2 hours the mixture is filtered, the solids collected and washed twice with 500 ml water containing sodium acetate followed by water to remove all the sulfuric acid. The solid is dried to give 289 g of product, mp 176—178°C. Material made in a similar way and analytically pure had mp 188—190°C.

Employing the appropriate pyrrolopyridineacetronitrile in the above procedure, the following pyrrolopyridineacetamides are prepared.



	R ₁	R ₂	X	Y	Z	mp°C
55	CH ₃	CH ₃	H	H	H	203—5
	CH ₃	C ₂ H ₅	H	H	H	158—161
60	CH ₃		H	H	H	195—198

Example 3

Preparation of 3-Isopropyl-3-methyl-5H-imidazo[1',2':,1,2]pyrrolo[3,4,b]pyridine-2-(3H), 5-dione

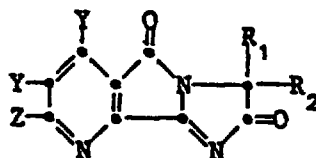
A mixture of 50 g amide and 450 ml toluene is heated under a Dean-Stark water separator to remove traces of water. To the cooled mixture is added 10.1 g of a 50% suspension of sodium hydride in mineral oil

and the mixture heated under reflux for 23 hours. The hot solution is filtered, concentrated *in vacuo* where upon the residue is crystallized. The mineral oil is removed by decantation and the solid washed with hexanes and dried *in vacuo* to give 45.5 g product which, by nmr analysis, is approximately 90% the desired isomer II and 10% the undesired isomer IIa.

A pure sample of isomer II can be obtained by recrystallizing the crude product from hexane-methylene chloride mp 107—115°C.

The cyclisation can be achieved by either the basic reagent sodium and potassium hydroxide, or the acidic reagent *p*-toluenesulfonic acid in a toluene solvent. It should be understood that a mixture of products corresponding to Structures II and IIa above is obtained and in general these are not purified but used directly for the preparation of the derived nicotinic acid esters.

Employing the appropriate pyrrolopyridine carboxamide, the following imidazopyrrolopyridines are prepared.



R ₁	R ₂	X	Y	Z	mp°C
CH ₃	CH	h	H	H	
CH ₃	C ₂ H ₅	H	H	H	
CH ₃		H	H	H	
$\text{—CH—CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{—}$ CH ₃		H	H	H	125—130
CH ₃	CH(CH ₃) ₂	H	H	OCH ₃	147—147.5

Example 4

Preparation of 3-Isopropyl-5-H-imidazo[1',2':1,2]pyrrolo[3,4-b]pyridine-2(3H)-5-dione

A mixture containing 52 g of 3-[(1-Carbamoyl-1,2-dimethylpropyl)picolinate, 1.77 ml 1,5-diazabicyclo[5.4.0]-undec-5-ene(DBU) in 400 ml xylene is heated under reflux under a Dean-Stark water separator for 2 hours. The mixture is concentrated *in vacuo* and the residue is chromatographed on 400 g basic alumina. The mixture of desired products is eluted with methylene chloride and used without further purification.

Example 5

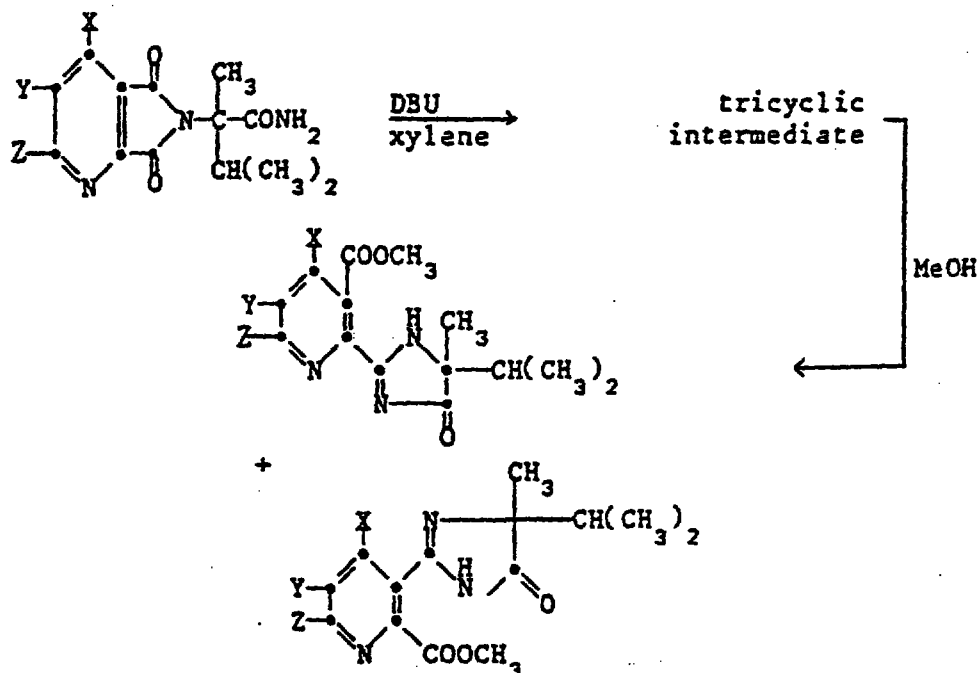
Preparation of Methyl 2-(isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate

To 20 ml dry methanol in which 10 mg sodium hydride had reacted is added 2.0 g of a mixture of the imidazopyrrolopyridines. After stirring for 16 hours, 0.03 g glacial acetic acid is added (to neutralize the base), the solution concentrated *in vacuo* and the residue chromatographed on silica gel in ether. The faster moving material, the desired ester, is obtained in several fractions, combined, concentrated and crystallized from acetonitrile to give the imidazolinyl nicotinate, mp 121—123.5°C. An analytically pure sample crystallized from methylene chloride hexane exhibits a melting point of from 121—122°C.

Example 6

Preparation of Methyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-yl)nicotinate

This method involves the formation of the tricyclic compounds of Example 3 and 4, without isolation, directly forming the nicotinic acid esters:



A mixture of 25 g amide and 1 ml 1,5-diazabicyclo-[5.4.0]undec-5-ene (DBU) in 500 ml xylene is heated under reflux for 1 hour under a Dean-Stark water separator. The mixture is cooled somewhat, the water separator removed, 100 ml anhydrous methanol added and the mixture heated under reflux for 1 hour. The solvents are then removed *in vacuo* and the product isolated by chromatography as described in Example 5 above to give 13.65 g product mp 120–122°C identical to that described in Example 5 above.

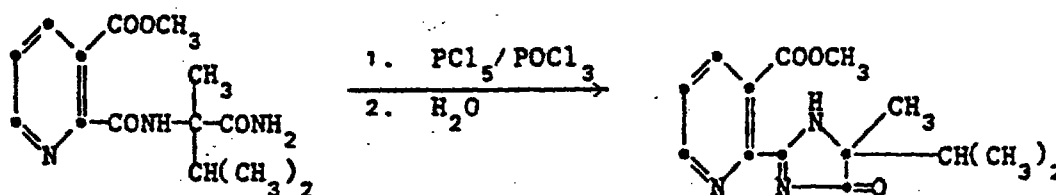
Example 7

Preparation of Methyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate. Method A (Flow Diagram pg.11)

A mixture of 13.65 g of the nicotinate and 9.69 g phosphorus pentachloride in 110 ml dry toluene is heated with stirring to 80°C. After 1 1/2 hours, the thick mixture is cooled, filtered and the solid washed with ether and dried. This is the hydrochloride salt of the desired product.

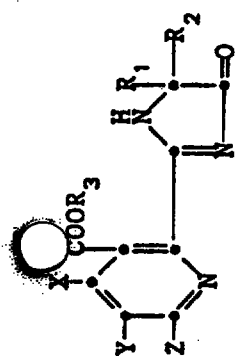
This salt is dissolved in 60 ml water; neutralized with sodium bicarbonate, the resulting precipitate removed by filtration, washed with water and air-dried to give the product identical to that prepared by the procedure of Example 5.

Method B

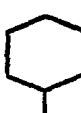


A mixture of 5.0 g nicotinate and 7.1 g phosphorus pentachloride in 40 ml phosphorus oxychloride is stirred at room temperature overnight. The phosphorus oxychloride is removed *in vacuo*, the residue suspended in 40 ml toluene and again concentrated. This is repeated. Water (40 ml) is added to the residue and the mixture heated to reflux and held there for 1 hour. After cooling, the mixture is extracted with methylene chloride, the extract dried and concentrated to give 1.05 g of the desired product. The pH of the aqueous phase from the methylene chloride extraction is adjusted to 5–6 with sodium bicarbonate solution and the mixture extracted again with methylene chloride. The dried extract was concentrated and the residue crystallized to give a further 2.65 g of the desired product identical to that described in Example 5.

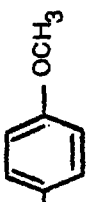
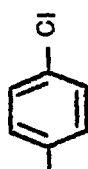
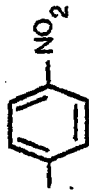
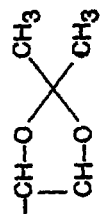
The following nicotinic acid esters are prepared by one or more of the methods described above:



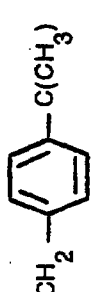
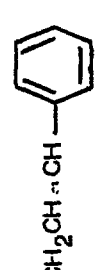
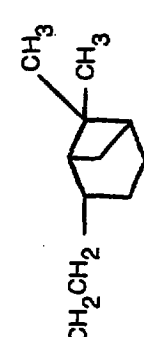
R ₃	R ₁	R ₂	X	Y	Z	mp °C
CH ₃	CH ₃	C ₂ H ₅	H	H	H	126.5 - 128.5
CH ₂ =CH	CH ₃	CH(CH ₃) ₂	H	H	H	104 - 106
CH ₃	-CH-(CH ₂) ₄ - CH ₃		H	H	H	151 - 155.3
CH ₂ C≡CH	-CH-(CH ₂) ₄ - CH ₃		H	H	H	117 - 120
CH ₂ C ₆ H ₅	-CH-(CH ₂) ₄ - CH ₃		H	H	H	148.5 - 151.3
CH ₂ C≡CH	CH ₃	CH ₃	H	H	H	171 - 173
CH ₃	CH ₃	CH ₃	H	H	H	148 - 150
CH ₂ C ₆ H ₅	CH ₃	CH ₃	H	H	H	142 - 144
CH ₂ C ₆ H ₅	CH ₃	C ₂ H ₅	H	H	H	118 - 120
CH ₂ C≡CH	CH ₃	C ₂ H ₅	H	H	H	138 - 140
-C ₁₂ H ₂₅ -n	CH ₃	CH(CH ₃) ₂	H	H	H	55 - 57
-C ₂ H ₅	CH ₃	CH(CH ₃) ₂	H	H	H	72 - 75
CH ₂ CH ₂ OCH ₂ C ₆ H ₅	CH ₃	CH(CH ₃) ₂	H	H	H	90 - 92.5
-CH ₂ - 	CH ₃	CH(CH ₃) ₂	H	H	H	120.5 - 122

R ₃	R ₁	R ₂	X	Y	Z	mp°C
-CH(CH ₃) ₂	CH ₃	CH(CH ₃) ₂	H	H	H	94 - 97.5
-CH ₂ C ₆ H ₅	CH ₃	CH(CH ₃) ₂	H	H	H	122 - 125
-CH ₂ -C≡C-C ₇ H ₁₅ -n	CH ₃	CH(CH ₃) ₂	H	H	H	oil
CH ₂ CH ₂ OCH ₃	CH ₃	CH(CH ₃) ₂	H	H	H	60 - 63
CH ₂ CH=CH ₂	CH ₃	CH(CH ₃) ₂	H	H	H	81 - 84
-CH-CH=CH ₂ CH ₃	CH ₃	CH(CH ₃) ₂	H	H	H	oil
CH ₂ -C=CH ₂ CH ₃	CH ₃	CH(CH ₃) ₂	H	H	H	98 - 100
CH-C≡CH CH ₃	CH ₃	CH(CH ₃) ₂	H	H	H	oil
CH ₂ -CH=CHCH ₃	CH ₃	CH(CH ₃) ₂	H	H	H	87 - 89
-C(CH ₃) ₃	CH ₃	CH(CH ₃) ₂	H	H	H	124 - 126
	CH ₃	CH(CH ₃) ₂	H	H	H	95.5 - 98
C ₁₈ H ₃₇ -n	CH ₃	CH(CH ₃) ₂	H	H	H	77.3 - 79.2
CH ₂ C ₆ H ₅	CH ₃	CH(CH ₃) ₂	H	H	H	116.5 - 119
-CH ₂ C ₆ H ₅	CH ₃	CH ₂ CH(CH ₃) ₂	H	H	H	76 - 78.5

R_3	R_1	R_2	X	Y	Z	mp °C
CH_3	CH_3	$CH_2CH(CH_3)_2$	H	H	H	92 - 94
$-C_4H_9-n$	CH_3	$CH_2(CH_3)_2$	H	H	H	54 - 57
$CH_2C\equiv CH$	CH_3	$CHCH(CH_3)_2$	H	H	H	128.5 - 131
CH_3	CH_3		H	H	H	128 - 131
$CH_2C_6H_5$	CH_3		H	H	H	111 - 113
CH_3	CH_3	$CH(CH_3)_2$	H	H	OCH_3	154 - 155
$CH_2-CH=CH-C_7H_{15}-n$	CH_3	$CH(CH_3)_2$	H	H	H	oil
$CH_2-C(Cl)=CH_2$	CH_3	$CH(CH_3)_2$	H	H	H	73 - 77
$C_6H_{13}-n$	CH_3	$CH(CH_3)_2$	H	H	H	oil
$CH(CH_3)CH=CH-CH_3$	CH_3	$CH(CH_3)_2$	H	H	H	oil
CH_3		$-(CH_2)_5-$	H	H	H	148 - 148
$CH_2CH=(CH_3)_2$	CH_3	$CH(CH_3)_2$	H	H	H	77.5 - 79
$CH_2C_6H_5$		$-(CH_2)_5-$	H	H	H	117 - 122
$CH_2\equiv CCH_2OH$	CH_3	$CH(CH_3)_2$	H	H	H	gum
$CH_2C_6H_5$	C_2H_5	C_2H_5	H	H	H	114.5 - 118
$C(CH_3)C\equiv CH$	CH_3	$CH(CH_3)_2$	H	H	H	128 - 132
$CH_2CH_2N^+(CH_3)_3$	CH_3	$CH(CH_3)_2$	H	H	H	165 - 175

R ₃	R ₁	R ₂	X	Y	Z	mp °C
CH ₃	C ₂ H ₅	C ₂ H ₅	H	H	H	132.5 - 135.5
C(CH ₃) ₂ C≡CH	CH ₃	CH(CH ₃) ₂	H	H	H	104 - 108
CH ₂ C≡CH	CH ₃	Δ	H	H	H	122 - 124
CH ₂ C≡CH		-(CH ₂)-	H	H	H	184.5 - 186.5
CH ₃	CH ₃	CH(CH ₃) ₂	CH ₃	H	H	114 - 115.5
CH ₂ C≡CH	C ₂ H ₅	C ₂ H ₅	H	H	H	135.5 - 137
	CH ₃	CH(CH ₃) ₂	H	H	H	111 - 113
	CH ₃	CH(CH ₃) ₂	H	H	H	136 - 138
	CH ₃	CH(CH ₃) ₂	H	H	H	131.5 - 133
CH ₂ COOCH ₃	CH ₃	CH(CH ₃) ₂	H	H	H	104 - 108
	CH ₃	CH(CH ₃) ₂	H	H	H	95 - 97
CH ₂ CH ₂ CH ₂ COOC ₂ H ₅	CH ₃	CH(CH ₃) ₂	H	H	H	oil
CH(CH ₃)COOCH ₃	CH ₃	CH(CH ₃) ₂	H	H	H	133 - 135

(47)

R ₃	R ₁	R ₂	X	Y	Z	mp°C
CH ₃	CH ₃	CH(CH ₃) ₂	H	Br	H	122.5 - 126
CH ₂ CH=CH-COOC ₂ H ₅	CH ₃	CH(CH ₃) ₂	H	H	H	oil
(CH ₂) ₄ COOCH ₃	CH ₃	CH(CH ₃) ₂	H	H	H	oil
	CH ₃	CH(CH ₃) ₂	H	H	H	108 - 111
	CH ₃	CH(CH ₃) ₂	H	H	H	107 - 109
	CH ₃	CH(CH ₃) ₂	CH ₃	H	H	130 - 132
	CH ₃	CH(CH ₃) ₂	H	H	H	113 - 115
CH ₂ CH=C(CH ₃)- CH ₂ CH ₂ CH=C(CH ₃) ₂	CH ₃	CH(CH ₃) ₂	H	H	H	oil
CH ₂ CH(OH)CH ₂ OH	CH ₃	CH(CH ₃) ₂	H	H	H	oil
(CH ₂) ₃ C≡CH	CH ₃	CH(CH ₃) ₂	H	H	H	73 - 75
	CH ₃	CH(CH ₃) ₂	H	H	H	oil

R ₃	R ₁	R ₂	X	Y	Z	mp°C
CH(C ₆ H ₅)COOCH ₃	CH ₃	CH(CH ₃) ₂	H	H	H	oil
CH ₂ CH ₂ -C(CH ₃)=CH ₂	CH ₃	CH(CH ₃) ₂	H	H	H	oil
(CH ₂) ₉ CH=CH ₂	CH ₃	CH(CH ₃) ₂	H	H	H	oil
CH(CH ₃)C ₆ H ₅	CH ₃	CH(CH ₃) ₂	H	H	H	oil
CH ₃	$\left[\begin{array}{c} \text{CH}(\text{CH}_2)_4 \\ \\ \text{CH}_3 \end{array} \right]$		H	H	H	122 - 124
	$\left[\begin{array}{c} \text{CH}(\text{CH}_2)_4 \\ \\ \text{CH}_3 \end{array} \right]$		H	H	H	132 - 134.5
CH ₂ C≡CH	$\left[\begin{array}{c} \text{CH}(\text{CH}_2)_4 \\ \\ \text{CH}_3 \end{array} \right]$		H	H	H	123 - 125
CH ₃	CH ₃	CH(CH ₃) ₂	H	H	Cl	102.5 - 104.5
CH ₂ COOCH ₂ CH ₃	CH ₃	CH(CH ₃) ₂	H	H	H	86 - 90
CH ₂ COOH	CH ₃	CH(CH ₃) ₂	H	H	H	187 - 189
CH ₂ COOCH ₂ C ₆ H ₅	CH ₃	CH(CH ₃) ₂	H	H	H	121.5 - 123
CH ₂ COOH	CH ₃	CH(CH ₃) ₂	H	H	H	106 - 110
CH ₃	CH ₃	CH(CH ₃) ₂	H	H	H	110 - 112
						[α] _D = +27.41°

49

R_3	R_1	R_2	X	Y	Z	mp°C
CH ₃	CH ₃	CH(CH ₃) ₂	H	H	H	110.5 – 114 [α] _D = +27.80°
CH ₂ C ₆ H ₅	CH ₃	CH(CH ₃) ₂	H	H	H	102 – 105 [α] _D = +13.08°
CH ₂ C ₆ H ₅	CH ₃	CH(CH ₃) ₂	H	H	H	104 – 107 [α] _D = +12.76°
CH ₃	CH ₃	CH(CH ₃) ₂	H	H	N(CH ₃) ₂	184.5 – 185.5

Example 8

Preparation of the Hydrochloride salt of methyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)-nicotinate

To a stirred suspension of 3.0 g of the ester of Example 5 in 40 ml ether is added enough methylene chloride to obtain a solution. Dry hydrogen chloride is then passed into the solution for about 20 minutes. After 1 hour the mixture is filtered to remove the product which is washed with ether and dried to give 1.90 g of analytically pure hydrochloride salt and melting point equal to 195—196°C.

Example 9

Preparation of 2-(5-Isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinic acid

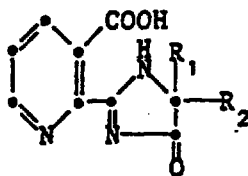
To 22.63 g ester of Example 5 in 100 ml water is added a solution containing 3.29 g sodium hydroxide in 25 ml water and the mixture heated under reflux with stirring for 1.5 hours. After standing at room temperature overnight, 6.8 ml concentrated hydrochloric acid is added causing a heavy precipitate to form. This is removed by filtration, washed with 20 ml water, followed by 30 ml ether and dried to give 19.27 g acid, mp 168—170°C. This material is dissolved in 350 ml methylene chloride, filtered (to remove a small amount of the isomeric 2-acid) and concentrated to give 17.91 g of pure acid, mp 170—172°C. The analytically pure sample is prepared by recrystallization of the material from acetone-hexane, mp 170—172.5°C.

Example 10

Preparation of 2-(5-Isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinic acid

To 1.0 g of the benzyl ester in 20 ml ethanol is added 50 mg 5% palladium on carbon catalyst and the mixture shaken in an atmosphere of hydrogen until one equivalent of hydrogen has been absorbed. The catalyst is removed by filtration, the solvent removed *in vacuo* and the residue crystallized from acetone-hexane to give the acid as described in Example 9.

The following acids are made by the above methods:



R ₁	R ₂	mp°C
CH ₃	C ₂ H ₅	124—126°
—CH—(CH ₂) ₄ — CH		180—183°
CH ₃	CH ₃	204—205.5°
CH ₃	△	198—200°

Example 11

Preparation of Calcium 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate

To 0.98 g of the acid of Example 9 partially dissolved in 10 ml water is added, with stirring 0.18 g calcium carbonate. After 10 minutes, the solution is filtered, the filtrate concentrated and the residue treated with ether to give a crystalline product which is dried at 40°C and 25 mm pressure to give 0.88 g of the calcium salt mp 265°C.

The sodium, diisopropylammonium, and triethylammonium salts are prepared in a similar manner.

The following salts can be prepared by the above procedure using the appropriate acid and the oxide, carbonate, bicarbonate or hydroxide of the selected metal, alkali metal, alkaline earth metal, ammonia or aliphatic amine.

(51)

5
10
15
20
25
30
35
40
45
50
55
60
65

Z⁺ mp°C

$\text{NH}_3\text{CH}(\text{CH}_3)\text{C}_6\text{H}_5$ gum

NH_4 sublimes >168

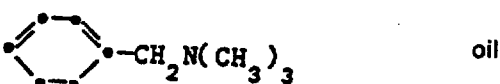
Ba/2 >225

Cu/2 >225

K >225

Li >225

Mg/2 >225



$\text{H}_2\text{N}-(\text{CH}_2)_6\text{NH}_2$ oil

$\text{C}_{18}\text{H}_{35}$ wax

$n\text{-C}_{12}\text{H}_{25}\text{NH}_2$ 150—153

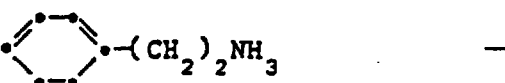
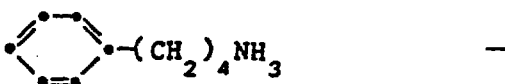
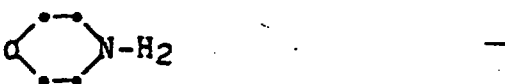
$(\text{CH}_3)_3\text{CCH}_2\text{C}(\text{CH}_3)_2\text{NH}_2$ —

$(n\text{-C}_4\text{H}_9)_2\text{NH}_2$ —

$\text{HOCH}_2\text{CH}_2\text{NH}_2\text{CH}_3$ —



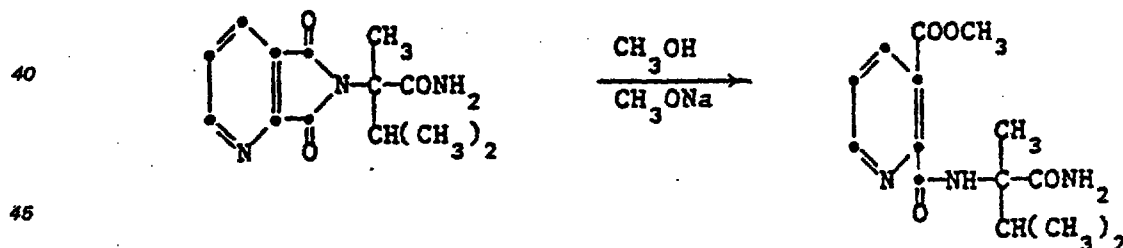
$n\text{-C}_8\text{H}_{17}\text{NH}_2$ —





	Z ⁺	mp°C
5	(CH ₃ O) ₂ CHCH ₂ NH ₃	—
	(C ₂ H ₅ OCH ₂ CH ₂)NH ₃	—
	CH ₃ O(CH ₂) ₃ NH ₃	—
10	(HOCH ₂ CH ₂) ₂ NH ₂	—
	Fe/2	>225
	Fe/3	155—158
15	HOCH ₂ CH ₂ NH ₃	—
20		—
	(C ₂ H ₅) ₂ NH ₂	—
25	(CH ₃) ₂ CHNH ₃	—
	CH ₂ =C(CH ₃)CH ₂ NH ₃	—
	(CH ₃) ₂ CHCH ₂ NH ₃	—
30	CH ₃ OCH ₂ CH(CH ₃)NH ₃	—
	(CH ₃) ₃ CNH ₃	—

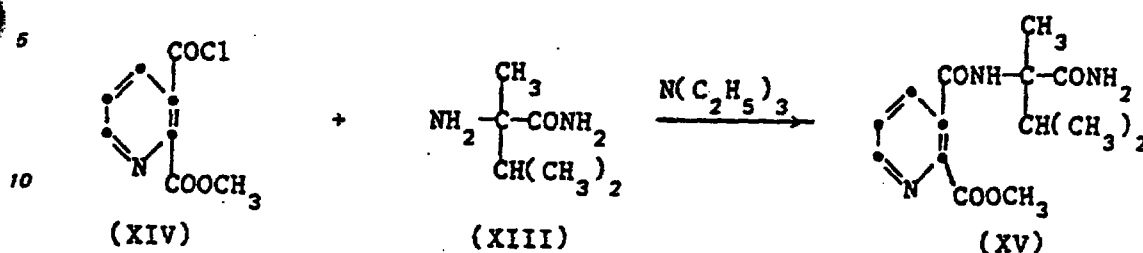
Example 12
Preparation of Methyl 2-[(carbamoyl-1,2-dimethylpropyl)carbamoyl]nicotinate



50 Sodium hydride (0.47 g of a 50% suspension in mineral oil) is reacted with 500 ml dry methanol under nitrogen. To this is added 51.4 g of the amide of Example 2 and the mixture stirred at room temperature overnight. The mixture is concentrated, the residue dissolved in methylene chloride and the solution washed first with 150 ml water followed by 150 ml brine. After drying (Na₂SO₄), the organic phase is concentrated and the residue crystallized from ether to give 47.85 g of product which is analytically pure mp 108—145°C with decomposition.

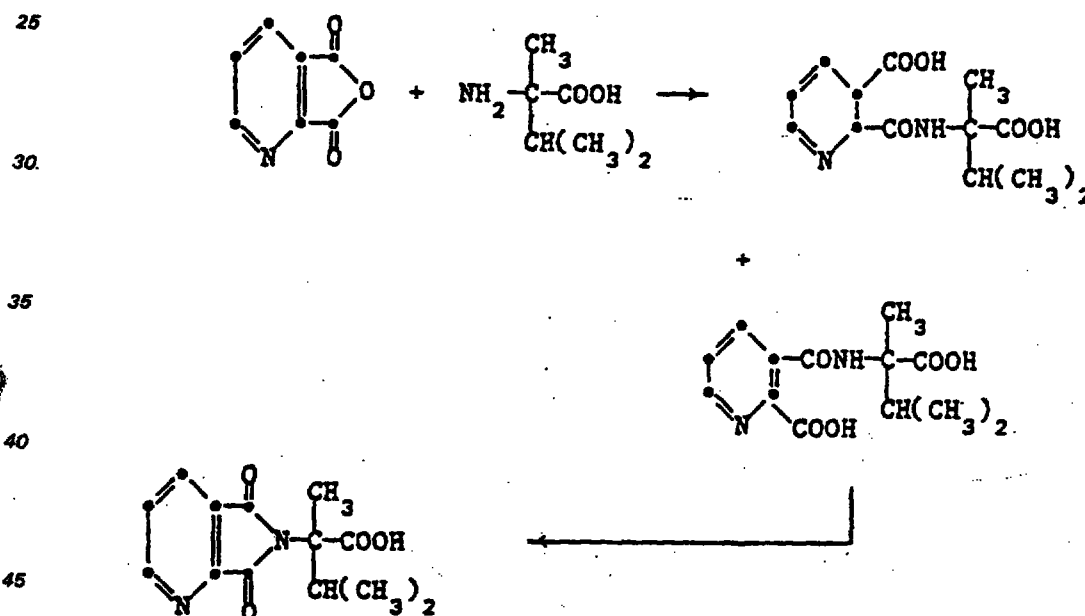
Example 13

Preparation of Methyl 3-[1-carbamoyl-1,2-dimethylpropyl]carbamoyl]picolinate



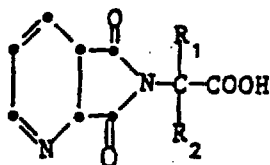
To a stirred mixture containing 25.5 g acid chloride [(Helv. Chem. Acta, 34, 488 (1951))] and 29.7 ml triethylamine in 200 ml methylene chloride is added, under nitrogen, dropwise a solution containing 13.93 g amino amide as disclosed in (U.S. 4,017,510) at such a rate that the temperature of the reaction mixture remains below 30°C. After 1 hour, the mixture is filtered, the solid washed with methylene chloride and dried to give 19.8 g product, mp 176—177°C (decomp). A sample recrystallized from nitromethane had mp 196—196.5°C (decomp) and analytically pure.

Example 14

Preparation of 5,7-Dihydro- α -isopropyl- α -methyl-5,7-dioxo-6-*H*-pyrrol[3,4-*b*]pyridine-6-acetic acid (-isomer)

To a stirred suspension of 18.4 g of the anhydride in 760 ml of dry acetone is added, under nitrogen, 16.2 g of (+)-methylvaline. After stirring at room temperature for 48 hours, the mixture is filtered and the filtrate concentrated to give the crude intermediate. This material is dissolved in 500 ml acetic anhydride, a catalytic quantity of sodium acetate added and the mixture stirred at room temperature for 5 hours. After heating under reflux for 1.5 hours, the mixture is concentrated. The residue is dissolved in ethyl acetate and washed with water. The dried extract is concentrated to give a dark syrup. A sample is dissolved in ethyl acetate, treated with charcoal, filtered and concentrated. The residue is crystallized from methylene chloride to give the product, mp 122—125°C $[\alpha]_D^{25} = -7.73^\circ$ ($c = 0.100$, THF).

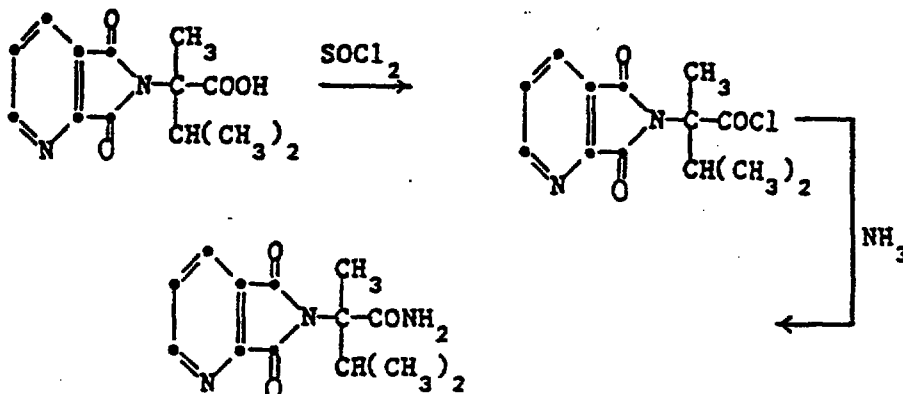
By essentially the same procedure and using the appropriate starting quinolinic anhydride and amino acid the following amides are prepared



R ₁	R ₂	mp°C
—CH ₃	—CH(CH ₃) ₂	126—127 [α] _D ²⁵ = +6.93 (c = 0.100, THF)
CH ₃	CH ₂ CH(CH ₃) ₂	174—176
CH ₃	CH(CH ₃) ₂	196.5—198.5
—CHCH ₂ CH ₂ CH ₂ CH ₂ — CH ₃		183—186

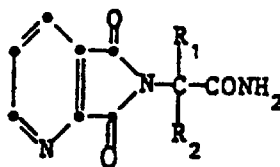
Example 15

Preparation of 5,7-Dihydro-α-isopropyl-α-methyl-5,7-dioxo-6H-pyrrolo[3,4-b]pyridine-6-acetamide



To a mixture containing 32 g of (—)-acid in 375 ml of toluene is added 2 ml of dimethylformamide followed by 13 ml of thionyl chloride. After heating at reflux for 1.25 hours, the mixture is concentrated *in vacuo*. The residue is dissolved in 350 ml of tetrahydrofuran, cooled to 0°C and a slight excess of gaseous ammonia bubbled through the mixture. The solvent is removed *in vacuo* to leave a solid which is washed with water and air-dried. A portion of this solid is crystallized twice from ethyl acetate (with charcoal treatment) to give the desired product as a white crystalline solid, mp 188—189°C [α]_D²⁵ = +3.59 (c = 0.0791, DMSO).

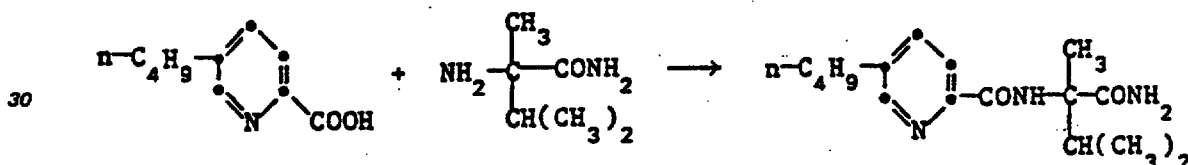
By essentially the same procedure and using the appropriate acid, the following amides are prepared.



R ₁	R ₂	mp°C
CH ₃	CH(CH ₃) ₂	189.5—192 [α] _D ²⁵ = -3.02 (c = 0.0744, DMSO)
CH ₃	CH ₂ CH(CH ₃) ₂	176—178
—CHCH ₂ CH ₂ CH ₂ CH ₂ — CH ₃		186—188

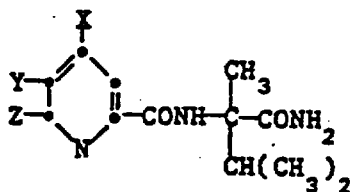
Example 16

Preparation of 5-Butyl-N-(1-carbamoyl-1,2-dimethylpropyl)picolinamide



To a suspension of 20 g of acid in 200 ml of dry tetrahydrofuran is added with stirring 10.7 ml of ethyl chloroformate. The mixture is cooled to -10°C and 17.1 ml of triethylamine added dropwise so that the temperature does not exceed 0°C. After 10 minutes, a solution containing 14.3 g of the amino amide in 150 ml of dry tetrahydrofuran is added dropwise at 0°C with stirring. The mixture is allowed to reach room temperature and after 2 hours, enough water added to dissolve the solid. The tetrahydrofuran is removed in vacuo. The aqueous residue is extracted with ethyl acetate, and after saturating with salt, extracted again. The organic phases are combined, washed with brine dried and concentrated. The residual oil crystallized. A portion was crystallized first from methylene chloride-hexane followed by ether-hexane to give analytically pure product mp 83—86°C.

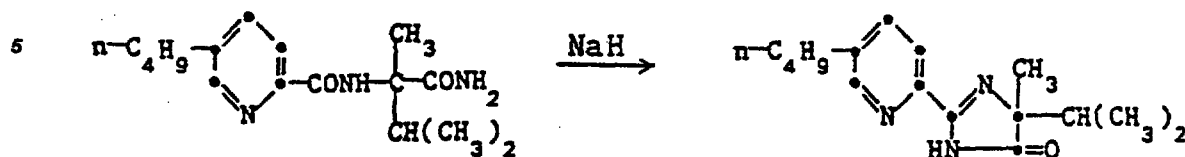
Using essentially the same procedures described above the following picolinic acids are prepared.



X	Y	Z	mp°C
H	CH ₃	H	126—127.5°
H	H	CH ₃	
H	C ₆ H ₅	H	
H	NO ₂	H	

Example 17

Preparation of 2-(5-Butyl-2-pyridyl)-5-isopropyl-5-methyl-2-imidazolin-4-one



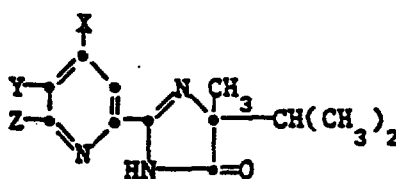
A stirred suspension of sodium hydride (2.4 g) in 250 ml of dry toluene is heated with stirring, under reflux under a Dean-Stark water Separator. To this mixture is added slowly 26.52 g of diamide. After the addition, heating is continued for 1.5 hours. After standing overnight, the reaction is quenched with water, the pH adjusted to 5 with hydrochloric acid and the phases separated. The aqueous phase is further extracted twice with ethyl acetate, the organic extracts combined, washed with brine, dried and concentrated.

The residue is recrystallized from hexane to give the pure product mp 60–62°C.

Using essentially the same procedure, the following imidazolinones are prepared.

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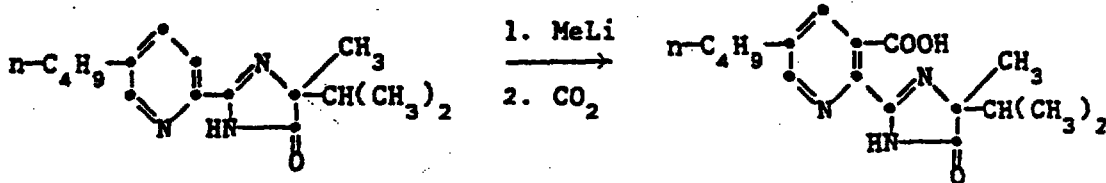
X	Y	Z	mp°C
H	C ₆ H ₅	H	
H	H	CH ₃	
H	CH ₃	H	
H	NO ₂	H	

Example 18

Preparation of 5-Butyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinic acid

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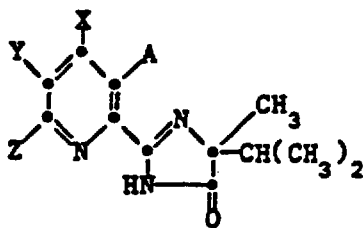
To a stirred solution containing 10.0 g imidazolinone in 100 ml dry tetrahydrofuran at -76° under nitrogen is added dropwise 47.3 ml of a 1.7 M solution of methyl lithium in ether. The mixture becomes very thick and 2 ml hexamethylphosphoramide and about 150 ml tetrahydrofuran is added. The mixture is allowed to warm to -10°C and held at this temperature for 0.75 hour. The mixture is cooled to -70° and added to slurry of carbon dioxide in tetrahydrofuran. After stirring for 0.5 hour, water is added to the mixture, the pH adjusted to 2 with dilute sulfuric acid, and the product extracted into methylene chloride. The extract is washed with brine, dried and concentrated to give the product as a yellow solid. Recrystallization from methylene-chloride-hexane gave an analytically pure sample, mp 152–154°.

Using essentially the same procedure as described above but substituting the appropriate imidazolinone for 2-(5-butyl-2-pyridyl)-5-isopropyl-5-methyl-2-imidazolinone, and using

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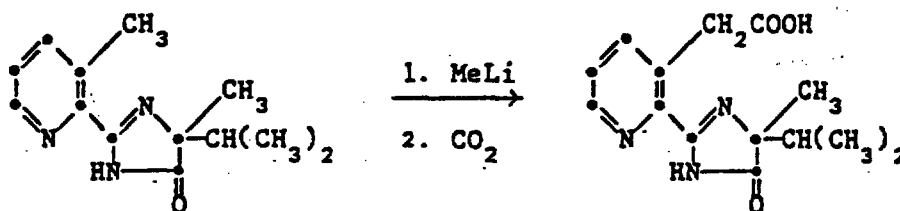
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dimethylformamide and methyl iodide as well as carbon dioxide as electrophiles, the following imidazolinones are prepared:



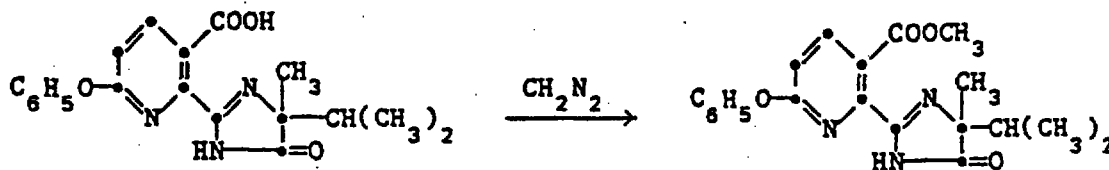
	A	X	Y	Z	mp°C
16	COOH	Cl	H	H	184—186
	COOH	H	CH ₃	H	203.5—204.5
20	COOH	H	C ₆ H ₅	H	150—151.5
	CH ₃	H	H	H	93—96
	CHO	H	H	H	223—225
25	COOH	H	H	C ₆ H ₅	252—254
30	COOH	H	$\begin{array}{c} \text{CH}_3 \\ \\ \text{CH}_2\text{O}-\text{Si}-\text{CH}_3 \\ \\ \text{C}(\text{CH}_3)_3 \end{array}$	H	82—85 (intermediate)
	COOH	H	C ₂ H ₅	H	

Example 19
Preparation of 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)-3-pyridineacetic acid



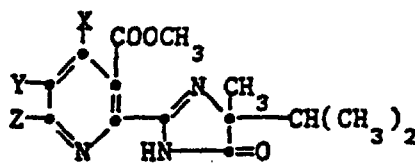
Using essentially the same procedure as described in Example 18 but substituting 5-isopropyl-5-methyl-2-(3-methyl-2-pyridyl)-2-imidazolin-4-one for 5-isopropyl-5-methyl-2-(5-n-butyl-2-pyridyl)-2-imidazolin-4-one, there is obtained the desired pyridine-acetic acid, mp 173 (dec.).

Example 20
Preparation of Methyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)-6-phenoxy nicotinate



A solution of the acid in ether is treated with excess diazomethane. After a few minutes excess diazomethane is removed by warming. The solvent is removed and the residue crystallized from ether hexane to give the desired methyl ester mp 128—131°C.

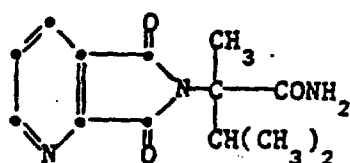
Using essentially the same conditions as those described above, the following methyl esters are prepared starting with the appropriate acid.



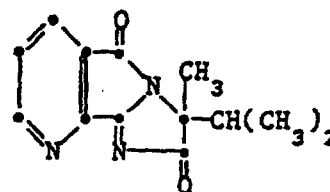
	X	Y	Z	mp°C
5	H	H	-OC ₆ H ₅	128—131
10	H	-C ₄ H ₉ -n	H	69—71.5
15	Cl	H	H	110—113
20	H	H	OCH ₂ C ₆ H ₅	187—188
	H	H	OC ₂ H ₅	126—129
	OC ₆ H ₅	H	H	175—177
25	H	CH ₃	H	129—130.5
	H	C ₆ H ₅	H	
30	H	H	C ₆ H ₅	
	OCH ₂ C ₆ H ₅	H	H	164—171
	H	C ₂ H ₅	H	
35	H	CH ₂ OH	H	146—147

Example 21

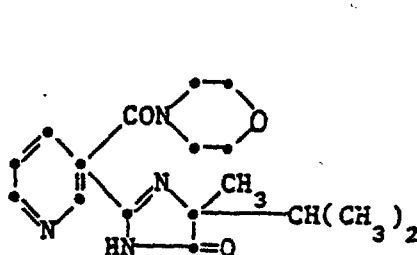
Preparation of 4 [2-(5-Isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinoyl]morpholine



DBU



isomer

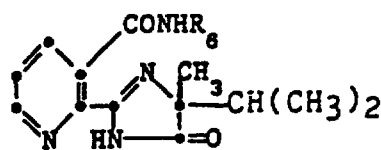


The cyclization of the amide is accomplished by heating 7.83 g of amide in 150 ml of toluene and 0.45 ml of 1,8-diazabicyclo[5.4.0]undec-7-ene under a Dean-Stark water Separator for 2 hours as described in

59

Example 4. The separator is removed, 4 ml of morpholine is added and heating continued for 3 hours. The mixture is concentrated and the residue chromatographed on silica gel in ethyl acetate. The product is eluted first and this material is recrystallized from ether-hexane to give pure amide mp 143—145.5°C.

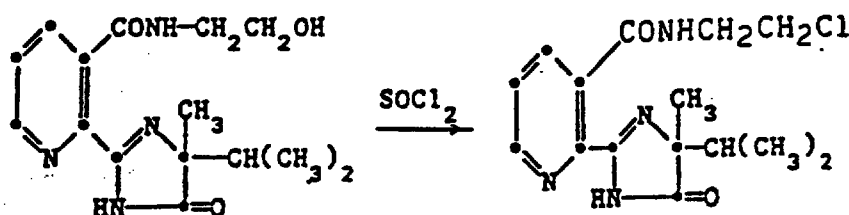
By substituting the appropriate amine for morpholine, the following amides are prepared.



R_6	mp°C
$-\text{CH}_2\text{C}\equiv\text{CH}$	171—173.5
 $-\text{Cl}$	227.5—228.5
$-\text{CH}_2\text{CH}_2\text{OH}$	174.5—175.5

Example 22

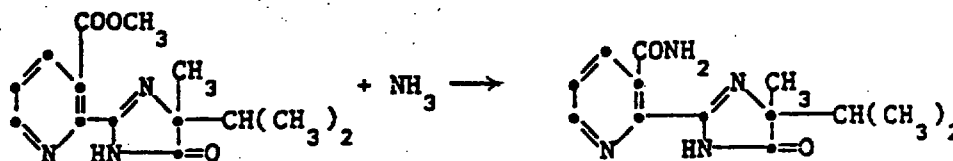
Preparation of N-(2-chloroethyl)-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinamide



A mixture containing 4.04 g of hydroxyethylamide and 8.2 ml of thionyl chloride in 250 ml of methylene chloride is heated at reflux for 3.5 hours. The mixture is cooled, poured into water and the aqueous phase made basic with sodium carbonate. The mixture is shaken, the organic phase separated, washed with water, dried and concentrated to leave a white solid which is recrystallized from toluene to give the desired chloroethylamide as a white crystalline solid, melting partially at 128.5°C with complete melting at 157°C.

Example 23

Preparation of 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinamide

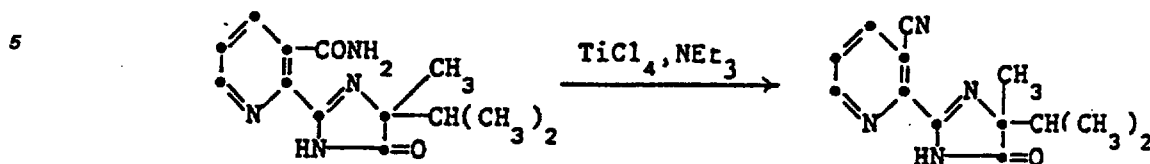


A solution containing 10.0 g of ester in 50 ml of tetrahydrofuran is added to 100 ml of liquid ammonia in a glass bomb. The bomb is sealed and the contents heated at 100°C for 16 hours. After cooling, the ammonia is evaporated and the residue concentrated. This residue is combined with material from similar reactions using 5 g and 7 g of the ester. These are crystallized from ethyl acetate to give 5 g of product. The filtrate is concentrated after treatment with charcoal to give a further 15.7 g of product.

Two recrystallizations of a sample from ethyl acetate gives the pure nicotinamide as a white crystalline solid mp 178—182°C.

Example 24

Preparation of 2-[5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]nicotinonitrile

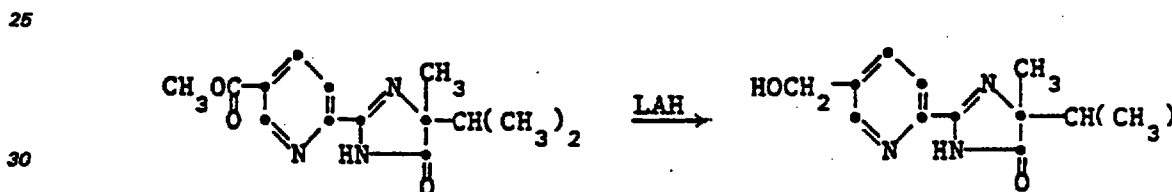


To 75 ml of ice-cold tetrahydrofuran under nitrogen is added with stirring 12 ml of titanium tetrachloride in 20 ml of carbon tetrachloride at such a rate that the temperature does not exceed 5°C. This is followed by the addition of 5.2 g of the amide in 75 ml of tetrahydrofuran again maintaining a temperature of <5°C. Finally, 17 ml of triethylamine in 5 ml of tetrahydrofuran is added to the mixture under the same conditions. After 1.5 hours at 5°C, the mixture is stirred overnight at room temperature. Water (100 ml) is cautiously added at 0°C, the upper organic phase is separated and the aqueous phase extracted with methylene chloride (4 × 100 ml). The combined extracts are washed with brine, dried and concentrated. The solid residue is recrystallized from hexane-methylene-chloride to give the nicotinonitrile as a tan solid, mp 144—148°C. The analytically pure compound has mp 148—150°C.

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Example 25

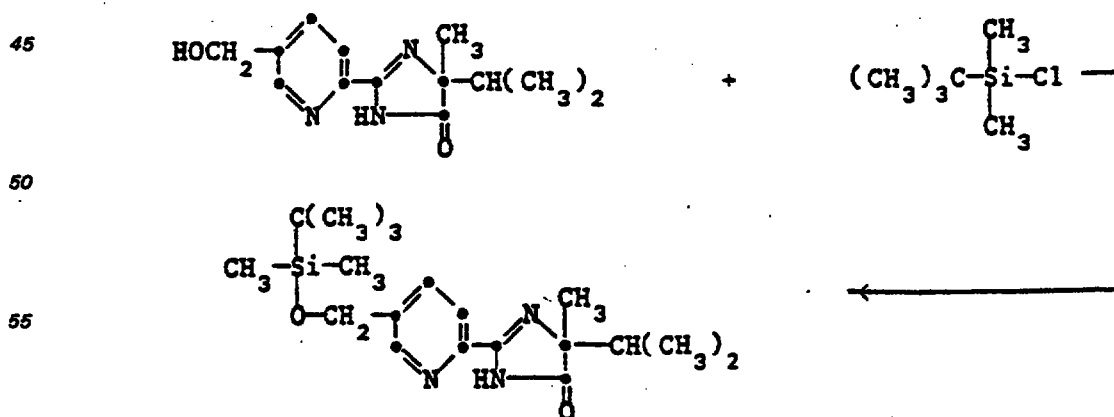
Preparation of 2-[5-(hydroxymethyl)-2-pyridyl]-5-isopropyl-5-methyl-2-imidazolin-4-one



To a stirred slurry of 23 g lithium aluminum hydride in 250 ml tetrahydrofuran under nitrogen at -70°C is added dropwise 46.8 g of the ester in 350 ml tetrahydrofuran. The mixture is warmed to room temperature, 73 ml of a saturated ammonium chloride solution added cautiously with vigorous stirring, the mixture filtered and the solid washed with tetrahydrofuran. The filtrate is concentrated to leave a gum. This is chromatographed on silica gel and the product eluted by ethyl acetate, mp 101—104°C.

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Example 26

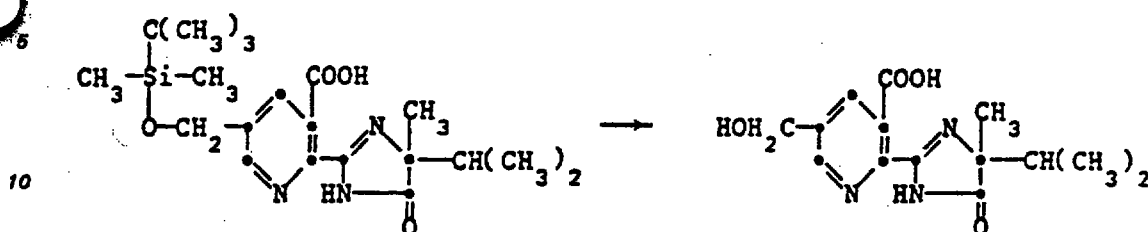
Preparation of 2-[5-(*tert*-butyldimethylsiloxy)methyl-2-pyridyl]-5-isopropyl-5-methyl-2-imidazolin-4-one (intermediate)

To a stirred solution containing 2.03 g alcohol in 3.5 ml dimethylformamide under nitrogen is added 0.68 g imidazole followed by 3.1 g *t*-butyldimethylsilyl chloride. The mixture is kept at 35°C for 10 hours and room temperature for 10 hours. Saturated sodium sulfate is added and the aqueous mixture extracted with ether. The extract is washed with brine, dried and evaporated. The pure product is isolated as a gum by chromatography of the crude product on silica gel and elution with methylene chloride followed by ether.

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Example 27

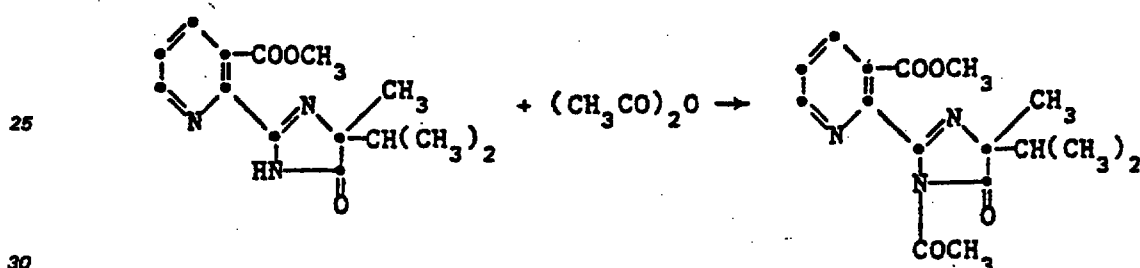
Preparation of 5-(Hydroxymethyl)-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinic acid



A solution containing 0.29 g silyl ether in 10 ml 80% aqueous acetic acid is heated on the steam bath for 0.5 hours. The mixture is concentrated and the residue dried azeotropically with toluene. The residue, a gum, is crystallized from methylene chloride-hexane. The pure product has mp 170—171.5°C.

