1035,097

PATENT SPECIFICATION

NO DRAWINGS

1,035,097

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Int. Cl.:—C 07 d 51/28 // A 01 n

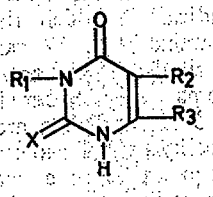
COMPLETE SPECIFICATION

Improvements relating to Herbicides

We, E. I. DU PONT DE NEMOURS AND COMPANY, a Corporation organised and existing under the laws of the State of Delaware, United States of America, of Wilmington 98, Delaware, United States of America, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

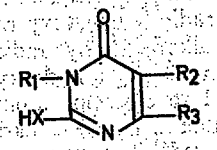
This invention relates to 3-substituted uracils and is an improvement in or modification of the invention described in our Patent No. 968,661.

Our Specification No. 968,661 discloses that certain 3-substituted uracils have herbicidal activity. Those 3-substituted uracils are compounds of the general formula:



I

or the corresponding isomeric formula:



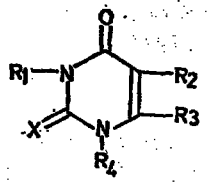
II

wherein R_1 is a covalent organic radical of molecular weight 15 to 250 which is an alkyl group of up to 10 carbon atoms, a substituted alkyl group in which the alkyl group contains up to 3 carbon atoms, a phenyl group, a substituted phenyl group, an aralkyl group of 7 or 8 carbon atoms, a substituted aralkyl group of 7 to 12 carbon atoms, an alkenyl group of 3 to 6 carbon atoms, a propynyl group, a butynyl group, a cycloalkyl group of 5 to 8 carbon atoms, a cycloalkenyl group of 5 to 8 carbon atoms or a cyano group; R_2 is a hydrogen or halogen atom or an alkyl group of up to 4 carbon atoms, an alkoxy group of up to 3 carbon atoms, a nitro group, an alkoxymethyl group of 2 to 4 carbon atoms, a hydroxymethyl group, a hydroxyethyl group, an allyl group, a thiocyanato group, a cyano group, a halogenomethyl group or a methyl thiomethyl group; R_3 is a hydrogen or chlorine atom or an alkyl group of up to 5 carbon atoms, a methoxy group or an ethoxy group; or R_2 and R_3 together form a divalent alkylene bridge of formula $(CH_2)_n$, wherein n is 3, 4 or 5; and X is oxygen or sulphur, preferably oxygen; with the proviso that if R_2 is a hydrogen atom, then either R_3 is an alkyl group of 1 to 5 carbon atoms and R_1 is an alkyl group of 3 to 6 carbon atoms, an allyl group, a propynyl group or a cycloalkyl or cycloalkenyl group of 5 to 8 carbon atoms, or R_3 is a hydrogen atom and R_1 is a cycloalkyl or cycloalkenyl group of 5 to 8 carbon atoms; and metal salts of such uracils.

Within the broad class of 3-substituted uracils defined in Specification No. 968,661 are four particular classes which are the subject of our Patents Nos. 968,662; 968,663; 968,664 and 968,665, which are patents of addition to

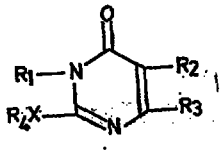
[*Price 4s. 6d.*]

Patent No. 968,661. Certain other 3-substituted uracils having herbicidal properties are disclosed in our Patent No. 968,666, which is also a patent of addition to our Patent No. 968,661. These uracils, all of which have a substituent in the 1- or 2-position are compounds of the general formula:



I

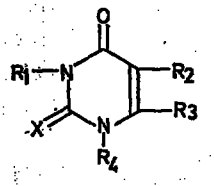
or the corresponding isomeric formula:



II

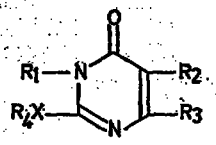
wherein R_1 is a covalent organic radical of molecular weight 15 to 250 which is an alkyl group of up to 10 carbon atoms, a substituted alkyl group in which the alkyl group contains up to 3 carbon atoms, a phenyl group, a substituted phenyl group, an aralkyl group of 7 or 8 carbon atoms, a substituted aralkyl group of 7 to 12 carbon atoms, an alkenyl group of 3 to 6 carbon atoms, a propynyl group, a butynyl group, a cycloalkyl group of 5 to 8 carbon atoms, a cycloalkenyl group of 5 to 8 carbon atoms or a cyano group; R_2 is a hydrogen or halogen atom or an alkyl group of up to 4 carbon atoms, an alkoxy group of up to 3 carbon atoms, a nitro group, an alkoxymethyl group of 2 to 4 carbon atoms, a hydroxymethyl group, a hydroxyethyl group, an allyl group, a thiocyanato group, a cyano group, a halogenomethyl group, or a methyl thiomethyl group; R_3 is a hydrogen or chlorine atom or an alkyl group of up to 5 carbon atoms, a methoxy group, or an ethoxy group; or R_2 and R_3 together form a divalent alkylene bridge of formula $(CH_2)_n$, wherein n is 3, 4 or 5; R_4 is a covalent radical of molecular weight up to 250 which is an alkyl group of up to 3 carbon atoms, a hydroxymethyl group, a hydroxyethyl group, a carboxyethyl group, a substituted carbamyl group, a substituted thiocarbamyl group, a diethylphosphoryl group, a chloromethylthio group, a phenylthio group, a halogenophenylthio group, a nitrophenylthio group, a dinitrophenylthio group, a tolylthio group or an acyl group; and X is oxygen or sulphur; with the proviso that if R_2 is a hydrogen atom and R_4 is a methyl group, then R_1 is a cycloalkyl or cycloalkenyl group of 5 to 8 carbon atoms.

It has now been discovered that a wider range of 3-substituted uracils having a 1-substituent have herbicidal activity, namely those compounds of the general formula



I

or the corresponding isomeric formula



II

wherein

R_1 represents an alkyl radical containing 1 to 10 carbon atoms, a substituted alkyl radical containing 1 to 10 carbon atoms, an aryl radical containing 5 to 14 carbon atoms, a substituted aryl radical containing 6 to 14 carbon atoms, an aralkyl radical containing 5 to 15 carbon atoms, a substituted aralkyl radical containing 7 to 15 carbon atoms, an alkenyl radical containing 3 to 10 carbon atoms, an alkynyl radical containing 3 to 10 carbon atoms, a cycloalkyl radical containing 3 to 12 carbon atoms, a cycloalkenyl radical containing 4 to 12 carbon atoms, a substituted cycloalkyl radical in which the cycloalkyl radical contains 3 to 12 carbon atoms, a substituted cycloalkenyl radical in which the cycloalkenyl radical contains 4 to 12 carbon atoms, a cycloalkyl alkyl radical containing 4 to 13 carbon atoms, a cycloalkenyl alkyl radical containing 5 to 13 carbon atoms, a (substituted cycloalkyl) alkyl radical containing 5 to 14 carbon atoms or a cyano radical;

R_2 represents a hydrogen, chlorine, fluorine, bromine or iodine atom, a methyl radical, an ethyl radical, a propyl radical, a butyl radical, a methoxy radical, an ethoxy radical, a propoxy radical, a butoxy radical, a nitro radical, an alkoxy-methyl radical containing 2 to 6 carbon atoms, a hydroxy alkyl radical containing 1 to 6 carbon atoms, an alkenyl radical containing 3 to 6 carbon atoms, a thiocyanato radical, a cyano radical, a mercaptomethyl radical, a methylthiomethyl radical, a phenylthiomethyl radical, an alkylthio radical containing 1 to 4 carbon atoms, a bromomethyl radical, a fluoromethyl

radical, a chloromethyl radical or a carboxymethylthiomethyl radical;

R_3 represents a hydrogen, chlorine or bromine atom, an alkyl radical containing 1 to 5 carbon atoms, a chloroalkyl radical containing 1 to 4 carbon atoms, a bromoalkyl radical containing 1 to 4 carbon atoms, or an alkoxy radical containing 1 to 5 carbon atoms; or

R_2 and R_3 together represent a divalent radical which forms, together with the carbon atoms to which R_2 and R_3 are attached, a 5-, 6- or 7-membered ring, preferably a divalent alkylene radical of formula $(CH_2)_n$ where n is 3, 4 or 5;

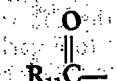
R_4 represents a covalent radical of molecular weight from 15 to 250 which is an alkyl radical containing 1 to 10 carbon atoms, a substituted alkyl radical containing 1 to 10 carbon atoms, a cycloalkyl radical containing 3 to 12 carbon atoms, a substituted cycloalkyl radical in which the cycloalkyl radical contains 3 to 12 carbon atoms, a cycloalkylalkyl radical containing 4 to 13 carbon atoms, a (substituted cycloalkyl)alkyl radical in which the cycloalkylalkyl radical contains 4 to 13 carbon atoms, a phenyl radical, a substituted phenyl radical, a phenylalkyl radical, a substituted phenylalkyl radical, a dialkylamino radical containing 2 to 10 carbon atoms, an alkoxy radical containing 1 to 10 carbon atoms, a carbamyl radical, a substituted carbamyl radical, a thiocarbamyl radical, a substituted thiocarbamyl radical, a glycosyl radical, a cyano radical, an acyl radical, a carboxyethyl radical, a dialkoxyphosphoryl radical containing 2 to 6 carbon atoms, an alkylthio radical containing 1 to 12 carbon atoms, a bromoalkylthio radical containing 1 to 12 carbon atoms, a chloroalkylthio radical containing 1 to 12 carbon atoms, a benzylthio radical, a phenylthio radical, a halophenylthio radical, a mononitrophenylthio radical, a *p-tert* butylphenylthio radical a dinitrophenylthio radical or a tolylthio radical; and

X represents an oxygen or sulphur atom, preferably an oxygen atom.

