968,666

PATENT SPECIFICATION

NO DRAWINGS

968,666

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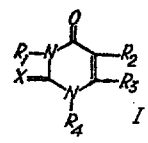
COMPLETE SPECIFICATION

Herbicidal Compositions containing 3-Substituted Uracils

We, E. I. Du Pont de Nemours & 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:—

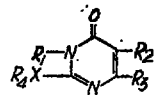
This invention relates to 3-substituted uracils and is an improvement in or modification of the invention described in our Application No. 28,141/60 (Serial No. 968,661).

Our Application No. 28,141/60 (Serial No. 968,661) discloses that certain 3-substituted uracils of defined formula have herbicidal activity. The present invention is concerned with closely related 3-substituted uracils having an additional substituent in the 1- or 2-position, namely 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 thiocyanate 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

[*Price 4s. 6d.*]

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. These compounds also have herbicidal activity.

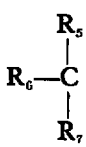
It will be noted that the definition above refers to the isomeric enol form of the uracil, as well as the usual keto form. It is not known with certainty whether the uracils exist in the keto or the enol form, but for the sake of convenience the keto form is generally referred to herein.

Examples of substituted alkyl groups in which the alkyl group contains 1 to 3 carbon atoms include such alkyl groups substituted by alkoxy groups, e.g. methoxy groups, or chlorine atoms. Examples of substituted phenyl groups include phenyl groups substituted by one or more of the following radicals; alkyl groups, e.g. methyl and butyl groups; halogen atoms, e.g. fluorine, chlorine and bromine atoms; nitro groups; alkoxy groups, e.g. methoxy and ethoxy groups; cyano groups; and hydroxy groups. Examples of substituted aralkyl groups containing 7 to 12 carbon atoms include such groups substituted by one or more of the following radicals; alkyl groups, as in methylbenzyl and butylphenethyl groups; chlorine atoms, as in chlorobenzyl; nitro groups; and methoxy groups, as in methoxybenzyl.

Examples of substituted carbamyl and thiocarbamyl groups include such groups substituted by one or two alkyl groups, e.g. methyl, ethyl and butyl groups.

The term "acyl group" is used to include both unsubstituted hydrocarbyl acyl groups such as alkanoyl and aroyl groups and substituted hydrocarbyl acyl groups, particularly halogen-substituted hydrocarbyl acyl groups. The acyl group is preferably one derived from a carboxylic acid.

One preferred group of compounds is that in which X represents an oxygen atom. A second preferred group of compounds is that in which R_1 represents a cycloalkyl or cycloalkenyl group of 5 to 8 carbon atoms or a group of the formula:



wherein R_5 is a hydrogen atom or a methyl group,

R_6 is a methyl or ethyl group, and

R_7 is an alkyl radical of 1 to 5 carbon atoms;

R_2 is a chlorine or bromine atom; and R_3 is a methyl group.

The 3-substituted uracils can be formulated as herbicidal compositions comprising at least one 3-substituted uracil which is a compound of general formula I or II as defined above 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.

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 of at least 125° C. Two or more different types of diluent may be present, as for example in compositions obtained by dispersing a wettable powder in a liquid diluent. Liquid compositions may be in the form of solutions or dispersions.

Examples of oil carriers are aliphatic and aromatic hydrocarbons, for example, hydrocarbons of petroleum origin. Dispersions in oils may be prepared by milling the active material, usually with dispersing agents and suspending agents, with the oil in mills such as pebble mills. The amount of the herbicide in the dispersion may be from 10% or less to 48 and 50% of the oil dispersion. Preferably, the particles in such dispersions range from about 1 to 50 microns, although the majority are preferably in the range of from about 5 to 20 microns in average diameters. In general, the oils used include aliphatic and aromatic hydrocarbons and mixtures thereof, particularly those derived from petroleum and having a boiling point in the range from about 125 to 400° C. A hydrocarbon oil having a boiling point lower than 125° C. should not be used because when sprayed from a nozzle, such a hydrocarbon tends to volatilize undesirably. Furthermore, low-boiling hydrocarbons present a serious fire hazard.