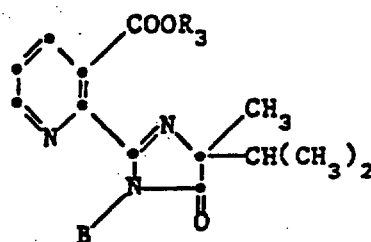
Example 28

Preparation of Methyl 2-(1-acetyl-4-isopropyl-4-methyl-5-oxo-2-imidazolin-2-yl)nicotinate



A solution containing 10 g methyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate in 100 ml acetic anhydride is heated under reflux for 16 hours. The mixture is concentrated and the residue crystallized from ether-hexane to give the N-acetyl derivative, mp 88—90°C. This is the mp of analytically pure material.

Using essentially the same conditions as those described above, the following N-substituted imidazolinones are prepared by reacting the appropriate imidazolinyl nicotinate with the appropriate acyl anhydride, acyl halide, sulfonyl halide, alkyl halide or sulfate either alone or in a solvent such as pyridine or toluene.

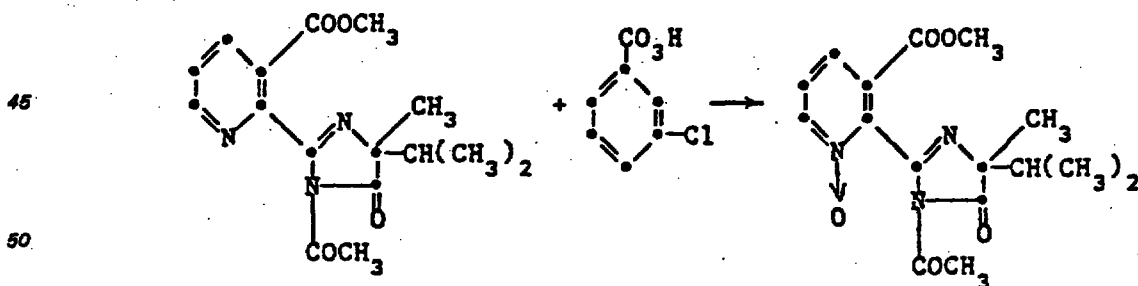


R ₃	B	mp°C
CH ₃	CH ₃	oil
CH ₃	COC(CH ₃) ₃	85—87
CH ₃	COC ₁₁ H ₂₃ —n	oil
CH ₃	COC ₆ H ₅	104—107
CH ₃	COC ₂ H ₅	90—92.5
CH ₃	COCH ₂ Cl	98—100
CH ₂ C ₆ H ₅	COC ₂ H ₅	oil
CH ₂ C ₆ H ₅	COC(CH ₃) ₃	oil

	R ₃	B	mp°C
5	CH ₂ C ₆ H ₅	COCH ₂ Cl	oil
	CH ₃	SO ₂ CH ₃	115—118
	CH ₂ ≡CH	COCH ₃	125—127
10	CH ₂ C≡CH	COCH ₂ Cl	118—122
	CH ₂ C≡CH	COC ₆ H ₅	118—120
	CH ₂ C≡CH	COC(CH ₃) ₃	101—104
15	CH ₃	COOC ₂ H ₅	oil
20	CH ₃	SO ₂ - 	114—118
	CH ₂ C ₆ H ₅	COC ₆ H ₅	117—125
25	CH ₂ C≡CH	COC ₂ H ₅	85—88
	CH ₃	CO- 	122—125
30	CH ₃	CO- 	119.5—121.5
35	CH ₃	CO- 	148—151

Example 29

40 Preparation of Methyl 2-(1-acetyl-4-isopropyl-4-methyl-5-oxo-2-imidazolin-2-yl)nicotinate-1-oxide



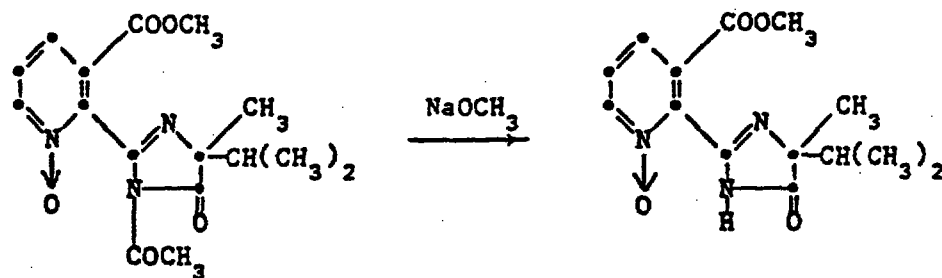
55 To a solution containing 40 g (126 mmoles) of the nicotinate in 500 ml methylene chloride is added 30 g of 80—90% pure (139 mmoles based on 80% purity) m-chloroperbenzoic acid. After heating at reflux overnight, excess peracid is destroyed by the addition of excess 1-hexene. The solution is washed with saturated sodium bicarbonate solution, dried and concentrated. The residue is crystallized from methylene chloride-hexane-ether to give 18.3 g of the desired N-oxide, mp 92—100°C. The analytically pure N-oxide has mp 95—99°C.

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Example 30

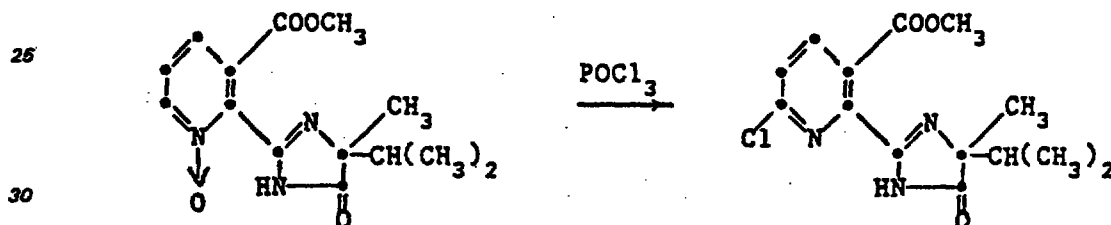
Preparation of Methyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate-1-oxide



To a solution of 30 g of the N-acetyl compound in 200 ml methanol is added approximately 0.5 g sodium methoxide. After stirring for two hours, the product is removed by filtration and air dried, mp 197—201°C. The analytically pure sample which has been recrystallized from acetone-hexane has mp 200—201°C.

Example 31

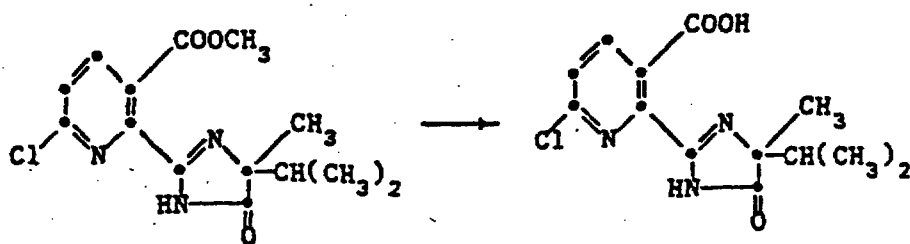
Preparation of Methyl 6-chloro-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate



A solution containing 22.0 g N-oxide in 135 ml phosphorus oxychloride is heated under reflux for four hours. After standing at room temperature overnight, excess phosphorus oxychloride is removed *in vacuo* and the residue treated with xylene and again concentrated. The residue is dissolved in methylene chloride and treated with water, the pH adjusted to 5 with sodium carbonate and ether added to make the organic layer the upper layer. The layers are separated and the aqueous phase reextracted twice with ether. The combined organic extracts are washed with brine, dried and concentrated. The residue is chromatographed on 250 g of silica gel in a mixture of ether and hexane to give 10.6 g of the desired product. This is recrystallized from ether-hexane to give 8.95 g of the 6-chloro derivative, mp 104—106°C. The analytically pure sample melted at 102.5—104.5°C.

Example 32

Preparation of 6-Chloro-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinic acid

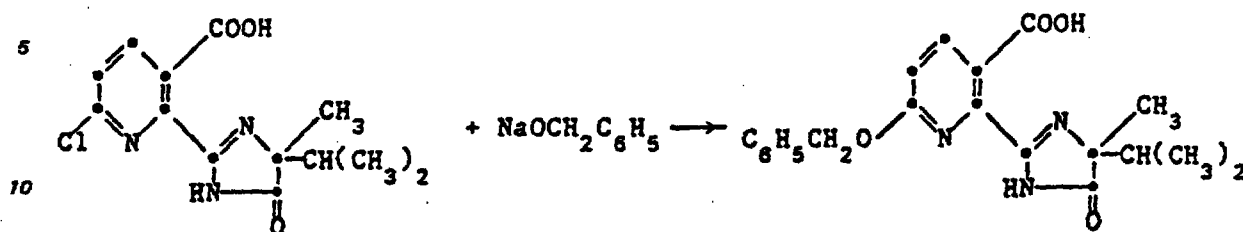


A suspension of 3.0 g of the ester in 5.8 ml of 2N sodium hydroxide, 5 ml water and 3 ml methanol is warmed to 35°C to obtain a clear solution. After stirring the solution for three hours, it is cooled, extracted with ether and the organic phase discarded. The pH of the aqueous phase is adjusted to 2 with 6N hydrochloric acid and then sodium bicarbonate solution added to bring the pH to 4. The aqueous phase is extracted twice with methylene chloride, the pH of the aqueous phase adjusted to 2 and again extracted twice with methylene chloride. The organic phases are combined, dried and concentrated and the residue crystallized from methylene chloride-hexane to give the analytically pure acid, mp 154—157°C.

Following the above procedure but substituting the 5-bromo ester for the 6-chloro ester yields 5-bromo-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinic acid, mp 211—213°C.

Example 33

Preparation of 6-(Benzyloxy)-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinic acid



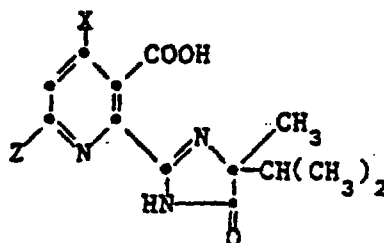
To sodium hydride (from 0.34 g 50% sodium hydride in oil) in 2 ml of N-methyl pyrrolidone is added with stirring and under nitrogen 2 ml benzyl alcohol. After the formation of the alkoxide is complete, 0.6 g of the chloro acid is added and the mixture heated at 165–175° for five hours.

After cooling, the mixture is diluted with water, the pH thereof adjusted to 1 with 1N hydrochloric acid and then back to pH 8 with saturated sodium bicarbonate. The mixture is extracted twice with ether and the ether discarded. The pH of the aqueous phase is adjusted to 5 and extracted several times with methylene chloride. The extracts are combined, dried and concentrated. Crystallization from ether-hexane gives the 6-benzyloxy derivative mp 205–207°C.

Using essentially the same conditions as described above, and using the appropriate 4- or 6-chloro-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinic acid and appropriate sodium alkoxide, phenoxide or thioalkoxide, the following imidazolinyl nicotinic acids are prepared.

25

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35

40

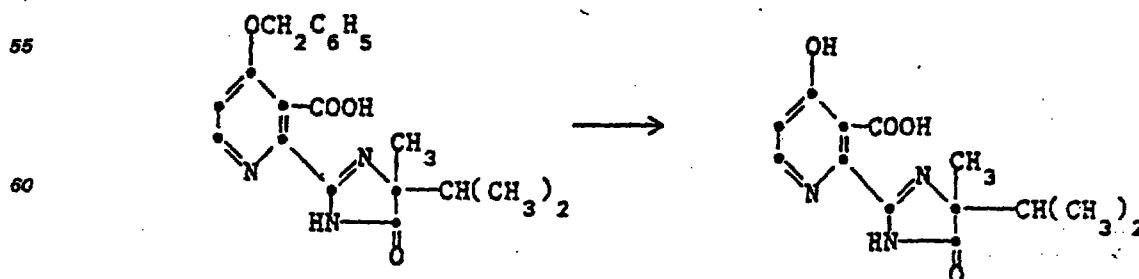
45

50

X	Z	Mp°C
H	OCH ₃	190–191.5
OC ₆ H ₅	H	196–198
H	OC ₆ H ₅	182.5–185.5
H	OC ₂ H ₅	190–191.5
H	SCH ₃	188.5–190
OCH ₂ C ₆ H ₅	H	172–174
H	OCH ₂ C ₆ H ₅	205–207

Example 34

Preparation of 4-Hydroxy-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinic acid



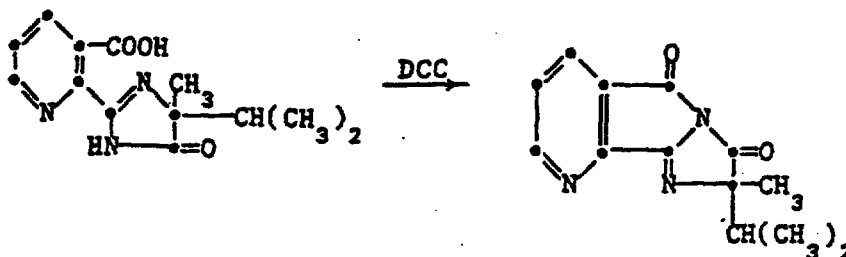
65

To 15 ml concentrated sulfuric acid is added slowly, with stirring 1.55 g of the benzyloxy derivative. To

this mixture is added 7 ml ethylenedichloride. After 16 hours at room temperature, the mixture is poured over ice, the pH adjusted to 4 with dilute sodium hydroxide and extracted with ethyl acetate. The extract was dried and concentrated to leave a tan solid which is recrystallized from methylene chloride-ether, mp 210—211°C.

Example 35

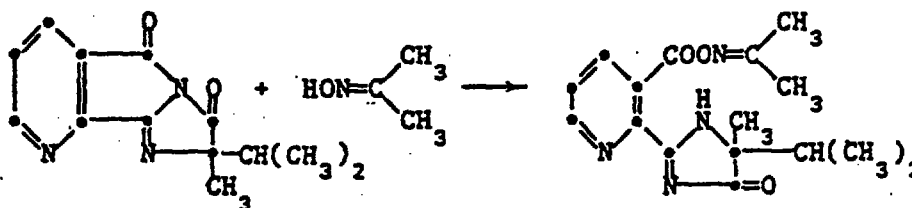
Preparation of 2-Isopropyl-2-methyl-5*H*-imidazo[1',2':1,2]pyrrolo[3,4-*b*]pyridine-3(2*H*), 5-dione



To a solution containing 50.9 g of dicyclohexylcarbodiimide in 600 ml of dry methylene chloride is added, while stirring, 60 g of the acid at such a rate that the temperature does not exceed 32°C. After stirring at room temperature for 2.5 hours, the mixture is filtered and the filtrate concentrated to give a white solid. This solid is recrystallized from methylene chloride to give 57.4 g of the dione, mp 125—128.5°C. The analytically pure dione melts at 132—134°C.

Example 36

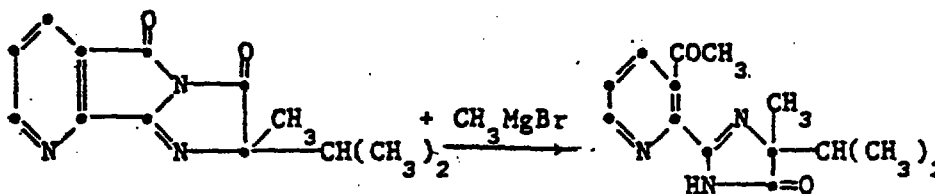
Preparation of the Acetone oxime ester of 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinic acid



To a solution containing 2.0 g of the 3,5-dione in 15 ml of toluene is added 0.6 g of acetone oxime. The mixture is heated and stirred at 50—60°C for 2.75 hours. After stirring overnight at room temperature, the solvent is removed and the residue chromatographed on silica gel using 10% acetonitrile in methylene chloride followed by 30% acetonitrile in methylene chloride as the eluent. Toluene is removed from the fractions containing the product and the product collected. This is recrystallized from methylene chloride-hexane to give analytically pure oxime ester mp 117—119.5°C. The ester from 2,2,2-trichloroethanol mp 114—116°C is prepared in essentially the same manner.

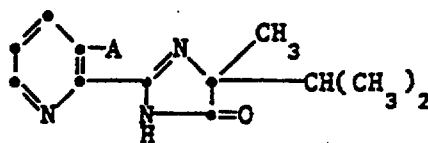
Example 37

Preparation of 2-(3-Acetyl-2-pyridyl)-5-isopropyl-5-methyl-2-imidazolin-4-one



To a stirred solution containing 10.0 g of the dione in 100 ml of dry tetrahydrofuran under nitrogen and -78°C is added dropwise 15.1 ml of a 3M solution of methyl magnesium bromide in ether. A temperature of <-60°C is maintained during the addition. After the addition, stirring is continued at -78°C and then the mixture warmed slowly to room temperature. The mixture is diluted with an equal volume of water, the pH adjusted to 4 with glacial acetic acid and extracted three times with methylene chloride. The combined extracts are dried and concentrated. The residue is chromatographed on silica gel with ether. Concentration of the appropriate fractions give 6.1 g of product as a crystalline solid mp 104—108°C. An analytically pure sample has mp 103—105°C.

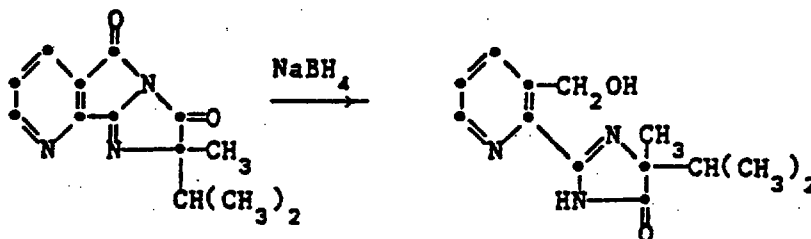
Using essentially the same procedure as described above but substituting phenyl lithium or sodium trimethyl phosphonoacetate for methyl magnesium bromide, the following imidazolinones are prepared.



A	mp°C
COC ₆ H ₅	138—140.5
	131.5—134

Example 38

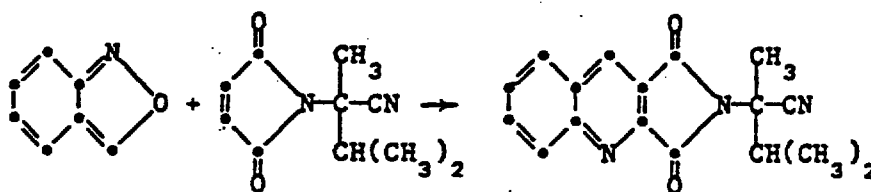
Preparation of 2-[3-(Hydroxymethyl)-2-pyridyl]-5-methyl-2-imidazolin-4-one



To a stirred solution of 0.32 g sodium borohydride in 25 ml absolute ethanol at 0°C is added during 10 minutes with stirring a solution containing 2.0 g dione in 25 ml dry tetrahydrofuran. The mixture is then stirred a further three hours at room temperature. The mixture is poured into 200 ml ice water, extracted with methylene chloride, the extract dried and concentrated. The residue is crystallized from methylene-chloride-hexane to give the desired product. The analytically pure sample has mp 145—149°C.

Example 39

Preparation of 1,3-Dihydro- α -isopropyl- α -methyl-1,3-dioxo-2-*H*-pyrrolo-[3,4-*b*] quinoline-2-acetonitrile
Procedure A

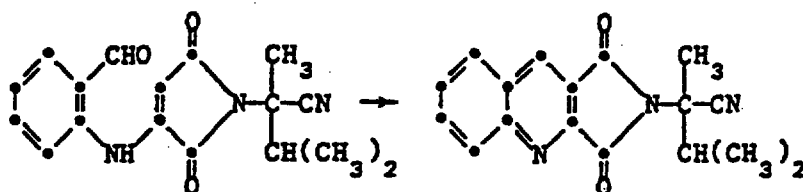


Anthranil (59.6 g, 0.5 mol) is added dropwise under nitrogen, with stirring, over a 45 minute period, to a refluxing solution of α -isopropyl- α -methyl-2,5-dioxo-3-pyrroline-1-acetonitrile in *o*-dichlorobenzene (450 ml). After 18 hours the reaction mixture is cooled and methylene chloride added. This solution is passed through a 3 inch silica gel column, by eluting with methylene chloride. The eluate is concentrated to 500 ml and hexane added. A precipitate forms and is filtered off and air dried, to yield the product 110.6 g, (75%) as a light brown solid. Crystallization from ethyl acetate-hexane gives pale yellow crystals, mp 195—196°C.

Anal. calcd. for C₁₇H₁₅N₃O₂: C, 69.61; H, 5.15; N, 14.33. Found: C, 69.37; H, 5.15; N, 14.43.

Employing similar conditions the compounds of Table I are prepared.

Procedure B

Cyclization of *o*-formylanilino-maleimides

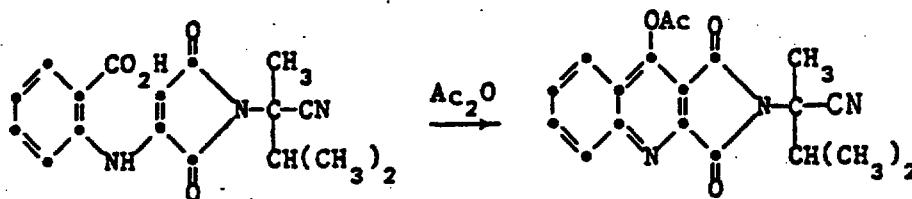
A solution of *N*-(1-cyano-1,2-dimethylpropyl)-2-(*o*-formylanilino) maleimide (7.19 g, 0.023 mol) in xylene (300 ml) containing *p*-toluenesulfonic acid (0.3 g, 0.0016 mol) is heated at reflux for 4 hours using a Dean-Stark trap to collect the eliminated water. The reaction is cooled, evaporated under reduced pressure and dissolved in hot ethyl acetate which is passed through a 3 inch silica gel column. The ethyl acetate fractions eluted are combined to give a solid, mp 195—195.5°C, 5.51 g, (81%) of 1,3-dihydro- α -isopropyl- α -methyl-1,3-dioxo-2-*H*-pyrrolo [3,4-*b*] quinoline-2-acetonitrile.

Other compounds prepared by this procedure are listed in Table I.

Example 40

Procedure C

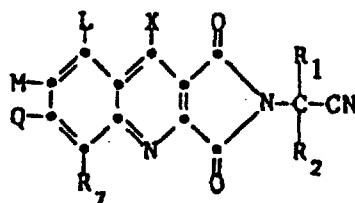
Preparation of 1,3-Dihydro- α -isopropyl- α -methyl-1,3-dioxo-2-*H*-pyrrolo[3,4-*b*] 4-acetoxyquinoline-2-acetonitrile



A solution of *N*-[1-(1-cyano-1,2-dimethylpropyl)-2,5-dioxo-3-pyrrolin-3-yl] anthranilic acid (3.27 g, 0.01 mol) in acetic anhydride (20 ml) is treated all at once with triethylamine (10 ml) and dimethylaminopyridine (0.122 g, 0.001 mol). After stirring under nitrogen for 1 hour at 25° the reaction is poured into ice-water. A solid forms and is filtered off. Purification is achieved by re-suspension in ether, filtering and drying. Yield 2.54 g (72%) of product, mp 145—151°C,

$$\frac{m+1}{e} = 352.$$

TABLE I



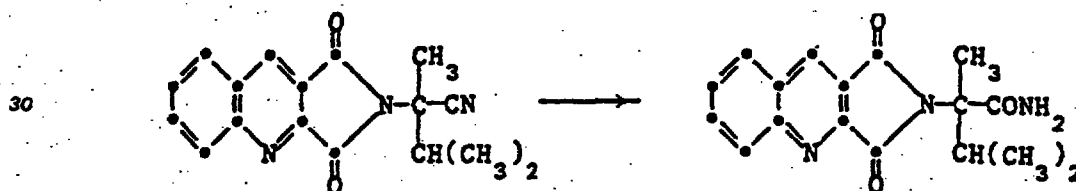
R ₁	R ₂	X	L	M	Q	R ₇	Procedure	mp°C
CH ₃	CH(CH ₃) ₂	H	H	NO ₂	H	H	A	230—232
CH ₃	CH(CH ₃) ₂	H	H	H	NO ₂	H	A	260—261
CH ₃	CH(CH ₃) ₂	H	NO ₂	H	H	H		
CH ₃	CH(CH ₃) ₂	H	H	H	H	NO ₂	A	
CH ₃	CH(CH ₃) ₂	H	Br	H	H	H	A	
CH ₃	CH(CH ₃) ₂	H	Cl	H	H	H	A,B	139.5—142
CH ₃	CH(CH ₃) ₂	H	H	CF ₃	H	H	B	
CH ₃	CH(CH ₃) ₂	H	H	H	Cl	H	B	188
CH ₃	CH(CH ₃) ₂	H	H	CH ₃	H	H	B	
CH ₃	CH(CH ₃) ₂	H	H	H	CH ₃	H	B	186—190
CH ₃	CH(CH ₃) ₂	H	H	H	H	CH ₃	B	
CH ₃	CH(CH ₃) ₂	H	H	OCH ₃	H	H	B	
CH ₃	CH(CH ₃) ₂	H	H	H	CH ₃	CH ₃	B	
CH ₃	CH(CH ₃) ₂	H	H	CH ₃	H	CH ₃	B	
CH ₃	CH(CH ₃) ₂	H	CH ₃	H	H	CH ₃	B	
CH ₃	CH(CH ₃) ₂	H	H	H	Cl	CH ₃	B	
CH ₃	CH(CH ₃) ₂	H	Cl	H	H	CH ₃	B	
CH ₃	CH(CH ₃) ₂	H	H	Cl	H	CH ₃	B	
CH ₃	CH(CH ₃) ₂	H	Cl	H	H	OCH ₃	B	
CH ₃	C ₃ H ₇	H	H	H	H	H	A	
CH ₃	C ₂ H ₅	H	H	H	H	H	A	
CH ₃	<i>n</i> -C ₄ H ₉	H	H	H	H	H	A	
CH ₃	<i>s</i> -C ₄ H ₉	H	H	H	H	H	A	
CH ₃	<i>i</i> -C ₄ H ₉	H	H	H	H	H	A	
CH ₃	<i>t</i> -C ₄ H ₉	H	H	H	H	H	A	
CH ₃	cyclopropyl	H	H	H	H	H	A	

TABLE I (cont'd)

	R ₁	R ₂	X	L	M	Q	R ₇	Procedure	mp°C
5	CH ₃	CH ₂ CH=CH ₂	H	H	H	H	H	A	
	CH ₃	cyclohexyl	H	H	H	H	H	A	
		(CH ₂) ₅	H	H	H	H	H	A	
10	CH ₃	CH(CH ₃) ₂	Cl	H	H	H	H		
	CH ₃	CH(CH ₃) ₂	CH ₃	H	H	H	H		
15	CH ₃	CH(CH ₃) ₂	F	H	H	H	H		
	CH ₃	CH(CH ₃) ₂	OCH ₃	H	H	H	H		
	CH ₃	CH(CH ₃) ₂	OH	H	H	H	H		
20	CH ₃	CH(CH ₃) ₂	H	H	Cl		H	A	202.5—203.5

Example 41

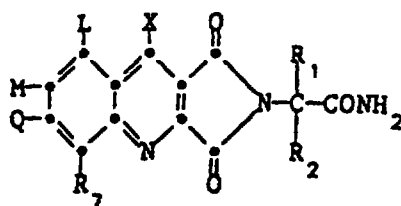
25 Preparation of 1,3-Dihydro- α -isopropyl- α -methyl-1,3-dioxo-2-*H*-pyrrolo [3,4-*b*]quinoline-2-acetamide



35 1,3-Dihydro- α -isopropyl- α -methyl-1,3-dioxo-2-*H*-pyrrolo [3,4-*b*] quinoline-2-acetonitrile (0.44 g, 0.0015 mol) is dissolved in conc. sulfuric acid (5 ml) at room temperature and stirred overnight. The reaction mixture is poured onto crushed ice (50 ml) and a white precipitate forms and is filtered off, washed with water, aqueous sodium bicarbonate and water and then vacuum dried. This gives 0.34 g (74%) of product, mp 237—239°C (dec.). Anal. calcd. for C₁₇H₁₇N₃O₃: C, 65.58; H, 5.50; N, 13.50. Found: C, 65.03; H, 5.63; N, 13.19.

40 The following compounds are prepared in the same manner as described above.

TABLE II



R ₁	R ₂	X	L	M	Q	R ₇	mp°C
CH ₃	CH(CH ₃) ₂	H	H	NO ₂	H	H	225—227 (dec.)
CH ₃	CH(CH ₃) ₂	H	H	H	NO ₂	H	221—224
CH ₃	CH(CH ₃) ₂	H	NO ₂	H	H	H	
CH ₃	CH(CH ₃) ₂	H	Br	H	H	H	
CH ₃	CH(CH ₃) ₂	H	H	Cl	H	H	
CH ₃	CH(CH ₃) ₂	H	H	CF ₃	H	H	
CH ₃	CH(CH ₃) ₂	H	H	H	CF ₃	H	
CH ₃	CH(CH ₃) ₂	H	H	H	Cl	H	232—234
CH ₃	CH(CH ₃) ₂	H	H	H	H	Cl	
CH ₃	CH(CH ₃) ₂	H	H	CH ₃	H	H	
CH ₃	CH(CH ₃) ₂	H	H	H	CH ₃	H	223—227 (dec.)
CH ₃	CH(CH ₃) ₂	H	H	H	H	CH ₃	
CH ₃	CH(CH ₃) ₂	H	H	OCH ₃	H	H	
CH ₃	CH(CH ₃) ₂	H	H	H	CH ₃	CH ₃	
CH ₃	CH(CH ₃) ₂	H	H	CH ₃	H	CH ₃	
CH ₃	CH(CH ₃) ₂	H	CH ₃	H	H	CH ₃	
CH ₃	CH(CH ₃) ₂	H	H	H	Cl	CH ₃	
CH ₃	CH(CH ₃) ₂	H	Cl	H	H	CH ₃	
CH ₃	CH(CH ₃) ₂	H	H	Cl	H	CH ₃	
CH ₃	CH(CH ₃) ₂	H	Cl	H	H	OCH ₃	
CH ₃	C ₃ H ₇	H	H	H	H	H	
CH ₃	C ₂ H ₅	H	H	H	H	H	
CH ₃	C ₄ H ₉	H	H	H	H	H	
CH ₃	<i>s</i> -C ₄ H ₉	H	H	H	H	H	
CH ₃	<i>i</i> -C ₄ H ₉	H	H	H	H	H	
CH ₃	<i>t</i> -C ₄ H ₉	H	H	H	H	H	

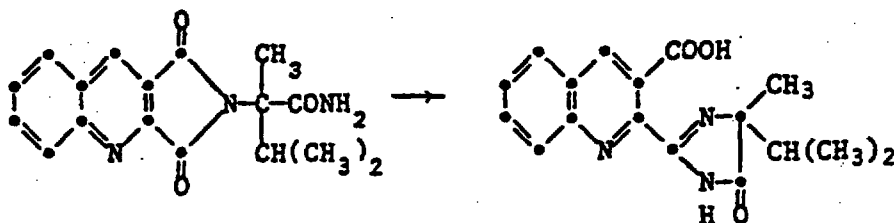
TABLE II (cont'd)

	R ₁	R ₂	X	L	M	Q	R ₇	mp°C
5	CH ₃		H	H	H	H	H	
	CH ₃	CH ₂ CH=CH ₂	H	H	H	H	H	
10	CH ₃		H	H	H	H	H	
		(CH ₂) ₅	H	H	H	H	H	
15	CH ₃	CH(CH ₃) ₂	Cl	H	H	H	H	
	CH ₃	CH(CH ₃) ₂	CH ₃	H	H	H	H	
20	CH ₃	CH(CH ₃) ₂	F	H	H	H	H	
	CH ₃	CH(CH ₃) ₂	OCH ₃	H	H	H	H	
25	CH ₃	CH(CH ₃) ₂	OH	H	H	H	H	
	CH ₃	CH(CH ₃) ₂	OAc	H	H	H	H	
	CH ₃	CH(CH ₃) ₂	H	Cl	H	H	H	198—199 (dec.)

Example 42

Preparation of 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)-3-quinolinecarboxylic acid

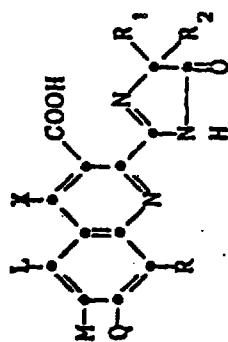
Procedure A



To a slurry of 1,3-dihydro- α -isopropyl- α -methyl-1,3-dioxo-2-H-pyrrolo [3,4-b] quinoline-2-acetamide (5.76 g, 0.0185 mol) in dry xylene (600 ml) is added a 50% oil dispersion of sodium hydride (1.33 g, 0.0278 mol) and the mixture is heated to reflux, whereupon the reaction mixture becomes homogeneous. After 3 hours at reflux the reaction is set aside at room temperature overnight and then methanol (15 ml) containing sodium methoxide (0.1 g) is slowly added and warmed at reflux for 1 hour. The mixture is filtered while hot and the organic solvents stripped to give an oil and solid. A methylene chloride-water mixture is shaken with the above residues, until they dissolve. The aqueous layer (200 ml) is separated and slowly acidified with acetic acid (5 ml). A precipitate of the product is formed and is collected by filtration to give 3.91 g (72%) of mp 219—224°C. Recrystallization from hexane-ethyl acetate gives mp 219—222°C (dec.). Anal. calcd. for C₁₇H₁₇N₃O₃: C, 65.58; H, 5.50; N, 13.50. Found: C, 65.09; H, 5.50; N, 13.59.

This example is used to prepare the following examples. However to avoid ester formation, rather than filter off the insolubles and strip down the xylene one may simply add methanol followed by water (caution hydrogen may be evolved) to the xylene layer.

TABLE III



R	R	X	L	M	Q	R	Procedure	mp°C
CH ₃	CH(CH ₃) ₂	H	H	H	NO ₂	H	A	247 - 251
CH ₃	CH(CH ₃) ₂	H	H	NO ₂	H	H	A	241.5 - 242
CH ₃	CH(CH ₃) ₂	H	NO ₂	H	H	H	A	
CH ₃	CH(CH ₃) ₂	H	H	H	H	NO ₂	A	
CH ₃	CH(CH ₃) ₂	H	Br	H	H	H	A	
CH ₃	CH(CH ₃) ₂	H	H	Cl	H	H	A	
CH ₃	CH(CH ₃) ₂	H	H	H	Cl	H	A	238 - 240
CH ₃	CH(CH ₃) ₂	H	H	H	H	Cl	A	
CH ₃	CH(CH ₃) ₂	Cl	H	H	H	H	A	
CH ₃	CH(CH ₃) ₂	H	Cl	H	H	H	A	
CH ₃	CH(CH ₃) ₂	H	H	CF ₃	H	H	A	255 - 256 (dec.)
CH ₃	CH(CH ₃) ₂	H	H	H	CF ₃	H	A	
CH ₃	CH(CH ₃) ₂	H	H	H	CF ₃	H	A	
CH ₃	CH(CH ₃) ₂	H	H	F	H	H	A	
CH ₃	CH(CH ₃) ₂	H	H	CH ₃	H	H	A	
CH ₃	CH(CH ₃) ₂	H	H	H	CH ₃	H	A	

73

TABLE III (Continued)

R	R	X	L	M	Q	R	Procedure	mp°C
CH ₃	CH(CH ₃) ₂	H	H	H	H	CH ₃	A	
CH ₃	CH(CH ₃) ₂	CH ₃	H	H	H	H	A	
CH ₃	CH(CH ₃) ₂	H	H	OCH ₃	H	H	A	
CH ₃	CH(CH ₃) ₂	H	H	SCH ₃	H	H	A	
CH ₃	CH(CH ₃) ₂	H	H	SO ₂ CH ₃	H	H	(peracid on above)	
CH ₃	CH(CH ₃) ₂	F	H	H	H	H	A	
CH ₃	CH(CH ₃) ₂	H	H	H	CH ₃	CH ₃	A	
CH ₃	CH(CH ₃) ₂	H	H	CH ₃	H	CH ₃	A	
CH ₃	CH(CH ₃) ₂	H	CH ₃	H	H	CH ₃	A	
CH ₃	CH(CH ₃) ₂	H	H	H	Cl	CH ₃	A	
CH ₃	CH(CH ₃) ₂	H	Cl	H	H	CH ₃	A	
CH ₃	CH(CH ₃) ₂	OCH ₃	H	H	H	H	A	
CH ₃	CH(CH ₃) ₂	OH	H	H	H	H		
CH ₃	CH(CH ₃) ₂	OAc	H	H	H	H		
CH ₃	CH(CH ₃) ₂	H	H	Cl	H	CH ₃	A	
CH ₃	CH(CH ₃) ₂	H	Cl	H	H	OCH ₃	A	
CH ₃	C ₃ H ₇ -n	H	H	H	H	H	A	
CH ₃	C ₂ H ₅	H	H	H	H	H	A	
CH ₃	C ₄ H ₉ -n	H	H	H	H	H	A	
CH ₃	C ₄ H ₉ -sec	H	H	H	H	H	A	

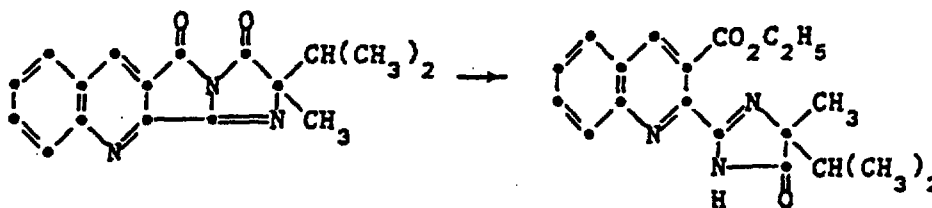
TABLE III (Continued)

R	R	X	L	M	Q	R	Procedure	mp°C
CH ₃	C ₄ H ₉ -iso	H	H	H	H	H	A	
CH ₃	C ₄ H ₉ -tert	H	H	H	H	H	A	
CH ₃	Δ	H	H	H	H	H	A	
CH ₃	CHCH=CH ₂	H	H	H	H	H	A	
CH ₃		H	H	H	H	H	A	
	$\text{---}(\text{CH}_2)_5\text{---}$	H	H	H	H	H	A	
CH ₃	CH(CH ₃) ₂	H	H	H	F	H	A	
CH ₃	CH(CH ₃) ₂	H	H	H	CN	H		
CH ₃	CH(CH ₃) ₂	H	H	H	N(CH ₃) ₂	H	A	
CH ₃	CH(CH ₃) ₂	H	H	H	NH ₂	H	(reduction Q = NO ₂)	
CH ₃	CH(CH ₃) ₂	H	H	H	I	H	A	

Example 43

Preparation of Ethyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)-3-quinolinecarboxylic acid

Procedure A



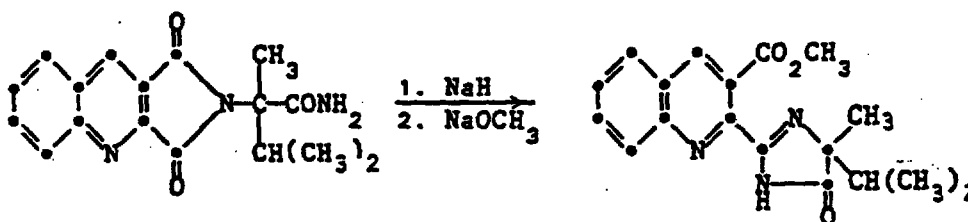
To 2-isopropyl-2-methyl-5-*H*-imidazo[1',2':1,2]pyrazolo[3,4-*b*]quinoline-3H(2H), 5-dione (2 g, 0.0068 mol) in absolute ethanol (40 ml) under nitrogen is added 50% sodium hydride (0.34 g, 0.00716 mol) with ice-cooling. Gas evolution is observed. After 10 minutes the reaction is neutralized with aqueous ammonium chloride, stripped and partitioned between water and ethyl acetate. The organic layer is separated and dried over anhydrous magnesium sulfate, filtered, stripped and the residue crystallized from ethyl acetate-hexane to give 1.38 g (60%) of a white solid, mp 146–147.5°C.

In a similar manner, the following esters in Table IV may be prepared by Procedure A.

Example 44

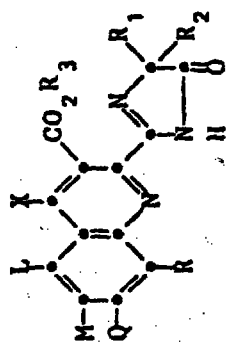
Preparation of Methyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)-3-quinolinecarboxylic acid

Procedure B



A 50% sodium hydride oil dispersion (1.4 g, 0.0292 mol) is added to azeotropically dried 1,3-dihydro- α -methyl-1,3-dioxo-2-*H*-pyrrolo [3,4-*b*] quinoline-2-acetamide (6 g, 0.0193 mol) under nitrogen. The mixture is heated and stirred under reflux for 6 hours, cooled and slowly quenched with a solution of sodium methoxide (0.1 g) in methanol (20 ml). After heating at 60°C for 3 hours the mixture is filtered and the filtrate stripped to give a white solid, which is dissolved in a methylene chloride-water mixture. Separation of the organic layer and stripping afforded a solid of 0.48 g, which is purified by passing through a silica gel pad with ethyl acetate as solvent. After removal of the solvent, the solid residue is crystallized from ethyl acetate-hexane to give white needles of the required ester, 0.4 g, mp 145–154°C. Anal. calcd. for $C_{18}H_{19}N_3O_3$: C, 66.44; H, 5.89; N, 12.92. Found: C, 66.35; H, 5.93; N, 12.83.

TABLE IV



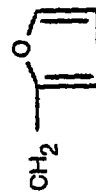
R ₃	R ₁	R ₂	X	L	M	Q	R	mp°C	Example Procedure
CH ₃	CH ₃	CH(CH ₃) ₂	H	H	H	H	H	145 - 154	B
C ₂ H ₅	CH ₃	CH(CH ₃) ₂	H	H	H	H	H	146 - 147.5	A
CH(CH ₃) ₂	CH ₃	CH(CH ₃) ₂	H	H	H	H	H		
CH ₂ CH=CH ₂	CH ₃	CH(CH ₃) ₂	H	H	H	H	H		
	CH ₃	CH(CH ₃) ₂	H	H	H	H	H		
CH ₂ C ₆ H ₅	CH ₃	CH(CH ₃) ₂	H	H	H	H	H		
C ₆ H ₅	CH ₃	CH(CH ₃) ₂	H	H	H	H	H		
C ₈ H ₁₇	CH ₃	CH(CH ₃) ₂	H	H	H	H	H		
CH ₃	CH ₃	C ₂ H ₅	H	H	H	H	H		
	CH ₃	C ₂ H ₅	H	H	H	H	H		A
CH ₃	CH ₃	CH(CH ₃) ₂	H	H	CH ₃	H	H		
CH ₃	CH ₃	CH(CH ₃) ₂	H	H	H	Cl	H		

TABLE IV (Continued)

R_3	R_1	R_2	X	L	M	Q	R	mp°C	Example Procedure
CH ₃	CH ₃	CH(CH ₃) ₂	H	H	N(CH ₃) ₂	H	H	133.5 - 134.5	A
C ₄ H ₉	CH ₃	CH(CH ₃) ₂	H	H	H	H	H		
CH ₃	CH ₃	C ₂ H ₅	H	H	H	H	H		
CH ₃	CH ₃	Δ	H	H	H	H	H		
CH ₃	CH ₃	sec-C ₄ H ₉	H	H	H	H	H		
CH ₃	—	(CH ₂) ₅ —	H	H	H	H	H		



Example 45

Acid Salts of Quinolinecarboxylic acid esters:

5 Preparation of the hydrochloride salt of methyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)-3-quinoline carboxylic acid

10 A solution of the ester is dissolved in an ether-methylene chloride solution and dry hydrogen chloride is passed through the solution until all of the solid hydrochloride salt forms and is filtered off, ether washed and vacuum dried, with mp 226—270°C. The following salts may be prepared in a similar manner, substituting the appropriate acid HX, although some are hygroscopic oils, and employing ethyl acetate as a preferred solvent for acid salts.

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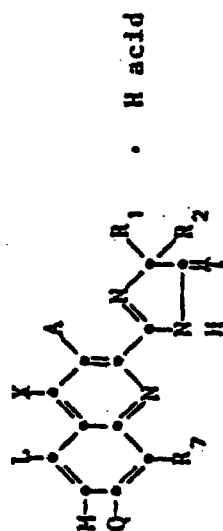
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TABLE V

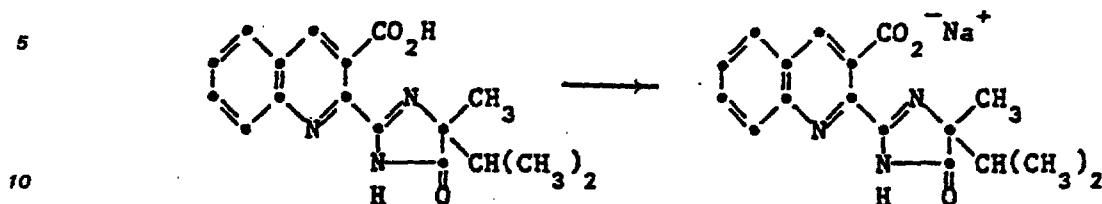


R ₁	R ₂	T	A	L	M	Q	R ₇	H Acid	mp°C
CH ₃	CH(CH ₃) ₂	O	CO ₂ CH ₃	H	H	H	H	HCl	
CH ₃	CH(CH ₃) ₂	S	CO ₂ CH ₃	H	H	H	H	HCl	
CH ₃	CH(CH ₃) ₂	O	CO ₂ CH ₃	H	H	H	H	HBr	
CH ₃	CH(CH ₃) ₂	O	CO ₂ CH ₃	H	H	H	H	HNO ₃	
CH ₃	CH(CH ₃) ₂	O	CO ₂ CH ₃	H	H	H	H	H ₂ SO ₄	266 - 270
CH ₃	CH(CH ₃) ₂	O	CO ₂ H	H	H	H	H	HCl	
CH ₃	CH(CH ₃) ₂	O	CHO	H	H	H	H	HCl	
CH ₃	CH(CH ₃) ₂	O	CH ₂ OH	H	H	H	H	HCl	
CH ₃	CH(CH ₃) ₂	O	CO ₂ CH ₃	H	H	Cl	H	HCl	
CH ₃	CH(CH ₃) ₂	O	CO ₂ CH ₃	H	H	CH ₃	H	HCl	
CH ₃	CH(CH ₃) ₂	O	CO ₂ CH ₃	H	CH ₃	H	H	HCl	



Example 46

Preparation of Sodium 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)-3-quinolinecarboxylic acid



15 A solution of 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)-3-quinolinecarboxylic acid (2.33 g, 0.0075 mol) in water (22 ml) containing sodium hydroxide (0.3 g, 0.0075 mol) is stirred at room temperature overnight, then washed with methylene chloride and the aqueous layer separated and evaporated to an orange solid, which is washed with ether and air dried. The product as a dihydrate is obtained as a cream solid, mp 235—250°C (dec.). Anal. calcd. for $C_{17}H_{18}N_3O_3Na + 2H_2O$: C, 55.27; H, 5.45; N, 11.37; Na, 6.22. Found: C, 55.56; H, 5.31; N, 11.35; Na, 6.30.

20 Substituting for sodium hydroxide the following salts are prepared in a similar manner. Compounds prepared in this manner are described in Table VI.

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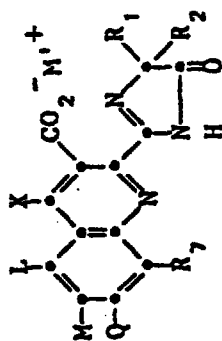
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TABLE VI



R ₁	R ₂	X	L	M	Q	R ₇	M'	mp °C
CH ₃	(CH ₃) ₂ CH	H	H	H	H	H	Na	235 - 250
CH ₃	(CH ₃) ₂ CH						K	
CH ₃	(CH ₃) ₂ CH	H	H	H	H	H	NH ₄	128 - 137
CH ₃	(CH ₃) ₂ CH	H	H	H	H	H	H ₃ NCH ₃	
CH ₃	(CH ₃) ₂ CH	H	H	H	H	H	H ₂ N(CH ₃) ₂	
CH ₃	(CH ₃) ₂ CH	H	H	H	H	H	HN(CH ₃) ₃	
CH ₃	(CH ₃) ₂ CH	H	H	H	H	H	H ₂ N(C ₃ H ₇ -l) ₂	237 - 239
CH ₃	(CH ₃) ₂ CH	H	H	H	H	H	NH ₃ CH ₂ CH=CH ₂	
CH ₃	(CH ₃) ₂ CH	H	H	H	H	H	NH ₃ CH ₂ C≡CH	
CH ₃	(CH ₃) ₂ CH	H	H	H	H	H	NH ₃ C ₆ H ₅	
CH ₃	(CH ₃) ₂ CH	H	H	H	H	H	NH ₃ C ₈ H ₁₇	
CH ₃	(CH ₃) ₂ CH	H	H	H	H	H	NH ₃ C ₁₈ H ₃₇	
CH ₃	(CH ₃) ₂ CH	H	H	H	H	H	NH ₃ C ₃ H ₇ -i	
CH ₃	(CH ₃) ₂ CH	H	H	H	H	H	NH ₃ -CH ₂ - 	

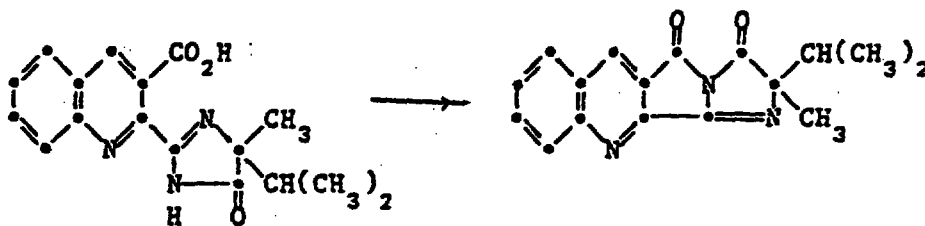
TABLE VI (Continued)

R_1	R_2	X	L	M	Q	R_7	M'	mp°C
CH_3	$(CH_3)_2CH$	H	H	H	H	H	Ca	270 - 290
CH_3	$(CH_3)_2CH$	H	H	H	Cl	H	Ca	
CH_3	$(CH_3)_2CH$	H	H	H	CH_3	H	$NH_2(C_3H_7)_2$	
CH_3	C_2H_5	H	H	H	H	H	$NH_3C_8H_{17}$	
$-(CH_2)_5-$		H	H	H	H	H	$NH_3C_{18}H_{37}$	

Example 47

Preparation of 2-isopropyl-2-methyl-5-H-imidazo[1',2':1,2]pyrazolo 3,4-b quinoline 3(2H), 5-dione, 2-isopropyl-2-methyl

Procedure A

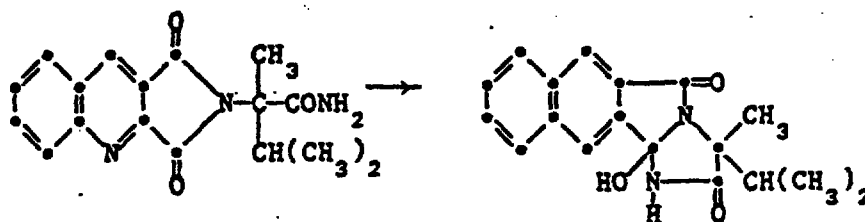


Dicyclohexylcarbodiimide (3.47 g, 0.0168 mol) in methylene chloride under nitrogen is added to a stirred suspension of 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)-3-quinolinecarboxylic acid, (5.24 g, 0.0168 mol) in methylene chloride at room temperature overnight. Since reaction was incomplete a further 0.3 g of dicyclohexylcarbodiimide was added and the mixture stirred for a further 48 hours. The reaction mixture is evaporated to a yellow solid and is purified by chromatography on a silica gel column. The product elutes with acetonitrile-methylene chloride as a white solid, which is crystallized from toluene as mp 225—227°C. Anal. calcd. for $C_{17}H_{15}N_3O_2$: C, 69.61; H, 5.15; N, 14.33. Found: C, 69.76; H, 5.31; N, 14.13.

Example 48

Procedure B

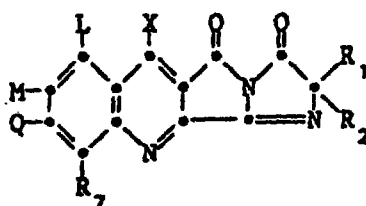
Preparation of cis and trans 1,11b-Dihydro-11b-hydroxy-3-isopropyl-3-methyl-5-H-imidazo[1',2':1,2]pyrrolo [3,4-b]quinoline-2(3H), 5-dione



A solution of 1,3-dihydro-α-isopropyl-α-methyl-1,3-dioxo-2-H-pyrrolo[3,4-b]quinoline-2-acetamide (0.5 g, 0.0016 mol) was heated under reflux in xylene for 23 hours. On cooling, a white solid 0.17 g, mp 191—192°C precipitates and a further crop of 0.1 g, mp 187—189°C is formed by dilution of the filtrate by hexane. Anal. calcd. for $C_{17}H_{17}N_3O_3$: C, 65.58; H, 5.50; N, 13.50. Found: C, 66.08; H, 5.65; N, 13.00.

Other tricycles are obtained by procedures similar to Procedures A and B above.