It will be seen that the definition given above overlaps the definition of the 3-substituted uracils given in Patent No. 968,666 and quoted above. The present invention relates only to those uracils which are outside the scope of the definition of Patent No. 968,666.

If R_1 represents a substituted alkyl radical, the or each substituent is preferably a bromine or chlorine atom, a hydroxy radical, an alkoxy radical, an alkoxycarbonyl radical, a dialkylamino radical or a cyano radical; if R_1 represents a substituted aryl radical, the or each substituent is preferably a chlorine, bromine or fluorine atom, an alkoxy radical, an alkyl radical, a nitro radical, a chloroalkyl radical, a chloroalkoxy radical or a trifluoromethyl radical; if R_1 represents a substituted benzyl radical the or each substituent is preferably a chlorine atom, an alkyl radical, an alkoxy radical or a nitro radical; and if R_1 represents a substituted cycloalkyl, substituted cycloalkenyl, (substituted cycloalkyl) alkyl or (substituted cycloalkenyl)alkyl radical the or each substituent is preferably an alkyl radical containing 1 to 4 carbon atoms, a methoxy radical or a chlorine or bromine atom.

If R_4 represents a substituted alkyl radical the or each substituent is preferably a bromine or chlorine atom, an hydroxy radical, an alkoxy radical, an alkoxycarbonyl radical, a dialkylamino radical or a cyano radical; if R_4 represents a substituted phenyl radical the or each substituent is preferably a chlorine, bromine or fluorine atom, an alkoxy radical, an alkyl radical, a nitro radical, a chloroalkyl radical, a chloroalkoxy radical or a trifluoromethyl radical; if R_4 represents a substituted benzyl radical the or each substituent is preferably a chlorine atom, an alkyl radical, an alkoxy radical or a nitro radical; if R_4 represents a substituted carbamyl or thiocarbamyl radical, the or each substituent is preferably an alkyl radical containing 1 to 4 carbon atoms, a phenyl radical, a monochlorophenyl radical, a dichlorophenyl radical or a methoxy radical. The term "acyl radical" is used herein in a broad sense to denote a radical derived from an organic acid by removal of the hydroxyl group. If R_4 represents an acyl radical it is preferably a radical of the formula



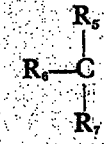
wherein

R_{11} represents a hydrogen atom, an alkyl radical containing 1 to 4 carbon atoms, a monochloroalkyl radical containing 1 to 4 carbon atoms, a polychloroalkyl radical containing 1 to 4 carbon atoms, a phenyl radical, a chlorophenyl radical containing 1, 2 or 3 chlorine atoms, a benzyl radical, a chlorobenzyl radical containing 1, 2 or 3 chlorine atoms, a phenoxymethyl radical or a chlorophenoxymethyl radical containing 1 to 3 chlorine atoms.

In one preferred class of compounds,

X represents an oxygen atom,

R_1 represents a cycloalkyl or cycloalkenyl radical as defined above, a phenyl radical, or a radical of formula



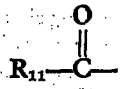
where R_5 represents a hydrogen atom or methyl radical, R_6 represents a methyl or ethyl radical and R_7 represents an alkyl radical containing 1 to 5 carbon atoms;

R_2 represents a hydrogen or halogen atom, or a methyl, nitro, hydroxymethyl or methoxymethyl radical;

R_3 represents a hydrogen atom or a methyl radical; or

R_2 and R_3 together represent a divalent radical of formula $(CH_2)_n$ where n is 3, 4 or 5; and

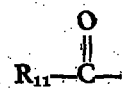
R_4 represents a trichloromethylthio radical, an alkyl or substituted alkyl radical containing 1 to 10 carbon atoms, or an acyl radical of formula



where R_{11} is as defined above,

with the proviso that when R_2 represents a hydrogen atom, R_1 represents a cycloalkyl or cycloalkenyl radical. Within this class particularly preferred compounds are those in which (A) R_1 represents a 1-alkylethyl radical wherein the alkyl radical contains 1 to 4 carbon atoms; R_2 represents a halogen atom; R_3 represents a methyl radical and R_4 represents a methyl radical, an acyl radical containing 2 to 5 carbon atoms or a trichloromethylthio radical; or (B) R_1 represents a phenyl radical, R_2 represents a halogen atom, R_3 represents a methyl radical and R_4 represents a trichloromethylthio or an acyl radical containing 2 to 5 carbon atoms; or (C) R_1 represents a cycloalkyl radical, R_2 represents a halogen atom, R_3 represents a methyl radical and R_4 represents a trichloromethylthio radical or an acyl radical containing 2 to 5 carbon atoms.

The compounds to which the present invention relates in which X represents an oxygen atom; R_2 represents a halogen atom; R_3 represents a methyl radical; and R_4 represents a trichloromethylthio radical or an acyl radical of formula



wherein R_{11} is as defined above, are believed to be novel and as such form part of the present invention.

Specific radicals included within the term "substituted alkyl" as used herein include bromoalkyl of 1 to 10 carbon atoms, chloroalkyl of 1 to 10 carbon atoms, hydroxyalkyl of 1 to 10 carbon atoms, alkoxyalkyl of 2 to 10 carbon atoms, alkoxy carbonyl alkyl of 3 to 10 carbon atoms, dialkyl amino alkyl of 3 to 10 carbon atoms and cyanoalkyl of 2 to 10 carbon atoms.

Specific radicals included within the terms "aryl", and "substituted aryl" as used herein include phenyl, naphthyl, *o*-biphenyl, pyridyl, chlorophenyl, bromophenyl, alkoxyphenyl, dichlorophenyl, dibromophenyl, fluorophenyl, trichlorophenyl, alkylphenyl of 7 to 11 carbon atoms, dialkylphenyl of 8 to 12 carbon atoms, chloroalkylphenyl of 7 to 10 carbon atoms, nitrochlorophenyl, nitrophenyl, dichloronitrophenyl, chloroalkoxyphenyl of 7 to 11 carbon atoms, trifluoromethylphenyl, alkylnaphthyl of 11 to 15 carbon atoms, chloronaphthyl, tetrahydronaphthyl and indenyl.

Specific radicals included within the terms "aralkyl" and "substituted aralkyl" as used herein include furfuryl, benzyl, phenylalkyl of 8 to 11 carbon atoms (total), chlorobenzyl, dichlorobenzyl, alkylbenzyl of 8 to 11 carbon atoms (total), dialkylbenzyl of 9 to 13 carbon atoms (total), nitrobenzyl, alkoxybenzyl of 8 to 11 carbon atoms (total) and naphthylmethyl.

Specific radicals included within the terms "cycloalkyl", "cycloalkenyl", "cycloalkyl alkyl", and "cycloalkenyl alkyl" as used herein include cyclododecyl, cyclohexyl, cyclohexenyl, cyclohexylalkyl, cyclohexenyl alkyl, cyclopentyl, cyclopentenyl, cyclopentyl alkyl, cyclopentenyl alkyl, cycloheptyl, cycloheptenyl, cyclooctyl, norbornyl, norbornenyl, norbornyl alkyl, norbornenyl alkyl, bicyclo (2,2,2) octyl, bicyclo (2,2,2) octenyl, bicyclo (2,2,2) octyl alkyl, bicyclo (2,2,2) octenyl alkyl, cyclopropyl, cyclobutyl, cyclobutyalkyl, cyclobutenyl, cyclobutenylalkyl, indanyl, hexahydroindenyl, tetrahydroindanyl, hexahydroindenyl alkyl, hexahydroindanyl, tetrahydroindanyl alkyl, fenchyl, bornyl, hexahydroindanyl alkyl, hexahydro-4,7-methanoindenyl, hexahydro - 4,7 - methanoindenyl alkyl, hexahydro - 4,7 - methanoindanyl, tetrahydro - 4,7 - methanoindanyl, hexahydro - 4,7 - methanoindanyl alkyl, tetrahydro - 4,7 - methanoindanyl alkyl, decahydronaphthyl, decahydronaphthyl alkyl, tetrahydronaphthyl, tetrahydronaphthyl alkyl, decahydro-1,4-methanonaphthyl, decahydro - 1,4 - methanonaphthyl alkyl, octahydro - 1,4 - methanonaphthyl, octahydro - 1,4 - methanonaphthyl alkyl, decahydro - 1,4,5,8 - dimethanonaphthyl, decahydro - 1,4,5,8 - dimethanonaphthyl alkyl, octahydro - 1,4,5,8 - dimethanonaphthyl, octahydro-1,4,5,8-dimethanonaphthyl alkyl.

The 3-substituted uracils to which the present invention relates can be prepared by methods known for the preparation of the same or related compounds. Various general preparative methods are disclosed in Patent No. 968,666 and examples of the preparation of specific compounds are disclosed in the Examples given later in this specification.

It will be noted that the definition above refers to the isomeric enol form of the uracil, as well as the usual keto form. It is thought that there is a tautomeric equilibrium between the two forms. However, for the sake of convenience the keto form is generally referred to herein. It may also be noted that since "uracil" is the commonly accepted name for 2,4-dihydroxypyrimidine, or, in its keto form, 1,2,3,4 - tetra - hydropyrimidine - 2,4 - dione, the compounds can also be named as pyrimidines.

The compounds to which the present invention relates (referred to herein as "the said compounds") can be formulated as herbicidal compositions comprising at least one of the said compounds associated with a compatible diluent or surface-active agent, or both. The term "herbicidal composition" is used herein to include both compositions which are ready for use as herbicides and concentrates which require dilution before use as herbicides. The compositions may contain for example 0.5 to 95% by weight of the 3-substituted uracil. (Parts, proportions and percentages are by weight throughout this specification except where otherwise noted.)

The diluent may be a liquid other than an oil, especially water, or an oil, or a solid carrier. The term "oil" is used herein to denote a liquid which is immiscible with water and soluble in ether, and which has a boiling point not lower than 125°C. Two or more different types of diluent may be present, as for example in compositions obtained by dispressing a wettable powder in a liquid diluent. Liquid compositions may be in the form of solutions or dispersions.