Compositions containing the uracils in association with a solid diluent may be in the form of powdered solids, granules or pellets. Powdered or dust compositions may be prepared by mixing the active material with finely divided inert solid carriers, preferably talcs, natural clays, pyrophyllite, diatomaceous earth, synthetic fine silica, calcium silicate, and flours such as walnut shell, wheat, redwood, soya bean, and cottonseeds, and including also magnesium and calcium carbonates, calcium phosphates, calcium silicate, sulphur and lime, either in powder or granular form.

Granule or pellet compositions may be prepared by mixing the active material in finely divided form with a clay (with or without a water-soluble binder), moistening

the mixture with 15—20% water, extruding the mass under pressure through an orifice, and either cutting the extruded material to size before drying to yield pellets, or first drying and then granulating to yield granules. Alternatively granules, but usually not pellets, may be made by spraying active material in solution or suspension upon the surface of a preformed granule of clay, vermiculite, or other suitable granular material. When the active material is soluble in the spray medium so that it can penetrate into the pores of the granular carrier, no binding agent is needed. When it is insoluble and in suspension form, a binder is needed to cause the active material to adhere to the surface. The binder may be soluble such as goulac, or dextrin or colloidally soluble such as swollen starch, glue or polyvinyl alcohol. The final step in either case is to remove the liquid medium, whether solvent or carrier.

The compositions of the invention will usually contain a surface-active agent, in the case of concentrates the amount suitably being sufficient to render the concentrate, e.g. wettable powder, readily dispersible in water or in oil.

The term "surface-active agent" is used herein to include wetting agents, dispersing agents, suspending agents and emulsifying agents. Suitable surface-active agents are listed in, for example, United States Patent Specifications 2,426,417, 2,655,447 and 2,412,510 and British Specification No. 492,742, "Soap and Chemical Specialties", *31*, No. 7, pages 50—61, No. 8, pages 48—61, No. 9, pages 52—67, and No. 10, pages 38—67 (1955), McCutcheon in "Soap and Chemical Specialties", December, 1957; January, February, March, 1958, and Bulletin E-607 of the Bureau of Entomology and Plant Quarantine of the U.S. Department of Agriculture. In general, less than 10% by weight of surface-active agent need be present in herbicidal compositions according to the invention, and the amount of surface-active agent may be 1% by weight or even less.

The herbicidal compositions of this invention may contain two or more of the substituted uracils. They may also be formulated to contain at least one other herbicide in addition to the substituted uracils, for example one of the 3-substituted uracils disclosed in our Applications Nos. 28,141/60, 32,469/60, 17,417/64, 17,418/64 and 17,419/64 (Serial Nos. 968,661, 968,662, 968,663, 968,664 and 968,665) and/or one of the following known herbicides:—

2,3,6 - trichlorobenzoic acid and salts thereof
2,3,5,6-tetrachlorobenzoic acid and salts thereof
2-chloro-N,N-diallylacetamide
N,N - dipropylthiolcarbamic acid, ethyl ester
2,2 - dichloropropionic acid and salts thereof

methylarsenic acid and salts thereof
borates
chlorates
ammonium sulphamate
2,4-dichlorophenoxyacetic acid

2,4,5-trichlorophenoxyacetic acid
N-phenylcarbamic acid, isopropyl ester
N - (*m* - chlorophenyl)carbamic acid, isopropyl ester
trichloroacetic acid
maleic hydrazide

1,1 - dimethyl - 3 - (3,4-dichlorophenyl)-urea
1,1 - dimethyl - 3 - (*p* - chlorophenyl)-urea
1,1 - dimethyl - 3 - phenylurea
1 - *n* - butyl - 1 - methyl - 3 - (3,4-dichlorophenyl)urea
1 - methoxy - 1 - methyl - 3 - (3,4-dichlorophenyl)urea

1 - methoxy - 1 - methyl - 3 - (*p*-chlorophenyl)urea
1,1,3 - trimethyl-3-(3,4 - dichlorophenyl)-urea
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
2,4 - bis(isopropylamino) - 6 - methoxy-*s* - triazine
dinitro-*sec.*-butylphenol
2,3,6 - trichlorophenylacetic acid
5,6 - dihydro - (4A,6A) - dipyrido - (1, 2-A, 2^1, 1^1-C) pyrazinium dibromide
2,6 - dichlorobenzonitrile

Optionally, the compositions may contain conventional additives, e.g. adhesives such as gelatin and blood albumin; resins, for example rosin and alkyd resins, may also be used in certain compositions to increase retention or tenacity of deposits following application.