Examples of Tricycles:



$Q = CH_3$	$X, L, M, R_7 = H$	$R_1 = CH_3$	$R_2 = CH(CH_3)_2$
$Q = Cl$	$X, L, M, R_7 = H$	$R_1 = CH_3$	$R_2 = CH(CH_3)_2$
$M = CH_3$	$X, L, Q, R_7 = H$	$R_1 = CH_3$	$R_2 = CH(CH_3)_2$
$M = Cl$	$X, L, Q, R_7 = H$	$R_1 = CH_3$	$R_2 = CH(CH_3)_2$
$Q = CF_3$	$X, L, M, R_7 = H$	$R_1 = CH_3$	$R_2 = CH(CH_3)_2$
$M = N(CH_3)_2$	$X, L, Q, R_7 = H$	$R_1 = CH_3$	$R_2 = CH(CH_3)_2$
$M = OCH_3$	$X, L, Q, R_7 = H$	$R_1 = CH_3$	$R_2 = CH(CH_3)_2$
$X = OH$	$L, M, Q, R_7 = H$	$R_1 = CH_3$	$R_2 = CH(CH_3)_2$

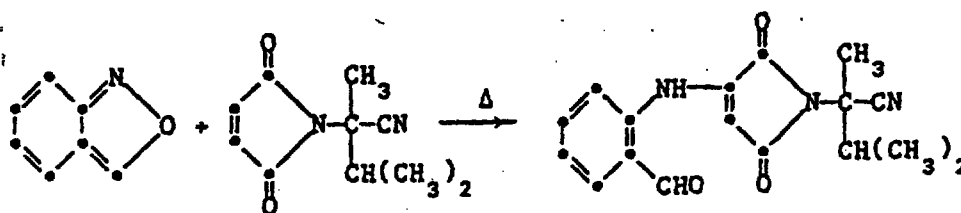
X, L, M, R, Q = H

R₁R₂CH₃C₂H₅CH₃C₃H₇CH₃C₄H_{9-n}CH₃C₄H_{9-sec}CH₃C₄H_{9-iso}CH₃(CH₂)₅CH₃

Example 49

Preparation of N-(1-cyano-1,2-dimethylpropyl-2-(o-formylanilino)maleimide

Procedure A



A solution of anthranil (3.55 g, 0.0298 mol) and α -isopropyl- α -methyl-2,5-dioxo-3-pyrroline-1-acetonitrile (5.73 g, 0.0298 mol) in xylene (20 ml) is heated at reflux for 39 hours under nitrogen. On cooling a yellow precipitate forms and is filtered off to give 2.78 g of mp 191–192°C product. Anal. calcd. for C₁₇H₁₇N₃O₃: C, 65.58; H, 5.50; N, 13.50. Found: C, 65.33; H, 5.44; N, 13.36.



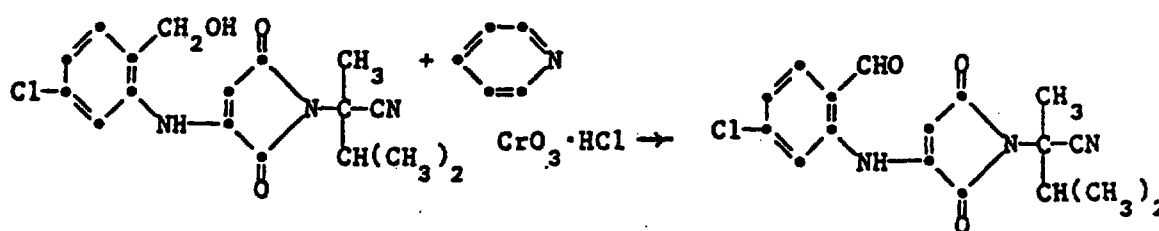
Example 50

Procedure B

Preparation of N-(1-cyano-1,2-dimethylpropyl)-2-(2-formyl-5-chloroanilino)maleimide

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Pyridinium chlorochromate (4.4 g, 0.0204 mol) in methylene dichloride (20 ml) is added rapidly to a methylene chloride (20 ml) solution of N-(1-cyano-1,2-dimethylpropyl)-2-(5-chloro-2-hydroxymethylanilino)maleimide (4.75 g, 0.0136 mol). After 2 hours the dark reaction mixture is diluted with ether (20 ml) and a yellow precipitate is formed and is filtered off. This solid is redissolved in ethyl acetate:methylene chloride (1:1) and is passed through a silica gel column to give a yellow solid 4.31 g, (92%) with mp 80°C (dec.).

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The following aldehydes are prepared according to Procedures A or B as shown in Table VII.

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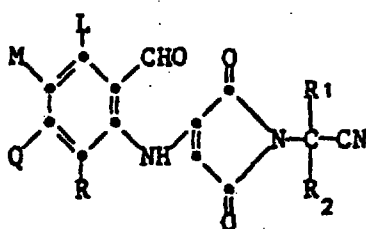
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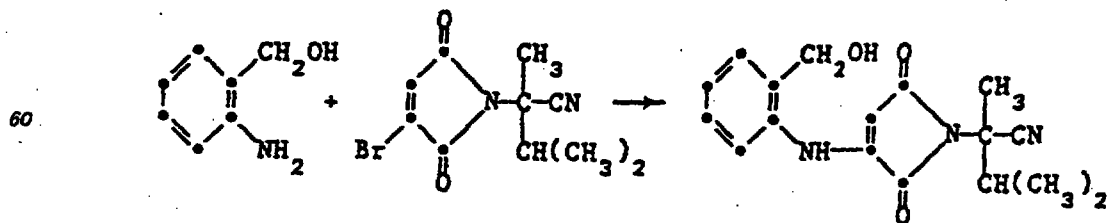
TABLE VII



	R ₁	R ₂	L	M	Q	R	Example Method	mp°C
15	CH ₃	CH(CH ₃) ₂	Cl	H	H	H		
	CH ₃	CH(CH ₃) ₂	H	Cl	H	H	50B	
	CH ₃	CH(CH ₃) ₂	H	H	Cl	H	49A	80
20	CH ₃	CH(CH ₃) ₂	H	H	H	Cl		
	CH ₃	CH(CH ₃) ₂	CH ₃	H	H	H		
25	CH ₃	CH(CH ₃) ₂	H	CH ₃	H	H	50B	
	CH ₃	CH(CH ₃) ₂	H	H	CH ₃	H	50B	205—212
	CH ₃	CH(CH ₃) ₂	H	H	H	CH ₃		
30	CH ₃	CH(CH ₃) ₂	H	H	H	OCH ₃		
	CH ₃	CH(CH ₃) ₂	H	H	Cl	CH ₃		
35	CH ₃	CH(CH ₃) ₂	Cl	H	H	CH ₃		
	CH ₃	CH(CH ₃) ₂	H	Cl	H	CH ₃		
	CH ₃	CH(CH ₃) ₂	Cl	H	H	OCH ₃		
40	CH ₃	CH(CH ₃) ₂	CH ₃	H	H	CH ₃		
	CH ₃	CH(CH ₃) ₂	H	CH ₃	H	CH ₃		
45	CH ₃	CH(CH ₃) ₂	H	H	CH ₃	CH ₃		
	CH ₃	CH(CH ₃) ₂	H	CF ₃	H	H		
	CH ₃	CH(CH ₃) ₂	H	H	CF ₃	H		
50	(CH ₂) ₅		H	H	H	H		

Example 51

Preparation of N-(1-cyano-1,2-dimethylpropyl)-2-(2-hydroxymethylanilino)maleimide

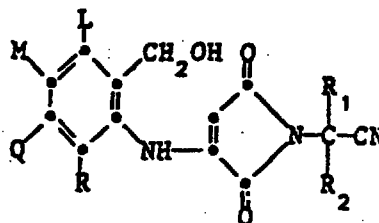


To o-aminobenzyl alcohol, (2 g, 0.0125 mol) and 3-bromo-4-isopropyl-5-methyl-2,5-dioxo-3-pyrroline-1-

acetonitrile (2.7 g, 0.01 mol) is added absolute ethanol (100 ml) containing 3 g of 5 A pulverized sieves. The mixture is stirred for 20 hours at room temperature. The solvent is removed and the residue is purified through a silica gel dry column, eluant ether-hexane (2:1). Starting bromomaleimide is first recovered, followed by a bright yellow solid 1.89 g (60%), mp 39–45°C. Anal. calcd. for $C_{17}H_{19}N_3O_3$; C, 65.16; H, 6.11; N, 13.41. Found: C, 65.94; H, 6.21; N, 12.87.

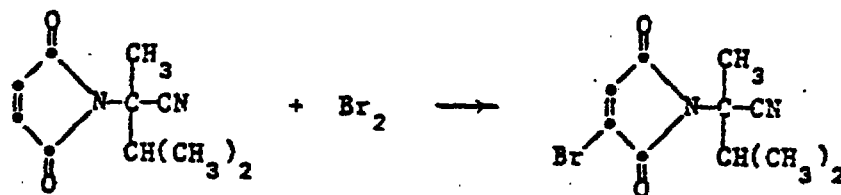
Other compounds are prepared by the above procedure with variously substituted *o*-aminobenzyl-alcohols. Employing *i*-propanol or *t*-butanol for ethanol generally improves the product yield and bases as acid acceptors may also be employed.

TABLE VIII



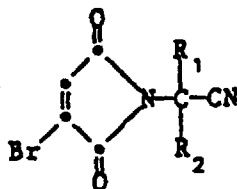
	R ₁	R ₂	L	M	Q	R	mp°C
	CH ₃	CH(CH ₃) ₂	H	H	H	CH ₃	
	CH ₃	CH(CH ₃) ₂	H	H	CH ₃	H	gum
25	CH ₃	CH(CH ₃) ₂	H	CH ₃	H	H	
	CH ₃	CH(CH ₃) ₂	CH ₃	H	H	H	
30	CH ₃	CH(CH ₃) ₂	H	H	H	Cl	
	CH ₃	CH(CH ₃) ₂	H	H	Cl	H	98–100
	CH ₃	CH(CH ₃) ₂	H	Cl	H	H	
35	CH ₃	CH(CH ₃) ₂	Cl	H	H	H	
	CH ₃	CH(CH ₃) ₂	H	H	H	OCH ₃	
40	CH ₃	CH(CH ₃) ₂	H	H	Cl	CH ₃	
	CH ₃	CH(CH ₃) ₂	H	Cl	H	CH ₃	
	CH ₃	CH(CH ₃) ₂	Cl	H	H	OCH ₃	
45	CH ₃	CH(CH ₃) ₂	CH ₃	H	H	CH ₃	
	CH ₃	CH(CH ₃) ₂	H	CH ₃	H	CH ₃	
50	CH ₃	CH(CH ₃) ₂	H	H	CH ₃	CH ₃	
	CH ₃	CH(CH ₃) ₂	H	H	CF ₃	H	
	CH ₃	CH(CH ₃) ₂	H	CF ₃	H	H	
55	(CH ₂) ₅		H	H	H	H	

Example 52

Preparation of 3-Bromo- α -isopropyl- α -methyl-2,5-dioxo-3-pyrroline-1-acetonitrile (intermediate)

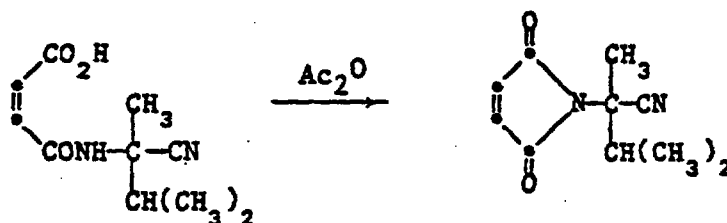
To a solution of α -isopropyl- α -methyl-2,5-dioxo-3-pyrroline-1-acetonitrile (50 g, 0.25 mol) in acetic acid (500 ml) heated at 75°C is added bromine (40.76 g, 0.255 mol) in acetic acid (80 ml) dropwise with stirring. The reaction is maintained at 85° overnight and evaporated to a syrup, which is dissolved in methylene chloride (300 ml), is cooled to 5°C to which triethylamine (34.78 ml) is added. After stirring for 2 hours the brown methylene chloride solution is diluted with ether and a white precipitate is formed. This is extracted with water (400 ml) and the organic layer is dried over anhydrous magnesium sulfate, then passed through a 2 inch bed of silica gel with methylene chloride to elute. The eluate is obtained as a dark brown oil. Anal. calcd. for $C_{10}H_{10}N_2O_2Br$: C, 44.29; H, 4.09; N, 10.33. Found: C, 43.37; H, 4.05; N, 10.07.

Other bromomaleimides are prepared in a similar manner.



R ₁	R ₂
CH ₃	C ₂ H ₅
CH ₃	C ₄ H ₉
CH ₃	C ₄ H ₉ -iso
CH ₃	C ₄ H ₉ -sec
CH ₃	C ₄ H ₉ -tert
CH ₃	
CH ₃	(CH ₂) ₅
CH ₃	CH ₂ CH=CH ₂
CH ₃	

Example 53

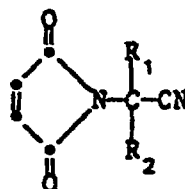
Preparation of α -isopropyl- α -methyl-2,5-dioxo-3-pyrroline-1-acetonitrile (intermediate)

A solution of N-(1-cyano-1,2-dimethylpropyl)maleamic acid (595 g, 2.83 mol) in acetic anhydride (3.96

liters) containing sodium acetate (13.72 g, 0.167 mol) is heated under reflux for one hour, cooled and the solvent removed in vacuo. The product is distilled* at 120–130°C/0.1 mm to give 337 g (63%) of product.

*The pot temperature should not exceed 200°. Anal. calcd. for $C_{10}H_{12}N_2O_2$: C, 62.49; H, 6.29; N, 14.57. Found: C, 62.32; H, 6.36; N, 14.59.

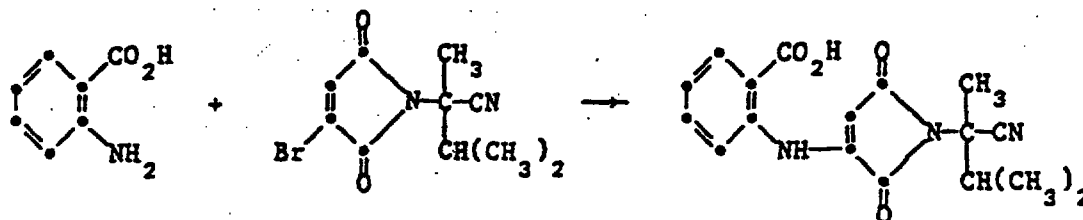
In a similar manner the following compounds are prepared.



R_1	R_2	mp°C
CH ₃	CH(CH ₃) ₂	
CH ₃	C ₂ H ₅	
CH ₃	C ₃ H ₇	
CH ₃	C ₄ H ₉	
CH ₃	C ₄ H ₉ -iso	
CH ₃	C ₄ H ₉ -sec	
CH ₃	C ₄ H ₉ -tert	
CH ₃		
CH ₃		
	(CH ₂) ₅	
CH ₃	CH ₂ CH=CH ₂	

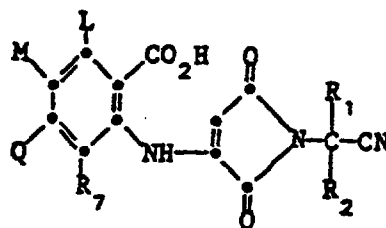
Example 54

Preparation of N-[1-(1-cyano-1,2-dimethylpropyl)-2,5-dioxo-3-pyrrolin-3-yl]anthranilic acid



A mixture of anthranilic acid, (13.7 g, 0.1 mol), 3-bromo- α -isopropyl- α -methyl-2,5-dioxo-3-pyrrolidine-1-acetonitrile (27 g, 0.1 mol), isopropanol (200 ml) and sodium acetate (8.2 g) is stirred at room temperature 3 days and then is heated at reflux 1 hour. On cooling, and with the addition of ether, a yellow solid 31.6 g, (97.7%) is obtained, mp 262–266°C after crystallizing from acetic acid. Anal. calcd. for $C_{17}H_{17}N_3O_4$: C, 62.37; H, 5.24; N, 12.84. Found: C, 62.24; H, 5.19; N, 12.70.

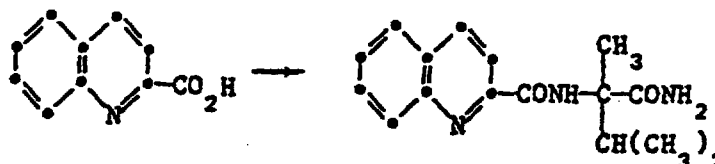
In a similar manner other maleimides may be prepared.



R ₁	R ₂	L	M	Q	R ₇
CH ₃	CH(CH ₃) ₂	H	Cl	H	H
CH ₃	CH(CH ₃) ₂	H	H	Cl	H
CH ₃	CH(CH ₃) ₂	H	CH ₃	H	H
CH ₃	CH(CH ₃) ₂	H	H	CH ₃	H

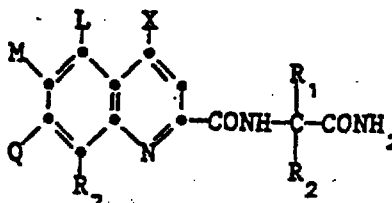
Example 55

Preparation of N-(1-carbamoyl-1,2-dimethylpropyl)quinaldamide



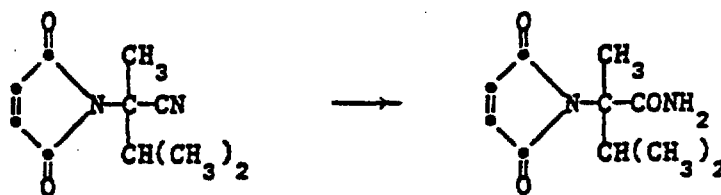
To a solution of quinaldic acid (20 g, 0.116 mol) in tetrahydrofuran (500 ml) cooled to -9°C is added methyl chloroformate (8.92 ml, 0.116 mol) followed by triethylamine (18.4 ml, 0.139 mol). After 20 minutes α -isopropyl- α -methyl-3-pyrroline-1-acetamide (15.1 g, 0.116 mol) is added and the mixture stirred overnight at room temperature. Water is added and the solution is reduced to 200 ml on a rotorvap. A white solid separates and is filtered off, water washed and dried. Recrystallization from absolute ethanol gives the product mp $179-180^{\circ}\text{C}$, 26.86 g (87%). Anal. calcd. for $\text{C}_{16}\text{H}_{19}\text{N}_3\text{O}_2$: C, 67.34; H, 6.73; N, 14.72. Found: C, 67.14; H, 6.17; N, 14.72.

In a similar manner other quinolinecarboxamides may be prepared.



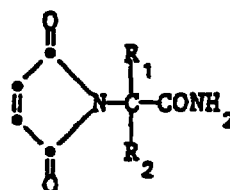
R ₁	R ₂	X	L	M	Q	R ₇
CH ₃	CH(CH ₃) ₂	OCH ₃	H	H	H	H
CH ₃	CH(CH ₃) ₂	CH ₃	H	H	H	H
CH ₃	CH(CH ₃) ₂	Cl	H	H	H	H
CH ₃	CH(CH ₃) ₂	H	H	H	H	Cl
CH ₃	CH(CH ₃) ₂	H	H	H	H	NO ₂
CH ₃	C ₂ H ₅	H	H	H	H	H
CH ₃	C ₄ H ₉ -sec	H	H	H	H	H
—(CH ₂) ₅ —		H	H	H	H	H
CH ₃	CH(CH ₃) ₂	H	H	H	H	Br

Example 56

Preparation of α -isopropyl- α -methyl-2,5-dioxo-3-pyrroline-1-acetamide (intermediate)

A solution of α -isopropyl- α -methyl-2,5-dioxo-3-pyrroline-1-acetonitrile (2.0 g, 0.104 mol) in methylene chloride (30 ml) is added in a fine stream to concentrated sulfuric acid at room temperature. After stirring overnight at room temperature for 16 hours the mixture is poured onto ice, containing sodium chloride and ethyl acetate. The organic layer is washed with aqueous sodium bicarbonate, brine and dried. Evaporation after washing with ether-pentane gives a solid (72%), mp 138.5–140°C. Anal. calcd. for $C_{10}H_{14}N_2O_3$: C, 57.13; H, 6.71; N, 13.33. Found: C, 56.89; H, 6.64; N, 13.16.

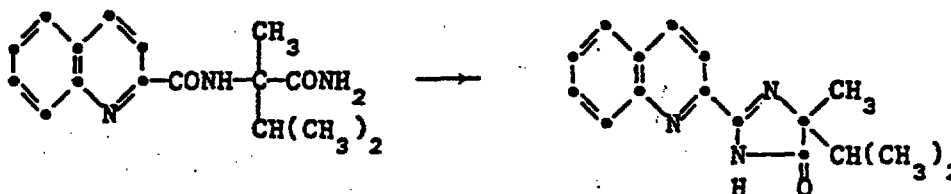
In a similar manner other imideamides are prepared.



R ₁	R ₂
CH ₃	C ₂ H ₅
CH ₃	C ₃ H ₇
CH ₃	C ₄ H ₉ -n
CH ₃	C ₄ H ₉ -iso
CH ₃	C ₄ H ₉ -sec
CH ₃	C ₄ H ₉ -tert
CH ₃	
CH ₃	CH ₂ CH=CH ₂
CH ₃	
	(CH ₂) ₅

Example 57

Preparation of 5-isopropyl-5-methyl-2-(2-quinolyl)-2-imidazolin-4-one

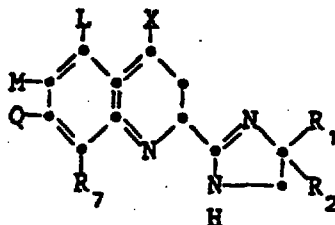


To a slurry of N-(1-carbamoyl-1,2-dimethylpropyl)-2-quinolinecarboxamide (16.04 g, 0.0562 mol) in

xylene (610 ml) under nitrogen is added a 50% oil dispersion of sodium hydride (2.7 g, 0.056 mol) at 20°C. The reaction is heated to reflux for 2 hours, cooled and water (50 ml) added. The aqueous layer is extracted with methylene chloride and the organic layers combined and evaporated to give a yellow oil, 17 g. Purification is accomplished by passing through a silica gel column using hexane-ethyl acetate as solvent. A pale yellow solid is obtained and is recrystallized from ethyl acetate to give 11.77 g (78%) of white product, mp 112–117°C. Anal. Calcd. for $C_{16}H_{17}N_3O$: C, 71.88; H, 6.41; N, 15.72. Found: C, 71.91; H, 6.47; N, 15.70.

Other compounds prepared in a similar manner are shown in Table IX.

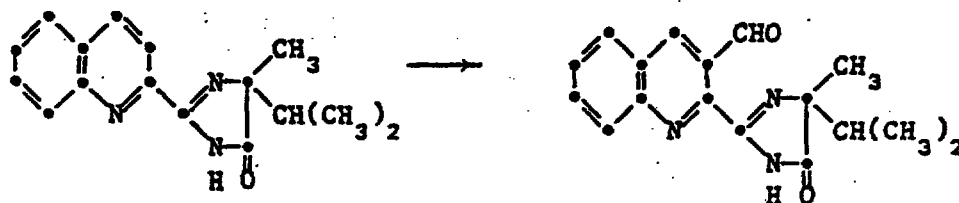
TABLE IX



R_1	R_2	X	L	M	Q	R_7
CH ₃	CH(CH ₃) ₂	OCH ₃	H	H	H	H
CH ₃	CH(CH ₃) ₂	CH ₃	H	H	H	H
CH ₃	CH(CH ₃) ₂	Cl	H	H	H	H
CH ₃	CH(CH ₃) ₂	H	H	H	H	Cl
CH ₃	CH(CH ₃) ₂	H	H	H	H	NO ₂
CH ₃	C ₂ H ₅	H	H	H	H	H
CH ₃	C ₃ H ₇	H	H	H	H	H
CH ₃	C ₄ H _{9-n}	H	H	H	H	H
CH ₃	C ₄ H _{9-i}	H	H	H	H	H
CH ₃	C ₄ H _{9-sec}	H	H	H	H	H
CH ₃	C ₄ H _{9-t}	H	H	H	H	H
CH ₃	cyclopropyl	H	H	H	H	H
CH ₃	CH ₂ CH=CH ₂	H	H	H	H	H
CH ₃	cyclohexyl	H	H	H	H	H
(CH ₂) ₆		H	H	H	H	H

Example 58

Preparation of 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)-3-quinolinecarboxaldehyde



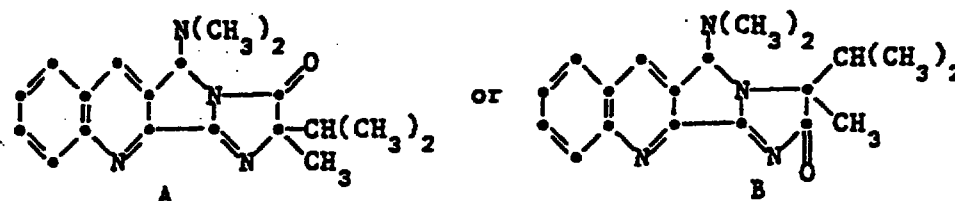
To a mixture of 5-isopropyl-5-methyl-2-(2-quinolyl)-2-imidazolin-4-one (3 g, 0.0112 mol) in ether

(150 ml) is added tetramethylethylenediamine (3.4 g, 0.00225 mol). *n*-Butyllithium (17 ml, 0.027 mol) in hexane is added dropwise to the reaction mixture cooled to -63°C . An intense red color is generated and after the addition the mixture was maintained at -10 to -20°C for 2½ hours. Dry DMF (5 ml) was added at -10°C and the mixture is allowed to attain room temperature, while stirring overnight. The mixture is diluted with water (75 ml) and is neutralized with acetic acid. A pale yellow solid 2.57 g (78%) is obtained with mp 226 – 227°C after crystallization* from 95% ethanol. Anal. calcd. for $\text{C}_{17}\text{H}_{17}\text{N}_3\text{O}_2$: C, 69.13; H, 5.80; N, 14.23. Found: C, 68.98; H, 5.88; N, 14.25.

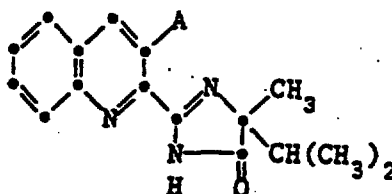
* Dilution of the 95% ethanol with 5–10 ml of water gives a new solid which is filtered off. Washing the solid with 95% ethanol removes the yellow color and gives a material mp 168 – 169°C . An

$$\frac{m + l}{e}$$

confirms either tricyclic structure A or B.



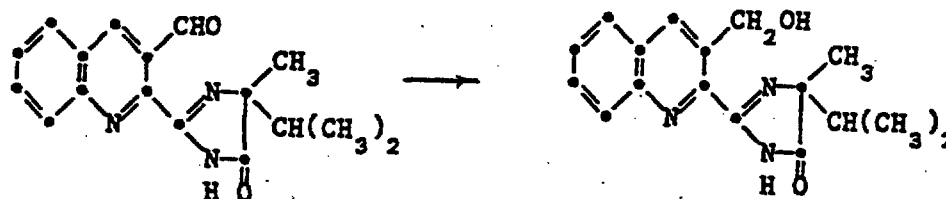
In a similar manner, other A groups are prepared.



A	mp $^{\circ}\text{C}$
COOH	
$\text{CH}_2\text{CH}_2\text{OH}$	
CH_3	
$\text{CH}_2\text{CO}_2\text{CH}_3$	
CH_3CHOH	
$\text{C}_6\text{H}_5\text{CHOH}$	
$(\text{CH}_3)_2\text{COH}$	181–184
$\text{C}_6\text{H}_5\text{COH}$	
CH_3	135–199 a diastereomeric mixture

Example 59

Preparation of 2-3-(Hydroxymethyl)-2-quinolyl-5-isopropyl-5-methyl-2-imidazolin-4-one

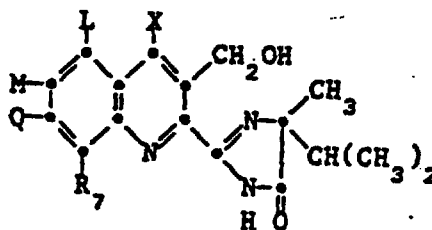


Powdered sodium borohydride (0.5 g, 0.013 mol) is added to 2-(5-isopropyl-5-methyl-4-oxo-2-imida-

zolin-2-yl)-3-quinolinecarboxaldehyde (0.78 g, 0.00264 mol) which is suspended in ethanol (150 ml) under nitrogen. A clear yellow solution results. After 20 minutes the reaction is concentrated to 40 ml, and is diluted with water (75 ml). Methylene chloride extraction and evaporation gives a solid which is crystallized from hexane-ethyl acetate to give pale yellow crystals, mp 138–149°C, M/e 298.

Other compounds may be prepared by the above procedure using the appropriately substituted quinoline-carboxaldehyde. Such compounds are shown in Table X.

TABLE X



X = Cl, Me	L, M, Q, R ₇ = H
L = Me, Cl	X, M, Q, R ₇ = H
M = Me, Cl	X, L, Q, R ₇ = H
Q = Me, Cl	X, L, M, R ₇ = H
R ₇ = Me, Cl	X, L, M, Q = H

Example 60

Post-Emergence Herbicidal Evaluation of Test Compounds

The postemergence herbicidal activity of the compounds of the present invention is demonstrated by the following tests, wherein a variety of monocotyledonous and dicotyledonous plants are treated with test compounds dispersed in aqueous acetone mixtures. In the tests, seedling plants are grown in jiffy flats for about two weeks. The test compounds are dispersed in 50/50 acetone/water mixtures containing 0.5% TWEEN® 20, a polyoxyethylene sorbitan monolaurate surfactant of Atlas Chemical Industries, in sufficient quantity to provide the equivalent of about .016 kg of 10 kg per hectare of active compound when applied to the plants through a spray nozzle operating at 40 psi for a predetermined time. After spraying, the plants are placed on greenhouse benches and are cared for in the usual manner, commensurate with conventional greenhouse practices. From 4 to 5 weeks after treatment, the seedling plants, are examined and rated according to the rating system provided below. The data obtained are recorded in Table XI below.

15	Rating System	% Difference in Growth from the Check*
	0 — No effect	0
	1 — Possible effect	1—10
20	2 — Slight effect	11—25
	3 — Moderate effect	26—40
25	5 — Definite injury	41—60
	6 — Herbicidal effect	61—75
	7 — Good Herbicidal effect	76—90
30	8 — Approaching complete kill	91—99
	9 — Complete kill	100
35	4 — Abnormal growth, that is, a definite physiological malformation but with an over-all effect less than a 5 on the rating scale.	

In most cases the data are for a single test, but in several instances, they are average values obtained from more than one test.

Plant Species Used

5	Barnyardgrass	(<i>Echinochloa crusgalli</i>)
	Green foxtail	(<i>Setaria viridis</i>)
10	Purple Nutsedge	(<i>Cyperus rotundus</i> L.)
	Wild Oats	(<i>Avena Fatua</i>)
	Quackgrass	(<i>Agropyron repens</i>)
15	Field Bindweed	(<i>Convolvulus arvensis</i> L.)
	Cocklebur	(<i>Xanthium pensylvanicum</i>)
20	Morningglory	(<i>Ipomoea purpurea</i>)
	Ragweed	(<i>Ambrosia artemisiifolia</i>)
	Velvetleaf	(<i>Abutilon Theophrasti</i>)
25	Barley	(<i>Hordeum vulgare</i>)
	Corn	(<i>Zea Mays</i>)
30	Rice	(<i>Oryza Sativa</i>)
	Soybean	(<i>Glycine max</i>)
	Sunflower	(<i>Helianthus annus</i>)
35	Wheat	(<i>Triticum aestivum</i>)
40		
45		
50		
55		
60		
65		

TABLE XI

Compounds	RATE	BARN-YARDGR	GREEN FOX	P NUT-SEGE	WILD OATS	QUACK GRASS	FLD BINDWD	COCKLE-BUR
Triethylammonium-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0	9.0	8.0	9.0	9.0	9.0	9.0
	.032	9.0	9.0	8.0	9.0	9.0	9.0	7.0
Sodium-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000	9.0	9.0	8.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	8.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	8.0	9.0	9.0	9.0	9.0
	.063	9.0	9.0	8.0	9.0	9.0	9.0	8.0
	.032	9.0	9.0	7.0	9.0	9.0	9.0	8.0
Methyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	10.000	9.0	9.0	9.0	9.0		9.0	9.0
	2.000	9.0	9.0	9.0	9.0		9.0	9.0
	1.000	9.0	9.0	8.9	9.0	9.0	9.0	9.0
	.500	9.0	9.0	8.2	9.0	9.0	9.0	9.0
	.250	8.8	9.0	7.6	8.9	8.5	9.0	8.4
	.125	6.9	8.8	5.2	8.9	8.3	8.6	7.4
2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinic acid	.063	4.4	8.0	3.3	8.0	5.5	7.8	6.2
	.032	2.3	7.4	1.9	5.6	4.0	6.6	6.5
	.016							
	10.000	9.0	9.0	9.0	9.0			
	2.000	9.0	9.0	9.0	9.0			
	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0
Methyl-2-(5-ethyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	8.7	9.0	9.0	9.0	9.0
	.250	8.7	9.0	8.3	9.0	9.0	9.0	9.0
	.125	9.0	9.0	7.7	9.0	9.0	9.0	9.0
	.063	9.0	9.0	7.3	9.0	9.0	9.0	9.0
	.032	8.3	9.0	5.7	9.0	9.0	9.0	9.0
	.016	5.0	9.0	0.0	9.0	9.0	9.0	8.5



TABLE XI (cont'd.)

Compounds	RATE	XXX MRN GLY	RAG- WEED	VELVET- LEAF	S BARLEY LA	CORN FIELD	RICE NATO	SOYBEAN WI	SUNFLR XXY	S WHEAT ER
Triethylammonium-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)-nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0	7.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0
	.032	9.0	5.0	9.0	7.0	9.0	9.0	8.0	9.0	9.0
Sodium-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.032	9.0	7.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0
Methyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	10.000	9.0	9.0	9.0						
	2.000	9.0	9.0	9.0		9.0	9.0	9.0	9.0	8.8
	1.000	9.0	8.6	9.0	8.8	8.8	8.8	9.0	9.0	7.9
	.500	8.9	8.0	9.0	8.7	8.9	7.8	9.0	9.0	7.5
	.250	8.6	7.1	9.0	8.5	8.6	7.5	8.7	8.7	6.8
	.125	8.2	5.7	8.8	8.8	8.4	6.8	8.3	7.5	5.5
	.063	7.6	2.8	8.8	6.7	8.4	4.3	7.6	5.5	3.0
	.032	7.1	0.6	7.7	6.1	6.7	2.8	7.2	7.5	1.8
	.016				7.5	6.0	3.0	6.5		
2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinic acid	10.000	7.0	9.0	9.0						
	2.000	8.0	8.0	9.0		9.0	9.0	9.0	9.0	9.0
	1.000	8.7	8.7	9.0	9.0	9.0	8.7	9.0	9.0	9.0
	.500	8.7	8.3	8.7	9.0	9.0	8.7	9.0	9.0	9.0
	.250	8.7	8.3	8.7	9.0	9.0	8.7	8.5	9.0	9.0
	.125	8.7	7.3	8.7	9.0	9.0	8.3	8.5	9.0	9.0
	.063	8.7	7.3	8.7	8.5	9.0	8.0	8.5	9.0	9.0
	.032	8.7	5.7	8.7	8.5	9.0	7.3	7.5	9.0	9.0
	.016	6.0	0.0	6.0		9.0	8.0	8.0		
Methyl-2-(5-ethyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000	8.0	4.0	9.0		1.0	7.0	7.0		
	.500	8.0	3.0	9.0		1.0	4.8	6.0		
	.250	8.0	0.0	9.0		0.0	4.0	6.0		
	.125	7.0	0.0	9.0		0.0	2.0	2.0		
	.063	4.0	0.0	9.0		0.0	0.0	2.0		

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TABLE XI (cont'd.)

Compounds	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEDGE	WILD OATS	QUACK GRASS	FLD BINDWD	COCKLE- BUR
2-Propynyl-2-(5-isopropyl- 5-methyl-4-oxo-2- imidazolin-2-yl)nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	8.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	8.0	9.0	9.0	9.0	9.0
	.063	8.0	9.0	7.0	9.0	9.0	9.0	8.0
	.032	4.0	9.0	4.0	9.0	5.0	9.0	2.0
2-Propynyl-2-(5,5-dimethyl- 4-oxo-2-imidazolin- 2-yl)-nicotinate	1.000	5.0	9.0	9.0	1.0	8.0	8.0	4.0
	.500	1.0	8.0	0.0	0.0	6.0	4.0	0.0
	.250	0.0	8.0	0.0	0.0	2.0	8.0	0.0
	.125	0.0	6.0	0.0	0.0	1.0	1.0	0.0
	.063	9.0	4.0	0.0	0.0	0.0	0.0	0.0
	.032	0.0	2.0	0.0	0.0	0.0	0.0	0.0
Tert-Butyl-2-(5-isopropyl- 5-methyl-4-oxo-2-imidazolin- 2-yl)nicotinate	1.000		2.0	8.0	9.0		9.0	9.0
	.500			8.0	8.0	9.0	9.0	8.0
	.250			6.0	3.0	8.0	9.0	7.0
	.125			3.0	3.0	7.0	8.0	3.0
	.063			1.0	0.0	1.0	2.0	2.0
	.032			0.0	0.0	0.0	0.0	
Cyclohexyl-2-(5-isopropyl- 5-methyl-4-oxo-2-imidazolin- 2-yl)nicotinate	1.000			6.0	0.0	9.0	8.0	9.0
	.500			2.0	0.0	6.0	7.0	3.0
	.250			1.0	0.0	1.0	2.0	0.0
	.125			0.0	0.0	0.0	1.0	0.0
	.063			0.0	0.0	0.0	0.0	0.0
	.032			0.0	0.0	0.0	0.0	0.0

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TABLE XI (cont'd.)

Compounds	RATE	XXX MRN GLY	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	RICE NATO	SOYBEAN WI	SUNFLR XXY	S WHEAT ER
2-Propynyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0	8.0	9.0	9.0	9.0	7.0	8.0	9.0	9.0
	.032	9.0	4.0	9.0	9.0	9.0	6.0	4.0	9.0	8.0
2-Propynyl-2-(5,5-dimethyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000	8.0	1.0	8.0	5.0	1.0	8.0	4.0	5.0	5.0
	.500	6.0	0.0	8.0	1.0	0.0	7.0	2.0	1.0	2.0
	.250	4.0	0.0	8.0	0.0	0.0	4.0	0.0	0.0	0.0
	.125	1.0	0.0	4.0	0.0	0.0	1.0	0.0	0.0	0.0
	.063	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	.032	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tert-Butyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000	8.0	8.0	9.0	0.0	0.0	8.0	9.0	9.0	9.0
	.500	8.0	7.0	9.0	0.0	8.0	8.0	8.0	9.0	9.0
	.250	7.0	1.0	9.0	0.0	7.0	4.0	7.0	9.0	8.0
	.125	6.0	0.0	8.0	8.0	7.0	3.0	7.0	8.0	7.0
	.063	3.0	0.0	6.0	2.0	0.0	1.0	0.0	4.0	4.0
	.032	2.0	0.0	2.0	1.0	0.0	0.0	0.0	1.0	1.0
Cyclohexyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000	8.0	1.0	8.0	7.0	1.0	4.0	6.0	8.0	9.0
	.500	7.0	0.0	8.0	4.0	0.0	3.0	2.0	6.0	7.0
	.250	3.0	0.0	6.0	2.0	0.0	2.0	0.0	2.0	3.0
	.125	0.0	0.0	3.0	1.0	0.0	0.0	0.0	0.0	0.0
	.063	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
	.032	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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TABLE XI (cont'd.)

Compounds	RATE	BARN-YARDGR	GREEN FOX	P NUT-SEDE	WILD OATS	QUACK GRASS	FLD BINDWD	COCKLE-BUR
Methyl-2-(5,5-dimethyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000	2.0	9.0	0.0	0.0	2.0	0.0	4.0
	.500	1.0	8.0	0.0	0.0	0.0	8.0	2.0
	.250	0.0	8.0	0.0	0.0	0.0	7.0	0.0
	.125	0.0	8.0	0.0	0.0	0.0	4.0	0.0
	.063	0.0	4.0	0.0	0.0	0.0	0.0	0.0
	.032	0.0	2.0	0.0	0.0	0.0	0.0	0.0
Benzyl-2-(5,5-dimethyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000	1.0	8.0	0.0	9.0	0.0	9.0	2.0
	.500	1.0	8.0	0.0	0.0	0.0	4.0	0.0
	.250	0.0	7.0	0.0	0.0	0.0	2.0	0.0
	.125	0.0	2.0	0.0	0.0	0.0	2.0	0.0
	.063	0.0	0.0	0.0	0.0	0.0	2.0	0.0
	.032	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Calcium-2-(5-isopropyl-6-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0	9.0	8.0	9.0	9.0	9.0	9.0
	.032	8.0	9.0	8.0	9.0	9.0	9.0	6.0
Benzyl-2-(5-ethyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000	7.0	9.0	3.0	8.0	4.0	8.0	9.0
	.500	2.0	9.0	2.0	7.0	5.0	8.0	9.0
	.250	1.0	9.0	2.0	1.0	4.0	7.0	1.0
	.125	0.0	7.0	1.0	0.0	0.0	7.0	0.0
	.063	0.0	2.0	0.0	0.0	0.0	8.0	0.0
	.032	0.0	1.0	0.0	0.0	0.0	4.0	0.0
2-Propynyl-2-(5-ethyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000	9.0	9.0	8.0	9.9	9.9	9.9	8.0
	.500	7.0	9.0	6.0	9.0	8.0	9.0	3.0
	.250	6.0	9.0	2.0	9.0	6.0	9.0	5.0
	.125	5.0	9.0	1.0	6.0	2.0	9.0	8.0
	.063	1.0	9.0	0.0	0.0	0.0	8.0	1.0
	.032	0.0	6.0	0.0	0.0	0.0	5.0	0.0

TABLE XI (cont'd.)

Compounds	RATE	XXX MRN GLY	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	RICE NATO	SOYBEAN WI	SUNFLR XXY	S WHEAT ER
Methyl-2-(5,5-dimethyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000	7.0	2.0	9.0	0.0	0.0	7.0	2.0	0.0	1.0
	.500	7.0	3.0	8.0	0.0	0.0	7.0	2.0	0.0	0.0
	.250	8.0	0.0	8.0	0.0	0.0	6.0	0.0	0.0	0.0
	.125	6.0	0.0	3.0	0.0	0.0	1.0	0.0	0.0	0.0
	.063	1.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	0.0
	.032	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Benzyl-2-(5,5-dimethyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000	6.0	0.0	7.0	1.0	0.0	2.0	3.0	1.0	0.0
	.500	6.0	0.0	7.0	0.0	0.0	1.0	2.0	0.0	0.0
	.250	4.0	0.0	3.0	0.0	0.0	1.0	0.0	0.0	0.0
	.125	4.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
	.063	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	.032	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Calcium-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.032	9.0	6.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0
Benzyl-2-(5-ethyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000	9.0	7.0	9.0	7.0	0.0	8.0	8.0	8.0	8.0
	.500	9.0	3.0	9.0	6.0	8.0	4.0	9.0	1.0	4.0
	.250	9.0	1.0	9.0	3.0	8.0	3.0	9.0	0.0	1.0
	.125	8.0	0.0	7.0	0.0	1.0	1.0	3.0	0.0	0.0
	.063	7.0	0.0	7.0	0.0	1.0	0.0	1.0	0.0	0.0
	.032	4.0	0.0	4.0	0.0	1.0	0.0	1.0	0.0	0.0
2-Propynyl-2-(5-ethyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	3.0	9.0	8.0	9.0	9.0	7.0	9.0	8.0
	.125	8.0	0.0	9.0	7.0	4.0	8.0	8.0	8.0	4.0
	.063	7.0	0.0	8.0	1.0	0.0	4.0	5.0	1.0	1.0
	.032	6.0	0.0	5.0	0.0	0.0	1.0	1.0	0.0	0.0

TABLE XI (cont'd.)

Compounds	RATE	BARN-YARDGR	GREEN-FOX	P NUT-SEGE	WILD-OATS	QUACK-GRASS	FLD-BINDWD	COCKLE-BUR
2-(5-Ethyl-5-methyl-4-oxo-2-imidazolyl-2-yl)nicotinic acid	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	7.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	4.0	9.0	9.0	9.0	8.0
	.063	8.0	9.0	1.0	8.0	4.0	8.0	7.0
	.032	3.0	7.0	1.0	1.0	2.0	8.0	2.0
Diisopropylammonium-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolyl-2-yl)nicotinic acid	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	5.9	9.0	9.0	9.0	9.9	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	8.0	9.0	8.0	9.0	9.0	9.0	6.0
	.032							
Dodecyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolyl-2-yl)nicotinate	1.000	6.0	8.0	7.0	8.0	9.0	9.0	9.0
	.500	3.0	8.0	3.0	8.0	8.0	9.0	9.0
	.250	3.0	7.0	1.0	6.0	3.0	7.0	9.0
	.125	1.0	6.0	0.0	4.0	1.0	6.0	6.0
	.063	0.0	3.0	0.0	4.0	0.0	3.0	1.0

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TABLE XI (cont'd.)

Compounds	RATE	XXX MRN GLY	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	RICE NATO	SOYBEAN WI	SUNFLR XXY	S WHEAT ER
2-(5-Ethyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinic acid	1.000	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	6.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	3.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0
	.063	9.0	0.0	9.0	8.0	7.0	7.0	7.0	9.0	8.0
Disopropylammonium-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinic acid	.032	8.0	0.0	9.0	1.0	0.0	6.0	6.0	0.0	4.0
	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
Dodecyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.063	9.0	8.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0
	.032	8.0	5.0	9.0	9.0	9.0	8.0	8.0	9.0	9.0
	1.000	8.0	6.0	9.0	8.0	7.0	8.0	7.0	9.0	8.0
	.500	7.0	2.0	9.0	8.0	4.0	2.0	7.0	9.0	7.0
	.250	7.0	0.0	9.0	7.0	2.0	0.0	3.0	3.0	3.0
	.125	7.0	0.0	7.0	4.0	0.0	0.0	3.0	0.0	1.0
	.063	7.0	0.0	7.0	4.0	0.0	0.0	1.0	0.0	0.0

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TABLE XI (cont'd.)

Compounds	RATE	BARN-YARDGR	GREEN FOX	P NUT-SEDGE	WILD OATS	QUACK GRASS	FLD BINDWD	COCKLE-BUR
2-Decynyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)-nicotinate	1.000		9.0	8.0	9.0		9.0	9.0
	.500		9.0	7.0	9.0		9.0	9.0
	.250		9.0	7.0	9.0		9.0	8.0
	.125		9.0	6.0	9.0		9.0	6.0
	.063		7.0	2.0	9.0		9.0	3.0
	.032		1.0	0.0	7.0		8.0	1.0
2-Methoxyethyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)-nicotinate	1.000		9.0	9.0	9.0		9.0	9.0
	.500		9.0	8.0	9.0		9.0	9.0
	.250		9.0	8.0	9.0		8.0	3.0
	.125		9.0	2.0	9.0		8.0	2.0
	.063		2.0	0.0	9.0		7.0	0.0
	.032		1.0	0.0	4.0		3.0	0.0
Allyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000		9.0	8.0	9.0		9.0	9.0
	.500		9.0	8.0	9.0		9.0	9.0
	.250		9.0	2.0	9.0		9.0	8.0
	.125		8.0	1.0	9.0		9.0	4.0
	.063		7.0	0.0	9.0		8.0	1.0
	.032		2.0	0.0	7.0		7.0	0.0
1-Methylallyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)-nicotinate	1.000		9.0	8.0	9.0		9.0	9.0
	.500		9.0	8.0	9.0		8.0	9.0
	.250		8.0	1.0	9.0		8.0	5.0
	.125		4.0	0.0	9.0		7.0	1.0
	.063		1.0	0.0	8.0		7.0	1.0
	.032		0.0	0.0	3.0		4.0	0.0
1-Methyl-2-propynyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)-nicotinate	1.000		9.0	8.0	9.0		9.0	9.0
	.500		9.0	8.0	9.0		9.0	9.0
	.250		9.0	8.0	9.0		9.0	7.0
	.125		9.0	7.0	9.0		9.0	4.0
	.063		7.0	5.0	9.0		8.0	4.0
	.032		4.0	2.0	7.0		8.0	1.0

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TABLE XI (cont'd.)

Compounds	RATE	XXX MRN GLY	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	RICE NATO	SOYBEAN WI	SUNFLR XXY	S WHEAT ER
2-Decynyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-3-yl)-nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0
	.250	8.0	6.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0
	.125	8.0	6.0	8.0	8.0	9.0	7.0	9.9	9.0	9.0
	.063	7.0	2.0	8.0	8.0	7.0	6.0	9.0	8.0	8.0
	.032	6.0	0.0	6.0	7.0	6.0	2.0	9.0	2.0	7.0
2-Methoxyethyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)-nicotinate	.000	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	8.0	0.0	0.0	0.0
	.250	9.0	9.0	9.0	9.0	9.0	4.0	9.0	9.0	9.0
	.125	8.0	6.0	8.0	9.0	9.0	4.0	9.0	9.0	9.0
	.063	7.0	1.0	8.0	8.0	7.0	2.0	8.0	4.0	8.0
	.032	4.0	0.0	6.0	7.0	0.0	1.0	7.0	1.0	4.0
Allyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0
	.250	9.0	8.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0
	.125	9.0	7.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0
	.063	8.0	4.0	8.0	8.0	7.0	6.0	8.0	8.0	8.0
	.032	7.0	1.0	6.0	7.0	0.0	3.0	7.0	7.0	4.0
1-Methylallyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)-nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0
	.500	9.0	8.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0
	.250	8.0	7.0	8.0	9.0	7.0	5.0	8.0	9.0	9.0
	.125	8.0	1.0	8.0	9.0	4.0	3.0	7.0	7.0	8.0
	.063	7.0	0.0	7.0	7.0	0.0	1.0	7.0	7.0	7.0
	.032	6.0	0.0	6.0	2.0	0.0	0.0	1.0	1.0	4.0
1-Methyl-2-propynyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)-nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0
	.125	9.0	6.0	8.0	9.0	9.0	7.0	7.0	9.0	9.0
	.063	8.0	4.0	7.0	9.0	7.0	6.0	6.0	8.0	9.0
	.032	7.0	1.0	7.0	7.0	7.0	5.0	6.0	7.0	7.0

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TABLE XI (cont'd.)

Compounds	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEEDGE	WILD OATS	QUACK GRASS	FLD BINDWD	COCKLE- BUR
Ethyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000	8.0	9.0	8.0	9.0	9.0	9.0	9.0
	.500	7.0	9.0	7.0	9.0	9.0	9.0	9.0
	.250	3.0	9.0	7.0	9.0	8.0	9.0	9.0
	.125	0.0	8.0	2.0	8.0	7.0	8.0	9.0
	.063	0.0	6.0	0.0	2.0	3.0	8.0	8.0
	.032	0.0	3.0	0.0	1.0	1.0	7.0	8.0
2-(Benzyloxy)ethyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000	9.0	9.0	8.0	9.0	9.0	9.0	9.0
	.500	8.0	8.0	1.0	9.0	9.0	9.0	7.0
	.250	3.0	9.0	0.0	8.0	7.0	9.0	9.0
	.125	1.0	7.0	0.0	6.0	4.0	9.0	1.0
	.063	0.0	3.0	0.0	0.0	0.0	6.0	0.0
	.032	0.0	2.0	0.0	0.0	0.0	0.0	0.0
3-Isopropyl-3-methyl-(3H)-imidazo-[1',2':1,2]pyrrolo[3,4-b]pyridine-2-(3H)-5-dione	1.000	9.0	9.0	8.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	7.0	9.0	9.0	9.0	4.0
	.250	9.0	8.0	7.0	9.0	8.0	9.0	3.0
	.125	4.0	8.0	3.0	6.0	4.0	9.0	3.0
	.063	3.0	4.0	6.0	2.0	0.0	8.0	2.0
	.032	1.0	4.0	1.0	1.0	0.0	1.0	1.0
Methyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate hydrochloride	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	8.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	8.0	9.0	8.0	9.0	8.0
	.063	4.0	9.0	7.0	7.0	4.0	8.0	9.0
	.032	2.0	6.0	6.0	6.0	4.0	8.0	8.0
Furfuryl-2-(5-isopropyl)-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	8.0	9.0	9.0	9.0	9.0
	.063	8.0	8.0	7.0	9.0	8.0	9.0	9.9
	.032	7.0	7.0	3.0	9.0	6.0	9.0	4.0

TABLE XI (cont'd.)

Compounds	RATE	XXX MRN GLY	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	RICE NATO	SOYBEAN WI	SUNFLR XXY	S WHEAT ER
Ethyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0
	.500	9.0	8.0	9.0	9.0	8.0	8.0	9.0	9.0	9.0
	.250	9.0	8.0	9.0	9.0	8.0	6.0	8.0	9.0	8.0
	.125	9.0	8.0	9.0	3.0	0.0	2.0	5.0	9.0	7.0
	.063	7.0	4.0	8.0	0.0	0.0	0.0	0.0	1.0	3.0
	.032	1.0	0.0	8.0	0.0	0.0	0.0	0.0	0.0	2.0
2-(Benzoyloxy)ethyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000	9.0	8.0	9.0	8.0	8.0	8.0	9.0	9.0	8.0
	.500	9.0	8.0	9.0	8.0	8.0	8.0	9.0	9.0	8.0
	.250	8.0	7.0	8.0	7.0	2.0	4.0	8.0	8.0	8.0
	.125	8.0	1.0	8.0	7.0	2.0	1.0	8.0	1.0	4.0
	.063	8.0	0.0	3.0	0.0	0.0	0.0	2.0	0.0	0.0
	.032	4.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
3-isopropyl-3-methyl-[3H]-imidazo-[1',2':1,2]pyrrolo[3,4-b]pyridine-2-(3H),5-dione	1.000	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0
	.500	9.0	9.0	7.0	9.0	9.0	8.0	9.0	9.0	9.0
	.250	9.0	6.0	6.0	9.0	9.0	7.0	8.0	9.0	8.0
	.125	9.0	1.0	6.0	8.0	9.0	7.0	8.0	8.0	8.0
	.063	7.0	0.0	3.0	2.0	9.0	2.0	7.0	4.0	3.0
	.032	7.0	0.0	2.0	4.0	8.0	2.0	6.0	1.0	1.0
Methyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate hydrochloride	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0
	.500	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	8.0
	.250	9.0	8.0	9.0	9.0	9.0	8.0	9.0	9.0	8.0
	.125	8.0	7.0	9.0	8.0	9.0	8.0	9.0	9.0	7.0
	.063	8.0	6.0	8.0	8.0	9.0	7.0	9.0	4.0	6.0
	.032	8.0	4.0	7.0	8.0	9.0	4.0	8.0	4.0	4.0
Furfuryl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0	8.0	8.0	8.0	9.0	7.0	8.0	9.0	9.0
	.032	9.0	3.0	7.0	8.0	9.0	7.0	7.0	9.0	9.0

TABLE XI (cont'd.)