Powder and dust preparations can be made by mixing the said compounds with finely-divided solids, preferably talcs, natural clays, pyrophyllite, diatomaceous earth, flours such as walnut shell, wheat, redwood, soya bean and cotton seed flours, or inorganic substances such as magnesium carbonate, calcium carbonate, calcium phosphate, sulphur and lime. These preparations are made by thoroughly blending the active ingredient and the solid. The particles in such preparations are preferably less than 50 microns in average diameter.

Water-soluble preparations can be prepared by mixing a said compound with an alkaline solubilising agent. Solid bases having a pH of at least 9.5 in a 1% aqueous solution, such as sodium or potassium phosphates, silicates, carbonates, borates, oxides or hydroxides are suitable. The preparations can contain from 0.5 to 80% of the said compound and from 5 to 99.5% of the solubilising agent. Water-soluble diluents such as urea and dextrose may also be used.

Granules and pellets can be made by mixing a said compound in finely-divided form with a suitable clay, moistening this mixture with from 15 to 20% by weight of water, and for example extruding the mass through a suitable die under pressure. The extrusions are cut into pellets of pre-determined lengths and then dried. These pellets can be granulated if desired.

Granules or pellets can also be prepared by spraying a suspension or solution of a said compound onto the surface of a preformed granule of clay, vermiculite or other suitable granular material. If the said compound is in solution, it will penetrate into the pores of the granule and so will adhere without the aid of a binding agent. When the said compound is insoluble in the liquid and is carried as a suspension, it is preferable that a binding agent such as goulac, dextrin, swollen starch, glue or polyvinyl alcohol be added. In either case, the granule is then dried and ready for use.

The said compounds can also be formulated with non-aqueous liquids. Aliphatic and aromatic hydrocarbons, especially those derived from petroleum and having boiling points of from 125°C. to 400°C. are preferred. Hydrocarbons having lower boiling points should not be used because of their undesirable volatilisation characteristics and inflammability. In the case of those compounds having inadequate solubility in the carrier, it is convenient to prepare liquid compositions by milling the components in a mill such as a pebble mill until the particles have average diameters of from 1 to 50 microns, preferably 5 to 20 microns.

The herbicidal compositions, whatever physical form they take, can also contain a surface-active agent. The surfactant renders the preparations readily dispersible in liquids and improves their action on waxy leaves and the like. For general application, surface-active agents are used in the compositions at concentrations of from 1 to 10% by weight. Levels of from 0.5 to 6 parts of surfactant for each part of uracil, however, sometimes give unusual and unexpected results. Preparations having these higher levels of surfactants sometimes show greater herbicidal effectiveness than can be expected from a consideration of activity of the components used separately.

The term "surface-active agent" is used herein to include wetting agents, dispersing agents, suspending agents and emulsifying agents. Surface-active agents suitable for use are set forth in "Detergents and Emulsifiers . . . up-to-date", 1962, John W. McCutcheon, Inc., Morristown, New Jersey. Other surface-active agents which can be used in these preparations are listed in U.S. Patent Specifications 2,412,510; 2,426,417 and 2,655,447, British Specification No. 492,742 and Bulletin E-607 of the Bureau of Entomology and Plant Quarantine of the U.S. Department of Agriculture.

The compositions can also optionally contain adhesives such as gelatin, blood albumin and such resins as rosin alkyd resins. These increase retention and tenacity of deposits following application.

The preparations can also contain corrosion inhibitors, antifoam agents, dyes and pigments, anticaking agents, and hard water stabilisers.

The herbicidal compositions can be formulated to contain two or more of the said compounds. They can also be formulated to contain other herbicides in addition to the said compounds to give compositions which have advantages over compositions containing only the individual herbicides. The other herbicide may be a 3-substituted uracil or salt or nitro-

genous base or phenol addition compound thereof as disclosed in or in our copending applications Nos. 46342/62 (Serial No. 1,035,091), 6191/66 (Serial No. 1,035,092), 6192/66 (Serial No. 1,035,093), 6193/66 (Serial No. 1,035,094), 6194/66 (Serial No. 1,035,095), 6195/66 (Serial No. 1,035,096) and 8987/66 (Serial No. 1,035,098).

Among the known herbicides which can be combined with the said compounds are:

Substituted Ureas

3-(3,4-dichlorophenyl)-1,1-dimethylurea
3-(4-chlorophenyl)-1,1-dimethylurea
3-phenyl-1,1-dimethylurea
3 - (3,4-dichlorophenyl) - 3 - methoxy - 1,1 - dimethylurea
3 - (4 - chlorophenyl) - 3 - methoxy - 1,1 - dimethylurea
3 - (3,4 - dichlorophenyl) - 1 - *n* - butyl - 1 - methylurea
3 - (3,4 - dichlorophenyl) - 1 - methoxy - 1 - methylurea
3-(4-chlorophenyl)-1-methoxy-1-methylurea
3-(3,4-dichlorophenyl)-1,1,3-trimethylurea
3-(3,4-dichlorophenyl)-1,1-diethylurea
3 - (*p* - chlorophenoxyphenyl) - 1,1 - dimethylurea

These ureas can be mixed with the said compounds in proportions of from 1:4 to 4:1, respectively, the preferred ratio being 1:2 to 2:1.

Substituted triazines

2-chloro-4,6-bis(ethylamino)-*s*-triazine
2 - chloro - 4 - ethylamino - 6 - isopropylamino - *s* - triazine
2 - chloro - 4,6 - bis(methoxypropylamino) - *s* - triazine
2 - methoxy - 4,6 - bis(isopropylamino) - *s* - triazine
2 - diethylamino - 4 - isopropylacetamido - 6 - methoxy - *s* - triazine
2 - isopropylamino - 4 - methoxyethylamino - 6 - methylmercapto - *s* - triazine
2 - methylmercapto - 4,6 - bis(isopropylamino) - *s* - triazine
2 - methylmercapto - 4,6 - bis(ethylamino) - *s* - triazine
2 - methylmercapto - 4 - ethylamino - 6 - isopropylamino - *s* - triazine
2-methoxy-4,6-bis(ethylamino)-*s*-triazine
2 - methoxy - 4 - ethylamino - 6- isopropylamino - *s* - triazine
2 - chloro - 4,6 - bis(isopropylamino) - *s* - triazine

These triazines can be mixed with the said compounds in proportions of from 1:4 to 4:1 respectively, the preferred ratio being 1:2 to 2:1.

Phenols

Dinitro-o-*sec*-~~butylphenol~~ and its salts
Pentachlorophenol and its salts

These phenols can be mixed with the said compounds in the proportions of 1:10 to 20:1, respectively, the preferred ratio being 1:5 to 5:1.

Carboxylic Acids and Derivatives

The following carboxylic acids and derivatives can be mixed with the said compounds in the listed proportions:

A. 2,3,6-trichlorobenzoic acid and its salts
2,3,5,6-tetrachlorobenzoic acid and its salts
2-methoxy-3,5,6-trichlorobenzoic acid and its salts
2-methoxy-3,6-dichlorobenzoic acid and its salts
3-amino-2,5-dichlorobenzoic acid and its salts
3-nitro-2,5-dichlorobenzoic acid and its salts
2-methyl-3,6-dichlorobenzoic acid and its salts
2,4-dichlorophenoxyacetic and and its salts and esters
2,4,5-trichlorophenoxyacetic acid and its salts and esters
(2-methyl-4-chlorophenoxy)acetic acid and its salts and esters
2-(2,4,5-trichlorophenoxy)propionic acid and its salts and esters
2 - (2,4,5 - trichlorophenoxy)ethyl 2,2-dichloropropionate
4-(2,4-dichlorophenoxy)butyric acid and its salts and esters
4-(2-methyl-4-chlorophenoxy)butyric acid and its salts and esters
2,3,6-trichlorobenzoyloxypropanol
Mixed in a 1:16 to 8:1 ratio, preferably a 1:4 to 4:1 ratio.

B. 2,6-dichlorobenzonitrile
Mixed in a 1:4 to 4:1 ratio, preferably a 1:3 to 3:1 ratio.

C. Trichloroacetic acid and its salts
Mixed in a 1:2 to 25:1 ratio, preferably a 1:1 to 8:1 ratio.

D. 2,2-dichloropropionic acid and its salts
Mixed in a 1:4 to 8:1 ratio, preferably a 1:2 to 4:1 ratio.

E. N,N - di(*n* - propyl)thiolcarbamic acid, ethyl ester
N,N-di(*n*-propyl)thiolcarbamic acid, *n*-propyl ester
N-ethyl-N-(*n*-butyl)thiolcarbamic acid, ethyl ester
N-ethyl-N-(*n*-butyl)thiolcarbamic acid, n-propyl ester
Mixed in a 1:2 to 24:1 ratio, preferably a 1:1 to 12:1 ratio.

F. N-phenylcarbamic acid, isopropyl ester
N-(*m*-chlorophenyl)carbamic acid, isopropyl ester
N-(*m*-chlorophenyl)carbamic acid, 4-chloro-2-butynyl ester
Mixed in a 1:2 to 24:1 ratio, preferably a 1:1 to 12:1 ratio.

G. 2,3,6-trichlorophenylacetic acid and its salts

Mixed in a 1:12 to 8:1 ratio, preferably a 1:4 to 4:1 ratio.

H. 2-chloro-N,N-diallylacetamide
Maleic hydrazide
Mixed in a 1:2 to 10:1 ratio, preferably a 1:1 to 5:1 ratio.

Inorganic and Mixed Inorganic-Organic Salts

The following salts can be mixed with the said compounds in the listed proportions:

A. Calcium propylarsonate
Disodium monomethylarsonate
Octyl-dodecylammoniummethylarsonate
Dimethylarsinic acid
Mixed in a 1:4 to 4:1 ratio, preferably a 1:2 to 2:1 ratio.

B. Sodium arsenite
Mixed in a 1:5 to 40:1 ratio, preferably a 1:4 to 25:1 ratio.

C. Lead arsenate
Calcium arsenate
Mixed in a 100:1 to 600:1 ratio, preferably a 150:1 to 400:1 ratio.

D. Sodium tetraborate hydrated, granulated
Sodium metaborate
Sodium pentaborate
Polyborchlorate
Unrefined borate ore such as borascu
Mixed in a 3:1 to 1500:1 ratio, preferably a 6:1 to 1000:1 ratio.

E. Ammonium thiocyanate
Mixed in a 1:10 to 20:1 ratio, preferably a 1:5 to 5:1 ratio.

F. Sodium chlorate
Mixed in a 1:1 to 40:1 ratio, preferably a 2:1 to 20:1 ratio.

G. Ammonium sulphamate
Mixed in a 1:1 to 100:1 ratio, preferably a 1:1 to 50:1 ratio.

Other Organic Herbicides

These organic herbicides can be mixed with the said compounds in the listed proportions:

A. 5,6 - dihydro - (4A,6A) - dipyrido - (1,2 - A,2',1' - C) pyrazinium dibromide
Mixed in a 1:20 to 16:1 ratio, preferably a 1:5 to 5:1 ratio.

B. 3-amino-1,2,4-triazole
Mixed in a 1:20 to 20:1 ratio, preferably a 1:5 to 5:1 ratio.

C. 3,6-endoxohexahydrophthalic acid
Mixed in a 1:3 to 20:1 ratio, preferably a 1:2 to 10:1 ratio.

D. Hexachloroacetone
Mixed in a 1:2 to 16:1 ratio, preferably a 1:1 to 8:1 ratio.

E. Diphenylacetonitrile
N,N-dimethyl-α,α-diphenylacetamide
N,N - di - *n* - propyl - 2,6 - dinitro - 4 - trifluoromethylaniline
N,N - di - *n* - propyl - 2,6 - dinitro - 4 - methylaniline
Mixed in a 1:10 to 30:1 ratio, preferably a 1:5 to 20:1 ratio.

F. O - (2,4 - dichlorophenyl) - O - methyl - isopropylphosphoramidothioate
2,3,5,6 - tetrachloroterephthalic acid, dimethyl ester
Mixed in a 1:4 to 20:1 ratio, preferably a 1:3 to 15:1 ratio.

G. 2,4-dichloro-4'-nitrodiphenyl ether
Mixed in a 1:10 to 30:1 ratio, preferably a 1:5 to 20:1 ratio.

In a further aspect the invention provides a method of controlling the growth of weeds at a locus which comprises applying to the locus a herbicidally effective quantity of at least one of the said compounds. The amount of active compound used will depend on the weeds to be controlled, the formulation used, the mode of application, the climate, season of the year, rainfall and other variables, and because of this it is not possible to state generally a particular rate of application which will be suitable for all situations.

Some of the said compounds are especially useful in controlling the growth of weeds on uncultivated areas. Thus in suitable circumstances some of the said compounds can be used as soil sterilants and/or in soil-foliage applications.

It has been found that strikingly similar herbicidal activity can be obtained with seemingly unrelated substituents round the uracil ring. It has also been found that changes in useful selective phytotoxicity (applicable in certain weed-crop combinations) may result when a relatively minor structural modification of R_1 (for example a normal alkyl chain altered to a branched chain) has been made. The 5-substituents (described for R_2 above) for example, have been found to have a minimum range of herbicidal effectiveness and/or species selectivity dependent on the nature of the substituent (if any) in the 3- or 6-position. There has been found little continuity of herbicidal effect which could be ascribed to a particular substituent independently of the other two substituents in the 3,5,6-positions.

Some of the said compounds are particularly useful against both broadleaf and grass weeds. Others are particularly effective against hard-to-kill nutsedge and perennial grasses such as quack grass, Johnson grass, and Bermuda grass. Others are particularly effective on highly adsorptive substrates such as railroad ballast, heavy clay soil, and soils high in organic matter. For example, a pre-emergence treatment has been used to control such germinating broadleaf weeds as pigweed, lamb's quarter, mustard, chickweed and ragweed, and such grass weed as crab grass and foxtails. Some of the said compounds are particularly effective in soil-foliage applications for the control of such broadleaves as pigweed, lamb's quarter, mustard, chickweed and ragweed and such grass weeds as crab grass, foxtails, quack grass and seedling Johnson grass.

Some of the said compounds are particu-

larly useful as soil sterilants and for general weed control, e.g. on industrial areas, railroad rights-of-way, and areas adjacent to croplands in agricultural areas.

Certain of the said compounds also exhibit selective herbicidal action in crops. By properly selecting a said compound and a rate and time of application, annual grass and broadleaf seedlings in such crops as asparagus, corn, flax, sugar cane, safflower, peanuts, citrus, alfalfa, strawberries, gladiolus, stone fruits, sorghum, sugar beets, red beets, mangels, spinach, potatoes, pineapple, cotton and cucurbits can be controlled.

By proper selection of rate and time of application, certain of the said compounds can also be used to control weeds growing in dormant crops.

This selective activity and activity on weeds growing in dormant crops is described in more detail in the Examples.

Many of the compounds have unusually high oil solubility, and so are useful for application in oils such as herbicidal oils, diesel oil, kerosene, xylene, and other commercially available spray oils. High oil solubility makes shipment of many uracil/oil "concentrates" practical. Such concentrates can be diluted with low-cost diesel oil and herbicidal oils at the site of application.

Broadly speaking, the compounds are used at levels of about ¼ pound per acre to about 80 pounds per acre for general weed control. For selective weed control in crops, rates of ¼ or ½ to 3 or 8 pounds per acre will generally be used, and in pre-emergence treatments from ¼ to 5, preferably ½ to 2 or 4 pounds per acre, may for example be used. More of the active material can be used to control difficult-to-kill species growing under adverse conditions. Economic factors, such as inaccessibility of the area to be treated, e.g. fire breaks in forests, may also favour higher rates, with less frequent treatments.

The invention is illustrated by the following Examples.

EXAMPLE 1

The following uracils can be prepared by the method of Example 123 of Specification No. 968,666 in a similar fashion by substituting equivalent amounts of the indicated alkyl halide and uracil for the isopropyl bromide and 3-isopropyl-5-bromo-6-methyl-uracil:

Uracil Reactant	Alkyl Halide	Uracil Product
3-(1,1-dimethylbutyl)-5-bromo-6-methyluracil	*p*-chlorobenzyl chloride	5-bromo-1-(*p*-chlorobenzyl)-3-(1,1-dimethylbutyl)-6-methyluracil
3-(2-isopropyl-5-methylhexyl)-5-methyluracil	3,4-dichlorobenzyl chloride	1-(3,4-dichlorobenzyl)-3-(2-isopropyl-5-methylhexyl)-5-methyluracil
3-isopropyl-5-bromo-6-methyluracil	benzyl bromide	1-benzyl-5-bromo-3-isopropyl-6-methyluracil
3-cyclohexyl-5-methoxymethyl-6-methyluracil	3,4-dimethylbenzyl chloride	3-cyclohexyl-1-(3,4-dimethylbenzyl)-5-methoxymethyl-6-methyluracil
3-norbornenyl-5,6-dimethyluracil	*p*-butoxybenzyl chloride	1-(*p*-butoxybenzyl)-5,6-dimethyl-3-norbornenyluracil
3-ethoxycarbonylmethyl-5-bromo-6-methyluracil	*m*-methylbenzyl chloride	5-bromo-3-ethoxycarbonylmethyl-6-methyl-1-(*m*-methylbenzyl)uracil

EXAMPLE 2

The following uracils can be prepared by the method of Examples 127 and 128 of Specification No. 968,666 by substituting an equivalent amount of the indicated uracil for the substituted uracils of those Examples:

Uracil Reactant	Uracil Product
3-norbornyl-5-bromo-6-methyluracil	3-norbornyl-5-bromo-6-methyl-1-trichloromethylthio)uracil
3-chloronorbornyl-5-chloro-6-methyl-uracil	3-chloronorbornyl-5-chloro-6-methyl-1-(trichloromethylthio)uracil
3-fenchyl-5-bromo-6-methyluracil	3-fenchyl-5-bromo-6-methyl-1-(tri-chloromethylthio)uracil
3-decalinyl-5-bromo-6-methyluracil	3-decalinyl-5-bromo-6-methyl-1-(trichloromethylthio)uracil
3-decahydronaphthyl-5,6-dimethyl-uracil	3-decahydronaphthyl-5,6-dimethyl-1-(trichloromethylthio)uracil
3-(3a,4,5,6,7,7a-hexahydro-4,7-methano-5-indenyl)-5,6-dimethyluracil	3-(3a,4,5,6,7,7a-hexahydro-4,7-methano-5-indenyl)-5,6-dimethyl-1-(trichloromethylthio)uracil

EXAMPLE 3

The following uracils can be prepared by the method of Example 78 of Specification No. 968,666 substituting equivalent weights of the listed reactants for those used before:

Uracil Starting Reactant	Reactant	Uracil Product
5-hydroxymethyl-3-(5,6,7,8-tetrahydronaphthyl)uracil	*tert.*-butylsulphenyl chloride	1-*tert.*-butylthio-5-hydroxy-methyl-3-(5,6,7,8-tetrahydro-naphthyl)uracil
5,6-dimethyl-3-(4-isopropyl-cyclohexyl)uracil	methanesulphenyl chloride	5,6-dimethyl-3-(4-isopropyl-cyclohexyl)-1-(methylthio)-uracil
3-isopropyl-5-bromo-6-methyl-uracil	*p-tert.*-butylphenyl-sulphenyl chloride	5-bromo-1-(*p-tert.*-butyl-phenylthio)-3-isopropyl-6-methyluracil

EXAMPLE 4

The following compounds can be prepared by the method of Example 13 of Specification No. 968,666 substituting equivalent amounts of the corresponding uracil and acyl halide starting reactants for the 3-(3-n-amyl)-5-bromo-6-methyluracil and benzoyl chloride used in that Example:

Uracil Reactant	Acylating Agent	Uracil Product
5-hydroxymethyl-6-methyl-3-(1,2,3,4-tetrahydronaphthyl)uracil	phenylacetyl chloride	5-hydroxymethyl-6-methyl-1-phenyl-acetyl-3-(1,2,3,4-tetrahydronaphthyl)uracil

EXAMPLE 5

Into a rocker-type pressure vessel were placed 180 parts by weight of 3-norbornyl-5,6-dimethyluracil, 500 parts by weight of water, 82.5 parts by weight of a 40% aqueous formaldehyde solution, and 15 parts by weight of barium hydroxide. The mixture was rocked and heated at 175—200°C. for 3—5 hours. The vessel was then cooled, vented and the contents were neutralized with acetic acid. After cooling, the product, 3 - norbornyl - 5,6 - dimethyl - 1 - hydroxymethyluracil, was separated, washed with cold water and dried.