Compounds	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEDGE	WILD OATS	QUACK GRASS	FLD BINDWD	COCKLE- BUR
Isopropyl-2-(6-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)-nicotinate	1.000	8.0	7.0	2.0	9.0	8.0	9.0	9.0
	.500	1.0	7.0	1.0	8.0	8.0	9.0	6.0
	.250	1.0	3.0	0.0	6.0	1.0	8.0	6.0
	.125	1.0	8.0	0.0	2.0	0.0	6.0	8.0
	.063	0.0	2.0	0.0	1.0	0.0	3.0	0.0
	.032	0.0	2.0	0.0	0.0	0.0	2.0	0.0
Benzyl-2-(6-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000	9.0	9.0	8.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	8.0	9.0	9.0	9.0	9.0
	.250	7.0	9.0	7.0	9.0	9.0	8.0	9.0
	.125	6.0	9.0	6.0	9.0	9.0	8.0	2.0
	.063	4.0	7.0	1.0	9.0	9.0	7.0	0.0
	.032	1.0	6.0	1.0	6.0	0.0	4.0	0.0

TABLE XI (cont'd.)

Compounds	RATE	XXX MRN GLY	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	RICE NATO	SOYBEAN WI	SUNFLR XXY	S WHEAT ER
Isopropyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)-nicotinate	1.000	9.0	9.0	9.0	8.0	1.0	8.0	8.0	9.0	8.0
	.500	9.0	8.0	9.0	7.0	1.0	2.0	8.0	9.0	2.0
	.250	8.0	6.0	9.0	3.0	0.0	2.0	7.0	4.0	1.0
	.125	9.0	6.0	7.0	2.0	0.0	0.0	7.0	1.0	0.0
	.063	4.0	1.0	6.0	3.0	0.0	0.0	3.0	1.0	3.0
	.012	4.0	0.0	6.0	1.0	0.0	0.0	1.0	1.0	0.0
Benzyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	6.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0
	.125	9.0	1.0	9.0	8.0	9.0	7.0	9.0	9.0	8.0
	.063	8.0	1.0	2.0	2.0	8.0	7.0	4.0	9.0	4.0
	.012	8.0	0.0	1.0	2.0	1.0	2.0	1.0	9.0	2.0

TABLE XI (cont'd.)
POST-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEDGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
2-Methylallyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	8.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0
	.250	8.0	8.0	7.0	8.0	8.0	9.0	8.0	6.0	8.0	9.0	9.0	9.0	8.0	9.0
	.125	3.0	8.0	6.0	7.0	7.0	7.0	8.0	5.0	8.0	8.0	7.0	9.0	8.0	8.0
	.063	1.0	7.0	1.0	6.0	6.0	7.0	8.0	1.0	7.0	7.0	3.0	9.0	4.0	7.0
	.032	0.0	4.0	0.0	1.0	3.0	7.0	7.0	0.0	6.0	2.0	1.0	9.0	3.0	3.0
2-Butenyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000	9.0	9.0	8.0	9.0	7.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0
	.500	9.0	9.0	7.0	9.0	7.0	8.0	9.0	8.0	9.0	9.0	9.0	9.0	8.0	9.0
	.250	7.0	9.0	6.0	9.0	7.0	8.0	9.0	7.0	9.0	9.0	8.0	9.0	8.0	8.0
	.125	4.0	8.0	5.0	7.0	7.0	8.0	9.0	7.0	8.0	9.0	8.0	9.0	7.0	8.0
	.063	3.0	7.0	4.0	6.0	6.0	7.0	9.0	1.0	7.0	8.0	1.0	9.0	6.0	6.0
	.032	1.0	5.0	1.0	2.0	4.0	7.0	7.0	0.0	6.0	3.0	0.0	9.0	1.0	3.0
Octadecyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	0.000	7.0	1.0	7.0	9.0	9.0	9.0	6.0	3.0	9.0	2.0	0.0	0.0	0.0	
	1.000		0.0	0.0	4.0	0.0	0.0	0.0	0.0	3.0					
Propyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	0.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	1.000	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	7.0	9.0	8.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	8.0
	.250	8.0	9.0	7.0	9.0	7.0	9.0	9.0	9.0	9.0	8.0	7.0	9.0	4.0	8.0
	.125	2.0	9.0	5.0	7.0	5.0	7.0	9.0	6.0	9.0	8.0	2.0	9.0	2.0	7.0
	.063	0.0	7.0	1.0	2.0	4.0	5.0	8.0	3.0	8.0	7.0	0.0	9.0	1.0	6.0
	.032	0.0	6.0	0.0	1.0	3.0	4.0	6.0	0.0	6.0	3.0	0.0	9.0	1.0	6.0

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TABLE XI (cont'd.)
POST-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEDGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
Butyl 2-[5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]nicotinate	8.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	1.000	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	7.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0
	.250	6.0	9.0	7.0	9.0	6.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	8.0
	.125	2.0	8.0	2.0	7.0	5.0	7.0	4.0	3.0	9.0	9.0	6.0	9.0	7.0	7.0
Methyl 2-[5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]-6methoxynicotinate	8.000	9.0	9.0	9.0	9.0	9.0	7.0	9.0	8.0	9.0	9.0	9.0	9.0	7.0	9.0
	1.000	9.0	9.0	7.0	9.0	8.0	7.0	8.0	2.0	7.0	9.0	9.0	9.0	7.0	9.0
	.500	9.0	9.0	7.0	8.0	7.0	7.0	9.0	7.0	7.0	8.0	9.0	8.0	7.0	9.0
	.250	7.0	9.0	7.0	8.0	7.0	6.0	9.0	0.0	4.0	8.0	9.0	6.0	6.0	7.0
	.125	7.0	8.0	6.0	7.0	6.0	6.0	8.0	0.0	2.0	7.0	8.0	4.0	6.0	4.0
	.063	6.0	7.0	6.0	7.0	4.0	2.0	7.0	0.0	1.0	4.0	4.0	1.0	4.0	3.0
2-Decenyl 2-[5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]nicotinate	.032	2.0	4.0	0.0	6.0	1.0	1.0	2.0	0.0	0.0	1.0	7.0	1.0	3.0	3.0
	1.000	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0
	.500	9.0	9.0	7.0	9.0	8.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	8.0	7.0
	.250	7.0	9.0	7.0	9.0	7.0	9.0	9.0	6.0	9.0	9.0	7.0	8.0	8.0	7.0
	.125	3.0	9.0	6.0	8.0	7.0	7.0	3.0	1.0	8.0	8.0	2.0	7.0	6.0	5.0
	.063	2.0	4.0	2.0	7.0	7.0	7.0	2.0	0.0	8.0	8.0	1.0	7.0	2.0	3.0
N,N-diethyl 2-[5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]nicotinamide	.032	0.0	2.0	0.0	0.0	4.0	2.0	2.0	0.0	3.0	3.0	1.0	5.0	1.0	2.0
	8.000	8.0	9.0	9.0	9.0	9.0	1.0	9.0	6.0	8.0					

TABLE XI (cont'd.)

POST-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEDGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
3-Isopropyl-8-methoxy-3-methyl-5H-imidazo-[1',2':1,2]pyrrolo[3,4-b]pyridine-2-(3H)-5-dione	8.000	9.0	9.0	9.0	9.0	9.0	0.0	0.0	8.0	9.0	0.0	6.0	9.0	7.0	4.0
	1.000	6.0	8.0	8.0	9.0	8.0	7.0	0.0	2.0	2.0	0.0	2.0	7.0	7.0	1.0
	.500	6.0	8.0	7.0	3.0	6.0	7.0	2.0	0.0	1.0	1.0	1.0	6.0	7.0	1.0
	.250	4.0	7.0	4.0	1.0	4.0	3.0	2.0	0.0	0.0	0.0	1.0	6.0	6.0	1.0
	.125	2.0	4.0	1.0	0.0	2.0	2.0	1.0	0.0	0.0	0.0	0.0	2.0	4.0	1.0
	.063	2.0	4.0	1.0	0.0	2.0	1.0	0.0	0.0	0.0	0.0	0.0	2.0	4.0	1.0
	.032	0.0	3.0	1.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	1.0	3.0	0.0
2-Chloroallyl 2-[5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]nicotinate	1.000	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	8.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	7.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	7.0	9.0	7.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	8.0
	.063	9.0	9.0	7.0	9.0	7.0	9.0	8.0	6.0	9.0	9.0	9.0	9.0	9.0	8.0
	.032	6.0	9.0	6.0	7.0	6.0	7.0	6.0	2.0	9.0	9.0	8.0	9.0	8.0	6.0
Methyl 2-(1-acetyl-4-isopropyl-4-methyl-5-oxo-2-imidazolin-2-yl)nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	8.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	7.0	9.0	7.0	9.0	8.0	9.0	8.0	2.0	9.0	9.0	9.0	9.0	8.0	8.0
	.063	4.0	9.0	7.0	7.0	7.0	7.0	7.0	1.0	9.0	9.0	9.0	8.0	7.0	8.0
	.032	1.0	7.0	3.0	3.0	6.0	7.0	4.0	0.0	9.0	6.0	8.0	7.0	2.0	7.0
Methyl 2-[5-cyclopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]nicotinate	1.000	9.0	9.0	8.0	9.0	7.0	8.0	8.0	8.0	9.0	9.0	8.0	8.0	9.0	9.0
	.500	7.0	9.0	7.0	4.0	4.0	8.0	8.0	4.0	9.0	8.0	7.0	8.0	9.0	9.0
	.250	2.0	8.0	3.0	1.0	3.0	6.0	8.0	2.0	7.0	4.0	7.0	8.0	7.0	9.0
	.125	0.0	8.0	1.0	0.0	1.0	5.0	6.0	0.0	7.0	3.0	2.0	4.0	4.0	9.0
	.063	0.0	6.0	0.0	0.0	1.0	4.0	4.0	0.0	4.0	2.0	0.0	2.0	1.0	7.0
	.032	0.0	2.0	0.0	0.0	1.0	3.0	3.0	0.0	3.0	0.0	0.0	2.0	1.0	2.0

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TABLE XI (cont'd.)
POST-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEEDGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
Hexyl 2-[5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]nicotinate	8.000	9.0	9.0	9.0	9.0	9.0	2.0	8.0	8.0	9.0	9.0	7.0	8.0	8.0	8.0
	1.000	3.0	6.0	8.0	9.0	9.0	8.0	8.0	6.0	9.0	9.0	6.0	8.0	4.0	8.0
	.500	1.0	4.0	6.0	6.0	8.0	8.0	8.0	2.0	8.0	9.0	6.0	8.0	4.0	7.0
	.250	1.0	4.0	3.0	6.0	8.0	6.0	7.0	1.0	8.0	9.0	3.0	8.0	4.0	7.0
	.125	1.0	2.0	1.0	4.0	8.0	4.0	4.0	0.0	6.0	9.0	1.0	7.0	1.0	6.0
1-Methyl-2-butenyl 2-[5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]nicotinate	.063	0.0	1.0	1.0	0.0	6.0	3.0	3.0	0.0	4.0	8.0	1.0	4.0	1.0	2.0
	.032	0.0	0.0	0.0	0.0	2.0	1.0	1.0	0.0	2.0	3.0	1.0	2.0	1.0	1.0
	8.000	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
Methyl 2-[4-isopropyl-1,4-dimethyl-5-oxo-2-imidazolin-2-yl]nicotinate	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	8.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0	9.0	8.0	9.0	8.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	8.0	8.0
	.032	9.0	9.0	7.0	9.0	7.0	7.0	9.0	4.0	7.0	9.0	9.0	9.0	7.0	8.0
	5.000	8.0	9.0	8.0	9.0	9.0	1.0	8.0	7.0	9.0	9.0	9.0	7.0	8.0	7.0
Methyl 2-[4-isopropyl-4-methyl-5-oxo-2-imidazolin-2-yl]nicotinate	1.000	7.0	9.0	6.0	8.0	7.0	6.0	7.0	3.0	8.0	9.0	9.0	7.0	7.0	7.0
	.500	1.0	8.0	2.0	6.0	4.0	6.0	7.0	1.0	7.0	4.0	9.0	6.0	7.0	7.0
	.250	1.0	8.0	0.0	2.0	4.0	4.0	7.0	0.0	6.0	4.0	6.0	6.0	6.0	3.0
	.125	1.0	6.0	0.0	0.0	4.0	2.0	4.0	0.0	4.0	2.0	2.0	6.0	4.0	3.0
	.063	1.0	2.0	0.0	0.0	2.0	2.0	4.0	0.0	1.0	1.0	1.0	3.0	0.0	2.0
Methyl 2-[4-isopropyl-4-methyl-5-oxo-1-pivaloyl-2-imidazolin-2-yl]nicotinate	.032	0.0	1.0	0.0	0.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	2.0	0.0	2.0
	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0
	.500	9.0	9.0	8.0	9.0	7.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	8.0	9.0	7.0	9.0	6.0	4.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	8.0	9.0	7.0	8.0	7.0	9.0	7.0	4.0	9.0	9.0	9.0	9.0	7.0	8.0
	.063	6.0	9.0	2.0	6.0	7.0	7.0	3.0	1.0	8.0	8.0	8.0	9.0	6.0	7.0
	.032	1.0	8.0	1.0	2.0	3.0	7.0	1.0	0.0	6.0	7.0	8.0	7.0	3.0	6.0

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TABLE XI (cont'd.)
POST-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
Methyl 2-(4-oxo-1,3-diazo- spiro[4.5]dec-2-en-2-yl)- nicotinate	0.000	9.0	9.0	8.0	9.0	9.0	0.0	8.0	4.0	9.0	9.0	1.0	7.0	8.0	4.0
	1.000	3.0	9.0	7.0	9.0	6.0	7.0	1.0	2.0	9.0	9.0	1.0	4.0	6.0	2.0
	.500	2.0	8.0	3.0	7.0	3.0	4.0	0.0	0.0	8.0	2.0	1.0	4.0	6.0	2.0
	.250	0.0	8.0	2.0	2.0	3.0	4.0	0.0	0.0	9.0	1.0	0.0	4.0	3.0	0.0
	.125	0.0	4.0	0.0	1.0	1.0	2.0	0.0	0.0	3.0	0.0	0.0	2.0	3.0	0.0
	.063	0.0	1.0	0.0	0.0	1.0	1.0	0.0	0.0	2.0	0.0	0.0	0.0	1.0	0.0
	.032	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
3-Methyl-2-butenyl 2-(5- isopropyl-6-methyl-4-oxo-2- imidazolin-2-yl)nicotinate	0.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	7.0	9.0	7.0	9.0	7.0	9.0	7.0	3.0	7.0	9.0	9.0	9.0	8.0	7.0
	.032	2.0	7.0	7.0	7.0	6.0	8.0	7.0	1.0	6.0	8.0	2.0	8.0	7.0	6.0
Benzyl 2-(4-oxo-1,3-diazo- spiro[4.5]dec-2-en-2-yl)- nicotinate	0.000	9.0	9.0	9.0	9.0	9.0	3.0	9.0	7.0	9.0	9.0	1.0	3.0	3.0	0.0
	1.000	0.0	7.0	2.0	0.0	3.0	7.0	2.0	0.0	2.0	4.0	1.0	3.0	1.0	0.0
	.500	0.0	1.0	1.0	0.0	0.0	2.0	1.0	0.0	0.0	1.0	0.0	3.0	1.0	0.0
	.250	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0
	.125	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
	.063	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	.032	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-(5-Isopropyl-6-methyl- 4-oxo-2-imidazolin-2-yl)- nicotinohydroxamic acid	0.000	9.0	9.0	9.0	9.0	9.0	3.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	8.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	8.0
	.125	8.0	9.0	9.0	9.0	7.0	8.0	9.0	4.0	7.0	9.0	9.0	9.0	9.0	8.0
	.063	6.0	9.0	2.0	9.0	7.0	0.0	8.0	2.0	7.0	7.0	9.0	8.0	9.0	7.0
	.032	1.0	6.0	1.0	5.0	7.0	7.0	4.0	1.0	4.0	7.0	7.0	7.0	8.0	4.0

TABLE XI (cont'd.)
POST-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN-YARDGR	GREEN FOX	P NUT-SEEDGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG-WEED	VELVET-LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
Benzyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	8.000	9.0	9.0	9.0	9.0	9.0	3.0	9.0	9.0	9.0	8.0	4.0	9.0	8.0	9.0
	1.000	9.0	9.0	6.0	8.0	6.0	9.0	9.0	7.0	9.0	8.0	4.0	9.0	7.0	9.0
	.500	9.0	9.0	1.0	0.0	6.0	8.0	8.0	5.0	9.0	7.0	4.0	9.0	4.0	6.0
	.250	4.0	6.0	1.0	7.0	5.0	8.0	8.0	0.0	9.0	6.0	3.0	9.0	3.0	4.0
	.125	1.0	5.0	0.0	3.0	2.0	7.0	8.0	0.0	7.0	6.0	1.0	8.0	0.0	3.0
	.063	0.0	2.0	0.0	1.0	2.0	7.0	7.0	0.0	6.0	3.0	0.0	8.0	0.0	1.0
6-methoxy 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinic acid	.032	0.0	1.0	0.0	0.0	1.0	4.0	6.0	0.0	3.0	1.0	0.0	7.0	0.0	1.0
	5.000	9.0	9.0	9.0	9.0	9.0	2.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	6.0	7.0	9.0	9.0	9.0	9.0	8.0
2-(4-oxo-1,3-diazaspiro-[4,5]dec-2-en-2-yl)nicotinic acid	.063	9.0	8.0	8.0	9.0	7.0	8.0	9.0	3.0	3.0	7.0	9.0	7.0	9.0	8.0
	.032	7.0	8.0	7.0	9.0	7.0	8.0	6.0	3.0	3.0	7.0	9.0	6.0	8.0	6.0
	1.000	9.0	9.0	7.0	9.0	7.0	9.0	4.0	6.0	9.0	9.0	9.0	9.0	9.0	5.0
	.500	8.0	9.0	7.0	9.0	7.0	9.0	3.0	5.0	9.0	9.0	9.0	8.0	8.0	4.0
	.250	6.0	9.0	7.0	9.0	7.0	9.0	1.0	3.0	6.0	9.0	9.0	7.0	8.0	3.0
	.125	6.0	9.0	1.0	9.0	4.0	9.0	1.0	3.0	4.0	8.0	8.0	7.0	7.0	1.0
α-Methylbenzylammonium 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.063	1.0	4.0	1.0	1.0	3.0	4.0	1.0	0.0	1.0	3.0	3.0	3.0	2.0	1.0
	.032	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	1.0	0.0	0.0
	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0
	.063	9.0	9.0	7.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0
	.032	9.0	8.0	7.0	9.0	8.0	9.0	8.0	2.0	9.0	9.0	9.0	9.0	9.0	8.0

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TABLE XI (cont'd.)
POST-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN-YARDGR	GREEN FOX	P NUT-SEGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG-WEED	VELVET-LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
α -Cyclopropyl-5,7-dihydro- α -methyl-5,7-dioxo-6H-pyrrolo[3,4-b]pyridine-6-acetamide	5.000	9.0	9.0	9.0	9.0	9.0	1.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	1.000	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	8.0	9.0	9.0	9.0	9.0	3.0	8.0	9.0	8.0	9.0	8.0	8.0
2-[5-Cyclopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]-nicotinic acid	.063	7.0	9.0	2.0	7.0	7.0	9.0	7.0	2.0	8.0	9.0	4.0	9.0	8.0	8.0
	.032	2.0	7.0	1.0	3.0	6.0	9.0	7.0	1.0	8.0	9.0	3.0	8.0	3.0	7.0
	8.000	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	8.0
1,1-Dimethyl-2-propynyl 2-[5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]nicotinate	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	3.0	9.0	9.0	9.0	9.0	9.0	8.0
	.125	9.0	9.0	8.0	8.0	9.0	9.0	9.0	3.0	9.0	9.0	9.0	9.0	8.0	8.0
	.063	9.0	8.0	7.0	8.0	7.0	9.0	9.0	0.0	8.0	9.0	8.0	8.0	8.0	8.0
	.032	7.0	6.0	0.0	3.0	2.0	9.0	9.0	0.0	8.0	4.0	7.0	8.0	6.0	4.0
	1.000	9.0	9.0	8.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
2-trimethylammoniummethyl 2-[5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]nicotinate iodide	.500	9.0	9.0	8.0	9.0	8.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	8.0
	.250	9.0	9.0	8.0	9.0	7.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	8.0
	.125	8.0	8.0	8.0	9.0	7.0	9.0	9.0	4.0	9.0	9.0	8.0	9.0	8.0	8.0
	.063	7.0	8.0	8.0	9.0	6.0	8.0	8.0	1.0	9.0	9.0	8.0	9.0	9.0	7.0
	.032	6.0	7.0	7.0	9.0	5.0	8.0	8.0	0.0	7.0	8.0	7.0	7.0	6.0	6.0

TABLE XI (cont'd.)
POST-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEDEGE	WILD- OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
N-(2-Hydroxyethyl)-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolyl-2-yl)nicotinamide	8.000	7.0	9.0	9.0	9.0	9.0	0.0	7.0	6.0	7.0					
Ammonium 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolyl-2-yl)nicotinate	1.000 .500 .250 .125 .063 .032	9.0 9.0 9.0 9.0 9.0 8.0	9.0 9.0 9.0 9.0 9.0 8.0	8.0 8.0 7.0 7.0 7.0 6.0	9.0 9.0 9.0 9.0 9.0 9.0	9.0 9.0 9.0 9.0 9.0 8.0	9.0 9.0 9.0 9.0 9.0 9.0	9.0 9.0 9.0 9.0 9.0 9.0	9.0 9.0 9.0 7.0 7.0 7.0	9.0 9.0 9.0 9.0 9.0 9.0	9.0 9.0 9.0 9.0 9.0 9.0	9.0 9.0 9.0 9.0 9.0 9.0	9.0 9.0 9.0 9.0 9.0 9.0	9.0 9.0 9.0 9.0 9.0 8.0	9.0 9.0 9.0 9.0 9.0 8.0
Methyl 2-(4-isopropyl-1-lauroyl-4-methyl-5-oxo-2-imidazolyl-2-yl)nicotinate	8.000 1.000 .500 .250 .125 .063 .032	9.0 9.0 9.0 9.0 4.0 4.0 0.0	9.0 9.0 9.0 9.0 9.0 9.0 6.0	9.0 9.0 9.0 7.0 3.0 0.0 0.0	9.0 9.0 9.0 9.0 8.0 6.0 0.0	9.0 9.0 7.0 7.0 7.0 4.0 1.0	3.0 9.0 9.0 9.0 9.0 7.0 6.0	9.0 9.0 9.0 3.0 6.0 0.0 0.0	9.0 8.0 7.0 7.0 1.0 0.0 0.0	9.0 9.0 9.0 9.0 9.0 6.0 4.0	9.0 9.0 9.0 9.0 9.0 3.0 2.0	9.0 9.0 9.0 9.0 9.0 8.0 2.0	9.0 9.0 9.0 9.0 8.0 7.0 5.0	8.0 9.0 9.0 9.0 7.0 3.0 2.0	9.0 9.0 9.0 9.0 8.0 7.0 6.0
1,1-Dimethylallyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolyl-2-yl)nicotinate	8.000 1.000 .500 .250	9.0 9.0 9.0 9.0	9.0 9.0 9.0 9.0	9.0 9.0 9.0 9.0	9.0 9.0 9.0 9.0	9.0 9.0 9.0 9.0	7.0 9.0 9.0 9.0	9.0 9.0 9.0 8.0	9.0 9.0 9.0 9.0	9.0 9.0 9.0 9.0	9.0 9.0 9.0 9.0	9.0 9.0 9.0 9.0	9.0 9.0 9.0 9.0	9.0 9.0 9.0 9.0	9.0 9.0 9.0 9.0

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TABLE XI (cont'd.)
POST-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN-YARDGR	GREEN-FOX	P NUT-SEEDGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG-WEED	VELVET-LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
2-Propynyl 2-(5-cyclopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	8.000	9.0	9.0	9.0	9.0	9.0	9.0	7.0	2.0	9.0	9.0	9.0	9.0	9.0	8.0
	1.000	9.0	8.0	7.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0
	.500	8.0	8.0	7.0	9.0	7.0	9.0	9.0	8.0	9.0	9.0	8.0	9.0	8.0	6.0
	.250	6.0	7.0	4.0	9.0	6.0	9.0	9.0	6.0	5.0	9.0	8.0	8.0	7.0	5.0
	.125	1.0	7.0	1.0	8.0	5.0	9.0	8.0	3.0	5.0	8.0	7.0	8.0	4.0	5.0
	.063	1.0	3.0	0.0	4.0	4.0	6.0	4.0	3.0	3.0	7.0	7.0	7.0	4.0	4.0
	.032	0.0	3.0	0.0	4.0	1.0	4.0	2.0	3.0	2.0	7.0	1.0	7.0	4.0	4.0
2-Propynyl 2-(4-oxo-1,3-diazaspiro[4.5]dec-2-en-2-yl)nicotinate	5.000	9.0	9.0	8.0	9.0	9.0	9.0	8.0	3.0	9.0	9.0	9.0	7.0	9.0	3.0
	1.000	6.0	7.0	7.0	9.0	7.0	9.0	3.0	2.0	7.0	6.0	2.0	7.0	9.0	2.0
	.500	6.0	6.0	2.0	9.0	3.0	9.0	1.0	2.0	6.0	9.0	1.0	6.0	8.0	2.0
	.250	2.0	5.0	0.0	9.0	1.0	9.0	1.0	0.0	3.0	6.0	1.0	6.0	8.0	2.0
	.125	0.0	4.0	0.0	7.0	1.0	7.0	0.0	0.0	1.0	8.0	1.0	4.0	8.0	2.0
N-(2-Chloroethyl)-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinamide	8.000	9.0	9.0	9.0	9.0	9.0	3.0	9.0	8.0	9.0	9.0	9.0	8.0	9.0	7.0
	1.000	8.0	7.0	8.0	9.0	8.0	9.0	8.0	7.0	8.0	9.0	9.0	8.0	7.0	7.0
	.500	6.0	6.0	7.0	9.0	7.0	9.0	7.0	7.0	8.0	9.0	9.0	8.0	6.0	6.0
	.250	4.0	5.0	6.0	7.0	7.0	8.0	7.0	6.0	6.0	8.0	6.0	7.0	5.0	4.0
	.125	1.0	3.0	4.0	6.0	4.0	7.0	7.0	6.0	6.0	7.0	6.0	7.0	4.0	3.0
	.063	1.0	3.0	2.0	6.0	4.0	6.0	4.0	1.0	6.0	9.0	6.0	6.0	4.0	3.0
	.032	0.0	2.0	1.0	5.0	4.0	6.0	3.0	1.0	6.0	7.0	3.0	5.0	3.0	3.0
p-Methoxybenzyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	8.000	9.0	9.0	9.0	9.0	9.0	9.0	6.0	8.0	9.0	9.0	7.0	9.0	9.0	9.0
	1.000	9.0	8.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	8.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0
	.250	7.0	8.0	7.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	8.0	8.0	8.0	7.0
	.125	6.0	8.0	7.0	9.0	8.0	9.0	9.0	3.0	9.0	9.0	8.0	8.0	7.0	6.0
	.063	4.0	9.0	5.0	9.0	7.0	9.0	8.0	3.0	9.0	8.0	8.0	8.0	7.0	6.0
	.032	2.0	7.0	2.0	7.0	7.0	9.0	7.0	0.0	7.0	8.0	8.0	7.0	7.0	4.0

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TABLE XI (cont'd.)
POST-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEDGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
Barium 2-[6-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]-nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	8.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	8.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	8.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	8.0	8.0
	.063	9.0	9.0	7.0	9.0	8.0	9.0	9.0	3.0	9.0	9.0	9.0	9.0	8.0	8.0
	.032	8.0	8.0	7.0	9.0	8.0	9.0	8.0	3.0	9.0	9.0	9.0	9.0	7.0	7.0
Cupric 2-[6-isopropyl-5-methyl-4-oxo-imidazolin-2-yl]nicotinate	1.000	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	8.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	8.0	7.0	9.0	7.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	8.0	7.0	9.0	8.0	9.0	9.0	7.0	9.0	9.0	8.0	9.0	9.0	9.0
	.063	9.0	8.0	6.0	9.0	7.0	9.0	8.0	7.0	9.0	9.0	8.0	9.0	9.0	8.0
	.032	9.0	8.0	5.0	9.0	7.0	8.0	8.0	2.0	9.0	9.0	7.0	8.0	8.0	7.0
Potassium 2-[6-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	8.0	9.0	8.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	7.0	9.0	7.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0	9.0	7.0	9.0	9.0	9.0	9.0	4.0	9.0	9.0	9.0	9.0	9.0	9.0
	.032	9.0	9.0	7.0	9.0	8.0	9.0	9.0	2.0	9.0	9.0	9.0	9.0	8.0	7.0
Lithium 2-[6-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]nicotinate	1.000	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	8.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	8.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	8.0	9.0	7.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0	9.0	7.0	9.0	8.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	9.0	8.0
	.032	9.0	9.0	7.0	9.0	7.0	9.0	9.0	5.0	8.0	9.0	9.0	9.0	8.0	9.0

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TABLE XI (cont'd.)
POST-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
Magnesium 2-[5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]nicotinate	1.000	9.0	9.0	8.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	8.0	7.0	9.0	7.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	8.0
	.063	9.0	8.0	8.0	9.0	8.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	8.0
	.032	9.0	8.0	7.0	9.0	7.0	9.0	8.0	6.0	9.0	9.0	9.0	9.0	9.0	8.0
Piperidinium 2-[5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	8.0
	.063	9.0	9.0	8.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	8.0
	.032	9.0	9.0	7.0	9.0	9.0	9.0	9.0	3.0	9.0	9.0	9.0	9.0	9.0	7.0
p-Chlorobenzyl 2-[5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]nicotinate	8.000	9.0	9.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0
	1.000	9.0	9.0	7.0	9.0	7.0	9.0	9.0	8.0	9.0	9.0	8.0	8.0	7.0	8.0
	.500	7.0	7.0	7.0	9.0	7.0	8.0	9.0	8.0	9.0	9.0	8.0	7.0	7.0	7.0
	.250	5.0	7.0	4.0	9.0	6.0	8.0	7.0	7.0	7.0	8.0	6.0	7.0	5.0	7.0
	.125	4.0	6.0	3.0	8.0	6.0	8.0	7.0	4.0	7.0	8.0	5.0	6.0	4.0	5.0
	.063	1.0	6.0	2.0	4.0	3.0	7.0	4.0	0.0	6.0	7.0	4.0	5.0	1.0	3.0
	.032	0.0	3.0	0.0	4.0	1.0	4.0	3.0	0.0	5.0	6.0	4.0	5.0	1.0	3.0
p-Nitrobenzyl 2-[5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]nicotinate	8.000	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	1.000	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	8.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	8.0	7.0	9.0	8.0	9.0	9.0	6.0	9.0	9.0	7.0	9.0	9.0	9.0
	.125	9.0	8.0	4.0	9.0	8.0	9.0	9.0	5.0	9.0	9.0	9.0	9.0	9.0	6.0
	.063	7.0	7.0	4.0	9.0	7.0	9.0	8.0	4.0	8.0	9.0	8.0	8.0	6.0	5.0
	.032	5.0	7.0	3.0	7.0	4.0	8.0	8.0	1.0	7.0	8.0	8.0	7.0	6.0	5.0

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TABLE XI (cont'd.)
POST-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE NATO	SOYBEAN AD
Benzyltrimethylammonium 2-(5-isopropyl-5-methyl-4-oxo- 2-imidazolin-2-yl)nicotinate	1.000	9.0	9.0	9.0		9.0	9.0	9.0		9.0	9.0	9.0		9.0	
	.500	3.0	9.0	6.0		8.0	9.0	8.0	2.0	7.0		9.0	8.0	8.0	
	.250	3.0	8.0	1.0	7.0	4.0	7.0	7.0		7.0	5.0	9.0	7.0	7.0	4.0
	.125		7.0	0.0	5.0	1.0	7.0	3.0	1.0	3.0	5.0	8.0	7.0	6.0	3.0
	.063	2.0	7.0	8.0	5.0	1.0	6.0	3.0		3.0	5.0	5.0	7.0	6.0	3.0
Omega-Aminohexammonium 2-(5-isopropyl-5-methyl-4-oxo- 2-imidazolin-2-yl)nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	8.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	8.0	9.0	9.0	9.0	8.0	8.0	9.0	9.0	9.0	9.0	9.0	8.0
	.063	9.0	8.0	8.0	9.0	9.0	9.0	8.0	6.0	9.0	9.0	9.0	8.0	9.0	7.0
Tallowammonium 2-(5-isopropyl- 5-methyl-4-oxo-2-imidazolin- 2-yl)nicotinate	.032	8.0	8.0	1.0	9.0	9.0	9.0	6.0	3.0	9.0	9.0	9.0	8.0	9.0	7.0
	.000	9.0	9.0	9.0	9.0	9.0	1.0	9.0	9.0	9.0					
	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500		9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
Carbomethoxymethyl 2-(5- isopropyl-5-methyl-4-oxo-2- imidazolin-2-yl)nicotinate	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	8.0
	.063	9.0	9.0	9.0	9.0	9.0	9.0	9.0	4.0	9.0	9.0	9.0	9.0	9.0	8.0
	.032	9.0	9.0	7.0	9.0	9.0	9.0	9.0	3.0	9.0	9.0	9.0	9.0	9.0	8.0
	.000	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0					
	1.000	9.0	8.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
Carbomethoxymethyl 2-(5- isopropyl-5-methyl-4-oxo-2- imidazolin-2-yl)nicotinate	.500	9.0	9.0	8.0	9.0	8.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	8.0	9.0	8.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	7.0	7.0	7.0	9.0	6.0	9.0	9.0	3.0	9.0	9.0	8.0	8.0	8.0	7.0
	.063	6.0	6.0	6.0	8.0	6.0	8.0	8.0	1.0	7.0	7.0	8.0	7.0	7.0	5.0
	.032	4.0	6.0	3.0	7.0	3.0	8.0	7.0	0.0	7.0	7.0	7.0	7.0	4.0	4.0

TABLE XI (cont'd.)
POST-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN-YARDGR	GREEN-FOX	P NUT-SEEDGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG-WEED	VELVET-LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
Dodecylammonium 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	8.000	9.0	9.0	9.0	9.0	9.0	1.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	8.0	9.0	9.0	9.0	9.0	9.0	4.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0	8.0	9.0	9.0	9.0	9.0	9.0	3.0	8.0	9.0	9.0	9.0	9.0	9.0
	.032	6.0	8.0	6.0	9.0	9.0	9.0	7.0	1.0	7.0	9.0	9.0	7.0	9.0	9.0
1,1,3,3-Tetramethylbutylammonium 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	8.000	9.0	9.0	9.0	9.0	9.0	1.0	9.0	9.0	9.0		9.0	9.0	9.0	8.0
	1.000		9.0	9.0	9.0	9.0	9.0	9.0	1.0	9.0		9.0	9.0	9.0	7.0
	.500		9.0	7.0	9.0	8.0	9.0	8.0		9.0	9.0	9.0	8.0	8.0	
	.250	3.0	9.0	6.0	9.0	7.0	9.0	8.0		8.0	9.0	9.0	7.0	7.0	
	.125	2.0	8.0	3.0	4.0	2.0	4.0	3.0	0.0	3.0	3.0	7.0	7.0	3.0	4.0
	.063	1.0	7.0	0.0	4.0	0.0	0.0	1.0	0.0	0.0	2.0	4.0	5.0	3.0	2.0
	.032	1.0	4.0	0.0	4.0	0.0	0.0								
Dibutylammonium 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	8.000	9.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0		9.0	9.0	9.0	9.0
	1.000		9.0	9.0	9.0	9.0	9.0	9.0	1.0	9.0	9.0	9.0	9.0	9.0	7.0
	.500	9.0	9.0	7.0	9.0	9.0	9.0	9.0	0.0	9.0	9.0	9.0	9.0	7.0	5.0
	.250	9.0	9.0	6.0	9.0	8.0	9.0	9.0		9.0	9.0	9.0	8.0	7.0	4.0
	.125		8.0	3.0	9.0	7.0	9.0	8.0		6.0	9.0	9.0	7.0	6.0	4.0
	.063	4.0	8.0	1.0	8.0	5.0	8.0	6.0		3.0	8.0	7.0	7.0	6.0	4.0
	.032	4.0	6.0	0.0	7.0	0.0	6.0	2.0	0.0	0.0	6.0	4.0	6.0	4.0	2.0
2-(Methylamino)ethyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0		9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0		9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	7.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0	9.0	7.0	9.0	9.0	9.0	7.0	6.0	9.0	9.0	9.0	9.0	9.0	8.0
	.032	4.0	9.0	7.0	9.0	9.0	9.0	6.0	2.0	9.0	9.0	9.0	8.0	9.0	7.0

(2A)

TABLE XI (cont'd.)
POST-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
1-Methylpyrrolidinium 2-[5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0
	.125	9.0	9.0	8.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	7.0
	.063	8.0	9.0	8.0	9.0	9.0	9.0	7.0	5.0	9.0	9.0	9.0	9.0	9.0	7.0
	.032	8.0	8.0	7.0	9.0	7.0	9.0	6.0	3.0	9.0	9.0	9.0	9.0	9.0	7.0
Octylammonium 2-[5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.360	9.0	9.0	8.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.190	9.0	9.0	7.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	8.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
Benzylammonium 2-[5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]nicotinate	.095	9.0	9.0	6.0	9.0	9.0	9.0	9.0	5.0	9.0	9.0	9.0	9.0	9.0	9.0
	6.000	9.0	9.0	9.0	9.0	9.0	1.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	4.0	7.0	8.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	7.0
	.250		9.0	8.0	9.0	9.0	9.0	7.0	4.0	9.0	9.0	9.0	9.0	9.0	5.0
	.125		8.0	1.0	8.0	6.0	8.0	7.0	1.0	3.0	7.0	9.0	8.0	9.0	4.0
Cyclohexylammonium 2-[5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]nicotinate	.063		8.0	0.0	9.0	1.0	4.0	6.0	0.0	1.0	7.0	7.0	7.0	7.0	3.0
	.032	0.0	7.0	0.0	6.0	0.0	1.0	4.0	0.0	1.0	7.0	2.0	5.0	5.0	2.0
	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.350	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.175	9.0	9.0	6.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	8.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0

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TABLE XI (cont'd.)
POST-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
Morpholinium 2-[5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0	9.0	8.0	9.0	9.0	9.0	8.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0
	.032	9.0	9.0	7.0	9.0	9.0	9.0	7.0	6.0	9.0	9.0	9.0	9.0	9.0	8.0
4-Phenylbutylammonium 2-[5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]nicotinate	6.000	9.0	9.0	9.0	9.0	9.0	4.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0
	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	8.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	8.0
	.250	9.0	9.0	8.0	9.0	8.0	9.0	7.0	3.0	9.0	9.0	9.0	9.0	9.0	8.0
	.125	4.0	7.0	2.0	9.0	5.0	8.0	7.0	3.0	7.0	7.0	8.0	7.0	8.0	4.0
	.063	4.0	9.0	8.0	7.0	7.0	7.0	4.0	0.0	4.0	7.0	7.0	7.0	8.0	6.0
Phenethylammonium 2-[5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]nicotinate	.032	2.0	6.0	0.0	7.0	5.0	3.0	2.0	0.0	3.0	7.0	2.0	7.0	7.0	3.0
	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.370	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.185	9.0	9.0	8.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	8.0
Dimethoxymethylammonium 2-[5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]nicotinate	.125	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0
	.093	9.0	9.0	8.0	9.0	9.0	9.0	9.0	4.0	9.0	9.0	9.0	9.0	9.0	8.0
	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	8.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	8.0
	.032	7.0	9.0	7.0	9.0	9.0	9.0	5.0	4.0	9.0	9.0	9.0	9.0	9.0	8.0

(26)

TABLE XI (cont'd.)
POST-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEEDGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
2,2'-Diethoxydiethylammonium 2-[5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	7.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0
	.063	7.0	9.0	8.0	9.0	9.0	9.0	9.0	5.0	9.0	9.0	9.0	9.0	9.0	8.0
	.032	3.0	9.0	8.0	9.0	9.0	9.0	9.0	2.0	9.0	9.0	9.0	9.0	9.0	8.0
3-Methoxypropylammonium 2-[5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]- nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.340	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.170	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
3-Carboethoxypropyl 2-[5- isopropyl-5-methyl-4-oxo-2- imidazolin-2-yl]nicotinate	.085	9.0	9.0	7.0	9.0	9.0	9.0	9.0	5.0	9.0	9.0	9.0	9.0	9.0	8.0
	8.000	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	1.000	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	7.0	7.0	7.0	9.0	7.0	9.0	9.0	7.0	9.0	9.0	8.0	9.0	8.0	8.0
	.250	7.0	7.0	6.0	9.0	6.0	9.0	9.0	7.0	9.0	8.0	7.0	8.0	7.0	7.0
	.125	4.0	6.0	4.0	7.0	3.0	8.0	6.0	3.0	9.0	8.0	7.0	7.0	6.0	6.0
1-Carbomethoxyethyl 2-[5- isopropyl-5-methyl-4-oxo-2- imidazolin-2-yl]nicotinate	.063	1.0	6.0	2.0	5.0	2.0	8.0	4.0	0.0	7.0	6.0	6.0	5.0	3.0	5.0
	.032	1.0	3.0	1.0	2.0	1.0	5.0	3.0	0.0	6.0	5.0	3.0	5.0	2.0	2.0
	8.000	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	8.0	9.0	8.0	9.0
	1.000	9.0	8.0	8.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	8.0
	.500	8.0	8.0	7.0	9.0	7.0	8.0	8.0	7.0	9.0	9.0	8.0	9.0	9.0	8.0
	.250	7.0	9.0	6.0	8.0	6.0	8.0	7.0	1.0	8.0	9.0	8.0	9.0	9.0	8.0
	.125	6.0	7.0	3.0	8.0	5.0	7.0	7.0	1.0	7.0	7.0	8.0	8.0	7.0	8.0
	.063	3.0	6.0	2.0	7.0	4.0	6.0	6.0	1.0	6.0	6.0	5.0	7.0	4.0	7.0
	.032	2.0	3.0	0.0	2.0	1.0	4.0	3.0	0.0	4.0	5.0	3.0	6.0	1.0	4.0

TABLE XI (cont'd.)
POST-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARIN- YARDGR	GREEN FOX	P NUT- SEEDGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
Methyl 5-bromo-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	0.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0					
	1.000	4.0	5.0	7.0	6.0	5.0	3.0	4.0	6.0	5.0	6.0	6.0	7.0	8.0	6.0
	.500	3.0	3.0	6.0	7.0	3.0	2.0	3.0	8.0	3.0	7.0	6.0	6.0	6.0	5.0
	.250	2.0	3.0	3.0	7.0	3.0	0.0	2.0	7.0	3.0	3.0	5.0	3.0	6.0	2.0
	.125	1.0	2.0	1.0	7.0	2.0	0.0	0.0	6.0	1.0	3.0	3.0	2.0	6.0	2.0
	.063	0.0	2.0	1.0	6.0	1.0	0.0	0.0	6.0	1.0	2.0	3.0	1.0	4.0	2.0
	.032	0.0	1.0	0.0	2.0	1.0	0.0	0.0	0.0	0.0	2.0	3.0	1.0	3.0	1.0
3-Carboethoxy-2-propenyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	0.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0					
	1.000	9.0	9.0	7.0	9.0	8.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	7.0	9.0	8.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	8.0	7.0	9.0	6.0	9.0	9.0	6.0	9.0	9.0	9.0	8.0	9.0	9.0
	.125	7.0	7.0	7.0	9.0	7.0	9.0	9.0	2.0	9.0	9.0	8.0	9.0	9.0	9.0
	.063	5.0	6.0	4.0	8.0	6.0	8.0	8.0	1.0	9.0	7.0	8.0	9.0	9.0	8.0
	.032	3.0	4.0	2.0	7.0	3.0	8.0	6.0	0.0	6.0	8.0	6.0	7.0	7.0	7.0
3-Butenyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	0.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0					
	1.000	9.0	8.0	8.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	8.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	8.0	7.0	9.0	8.0	9.0	9.0	4.0	9.0	9.0	9.0	9.0	8.0	9.0
	.125	9.0	8.0	6.0	9.0	7.0	9.0	9.0	2.0	8.0	9.0	9.0	9.0	9.0	9.0
	.063	8.0	7.0	4.0	9.0	7.0	8.0	8.0	1.0	7.0	8.0	8.0	8.0	9.0	7.0
	.032	1.0	6.0	1.0	8.0	4.0	6.0	8.0	0.0	6.0	7.0	8.0	7.0	9.0	2.0
4-Carbomethoxybutyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	0.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0					
	1.000	8.0	9.0	6.0	9.0	7.0	8.0	9.0	8.0	9.0	9.0	8.0	8.0	8.0	9.0
	.500	7.0	8.0	6.0	9.0	6.0	9.0	8.0	7.0	9.0	9.0	8.0	8.0	8.0	9.0
	.250	6.0	7.0	5.0	9.0	4.0	8.0	8.0	2.0	7.0	7.0	6.0	8.0	7.0	7.0
	.125	3.0	6.0	0.0	7.0	3.0	8.0	7.0	0.0	7.0	7.0	4.0	7.0	6.0	7.0
	.063	1.0	3.0	0.0	6.0	0.0	7.0	6.0	0.0	6.0	5.0	3.0	6.0	3.0	3.0
	.032	0.0	2.0	0.0	5.0	0.0	6.0	4.0	0.0	4.0	4.0	2.0	2.0	2.0	2.0

TABLE XI (cont'd.)
POST-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEEDGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
Ferrous 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0
	.032	9.0	9.0	9.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	9.0	7.0
Ferric 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0
	.063	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0
	.032	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0
Diethanolammonium 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	8.000	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	3.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	8.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	8.0
	.063	9.0	9.0	8.0	9.0	9.0	9.0	9.0	4.0	9.0	9.0	9.0	9.0	9.0	7.0
	.032	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0
<i>p</i> -tert-Butylbenzyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	8.000	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	8.0	8.0	7.0	8.0	8.0
	1.000	6.0	7.0	6.0	9.0	8.0	9.0	9.0	7.0	9.0	8.0	8.0	7.0	8.0	7.0
	.500	6.0	6.0	4.0	8.0	8.0	9.0	9.0	5.0	9.0	7.0	8.0	7.0	7.0	7.0
	.250	4.0	6.0	2.0	8.0	6.0	7.0	8.0	5.0	7.0	7.0	6.0	6.0	5.0	7.0

TABLE XI (cont'd.)
POST-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEDE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
Phenethyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	0.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0					
	1.000	9.0	9.0	7.0	9.0	8.0	9.0	9.0	7.0	9.0	9.0	9.0	8.0	9.0	8.0
	.500	9.0	8.0	7.0	9.0	7.0	9.0	9.0	7.0	9.0	9.0	9.0	8.0	9.0	8.0
	.250	9.0	7.0	7.0	9.0	6.0	7.0	8.0	6.0	9.0	9.0	8.0	7.0	8.0	8.0
	.125	3.0	7.0	2.0	9.0	6.0	7.0	8.0	2.0	9.0	9.0	8.0	6.0	6.0	6.0
	.063	1.0	3.0	2.0	7.0	6.0	7.0	7.0	0.0	7.0	8.0	5.0	5.0	3.0	4.0
	.032	0.0	1.0	0.0	5.0	5.0	4.0	5.0	0.0	3.0	7.0	4.0	5.0	2.0	
Cinnamyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	0.000	9.0	9.0	9.0	9.0	9.0	3.0	9.0	9.0	9.0					
	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	8.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	7.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	9.0	8.0
	.063	8.0	7.0	5.0	9.0	9.0	9.0	8.0	4.0	8.0	9.0	9.0	9.0	8.0	7.0
	.032	7.0	6.0	4.0	7.0	7.0	9.0	7.0	3.0	8.0	9.0	7.0	7.0	8.0	6.0
5- α -Hydroxy-3 α -isopropyl-3-methyl-5H-imidazo-[1',2':1,2]pyrrolo[3,4-b]pyridin-2-(3H)one	0.000	9.0	9.0	9.0	9.0	9.0	3.0	9.0	9.0	9.0					
	1.000	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0
	.500	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0
	.250	7.0	7.0	6.0	9.0	9.0	9.0	8.0	8.0	9.0	9.0	7.0	8.0	7.0	9.0
	.125	8.0	7.0	6.0	7.0	7.0	9.0	8.0	8.0	6.0	8.0	4.0	7.0	7.0	7.0
	.063	3.0	7.0	4.0	7.0	7.0	8.0	8.0	7.0	7.0	6.0	4.0	7.0	5.0	7.0
	.032	0.0	4.0	1.0	4.0	6.0	7.0	7.0	6.0	2.0	1.0	3.0	4.0	3.0	3.0
5-isopropyl-5-methyl-2-(3-methyl-2-pyridyl)-2-imidazolin-4-one	0.000	0.0	7.0	9.0	9.0	9.0	5.0	8.0	7.0	8.0					
	1.000	0.0	0.0	0.0	0.0	6.0	4.0	2.0	0.0	4.0	0.0	0.0	0.0	0.0	2.0
	.500	0.0	0.0	0.0	0.0	2.0	3.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	1.0
	.250	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	1.0
	.125	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	1.0
	.063	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
	.032	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0

TABLE XI (cont'd.)
POST-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
3,7-Dimethyl-2,6-octadienyl 2-[5-isopropyl-5-methyl- 4-oxo-2-imidazolin-2-yl]- nicotinate	8.000	9.0	9.0	9.0	9.0	9.0	2.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	8.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	8.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	8.0	7.0	9.0	8.0	9.0	7.0	7.0	9.0	9.0	9.0	9.0	8.0	8.0
	.053	8.0	7.0	7.0	8.0	8.0	9.0	7.0	6.0	9.0	9.0	7.0	9.0	7.0	7.0
	.032	2.0	4.0	1.0	7.0	2.0	9.0	6.0	4.0	6.0	7.0	6.0	7.0	7.0	6.0
2,3-Dihydroxypropyl 2-[5- isopropyl-5-methyl-4-oxo-2- imidazolin-2-yl]nicotinate	8.000	6.0	5.0	2.0	2.0	9.0	9.0	5.0	8.0	0.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	7.0	9.0	9.0	9.0	8.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	7.0	8.0	7.0	9.0	9.0	9.0	8.0	6.0	8.0	9.0	9.0	9.0	8.0	7.0
	.063	5.0	6.0	4.0	9.0	8.0	9.0	8.0	6.0	8.0	9.0	9.0	7.0	8.0	7.0
	.032	1.0	4.0	0.0	7.0	7.0	9.0	7.0	3.0	6.0	7.0	4.0	7.0	7.0	5.0
4-Pentynyl 2-[5-isopropyl-5- methyl-4-oxo-2-imidazolin- 2-yl]nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	8.0	8.0	6.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	8.0
	.125	8.0	8.0	6.0	9.0	7.0	9.0	9.0	6.0	8.0	9.0	9.0	9.0	8.0	8.0
	.063	3.0	7.0	2.0	9.0	7.0	7.0	8.0	6.0	9.0	9.0	7.0	8.0	8.0	8.0
	.032	2.0	5.0	1.0	8.0	7.0	6.0	7.0	0.0	7.0	9.0	5.0	8.0	6.0	7.0
2-[5-isopropyl-5-methyl- 4-oxo-2-imidazolin-2-yl]- 3-quinolinecarboxylic acid	1.000	9.0	9.0	9.0	9.0	9.0	8.5	9.0	9.0	8.0	9.0	9.0	9.0	9.0	6.0
	.500	6.7	9.0	8.3	9.0	8.5	8.0	6.5	8.3	6.0	9.0	9.0	9.0	9.0	4.7
	.250	8.3	8.3	7.3	9.0	7.5	8.0	8.5	8.0	4.7	9.0	9.0	9.0	9.0	3.0
	.125	9.0	7.3	5.3	6.5	6.0	6.5	5.0	5.0	3.7	9.0	9.0	9.0	9.0	2.3
	.063	4.3	6.3	3.7	4.5	5.0	5.0	6.0	1.3	3.0	9.0	9.0	8.5	7.0	2.0
	.032	1.0	6.0	1.0	3.0	4.5	4.0	4.0	0.5	2.0	8.5	9.0	9.0	3.0	2.0

TABLE XI (cont'd.)
POST-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN-YARDGR	GREEN FOX	P NUT-SEGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG-WEED	VELVET-LEAF	S BARLY LA	CORN FIELD	COTON	RICE, NATO	SOYBEAN AD
6,6-Dimethyl-2-norpinene-2-ethyl 2-(5-isopropyl-5-methyl-4-oxo-2-yl)nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0		9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	8.0	9.0	7.0	9.0	8.0	9.0	9.0		9.0	9.0	9.0	9.0	9.0	8.0
	.063	7.0	7.0	4.0	9.0	7.0	9.0	9.0	6.0	7.0	9.0	9.0	7.0	7.0	7.0
	.032	2.0	6.0	1.0	9.0	6.0	9.0	9.0		7.0	9.0	7.0	7.0	7.0	5.0
α -Carbomethoxybenzyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	8.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0		9.0					
	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	9.0	8.0
	.125	7.0	9.0	8.0	9.0	9.0	9.0	9.0	1.0	9.0	9.0	9.0	9.0	9.0	8.0
	.063	6.0	9.0	8.0	9.0	6.0	9.0	8.0	0.0	9.0	9.0	9.0	8.0	9.0	7.0
Methyl 2-(1-acetyl-4-isopropyl-4-methyl-5-oxo-2-imidazolin-2-yl)nicotinate-1-oxide	.032	5.0	8.0	8.0	9.0	8.0	7.0	6.0	0.0	8.0	9.0	8.0	7.0	6.0	7.0
	8.000	9.0	9.0	9.0	9.0	9.0	9.0	8.0		9.0					
	1.000	9.0	9.0	8.0	9.0	9.0	9.0	9.0		9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	1.0	9.0	7.0	8.0	9.0	9.0	7.0	0.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	0.0	8.0	7.0	8.0	8.0	8.0	7.0	0.0	9.0	9.0	9.0	9.0	9.0	9.0
3-Methyl-3-butenyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.063	0.0	7.0	0.0	8.0	8.0	7.0	8.0	0.0	7.0	3.0	7.0	7.0	4.0	7.0
	.032	0.0	3.0	0.0	2.0	3.0	7.0	2.0	0.0	6.0	2.0	3.0	6.0	2.0	5.0
	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0		9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	7.0	9.0	7.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	8.0	8.0
3-Methyl-3-butenyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.063	3.0	9.0	7.0	9.0	9.0	9.0	9.0	8.0	8.0	9.0	9.0	8.0	7.0	7.0
	.032	1.0	6.0	6.0	8.0	6.0	7.0	8.0	8.0	8.0	9.0	9.0	8.0	7.0	6.0

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TABLE XI (cont'd.)
POST-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN-YARDGR	GREEN FOX	P NUT-SEGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG-WEED	VELVET-LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
10-Undecenyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0		9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0		9.0	9.0	9.0	9.0	9.0
	.250	7.0	7.0	7.0	9.0	9.0	9.0	9.0		9.0	9.0	9.0	8.0	9.0	8.0
	.125	4.0	6.0	7.0	9.0	8.0	9.0	8.0		8.0	9.0	8.0	7.0	8.0	8.0
	.063	2.0	6.0	4.0	8.0	6.0	9.0	6.0	4.0	7.0	8.0	7.0	7.0	7.0	7.0
	.032	1.0	6.0	1.0	6.0	4.0	4.0	7.0		5.0	8.0	6.0	6.0	4.0	6.0
5-Bromo-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinic acid	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	7.5
	.500	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	7.5
	.250	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	5.5
	.125	9.0	9.0	7.0	9.0	9.0	7.0	9.0	8.0	7.0	9.0	9.0	9.0	9.0	5.5
	.063	8.0	9.0	7.0	3.0	7.0	7.0	6.0	8.0	7.0	8.0	8.5	8.0	9.0	3.5
	.032	5.0	9.0	6.0	2.0	7.0	6.0	6.0	7.0	6.0	7.0	9.0	6.0	8.0	3.0
α-methylbenzyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	8.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	8.0	9.0	8.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	8.0
	.125	8.0	9.0	8.0	9.0	9.0	9.0	9.0	6.0	8.0	9.0	9.0	9.0	9.0	8.0
	.063	8.0	9.0	7.0	9.0	9.0	8.0	8.0	4.0	9.0	9.0	9.0	9.0	9.0	8.0
	.032	8.0	8.0	7.0	7.0	8.0	7.0	8.0	0.0	4.0	6.0	9.0	7.0	8.0	6.0
Methyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate-1-oxide	8.000	9.0	9.0	8.0	9.0	9.0	9.0	9.0		9.0	9.0	9.0	9.0	9.0	9.0
	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	8.0	9.0	7.0	9.0	7.0	8.0	9.0	3.0	9.0	9.0	9.0	9.0	8.0	9.0
	.250	7.0	9.0	7.0	9.0	9.0	9.0	9.0	1.0	9.0	6.0	9.0	8.0	8.0	9.0

TABLE XI (cont'd.)
POST-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEDGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
Methyl 6-chloro-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	8.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0		9.0		9.0	9.0	9.0	7.5
	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	6.5
	.500	9.0	9.0	7.0	9.0	9.0	6.0	9.0	9.0	4.0	9.0	8.5	9.0	9.0	6.0
	.250	9.0	9.0	6.0	9.0	8.0	5.0	9.0	9.0	3.0	9.0	7.0	9.0	9.0	5.0
	.125	7.0	9.0	4.0	9.0	8.0	5.0	6.0	8.0	2.0	6.5	4.5	6.0	8.0	4.5
	.063	7.0	9.0	4.0	9.0	8.0	4.0	6.0	7.0	2.0	6.5	4.5	5.5	9.0	4.0
2-Isopropyl-2-methyl-5- <i>H</i> -imidazol[1',2':1,2]pyrrolo-[3,4- <i>b</i>]pyridine-3(2 <i>H</i>),5-dione	8.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0		9.0	9.0	9.0	9.0
	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
2-[3-Hydroxymethyl)-2-pyridyl]-5-isopropyl-5-methyl-2-imidazo-4-one	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	8.0
	.500	8.0	9.0	8.0	9.0	9.0	9.0	9.0	4.0	9.0	9.0	9.0	7.0	9.0	7.0
	.250	7.0	8.0	8.0	9.0	7.0	9.0	8.0	1.0	9.0	9.0	8.0	7.0	8.0	7.0
	.125	3.0	6.0	3.0	7.0	5.0	4.0	7.0		8.0	9.0	7.0	6.0	7.0	3.0
	.063	1.0	6.0	2.0	5.0	4.0	4.0	4.0	0.0	7.0	9.0	4.0	6.0	7.0	3.0
	.032	1.0	4.0	0.0	2.0	2.0	3.0	2.0	0.0	6.0	8.0	3.0	3.0	4.0	3.0
Carboethoxymethyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0
	.063	7.0	8.0	7.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	8.0
	.032	7.0	7.0	3.0	9.0	7.0	9.0	9.0	4.0	9.0	9.0	7.0	8.0	9.0	7.0

TABLE XI (cont'd.)
POST-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN-YARDGR	GREEN FOX	P NUT-SEEDGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG-WEED	VELVET-LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
Carbobenzoyloxymethyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolyl)nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	7.0	9.0	7.0	9.0	9.0	3.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	7.0	7.0	4.0	9.0	4.0	9.0	9.0	3.0	9.0	9.0	8.0	8.0	9.0	7.0
	.032	5.0	5.0	0.0	7.0	4.0	8.0	8.0	1.0	7.0	9.0	5.0	7.0	8.0	7.0
Carboxymethyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolyl)nicotinate	1.000	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	6.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0
	.063	9.0	8.0	4.0	9.0	7.0	9.0	7.0	4.0	8.0	9.0	8.0	7.0	9.0	8.0
	.032	6.0	4.0	0.0	7.0	5.0	4.0	6.0	1.0	7.0	9.0	6.0	7.0	8.0	8.0
Cyanomethyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolyl)nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	8.0	9.0	7.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	8.0
	.063	8.0	9.0	5.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	9.0	8.0
	.032	9.0	9.0	4.0	9.0	8.0	9.0	9.0	4.0	9.0	9.0	9.0	9.0	7.0	7.0
Methyl (-)-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolyl)nicotinate	1.000	9.0	9.0	8.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	8.0	9.0	6.0	9.0	8.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	7.0
	.250	8.0	9.0	4.0	9.0	7.0	9.0	7.0	7.0	9.0	9.0	9.0	8.0	9.0	6.0
	.125	3.0	9.0	2.0	6.0	5.0	6.0	7.0	4.0	9.0	7.0	6.0	7.0	8.0	6.0
	.063	1.0	7.0	1.0	2.0	3.0	3.0	6.0	1.0	9.0	5.0	3.0	7.0	7.0	4.0
	.032	0.0	7.0	0.0	0.0	0.0	2.0	4.0	0.0	6.0	3.0	2.0	7.0	7.0	4.0

TABLE XI (cont'd.)