If desired, the product can be recrystallized from an aqueous alcohol solution.

EXAMPLE 6

Preparation of 1,3-diisopropyl-6-methyluracil

A solution of 28.6 parts of N-isopropylacetoacetamide and 23.6 parts of isopropylamine in 80 parts of ether was allowed to stand overnight. The solvent was then removed, leaving 37 parts of β-isopropylamino-N-isopropylcrotonamide as a viscous oil.

Scratching the walls of the flask caused this oil to crystallize. The product was a white solid melting at 90—93°C.

A solution of sodium ethoxide was prepared by dissolving 9.2 parts of sodium in 300 parts of ethanol. To this solution were added 37 parts of β-isopropylamino-N-isopropylcrotonamide and 40.8 parts of diethyl carbonate. The resulting solution was heated at reflux for 22 hours, and the solvent was then removed *in vacuo*.

The residue was taken up in 250 parts of water and 1,3-diisopropyl-6-methyluracil separated as a solid. It was collected by filtration, washed with water and dried to give 29 parts of the product melting at 94—95°C.

The following uracils can be similarly prepared by substituting equivalent amounts of the listed substituted acetoacetamides and amines for the N-isopropylacetoacetamide and isopropylamine:

Amine	Acetoacetamide	Uracil Product
methoxypropylamine	N-decahydronaphthyl-	3-decahydronaphthyl-1-methoxypropyl-6-methyluracil
methoxyisopropylamine	N-cyclohexyl-	3-cyclohexyl-1-methoxyisopropyl-6-methyluracil
ethoxycarbamylmethylamine	N-(*tert*.-butyl)-α-methyl	3-*tert*.-butyl-5,6-dimethyl-1-ethoxy-carbamylmethyluracil
N,N-dimethylaminoethylamide	N-cyclobutyl-α-propylthio-	3-cyclobutyl-1-dimethylaminoethyl-6-methyl-5-(propylthio)uracil
cyanopropylamine	N-phenyl-	1-cyanopropyl-6-methyl-3-phenyluracil
aniline	N-cyclohexyl-	3-cyclohexyl-6-methyl-1-phenyluracil
p-chloroaniline	N-norbornyl-	1-*p*-chlorophenyl-6-methyl-3-norbornyluracil
p-bromoaniline	N-ethyl-	1-*p*-bromophenyl-3-ethyl-6-methyluracil
3,4-dichloroaniline	N-isopropyl-	1-(3,4-dichlorophenyl)-3-isopropyl-6-methyluracil
3-nitro-4-chloroaniline	N-(4-methylcyclohexyl)-	6-methyl-3-(4-methylcyclohexyl)-1-(3-nitro-4-chlorophenyl) uracil
3,4-dimethylaniline	N-(*sec*.-amyl)-α-ethyl-	3-*sec*.-amyl-1-(3,4-dimethylphenyl)-5-ethyl-6-methyluracil
p-isopropylaniline	N-ethyl-	1-(*p*-cumyl)-3-ethyl-6-methyluracil

Amine	Acetoacetamide	Uracil Product
3-chloro-4-methylaniline	N-cyclobutyl-	1-(3-chloro-4-methylphenyl)-3-cyclobutyl-6-methyluracil
3-chloro-4-isopropoxy-aniline	N-methyl-	1-(3-chloro-4-isopropoxy-phenyl)-3,6-dimethyluracil
m-(α,α,α-trifluoromethyl) aniline	N-neopentyl-α-methyl-	5,6-dimethyl-3-neopentyl-1-[*m*-(α,α,α-trifluoromethyl) phenyl]uracil
3,4,5-trichloroaniline	N-isopropyl-α-methyl-	5,6-dimethyl-3-isopropyl-1-(3,4,5-trichlorophenyl)uracil
p-fluoroaniline	N-*tert*.-butyl-	3-*tert*.-butyl-1-(*p*-fluoro-phenyl)-6-methyluracil
p-nitroaniline	N-propyl-	6-methyl-1-(*p*-nitrophenyl)-3-propyluracil
cyclopropylamine	N-cyclopropyl-	1,3-dicyclopropyl-6-methyluracil
(4-methylcyclohexyl)amine	N-isopropyl-	3-isopropyl-6-methyl-1-(4-methylcyclohexyl)uracil
norbornylamine	N-isopropyl-	3-isopropyl-6-methyl-1-norbornyluracil
decahydronaphthylamine	N-ethyl-α-methyl-	1-decahydronaphthyl-5,6-dimethyl-3-ethyluracil
cyclododecylamine	N-methyl-α-methyl-	1-cyclododecyl-3,5,6-trimethyluracil
(3a,4,5,6,7,7a-hexahydro-4,7-methano-5-indenyl)amine	N-isopropyl-	1-(3a,4,5,6,7,7a-hexahydro-4,7-methano-5-indenyl)-3-isopropyl-6-methyluracil
(4-isopropylcyclohexyl) amine	N-*tert*.-butyl-	3-*tert*.-butyl-1-(4-isopropylcyclohexyl)-6-methyluracil
chloronorbornylamine	N-isobutyl-	1-chloronorbornyl-3-isobutyl-6-methyluracil
(4-isopropylcyclohexyl-methyl)amine	N-(1,1-dimethylbutyl)-	3-(1,1-dimethylbutyl)-1-(4-isopropylcyclohexyl-methyl)-6-methyluracil

Amine	Acetoacetamide	Uracil Product
(decahydro-1,4-5,8-dimethanonaphth-2-ylmethyl) amine	N-ethyl-α-methyl-	1-(decahydro-1,4-5,8-dimethanonaphth-2-yl-methyl)-5,6-dimethyl-3-ethyluracil
N,N-dimethylhydrazine	N-norbornenyl-α-methyl-	5,6-dimethyl-1-dimethyl-amino-3-norbornenyl-uracil
N,N-diethylhydrazine	N-fenchyl-	1-diethylamino-3-fenchyl-6-methyluracil
cyanamide	N-cyclooctyl-	1-cyano-3-cyclooctyl-6-methyluracil
O-methylhydroxylamine	N-cyclohexyl-	3-cyclohexyl-1-methoxy-6-methyluracil
O-propylhydroxylamine	N-isopropyl-α-methyl-	5,6-dimethyl-3-isopropyl-1-propoxyuracil
O-butylhydroxylamine	N-cyclobutyl-	1-butoxy-3-cyclobutyl-6-methyluracil

EXAMPLE 7

Aqueous Suspension

3 - (1 - ethylhexyl) - 1 - benzyl - 5,6 - dimethyluracil	25%
Sodium alkyl naphthalene sulphonate	1%
Desugared sodium lignin sulphonate	1%
Sodium silico-aluminate	73%

These ingredients are blended, micropulverized, and then passed through a fluid energy, air attrition mill until the particles are under 5 microns in diameter.

Twenty to forty pounds (active) of this preparation are suspended in 80—120 gallons of water and sprayed around a tank farm in a semiarid area, just prior to the rainy season.

This treatment effectively controls such annual weeds as crab grass, ryegrass, foxtail, goose grass, chickweed, henbit, mustard and pigweed growing around the tanks.

The following uracils can be similarly formulated, and when used in equivalent amounts, will give similar results:

3 - (1,1 - dimethylbutyl) - 5 - bromo - 1 - (*p* - chlorobenzyl) - 6 - methyluracil

3 - (3 - chloro - 1 - methylpropyl) - 1 - benzylthio - 5 - methyluracil

3 - (2 - isopropyl - 5 - methylhexyl) - 5 - methyl - 1 - (3,4 - dichlorobenzyl)uracil

3 - ethoxycarbonylmethyl - 1 - (*m* - methylbenzyl) - 5 - bromo - 6 - methyluracil

3 - naphthyl - 5 - fluoromethyl - 6 - methyl - 1 - trichloromethylthio - 2 - thiouracil

3 - (5,6,7,8 - tetrahydronaphthyl) - 1 - butyl - 5 - hydroxymethyluracil

3 - (*p* - bromophenyl) - 5 - bromo - 6 - bromomethyl - 1 - (trichloromethylthio)-uracil

3 - (3,4 - dichlorophenyl) - 5 - bromo - 6 - methyl - 1 - (methylthio)uracil

3 - (*p* - fluorophenyl) - 1 - benzylthio - 5 - methyluracil

3 - (*m* - tolyl) - 5 - bromo - 6 - bromomethyl - 1 - methyluracil

3 - (3 - methyl - 4 - chlorophenyl) - 1,6 - dimethyluracil

3 - (*p* - nitrophenyl) - 6 - butoxy - 5 - bromo - 1 - chloroacetyluracil

3 - (3 - chloro - 4 - nitrophenyl) - 5 - bromo - 6 - methyl - 1 - (ethylthio)uracil

EXAMPLE 8

Aqueous suspension

5 - bromo - 3 - norbornyl - 1.6 - dimethyluracil	30.00%
Sodium lignin sulfonate	15.00%
Hydrated attapulgite	1.75%
Anhydrous disodium phosphate	0.80%
Sodium pentachlorophenate	0.50%
Water	51.95%

These components are mixed together and pebble-milled or sand-milled until the active material is below 5 microns in particle size. The resultant stable aqueous suspension can be readily diluted with water to give a highly dispersed, very slow settling composition which can be sprayed from equipment having no means for agitating the suspension.

This composition is applied at 0.75 to 2 pounds of active ingredient per acre in 40 gallons water for control of annual and perennial broadleaf and grass weeds such as wild oats, foxtail, crab grass, chickweed, velvetleaf and pigweed growing in corn, sorghum, sugarcane, safflower and asparagus.

EXAMPLE 9

Emulsifiable Oil

1,3,5-tricyanouracil	15%
Mixed polyoxyethylene ethers and oil-soluble sulphonates	3%
Isophorone	40%
Alkylated naphthalene, principally α-methylnaphthalene	42%

These components are mixed together to form a homogeneous solution.

Twenty-five to thirty pounds (active) of this formulation are suspended in 60 gallons of herbicidal oil and applied with a sprayer along roadsides and beneath highway signs in a semi-arid area. Application is made when the weeds are 2 to 6 inches tall, and controls the growth of such troublesome annual weeds as crab grass, foxtail, prostrate knotweed, carpetweed and purslane.

The following uracils can be similarly formulated, and when used in equivalent amounts, will give similar results:

3 - (1,2 - dimethylcyclopentyl) - 5 - carboxymethylthiomethyl - 1 - methyl - 6 - (3 - chlorobutyl)uracil

3 - (bicyclo[2,2,2]oct - 5 - en - 2 - yl) - 5 - phenylthiomethyl - 1,6 - dimethyluracil

EXAMPLE 10

Emulsifiable Oil Solution

1 - methoxypropyl - 3 - decahydronaphthyl - 6 - methyluracil	25%
Methyl isoamyl ketone	50%
Alkylated naphthalene, principally α-methyl naphthalene	25%

These ingredients are combined to give a solution.

Eight to twelve gallons of this preparation are mixed with 65 gallons of herbicidal oil and applied along access trials in a park located in a semi-arid area. The application covers one acre and is applied as the weeds reach a height of 2 to 6 inches.

Such annual weeds as crab grass, chickweed, mustard, purslane, ragweed and the foxtails are controlled.

The following uracils can be similarly formulated, and when used in equivalent amounts, will give similar results:

1 - dimethylaminoethyl - 3 - cyclobutyl - 6 - methyl - 5 - (propylthio)uracil

1-cyanopropyl-6-methyl-3-phenyluracil

1-phenyl-3-cyclohexyl-6-methyluracil

1 - (*p* - chlorophenyl) - 6 - methyl - 3 - norbornyluracil

1 - (3,4 - dibromophenyl) - 6 - methyl - 1 - (3 - nitro - 4 - chlorophenyl)uracil

1 - [*m* - (α,α,α - trifluoromethylphenyl)] - 3 - neopentyl - 5,6 - dimethyluracil

1-(*p*-cumyl)-3-ethyl-6-methyluracil

1 - (3,4 - dimethylphenyl) - 3 - *sec.* - amyl - 5 - ethyl - 6 - methyluracil

1 - (*p* - fluorophenyl) - 3 - *tert.* - butyl - 6 - methyluracil

1,3-dicyclopropyl-6-methyluracil

1 - decahydronaphthyl - 5,6 - dimethyl - 3 - ethyluracil

1-chloronorbornyl-3-isobutyl-6-methyluracil

1 - (4 - isopropylcyclohexyl) - 3 - *tert.* - butyl - 6 - methyluracil

1 - bornyl - 3 - isopropyl - 5 - bromo - 6 - methyluracil

1-cyclododecyl-3,5,6-trimethyluracil

1 - (decahydro - 1,4 - 5,8 - dimethanonaphthyl) - 3 - isopropyl - 5 - methyluracil

1 - (4 - isopropylcyclohexylmethyl) - 3 - (1,1 - dimethylbutyl) - 6 - methyluracil

1 - (decahydro - 1,4 - 5,8 - dimethanonaphth - 2 - ylmethyl) - 3 - isopropyl - 5 - methyluracil

1 - (4 - chlorocyclohexylmethyl) - 3 - isopropyl - 5 - methoxymethyl - 6 - methyluracil

EXAMPLE 11

Emulsifiable oil suspension

5 - chloro - 3 - fenchyl - 6 - methyl - 1 - (trichloromethylthio)uracil	25%
Blend of polyalcohol carboxylic esters and oil-soluble petroleum sulphonates	6%
Diesel oil	69%

These components are mixed together and milled in a roller mill, pebble mill, or sand mill until the patricles of the active component are below 10 microns in size. The resulting suspension can be emulsified in water or diluted further with weed oils for spray application.

This formulation is diluted with 60 gallons of Lion Herbicidal Oil—No. 6 and applied at 10—15 pounds of active ingredient per acre for the control of morning glory, yarrow, ragweed, wild carrot, quack grass, witch grass, perennial rye grass, pigweed, wild mustard, foxtail, flower-of-an-hour, crab grass, and oak and maple seedlings growing along railroad rights-of-way. Excellent control is obtained.

5 - bromo - 3 - (x - chloronorbornyl) - 6 - methyl - 1 - (trichloromethylthio)uracil can be formulated and used in the same fashion.

EXAMPLE 12

A wettable powder is prepared by blending the following components, micropulverising them until the particles are below 50 microns in size and then reblending.

5 - chloro - 3 - norbornyl - 1,6 - dimethyluracil	80.00%
Alkyl naphthalene sulphonic acid, sodium salt	1.75%
Low viscosity methylcellulose	0.25%
Disodium phosphate	0.80%
Attapulgite clay	17.20%

This wettable powder preparation was used for control of vegetation on industrial sites and railroad ballast. When applied at 10 to 20 pounds of active ingredient per acre in 100 gallons of water, excellent control of lamb's quarters, evening primrose, pokeweed, cockle-

bur, goose grass, crab grass, broom sedge, love grass, pigweed, chickweed, foxtail and barnyard grass was obtained.

EXAMPLE 13

Wettable Powder

3 - (3,4 - dimethylbenzyl) - 5 - chloro - 6 - chloromethyl - 1 - methyluracil	25.00%
Sodium lauryl sulphate	0.5%
Low viscosity methyl cellulose	0.25%
Attapulgite clay	74.25%

These components are blended, then ground in a mill with air classification until all particles are below 20 microns in diameter.

One hundred to one hundred twenty pounds of this formulation are mixed with enough water to form a slurry. This slurry is suspended in 100 to 150 gallons of water.

The material is kept suspended by mechanical or bypass agitation. It is sprayed, in the spring, on an acre of land around a lumberyard where such weeds as crab grass, foxtail, pigweed, giant ragweed, chickweed, mustard and lamb's quarter are a problem. When applied pre-emergence, or when the above weeds are in the two to three-leaf stage, this preparation provides good weed control.

The following compound, similarly formulated and used, will give good weed control: 3 - (9 - decenyl) - 5 - methylthio - 1,6 - dimethyluracil.

EXAMPLE 14

Wettable Powder

1 - dimethylamino - 5,6 - dimethyl - 3 - norbornenyluracil	25%
Dodecyl phenol-ethylene oxide condensation product	3%
Low viscosity polyvinyl alcohol	1%
Synthetic fine silica	40%
Attapulgite clay	31%

These components are blended, micropulverized until all particles are below 325 mesh (44 microns), and then reblended.

Thirty to thirty-five pounds (active) of this powder preparation are slurried with water and suspended in 125 gallons of water.

This suspension is applied with a sprayer to an acre of ground around a refinery. Such weeds as crab grass, goose grass, the foxtails, lamb's quarter, prostrate knotweed, carpetweed and pigweed are controlled.

The following uracils, when similarly formulated and used, give good weed control:
1-diethylamino-3-fenchyl-6-methyluracil
1-cyano-3-cyclooctyl-6-methyluracil
1-methoxy-3-cyclohexyl-6-methyluracil
1-butoxy-3-cyclobutyl-6-methyluracil

EXAMPLE 15

Granules

5 - chloro - 3 - (3a,4,5,6,7,7a - hexahydro - 5 - indanyl) - 6 - methyl - 1 - (trichloromethyl)uracil	10%
Anhydrous sodium sulphate	10%
Non-swelling sub-bentonite clay	80%

The components were blended and micropulverized, then moistened with water and granulated. The product was then dried and screened.

The granules were applied by hand for "spot treatment" of undesirable bunch grasses growing in agricultural areas. An application of 15 to 20 pounds of active ingredient per acre gave good control of undesirable bunch grasses for example orchard and fescue grasses.

1 - acetyl - 5 - chloro - 3 - (2 - chloro - 3a,4,5,6,7,7a - hexahydro - 4,7 - methano - 5 - indanyl) - 6 - methyluracil can also be formulated and used in this manner.

EXAMPLE 16

Granules

1 - (2,3,6 - trichlorobenzyl) - 3 - isopropyl - 5 - bromo - 6 - methyluracil	15%
Granular 8—15 mesh attapulgite clay	85%

This granular composition was prepared by dissolving the active ingredient in acetone and spraying this solution on the attapulgite granules while they were being tumbled. The granules were then dried.

These granules were applied by hand or by special spreaders at 10 to 25 pounds of active ingredient per acre. They control peppergrass, seedling Bermuda and Johnson grass, chickweed, perennial ryegrass, crab grass, foxtail, smartweed, barnyard grass, goose grass, and quack grass on industrial sites, along boundary fences and railroad rights-of-way, in parking areas, along roadsides, and under billboards.