POST-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEDGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
Methyl (+)-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	8.0	9.0	8.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0	9.0	6.0	9.0	8.0	8.0	9.0	5.0	9.0	9.0	9.0	9.0	9.0	9.0
	.032	7.0	9.0	6.0	9.0	8.0	8.0	8.0	3.0	9.0	9.0	9.0	8.0	9.0	9.0
Benzyl (+)-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000	9.0	9.0	4.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	8.0	9.0	4.0	9.0	8.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	7.0
	.250	6.0	9.0	3.0	9.0	8.0	9.0	9.0	7.0	9.0	8.0	9.0	9.0	9.0	6.0
	.125	2.0	7.0	1.0	7.0	7.0	7.0	8.0	3.0	9.0	7.0	8.0	9.0	8.0	5.0
	.063	2.0	8.0	1.0	6.0	2.0	9.0	4.0	1.0	9.0	7.0	6.0	8.0	7.0	5.0
	.032	0.0	6.0	0.0	2.0	1.0	8.0	3.0	0.0	8.0	5.0	5.0	8.0	6.0	5.0
Benzyl (-)-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	7.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	7.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0	9.0	6.0	9.0	8.0	9.0	9.0	5.0	9.0	9.0	9.0	9.0	9.0	9.0
	.032	6.0	9.0	3.0	9.0	8.0	9.0	4.0	1.0	9.0	9.0	9.0	9.0	8.0	7.0
(-)-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinic acid	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	8.0	9.0	9.0	9.0	9.0	3.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	6.0	9.0	8.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	7.0
	.063	6.0	9.0	5.0	9.0	9.0	9.0	9.0	4.0	9.0	9.0	9.0	9.0	9.0	6.0
	.032	6.0	9.0	2.0	8.0	8.0	9.0	4.0	1.0	9.0	8.0	3.0	9.0	9.0	5.0

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TABLE XI (cont'd.)
POST-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEEDGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
(+)2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)-nicotinic acid	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0	9.0	8.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.032	9.0	9.0	9.0	9.0	9.0	9.0	8.0	8.0	9.0	9.0	9.0	9.0	9.0	8.0
2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)-nicotinic acid hydrochloride	1.000	9.0	9.0	9.0	9.0	9.0	2.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	8.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	8.0	8.0
	.063	9.0	9.0	8.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	8.0	8.0
	.032	9.0	9.0	7.0	9.0	9.0	9.0	9.0	4.0	9.0	9.0	9.0	9.0	8.0	7.0
Methyl 2-(1-benzoyl-4-isopropyl-4-methyl-5-oxo-2-imidazolin-2-yl)nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	1.0	8.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0
	.500	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0
	.250	9.0	9.0	7.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	7.0	9.0
	.125	8.0	9.0	5.0	9.0	9.0	9.0	9.0	5.0	9.0	9.0	9.0	9.0	6.0	8.0
	.063	6.0	8.0	3.0	9.0	7.0	3.0	9.0	2.0	9.0	8.0	9.0	8.0	5.0	8.0
	.032	1.0	0.0	2.0	7.0	7.0	3.0	7.0	1.0	7.0	7.0	9.0	7.0	5.0	6.0
Methyl 6-dimethylamino-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000	9.0	6.0	0.0	6.0	3.0	0.0	9.0	0.0	2.0	6.0	9.0	5.0	6.0	3.0
	.500	9.0	5.0	0.0	3.0	1.0	0.0	9.0	0.0	2.0	4.0	9.0	5.0	5.0	3.0
	.250	9.0	4.0	0.0	0.0	0.0	0.0	9.0	0.0	0.0	2.0	9.0	2.0	5.0	2.0
	.125	6.0	3.0	0.0	0.0	0.0	0.0	7.0	0.0	0.0	2.0	9.0	2.0	4.0	2.0
	.063	2.0	3.0	0.0	0.0	0.0	0.0	7.0	0.0	0.0	0.0	9.0	2.0	3.0	1.0
	.032	0.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0	1.0	3.0	1.0

TABLE XI (cont'd.)

POST-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN-YARDGR	GREEN-FOX	P NUT-SEEDGE	WILD-OATS	QUACK-GRASS	FLD BINDWD	MRN GLRY SP	RAG-WEED	VELVET-LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
Methyl 2-(1-Chloroacetyl-4-isopropyl-4-methyl-5-oxo-2-imidazolin-2-yl)nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0
	.250	9.0	9.0	7.0	9.0	8.0	8.0	9.0	8.0	9.0	9.0	9.0	9.0	8.0	9.0
	.125	8.0	9.0	8.0	9.0	8.0	8.0	9.0	6.0	9.0	9.0	9.0	9.0	8.0	9.0
	.063	7.0	8.0	3.0	9.0	7.0	8.0	4.0	3.0	9.0	9.0	9.0	8.0	8.0	8.0
	.032	4.0	8.0	1.0	7.0	6.0	7.0	4.0	1.0	8.0	8.0	9.0	7.0	6.0	7.0
Methyl 2-(4-isopropyl)-4-methyl-5-oxo-1-propionyl-2-imidazolin-2-yl)nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	8.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	7.0	9.0	9.0	9.0	8.0	6.0	9.0	9.0	9.0	8.0	9.0	9.0
	.063	9.0	9.0	6.0	9.0	7.0	6.0	7.0	3.0	9.0	9.0	9.0	8.0	9.0	8.0
	.032	7.0	9.0	4.0	7.0	7.0	9.0	7.0	0.0	9.0	9.0	9.0	7.0	7.0	8.0
O-[2-(5-Isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)-nicotinoyl]acetone oxime	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0	9.0	6.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	8.0	7.0
	.032	9.0	9.0	6.0	9.0	8.0	9.0	7.0	0.0	8.0	9.0	9.0	9.0	7.0	7.0
2-(3-Acetyl-2-pyridyl)-6-isopropyl-5-methyl-2-imidazolin-4-one	1.000	4.0	6.0	8.0	9.0	7.0	6.0	9.0	7.0	9.0	9.0	9.0	7.0	8.0	8.0
	.500	2.0	8.0	4.0	7.0	6.0	8.0	9.0	4.0	9.0	9.0	9.0	7.0	8.0	7.0
	.250	2.0	6.0	1.0	6.0	6.0	6.0	9.0	0.0	4.0	7.0	9.0	7.0	6.0	7.0
	.125	0.0	5.0	0.0	4.0	2.0	2.0	7.0	0.0	1.0	2.0	7.0	6.0	6.0	5.0
	.063	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.0	2.0	2.0	3.0	4.0
	.032	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	1.0	4.0

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TABLE XI (cont'd.)

POST-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN-YARDGR	GREEN-FOX	P NUT-SEDGE	WILD-OATS	QUACK-GRASS	FLD BINDWD	MRN GLRY SP	RAG-WEED	VELVET-LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
Benzyl 2-(4-isopropyl-4-methyl-5-oxo-1-propionyl-2-imidazolin-2-yl)nicotinate	1.000	9.0	9.0	8.0	9.0	8.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	7.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	5.0	9.0	7.0	7.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	8.0
	.125	9.0	9.0	5.0	9.0	6.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	8.0	7.0
	.063	9.0	7.0	1.0	9.0	3.0	9.0	9.0	1.0	9.0	9.0	9.0	9.0	7.0	7.0
	.032	1.0	6.0	0.0	7.0	0.0	9.0	9.0	0.0	8.0	8.0	8.0	8.0	6.0	6.0
Benzyl 2-(4-isopropyl-4-methyl-5-oxo-1-pivaloyl-2-imidazolin-2-yl)nicotinate	1.000	9.0	9.0	9.0	9.0	8.0	8.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	8.0	9.0	7.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	3.0	9.0	8.0	7.0	9.0	7.0	9.0	9.0	9.0	9.0	8.0	9.0
	.125	9.0	9.0	2.0	9.0	7.0	9.0	9.0	2.0	9.0	9.0	9.0	9.0	8.0	8.0
	.063	9.0	9.0	0.0	9.0	7.0	0.0	9.0	0.0	7.0	9.0	9.0	9.0	8.0	7.0
	.032	1.0	7.0	0.0	6.0	2.0	0.0	7.0	0.0	8.0	7.0	5.0	9.0	6.0	6.0
Trimethyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)-β-oxo-α-phosphono-3-pyridinepropionate	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0	9.0	8.0	9.0	9.0	8.0	8.0	4.0	7.0	9.0	9.0	8.0	8.0	9.0
	.032	9.0	9.0	6.0	7.0	9.0	8.0	6.0	1.0	1.0	9.0	9.0	7.0	7.0	6.0
Methyl 2-(4-isopropyl-4-methyl-1-(methylsulfonyl)-5-oxo-2-imidazolin-2-yl)nicotinate	1.000	2.0	5.0	4.0	1.0	7.0	7.0	4.0	0.0	9.0	3.0	3.0	4.0	3.0	8.0

POST-EMERGENCE TESTS — RATES IN KG/HA

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TABLE XI (cont'd.)

POST-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEDGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
Isopropylammonium 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	9.0		9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0		9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0	9.0	7.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	9.0	8.0
	.032	9.0	9.0	7.0	9.0	9.0	9.0	9.0	1.0	8.0	9.0	9.0	8.0	9.0	9.0
2-Methylallylammonium 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-yl)nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	6.0
	.032	9.0	9.0	7.0	9.0	9.0	9.0	9.0	2.0	9.0	9.0	9.0	9.0	8.0	7.0
Isobutylammonium 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0		9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	8.0	9.0	9.0	9.0		9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0	9.0	7.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	9.0	9.0
	.032	9.0	9.0	7.0	9.0	9.0	9.0	9.0	4.0	9.0	9.0	9.0	8.0	9.0	9.0
2-Methoxy-1-methylethylammonium 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	8.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0	9.0	6.0	9.0	9.0	9.0	9.0	4.0	9.0	9.0	9.0	9.0	9.0	9.0
	.032	9.0	9.0	6.0	9.0	9.0	9.0	9.0	2.0	9.0	9.0	9.0	9.0	9.0	9.0

TABLE XI (cont'd.)
POST-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEEDGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
<i>tert</i> -Butylammonium 2-[5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	9.0		9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	8.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0	9.0	6.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0
	.032	9.0	9.0	5.0	9.0	9.0	9.0	9.0	1.0	9.0	9.0	9.0	8.0	8.0	9.0
2,2,2-Trichloroethyl 2-[5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]nicotinate	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	8.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	7.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	9.0	8.0
	.063	9.0	9.0	7.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0	8.0	8.0	7.0
	.032	9.0	9.0	6.0	9.0	9.0	9.0	9.0	2.0	6.0	9.0	9.0	6.0	8.0	6.0
6-Chloro-2-[5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]nicotinic acid	1.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	7.0
	.125	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	7.0
	.063	9.0	9.0	7.0	9.0	9.0	8.0	7.0	7.0	3.0	9.0	9.0	9.0	7.0	4.0
	.032	4.0	9.0	7.0	9.0	7.0	7.0	7.0	6.0	1.0	9.0	7.0	5.0	6.0	4.0
1-Ethylmethyl 2-[1-carboxy-4-isopropyl-4-methyl-5-oxo-2-imidazolin-2-yl]nicotinate	.500	9.0	9.0	8.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	8.0	9.0
	.250	9.0	9.0	8.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	6.0	7.0
	.125	6.0	8.0	7.0	8.0	7.0	9.0	6.0	4.0	9.0	7.0	9.0	7.0	3.0	6.0
	.063	3.0	8.0	1.0	5.0	7.0	7.0	6.0	0.0	9.0	6.0	9.0	7.0	1.0	4.0
	.032	1.0	7.0	1.0	4.0	4.0	7.0	5.0	0.0	4.0	6.0	9.0	7.0	1.0	4.0

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TABLE XI (cont'd.)
POST-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEDE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
Methyl 2-[4-isopropyl-4-methyl-5-oxo-1-(p-tolyl-sulfonyl)-2-imidazolin-2-yl]nicotinate	1.000	9.0	7.0	7.0	6.0	9.0	9.0	7.0	8.0	9.0	9.0	9.0	8.0	6.0	9.0
	.500	4.0	6.0	4.0	4.0	7.0	7.0	6.0	7.0	9.0	9.0	9.0	7.0	5.0	9.0
	.250	2.0	9.0	2.0	0.0	7.0	7.0	3.0	0.0	3.0	7.0	9.0	4.0	4.0	7.0
	.125	1.0	6.0	0.0	0.0	6.0	6.0	1.0	0.0	1.0	5.0	9.0	3.0	2.0	7.0
	.063	0.0	5.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	2.0	9.0	3.0	2.0	6.0
	.032	0.0	3.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0	2.0	8.0	3.0	1.0	4.0
5-Butyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinic acid															

Example 61

Preemergence Herbicidal Evaluation of Test Compounds

The preemergence herbicidal activity of the compounds of the present invention is exemplified by the following tests in which the seeds of a variety of monocotyledonous and dicotyledonous plants are separately mixed with potting soil and planted on top of approximately one inch of soil in separate pint cups. After planting, the cups are sprayed with the selected aqueous acetone solution containing test compound in sufficient quantity to provide the equivalent of about 0.016 to 10 kg per hectare of test compound per cup. The treated cups are then placed on greenhouse benches, watered and cared for in accordance with conventional greenhouse procedures. From 4 to 5 weeks after treatment, the tests are terminated and each cup is examined and rated according to the rating system set forth above. The herbicidal proficiency of the active ingredients of the present invention is evident from the test results which are recorded in Table XII below. Where more than one test is involved for a given compound, the data are averaged.

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TABLE XII
PRE-EMERGENCE TESTS — RATES IN KG/HA

Compounds	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEDE	WILD OATS	QUACK GRASS	FLD BINDWD	COCKLE- BUR
Triethylammonium-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	7.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	6.0	9.0	9.0	9.0	9.0	9.0	8.0
	.032	3.0	8.0	8.0	8.0	8.0	9.0	8.0
	.016	1.0	6.0	7.0	7.0	7.0	9.0	5.0
Sodium-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	7.0	9.0	9.0	9.0	9.0	9.0	9.0
	.032	6.0	8.0	9.0	8.0	9.0	9.0	9.0
	.016	2.0	6.0	8.0	8.0	7.0	9.0	8.0
Methyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	10.000	9.0	9.0	9.0	9.0		9.0	9.0
	2.000	9.0	9.0	9.0	9.0		9.0	9.0
	1.000	9.0	9.0	9.0	9.0		9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	8.7	8.9	9.0	9.0	9.0	9.0	9.0
	.125	7.9	8.9	8.8	9.0	8.0	9.0	8.7
	.063	6.7	7.9	8.5	8.8	8.0	9.0	6.6
	.032	4.0	6.9	6.7	8.8	5.3	9.0	4.4
	.016	2.4	5.6	4.6	6.3	4.3	9.0	

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TABLE XII (cont'd.)
PRE-EMERGENCE TESTS — RATES IN KG/HA

Compounds	RATE	XXX M RINGLY	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	RICE NATO	SOYBEAN WI	SUNFLR XXX	S WHEAT ER
Triethylammonium-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	8.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0
	.063	9.0	6.0	9.0	9.0	9.0	8.0	8.0	9.0	8.0
	.032	9.0	1.0	9.0	8.0	7.0	7.0	7.0	8.0	8.0
	.016	9.0	1.0	9.0	8.0	5.0	6.0		8.0	8.0
Sodium-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0	5.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.032	9.0	2.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0
	.016	8.0	1.0	9.0	9.0	7.0	8.0	8.0	6.0	8.0
Methyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	10.000	8.0	8.0	8.0		9.0	9.0			
	2.000	8.5	9.0	9.0		9.0	9.0	9.0		
	1.000	8.8	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	8.9	8.5	9.0	9.0	9.0	9.0	8.8	9.0	9.0
	.250	8.6	8.0	9.0	9.0	8.7	9.0	8.8	9.0	8.8
	.125	8.4	7.1	8.8	8.7	8.3	7.9	7.6	8.1	8.8
	.063	8.0	4.6	8.7	7.7	6.0	7.0	6.5	6.7	8.2
	.032	8.1	1.0	8.7	6.8	2.2	5.8	4.7	3.3	7.2
	.016	6.6	0.2	7.8						

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TABLE XII (cont'd.)

Compounds	PRE-EMERGENCE TESTS — RATES IN KG/HA							
	RATE	BARN-YARDGR	GREEN FOX	P NUT-SEEDGE	WILD OATS	QUACK GRASS	FLD BINDWD	COCKLE-BUR
Methyl-2-(5-ethyl-5-methyl-4-oxo-2-imidazolin-2-yl)-nicotinate	10.000	8.0	9.0	9.0	8.0			
	1.000	9.0	8.0	9.0	9.0			8.0
	.500	8.0	6.0	9.0	9.0			5.0
	.250	5.0	5.0	6.0	1.0			3.0
	.125	0.0	0.0	0.0	0.0			0.0
	.063	0.0	0.0	0.0	0.0			0.0
2-Propynyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	7.0	9.0	8.0	9.0	9.0	9.0	9.0
	.032	1.0	8.0	8.0	8.0	9.0	9.0	8.0
	.016	2.0	7.0	8.0	8.0	9.0	9.0	8.0
Calcium-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	7.0	9.0	9.0	9.0	8.0	9.0	9.0
	.032	5.0	7.0	8.0	8.0	9.0	9.0	9.0
	.016	3.0	5.0	8.0	7.0	8.0	9.0	7.0

TABLE XII (cont'd.)

PRE-EMERGENCE TESTS — RATES IN KG/HA

Compounds	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEGE	WILD OATS	QUACK GRASS	FLD BINDWD	COCKLE- BUR
Benzyl-2-(5-ethyl-5-methyl- 4-oxo-2-imidazolin-2-yl)- nicotinate	.500	7.0	9.0	9.0	4.0		9.0	5.0
	.250	6.0	8.0	5.0	2.0		9.0	0.0
	.125	1.0	6.0	2.0	0.0		9.0	0.0
	.063	0.0	3.0	0.0	0.0		9.0	0.0
	.032	0.0	0.0	0.0	0.0		9.0	0.0
	.016	0.0	0.0	0.0	0.0		0.0	0.0

TABLE XII (cont'd.)
PRE-EMERGENCE TESTS — RATES IN KG/HA

Compounds	RATE	XXX M RINGLY	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	RICE NATO	SOYBEAN WI	SUNFLR R XXX	S WHEAT ER
Methyl-2-(5-ethyl-5-methyl-4-oxo-2-imidazolin-2-yl)-nicotinate	10.0000	8.0	8.0	8.0		9.0	9.0	8.0		
	1.0000	8.0	0.0	9.0		9.0	9.0	8.0		
	.500	8.0	0.0	8.0		8.0	9.0	8.0		
	.250	8.0	0.0	8.0		5.0	5.0	7.0		
	.125	8.0	0.0	8.0		3.0	3.0	5.0		
	.063	5.0	0.0	7.0		0.0	0.0	1.0		
2-Propynyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.032	3.0	0.0	3.0		0.0	0.0	0.0		
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0	7.0	9.0	9.0	8.0	9.0	8.0	9.0	9.0
	.032	8.0	2.0	9.0	9.0	3.0	8.0	6.0	8.0	8.0
Calcium-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.016	8.0	1.0	9.0	8.0	2.0	7.0	5.0	8.0	7.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0	4.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.032	9.0	3.0	9.0	9.0	8.0	9.0	9.0	8.0	8.0
Benzyl-2-(5-ethyl-5-methyl-4-oxo-2-imidazolin-2-yl)-nicotinate	.016	7.0	1.0	9.0	8.0	3.0	8.0	9.0	7.0	8.0
	.500	9.0	0.0	9.0	4.0	5.0	9.0	1.0	1.0	5.0
	.250	8.0	0.0	9.0	0.0	2.0	8.0	0.0	0.0	2.0
	.125	7.0	0.0	8.0	0.0	0.0	6.0	0.0	0.0	0.0
	.063	1.0	0.0	5.0	0.0	0.0	2.0	0.0	0.0	0.0
	.032	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
	.016	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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TABLE XII (cont'd.)

PRE-EMERGENCE TESTS — RATES IN KG/HA

Compounds	RATE	BARN-YARDGR	GREEN FOX	P NUT-SEGE	WILD OATS	QUACK GRASS	FLD BINDWD	COCKLE-BUR
Diisopropylammonium-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	7.0	9.0	9.0	9.0	9.0	9.0	9.0
	.032	3.0	7.0	8.0	8.0	9.0	9.0	8.0
Dodecyl-2-(5-isopropyl)-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0		9.0	9.0
	.250	8.0	9.0	9.0	9.0		9.0	9.0
	.125	7.0	8.0	9.0	8.0		9.0	8.0
	.063	5.0	7.0	9.0	8.0		9.0	5.0
	.032	0.0	5.0	7.0	3.0		9.0	0.0
	.016	0.0	4.0	2.0	0.0		7.0	0.0
Ethyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0		9.0	8.0
	.250	8.0	9.0	9.0	9.0		9.0	8.0
	.125	8.0	9.0	9.0	9.0		9.0	8.0
	.063	5.0	7.0	8.0	9.0		9.0	6.0
	.032	2.0	6.0	5.0	6.0		9.0	2.0
	.016	0.0	6.0	2.0	1.0		9.0	0.0
2-(Benzoyloxy)ethyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	7.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	5.0	9.0	9.0	9.0	8.0	9.0	8.0
	.063	4.0	9.0	8.0	8.0	9.0	9.0	3.0
	.032	2.0	2.0	8.0	4.0	9.0	9.0	2.0
	.016	0.0	1.0	7.0	3.0	9.0	1.0	1.0



TABLE XII (cont'd.)
PRE-EMERGENCE TESTS — RATES IN KG/HA

Compounds	RATE	XXX M RINGLY	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	RICE NATO	SOYBEAN WI	SUNFLR XXX	S WHEAT ER
Diisopropylammonium-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0	3.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0
	.032	9.0	2.0	9.0	8.0	3.0	9.0	8.0	8.0	8.0
Dodecyl-2-(5-isopropyl)-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	8.0	1.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0
	.125	9.0	0.0	8.0	8.0	9.0	8.0	6.0	6.0	8.0
	.063	7.0	0.0	7.0	5.0	3.0	8.0	3.0	1.0	7.0
	.032	6.0	0.0	6.0	5.0	3.0	7.0	0.0	0.0	6.0
	.016	0.0	0.0	1.0	2.0	2.0	5.0	1.0	0.0	1.0
Ethyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	7.0	9.0	9.0	9.0	9.0	9.0	8.0	8.0
	.063	8.0	6.0	8.0	9.0	6.0	8.0	3.0	6.0	7.0
	.032	5.0	3.0	7.0	6.0	3.0	5.0	3.0	0.0	3.0
	.016	3.0	0.0	4.0	4.0	1.0	4.0	0.0	0.0	3.0
2-(Benzoyloxy)ethyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	7.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0
	.125	9.0	4.0	9.0	9.0	8.0	9.0	7.0	7.0	9.0
	.063	9.0	0.0	9.0	7.0	7.0	8.0	7.0	7.0	8.0
	.032	3.0	0.0	8.0	4.0	2.0	3.0	3.0	1.0	7.0
	.016	1.0	0.0	7.0	1.0	1.0	2.0	3.0	0.0	4.0

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TABLE XII (cont'd.)

PRE-EMERGENCE TESTS — RATES IN KG/HA

Compounds	RATE	BARN-YARDGR	GREEN FOX	P NUT-SEGE	WILD OATS	QUACK GRASS	FLD BINDWD	COCKLE-BUR
2-(5-Isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)-nicotinic acid	10.000	8.0	9.0	9.0	8.0			
	2.000	9.0	9.0	9.0	9.0			9.0
	1.000	9.0	9.0	9.0	9.0			9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	8.5
	.125	8.0	9.0	9.0	9.0	9.0	9.0	8.5
	.063	7.5	9.0	9.0	9.0	9.0	9.0	8.5
2-Propenyl-2-(5-ethyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.032	7.0	8.0	9.0	8.0	9.0	9.0	8.5
	.016	3.0	6.0	8.5	8.0	8.0	9.0	8.0
	.500	8.9	9.0	8.0	8.0	9.0	9.0	8.0
	.250	4.0	9.0	9.0	6.0	7.0	9.0	7.0
	.125	2.0	4.0	1.0	1.0	2.0	9.0	3.0
	.063	1.0	2.0	0.0	0.0	1.0	9.0	1.0
	.032	0.0	0.0	0.0	0.0	0.0	1.0	1.0
2-(5-Ethyl-5-methyl-4-oxo-2-imidazolin-2-yl)-nicotinic acid	.016	0.0	0.0	0.0	0.0	0.0	1.0	0.0
	.500	8.0	9.0	9.0	9.0		9.0	6.0
	.250	3.0	9.0	7.0	8.0		9.0	1.0
	.125	3.0	8.0	9.0	6.0		9.0	0.0
	.063	2.0	5.0	3.0	1.0		9.0	0.0
	.032	0.0	4.0	0.0	0.0		9.0	0.0
	.016	0.0	0.0	0.0	0.0		8.0	0.0
Methyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate hydrochloride	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	6.0	9.0	9.0	9.0	9.0	9.0	9.0
	.032	6.0	9.0	7.0	9.0	9.0	9.0	9.0
	.016	2.0	7.0	7.0	7.0	9.0	9.0	4.0

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TABLE XII (cont'd.)
PRE-EMERGENCE TESTS — RATES IN KG/HA

Compounds	RATE	XXX M RINGLY	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	RICE NATO	SOYBEAN WI	SUNFLR R XXX	S WHEAT ER
2-(5-Isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)-nicotinic acid	10.000	8.0	8.0	8.0		9.0	9.0	8.0		
	2.000	8.0	9.0	9.0		9.0	9.0	8.0		
	1.000	8.0	9.0	9.0	9.0	9.0	9.0	8.5	9.0	9.0
	.500	8.5	8.5	8.5	9.0	9.0	9.0	8.5	9.0	9.0
	.250	8.5	8.5	8.5	9.0	9.0	9.0	8.5	9.0	9.0
	.125	9.0	8.5	8.5	9.0	9.0	9.0	8.5	9.0	9.0
	.063	8.5	7.5	8.5	9.0	9.0	9.0	8.0	9.0	9.0
	.032	8.0	3.5	8.5	9.0	8.5	9.0	7.0	9.0	9.0
	.016	5.5	0.5	8.0	8.0	6.5	8.5	6.0	9.0	8.0
2-Propynyl-2-(5-ethyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	2.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0
	.250	8.0	1.0	9.0	8.0	6.0	8.0	9.0	7.0	8.0
	.125	4.0	1.0	8.0	7.0	1.0	8.0	2.0	2.0	7.0
	.063	1.0	0.0	7.0	3.0	0.0	4.0	1.0	1.0	2.0
	.032	0.0	0.0	3.0	1.0	0.0	2.0	1.0	0.0	1.0
	.016	0.0	0.0	1.0	0.0	0.0	1.0	1.0	0.0	0.0
2-(5-Ethyl-5-methyl-4-oxo-2-imidazolin-2-yl)-nicotinic acid	.500	8.0	3.0	9.0	8.0	9.0	9.0		9.0	9.0
	.250	8.0	0.0	9.0	7.0	6.0	9.0		8.0	8.0
	.125	7.0	0.0	9.0	6.0	5.0	8.0	1.0	0.0	7.0
	.063	6.0	0.0	8.0	2.0	0.0	8.0		0.0	3.0
	.032	0.0	0.0	7.0	0.0	0.0	5.0		0.0	0.0
	.016	0.0	0.0	5.0	0.0	0.0	3.0		0.0	0.0
Methyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate hydrochloride	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0	6.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.032	9.0	1.0	9.0	9.0	9.0	9.0	8.0	8.0	9.0
	.016	9.0	0.0	9.0	9.0	7.0	8.0	8.0	7.0	9.0

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TABLE XII (cont'd.)

PRE-EMERGENCE TESTS — RATES IN KG/HA

Compounds	RATE	BARN-YARDGR	GREEN FOX	P NUT-SEEDGE	WILD OATS	QUACK GRASS	FLD BINDWD	COCKLE-BUR
1-Methyl-2-Propynyl-2-(5-Isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.032	7.0	9.0	9.0	9.0	8.0	9.0	9.0
	.016	3.0	9.0	8.0	9.0	2.0	9.0	9.0
Tert-butyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	4.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	4.0	8.0	9.0	9.0	6.0	9.0	9.0
	.032	1.0	6.0	6.0	7.0	9.0	9.0	2.0
	.016	0.0	2.0	2.0	3.0	2.0	9.0	
Cyclohexyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	8.0	9.0	8.0	9.0	9.0
	.250	6.0	9.0	8.0	9.0	8.0	9.0	9.0
	.125	3.0	7.0	7.0	3.0	4.0	9.0	8.0
	.063	1.0	0.0	0.0	2.0	3.0	9.0	8.0
	.032	0.0	0.0	0.0	1.0	2.0	9.0	8.0
	.016	0.0	0.0	0.0	0.0	0.0	8.0	1.0
Octadecyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	8.0	9.0	8.0	9.0	9.0	9.0	9.0
	.250	1.0	6.0	1.0	7.0	8.0	9.0	4.0
	.125	0.0	4.0	1.0	7.0	3.0	9.0	2.0
	.063	0.0	0.0	0.0	2.0	0.0	9.0	1.0
	.032	0.0	0.0	0.0	1.0	0.0	3.0	0.0
	.016	0.0	0.0	0.0	0.0	0.0	3.0	0.0

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TABLE XII (cont'd.)

PRE-EMERGENCE TESTS — RATES IN KG/HA

Compounds	RATE	XXX M RINGLY	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	RICE NATO	SOYBEAN WI	SUNFLR R XXX	S WHEAT ER
1-Methyl-2-Propynyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolyl-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0	7.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0
	.032	9.0	2.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0
	.016	9.0	1.0	9.0	8.0	3.0	7.0	6.0	8.0	
Tert-butyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolyl-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	
	.125	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0	
	.063	8.0	2.0	9.0	9.0	3.0	7.0	2.0	9.0	
	.032	2.0	1.0	8.0	8.0	1.0	4.0	1.0	8.0	
	.016	1.0	0.0	2.0	8.0	1.0	2.0	0.0	6.0	
Cyclohexyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolyl-2-yl)nicotinate	.500	9.0	2.0	9.0	9.0	9.0	9.0	7.0	9.0	
	.250	9.0	2.0	9.0	8.0	7.0	7.0	6.0	8.0	
	.125	6.0	1.0	7.0	7.0	1.0	7.0	1.0	7.0	
	.063	3.0	0.0	4.0	7.0	0.0	6.0	0.0	6.0	
	.032	2.0	0.0	2.0	4.0	0.0	2.0	0.0	5.0	
	.016	1.0	0.0	0.0	3.0	0.0	2.0	0.0	3.0	
Octadecyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolyl-2-yl)nicotinate	.500	9.0	3.0	9.0	9.0	7.0	9.0	8.0	9.0	
	.250	2.0	1.0	7.0	9.0	6.0	6.0	3.0	8.0	
	.125	1.0	0.0	6.0	7.0	1.0	4.0	2.0	8.0	
	.063	1.0	0.0	1.0	7.0	0.0	0.0	0.0	4.0	
	.032	0.0	0.0	0.0	2.0	0.0	0.0	0.0	2.0	
	.016	0.0	0.0	0.0	1.0	0.0	0.0	0.0	2.0	



TABLE XII (cont'd.)

PRE-EMERGENCE TESTS -- RATES IN KG/HA

Compounds	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEdge	WILD OATS	QUACK GRASS	FLD BINDWD	COCKLE- BUR
Furfuryl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.032	7.0	9.0	9.0	9.0	9.0	9.0	9.0
	.016	3.0	9.0	8.0	9.0	9.0	9.0	4.0
Isopropyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	8.0	9.0	8.0	9.0	9.0	9.0	7.0
	.125	1.0	8.0	7.0	8.0	9.0	9.0	9.0
	.063	0.0	7.0	4.0	7.0	8.0	9.0	3.0
	.032	0.0	3.0	0.0	2.0	8.0	9.0	9.0
	.016	0.0	1.0	0.0	0.0	9.0	6.0	2.0
Benzyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	4.0	8.0	9.0	9.0	9.0	9.0	7.0
	.032	1.0	8.0	6.0	2.0	9.0	9.0	2.0
	.016	0.0	1.0	1.0	0.0	9.0	1.0	9.0
2-Decynyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	7.0	9.0	8.0	9.0	9.0	9.0	9.0
	.032	4.0	8.0	6.0	9.0	7.0	9.0	9.0
	.016	1.0	6.0	6.0	7.0	1.0	9.0	6.0
2-Methoxymethyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	7.0	9.0	9.0	9.0	9.0	9.0	9.0
	.032	6.0	8.0	8.0	9.0	7.0	9.0	9.0
	.016	1.0	7.0	7.0	4.0	3.0	9.0	9.0

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TABLE XII (cont'd.)
PRE-EMERGENCE TESTS — RATES IN KG/HA

Compounds	RATE	XXX M RINGLY	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	RICE NATO	SOYBEAN WI	SUNFLR R XXX	S WHEAT ER
Furfuryl-2-[5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0	2.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.032	9.0	1.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0
	.016	8.0	9.0	8.0	8.0	7.0	8.0	6.0	9.0	9.9
Isopropyl-2-[5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]nicotinate	.500	9.0	7.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0
	.250	9.0	6.0	9.0	9.0	9.0	9.0	8.0	9.0	8.0
	.125	9.0	1.0	9.0	8.0	7.0	9.0	7.0	6.0	8.0
	.063	9.0	0.0	9.0	6.0	4.0	7.0	6.0	3.0	7.0
	.032	8.0	0.0	7.0	6.0	2.0	1.0	3.0	0.0	4.0
	.016	4.0	0.0	7.0	8.0	1.0	1.0	3.0	0.0	3.0
Benzyl-2-[5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0
	.125	9.0	5.0	9.0	9.0	9.0	9.0	8.0	8.0	9.0
	.063	9.0	0.0	9.0	8.0	9.0	8.0	8.0	7.0	9.0
	.032	9.0	0.0	9.0	3.0	3.0	2.0	6.0	3.0	7.0
	.016	0.0	0.0	0.0	0.0	0.0	1.0	6.0	0.0	0.0
2-Decynyl-2-[5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0	2.0	9.0	9.0	5.0	9.0	6.0	6.0	9.0
	.032	9.0	2.0	9.0	7.0	5.0	8.0	6.0	6.0	9.0
	.016	7.0	0.0	8.0	7.0	1.0	3.0	1.0	1.0	8.0
2-Methoxymethyl-2-[5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0	6.0	9.0	9.0	9.0	9.0	7.0	7.0	9.0
	.032	8.0	1.0	9.0	8.0	8.0	9.0	6.0	6.0	8.0
	.016	7.0	0.0	9.0	8.0	1.0	8.0	1.0	1.0	8.0

TABLE XII (cont'd.)

PRE-EMERGENCE TESTS — RATES IN KG/HA

Compounds	RATE	BARN-YARDGR	GREEN-FOX	P NUT-SEDE	WILD-OATS	QUACK-GRASS	FLD-BINDWD	COCKLE-BUR
Allyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	8.0	9.0	8.0	9.0	8.0	9.0	9.0
	.032	7.0	9.0	8.0	9.0	3.0	9.0	9.0
	.016	3.0	8.0	6.0	8.0	3.0	9.0	6.0
1-Methylallyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	7.0	9.0	9.0	9.0	6.0	9.0	9.0
	.063	4.0	7.0	9.0	9.0	9.0	9.0	8.0
	.032	3.0	6.0	8.0	9.0	2.0	9.0	8.0
	.016	1.0	3.0	7.0	3.0	0.0	9.0	2.0
3-isopropyl-3-methyl(3H)-imidazo[1',2':1,2]pyrrolo-[3,4,6]-pyridine-2-(3-H)-5-dione	.500	0.0	8.0	9.0	8.0	9.0	9.0	1.0
	.250	0.0	3.0	6.0	1.0	8.0	9.0	1.0
	.125	0.0	0.0	1.0	0.0	2.0	9.0	0.0
	.063	0.0	0.0	0.0	0.0		4.0	0.0
	.032	0.0	0.0	0.0	0.0	0.0	4.0	
	.016	0.0	0.0	0.0	0.0	0.0	1.0	

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TABLE XII (cont'd.)
PRE-EMERGENCE TESTS — RATES IN KG/HA

Compounds	RATE	XXX M RINGLY	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	RICE NATO	SOYBEAN WI	SUNFLR R XXX	S WHEAT ER
Allyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0		9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0		9.0	9.0
	.125	9.0	7.0	9.0	9.0	9.0	9.0		9.0	9.0
	.063	9.0	7.0	9.0	9.0	8.0	9.0		9.0	9.0
	.032	8.0	6.0	9.0	9.0	7.0	9.0		6.0	9.0
	.016	8.0	1.0	8.0	8.0	2.0	3.0		2.0	8.0
1-Methylallyl-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0		9.0	9.0
	.250	9.0	7.0	9.0	9.0	9.0	9.0		9.0	9.0
	.125	9.0	7.0	9.0	9.0	9.0	9.0		8.0	9.0
	.063	8.0	1.0	9.0	9.0	3.0	8.0		5.0	9.0
	.032	8.0	0.0	9.0	9.0	1.0	7.0		8.0	9.0
	.016	8.0	0.0	9.0	7.0	8.0	4.0		2.0	8.0
3-isopropyl-3-methyl[3H]-imidazo[1',2':1,2]pyrrolo-[3,4,6]pyridine-2-(3-H),5-dione	.500	7.0	8.0	9.0	8.0	1.0	7.0	2.0	3.0	7.0
	.250	1.0	0.0	7.0	7.0	0.0	7.0	2.0	0.0	7.0
	.125	0.0	0.0	7.0	1.0	0.0	0.0		0.0	1.0
	.063	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
	.032	0.0	0.0			0.0	0.0		0.0	
	.016	0.0	0.0			0.0	0.0		0.0	

TABLE XII (cont'd.)
PRE-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEEDGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
2-Methylallyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	8.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	7.0	9.0	9.0	9.0	7.0	9.0	9.0	8.0	9.0	8.0	3.0	9.0	8.0	9.0
	.063	3.0	9.0	8.0	9.0	6.0	9.0	8.0	4.0	9.0	8.0	2.0	6.0	7.0	6.0
	.032	1.0	7.0	7.0	6.0	3.0	9.0	7.0	0.0	9.0	8.0	1.0	3.0	6.0	2.0
	.016	0.0	1.0	5.0	2.0	2.0	9.0	5.0	0.0	7.0	7.0	1.0	3.0	6.0	2.0
2-Butenyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	6.0	9.0	8.0	9.0	7.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	9.0	8.0
	.063	4.0	9.0	8.0	9.0	5.0	9.0	9.0	3.0	9.0	9.0	9.0	9.0	9.0	9.0
	.032	1.0	7.0	8.0	8.0	4.0	9.0	9.0	3.0	8.0	8.0	1.0	9.0	7.0	9.0
	.016	1.0	2.0	6.0	5.0	2.0	7.0	1.0	0.0	6.0	8.0	6.0	6.0	5.0	6.0
Octadecyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	8.000	8.0	8.0	8.0	8.0	9.0	9.0	7.0	9.0	8.0	9.0	7.0	8.0	9.0	7.0
	.500	8.0	9.0	8.0	9.0	9.0	9.0	2.0	3.0	9.0	9.0	6.0	8.0	6.0	7.0
	.250	1.0	6.0	1.0	7.0	8.0	9.0	1.0	1.0	7.0	9.0	1.0	0.0	4.0	1.0
	.125	0.0	4.0	1.0	7.0	3.0	9.0	1.0	0.0	6.0	7.0	0.0	0.0	0.0	0.0
	.063	0.0	0.0	0.0	2.0	0.0	9.0	1.0	0.0	1.0	7.0	0.0	0.0	0.0	0.0
Propyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	8.000	9.0	9.0	9.0	9.0	9.0	9.0	8.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0
	.250	7.0	9.0	9.0	9.0	8.0	9.0	9.0	8.0	9.0	9.0	7.0	9.0	9.0	8.0
	.125	6.0	9.0	7.0	9.0	7.0	9.0	8.0	3.0	9.0	9.0	7.0	9.0	9.0	8.0
	.063	2.0	8.0	7.0	7.0	6.0	9.0	4.0	1.0	8.0	9.0	4.0	7.0	6.0	7.0

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TABLE XII (cont'd.)
PRE-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEDGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
Butyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	0.000	9.0	9.0	9.0	9.0	9.0	9.0	0.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	0.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	7.0	9.0	9.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	3.0	9.0	0.0	9.0	0.0	9.0	9.0	1.0	9.0	0.0	9.0	9.0	7.0	7.0
	.063	1.0	0.0	7.0	6.0	7.0	0.0	7.0	0.0	0.0	0.0	6.0	6.0	5.0	6.0
Methyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)-6-methoxynicotinate	0.000	9.0	9.0	9.0	9.0	9.0	9.0	0.0	0.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	1.0	0.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	0.0	9.0	9.0	0.0	9.0	1.0	7.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	0.0	9.0	6.0	9.0	9.0	0.0	6.0	0.0	9.0	9.0	8.0	9.0
	.063	0.0	9.0	7.0	0.0	5.0	0.0	7.0	0.0	2.0	7.0	2.0	3.0	7.0	0.0
2-Decenyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.032	6.0	7.0	7.0	0.0	1.0	0.0	0.0	0.0	2.0	6.0	1.0	1.0	3.0	2.0
	.016	1.0	6.0	6.0	7.0	0.0	0.0	0.0	0.0	0.0	4.0	1.0	0.0	0.0	1.0
	0.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	0.0	9.0	0.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0
N,N-diethyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinamide	.125	7.0	9.0	0.0	9.0	0.0	9.0	9.0	2.0	9.0	9.0	7.0	9.0	9.0	7.0
	.063	2.0	9.0	0.0	0.0	9.0	9.0	9.0	0.0	0.0	0.0	6.0	6.0	6.0	4.0
	0.000	7.0	7.0	0.0	9.0	9.0	9.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	0.0	9.0	0.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0

TABLE XII (cont'd.)
PRE-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEDGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
3-Isopropyl-8-methoxy-3-methyl- 5H-imidazo[1,2-b]pyridine- 2-(3H)-5-dione	8.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	6.0	1.0	4.0	7.0	0.0
	.500	3.0	6.0	9.0	6.0	4.0	9.0	9.0	0.0	3.0	6.0	1.0	4.0	4.0	0.0
	.250	1.0	6.0	9.0	2.0	3.0	9.0	1.0	0.0	0.0	6.0	0.0	0.0	3.0	0.0
	.125	0.0	6.0	3.0	0.0	0.0	8.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0
	.063	0.0	0.0	1.0	0.0	0.0	8.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0
	.032	0.0	0.0	0.0	0.0	0.0	8.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0
	.016	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
2-Chloroallyl 2-(5-isopropyl- 5-methyl-4-oxo-2-imidazolin- 2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	6.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	6.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	6.0	9.0	9.0	9.0	9.0	9.0	9.0	3.0	9.0	9.0	9.0	9.0	9.0	8.0
	.032	4.0	9.0	9.0	9.0	9.0	9.0	8.0	3.0	9.0	9.0	7.0	7.0	9.0	7.0
	.016	2.0	6.0	9.0	3.0	9.0	9.0	6.0	0.0	7.0	9.0	4.0	4.0	7.0	4.0
Methyl 2-(1-acetyl-4-isopropyl- 4-methyl-5-oxo-2-imidazolin- 2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	6.0	9.0	9.0	9.0	9.0	9.0	9.0	2.0	9.0	9.0	8.0	8.0	9.0	8.0
	.032	3.0	9.0	4.0	7.0	9.0	9.0	8.0	1.0	8.0	9.0	6.0	6.0	8.0	6.0
	.016	2.0	9.0	3.0	1.0	3.0	9.0	8.0	0.0	7.0	8.0	2.0	3.0	6.0	3.0
Methyl 2-(5-cyclopropyl-5- methyl-4-oxo-2-imidazolin- 2-yl)nicotinate	.500	7.0	9.0	8.0	9.0	9.0	9.0	9.0	6.0	9.0	8.0	6.0	9.0	9.0	9.0
	.250	3.0	9.0	6.0	7.0	9.0	9.0	9.0	1.0	9.0	8.0	3.0	7.0	9.0	9.0

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TABLE XII (cont'd.)
PRE-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
Hexyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	0.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	8.0	9.0	9.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	9.0	8.0
	.125	7.0	9.0	9.0	9.0	9.0	9.0	9.0	3.0	8.0	9.0	8.0	8.0	9.0	8.0
	.063	2.0	9.0	7.0	6.0	9.0	9.0	6.0	2.0	7.0	9.0	3.0	7.0	7.0	4.0
	.032	2.0	7.0	6.0	2.0	9.0	9.0	4.0	1.0	7.0	6.0	3.0	4.0	7.0	4.0
1-Methyl-2-butanyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.016	1.0	2.0	2.0	0.0	9.0	2.0	4.0	0.0	3.0	4.0	2.0	2.0	7.0	2.0
	0.000	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	4.0	9.0	9.0	9.0	9.0	9.0	8.0
	.063	4.0	9.0	9.0	9.0	9.0	9.0	9.0	3.0	9.0	9.0	8.0	9.0	9.0	6.0
Methyl 2-(4-isopropyl-1,4-dimethyl-5-oxo-2-imidazolin-2-yl)nicotinate	.032	5.0	9.0	7.0	7.0	9.0	9.0	7.0	2.0	9.0	9.0	7.0	9.0	8.0	6.0
	.016	1.0	8.0	3.0	4.0	6.0	9.0	7.0	1.0	8.0	8.0	2.0	4.0	4.0	4.0
	5.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	6.0	9.0	7.0	9.0	4.0	9.0	9.0	9.0	8.0	8.0	2.0	4.0	9.0	8.0
	.250	1.0	7.0	4.0	2.0	0.0	9.0	7.0	0.0	4.0	7.0	1.0	2.0	7.0	5.0
	.125	1.0	4.0	3.0	0.0	0.0	9.0	0.0	0.0	3.0	7.0	0.0	1.0	7.0	4.0
Methyl 2-(4-isopropyl-4-methyl-5-oxo-1-pivaloyl-2-imidazolin-2-yl)nicotinate	.063	0.0	1.0	1.0	0.0	0.0	8.0	0.0	0.0	2.0	7.0	0.0	1.0	7.0	1.0
	.032	0.0	1.0	0.0	0.0	0.0	7.0	0.0	0.0	0.0	6.0	0.0	1.0	6.0	1.0
	.016	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	2.0	6.0	0.0	0.0	3.0	1.0
	.500	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	8.0	9.0	8.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	8.0	9.0	8.0	9.0	8.0	9.0	9.0	1.0	9.0	9.0	3.0	7.0	9.0	9.0
	.063	6.0	9.0	6.0	9.0	8.0	7.0	9.0	1.0	8.0	8.0	1.0	4.0	9.0	7.0
	.032	2.0	8.0	6.0	8.0	8.0	7.0	9.0	1.0	8.0	8.0	1.0	4.0	9.0	7.0
	.016	1.0	2.0	4.0	1.0	7.0	9.0	3.0	1.0	7.0	7.0	1.0	1.0	3.0	2.0

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TABLE XII (cont'd.)