Other compounds which can be used in a like manner are:
3 - cyclopropyl - 1 - acetyl - 5,6 - tetramethyleneuracil
3-bornyl-1-(trichloromethylthio)uracil
3 - (3a,4,5,6,7,7a - hexahydro - 4, 7 - methano - 5 - indanyl) - 1 - (trichloromethylthio) - uracil
3 - (x - bromonorbornyl) - 1 - hydroxymethyl - 5,6 - trimethyleneuracil

EXAMPLE 17

Granules

3 - (3 - methylcyclohexyl) - 1,6 - dimethyl - 5 - chlorouracil	10%
Kaolin clay	87%
Low viscosity methyl cellulose	3%

These components are blended and micropulverized, moistened with water, moist granulated, dried and screened to give granules between 15 and 60 mesh.

This preparation is applied around oil and gas wells in semi-arid areas prior to the rainy season.

Thirty pounds (active) per acre of the preparation will effectively control annual weeds such as chickweed, pigweed, mustard, crab grass, ryegrass, and foxtail in these areas.

The following uracils can be similarly formulated, and when used in equivalent amounts, will give good weed control:

3 - cyclododecyl - 1 - methyl - 5 - chloro - 6 - methyluracil
3 - (4 - methoxycyclohexyl) - 1,5,6 - trimethyluracil
3 - cyclohexyl - 1 - *tert.* - butylthio - 5 - bromo - 6 - methyluracil
3 - *sec.* - butyl - 1 - trichlorobenzyl - 6 - methyluracil

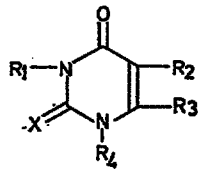
The following uracils can be prepared for use as described in Examples 7, 9, 10, 13 and 14 and when used in equivalent amounts, will give good weed control.

3 - (1,2,3,4 - tetrahydronaphthyl) - 5 - hydroxymethyl - 6 - methyl - 1 - phenylacetyluracil
3 - indenyl - 5 - isopropylthio - 1,6 - dimethyluracil
3 - (β - phenethyl) - 5 - isopropoxy - 6 - methyl - 1 - ethylthio - 2 - thiouracil
3 - (3,4 - dichlorbenzyl) - 5 - (*tert.* - butoxy) - 6 - methyl - 1 - (methylthio) uracil
3 - (*p* - nitrobenzyl) - 5 - butylthio - 1,6 - dimethyl - 2 - thiouracil
3 - (4 - isopropylcyclohexyl) - 5,6 - dimethyl - 1 - (methylthio)uracil
3 - (norbornyl) - 1 - (*p* - butoxybenzyl) - 5,6 - dimethyluracil

Reference has been made above to the 3-substituted uracils disclosed in Patent No. 968,666. No claim is made in this specification to any 3-substituted uracil within the scope of the general formula disclosed in Patent No. 968,666, nor to any herbicidal composition containing, or method of controlling the growth of weeds using, such a 3-substituted uracil.

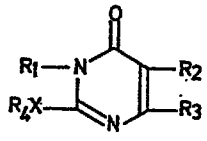
Subject to the foregoing disclaimer, WHAT WE CLAIM IS:—

1. A herbicidal composition comprising a diluent which is at least in part an oil and in association therewith at least one 3-substituted uracil which is a compound of the general formula



I

or the corresponding isomeric formula



II

wherein

R_1 represents an alkyl radical containing 1 to 10 carbon atoms, a substituted alkyl radical containing 1 to 10 carbon atoms, an aryl radical containing 5 to 14 carbon atoms, a substituted aryl radical containing 6 to 14 carbon atoms, an aralkyl radical containing 5 to 15 carbon atoms, a substituted aralkyl radical containing 7 to 15 carbon atoms, an alkenyl radical containing 3 to 10 carbon atoms, an alkynyl radical containing 3 to 10 carbon atoms, a cycloalkyl radical containing 3 to 12 carbon atoms, a cycloalkenyl radical containing 4 to 12 carbon atoms, a substituted cycloalkyl radical in which the cycloalkyl radical contains 3 to 12 carbon atoms, a substituted cycloalkenyl radical in which the cycloalkenyl radical contains 4 to 12 carbon atoms, a cycloalkyl alkyl radical containing 4 to 13 carbon atoms, a cycloalkenyl alkyl radical containing 5 to 13 carbon atoms, a (substituted cycloalkyl) alkyl radical containing 5 to 14 carbon atoms or a cyano radical;

R_2 represents a hydrogen, chlorine, fluorine, bromine or iodine atom, a methyl radical, an ethyl radical, a propyl radical, a butyl radical, a methoxy radical, an ethoxy radical, a propoxy radical, a butoxy radical, a nitro radical, an alkoxymethyl radical containing 2 to 6 carbon atoms, a hydroxy alkyl radical containing 1 to 6 carbon atoms, an alkenyl radical containing 3 to 6 carbon atoms, a thiocyanato radical, a cyano radical, a methylthiol radical, a methylthiomethyl radical, a phenylthiomethyl radical, an alkylthio radical containing 1 to 4 carbon atoms, a bromomethyl radical, a fluoromethyl radical, a chloromethyl radical or a carboxymethylthiomethyl radical;

R_3 represents a hydrogen, chlorine or bromine atom, an alkyl radical containing 1 to 5 carbon atoms, a chloroalkyl radical containing 1 to 4 carbon atoms, a bromoalkyl radical containing 1 to 4 carbon atoms, or an alkoxy radical containing 1 to 5 carbon atoms; or

R_2 and R_3 together represent a divalent radical which forms, together with the carbon atoms to which R_2 and R_3 are attached, a 5-, 6- or 7-membered ring;

R_4 represents a covalent radical of molecular weight from 15 to 250 which is an alkyl radical containing 1 to 10 carbon atoms, a substituted alkyl radical containing 1 to 10 carbon atoms, a cycloalkyl radical containing 3 to 12 carbon atoms, a substituted cycloalkyl radical in which the cycloalkyl radical contains 3 to 12 carbon atoms, a cycloalkylalkyl radical containing 4 to 13 carbon atoms, a (substituted cycloalkyl) alkyl radical in which the cycloalkyl alkyl radical contains 4 to 13 carbon atoms, a phenyl radical, a substituted phenyl radical, a phenylalkyl radical, a substituted phenylalkyl radical, a dialkylamino radical con-

3 - cyclododecyl - 1 - methyl - 5 - chloro - 6 - methyluracil
3 - (4 - methoxycyclohexyl) - 1,5,6 - trimethyluracil
3 - cyclohexyl - 1 - *tert.* - butylthio - 5 - bromo - 6 - methyluracil
3 - *sec.* - butyl - 1 - trichlorobenzyl - 6 - methyluracil

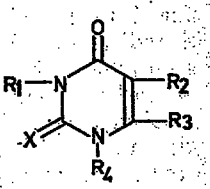
The following uracils can be prepared for use as described in Examples 7, 9, 10, 13 and 14 and when used in equivalent amounts, will give good weed control.

3 - (1,2,3,4 - tetrahydronaphthyl) - 5 - hydroxymethyl - 6 - methyl - 1 - phenylacetyluracil
3 - indenyl - 5 - isopropylthio - 1,6 - dimethyluracil
3 - (β - phenethyl) - 5 - isopropoxy - 6 - methyl - 1 - ethylthio - 2 - thiouracil
3 - (3,4 - dichlorbenzyl) - 5 - (*tert.* - butoxy) - 6 - methyl - 1 - (methylthio) uracil
3 - (*p* - nitrobenzyl) - 5 - butylthio - 1,6 - dimethyl - 2 - thiouracil
3 - (4 - isopropylcyclohexyl) - 5,6 - dimethyl - 1 - (methylthio)uracil
3 - (norbornyl) - 1 - (*p* - butoxybenzyl) - 5,6 - dimethyluracil

Reference has been made above to the 3-substituted uracils disclosed in Patent No. 968,666. No claim is made in this specification to any 3-substituted uracil within the scope of the general formula disclosed in Patent No. 968,666, nor to any herbicidal composition containing, or method of controlling the growth of weeds using, such a 3-substituted uracil.

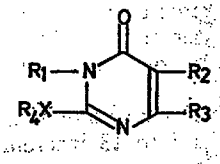
Subject to the foregoing disclaimer, WHAT WE CLAIM IS:—

1. A herbicidal composition comprising a diluent which is at least in part an oil and in association therewith at least one 3-substituted uracil which is a compound of the general formula



I

or the corresponding isomeric formula



II

wherein

R_1 represents an alkyl radical containing 1 to 10 carbon atoms, a substituted alkyl radical containing 1 to 10 carbon atoms, an aryl radical containing 5 to 14 carbon atoms, a substituted aryl radical containing 6 to 14 carbon atoms, an aralkyl radical containing 5 to 15 carbon atoms, a substituted aralkyl radical containing 7 to 15 carbon atoms, an alkenyl radical containing 3 to 10 carbon atoms, an alkynyl radical containing 3 to 10 carbon atoms, a cycloalkyl radical containing 3 to 12 carbon atoms, a cycloalkenyl radical containing 4 to 12 carbon atoms, a substituted cycloalkyl radical in which the cycloalkyl radical contains 3 to 12 carbon atoms, a substituted cycloalkenyl radical in which the cycloalkenyl radical contains 4 to 12 carbon atoms, a cycloalkyl alkyl radical containing 4 to 13 carbon atoms, a cycloalkenyl alkyl radical containing 5 to 13 carbon atoms, a (substituted cycloalkyl) alkyl radical containing 5 to 14 carbon atoms or a cyano radical;

R_2 represents a hydrogen, chlorine, fluorine, bromine or iodine atom, a methyl radical, an ethyl radical, a propyl radical, a butyl radical, a methoxy radical, an ethoxy radical, a propoxy radical, a butoxy radical, a nitro radical, an alkoxymethyl radical containing 2 to 6 carbon atoms, a hydroxy alkyl radical containing 1 to 6 carbon atoms, an alkenyl radical containing 3 to 6 carbon atoms, a thiocyanato radical, a cyano radical, a methylthiol radical, a methylthiomethyl radical, a phenylthiomethyl radical, an alkylthio radical containing 1 to 4 carbon atoms, a bromomethyl radical, a fluoromethyl radical, a chloromethyl radical or a carboxymethylthiomethyl radical;

R_3 represents a hydrogen, chlorine or bromine atom, an alkyl radical containing 1 to 5 carbon atoms, a chloroalkyl radical containing 1 to 4 carbon atoms, a bromoalkyl radical containing 1 to 4 carbon atoms, or an alkoxy radical containing 1 to 5 carbon atoms; or

R_2 and R_3 together represent a divalent radical which forms, together with the carbon atoms to which R_2 and R_3 are attached, a 5-, 6- or 7-membered ring;

R_4 represents a covalent radical of molecular weight from 15 to 250 which is an alkyl radical containing 1 to 10 carbon atoms, a substituted alkyl radical containing 1 to 10 carbon atoms, a cycloalkyl radical containing 3 to 12 carbon atoms, a substituted cycloalkyl radical in which the cycloalkyl radical contains 3 to 12 carbon atoms, a cycloalkylalkyl radical containing 4 to 13 carbon atoms, a (substituted cycloalkyl) alkyl radical in which the cycloalkyl alkyl radical contains 4 to 13 carbon atoms, a phenyl radical, a substituted phenyl radical, a phenylalkyl radical, a substituted phenylalkyl radical, a dialkylamino radical con-

taining 2 to 10 carbon atoms, an alkoxy radical containing 1 to 10 carbon atoms, a carbamyl radical, a substituted carbamyl radical, a thiocarbamyl radical, a substituted thiocarbamyl radical, a glycosyl radical, a cyano radical, an acyl radical, a carboxyethyl radical, a dialkoxyphosphoryl radical containing 2 to 6 carbon atoms, an alkylthio radical containing 1 to 12 carbon atoms, a bromoalkylthio radical containing 1 to 12 carbon atoms, a chloroalkylthio radical containing 1 to 12 carbon atoms, a benzylthio radical, a phenylthio radical, a halophenylthio radical, a mononitrophenylthio radical, a *p* - tert.butylphenylthio radical, a dinitrophenylthio radical or a tolylthio radical; and X represents an oxygen or sulphur atom.

2. A herbicidal composition comprising at least one 3-substituted uracil as defined in claim 1 associated with a diluent which is at least in part a solid.

3. A herbicidal composition according to Claim 1 which contains a surface-active agent.

4. A herbicidal composition according to Claim 2 which contains a surface-active agent.

5. A herbicidal composition comprising at least one 3-substituted uracil as defined in Claim 1 associated with a surface-active agent and a diluent which is a liquid other than an oil.

6. A herbicidal composition according to Claim 5 wherein the liquid is water.

7. A herbicidal composition comprising at least one 3-substituted uracil as defined in Claim 1 associated with a surface-active agent.

8. A herbicidal composition according to any one of Claims 3 to 7 which contains 1 to 10% by weight of the surface-active agent.

9. A herbicidal composition according to any one of the preceding claims which contains, in addition to the 3-substituted uracil, another compound having herbicidal properties.

10. A herbicidal composition comprising at least one 3-substituted uracil as defined in Claim 1 in association with a diluent and another compound having herbicidal properties.

11. A herbicidal composition according to Claim 9 or 10 wherein the other compound is one of the known herbicides specifically hereinbefore named.

12. A herbicidal composition according to any one of the preceding claims in the form of a concentrate which requires dilution before use as a herbicide.

13 A herbicidal composition according to any one of the preceding claims wherein X represents an oxygen atom.

14. A herbicidal composition according to any one of the preceding claims wherin if R_1 represents a substituted alkyl radical, the or each substituent is a bromine or chlorine atom, a hydroxy radical, an alkoxy radical, an alkoxycarbonyl radical, a dialkylamino radical or a cyano radical; if R_1 represents a substituted aryl radical, the or each substituent is a chlorine, bromine or fluorine atom, an alkoxy radical, an alkyl radical, a nitro radical, a chloroalkyl radical, a chloroalkoxy radical or a trifluoromethyl radical; if R_1 represents a substituted benzyl radical the or each substituent is a chlorine atom, an alkyl radical, an alkoxy radical or a nitro radical; and if R_1 represents a substituted cycloalkyl, substituted cycloalkenyl, (substituted cycloalkyl) alkyl or (substituted cycloalkenyl)alkyl radical the or each substituent is an alkyl radical containing 1 to 4 carbon atoms, a methoxy radical or a chlorine or bromine atom.

15. A herbicidal composition according to any one of the preceding claims wherein if R_4 represents a substituted alkyl radical the or each substituent is a bromine or chlorine atom, an hydroxy radical, an alkoxy radical, an alkoxycarbonyl radical, a dialkylamino radical or a cyano radical; if R_4 represents a substituted phenyl radical the or each substituent is a chlorine, bromine or fluorine atom, an alkoxy radical, an alkyl radical, a nitro radical, a chloroalkyl radical, a chloroalkoxy radical or a trifluoromethyl radical; if R_4 represents a substituted benzyl radical the or each substituent is a chlorine atom, an alkyl radical, an alkoxy radical or a nitro radical; if R_4 represents a substituted carbamyl or thiocarbamyl radical, the or each substituent is an alkyl radical containing 1 to 4 carbon atoms, a phenyl radical, a monochlorophenyl radical, a dichlorophenyl radical or a methoxy radical; and if R_4 represents an acyl radical it is a radical of the formula



wherein

R_{11} represents a hydrogen atom, an alkyl radical containing 1 to 4 carbon atoms, a monochloroalkyl radical containing 1 to 4 carbon atoms, a polychloroalkyl radical containing 1 to 4 carbon atoms, a phenyl radical, a chlorophenyl radical containing 1, 2 or 3 chlorine atoms, a benzyl radical, a chlorobenzyl radical containing 1, 2 or 3 chlorine atoms, a phenoxymethyl radical or a chlorophenoxymethyl radical containing 1 to 3 chlorine atoms.

16. A herbicidal composition according to any one of the preceding claims wherein if R_2 and R_3 together form a divalent radical, they form a radical of formula $(CH_2)_n$ where n is 3, 4 or 5.

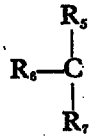
17. A herbicidal composition according to any one of Claims 1 to 13 wherein

X represents an oxygen atom,

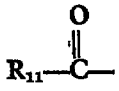
R_1 represents a cycloalkyl radical, a cyclo-

* C L M S *

alkenyl radical, a phenyl radical, or a radical of formula



where R_5 represents a hydrogen atom or methyl radical, R_6 represents a methyl or ethyl radical and R_7 represents an alkyl radical containing 1 to 5 carbon atoms;
R_2 represents a hydrogen or halogen atom, or a methyl, nitro, hydroxymethyl or methoxymethyl radical;
R_3 represents a hydrogen atom or a methyl radical; or
R_2 and R_3 together represent a divalent radical of formula $(CH_2)_n$ where n is 3, 4 or 5; and
R_4 represents a trichloromethylthio radical, an alkyl or substituted alkyl radical containing 1 to 10 carbon atoms, or an acyl radical of formula



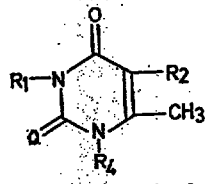
where R_{11} is as defined in Claim 15;
with the proviso that when R_2 represents a hydrogen atom, R_1 represents a cycloalkyl or cycloalkenyl radical.

18. A herbicidal composition according to Claim 17 wherein R_1 represents a 1-alkylethyl radical wherein the alkyl radical contains 1 to 4 carbon atoms; R_2 represents a halogen atom; R_3 represents a methyl radical and R_4 represents a methyl radical, an acyl radical containing 2 to 5 carbon atoms or a trichloromethylthio radical.

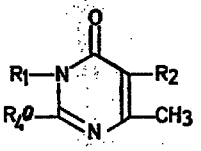
19. A herbicidal composition according to Claim 17 wherein R_1 represents a phenyl radical, R_2 represents a halogen atom, R_3 represents a methyl radical and R_4 represents a trichloromethylthio or an acyl radical containing 2 to 5 carbon atoms.

20. A herbicidal composition according to Claim 17 wherein R_1 represents a cycloalkyl radical, R_2 represents a halogen atom, R_3 represents a methyl radical and R_4 represents a trichloromethylthio radical or an acyl radical containing 2 to 5 carbon atoms.

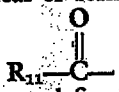
21. A herbicidal composition according to any one of Claims 1 to 14 wherein the 3-substituted uracil which is a compound of the general formula



or the corresponding isomeric formula



wherein
R_1 is as defined in Claim 1 or 14
R_2 represents a halogen atom; and
R_4 represents a trichloromethylthio radical or an acyl radical of formula



wherein R_{11} is as defined in Claim 15.

22. A herbicidal composition according to any one of claims 1 to 12 wherein the 3-substituted uracil is one of the compounds specifically named herein.

23. A herbicidal composition according to any one of the preceding claims substantially as hereinbefore described.

24. A herbicidal composition according to any one of Claims 1 to 22 substantially as described in any one of the foregoing Examples.

25. A method of controlling the growth of weeds at a locus which comprises applying to the locus a herbicidally effective quantity of at least one 3-substituted uracil as defined in any one of Claims 1 and 13 to 22.

26. A method according to Claim 25 wherein the 3-substituted uracil is applied in the form of a herbicidal composition as claimed in any one of Claims 1 to 24, after dilution where appropriate.

27. A method according to Claim 25 or 26 wherein the growth of the weeds specified in any one of Examples 7 to 17 is controlled by the application of the 3-substituted uracil or uracil complex specified in that Example.

28. A method according to Claim 25 substantially as hereinbefore described.

29. As a new compound a 3-substituted uracil as defined in Claim 21.

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