PRE-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEEDGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
Methyl 2-(4-oxo-1,3-diaza- spiro[4.5]dec-2-en-2-yl)- nicotinate	0.000	9.0	9.0	9.0	9.0	9.0	9.0	7.0	0.0	9.0	9.0	2.0	4.0	6.0	9.0
	.500	0.0	9.0	7.0	6.0	6.0	9.0	3.0	0.0	9.0	9.0	2.0	2.0	3.0	2.0
	.250	4.0	7.0	6.0	2.0	2.0	9.0	2.0	0.0	7.0	7.0	2.0	2.0	3.0	0.0
	.125	2.0	4.0	1.0	0.0	1.0	6.0	1.0	0.0	3.0	3.0	1.0	1.0	2.0	0.0
	.063	0.0	1.0	0.0	0.0	0.0	2.0	0.0	0.0	1.0	1.0	1.0	1.0	2.0	0.0
	.032	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	1.0	0.0	0.0	1.0	2.0	0.0
	.016	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0
3-Methyl-2-butenyl 2-(5- isopropyl-5-methyl-4-oxo- 2-imidazolin-2-yl)- nicotinate	0.000	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	0.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	0.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	3.0	9.0	9.0	9.0	9.0	9.0	9.0	3.0	9.0	9.0	8.0	8.0	9.0	7.0
	.032	1.0	9.0	9.0	8.0	7.0	9.0	3.0	0.0	8.0	8.0	6.0	6.0	9.0	7.0
	.016	0.0	9.0	4.0	6.0	7.0	7.0	1.0	0.0	8.0	8.0	4.0	3.0	4.0	4.0
Benzyl 2-(4-oxo-1,3-diazo- spiro[4.5]dec-2-en-2-yl)- nicotinate	0.000	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	0.0	0.0	0.0	1.0	0.0
	.500	0.0	0.0	6.0	0.0	8.0	9.0	3.0	0.0	3.0	0.0	0.0	0.0	1.0	0.0
2-(5-Isopropyl-5-methyl-4- oxo-2-imidazolin-2-yl)- nicotinohydroxamic acid	0.000	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	8.0
	.250	7.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	7.0	9.0	9.0	8.0
	.125	7.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	8.0	8.0	7.0	6.0	9.0	4.0
	.063	2.0	9.0	9.0	7.0	8.0	9.0	7.0	0.0	8.0	8.0	7.0	6.0	9.0	4.0

TABLE XII (cont'd.)
PRE-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
Benzyl 2-[5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl] nicotinate	8.000	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	8.0	6.0	8.0	7.0
	.500	3.0	9.0	7.0	9.0	7.0	9.0	8.0	0.0	9.0	9.0	8.0	6.0	8.0	5.0
	.250	1.0	4.0	6.0	7.0	4.0	9.0	7.0	0.0	8.0	8.0	3.0	4.0	6.0	5.0
6-methoxy 2-[5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]nicotinic acid	5.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	8.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	7.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	8.0	9.0	9.0	8.0	9.0	9.0
2-(4-oxo-1,3-diazospiro-[4.5]dec-2-en-2-yl)nicotinic acid	.500	6.0	8.0	8.0	6.0	7.0	9.0	8.0	7.0	9.0	8.5	4.5	8.5	9.0	1.0
	.250	1.0	7.0	2.0	3.0	1.0	9.0	3.0	3.0	9.0	5.0	1.5	7.5	8.0	0.0
α-Methylbenzylammonium 2-[5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]-nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	8.0	9.0	9.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	9.0	7.0
	.063	7.0	9.0	8.0	9.0	9.0	9.0	9.0	0.0	9.0	9.0	9.0	9.0	9.0	6.0
	.032	3.0	9.0	7.0	8.0	9.0	9.0	7.0	0.0	9.0	9.0	9.0	9.0	8.0	6.0
	.016	2.0	4.0	4.0	4.0	9.0	9.0	6.0	0.0	8.0	7.0	5.0	6.0	5.0	3.0

TABLE XII (cont'd.)
PRE-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEDGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
α -Cyclopropyl-5,7-dihydro- α -methyl-5,7-dioxo-8H-pyrrolo- [3,4-b]pyridine-6- acetamide	.500	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	6.0	9.0	9.0	9.0	8.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	3.0	6.0	6.0	7.0	9.0	8.0	8.0	2.0	9.0	9.0	9.0	7.0	9.0	7.0
	.063	1.0	3.0	6.0	3.0	4.0	9.0	4.0	0.0	7.0	7.0	4.0	4.0	3.0	
2-(5-Cyclopropyl-5-methyl-4- oxo-2-imidazolin-2-yl)- nicotinic acid	5.000	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	7.0	9.0	9.0	9.0	9.0	9.0	9.0	3.0	9.0	9.0	9.0	9.0	8.0	9.0
	.063	3.0	9.0	9.0	9.0	8.0	9.0	9.0	2.0	9.0	9.0	7.0	6.0	8.0	9.0
	.032	1.0	9.0	7.0	8.0	6.0	9.0	6.0	1.0	8.0	7.0	2.0	2.0	3.0	4.0
	.016	1.0	6.0	3.0	6.0	3.0	9.0	2.0							
1,1-Dimethyl-2-propynyl 2-(5- isopropyl-5-methyl-4-oxo-2- imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0
	.250	9.0	9.0	9.0	9.0	7.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	8.0
	.125	7.0	9.0	7.0	9.0	7.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	8.0
	.063	5.0	9.0	6.0	9.0	6.0	9.0	9.0	3.0	9.0	8.0	7.0	9.0	9.0	9.0
	.032	1.0	9.0	4.0	7.0	6.0	9.0	7.0	0.0	8.0	8.0	3.0	8.0	7.0	5.0
	.016	0.0	7.0	1.0	1.0	1.0	9.0	7.0	0.0	7.0	7.0	2.0	5.0	3.0	1.0
2-trimethylammoniummethyl, 2-(5-isopropyl-5-methyl-4- oxo-2-imidazolin-2-yl)- nicotinate iodide	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	8.0
	.125	8.0	9.0	9.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	9.0	8.0
	.063	7.0	9.0	9.0	9.0	8.0	9.0	9.0	1.0	9.0	9.0	9.0	6.0	9.0	8.0

TABLE XII (cont'd.)
PRE-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEDE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
N-(2-Hydroxyethyl)-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)-nicotinamide	0.000	0.0	9.0	9.0	9.0	9.0	9.0	0.0	0.0	0.0	9.0	7.0	6.0	0.0	6.0
	.500	4.0	7.0	9.0	9.0	9.0	9.0	0.0	0.0	7.0	9.0	5.0	1.0	6.0	3.0
	.250	1.0	3.0	4.0	7.0	9.0	6.0	6.0	0.0	3.0	4.0	2.0	1.0	6.0	3.0
	.125	0.0	2.0	3.0	3.0	9.0	7.0	5.0	0.0	3.0	3.0	2.0	1.0	6.0	3.0
	.063	0.0	0.0	1.0	0.0	4.0	2.0	0.0	0.0	2.0	1.0	1.0	0.0	4.0	1.0
	.032	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	0.0	3.0	1.0
	.016	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	9.0	0.0	3.0	1.0
Ammonium 2-(5-isopropyl-6-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	0.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	0.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0	9.0	9.0	9.0	9.0	9.0	9.0	2.0	9.0	9.0	9.0	0.0	9.0	0.0
	.032	4.0	9.0	7.0	0.0	9.0	9.0	7.0	0.0	0.0	9.0	9.0	7.0	9.0	0.0
	.016	0.0	9.0	2.0	7.0	9.0	9.0	0.0	0.0	0.0	0.0	7.0	4.0	6.0	3.0
Methyl 2-(4-isopropyl-1-lauroyl-4-methyl-5-oxo-2-imidazolin-2-yl)nicotinate	0.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	0.0	9.0	0.0	9.0	7.0	9.0	9.0	0.0	9.0	9.0	9.0	9.0	0.0	9.0
	.125	0.0	9.0	6.0	9.0	7.0	9.0	9.0	3.0	9.0	9.0	9.0	9.0	0.0	9.0
	.063	3.0	9.0	4.0	9.0	3.0	7.0	2.0	0.0	9.0	0.0	0.0	7.0	0.0	9.0
	.032	0.0	4.0	0.0	6.0	1.0	7.0	0.0	0.0	7.0	7.0	3.0	1.0	6.0	3.0
1,1-Dimethylallyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	0.000	9.0	9.0	9.0	9.0	9.0	9.0	0.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	0.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	2.0	9.0	9.0	9.0	9.0	9.0	9.0	3.0	9.0	9.0	9.0	9.0	9.0	9.0
	.032	2.0	7.0	0.0	0.0	3.0	9.0	0.0	1.0	0.0	0.0	9.0	7.0	7.0	6.0
	.016	0.0	1.0	3.0	4.0	2.0	9.0	2.0	0.0	3.0	0.0	0.0	6.0	7.0	3.0

TABLE XII (cont'd.)
PRE-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEEDGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
2-Propynyl 2-(5-cyclopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.250	6.0	9.0	7.0	7.0	9.0	9.0	9.0	1.0	8.0	9.0	6.0	8.0	9.0	9.0
	.125	4.0	3.0	8.0	4.0	9.0	9.0	7.0	1.0	8.0	6.0	4.0	7.0	4.0	9.0
	.063	0.0	1.0	0.0	1.0	3.0	9.0	0.0	0.0	4.0	4.0	2.0	3.0	2.0	0.0
	.032	0.0	0.0	0.0	1.0	0.0	9.0	0.0	0.0	3.0	3.0	1.0	0.0	2.0	0.0
	.016	0.0	0.0	0.0	1.0	0.0	7.0	0.0	0.0	0.0	2.0	1.0	0.0	1.0	0.0
2-Propynyl 2-(4-oxo-1,3-diazospiro[4.5]dec-2-en-2-yl)nicotinate	5.000	8.0	9.0	8.0	8.0	9.0	9.0	8.0	8.0	8.0	7.0	1.0	6.0	6.0	9.0
	.500	9.0	4.0	8.0	7.0	8.0	9.0	8.0	0.0	7.0	2.0	0.0	1.0	8.0	0.0
	.250	1.0	2.0	3.0	7.0	2.0	9.0	9.0	0.0	6.0	0.0	0.0	0.0	0.0	0.0
N-(2-Chloroethyl)-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinamide	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0
	.250	6.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	7.0
	.125	4.0	7.0	9.0	9.0	7.0	9.0	9.0	6.0	8.0	9.0	8.0	8.0	9.0	5.0
	.063	2.0	4.0	7.0	9.0	7.0	9.0	7.0	6.0	8.0	9.0	7.0	7.0	6.0	5.0
	.032	1.0	3.0	4.0	8.0	6.0	9.0	5.0	2.0	7.0	9.0	6.0	6.0	5.0	1.0
	.016	0.0	2.0	1.0	7.0	4.0	3.0	4.0	2.0	2.0	9.0	6.0	6.0	5.0	1.0
p-Methoxybenzyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	8.000	9.0	9.0	9.0	8.0	9.0	9.0	8.0	8.0	7.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0
	.250	9.0	9.0	9.0	9.0	8.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	8.0
	.125	9.0	9.0	9.0	9.0	7.0	9.0	8.0	2.0	9.0	9.0	9.0	9.0	9.0	6.0
	.063	3.0	7.0	6.0	8.0	7.0	9.0	8.0	2.0	9.0	9.0	6.0	6.0	9.0	6.0
	.032	0.0	4.0	4.0	3.0	3.0	6.0	8.0	0.0	8.0	7.0	2.0	6.0	6.0	1.0
	.016	0.0	2.0	1.0	1.0	0.0	9.0	0.0	0.0	6.0	6.0	2.0	2.0	3.0	0.0

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TABLE XII (cont'd.)
PRE-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEDE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
Barium 2-(6-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	8.0	9.0	8.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	8.0
	.063	8.0	9.0	9.0	9.0	9.0	9.0	9.0	3.0	9.0	9.0	9.0	9.0	9.0	7.0
	.032	1.0	9.0	8.0	9.0	9.0	9.0	9.0	0.0	8.0	9.0	9.0	9.0	9.0	7.0
	.016	0.0	6.0	7.0	7.0	9.0	9.0	9.0	0.0	8.0	8.0	7.0	4.0	5.0	
Cupric 2-(6-isopropyl-5-methyl-4-oxo-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	4.0	9.0	9.0	9.0	9.0	9.0	8.0	4.0	9.0	9.0	9.0	9.0	9.0	9.0
	.032	2.0	9.0	8.0	9.0	9.0	9.0	8.0	0.0	9.0	9.0	9.0	9.0	9.0	7.0
	.016	1.0	6.0	6.0	5.0	9.0	9.0	3.0	0.0	9.0	8.0	6.0	3.0	5.0	4.0
Potassium 2-(6-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	6.0	9.0	9.0	9.0	9.0	9.0	9.0	3.0	9.0	9.0	9.0	8.0	9.0	9.0
	.032	2.0	9.0	9.0	9.0	9.0	9.0	9.0	0.0	9.0	9.0	7.0	9.0	9.0	9.0
	.016	1.0	9.0	6.0	6.0	8.0	8.0	3.0	0.0	8.0	9.0	9.0	5.0	9.0	4.0
Lithium 2-(6-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate with tetrahydrofuran	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	9.0	9.0

TABLE XI (cont'd.)

PRE-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
Magnesium 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	8.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	8.0	9.0	8.0
	.063	9.0	9.0	9.0	9.0	9.0	9.0	9.0	1.0	9.0	9.0	9.0	8.0	9.0	7.0
	.032	2.0	9.0	9.0	9.0	9.0	9.0	9.0	0.0	9.0	9.0	9.0	8.0	7.0	4.0
	.016	0.0	9.0	3.0	6.0	8.0	9.0	4.0	0.0	7.0	7.0	7.0	5.0	6.0	4.0
Piperidinium 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	7.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	1.0	9.0	9.0	9.0	9.0	9.0	9.0	0.0	9.0	9.0	9.0	8.0	9.0	7.0
	.032	1.0	9.0	9.0	8.0	9.0	9.0	8.0	0.0	9.0	9.0	9.0	9.0	9.0	7.0
	.016	0.0	7.0	2.0	3.0	9.0	9.0	4.0	0.0	9.0	9.0	9.0	2.0	4.0	7.0
<i>p</i> -Chlorobenzyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	8.000	9.0	9.0	9.0	8.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	8.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	8.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	8.0	9.0	9.0
	.125	9.0	8.0	9.0	8.0	8.0	9.0	7.0	4.0	9.0	8.0	4.0	6.0	9.0	6.0
	.063	1.0	6.0	7.0	7.0	7.0	9.0	4.0	0.0	8.0	7.0	4.0	4.0	7.0	6.0
	.032	1.0	4.0	8.0	4.0	7.0	9.0	7.0	0.0	4.0	4.0	1.0	1.0	6.0	6.0
<i>p</i> -Nitrobenzyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.016	0.0	1.0	0.0	1.0	2.0	9.0	0.0	0.0	4.0	6.0	1.0	0.0	4.0	4.0
	8.000	9.0	9.0	9.0	8.0	9.0	9.0	8.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0	8.0	9.0	9.0
	.063	3.0	7.0	7.0	8.0	9.0	9.0	7.0	1.0	9.0	9.0	3.0	7.0	9.0	8.0
	.032	1.0	6.0	8.0	6.0	7.0	9.0	7.0	0.0	4.0	8.0	2.0	6.0	8.0	3.0
	.016	0.0	3.0	0.0	4.0	3.0	9.0	3.0	0.0	4.0	8.0	2.0	1.0	6.0	2.0

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TABLE XII (cont'd.)
PRE-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEDE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
Benzyltrimethylammonium 2-(5-isopropyl-5-methyl-4- oxo-2-imidazolin-2-yl)- nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	7.0	8.0	8.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	9.0	8.0
	.063	9.0	7.0	9.0	8.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	8.0	7.0	6.0
	.032	0.0	3.0	5.0	5.0	9.0	9.0	8.0	0.0	7.0	8.0	7.0	6.0	6.0	6.0
	.016	0.0	1.0	4.0	4.0	7.0	9.0	4.0	0.0	6.0	8.0	4.0	2.0	6.0	4.0
Omega-Aminohexammonium 2-(5-isopropyl-5-methyl-4- oxo-2-imidazolin-2-yl)- nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	8.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	5.0	9.0	9.0	9.0	9.0	9.0	9.0	5.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	3.0	9.0	8.0	9.0	9.0	9.0	9.0	0.0	9.0	9.0	7.0	9.0	9.0	7.0
Tallowammonium 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	8.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	7.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0
	.063	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0
	.032	2.0	6.0	7.0	7.0	8.0	9.0	9.0	0.0	9.0	9.0	9.0	9.0	7.0	7.0
Carbomethoxymethyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.016	0.0	2.0	0.0	6.0	6.0	9.0	6.0	0.0	5.0	7.0	9.0	3.0	5.0	2.0
	8.000	9.0	9.0	8.0	8.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	9.0	8.0
	.063	6.0	9.0	7.0	9.0	8.0	9.0	9.0	3.0	7.0	9.0	9.0	9.0	9.0	6.0
	.032	1.0	3.0	8.0	6.0	7.0	9.0	8.0	0.0	7.0	7.0	3.0	4.0	7.0	4.0
	.016	1.0	3.0	1.0	2.0	4.0	9.0	2.0	0.0	3.0	7.0	2.0	3.0	7.0	2.0

TABLE XII (cont'd.)
PRE-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEEDGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
Dodecylammonium 2-[6-iso-propyl-5-methyl-4-oxo-2-imidazolin-2-yl]nicotinate	0.000	9.0	9.0	9.0	9.0	9.0	9.0		9.0	9.0		9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	4.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0
	.063	4.0	7.0	6.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	8.0
	.032	1.0	7.0	1.0	7.0	8.0	9.0	8.0	9.0	9.0	9.0	7.0	8.0	7.0	6.0
	.016	0.0	0.0	0.0	2.0	8.0	9.0	2.0	9.0	9.0	7.0	3.0	3.0	4.0	3.0
1,1,3,3-Tetramethylbutylammonium 2-[6-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]nicotinate	0.000	9.0	9.0	9.0	9.0	9.0	9.0		9.0	9.0		9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	1.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0
	.063	1.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	8.0	7.0
	.032	1.0	4.0	7.0	8.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	8.0	6.0
	.016	0.0	2.0	2.0	6.0	7.0	9.0	7.0	9.0	5.0	9.0	7.0	4.0	6.0	3.0
Dibutylammonium 2-[6-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]nicotinate	0.000	9.0	9.0	9.0	9.0	9.0	9.0		9.0	9.0		9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	4.0	8.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	7.0
	.032	0.0	3.0	7.0	6.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	3.0	7.0	7.0
	.016	0.0	1.0	1.0	4.0	4.0	9.0	4.0	9.0	4.0	7.0	6.0	1.0	4.0	1.0
2-(Methylamino)ethyl 2-[5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0

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TABLE XII (cont'd.)
PRE-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEDE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
1-Methylpyrrolidinium 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	7.0	9.0	9.0	9.0	9.0	9.0	9.0	2.0	9.0	9.0	9.0	8.0	9.0	7.0
	.032	3.0	8.0	9.0	9.0	9.0	9.0	9.0	2.0	9.0	9.0	9.0	8.0	9.0	9.0
	.016	0.0	6.0	8.0	7.0	9.0	9.0	8.0	0.0	4.0	9.0	7.0	8.0	8.0	3.0
Octylammonium 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	4.0	9.0	9.0	9.0	9.0	9.0	9.0	2.0	9.0	9.0	9.0	8.0	9.0	9.0
	.032	2.0	8.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0
	.016	0.0	6.0	9.0	8.0	9.0	9.0	6.0		8.0	9.0	6.0	4.0	8.0	9.0
Benzylammonium 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	8.000	9.0	9.0	9.0	9.0	9.0	9.0		9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	7.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	7.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.032	2.0	4.0	6.0	9.0	7.0	9.0	4.0		7.0	7.0	9.0	8.0	9.0	7.0
	.016	0.0	3.0	3.0	5.0	7.0	9.0	2.0		3.0	7.0	4.0	5.0	8.0	5.0
Cyclohexylammonium 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	4.0	8.0	9.0	9.0	9.0	9.0	9.0	1.0	9.0	9.0	9.0	9.0	9.0	9.0

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TABLE XII (cont'd.)
PRE-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEEDGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
Morpholinium 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	8.0	9.0	9.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	9.0	9.0
	.032	4.0	9.0	9.0	8.0	9.0	9.0	9.0	2.0	9.0	9.0	9.0	8.0	9.0	9.0
4-Phenylbutylammonium 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	8.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0
	.125	7.0	8.0	9.0	9.0	9.0	9.0	9.0	4.0	9.0	9.0	9.0	9.0	9.0	8.0
	.063	4.0	8.0	9.0	9.0	9.0	9.0	9.0	3.0	9.0	9.0	9.0	9.0	9.0	8.0
	.032	1.0	4.0	7.0	7.0	7.0	9.0	9.0	0.0	9.0	8.0	9.0	6.0	7.0	6.0
Phenethylammonium 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.016	0.0	2.0	4.0	2.0	3.0	9.0	4.0	0.0	4.0	8.0	4.0	2.0	3.0	3.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	7.0	9.0	9.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	0.0	9.0	9.0	9.0
	.032	3.0	9.0	8.0	9.0	7.0	9.0	9.0	4.0	9.0	9.0	9.0	8.0	9.0	9.0
Dimethoxymethylammonium 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.016	1.0	7.0	6.0	3.0	9.0	9.0	3.0	4.0	6.0	7.0	6.0	3.0	7.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	7.0	9.0	9.0	9.0	9.0	9.0	9.0	5.0	9.0	9.0	9.0	8.0	9.0	9.0

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TABLE XII (cont'd.)
PRE-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
2,2'-Diethoxydiethyl- ammonium 2-(5-isopropyl-5- methyl-4-oxo-2-imidazolin- 2-yl)nicotinate	8.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	7.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.032	4.0	9.0	9.0	9.0	9.0	9.0	9.0	1.0	9.0	9.0	9.0	8.0	9.0	9.0
3-Methoxypropylammonium 2-(5-isopropyl-5-methyl- 4-oxo-2-imidazolin-2-yl)- nicotinate	.016	1.0	7.0	8.0	7.0	9.0	9.0	8.0	1.0	7.0	8.0	7.0	3.0	8.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	6.0	9.0	9.0	9.0	9.0	9.0	9.0	3.0	9.0	9.0	7.0	8.0	9.0	9.0
	.032	5.0	9.0	5.0	8.0	9.0	9.0	8.0	3.0	9.0	9.0	4.0	8.0	9.0	7.0
3-Carboethoxypropyl 2-(5- isopropyl-5-methyl-4-oxo- 2-imidazolin-2-yl)nicotinate	.016	0.0	7.0	2.0	6.0	9.0	9.0	2.0	3.0	7.0	7.0	1.0	4.0	7.0	5.0
	8.000	9.0	9.0	9.0	8.0	9.0	9.0	8.0	8.0	8.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	6.0	8.0	9.0	7.0	9.0	9.0	9.0	1.0	9.0	8.0	6.0	7.0	8.0	7.0
	.063	2.0	2.0	4.0	9.0	8.0	9.0	7.0	1.0	8.0	9.0	8.0	7.0	9.0	3.0
1-Carbomethoxyethyl 2-(5-isopropyl- 5-methyl-4-oxo-2-imidazolin-2- yl)nicotinate	.032	1.0	2.0	3.0	3.0	8.0	9.0	4.0	0.0	0.0	8.0	3.0	6.0	7.0	3.0
	.016	0.0	1.0	0.0	1.0	4.0	9.0	0.0	0.0	8.0	9.0	1.0	2.0	6.0	2.0
	8.000	9.0	9.0	9.0	8.0	9.0	9.0	8.0	8.0	8.0	9.0	9.0	9.0	9.0	9.0
	.500	8.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	7.0	9.0	9.0	9.0	9.0	9.0	9.0	6.0	8.0	9.0	9.0	9.0	9.0	8.0
	.125	3.0	4.0	9.0	7.0	8.0	9.0	6.0	1.0	8.0	8.0	9.0	6.0	9.0	3.0
	.063	1.0	1.0	3.0	7.0	7.0	9.0	4.0	0.0	3.0	8.0	3.0	6.0	6.0	6.0
	.032	1.0	0.0	0.0	1.0	8.0	9.0	0.0	0.0	4.0	7.0	2.0	1.0	7.0	7.0

TABLE XII (cont'd.)
PRE-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
Methyl 5-bromo-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	0.000	9.0	9.0	9.0	8.0	9.0	9.0	8.0	9.0	8.0	9.0	9.0	9.0	9.0	7.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	4.0
	.250	9.0	7.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	3.0
	.125	7.0	6.0	9.0	9.0	8.0	9.0	9.0	8.0	8.0	7.0	7.0	6.0	7.0	1.0
	.063	2.0	1.0	6.0	3.0	4.0	9.0	7.0	7.0	3.0	7.0	4.0	2.0	7.0	0.0
	.032	1.0	1.0	4.0	2.0	3.0	9.0	4.0	2.0	4.0	6.0	2.0	1.0	6.0	0.0
3-Carboethoxy-2-propenyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	0.000	9.0	9.0	9.0	8.0	9.0	9.0	8.0	8.0	8.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	6.0	9.0	9.0	9.0	9.0	9.0	6.0	5.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	5.0	7.0	9.0	9.0	8.0	9.0	7.0	3.0	8.0	8.0	9.0	8.0	9.0	7.0
	.032	4.0	6.0	9.0	6.0	7.0	9.0	7.0	1.0	8.0	8.0	4.0	7.0	7.0	4.0
3-Butenyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	0.000	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	4.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	6.0	9.0	9.0	9.0	9.0	9.0	9.0	2.0	9.0	9.0	9.0	8.0	9.0	9.0
	.063	3.0	9.0	7.0	9.0	9.0	9.0	9.0	1.0	8.0	9.0	9.0	7.0	7.0	9.0
	.032	1.0	0.0	3.0	7.0	6.0	6.0	7.0	0.0	4.0	8.0	5.0	3.0	4.0	4.0
4-Carbomethoxybutyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	0.000	9.0	9.0	9.0	8.0	9.0	9.0	8.0	8.0	8.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	6.0	9.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0	8.0	7.0	9.0
	.063	8.0	4.0	9.0	9.0	8.0	9.0	9.0	5.0	7.0	8.0	7.0	8.0	7.0	8.0
	.032	4.0	4.0	9.0	6.0	7.0	9.0	9.0	0.0	8.0	8.0	3.0	3.0	6.0	4.0
	.016	1.0	1.0	4.0	4.0	4.0	9.0	3.0	0.0	3.0	0.0	2.0	1.0	5.0	1.0

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TABLE XII (cont'd.)
PRE-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEDGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
Ferrous 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)-nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0	8.0	9.0	9.0	9.0	9.0	9.0	0.0	9.0	9.0	9.0	9.0	9.0	7.0
	.032	9.0	7.0	9.0	9.0	9.0	9.0	8.0		9.0	9.0	9.0	8.0	8.0	7.0
	.016	9.0	6.0	3.0	8.0	8.0	9.0	9.0		8.0	7.0	9.0	7.0	9.0	5.0
Ferric 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	7.0	8.0	9.0	9.0	9.0	9.0	9.0	3.0	9.0	9.0	9.0	8.0	9.0	9.0
	.032	6.0	8.0	9.0	9.0	9.0	9.0	9.0		9.0	9.0	9.0	8.0	9.0	8.0
	.016	3.0	9.0	9.0	9.0	9.0	9.0	6.0		9.0	9.0	9.0	8.0	9.0	7.0
Diethanolammonium 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	8.000	9.0	9.0	9.0	9.0	9.0	9.0		9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	4.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0
	.032	2.0	6.0	8.0	7.0	8.0	9.0	7.0		9.0	9.0	9.0	8.0	7.0	7.0
	.016	1.0	3.0	0.0	6.0	4.0	9.0	9.0	0.0	6.0	9.0	7.0	3.0	7.0	5.0
<i>p</i> -tert-Butylbenzyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	8.000	9.0	9.0	8.0	8.0	9.0	9.0	8.0	8.0	8.0					
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	7.0
	.250	8.0	8.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	7.0	9.0	7.0
	.125	4.0	7.0	9.0	7.0	9.0	9.0	7.0	4.0	9.0	7.0	7.0	6.0	7.0	6.0
	.063	1.0	1.0	3.0	4.0	7.0	9.0	7.0	2.0	3.0	7.0	4.0	3.0	7.0	4.0

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TABLE XII (cont'd.)
PRE-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN-YARDGR	GREEN-FOX	P-NUT-SEEDGE	WILD-OATS	QUACK-GRASS	FLD-BINDWD	MRN-GLRY SP	RAG-WEED	VELVET-LEAF	S-BARLY-LA	CORN-FIELD	COTTON	RICE, NATO	SOYBEAN-AD
Phenethyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	0.000	9.0	9.0	9.0	8.0	9.0	9.0	8.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	4.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	4.0	9.0	7.0	9.0	8.0	9.0	6.0	2.0	8.0	9.0	9.0	9.0	8.0	8.0
	.063	2.0	6.0	7.0	9.0	8.0	9.0	7.0	1.0	8.0	9.0	9.0	6.0	8.0	8.0
Cinnamyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	0.000	9.0	9.0	9.0	9.0	9.0	9.0	8.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	9.0	8.0
	.125	6.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	8.0	7.0
	.063	3.0	7.0	7.0	8.0	9.0	9.0	8.0	8.0	8.0	9.0	9.0	7.0	7.0	6.0
	.032	1.0	7.0	7.0	6.0	7.0	9.0	8.0	8.0	8.0	9.0	7.0	7.0	6.0	5.0
5- α -Hydroxy-3 α -isopropyl-3-methyl-5H-imidazo[1,2-b]pyrrolo[3,4-b]pyridin-2-(3H)one	0.000	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	8.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	8.0	9.0	7.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	5.0	8.0	7.0	7.0
	.063	1.0	9.0	3.0	7.0	4.0	9.0	9.0	9.0	9.0	8.0	4.0	7.0	6.0	3.0
	.032	0.0	9.0	0.0	4.0	3.0	9.0	8.0	7.0	7.0	7.0	1.0	2.0	4.0	1.0
5-Isopropyl-5-methyl-2-(3-methyl-2-pyridyl)-2-imidazolin-4-one	.016	0.0	7.0	0.0	2.0	2.0	9.0	8.0	5.0	4.0	6.0	1.0	1.0	4.0	0.0
	0.000	7.0	9.0	9.0	9.0	9.0	9.0	8.0	8.0	8.0	9.0	1.0	1.0	2.0	1.0
	.500	0.0	4.0	0.0	9.0	2.0	9.0	3.0	6.0	4.0	9.0	1.0	1.0	2.0	1.0

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TABLE XII (cont'd.)
PRE-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEDE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
3,7-Dimethyl-2,6-octadienyl 2-(5-isopropyl-5-methyl-4- oxo-2-imidazolin-2-yl)- nicotinate	8.000	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	3.0	9.0	9.0	9.0	9.0	9.0	8.0	3.0	9.0	9.0	9.0	9.0	9.0	6.0
2,3-Dihydroxypropyl 2-(5- isopropyl-5-methyl-4-oxo- 2-imidazolin-2-yl)- nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	2.0	7.0	8.0	9.0	9.0	9.0	9.0	0.0	9.0	9.0	9.0	8.0	9.0	6.0
	.032	1.0	7.0	8.0	7.0	9.0	9.0	9.0	0.0	3.0	2.0	9.0	6.0	9.0	3.0
	.016	0.0	2.0	1.0	4.0	1.0	9.0	6.0	0.0	1.0	3.0	7.0	6.0	4.0	2.0
4-Pentynyl 2-(5-isopropyl- 5-methyl-4-oxo-2-imidazolin- 2-yl)nicotinate	.500	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0
	.250	7.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	8.0
	.125	6.0	9.0	8.0	9.0	9.0	9.0	9.0	5.0	9.0	9.0	9.0	8.0	8.0	8.0
	.063	3.0	7.0	8.0	9.0	9.0	9.0	7.0	2.0	9.0	9.0	9.0	8.0	8.0	7.0
	.032	2.0	4.0	8.0	9.0	8.0	8.0	7.0	0.0	8.0	9.0	7.0	7.0	6.0	4.0
	.016	0.0	2.0	4.0	4.0	2.0	4.0	3.0	0.0	4.0	9.0	5.0	2.0	5.0	2.0
2-(5-Isopropyl-5-methyl- 4-oxo-2-imidazolin-2-yl)-3- quinolinecarboxylic acid	8.000	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0
	1.000	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	8.5	9.0	9.0	9.0	9.0	9.0	8.0	9.0	8.5	9.0	9.0	9.0	9.0	5.5
	.250	9.0	9.0	9.0	9.0	9.0	9.0	7.0	8.5	8.0	9.0	9.0	9.0	9.0	3.0
	.125	9.0	8.5	9.0	9.0	9.0	9.0	7.0	8.0	7.5	9.0	9.0	9.0	9.0	3.0
	.063	6.0	7.0	7.5	8.5	8.5	9.0	3.0	6.5	5.5	8.5	9.0	8.0	3.0	1.5
	.032	2.0	5.0	7.5	7.5	7.0	9.0	1.0	3.5	4.5	8.5	9.0	7.0	3.0	1.0

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TABLE XII (cont'd.)
PRE-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEEDGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
6,6-Dimethyl-2-norpinene-2-ethyl-2-(5-isopropyl-5-methyl-4-oxo-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	3.0	9.0	9.0	9.0	8.0	9.0	8.0
	.250	7.0	9.0	9.0	9.0	9.0	9.0	9.0	1.0	9.0	9.0	9.0	8.0	9.0	8.0
	.125	3.0	9.0	7.0	9.0	9.0	9.0	8.0	0.0	8.0	9.0	9.0	7.0	9.0	7.0
	.063	1.0	6.0	8.0	9.0	7.0	8.0	4.0	0.0	8.0	9.0	7.0	4.0	7.0	4.0
	.032	1.0	4.0	4.0	8.0	7.0	9.0	4.0	0.0	4.0	9.0	5.0	4.0	6.0	3.0
	.016	1.0	4.0	2.0	7.0	7.0	9.0	0.0	0.0	4.0	9.0	5.0	3.0	6.0	1.0
α-Carbomethoxybenzyl 2-[5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]nicotinate	8.000	9.0	9.0	9.0	8.0	9.0	9.0	8.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	7.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	7.0
	.125	4.0	9.0	9.0	9.0	9.0	9.0	7.0	3.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	3.0	9.0	8.0	9.0	9.0	9.0	7.0	0.0	9.0	9.0	9.0	7.0	9.0	6.0
	.032	1.0	7.0	0.0	4.0	4.0	9.0	6.0	0.0	6.0	8.0	9.0	5.0	6.0	6.0
Methyl 2-[1-acetyl-4-isopropyl-4-methyl-5-oxo-2-imidazolin-2-yl]nicotinate-1-oxide	.500	0.0	7.0	7.0	8.0	8.0	9.0	9.0	0.0	9.0	9.0	7.0	7.0	7.0	7.0
	.250	0.0	7.0	1.0	7.0	7.0	9.0	8.0	0.0	9.0	7.0	7.0	7.0	7.0	7.0
	.125	0.0	6.0	3.0	4.0	6.0	9.0	7.0	0.0	8.0	4.0	3.0	6.0	4.0	6.0
	.063	0.0	3.0	0.0	2.0	3.0	8.0	4.0	0.0	6.0	2.0	3.0	3.0	3.0	5.0
	.032	0.0	3.0	0.0	0.0	0.0	9.0	1.0	0.0	3.0	0.0	0.0	1.0	2.0	3.0
	.016	0.0	2.0	0.0	0.0	0.0	0.0	1.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
3-Methyl-3-butenyl 2-[5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	7.0	9.0	7.0	9.0	9.0	9.0	8.0	3.0	9.0	9.0	7.0	8.0	9.0	7.0
	.063	6.0	7.0	8.0	9.0	9.0	9.0	6.0	0.0	9.0	9.0	7.0	8.0	9.0	7.0
	.032	2.0	6.0	6.0	9.0	9.0	9.0	4.0	0.0	8.0	9.0	7.0	7.0	9.0	4.0
	.016	2.0	5.0	4.0	5.0	7.0	7.0	1.0	0.0	8.0	9.0	7.0	5.0	8.0	8.0

TABLE XII (cont'd.)
PRE-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEDGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
10-Undecenyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	8.0	9.0	8.0
	.125	7.0	9.0	7.0	9.0	9.0	9.0	9.0	3.0	9.0	9.0	9.0	8.0	8.0	7.0
	.063	3.0	8.0	7.0	9.0	8.0	9.0	8.0	1.0	8.0	9.0	7.0	7.0	8.0	4.0
	.032	2.0	3.0	7.0	7.0	7.0	9.0	7.0	0.0	8.0	7.0	7.0	6.0	7.0	3.0
	.016	1.0	0.0	7.0	3.0	5.0	3.0	1.0	0.0	6.0	7.0	7.0	1.0	4.0	1.0
5-Bromo-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinic acid	8.000	9.0	9.0	9.0	8.0	9.0	9.0	8.0	8.0	9.0	9.0	9.0	9.0	9.0	7.0
	.500	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	5.0
	.250	8.0	9.0	7.0	6.0	9.0	6.0	9.0	8.0	7.0	8.0	8.0	9.0	9.0	4.0
	.125	3.0	8.0	9.0	6.0	8.0	9.0	8.0	8.0	7.0	8.0	9.0	8.0	9.0	3.0
	.063	1.0	6.0	8.0	3.0	3.0	6.0	2.0	2.0	3.0	3.0	3.0	4.0	9.0	2.0
	.032	0.0	6.0	2.0	2.0	1.0	9.0	1.0	1.0	2.0	3.0	3.0	3.0	9.0	1.0
α-methylbenzyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	8.000	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	8.0	9.0	7.0
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	8.0	9.0	6.0
	.250	9.0	9.0	9.0	9.0	8.0	9.0	9.0	4.0	9.0	9.0	7.0	5.0	6.0	6.0
	.125	3.0	8.0	3.0	8.0	6.0	7.0	6.0	1.0	7.0	0.0	6.0	1.0	5.0	3.0
	.063	1.0	8.0	3.0	6.0	7.0	7.0	5.0	1.0	4.0	6.0	6.0	0.0	3.0	1.0
	.032	0.0	7.0	1.0	3.0	3.0	2.0	4.0	0.0	2.0	4.0	3.0	0.0	3.0	1.0
Methyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate-1-oxide	8.000	8.0	9.0	8.0	8.0	9.0	9.0	8.0	9.0	8.0	8.0	8.0	7.0	9.0	6.0
	.500	2.0	8.0	7.0	9.0	8.0	9.0	9.0	7.0	9.0	7.0	7.0	6.0	8.0	2.0
	.250	1.0	9.0	8.0	9.0	8.0	9.0	9.0	3.0	9.0	7.0	7.0	6.0	7.0	2.0
	.125	0.0	3.0	3.0	9.0	7.0	9.0	7.0	0.0	8.0	7.0	7.0	6.0	7.0	2.0
	.063	0.0	3.0	2.0	7.0	7.0	9.0	6.0	0.0	8.0	4.0	3.0	5.0	4.0	2.0
	.032	0.0	2.0	1.0	7.0	4.0	9.0	6.0	0.0	7.0	4.0	3.0	4.0	3.0	1.0
	.016	0.0	2.0	0.0	6.0	2.0	9.0	2.0	0.0	3.0	3.0	2.0	3.0	1.0	1.0

TABLE XII (cont'd.)

PRE-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	PNUT- SEDGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
Methyl 6-chloro-2-(5-iso- propyl-5-methyl-4-oxo-2- imidazolin-2-yl)nicotinate	8.000	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0					
	.500	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	8.0	9.0	7.0
	.250	7.0	9.0	9.0	9.0	7.0	9.0	7.0	8.0	4.0	9.0	7.0	8.0	9.0	6.0
	.125	3.0	7.0	6.0	9.0	9.0	7.0	7.0	8.0	3.0	8.0	4.0	7.0	8.0	
	.063	2.0	5.0	3.0	9.0	9.0	3.0	7.0	4.0	3.0	7.0	4.0	5.0	6.0	4.0
	.032	1.0	3.0	2.0	9.0	1.0	2.0	5.0	0.0	0.0	6.0	4.0	3.0	5.0	2.0
	.016	0.0	1.0	0.0	7.0	0.0	1.0	4.0	0.0	0.0	3.0	1.0	1.0	1.0	0.0
2-Isopropyl-2-methyl-5- H-imidazo[1',2':1,2]pyrrolo- [3,4-b]pyridine- 3(2H),5-dione	8.000	9.0	9.0	9.0	8.0	9.0	9.0	8.0	8.0	8.0					
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0	9.0	9.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	9.0	9.0
	.032	1.0	9.0	3.0	9.0	9.0	9.0	8.0	0.0	9.0	9.0	9.0	8.0	9.0	5.0
	.016	1.0	9.0	0.0	9.0	3.0	9.0	2.0	0.0	7.0	8.0	9.0	7.0	9.0	3.0
2-[3-(Hydroxymethyl)-2- pyridyl]-5-isopropyl-5-methyl- 2-imidazo-4-one	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	8.0	9.0	7.0
	.063	8.0	9.0	9.0	9.0	9.0	9.0	9.0	4.0	9.0	9.0	9.0	8.0	9.0	7.0
	.032	8.0	9.0	9.0	9.0	9.0	9.0	8.0	2.0	9.0	9.0	9.0	8.0	9.0	7.0
	.016	4.0	8.0	7.0	8.0	9.0	9.0	6.0	0.0	9.0	9.0	8.0	7.0	8.0	7.0
Carboethoxymethyl 2-(5- isopropyl-5-methyl-4-oxo-2- imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	5.0	9.0	9.0	9.0	9.0	9.0	8.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	9.0	8.0
	.063	8.0	9.0	9.0	9.0	9.0	9.0	9.0	1.0	8.0	9.0	9.0	8.0	9.0	7.0
	.032	5.0	7.0	7.0	9.0	9.0	9.0	7.0	0.0	8.0	9.0	9.0	7.0	9.0	7.0
	.016	4.0	7.0	8.0	8.0	8.0	9.0	0.0	0.0	8.0	9.0	7.0	6.0	9.0	7.0

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TABLE XII (cont'd.)
PRE-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
Carbonylmethyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	8.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	8.0
	.125	7.0	7.0	9.0	9.0	9.0	9.0	9.0	4.0	9.0	9.0	9.0	8.0	9.0	7.0
	.063	7.0	7.0	9.0	9.0	9.0	9.0	9.0	2.0	9.0	9.0	9.0	8.0	9.0	5.0
	.032	2.0	7.0	3.0	8.0	9.0	9.0	3.0	0.0	8.0	9.0	8.0	6.0	8.0	5.0
	.016	1.0	4.0	1.0	4.0	7.0	9.0	3.0	0.0	8.0	9.0	3.0	3.0	4.0	4.0
Carboxymethyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	8.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	8.0
	.063	5.0	8.0	9.0	9.0	9.0	9.0	8.0	2.0	9.0	9.0	9.0	8.0	9.0	7.0
	.032	3.0	7.0	2.0	9.0	9.0	9.0	7.0	0.0	8.0	9.0	9.0	8.0	9.0	7.0
	.016	0.0	4.0	0.0	2.0	5.0	3.0	6.0	0.0	7.0	8.0	3.0	4.0	6.0	3.0
Cyanomethyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0
	.125	6.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	8.0
	.063	6.0	9.0	9.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0	8.0	9.0	7.0
	.032	3.0	8.0	8.0	8.0	8.0	9.0	7.0	0.0	9.0	7.0	7.0	7.0	9.0	5.0
	.016	2.0	5.0	3.0	1.0	6.0	9.0	4.0	0.0	8.0	9.0	7.0	2.0	4.0	4.0
Methyl (-)-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	7.0
	.250	4.0	7.0	8.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	8.0	7.0	5.0
	.125	3.0	7.0	9.0	8.0	9.0	9.0	9.0	6.0	9.0	8.0	5.0	8.0	7.0	5.0
	.063	1.0	2.0	4.0	1.0	5.0	9.0	8.0	0.0	8.0	6.0	3.0	3.0	4.0	4.0
	.032	0.0	1.0	3.0	0.0	8.0	7.0	7.0	0.0	8.0	5.0	2.0	2.0	3.0	2.0

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TABLE XII (cont'd.)
PRE-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEDGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
Methyl (+)-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	7.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0
	.032	7.0	8.0	9.0	9.0	9.0	9.0	9.0	4.0	9.0	9.0	9.0	9.0	9.0	9.0
	.016	4.0	4.0	9.0	8.0	9.0	9.0	9.0	0.0	9.0	9.0	8.0	9.0	6.0	8.0
Benzyl (+)-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	8.0	9.0	7.0
	.250	4.0	7.0	8.0	6.0	9.0	9.0	8.0	2.0	9.0	9.0	6.0	8.0	8.0	3.0
	.125	3.0	5.0	7.0	1.0	6.0	9.0	8.0	1.0	9.0	4.0	5.0	7.0	4.0	3.0
	.063	1.0	1.0	1.0	0.0	2.0	9.0	1.0	0.0	4.0	4.0	3.0	4.0	3.0	2.0
Benzyl (-)-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.032	1.0	1.0	1.0	0.0	2.0	2.0	1.0	0.0	4.0	3.0	3.0	0.0	2.0	1.0
	.016	0.0	1.0	0.0	0.0	2.0	1.0	0.0	0.0	3.0	3.0	2.0	0.0	2.0	1.0
Benzyl (-)-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	8.0	7.0	7.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	9.0	6.0
	.063	7.0	7.0	7.0	9.0	9.0	9.0	9.0	1.0	9.0	9.0	9.0	9.0	9.0	6.0
(-)-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinic acid	.032	3.0	3.0	6.0	6.0	8.0	7.0	7.0	1.0	9.0	9.0	7.0	8.0	6.0	4.0
	.016	1.0	2.0	2.0	2.0	8.0	7.0	3.0	0.0	4.0	8.0	4.0	6.0	5.0	2.0
(-)-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinic acid	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	7.0
	.125	7.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	5.0
	.063	1.0	8.0	8.0	3.0	9.0	9.0	9.0	1.0	9.0	9.0	7.0	8.0	9.0	4.0
(-)-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinic acid	.032	0.0	5.0	5.0	1.0	9.0	9.0	8.0	0.0	9.0	9.0	5.0	7.0	9.0	3.0
	.016	0.0	1.0	1.0	0.0	7.0	9.0	8.0	0.0	9.0	7.0	4.0	5.0	7.0	2.0

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TABLE XII (cont'd.)
PRE-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
(+)2-(5-isopropyl-5-oxo-2-imidazolin-2-yl)nicotinic acid	.500	9.0		9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0		9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0		9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0		9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.032	8.0		9.0	9.0	9.0	9.0	9.0	3.0	9.0	9.0	9.0	9.0	9.0	9.0
	.016	8.0		9.0	9.0	9.0	9.0	9.0	1.0	9.0	9.0	9.0	8.0	9.0	8.0
2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)-nicotinic acid hydrochloride	6.000	9.0	9.0	9.0	9.0	9.0	9.0		9.0	9.0					
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	8.0	9.0	9.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	9.0	9.0
	.032	8.0	9.0	9.0	8.0	9.0	9.0	9.0	3.0	9.0	9.0	9.0	9.0	7.0	7.0
Methyl 2-(1-benzoyl-4-isopropyl-4-methyl-5-oxo-2-imidazolin-2-yl)nicotinate	8.000	9.0	9.0	9.0	9.0	9.0	9.0		9.0	9.0					
	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	7.0	9.0
	.063	7.0	9.0	9.0	9.0	9.0	9.0	9.0	4.0	9.0	9.0	9.0	9.0	7.0	8.0
	.032	4.0	7.0	6.0	7.0	8.0	9.0	6.0	2.0	9.0	9.0	9.0	8.0	7.0	7.0
Methyl 6-dimethylamino-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)-nicotinate	.016	2.0	1.0	3.0	5.0	6.0	9.0	4.0	1.0	7.0	9.0	8.0	7.0	7.0	6.0
	.500	9.0	9.0	0.0	7.0	7.0	6.0	0.0	0.0	9.0	9.0	7.0	2.0	8.0	6.0
	.250	8.0	9.0	0.0	5.0	2.0	1.0	0.0	0.0	2.0	8.0	3.0	2.0	8.0	
	.125	3.0	6.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	6.0	3.0	1.0	5.0	4.0
	.063	0.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.0	3.0	0.0	2.0	4.0

TABLE XII (cont'd.)

PRE-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN-YARDGR	GREEN FOX	P NUT-SEEDGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG-WEED	VELVET-LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
Methyl 2-(1-Chloroacetyl-4-isopropyl-4-methyl-5-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	7.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	6.0	9.0	8.0	9.0	9.0	9.0	9.0	1.0	9.0	9.0	9.0	8.0	9.0	8.0
	.032	3.0	9.0	8.0	9.0	9.0	9.0	9.0	1.0	9.0	9.0	7.0	7.0	9.0	8.0
	.016	2.0	8.0	7.0	7.0	7.0	9.0	9.0	0.0	8.0	8.0	6.0	7.0	7.0	7.0
Methyl 2-(4-isopropyl-4-methyl-5-oxo-1-propionyl-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	8.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	8.0
	.125	8.0	9.0	9.0	9.0	9.0	9.0	9.0	5.0	9.0	9.0	9.0	9.0	9.0	8.0
	.063	3.0	9.0	9.0	9.0	9.0	9.0	9.0	1.0	9.0	9.0	9.0	8.0	7.0	8.0
	.032	3.0	9.0	8.0	8.0	8.0	9.0	7.0	1.0	9.0	9.0	9.0	7.0	7.0	7.0
	.016	2.0	7.0	6.0	7.0	6.0	9.0	6.0	1.0	9.0	9.0	9.0	7.0	7.0	7.0
O-[2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)-nicotinyl]acetone oxime	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	8.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	8.0	9.0	9.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	9.0	8.0
	.063	6.0	9.0	9.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	9.0	8.0
	.032	4.0	9.0	9.0	9.0	9.0	9.0	8.0	1.0	9.0	8.0	9.0	8.0	9.0	7.0
	.016	0.0	6.0	7.0	1.0	9.0	3.0	3.0	0.0	6.0	7.0	5.0	4.0	8.0	4.0
2-(3-Acetyl-2-pyridyl)-5-isopropyl-5-methyl-2-imidazolin-4-one	.500	7.0	7.0	8.0	9.0	9.0	9.0	8.0	0.0	9.0	9.0	9.0	7.0	7.0	7.0
	.250	1.0	7.0	1.0	7.0	6.0	9.0	7.0	0.0	7.0	8.0	7.0	5.0	7.0	6.0
	.125	0.0	1.0	0.0	0.0	4.0	1.0	9.0	0.0	3.0	6.0	5.0	2.0	3.0	4.0
	.063	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	2.0	6.0	4.0	1.0	3.0	3.0

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TABLE XII (cont'd.)

PRE-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEDGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
Benzyl 2-(4-isopropyl-4-methyl-5-oxo-1-propionyl-2-imidazolin-2-yl)-nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	2.0	9.0	9.0	9.0	9.0	9.0	8.0
	.125	7.0	9.0	9.0	8.0	9.0	9.0	9.0	2.0	9.0	9.0	9.0	9.0	9.0	7.0
	.063	3.0	9.0	7.0	2.0	8.0	9.0	9.0	1.0	9.0	9.0	7.0	3.0	8.0	5.0
	.032	4.0	8.0	7.0	6.0	3.0	9.0	9.0	1.0	7.0	8.0	5.0	6.0	8.0	5.0
	.016	0.0	3.0	2.0	1.0	2.0	4.0	0.0	0.0	7.0	7.0	4.0	4.0	6.0	4.0
Benzyl 2-(4-isopropyl-4-methyl-5-oxo-1-pivaloyl-2-imidazolin-2-yl)-nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	8.0
	.250	8.0	9.0	9.0	9.0	9.0	9.0	9.0	5.0	9.0	9.0	9.0	9.0	9.0	7.0
	.125	7.0	9.0	8.0	8.0	8.0	9.0	9.0	2.0	9.0	9.0	9.0	8.0	9.0	7.0
	.063	3.0	9.0	9.0	7.0	9.0	9.0	5.0	1.0	9.0	9.0	7.0	8.0	7.0	6.0
	.032	2.0	6.0	6.0	5.0	3.0	9.0	5.0	0.0	9.0	7.0	4.0	7.0	7.0	5.0
	.016	0.0	1.0	2.0	1.0	2.0	2.0	5.0	0.0	1.0	5.0	4.0	4.0	6.0	4.0
Trimethyl 2-[5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]-β-oxo-α-phosphono-3-pyridinepropionate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	4.0	9.0	9.0	9.0	9.0	9.0	7.0	1.0	9.0	9.0	9.0	9.0	9.0	7.0
	.032	0.0	7.0	9.0	7.0	9.0	9.0	5.0	0.0	8.0	9.0	9.0	7.0	9.0	7.0
	.016	0.0	7.0	7.0	1.0	7.0	9.0	2.0	0.0	6.0	8.0	7.0	3.0	9.0	3.0
Methyl 2-[4-isopropyl-4-methyl-1-(methylsulfonyl)-5-oxo-2-imidazolin-2-yl]-nicotinate	.500	2.0	4.0	8.0	7.0	7.0	9.0	6.0	0.0	4.0	7.0	7.0	6.0	6.0	9.0
	.250	1.0	2.0	2.0	3.0	1.0	7.0	3.0	0.0	2.0	6.0	5.0	4.0	4.0	9.0
	.125	0.0	0.0	2.0	1.0	1.0	2.0	0.0	0.0	1.0	2.0	3.0		2.0	3.0

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TABLE XII (cont'd.)
PRE-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P.NUT- SEEDGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
2-Propynyl 2-(1-Acetyl-4-isopropyl-4-methyl-5-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	8.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	8.0
	.063	9.0	9.0	9.0	9.0	9.0	9.0	8.0	5.0	9.0	9.0	9.0	9.0	9.0	9.0
	.032	6.0	9.0	7.0	8.0	9.0	9.0	7.0	4.0	9.0	9.0	8.0	6.0	9.0	6.0
	.016	2.0	6.0	8.0	6.0	9.0	9.0	5.0	2.0	7.0	9.0	9.0	4.0	9.0	4.0
2-Ethanolammonium 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	7.0	9.0	9.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	9.0	9.0
	.032	6.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0
	.016	0.0	9.0	9.0	8.0	9.0	9.0	8.0	5.0	9.0	8.0	7.0	7.0	9.0	9.0
Pyrrolidinium 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	8.0	9.0	9.0	9.0	9.0	9.0	8.0	6.0	9.0	9.0	9.0	8.0	9.0	8.0
	.032	5.0	9.0	9.0	9.0	9.0	9.0	8.0	4.0	9.0	9.0	9.0	8.0	9.0	7.0
	.016	0.0	7.0	9.0	6.0	9.0	9.0	5.0	0.0	9.0	9.0	7.0	4.0	9.0	6.0
Diethylammonium 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	7.0	9.0	9.0	9.0	9.0	9.0	9.0	2.0	9.0	9.0	9.0	9.0	9.0	9.0
	.032	2.0	9.0	9.0	9.0	9.0	9.0	8.0	1.0	9.0	9.0	9.0	8.0	9.0	9.0
	.016	0.0	8.0	9.0	7.0	9.0	9.0	7.0	0.0	9.0	9.0	9.0	7.0	9.0	7.0

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TABLE XII (cont'd.)
PRE-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEDEGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
Isopropylammonium 2-(6-iso-propyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	7.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0
	.032	3.0	9.0	7.0	9.0	9.0	9.0	8.0	8.0	9.0	9.0	9.0	8.0	9.0	8.0
	.016	0.0	9.0	6.0	7.0	9.0	9.0	7.0	2.0	9.0	9.0	9.0	7.0	9.0	9.0
2-Methylallylammonium 2-(6-isopropyl-5-methyl-4-oxo-2-imidazolin-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.032	6.0	9.0	9.0	9.0	9.0	9.0	9.0	3.0	9.0	8.0	9.0	8.0	9.0	9.0
	.016	0.0	7.0	9.0	8.0	9.0	9.0	9.0	0.0	8.0	9.0	9.0	8.0	9.0	9.0
Isobutylammonium 2-(6-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0	9.0	9.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	9.0	9.0
	.032	6.0	9.0	9.0	9.0	9.0	9.0	9.0	5.0	9.0	9.0	9.0	9.0	9.0	9.0
	.016	0.0	7.0	9.0	8.0	9.0	9.0	9.0	4.0	9.0	8.0	9.0	7.0	8.0	9.0
2-Methoxy-1-methylethylammonium 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	9.0	9.0	3.0	9.0	9.0	9.0	9.0	3.0	9.0	9.0	9.0	9.0	9.0	9.0
	.032	7.0	9.0	7.0	7.0	9.0	9.0	9.0	3.0	9.0	9.0	9.0	9.0	9.0	9.0
	.016	0.0	7.0	9.0	9.0	9.0	9.0	9.0	0.0	9.0	9.0	9.0	8.0	9.0	9.0

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TABLE XII (cont'd.)

PRE-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN-YARDGR	GREEN FOX	P NUT-SEGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG-WEED	VELVET-LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
<i>tert</i> -Butylammonium 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	9.0	9.0	9.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	7.0	9.0	9.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	9.0	9.0
	.032	4.0	9.0	8.0	9.0	9.0	9.0	9.0	1.0	9.0	9.0	9.0	8.0	7.0	6.0
	.016	0.0	6.0	8.0	7.0	9.0	9.0	8.0	0.0	8.0	9.0	9.0	7.0	9.0	4.0
2,2,2-Trichloroethyl 2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinate	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	7.0	9.0	9.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	6.0	9.0	9.0	9.0	9.0	9.0	8.0	3.0	9.0	9.0	9.0	9.0	8.0	9.0
	.032	1.0	9.0	9.0	9.0	9.0	9.0	8.0	1.0	9.0	9.0	9.0	8.0	8.0	6.0
	.016	0.0	6.0	2.0	1.0	7.0	9.0	0.0	0.0	4.0	6.0	9.0	2.0	7.0	3.0
6-Chloro-2-(5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl)nicotinic acid	.500	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	.063	7.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0
	.032	6.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	8.0	7.0
	.016	3.0	7.0	9.0	9.0	9.0	9.0	6.0	3.0	7.0	9.0	7.0	7.0	7.0	
1-Ethylmethyl 2-(1-carboxy-4-isopropyl-4-methyl-5-oxo-2-imidazolin-2-yl)nicotinate	.500	8.0	9.0	9.0	9.0	9.0	9.0	9.0	6.0	9.0	9.0	9.0	9.0	9.0	9.0
	.250	8.0	9.0	9.0	9.0	9.0	9.0	9.0	3.0	9.0	9.0	9.0	9.0	9.0	9.0
	.125	6.0	9.0	8.0	9.0	8.0	9.0	8.0	1.0	9.0	9.0	9.0	8.0	7.0	7.0
	.063	4.0	8.0	7.0	9.0	7.0	9.0	7.0	1.0	9.0	7.0	9.0	8.0	7.0	7.0
	.032	3.0	7.0	4.0	4.0	4.0	9.0	6.0	0.0	9.0	6.0	5.0	3.0	6.0	
	.016	1.0	4.0	2.0	2.0	2.0	8.0	4.0	0.0	9.0	5.0	3.0	3.0	5.0	

TABLE XII (cont'd.)
PRE-EMERGENCE TESTS — RATES IN KG/HA

Compound	RATE	BARN- YARDGR	GREEN FOX	P NUT- SEDGE	WILD OATS	QUACK GRASS	FLD BINDWD	MRN GLRY SP	RAG- WEED	VELVET- LEAF	S BARLY LA	CORN FIELD	COTTON	RICE, NATO	SOYBEAN AD
Methyl 2-[4-isopropyl-4-methyl-5-oxo-1-(p-tolylsulfonyl)-2-imidazolin-2-yl]nicotinic acid	.500	2.0	9.0	8.0	7.0	8.0	8.0	8.0	0.0	9.0	8.0	6.0	4.0	7.0	9.0
	.250	0.0	7.0	6.0	6.0	7.0	9.0	1.0	0.0	9.0	7.0	6.0	2.0	6.0	9.0
	.125	0.0	5.0	5.0	4.0	4.0	9.0	0.0	0.0	9.0	4.0	3.0		3.0	2.0
	.063	0.0	2.0	3.0	0.0	1.0	9.0	0.0	0.0	2.0	1.0	3.0		2.0	2.0
	.032	0.0	0.0	3.0	0.0	0.0	9.0	0.0	0.0	0.0	1.0	2.0	1.0	2.0	1.0
	.016	0.0	0.0	1.0	0.0	0.0	9.0	0.0	0.0	0.0	0.0	2.0		2.0	
5-Butyl-2-[5-isopropyl-5-methyl-4-oxo-2-imidazolin-2-yl]nicotinic acid	.500	9.0	9.0	0.0	7.0	9.0	9.0	7.0	7.0	8.0	9.0	9.0	4.0	9.0	3.0
	.250	6.0	7.0	0.0	4.0	9.0	9.0	4.0	6.0	7.0	8.0	7.0	2.0	9.0	1.0
	.125	2.0	2.0	0.0	1.0	6.0	9.0	3.0	3.0	3.0	3.0	6.0	1.0	9.0	1.0
	.063	1.0	1.0	0.0	0.0	4.0	0.0	2.0	1.0	1.0	3.0	4.0	1.0	9.0	0.0
	.032	0.0	0.0	0.0	0.0	4.0	2.0	1.0	0.0	0.0	7.0	1.0	0.0	8.0	0.0
	.016	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0

Example 62

Evaluation of the Defoliation Effect of the Compounds of the Invention on Cotton

5 In the following tests, the appropriate compounds are dissolved or dispersed in acetone-water (1:1) mixtures at the final concentration corresponding to the kg/ha rates indicated in Table XIII below. The solutions also contain 0.1% to 0.25% v/v colloidal BIOFILM® (a product of Colloidal Products Corp.) which is a mixture of alkyl aryl polyoxyethanol, free and combined fatty acids, glycol ethers, dialkylbenzene carboxylate and 2-propanol.

The plant species used in these tests is cotton (*Gossypium hirsutum*, var. Stoneville 213).

10 The solution or dispersion of the compound under test is sprayed at the rate of 40 ml per pot (one plant per pot) applied to the foliage. The plants are well established seedlings of 4th leaf stage at the time of test.

The pots are watered immediately before treatment. Following treatment, the plants are placed in a random arrangement on greenhouse benches. Normal watering and fertilizing practices are followed (pesticides are applied to plants as needed). Minimum day and night temperatures of 18.3°C are maintained during cooler periods of the year. Normal daily fluctuations occur during the summer season. Plants are
15 sprayed to provide the kg/ha rates indicated in Table XIII below. Each treatment is replicated six times and the controls 12 times.

The plants are harvested 15 days after the postemergence application of the test solutions and the number of defoliated, dessicated or senescent leaves counted on each plant. Said plants are also examined for bud growth. Data obtained are reported in Table XIII below, as averages for each treatment.

TABLE XIII

Evaluation of the defoliation, dessication and/or senescent effect of test compounds on cotton plants

Compound	Rate kg/ha	No. of leaves defoliated, dessicated or senescent	Young bud regrowth
Control	—	0.5	5.5
Methyl 2-(5-isopropyl- 5-methyl-4-oxo-2- imidazolin-2-yl)nicotinate	2.0 1.0 0.5	3.7 1.8 3.3	2.0 0.5 0.83
2-(5-isopropyl-5-methyl- 4-oxo-2-imidazolin- 2-yl)nicotinic acid	2.0 1.0 0.5	3.53 4.63 2.13	0 0 0
Methyl 2-(5-ethyl-5-methyl- 4-oxo-2-imidazolin-2-yl) nicotinate	2.0 1.0 0.5	5.33 5.33 3.79	2.6 3.0 4.3
2-(5-ethyl-5-methyl-4- oxo-2-imidazolin-2- yl)nicotinic acid	2.0 1.0 0.5	1.0 3.3 2.5	5.0 3.5 4.8
2-propynyl 2-(5-isopropyl- 5-methyl-4-oxo-2-imida- zolin-2-yl)nicotinate	2.0 1.0 0.5	5.2 3.3 2.5	0 0.33 0
2-(5,5-dimethyl-4-oxo-2- imidazolin-2-yl)nicotinic acid	2.0 1.0 0.5	5.36 6.5 6.5	5.5 7.0 7.8
Calcium 2-(5-isopropyl- 5-methyl-4-oxo-2-imidazo- lin-2-yl)nicotinate	4.0 2.0 1.0	5.0 4.0 3.1	0 0 1.2
Furfuryl 2-(5-isopropyl- 5-methyl-4-oxo-2-imidazo- lin-2-yl)nicotinate	4.0 2.0 1.0	4.0 4.5 2.83	0 0 0
Triethylammonium 2-(5- isopropyl-5-methyl-4- oxo-2-imidazolin-2-yl)- nicotinate	4.0 2.0 1.0	4.3 5.0 3.2	0 0 0.5

Example 63

Evaluation of Test Compounds as Aquatic Herbicides using the Water Hyacinth *Eichhornia Crassipes* as the Plant Species

In these test paddies having established water hyacinth populations and seeded with 5 tilapia, eleven months prior to compound evaluations, are sprayed with 333 liters/ha of test solution containing 0.5% by weight of a surfactant and sufficient test compound to provide from 0.125 to 1.0 kg/ha of said test compound.

At 44 days after the post-emergence treatment, the test paddies are examined and the results recorded and reported in the table below.

TABLE XIV

Evaluation of test compounds as aquatic herbicides using
the water hyacinth *Eichhornia crassipes*

Compound	Rate kg/ha	Phytotoxicity rating	% Regrowth
2-(5-isopropyl-5-methyl- 4-oxo-2-imidazolin-2-yl)- nicotinic acid	0.125	3	0
	0.25	6	0
	0.50	7	0
	1.0	9	0
Calcium 2-(5-isopropyl-5- methyl-4-oxo-2-imidazolin- 2-yl)nicotinate	0.125	4	0
	0.25	6	0
	0.50	8	0
	1.0	9	0
Furfuryl 2-(5-isopropyl-5- methyl-4-oxo-2-imidazolin- 2-yl)nicotinate	0.125	3	0
	0.25	5	0
	0.50	7	0
	1.0	9	0
Antreated check	—	—	100*

Phytotoxicity rating: (0:9)—0 = no effect; 9 = weed completely dead.

*Continuously producing new plantlets.

1. A compound of the following formulae:

5

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15

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35 wherein

R₁ is C₁—C₄ alkyl;
R₂ is C₁—C₄ alkyl or C₃—C₆ cycloalkyl; and when R₁ and R₂ are taken together they may represent C₃—C₆ cycloalkyl optionally substituted with methyl;
A is COOR₃, CONHR₆, CHO, CH₂OH, COCH₃, COC₆H₅, CN, CH₃, CH=NOH, CH₂COOH, CONHOH,
40 CH₂CH₂COOH, CHR₈OH,

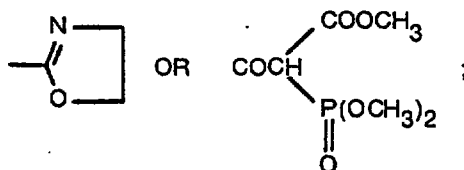
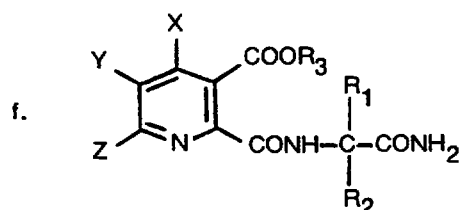
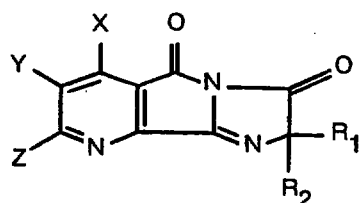
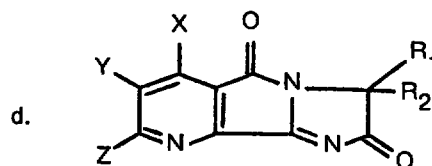
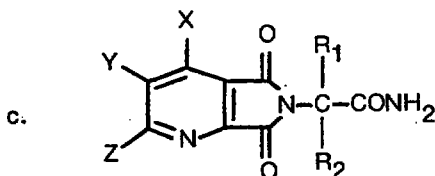
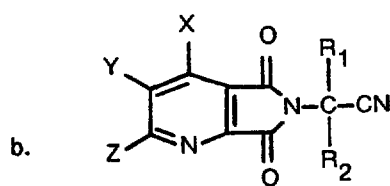
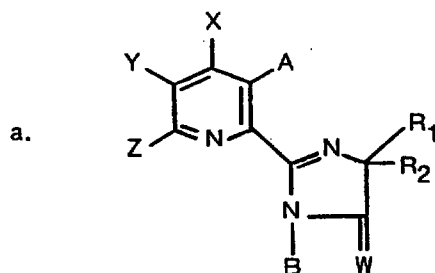
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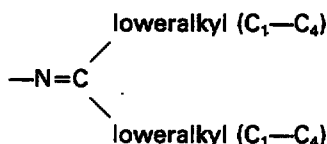
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65



R₃ is hydrogen,



C₁—C₁₂ alkyl optionally substituted with one of the following groups: C₁—C₃ alkoxy, halogen, hydroxyl, C₃—C₆ cycloalkyl, benzyloxy, furyl, phenyl, halophenyl, C₁—C₄ loweralkylphenyl, C₁—C₄ loweralkoxyphenyl, nitrophenyl, carboxyl, C₁—C₄ lower alkoxy carbonyl, cyano or C₁—C₄ triloweralkylammonium;

C₃—C₁₂ alkenyl optionally substituted with one of the following groups: C₄—C₃ alkoxy, phenyl, halogen, C₁—C₄ loweralkoxy carbonyl or with two C₁—C₃ alkoxy groups or two halogen atoms;

C₃—C₆ cycloalkyl optionally substituted with one or two C₁—C₃ alkyl groups;

C₃—C₁₀ alkynyl optionally substituted with one of two C₁—C₃ alkyl groups; or

a cation selected from alkali metals, alkaline earth metals, copper, iron, cobalt, silver, nickel, ammonium and organic ammonium;



R_6 is hydrogen, hydroxyl, C_3 -alkenyl, C_3 -alkynyl or C_1 - C_4 alkyl optionally substituted with one hydroxyl or one chlorine atom;

B is H, COR_4 or SO_2R_5 , provided that when B is COR_4 or SO_2R_5 ; A is $COOR_3$ in which R_3 is other than H, or a salt-forming cation, CH_3 or CN; W is O; and Y and Z are not alkylamino, hydroxyl, or C_1 - C_4 hydroxyloweralkyl;

R_4 is C_1 - C_{11} alkyl, chloromethyl or phenyl optionally substituted with one chloro, one nitro or one methoxy group;

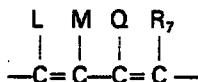
R_5 is C_1 - C_4 alkyl or phenyl optionally substituted with one methyl group;

W is O or S;

R_8 is C_1 - C_4 alkyl or phenyl;

X is hydrogen, halogen, hydroxyl or methyl, with the proviso that when Y and Z are taken together to form a ring $-(CH_2)_n-$, where n is 3 or 4, X is hydrogen;

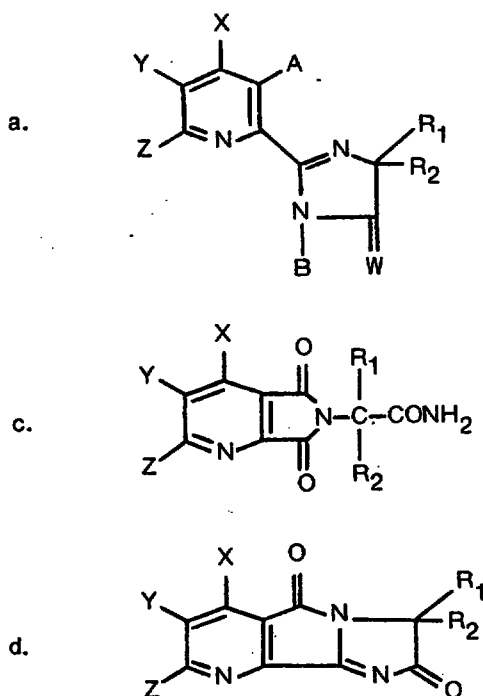
Y and Z each represent hydrogen, halogen, C_1 - C_6 alkyl, C_1 - C_4 hydroxy-loweralkyl, C_1 - C_6 alkoxy, C_1 - C_4 alkylthio, phenoxy, C_1 - C_4 -haloalkyl, nitro, cyano, C_1 - C_4 alkylamino, C_1 - C_4 diloweralkylamino or C_1 - C_4 alkylsulfonyl group, or phenyl optionally substituted with one C_1 - C_4 alkyl, C_1 - C_4 alkoxy or halogen; and when taken together, Y and Z may form a ring $-(CH_2)_n-$, where n is 3 or 4, provided that X is hydrogen;



where L, M, Q and R_7 each represent hydrogen, halogen, C_1 - C_4 alkyl, C_1 - C_4 alkoxy, C_1 - C_4 alkylthio, C_1 - C_4 alkylsulfonyl, C_1 - C_4 haloalkyl, NO_2 , CN, phenyl, phenoxy, amino, C_1 - C_4 alkylamino, C_1 - C_4 diloweralkylamino, chlorophenyl, methylphenyl, or phenoxy substituted with one Cl, CF_3 , NO_2 or CH_3 group, with the proviso that only one of L, M, Q, or R_7 , may represent a substituent other than hydrogen, halogen, C_1 - C_4 alkyl or C_1 - C_4 -alkoxy;

and when W is O and A is CN, CH_3 or $COOR_3$, provided that R_3 cannot be alkenyl or alkynyl and Y and Z cannot be alkylamino, dialkylamino or alkylthio, and the N-oxides thereof, and when R_1 and R_2 are not the same, the optical isomer thereof, and, except when R_3 is a salt-forming cation, the acid addition salts thereof.

2. A method for the control of monocotyledonous and dicotyledonous annual, perennial and aquatic plant species comprising: applying to the foliage of said plants or to soil or water containing seeds or other propagating organs thereof, a herbicidally effective amount of a compound of the following formulae:

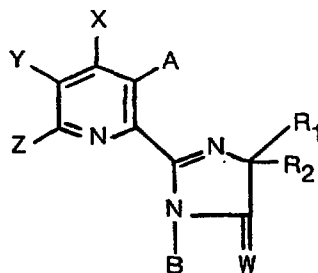


wherein R_1 , R_2 , X, Y, and Z, are as defined in Claim 1, B is hydrogen, W is oxygen and A is $COOR_3$ or $CONHR_6$ wherein R_3 and R_6 are as defined in Claim 1.

3. A method for defoliating cotton plants comprising apply to the foliage of said plants, approximately



five to fifteen days prior to anticipated harvest, a desiccating and defoliating amount of a compound of the following formula:



wherein R_1 , R_2 , A, X, Y, Z, B and W are as defined in Claim 1.

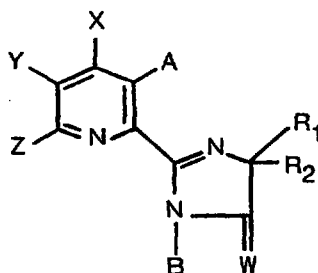
4. A herbicidal composition comprising an inert solid or liquid diluent and a herbicidally effective amount of a compound of the formulae a, c, d in Claim 1.

5. A solid herbicidal composition according to Claim 4, comprising from 20% to 45% by weight of a finely divided solid inert carrier; from 45% to 80% by weight of the herbicidal effective ingredient; from about 2% to 5% by weight of a dispersing agent and from about 2% to 5% by weight of a surface active agent.

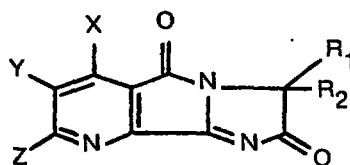
6. A liquid herbicidal composition according to Claim 4, comprising from 5% to 25% by weight of the herbicidally effective ingredient; from about 65% to 90% by weight of an inert organic solvent and from about 5% to 10% by weight of a surface active agent.

7. A granular herbicidal composition according to Claim 4, comprising from about 80% to 97% by weight of an inert granular carrier and from about 3% to 20% by weight of the herbicidally effective ingredient.

8. A process for the preparation of a compound of the formula:



wherein R_1 , R_2 , X, Y and Z are as defined in Claim 1, A is COOR_3 , wherein R_3 is as defined in Claim 1; or CONHR_6 , wherein R_6 is as defined in Claim 1; characterized by: reacting a compound having the formula:



wherein

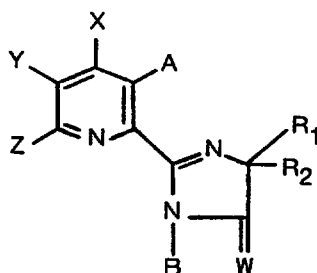
R_1 , R_2 , X, Y and Z are as defined in Claim 1 with

(a) at least one equivalent of an alcohol of formula $R_3\text{OH}$, and an alkali metal alkoxide $R_3\text{O}^\ominus\text{M}^\oplus$, wherein R_3 is as defined in Claim 1 and $\text{M}^\oplus$ is an alkali metal, at a temperature between 20°C and 50°C , alone or in the presence of an aprotic solvent; whereby the desired product, in which A is COOR_3 , wherein R_3 is as defined above, is formed; or

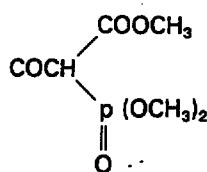
(b) at least one equivalent of an amine of formula: $R_6\text{NH}_2$, wherein R_6 is as defined in Claim 1, alone or in the presence of an aprotic solvent, at a temperature between 80°C and 125°C , whereby the desired product, in which A is CONHR_6 wherein R_6 is as defined above, is formed.



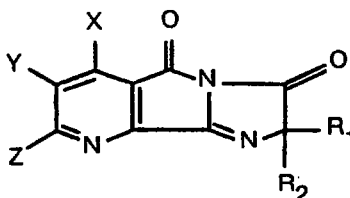
9. A process for the preparation of a compound of formula:



wherein R_1 , R_2 , X, Y and Z are as defined in Claim 1, A is COOR_3 , CONHR_6 , CH_2OH , COCH_3 , COC_6H_5 , or



wherein R_3 is as defined in Claim 1 except hydrogen, B is hydrogen and W is oxygen, comprising reacting a compound of formula:



wherein R_1 , R_2 , X, Y and Z are as defined above; with

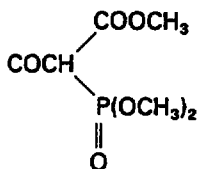
(a) at least one equivalent of an alcohol of formula $R_3\text{OH}$ and an alkali metal alkoxide $R_3\text{O}^-M^+$, where R_3 is as described above and M is an alkali metal, alone or in the presence of an aprotic solvent at a temperature between 20°C and 50°C , whereby the desired product, in which A is COOR_3 and R_3 is as defined above, is obtained;

(b) at least one equivalent of an amine of formula $R_6\text{NH}_2$, where R_6 is as defined in Claim 1, in the presence of $\text{C}_1\text{--C}_4$ loweralkyl alcohol or an aprotic solvent at a temperature between 80°C and 125°C , whereby the desired product, in which A is CONHR_6 wherein R_6 is as defined above, is obtained.

(c) at least one equivalent of methyl magnesium bromide, in the presence of an aprotic solvent at a temperature between -50°C and -80°C under a blanket of inert gas, whereby the desired product in which A is COCH_3 and is obtained;

(d) at least one equivalent phenyl lithium, in the presence of an aprotic solvent at a temperature between -50°C and -80°C under a blanket of inert gas, whereby the desired product, in which A is COC_6H_5 , is obtained; or

(e) at least one equivalent of sodium trimethylphosphonoacetate, in the presence of an aprotic solvent at -50°C to -80°C under a blanket of inert gas, whereby the desired product in which A is

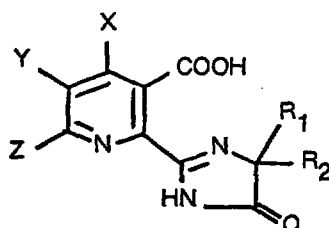


is obtained; or

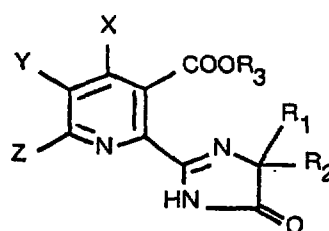
(f) at least one equivalent of sodium borohydride in ethanol at -10° to $+15^\circ\text{C}$ whereby the desired product in which A is CH_2OH , is obtained.



10. A method for the preparation of a compound of formula:



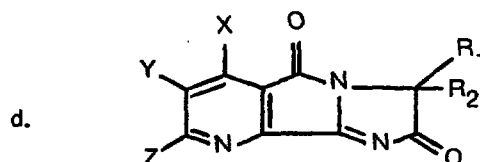
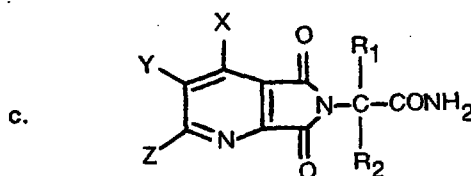
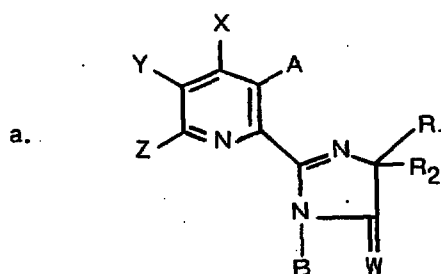
wherein R_1 , R_2 , X, Y and Z are as defined in Claim 1, characterized by reacting a compound of the formula:



wherein R_1 , R_2 , R_3 , X, Y and Z are as defined above, with at least one equivalent of base in aqueous solution, heating the mixture to between 20°C and 50°C; cooling said mixture and adjusting the pH thereof to between 6.5 and 7.5 by the addition thereto of a strong mineral acid.

30. Claims for the Contracting State: AT

1. A herbicidal composition comprising an inert solid or liquid diluent and a herbicidal effective amount of a compound of the formulae a, c and d



wherein

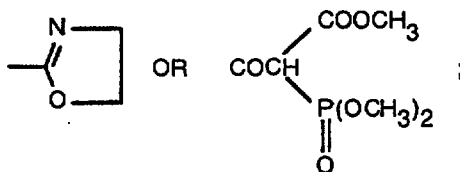
R_1 is C_1-C_4 alkyl;

R_2 is C_1-C_4 alkyl or C_3-C_6 cycloalkyl; and when R_1 and R_2 are taken together they may represent

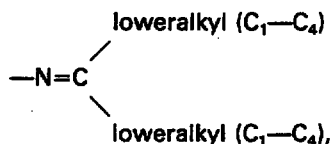
C_3-C_6 cycloalkyl optionally substituted with methyl;



A is COOR_3 , CONHR_6 , CHO , CH_2OH , COCH_3 , COC_6H_5 , CN , CH_3 , CH=NOH , CH_2COOH , CONHOH , $\text{CH}_2\text{CH}_2\text{COOH}$, CHR_8OH ,



R_3 is Hydrogen,



$\text{C}_1\text{--C}_{12}$ alkyl optionally substituted with one of the following groups: $\text{C}_1\text{--C}_3$ alkoxy, halogen, hydroxyl, $\text{C}_3\text{--C}_6$ cycloalkyl, benzyloxy, furyl, phenyl, halophenyl, $\text{C}_1\text{--C}_4$ loweralkylphenyl, $\text{C}_1\text{--C}_4$ loweralkoxyphenyl, nitrophenyl, carboxyl, $\text{C}_1\text{--C}_4$ loweralkoxycarbonyl, cyano or $\text{C}_1\text{--C}_4$ triloweralkylammonium;

$\text{C}_3\text{--C}_{12}$ alkenyl optionally substituted with one of the following groups: $\text{C}_1\text{--C}_3$ alkoxy, phenyl, halogen, $\text{C}_1\text{--C}_4$ loweralkoxycarbonyl or with two $\text{C}_1\text{--C}_3$ alkoxy groups or two halogen atoms;

$\text{C}_3\text{--C}_6$ cycloalkyl optionally substituted with one or two $\text{C}_1\text{--C}_3$ alkyl groups;

$\text{C}_3\text{--C}_{10}$ alkynyl optionally substituted with one or two $\text{C}_1\text{--C}_3$ alkyl groups; or

a cation selected from alkali metals, alkaline earth metals, copper, iron, cobalt, silver, nickel, ammonium and organic ammonium;

R_6 is hydrogen, hydroxyl, $\text{C}_3\text{--alkenyl}$, $\text{C}_3\text{--alkynyl}$ or $\text{C}_1\text{--C}_4$ alkyl optionally substituted with one hydroxyl or one chlorine atom;

B is H, COR_4 or SO_2R_5 , provided that when B is COR_4 or SO_2R_5 ; A is COOR_3 in which R_3 is other than H, or a salt-forming cation, CH_3 or CN ; W is O; and Y and Z are not alkylamino, hydroxyl, or $\text{C}_1\text{--C}_4$ hydroxyloweralkyl;

R_4 is $\text{C}_1\text{--C}_{11}$ alkyl, chloromethyl or phenyl optionally substituted with one chloro, one nitro or one methoxy group;

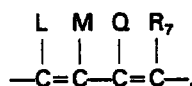
R_5 is $\text{C}_1\text{--C}_4$ alkyl or phenyl optionally substituted with one methyl group;

W is O or S;

R_8 is $\text{C}_1\text{--C}_4$ -alkyl or phenyl;

X is hydrogen, halogen, hydroxyl or methyl, with the proviso that when Y and Z are taken together to form a ring $-(\text{CH}_2)_n-$, where n is 3 or 4, X is hydrogen,

Y and Z each represent hydrogen, halogen, $\text{C}_1\text{--C}_6$ alkyl, $\text{C}_1\text{--C}_4$ hydroxy-loweralkyl, $\text{C}_1\text{--C}_6$ alkoxy, $\text{C}_1\text{--C}_4$ alkylthio, phenoxy, $\text{C}_1\text{--C}_4$ -haloalkyl, nitro, cyano, $\text{C}_1\text{--C}_4$ alkylamino, $\text{C}_1\text{--C}_4$ diloweralkylamino or $\text{C}_1\text{--C}_4$ alkylsulfonyl group, or phenyl optionally substituted with one $\text{C}_1\text{--C}_4$ alkyl, $\text{C}_1\text{--C}_4$ alkoxy or halogen; and when taken together, Y and Z may form a ring $-(\text{CH}_2)_n-$, where n is 3 or 4, provided that X is hydrogen;



where, L, M, Q and R_7 each represent hydrogen, halogen, $\text{C}_1\text{--C}_4$ alkyl, $\text{C}_1\text{--C}_4$ alkoxy, $\text{C}_1\text{--C}_4$ alkylthio, $\text{C}_1\text{--C}_4$ alkylsulfonyl, $\text{C}_1\text{--C}_4$ haloalkyl, NO_2 , CN, phenyl, phenoxy, amino, $\text{C}_1\text{--C}_4$ alkylamino, $\text{C}_1\text{--C}_4$ diloweralkylamino, chlorophenyl, methylphenyl, or phenoxy substituted with one Cl, CF_3 , NO_2 or CH_3 group, with the proviso that only one of L, M, Q or R_7 , may represent a substituent other than hydrogen, halogen, $\text{C}_1\text{--C}_4$ alkyl or $\text{C}_1\text{--C}_4$ -alkoxy;

and when W is O and A is CN, CH_3 or COOR_3 , provided that R_3 cannot be alkenyl or alkynyl and Y and Z cannot be alkylamino, dialkylamino or alkylthio, and the N-oxides thereof, and when R_1 and R_2 are not the same, the optical isomer thereof, and, except when R_3 is a salt-forming cation, the acid addition salts thereof.

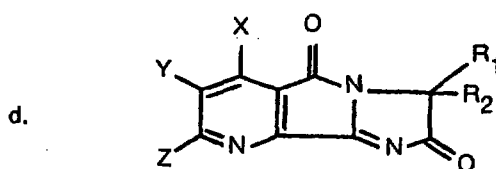
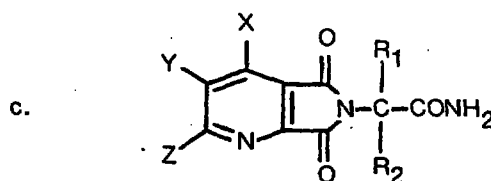
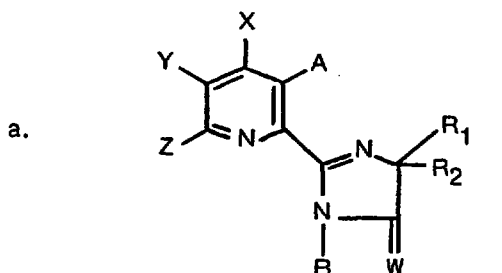
2. A solid herbicidal composition according to Claim 1, comprising from 20% to 45% by weight of a finely divided solid inert carrier; from 45% to 80% by weight of the herbicidal effective ingredient; from about 2% to 5% by weight of a dispersing agent and from about 2% to 5% by weight of a surface active agent.

3. A liquid herbicidal composition according to Claim 1, comprising from 5% to 25% by weight of the herbicidally effective ingredient; from about 65% to 90% by weight of an inert organic solvent and from about 5% to 10% by weight of a surface active agent.

4. A granular herbicidal composition according to Claim 1, comprising from about 80% to 97% by weight of an inert granular carrier and from about 3% to 20% by weight of the herbicidally effective ingredient.

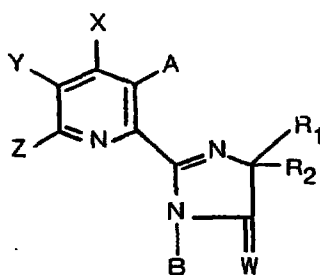


5. A method for the control of monocotyledonous and dicotyledonous annual, perennial and aquatic plant species comprising: applying to the foliage of said plants or to soil or water containing seeds or other propagating organs thereof, a herbicidally effective amount of a compound of the following formulae:



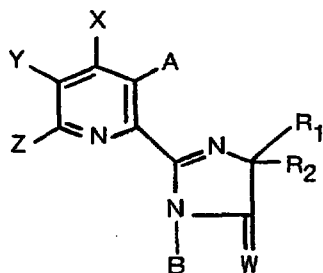
wherein R_1 , R_2 , X, Y, and Z, are defined in Claim 1, B is hydrogen, W is oxygen and A is COOR_3 or CONHR_4 wherein R_3 and R_4 are as defined in Claim 1.

6. A method for defoliating cotton plants comprising apply to the foliage of said plants, approximately five to fifteen days prior to anticipated harvest, a desiccating and defoliating amount of a compound of the following formula:



wherein R_1 , R_2 , A, X, Y, Z, B, and W are as defined in Claim 1.

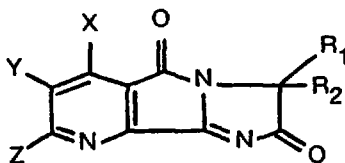
7. A process for the preparation or a compound of the formula:



wherein R_1 , R_2 , X, Y and Z are as defined in Claim 1, A is COOR_3 , wherein R_3 is as defined in Claim 1, or



CONHR₆, wherein R₆ is as defined in Claim 1; characterized by: reacting a compound having the formula:

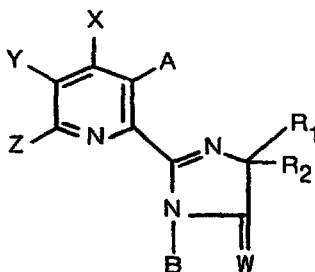


10 wherein R₁, R₂, X, Y and Z are as defined in Claim 1 with

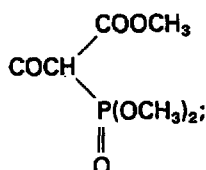
(a) at least one equivalent of an alcohol of formula R₃OH, and an alkali metal alkoxide R₃O⁻M⁺, wherein R₃ is as defined in Claim 1 and M⁺ is an alkali metal, at a temperature between 20°C and 50°C, alone or in the presence of an aprotic solvent; whereby the desired product, in which A is COOR₃, wherein R₃ is as defined above, is formed; or

15 (b) at least one equivalent of an amine of formula R₆NH₂, wherein R₆ is as defined in Claim 1, alone or in the presence of an aprotic solvent, at a temperature between 80°C and 125°C, whereby the desired product, in which A is CONHR₆ wherein R₆ is as defined above, is formed.

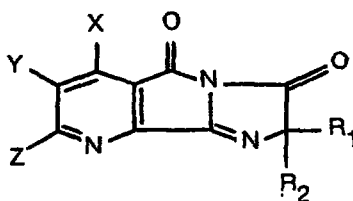
8. A process for the preparation of a compound of formula:



20 wherein R₁, R₂, X, Y and Z are as defined in Claim 1, A is COOR₃, CONHR₆, CH₂OH, COCH₃, COC₆H₅, or



30 wherein R₃ is as defined in Claim 1 except hydrogen, B is hydrogen and W is oxygen, comprising reacting a compound of formula:



40 wherein R₁, R₂, X, Y and Z are as defined above; with

(a) at least one equivalent of an alcohol of formula R₃OH and an alkali metal alkoxide R₃O⁻M⁺, where R₃ is as described above and M is an alkali metal; alone or in the presence of an aprotic solvent at a temperature between 20°C and 50°C, whereby the desired product, in which A is COOR₃ and R₃ is as defined above, is obtained;

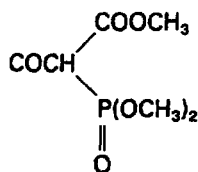
(b) at least one equivalent of an amine of formula R₆NH₂, where R₆ is as defined in Claim 1, in the presence of C₁—C₄ loweralkyl alcohol or an aprotic solvent at a temperature between 80°C and 125°C, whereby the desired product, in which A is CONHR₆ wherein R₆ is as defined above, is obtained;

(c) at least one equivalent of methyl magnesium bromide, in the presence of an aprotic solvent at a temperature between -50°C and -80°C under a blanket of inert gas, whereby the desired product, in which A is COCH₃, is obtained;

(d) at least one equivalent phenyl lithium, in the presence of an aprotic solvent at a temperature between -50°C and -80°C under a blanket of inert gas, whereby the desired product, in which A is COC₆H₅, is obtained; or



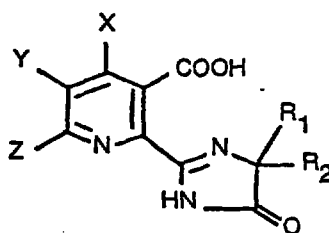
(e) at least one equivalent of sodium trimethylphosphonoacetate in the presence of an aprotic solvent at -50°C to -80°C under a blanket of inert gas, whereby the desired product in which A is



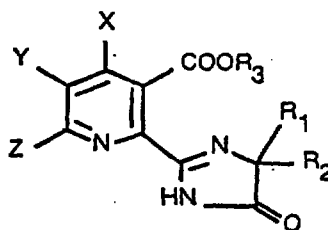
is obtained; or

(f) at least one equivalent of sodium borohydride in ethanol at -10° to $+15^{\circ}\text{C}$ whereby the desired product in which A is CH_2OH , is obtained.

9. A method for the preparation of a compound of formula



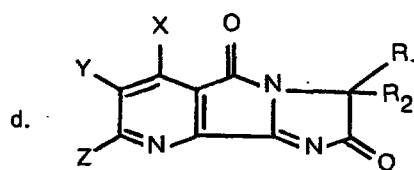
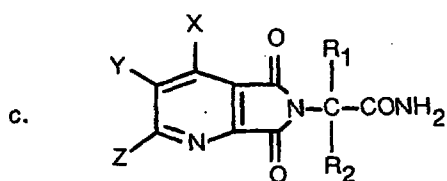
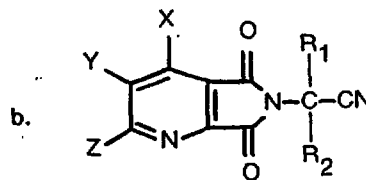
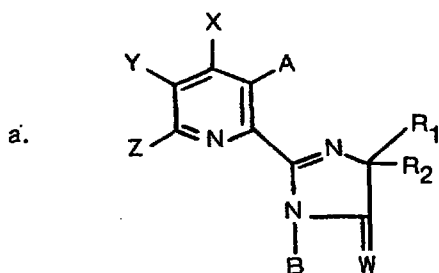
wherein R_1 , R_2 , X, Y and Z are as defined in Claim 1, characterized by reacting a compound of the formula:



wherein R_1 , R_2 , R_3 , X, Y and Z are as defined above, with at least one equivalent of base in aqueous solution, heating the mixture to between 20°C and 50°C ; cooling said mixture and adjusting the pH thereof to between 6.5 and 7.5 by the addition thereto of a strong mineral acid.

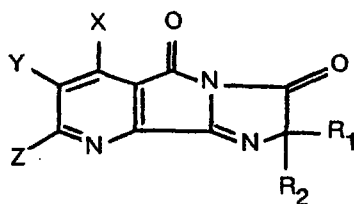
Patentansprüche für die Vertragsstaaten: BE CH FR GB IT LI NL SE

1. Verbindung mit einer der folgenden Formeln

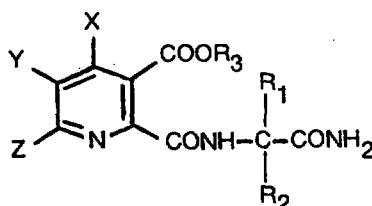




e.



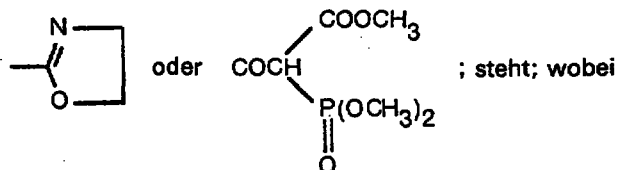
f.



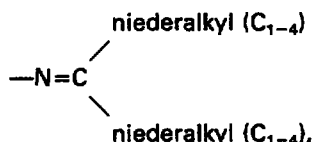
wobei

10 R_1 für C_{1-4} -Alkyl steht; R_2 für C_{1-4} -Alkyl oder C_{3-6} -Cycloalkyl; wobei R_1 und R_2 , wenn sie zusammengefaßt sind, C_{3-6} -Cycloalkyl bedeuten können, das gegebenenfalls mit Methyl substituiert ist;A für $COOR_3$, $CONHR_6$, CHO , CH_2OH , $COCH_3$, COC_6H_5 , CN , CH_3 , $CH=NOH$, CH_2COOH , $CONHOH$, CH_2CH_2COOH , CHR_8OH ,

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20

25 R_3 für Wasserstoff,30 C_{1-12} -Alkyl, gegebenenfalls substituiert mit einer der folgenden Gruppen: C_{1-3} -Alkoxy, Halogen, Hydroxyl, C_{3-6} -Cycloalkyl, Benzyloxy, Furyl, Phenyl, Halogenphenyl, C_{1-4} -niederalkylphenyl, C_{1-4} -niederalkoxyphenyl, Nitrophenyl, Carboxyl, C_{1-4} -niederalkoxycarbonyl, Cyano oder C_{1-4} -triniederalkyl ammonium,35 C_{3-12} -Alkenyl, gegebenenfalls substituiert mit einer der folgenden Gruppen: C_{1-3} -Alkoxy, Phenyl, Halogen, C_{1-4} -Niederalkoxycarbonyl oder mit zwei C_{1-3} -Alkoxygruppen oder mit zwei Halogenatomen; C_{3-6} -Cycloalkyl, gegebenenfalls substituiert mit einer oder mit zwei C_{1-3} -Alkylgruppe(n); C_{3-10} -Alkynyl, gegebenenfalls substituiert mit einer oder mit zwei C_{1-3} -Alkylgruppe(n); oder

ein Kation, ausgewählt unter Alkalimetallen, Erdalkalimetallen, Kupfer, Eisen, Kobalt, Silber, Nickel, Ammonium und organischen Ammoniumverbindungen, steht;

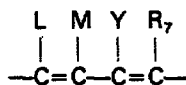
40 R_6 für Wasserstoff, Hydroxyl, C_3 -Alkenyl, C_3 -Alkynyl oder C_{1-4} -Alkyl, das gegebenenfalls mit einer Hydroxylgruppe oder mit einem Chloratom substituiert ist;B für H, COR_4 oder SO_2R_5 , mit der Maßgabe, daß dann, wenn B COR_4 oder SO_2R_5 bedeutet, A für $COOR_3$, wobei R_3 eine andere Bedeutung hat als H oder ein salzbildendes Kation, für CH_3 oder CN steht; W für O steht; und Y und Z nicht Alkylamino, Hydroxyl oder C_{1-4} -Hydroxyniederalkyl bedeuten;45 R_4 für C_{1-11} -Alkyl, Chlormethyl oder Phenyl, das gegebenenfalls mit einer Chlor-, einer Nitro- oder einer Methoxygruppe substituiert ist; R_5 für C_{1-4} -Alkyl oder Phenyl, das gegebenenfalls mit einer Methylgruppe substituiert ist;

W für O oder S;

 R_8 für C_{1-4} -Alkyl oder Phenyl;50 X für Wasserstoff, Halogen, Hydroxyl oder Methyl, mit der Maßgabe, daß dann, wenn Y und Z zur Bildung eines Ringes zusammengefaßt sind und YZ für die Struktur $-(CH_2)_n-$ steht, wobei n 3 oder 4 bedeutet, X für Wasserstoff steht;Y und Z jeweils ausgewählt sind unter Wasserstoff, Halogen, C_{1-6} -Alkyl, C_{1-4} -Hydroxy-niederalkyl, C_{1-6} -Alkoxy, C_{1-4} Alkylthio, Phenoxy, C_{1-4} -Halogenalkyl, Nitro, Cyano, C_{1-4} -Alkylamino, C_{1-4} -Di-niederalkylamino oder C_{1-4} -Alkylsulfonyl oder Phenyl, das gegebenenfalls mit einer C_{1-4} -Alkyl-, C_{1-4} -Alkoxy-Gruppe oder mit Halogen substituiert ist; und wobei Y und Z, wenn sie zusammengefaßt werden, einen Ring bilden können, in dem YZ für die Struktur $-(CH_2)_n-$ steht, wobei n 3 oder 4 ist, unter der Voraussetzung, daß X für Wasserstoff steht;

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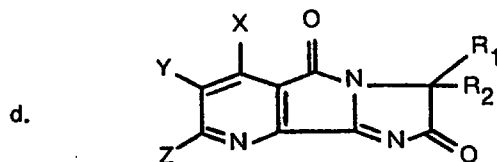
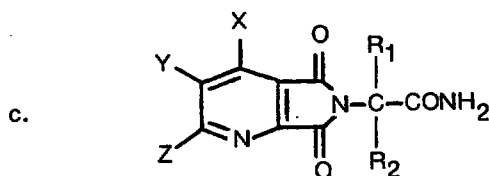
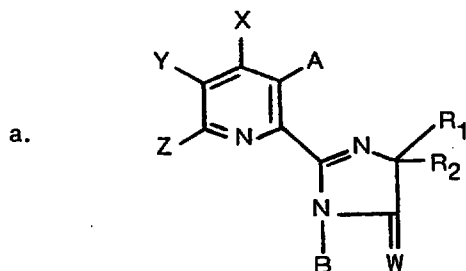
oder YZ für die Struktur

steht, wobei L, M, Q, und R_7 jeweils ausgewählt sind unter Wasserstoff, Halogen, C_{1-4} -Alkyl, C_{1-4} -Alkoxy, C_{1-4} -Alkylthio, C_{1-4} -Alkylsulfonyl, C_{1-4} -Halogenalkyl, NO_2 , CN , Phenyl, Phenoxy, Amino, C_{1-4} -Alkylamino, 65 C_{1-4} -Di-niederalkylamino, Chlorphenyl, Methylphenyl oder Phenoxy, das mit einer $Cl-$, CF_3- , NO_2- oder CH_3- 



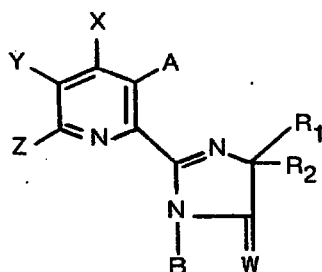
Gruppe substituiert ist, mit der Maßgabe, daß nur eines der Symbole L, M, Q oder R₇ für einen Substituenten stehen darf, der nicht Wasserstoff, Halogen, C₁₋₄-Alkyl oder C₁₋₄-Alkoxy ist; sowie die N-Oxide derselben in den Fällen, in denen W für O steht und A CN, CH₃ oder COOR₃ bedeutet, vorausgesetzt, daß R₃ keine Alkenyl- oder Alkynylgruppe ist und Y und Z nicht für Alkylamino, Dialkylamino oder Alkylthio stehen können; sowie die optischen Isomeren derselben, falls R₁ und R₂ nicht die gleiche Bedeutung haben; sowie die Säureadditionssalze derselben, ausgenommen den Fall, daß R₃ für ein salzbildendes Kation steht.

2. Verfahren zur Bekämpfung von einkeimblättrigen und zweikeimblättrigen, einjährigen, mehrjährigen, perennierenden und aquatischen Pflanzenspezies, dadurch gekennzeichnet, daß man den Blättern der Pflanzen oder dem Boden oder dem Wasser, die Samen oder andere Fortpflanzungsorgane derselben enthalten, eine herbizid wirksame Menge einer Verbindung mit einer der folgenden Formeln verabreicht:



wobei R₁, R₂, X, Y und Z die in Anspruch 1 angegebene Bedeutung haben, B für Wasserstoff, W für Sauerstoff und A für COOR₃ oder CONHR₆ steht und wobei R₃ und R₆ die in Anspruch 1 angegebene Bedeutung haben.

3. Verfahren zum Entblättern von Baumwollpflanzen, dadurch gekennzeichnet, daß man den Blättern der Pflanzen etwa 5 bis 15 Tage vor dem vorgesehenen Erntezeitpunkt eine zur Austrocknung und Entblätterung ausreichende Menge einer Verbindung der folgenden Formel verabreicht:



wobei R₁, R₂, A, X, Y, Z, B und W die in Anspruch 1 angegebene Bedeutung haben.

4. Herbizides Mittel, umfassend ein inertes, festes oder flüssiges Verdünnungsmittel und eine herbizid wirksame Menge einer Verbindung der Formeln a, c, d in Anspruch 1.

5. Festes, herbizides Mittel nach Anspruch 4, dadurch gekennzeichnet, daß es von 20 bis 45 Gew.% eines feinzerteilten, festen, inerten Trägers; von 45 bis 80 Gew.% des herbiziden Wirkstoffes; von etwa 2 bis 5 Gew.% eines Dispersionsmittels und von etwa 2 bis 5 Gew.% eines oberflächenaktiven Mittels umfaßt.

6. Flüssiges, herbizides Mittel nach Anspruch 4, dadurch gekennzeichnet, daß es von 5 bis 25 Gew.%

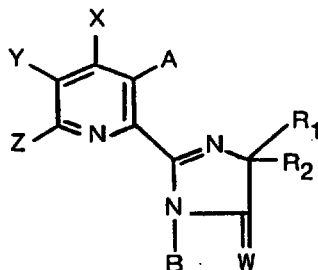


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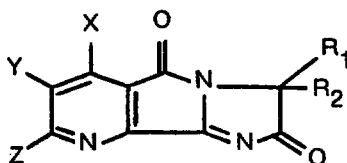
des herbiziden Wirkstoffs; von etwa 65 bis 90 Gew.% eines inerten, organischen Lösungsmittels und von etwa 5 bis 10 Gew.% eines oberflächenaktiven Mittels umfaßt.

7. Granulatförmiges, herbizides Mittel nach Anspruch 4, dadurch gekennzeichnet, daß es von etwa 80 bis 97 Gew.% eines inerten, granulatförmigen Trägers und von etwa 3 bis 20 Gew.% des herbiziden Wirkstoffes umfaßt.

8. Verfahren zur Herstellung einer Verbindung der Formel



wobei R_1 , R_2 , X, Y und Z die in Anspruch 1 angegebene Bedeutung haben, A für COOR_3 oder CONHR_6 steht, wobei R_3 und R_6 die in Anspruch 1 angegebene Bedeutung haben, dadurch gekennzeichnet, daß man eine Verbindung der Formel

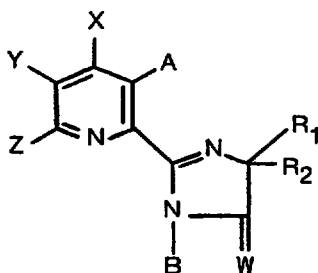


wobei R_1 , R_2 , X, Y und Z die in Anspruch 1 angegebenen Bedeutungen haben, umgesetzt mit entweder

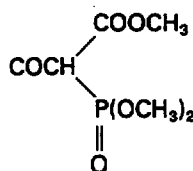
(a) wenigstens 1 Äquivalent eines Alkohols der Formel $R_3\text{OH}$ und einem Alkalimetallalkoxid $R_3\text{O}^-M^+$, wobei R_3 die in Anspruch 1 angegebene Bedeutung hat und M^+ für ein Alkalimetall steht, bei einer Temperatur zwischen 20 und 50°C , und zwar ohne Lösungsmittel oder in Gegenwart eines aprotischen Lösungsmittels; wobei man das angestrebte Produkt erhält, bei dem A für COOR_3 steht und R_3 die oben angegebene Bedeutung hat; oder

(b) wenigstens 1 Äquivalent eines Amins der Formel $R_6\text{NH}_2$, wobei R_6 die in Anspruch 1 angegebene Bedeutung hat, und zwar ohne Lösungsmittel oder in Gegenwart eines aprotischen Lösungsmittels und bei einer Temperatur zwischen etwa 80 und 125°C , wobei man das angestrebte Produkt erhält, in dem A für CONHR_6 steht und R_6 die oben angegebene Bedeutung hat.

9. Verfahren zur Herstellung einer Verbindung der Formel



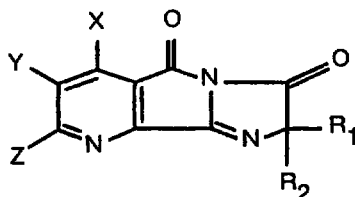
wobei R_1 , R_2 , X, Y und Z die in Anspruch 1 angegebene Bedeutung haben; A für COOR_3 , CONHR_6 , CH_2OH , COCH_3 , COC_6H_5 oder



steht, wobei R_3 die in Anspruch 1 angegebene Bedeutung hat mit Ausnahme von Wasserstoff, B für



Wasserstoff und W für Sauerstoff steht, dadurch gekennzeichnet, daß man eine Verbindung der Formel



wobei R_1 , R_2 , X, Y und Z die oben angegebenen Bedeutungen habe, umgesetzt mit

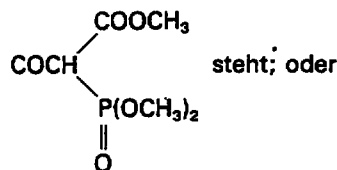
(a) wenigstens 1 Äquivalent eines Alkohols der Formel R_3OH und einem Alkalimetallalkoxid $R_3O^-M^+$, wobei R_3 die oben angegebene Bedeutung und M für ein Alkalimetall steht, und zwar ohne Lösungsmittel oder in Gegenwart eines aprotischen Lösungsmittels bei einer Temperatur zwischen 20 und 50°C, wobei man das angestrebte Produkt, in dem A für $COOR_3$ steht und R_3 die oben angegebene Bedeutung hat, erhält;

(b) wenigstens 1 Äquivalent eines Amins der Formel R_6NH_2 , wobei R_6 die in Anspruch 1 angegebene Bedeutung hat, und zwar in Gegenwart eines C_{1-4} -Niederalkylalkohols oder eines aprotischen Lösungsmittels bei einer Temperatur zwischen 80 und 125°C, wobei man das angestrebte Produkt, in dem A für $CONHR_6$ steht und R_6 die oben angegebene Bedeutung hat, erhält;

(c) wenigstens 1 Äquivalent Methylmagnesiumbromid in Gegenwart eines aprotischen Lösungsmittels bei einer Temperatur zwischen -50 und -80°C unter einer Decke aus inertem Gas, wobei man das angestrebte Produkt erhält, in dem A für $COCH_3$ steht;

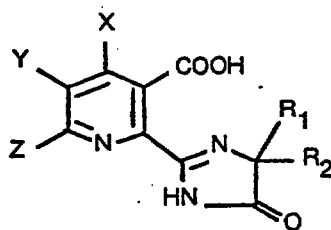
(d) wenigstens 1 Äquivalent Phenyllithium in Gegenwart eines aprotischen Lösungsmittels bei einer Temperatur zwischen -50 und -80°C unter einer Decke aus Inertgas, wobei man das angestrebte Produkt erhält, bei dem A für COC_6H_5 steht; oder

(e) wenigstens 1 Äquivalent Natriumtrimethylphosphonoacetat in Gegenwart eines aprotischen Lösungsmittels bei -50 bis -80°C unter einer Decke aus Inertgas, wobei man das angestrebte Produkt erhält, bei dem A für

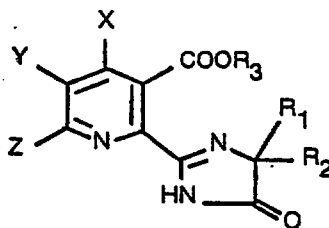


(f) wenigstens 1 Äquivalent Natriumborhydrid in Äthanol bei -10 bis +15°C, wobei man das angestrebte Produkt erhält, bei dem A für CH_2OH steht.

10. Verfahren zur Herstellung einer Verbindung der Formel



wobei R_1 , R_2 , X, Y und Z die in Anspruch 1 angegebene Bedeutung haben, dadurch gekennzeichnet, daß man eine Verbindung der Formel

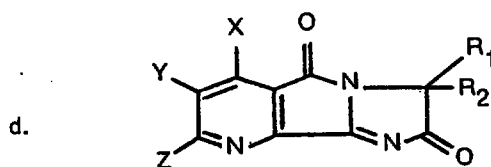
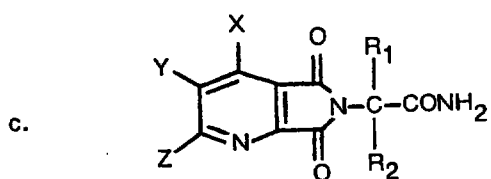
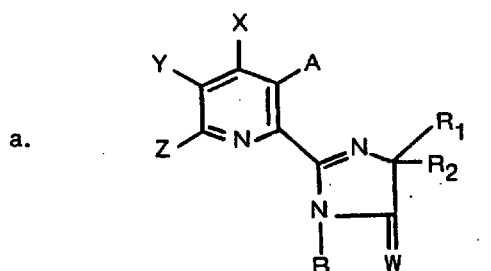


wobei R_1 , R_2 , R_3 , X, Y und Z die oben angegebenen Bedeutungen haben; mit wenigstens 1 Äquivalent Base in wäßriger Lösung umgesetzt; das Gemisch auf 20 bis 50°C erhitzt; die Mischung abkühlt und ihren pH durch Zugabe einer starken Mineralsäure auf 6,5 bis 7,5 einstellt.



Patentansprüche für den Vertragsstaat: AT

1. Herbizides Mittel, umfassend ein inertes, festes oder flüssiges Verdünnungsmittel und eine herbizid wirksame Menge einer Verbindung der Formeln a, c, d:

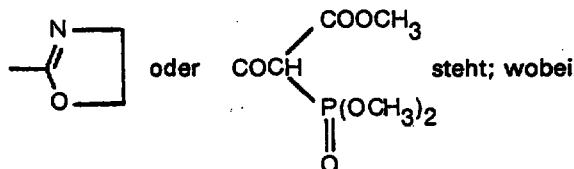


wobei

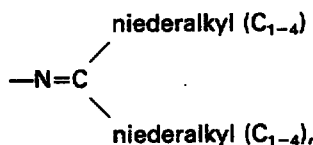
R_1 für C_{1-4} -Alkyl steht;

R_2 für C_{1-4} -Alkyl oder C_{3-6} -Cycloalkyl; wobei R_1 und R_2 , wenn sie zusammengefaßt sind, C_{3-6} -Cycloalkyl bedeuten können, das gegebenenfalls mit Methyl substituiert ist;

A für $COOR_3$, $CONHR_6$, CHO , CH_2OH , $COCH_3$, COC_6H_5 , CN , CH_3 , $CH=NOH$, CH_2COOH , $CONHOH$, CH_2CH_2COOH , CHR_8OH ,



R_3 für Wasserstoff,



C_{1-12} -Alkyl, gegebenenfalls substituiert mit einer der folgenden Gruppen: C_{1-3} -Alkoxy, Halogen, Hydroxyl, C_{3-6} -Cycloalkyl, Benzyloxy, Furyl, Phenyl, Halogenphenyl, C_{1-4} -niederalkylphenyl, C_{1-4} -niederalkoxyphenyl, Nitrophenyl, Carboxyl, C_{1-4} -niederalkoxycarbonyl, Cyano oder C_{1-4} -triniederalkyl ammonium,

C_{3-12} -Alkenyl, gegebenenfalls substituiert mit einer der folgenden Gruppen: C_{1-3} -Alkoxy, Phenyl, Halogen, C_{1-4} -Niederalkoxycarbonyl oder mit zwei C_{1-3} -Alkoxygruppen oder mit zwei Halogenatomen;

C_{3-6} -Cycloalkyl, gegebenenfalls substituiert mit einer oder mit zwei C_{1-3} -Alkylgruppe(n);

C_{3-10} -Alkynyl, gegebenenfalls substituiert mit einer oder mit zwei C_{1-3} -Alkylgruppe(n); oder

ein Kation, ausgewählt unter Alkalimetallen, Erdalkalimetallen, Kupfer, Eisen, Kobalt, Silber, Nickel, Ammonium und organischen Ammoniumverbindungen, steht;

R_6 für Wasserstoff, Hydroxyl, C_3 -Alkenyl, C_3 -Alkynyl oder C_{1-4} -Alkyl, das gegebenenfalls mit einer Hydroxylgruppe oder mit einem Chloratom substituiert ist;

B für H, COR_4 oder SO_2R_5 , mit der Maßgabe, daß dann, wenn B COR_4 oder SO_2R_5 bedeutet, A für



COOR₃, wobei R₃ eine andere Bedeutung hat als H oder ein salzbildendes Kation, für CH₃ oder CN steht; W für O steht; und Y und Z nicht Alkylamino, Hydroxyl oder C₁₋₄-Hydroxyniederalkyl bedeuten;

R₄ für C₁₋₁₁-Alkyl, Chlormethyl oder Phenyl, das gegebenenfalls mit einer Chlor-, einer Nitro- oder einer Methoxygruppe substituiert ist;

5 R₅ für C₁₋₄-Alkyl oder Phenyl, das gegebenenfalls mit einer Methylgruppe substituiert ist; W für O oder S;

R₆ für C₁₋₄-Alkyl oder Phenyl;

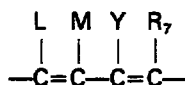
X für Wasserstoff, Halogen, Hydroxyl oder Methyl, mit der Maßgabe, daß dann, wenn Y und Z zur Bildung eines Ringes zusammengefaßt sind und YZ für die Struktur $-(CH_2)_n-$ steht, wobei n 3 oder 4

10 bedeutet, X für Wasserstoff steht;

Y und Z jeweils ausgewählt sind unter Wasserstoff, Halogen, C₁₋₆-Alkyl, C₁₋₄-Hydroxy-niederalkyl, C₁₋₆-Alkoxy, C₁₋₄ Alkylthio, Phenoxy, C₁₋₄-Halogenalkyl, Nitro, Cyano, C₁₋₄-Alkylamino, C₁₋₄-Di-niederalkylamino oder C₁₋₄-Alkylsulfonyl oder Phenyl, das gegebenenfalls mit einer C₁₋₄-Alkyl-, C₁₋₄-Alkoxy-Gruppe oder mit Halogen substituiert ist; und wobei Y und Z, wenn sie zusammengefaßt werden, einen

15 Ring bilden können, in dem YZ für die Struktur $-(CH_2)_n-$ steht, wobei n 3 oder 4 ist, unter der Voraussetzung, daß X für Wasserstoff steht;

20 oder YZ für die Struktur



steht, wobei L, M, Q, und R₇ jeweils ausgewählt sind unter Wasserstoff, Halogen, C₁₋₄-Alkyl, C₁₋₄-Alkoxy, C₁₋₄-Alkylthio, C₁₋₄-Alkylsulfonyl, C₁₋₄-Halogenalkyl, NO₂, CN, Phenyl, Phenoxy, Amino, C₁₋₄-Alkylamino, C₁₋₄-Di-niederalkylamino, Chlorphenyl, Methylphenyl oder Phenoxy, das mit einer Cl-, CF₃-, NO₂- oder CH₃-

25 Gruppe substituiert ist, mit der Maßgabe, daß nur eines der Symbole L, M, Q oder R₇ für einen Substituenten stehen darf, der nicht Wasserstoff, Halogen, C₁₋₄-Alkyl oder C₁₋₄-Alkoxy ist; sowie die N-Oxide derselben in den Fällen, in denen W für O steht und A CN, CH₃ oder COOR₃ bedeutet, vorausgesetzt, daß R₃ keine Alkenyl- oder Alkynylgruppe ist und Y und Z nicht für Alkylamino, Dialkylamino oder Alkylthio stehen können; sowie die optischen Isomeren derselben, falls R₁ und R₂ nicht die gleiche

30 Bedeutung haben; sowie die Säureadditionssalze derselben, ausgenommen den Fall, daß R₃ für ein salzbildendes Kation steht.

2. Festes, herbizides Mittel nach Anspruch 1, dadurch gekennzeichnet, daß es von 20 bis 45 Gew.% eines feinzerteilten, festen, inerten Trägers; von 45 bis 80 Gew.% des herbiziden Wirkstoffes; von etwa 2 bis 5 Gew.% eines Dispersionsmittels und von etwa 2 bis 5 Gew.% eines oberflächenaktiven Mittels

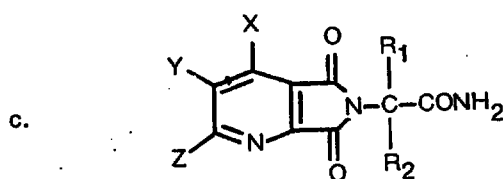
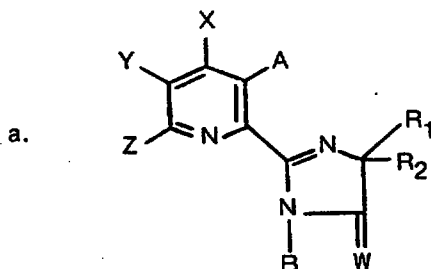
35 umfaßt.

3. Flüssiges, herbizides Mittel nach Anspruch 1, dadurch gekennzeichnet, daß es von 5 bis 25 Gew.% des herbiziden Wirkstoffes; von etwa 65 bis 90 Gew.% eines inerten, organischen Lösungsmittels und von etwa 5 bis 10 Gew.% eines oberflächenaktiven Mittels umfaßt.

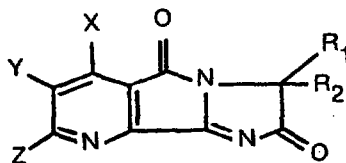
4. Granulatförmiges, herbizides Mittel nach Anspruch 1, dadurch gekennzeichnet, daß es von etwa 80 bis 97 Gew.% eines inerten, granulatförmigen Trägers und von etwa 3 bis 20 Gew.% des herbiziden Wirkstoffes umfaßt.

5. Verfahren zur Bekämpfung von einkeimblättrigen und zweikeimblättrigen, einjährigen, mehrjährigen, perennierenden und aquatischen Pflanzenspezies, dadurch gekennzeichnet, daß man den Blättern der Pflanzen oder dem Boden oder dem Wasser, die Samen oder andere fortpflanzungsorgane

45 derselben enthalten, eine herbizid wirksame Menge einer Verbindung mit einer der folgenden Formeln verabreicht:

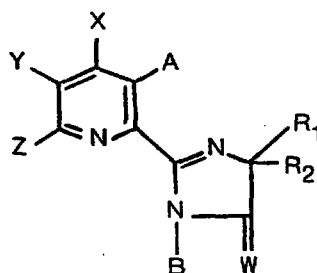


d.



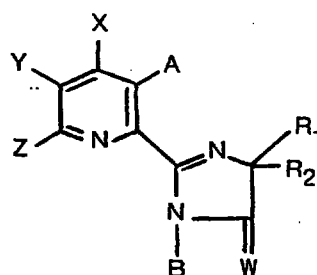
wobei R_1 , R_2 , X, Y und Z die in Anspruch 1 angegebene Bedeutung haben, B für Wasserstoff, W für Sauerstoff und A für COOR_3 oder CONHR_6 steht und wobei R_3 und R_6 die in Anspruch 1 angegebene Bedeutung haben.

6. Verfahren zum Entblättern von Baumwollpflanzen, dadurch gekennzeichnet, daß man den Blättern der Pflanzen etwa 5 bis 15 Tage vor dem vorgesehenen Erntezeitpunkt eine zur Austrocknung und Entblätterung ausreichende Menge einer Verbindung der folgenden Formel verabreicht:

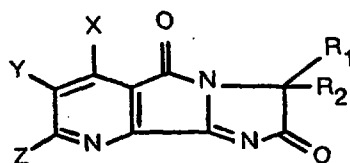


wobei R_1 , R_2 , A, X, Y, Z, B und W die in Anspruch 1 angegebene Bedeutung haben.

7. Verfahren zur Herstellung einer Verbindung der Formel



wobei R_1 , R_2 , X, Y und Z die in Anspruch 1 angegebene Bedeutung haben, A für COOR_3 oder CONHR_6 steht, wobei R_3 und R_6 die in Anspruch 1 angegebene Bedeutung haben, dadurch gekennzeichnet, daß man eine Verbindung der Formel

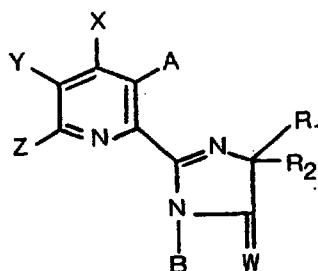


wobei R_1 , R_2 , X, Y und Z die in Anspruch 1 angegebenen Bedeutungen haben, umsetzt mit entweder

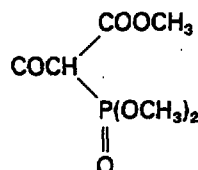
(a) wenigstens 1 Äquivalent eines Alkohols der Formel R_3OH und einem Alkalimetallalkoxid $\text{R}_3\text{O}^-\text{M}^+$, wobei R_3 die in Anspruch 1 angegebene Bedeutung hat und M^+ für ein Alkalimetall steht, bei einer Temperatur zwischen 20 und 50°C , und zwar ohne Lösungsmittel oder in Gegenwart eines aprotischen Lösungsmittels; wobei man das angestrebte Produkt erhält, bei dem A für COOR_3 steht und R_3 die oben angegebene Bedeutung hat; oder

(b) wenigstens 1 Äquivalent eines Amins der Formel R_6NH_2 , wobei R_6 die in Anspruch 1 angegebene Bedeutung hat, und zwar ohne Lösungsmittel oder in Gegenwart eines aprotischen Lösungsmittels und bei einer Temperatur zwischen etwa 80 und 125°C , wobei man das angestrebte Produkt erhält, in dem A für CONHR_6 steht und R_6 die oben angegebene Bedeutung hat.

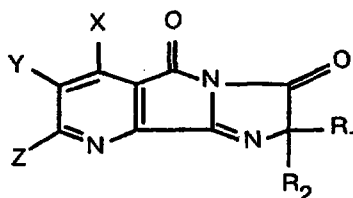
8. Verfahren zur Herstellung einer Verbindung der Formel



wobei R_1 , R_2 , X, Y und Z die in Anspruch 1 angegebene Bedeutung haben; A für COOR_3 , CONHR_6 , CH_2OH , COCH_3 , COC_6H_5 oder



steht, wobei R_3 die in Anspruch 1 angegebene Bedeutung hat mit Ausnahme von Wasserstoff, B für Wasserstoff und W für Sauerstoff steht, dadurch gekennzeichnet, daß man eine Verbindung der Formel



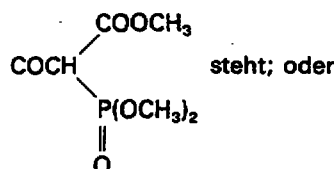
wobei R_1 , R_2 , X, Y und Z die oben angegebenen Bedeutungen haben, umsetzt mit
(a) wenigstens 1 Äquivalent eines Alkohols der Formel R_3OH und einem Alkalimetallalkoxid $\text{R}_3\text{O}^-\text{M}^+$, wobei R_3 die oben angegebene Bedeutung und M für ein Alkalimetall steht, und zwar ohne Lösungsmittel oder in Gegenwart eines aprotischen Lösungsmittels bei einer Temperatur zwischen 20 und 50°C , wobei man das angestrebte Produkt, in dem A für COOR_3 steht und R_3 die oben angegebene Bedeutung hat, erhält;

(b) wenigstens 1 Äquivalent eines Amins der Formel R_6NH_2 , wobei R_6 die in Anspruch 1 angegebene Bedeutung hat, und zwar in Gegenwart eines C_{1-4} -Niederalkylalkohols oder eines aprotischen Lösungsmittels bei einer Temperatur zwischen 80 und 125°C , wobei man das angestrebte Produkt, in dem A für CONHR_6 steht und R_6 die oben angegebene Bedeutung hat, erhält;

(c) wenigstens 1 Äquivalent Methylmagnesiumbromid in Gegenwart eines aprotischen Lösungsmittels bei einer Temperatur zwischen -50 und -80°C unter einer Decke aus inertem Gas, wobei man das angestrebte Produkt erhält, in dem A für COCH_3 steht;

(d) wenigstens 1 Äquivalent Phenyllithium in Gegenwart eines aprotischen Lösungsmittels bei einer Temperatur zwischen -50 und -80°C unter einer Decke aus Inertgas, wobei man das angestrebte Produkt erhält, bei dem A für COC_6H_5 steht; oder

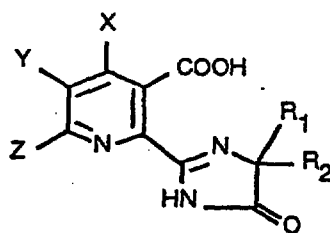
(e) wenigstens 1 Äquivalent Natriumtrimethylphosphonoacetat in Gegenwart eines aprotischen Lösungsmittels bei -50 bis -80°C unter einer Decke aus Inertgas, wobei man das angestrebte Produkt erhält, bei dem A für



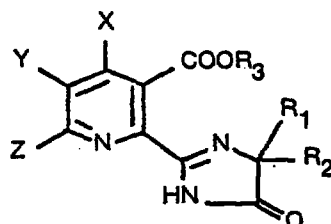
(f) wenigstens 1 Äquivalent Natriumborhydrid in Äthanol bei -10 bis $+15^\circ\text{C}$, wobei man das angestrebte Produkt erhält, bei dem A für CH_2OH steht.



9. Verfahren zur Herstellung einer Verbindung der Formel



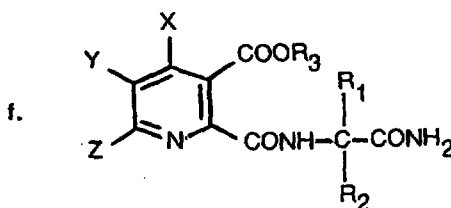
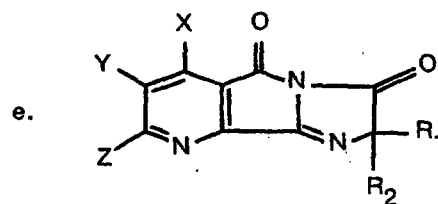
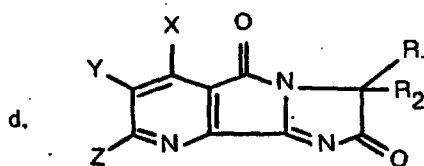
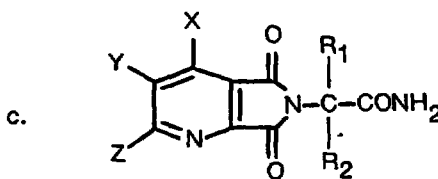
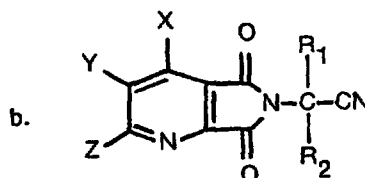
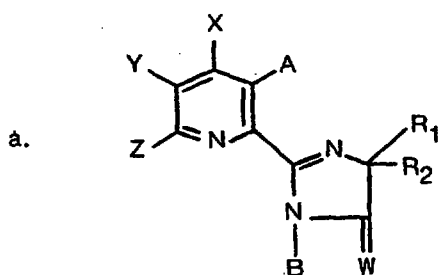
wobei R_1 , R_2 , X , Y und Z die in Anspruch 1 angegebene Bedeutung haben, dadurch gekennzeichnet, daß man eine Verbindung der Formel



wobei R_1 , R_2 , R_3 , X , Y und Z die oben angegebenen Bedeutungen haben; mit wenigstens 1 Äquivalent Base in wäßriger Lösung umgesetzt; das Gemisch auf 20 bis 50°C erhitzt; die Mischung abkühlt und ihren pH durch Zugabe einer starken Mineralsäure auf 6,5 bis 7,5 einstellt.

Revendications pour les Etats contractants: BE CH FR GB IT LI NL SE

1. Un composé répondant aux formules suivantes:



dans lesquelles

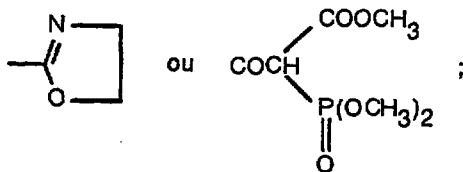
R_1 est un alkyle en C_1-C_4 ;

R_2 est un alkyle en C_1-C_4 ou un cycloalkyle en C_3-C_6 ; et, lorsque R_1 et R_2 sont pris ensemble, ils peuvent représenter un cycloalkyle en C_3-C_6 éventuellement substitué par un méthyle



A est COOR_3 , CONHR_6 , CHO , CH_2OH , COCH_3 , COC_6H_5 , CN , CH_3 , $\text{CH}=\text{NOH}$, CH_2COOH , CONHOH , $\text{CH}_2\text{CH}_2\text{COOH}$, CHR_6OH ,

5



10

R_3 est l'hydrogène,

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un alkyle en C_1-C_{12} éventuellement substitué par un des radicaux suivants: alcoxy en C_1-C_3 , halogéno, hydroxyle, cycloalkyle en C_3-C_6 , benzyloxy, furyle, phényle, halogénophényle, alkyl inférieur (en C_1-C_4) phényle, alcoxy inférieur (en C_1-C_4) phényle, nitrophényle, carboxyle, alcoxy inférieur (en C_1-C_4) carbonyle, cyano ou trialkyl inférieur (en C_1-C_4) ammonium;

un alcényle en C_3-C_{12} éventuellement substitué par un des radicaux suivants: alcoxy en C_1-C_3 , phényle, halogéno, alcoxy inférieur (en C_1-C_4) carbonyle, ou avec deux radicaux alcoxy en C_1-C_3 ou deux atomes d'halogène;

25

un cycloalkyle en C_3-C_6 éventuellement substitué par un ou deux radicaux alkyle en C_1-C_3 ;

un alcynyle en C_3-C_{10} éventuellement substitué par un ou deux radicaux alkyle en C_1-C_3 ; ou

un cation choisi dans le groupe constitué par les métaux alcalins, les métaux alcalino-terreux, le cuivre, le fer, le cobalt, l'argent, le nickel, l'ammonium et un ammonium organique;

R_6 est l'hydrogène, un hydroxyle, un alcényle en C_3 , un alcynyle en C_3 ou un alkyle en C_1-C_4 éventuellement substitué par un hydroxyle ou un atome de chlore,

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B est H, COR_4 ou SO_2R_5 , sous réserve que lorsque B est COR_4 ou SO_2R_5 : A est COOR_3 , où R_3 est autre que H, ou un cation formant un sel, CH_3 ou CN; W est O; et Y et Z ne sont pas un alkylamino, un hydroxyle ou un hydroxyalkyle inférieur en C_1-C_4 ;

R_4 est un alkyle en C_1-C_{11} , un chlorométhyle ou un phényle éventuellement substitué par un radical chloro, nitro ou méthoxy;

35

R_5 est un alkyle en C_1-C_4 ou un phényle éventuellement substitué par un radical méthyle;

W est O ou S;

R_6 est un alkyle en C_1-C_4 ou un phényle;

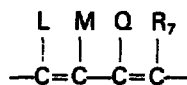
X est l'hydrogène, un halogène, un hydroxyle ou un méthyle, sous réserve que lorsque Y et Z sont pris ensemble pour former un cycle $-(\text{CH}_2)_n-$, dans lequel n est 3 ou 4, X est l'hydrogène;

40

Y et Z représentent chacun l'hydrogène, un halogène, un alkyle en C_1-C_6 , un hydroxy-alkyle inférieur en C_1-C_4 , un alcoxy en C_1-C_6 , un alkylthio en C_1-C_4 , un phénoxy, un halogénoalkyle en C_1-C_4 , un nitro, un cyano, un alkylamino en C_1-C_4 , un dialkyl inférieur (en C_1-C_4) amino, ou un alkylsulfonyl en C_1-C_4 , ou un phényle éventuellement substitué par un alkyle en C_1-C_4 , un alcoxy en C_1-C_4 ou un halogène; et, lorsqu'ils sont pris ensemble, Y et Z peuvent former un cycle $-(\text{CH}_2)_n-$, dans lequel n est 3 ou 4, sous

45

réserve que X soit l'hydrogène;



ou

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où L, M, Q et R_7 représentent chacun l'hydrogène, un halogène, un alkyle en C_1-C_4 , un alcoxy en C_1-C_4 , un alkylthio en C_1-C_4 , un alkylsulfonyl en C_1-C_4 , un halogénoalkyle en C_1-C_4 , NO_2 , CN, un phényle, un phénoxy, un amino, un alkylamino en C_1-C_4 , un dialkyl inférieur (en C_1-C_4) amino, un chlorophényle, un méthylphényle ou un phénoxy substitué par un radical Cl, CF_3 , NO_2 ou CH_3 , sous réserve qu'un seul de L, M, Q ou R_7 puisse représenter un substituant autre qu'un hydrogène, un halogène, un alkyle en C_1-C_4 ou

55

un alcoxy en C_1-C_4 ;

et lorsque W est O et A est CN, CH_3 ou COOR_3 , sous réserve que R_3 ne puisse pas être un alcényle ou un alcynyle, et Y et Z ne puissent pas être un alkylamino, dialkylamino ou alkylthio, et leurs N-oxydes, et lorsque R_1 et R_2 ne sont pas identiques, leur isomère optique, et, sauf lorsque R_3 est un cation formant un sel, leurs sels d'addition avec des acides.

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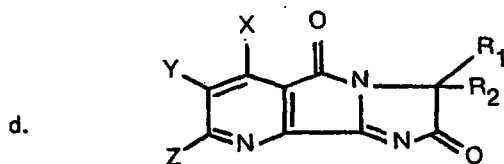
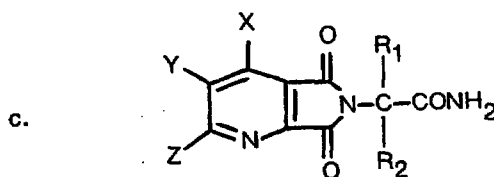
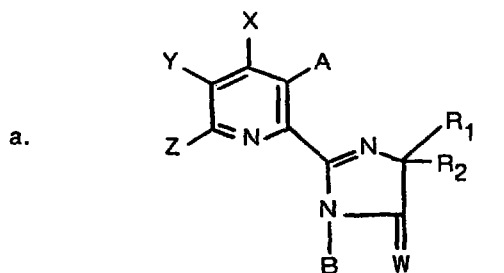
2. Un procédé pour la maîtrise des plantes des espèces monocotylédones et dicotylédones annuelles, vivaces et aquatiques, comprenant: l'application au feuillage desdites plantes ou au sol ou à l'eau

65



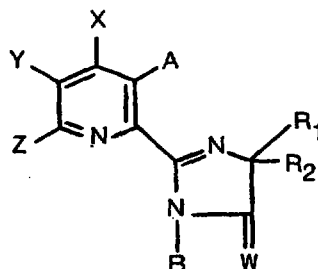
DNHOH,

contenant des semences ou d'autres organes de leur propagation d'une quantité herbicide efficace d'un composé répondant aux formules suivantes:



dans lesquelles R_1 , R_2 , X, Y et Z sont tels que définis dans la revendication 1, B est l'hydrogène, W est l'oxygène et A est COOR_3 ou CONHR_6 , où R_3 et R_6 sont tels que défini dans la revendication 1.

3. Un procédé pour défolier les cotonniers comprenant l'application à leur feuillage environ cinq à quinze jours avant la récolte prévue d'une quantité desséchante et défoliante d'un composé de formule suivante:



dans laquelle R_1 , R_2 , A, X, Y, Z, B et W sont tels que défini dans la revendication 1.

4. Une composition herbicide comprenant un diluant inerte solide ou liquide et une quantité herbicide efficace d'un composé de formules a, c, d dans la revendication 1.

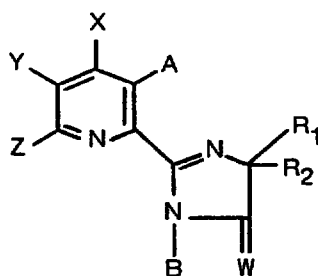
5. Une composition herbicide solide selon la revendication 4, comprenant de 20% à 45% en poids d'un support inerte solide finement divisé; de 45% à 80% en poids de l'ingrédient efficace herbicide; d'environ 2% à 5% en poids d'un agent dispersant et d'environ 2% à 5% en poids d'un agent tensio-actif.

6. Une composition herbicide liquide selon la revendication 4, comprenant de 5% à 25% en poids de l'ingrédient herbicide efficace; d'environ 65% à 90% en poids d'un solvant organique inerte et d'environ 5% à 10% en poids d'un agent tensio-actif.

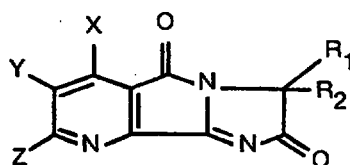
7. Une composition herbicide granulaire selon la revendication 4, comprenant environ 80% à 97% en poids d'un support granulaire inerte et environ 3% à 20% en poids de l'ingrédient herbicide efficace.



8. Un procédé de préparation d'un composé de formule:



15 dans laquelle R_1 , R_2 , X, Y et Z sont tels que défini dans la revendication 1, A est COOR_3 , où R_3 est tel que défini dans la revendication 1; ou CONHR_6 , où R_6 est tel que défini dans la revendication 1; caractérisé par: la réaction d'un composé répondant à la formule:

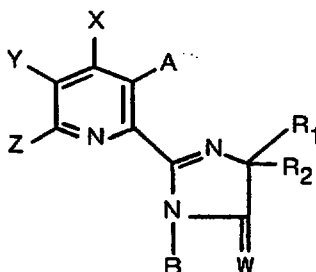


25 dans laquelle R_1 , R_2 , X, Y et Z sont tels que défini dans la revendication 1 avec

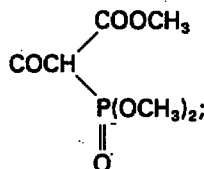
(a) au moins un équivalent d'un alcool de formule $R_3\text{OH}$, et un alcoolate de métal alcalin, $R_3\text{O}^\ominus\text{M}^\oplus$, où R_3 est tel que défini dans la revendication 1 et $\text{M}^\oplus$ est un métal alcalin, à une température comprise entre 20°C et 50°C , en présence ou non d'un solvant aprotique; formant ainsi le produit désiré dans lequel A est COOR_3 , où R_3 est tel que défini ci-dessus; ou

(b) au moins un équivalent d'une amine de formule: $R_6\text{NH}_2$, où R_6 est tel que défini dans la revendication 1, en présence ou non d'un solvant aprotique, à une température comprise entre 80°C et 125°C , formant ainsi le produit désiré dans lequel A est CONHR_6 , où R_6 est tel que défini ci-dessus.

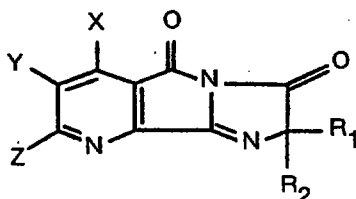
9. Un procédé de préparation d'un composé de formule:



45 dans laquelle R_1 , R_2 , X, Y et Z sont tels que défini dans la revendication 1, A est COOR_3 , CONHR_6 , CH_2OH , COCH_3 , COC_6H_5 ou



55 où R_3 est tel que défini dans la revendication 1, à l'exception de l'hydrogène, B est l'hydrogène et W est l'oxygène, comprenant la réaction d'un composé de formule:



dans laquelle R_1 , R_2 , X , Y et Z sont tels que défini ci-dessus; avec

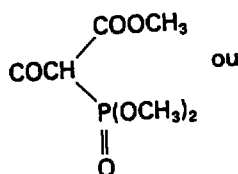
(a) au moins un équivalent d'un alcool de formule R_3OH et un alcoolate de métal alcalin $R_3O^-M^+$, où R_3 est tel que décrit ci-dessus et M est un métal alcalin, en présence ou non d'un solvant aprotique à une température comprise entre $20^\circ C$ et $50^\circ C$, obtenant ainsi le produit désiré dans lequel A est $COOR_3$ et R_3 est tel que défini ci-dessus;

(b) au moins un équivalent d'une amine de formule R_6NH_2 , où R_6 est tel que défini dans la revendication 1, en présence d'un alcool alkylique inférieur en C_1-C_4 ou d'un solvant aprotique, à une température comprise entre $80^\circ C$ et $125^\circ C$, obtenant ainsi le produit désiré dans lequel A est $CONHR_6$, où R_6 est tel que défini ci-dessus;

(c) au moins un équivalent de bromure de méthylmagnésium en présence d'un solvant aprotique à une température comprise entre $-50^\circ C$ et $-80^\circ C$, sous une protection de gaz inerte, obtenant ainsi le produit désiré dans lequel A est $COCH_3$;

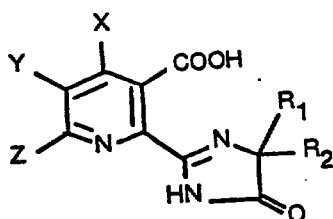
(d) au moins un équivalent de phényllithium en présence d'un solvant aprotique, à une température comprise entre $-50^\circ C$ et $-80^\circ C$, sous une protection de gaz inerte, obtenant ainsi le produit désiré dans lequel A est COC_6H_5 ; ou

(e) au moins un équivalent de triméthylphosphonoacétate de sodium en présence d'un solvant aprotique entre $-50^\circ C$ et $-80^\circ C$, sous une protection de gaz inerte, obtenant ainsi le produit désiré dans lequel A est

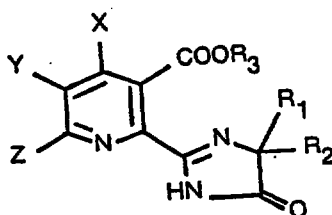


(f) au moins un équivalent de borohydrure de sodium dans l'éthanol entre -10 et $+15^\circ C$, obtenant ainsi le produit désiré dans lequel A est CH_2OH .

10. Un procédé de préparation d'un composé de formule:



dans laquelle R_1 , R_2 , R_3 , X , Y et Z sont tels que défini dans la revendication 1, caractérisé par la réaction d'un composé de formule:

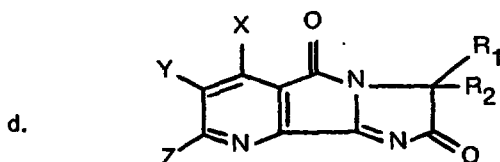
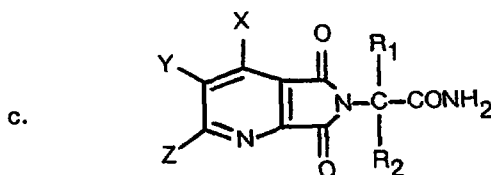
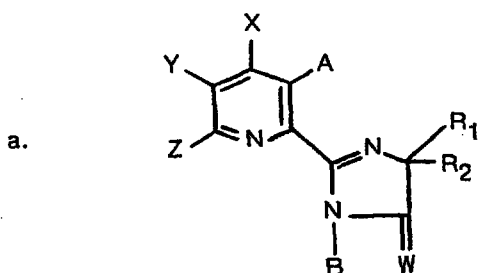


dans laquelle R_1 , R_2 , R_3 , X , Y et Z sont tels que défini ci-dessus avec au moins un équivalent d'une base en solution aqueuse, le chauffage du mélange entre $20^\circ C$ et $50^\circ C$; le refroidissement dudit mélange et l'ajustement de son pH entre 6,5 et 7,5 par addition d'un acide minéral fort.



Revendications pour l'Etat contractant: AT

1. Une composition herbicide comprenant un diluant inerte solide ou liquide et une quantité herbicide efficace d'un composé de formule a, c ou d.

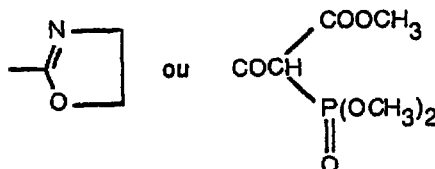


dans lesquelles

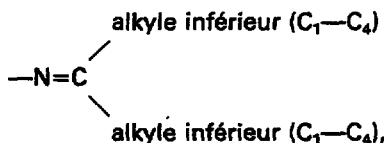
R₁ est un alkyle en C₁—C₄;

R₂ est un alkyle en C₁—C₄ ou un cycloalkyle en C₃—C₆; et, lorsque R₁ et R₂ sont pris ensemble, ils peuvent représenter un cycloalkyle en C₃—C₆ éventuellement substitué par un méthyle

A est COOR₃, CONHR₆, CHO, CH₂OH, COCH₃, COC₆H₅, CN, CH₃, CH=NOH, CH₂COOH, CONHOH, CH₂CH₂COOH, CHR₈OH,



R₃ est l'hydrogène,



un alkyle en C₁—C₁₂ éventuellement substitué par un des radicaux suivants: alcoxy en C₁—C₃, halogéno, hydroxyle, cycloalkyle en C₃—C₆, benzyloxy, furyle, phényle, halogénophényle, alkyl inférieur (en C₁—C₄) phényle, alcoxy inférieur (en C₁—C₄) phényle, nitrophényle, carboxyle, alcoxy inférieur (en C₁—C₄) carbonyle, cyano ou trialkyl inférieur (en C₁—C₄) ammonium;

un alcényle en C₃—C₁₂ éventuellement substitué par un des radicaux suivants: alcoxy en C₁—C₃, phényle, halogéno, alcoxy inférieur (en C₁—C₄) carbonyle, ou avec deux radicaux alcoxy en C₁—C₃ ou deux atomes d'halogène;

un cycloalkyle en C₃—C₆ éventuellement substitué par un ou deux radicaux alkyle en C₁—C₃;

un alcynyle en C₃—C₁₀ éventuellement substitué par un ou deux radicaux alkyle en C₁—C₃;

un cation choisi dans le groupe constitué par les métaux alcalins, les métaux alcalino-terreux, le cuivre, le fer, le cobalt, l'argent, le nickel, l'ammonium et un ammonium organique;

R₆ est l'hydrogène, un hydroxyle, un alcényle en C₃, un alcynyle en C₃ ou un alkyle en C₁—C₄ éventuellement substitué par un hydroxyle ou un atome de chlore,



B est H, COR₄ ou SO₂R₅, sous réserve que lorsque B est COR₄ ou SO₂R₅, A est COOR₃, où R₃ est autre que H, ou un cation formant un sel, CH₃ ou CN; W est O; et Y et Z ne sont pas un alkylamino, un hydroxyle ou un hydroxyalkyle inférieur en C₁—C₄;

R₄ est un alkyle en C₁—C₁₁, un chlorométhyle ou un phényle éventuellement substitué par un radical chloro, nitro ou méthoxy;

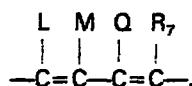
R₅ est un alkyle en C₁—C₄ ou un phényle éventuellement substitué par un radical méthyle;

W est O ou S;

R₆ est un alkyle en C₁—C₄ ou un phényle;

X est l'hydrogène, un halogène, un hydroxyle ou un méthyle, sous réserve que lorsque Y et Z sont pris ensemble pour former un cycle —(CH₂)_n, dans lequel n est 3 ou 4, X est l'hydrogène;

Y et Z représentent chacun l'hydrogène, un halogène, un alkyle en C₁—C₆, un hydroxy-alkyle inférieur en C₁—C₄, un alcoxy en C₁—C₆, un alkylthio en C₁—C₄, un phénoxy, un halogénoalkyle en C₁—C₄, un nitro, un cyano, un alkylamino en C₁—C₄, un dialkyl inférieur (en C₁—C₄) amino, ou un alkylsulfonyl en C₁—C₄, ou un phényle éventuellement substitué par un alkyle en C₁—C₄, un alcoxy en C₁—C₄ ou un halogène; et, lorsqu'ils sont pris ensemble, Y et Z peuvent former un cycle —(CH₂)_n—, dans lequel n est 3 ou 4, sous réserve que X soit l'hydrogène;



ou

où L, M, Q et R₇ représentent chacun l'hydrogène, un halogène, un alkyle en C₁—C₄, un alcoxy en C₁—C₄, un alkylthio en C₁—C₄, un alkylsulfonyl en C₁—C₄, un halogénoalkyle en C₁—C₄, NO₂, CN, un phényle, un phénoxy, un amino, un alkylamino en C₁—C₄, un dialkyl inférieur (en C₁—C₄) amino, un chlorophényle, un méthylphényle ou un phénoxy substitué par un radical Cl, CF₃, NO₂ ou CH₃, sous réserve qu'un seul de L, M, Q ou R₇ puisse représenter un substituant autre qu'un hydrogène, un halogène, un alkyle en C₁—C₄ ou un alcoxy en C₁—C₄;

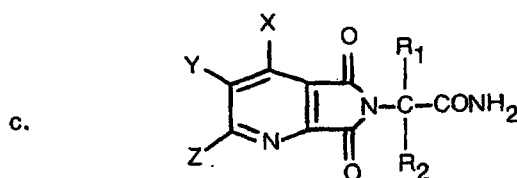
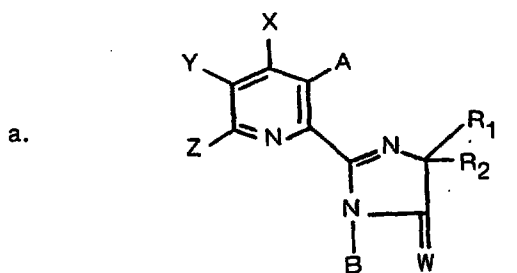
et lorsque W est O et A est CN, CH₃ ou COOR₃, sous réserve que R₃ ne puisse pas être un alcényle ou un alcynyle, et Y et Z ne puissent pas être un alkylamino, dialkylamino ou alkylthio, et leurs N-oxydes, et lorsque R₁ et R₂ ne sont pas identiques, leur isomère optique, et, sauf lorsque R₃ est un cation formant un sel, leurs sels d'addition avec des acides.

2. Une composition herbicide solide selon la revendication 1, comprenant de 20% à 45% en poids d'un support inerte solide finement divisé; de 45% à 80% en poids de l'ingrédient efficace herbicide; d'environ 2% à 5% en poids d'un agent dispersant et d'environ 2% à 5% en poids d'un agent tensio-actif.

3. Une composition herbicide liquide selon la revendication 1, comprenant de 5% à 25% en poids de l'ingrédient herbicide efficace; d'environ 65% à 90% en poids d'un solvant organique inerte et d'environ 5% à 10% en poids d'un agent tensio-actif.

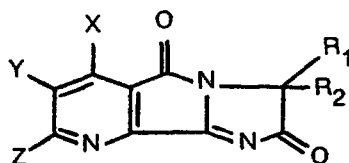
4. Une composition herbicide granulaire selon la revendication 4, comprenant environ 80% à 97% en poids d'un support granulaire inerte et environ 3% à 20% en poids de l'ingrédient herbicide efficace.

5. Un procédé pour la maîtrise des plantes des espèces monocotylédones et dicotylédones annuelles, vivaces et aquatiques, comprenant: l'application au feuillage desdites plantes ou au sol ou à l'eau contenant des semences ou d'autres organes de leur propagation d'une quantité herbicide efficace d'un composé répondant aux formules suivantes:



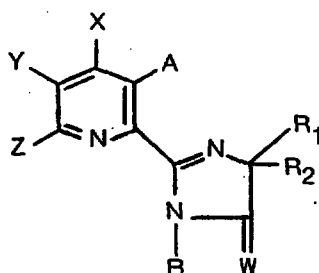
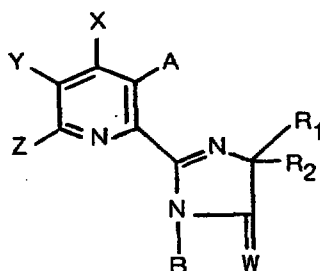


d.



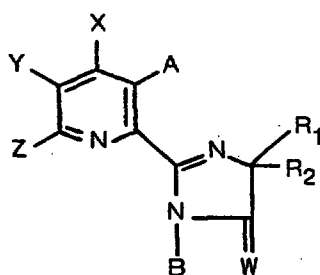
dans lesquelles R_1 , R_2 , X, Y et Z sont tels que définis dans la revendication 1, B est l'hydrogène, W est l'oxygène et A est COOR_3 ou CONHR_6 , où R_3 et R_6 sont tels que défini dans la revendication 1.

6. Un procédé pour défolier les cotonniers comprenant l'application à leur feuillage environ cinq à quinze jours avant la récolte prévue d'une quantité desséchante et défoliante d'un composé de formule suivante:

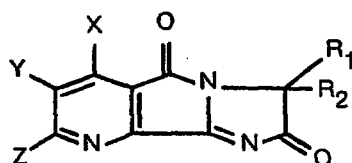


dans laquelle R_1 , R_2 , A, X, Y, Z, B et W sont tels que défini dans la revendication 1.

7. Un procédé de préparation d'un composé de formule:



dans laquelle R_1 , R_2 , X, Y et Z sont tels que défini dans la revendication 1, A est COOR_3 , où R_3 est tel que défini dans la revendication 1, ou CONHR_6 , où R_6 est tel que défini dans la revendication 1; caractérisé par: la réaction d'un composé répondant à la formule:



dans laquelle R_1 , R_2 , X, Y et Z sont tels que défini dans la revendication 1 avec

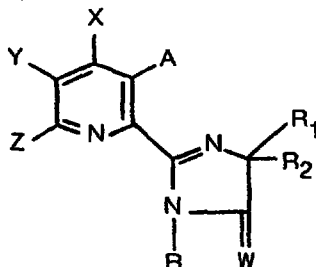
(a) au moins un équivalent d'un alcool de formule R_3OH , et un alcoolate de métal alcalin, $\text{R}_3\text{O}^\ominus\text{M}^\oplus$, où R_3 est tel que défini dans la revendication 1 et $\text{M}^\oplus$ est un métal alcalin, à une température comprise entre



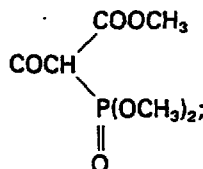
20°C et 50°C, en présence ou non d'un solvant aprotique; formant ainsi le produit désiré dans lequel A est COOR_3 , où R_3 est tel que défini ci-dessus; ou

(b) au moins un équivalent d'une amine de formule: $R_6\text{NH}_2$, où R_6 est tel que défini dans la revendication 1, en présence ou non d'un solvant aprotique, à une température comprise entre 80°C et 125°C, formant ainsi le produit désiré dans lequel A est CONHR_6 , où R_6 est tel que défini ci-dessus.

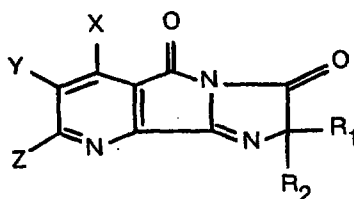
8. Un procédé de préparation d'un composé de formule:



dans laquelle R_1 , R_2 , X, Y et Z sont tels que défini dans la revendication 1, A est COOR_3 , CONHR_6 , CH_2OH , COCH_3 , COC_6H_5 ou



où R_3 est tel que défini dans la revendication 1, à l'exception de l'hydrogène, B est l'hydrogène et W est l'oxygène, comprenant la réaction d'un composé de formule:



dans laquelle R_1 , R_2 , X, Y et Z sont tels que défini ci-dessus; avec

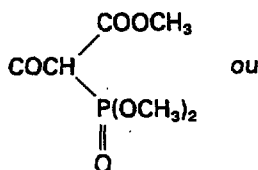
(a) au moins un équivalent d'un alcool de formule $R_3\text{OH}$ et un alcoolate de métal alcalin $R_3\text{O}^-\text{M}^+$, où R_3 est tel que décrit ci-dessus et M est un métal alcalin, en présence ou non d'un solvant aprotique à une température comprise entre 20°C et 50°C, obtenant ainsi le produit désiré dans lequel A est COOR_3 et R_3 est tel que défini ci-dessus;

(b) au moins un équivalent d'une amine de formule $R_6\text{NH}_2$, où R_6 est tel que défini dans la revendication 1, en présence d'un alcool alkylique inférieur en C_1-C_4 ou d'un solvant aprotique, à une température comprise entre 80°C et 125°C, obtenant ainsi le produit désiré dans lequel A est CONHR_6 , où R_6 est tel que défini ci-dessus;

(c) au moins un équivalent de bromure de méthylmagnésium en présence d'un solvant aprotique à une température comprise entre -50°C et -80°C, sous une protection de gaz inerte, obtenant ainsi le produit désiré dans lequel A est COCH_3 ;

(d) au moins un équivalent de phényllithium en présence d'un solvant aprotique, à une température comprise entre -50°C et -80°C, sous une protection de gaz inerte, obtenant ainsi le produit désiré dans lequel A est COC_6H_5 ; ou

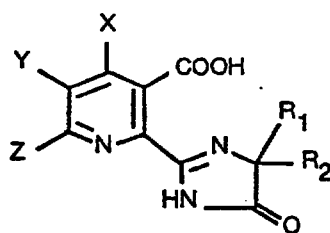
(e) au moins un équivalent de triméthylphosphonoacétate de sodium en présence d'un solvant aprotique entre -50°C et -80°C, sous une protection de gaz inerte, obtenant ainsi le produit désiré dans lequel A est



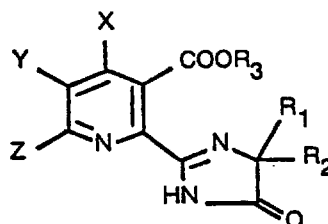
(f) au moins un équivalent de borohydrure de sodium dans l'éthanol entre -10 et +15°C, obtenant ainsi le produit désiré dans lequel A est CH_2OH .



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