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 3-substituted uracil which is a compound of general formula I or II as hereinbefore defined. 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 3-substituted uracils are especially useful in controlling the growth of weeds on uncultivated area. Thus in suitable circumstances some of the uracils can be used as soil sterilants and/or in soil-foliage applications; for the latter use, rates of at least 2 lb. per acre are generally required, while for tough weeds, rates of 10 to 25 or 35 lb. per acre, or even more, e.g. up to 80 lb. per acre, may be required. In suitable cases the uracils can be used to obtain selective control of weeds in the presence of crops. For such use pre-emergence application is usually preferred, in which case rates as low as 0.5 pounds per acre can be effective, though up to 2, 3, 4 or 5 pounds per acre or more may be needed in some instances. The uracils can also be used in some cases for post-emergence application.

The 3-substituted uracils can be prepared by the adaptation of methods known for the preparation of related compounds. For example they can be prepared from the corresponding uracils having no substituent in the 1-position by a substitution reaction of a known type, e.g. using one of the following reactants:—

Reactant	R_4
ketene	$CH_3—C(=O)—$
trichloroacetyl chloride + acid acceptor (or other acyl chlorides)	$CCl_3—C(=O)—$
2,2-dichloropropionyl chloride + acceptor	$CH_3—CCl_2—C(=O)—$
ethyleneoxide	$HO.CH_2CH_2—$
β-propiolactone (and other lactones)	$HO—CH_2—CH_2—C(=O)—$
(or alternatively, depending on the point of ring opening)	$HO—CO—CH_2—CH_2—$
trichloromethanesulphenyl chloride (and other suitable sulphenyl halides)	$Cl_3C—S—$
methylsulphate (and other suitable alkyl sulphates or alkyl halides)	$CH_3—$
ethylsulphate	$C_2H_5—$
isocyanates, e.g. $CH_3—N=C=O$	$CH_3—N(H)—C(=O)—$
isothiocyanates, e.g. $CH_3—N=C=S$	$CH_3—N(H)—C(=S)—$

In many cases the reagents will react on the 3-substituted uracils directly without solvent or catalyst to form the desired products. In general, however, it is preferable that a solvent be used to facilitate handling of the material, to moderate the reaction or to aid

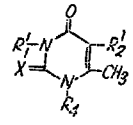
in maintaining a desired temperature. In many cases equivalent amounts of a base such as sodium hydroxide are necessary to promote the reaction. When a base such as sodium hydroxide is used, water is a very good medium in which to carry out the reaction. In certain other cases, however, stronger bases such as sodium hydride must be used and anhydrous solvent systems like dioxane, toluene, benzene and xylene are necessary and desirable for promoting the reaction.

General descriptions of other methods of preparation which can be adapted to the preparation of uracils of the formula given above in which R_1 is an alkyl, perchloromethylmercapto, acyl, aroyl, hydroxymethyl, arylsulphenyl, carbamyl, or carboxyethyl alkane radical may be found in the references given below:

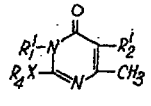
U.S. Patent Specification No. 2,553,770 JOC *14* 1099 (1949)
J.A.C.S. *52* 2006 (1930) J.A.C.S. *54* 2436 (1932)
Shirley in *Preparation of Organic Intermediates*, 1951, p. 59

Corresponding uracils with no substituent in the 1-position can be made by known methods or by methods known for the preparation of related compounds or by the new method disclosed and claimed in our Application No. 28,141/60 (Serial No. 968,661). Certain of these compounds are described and claimed in our Applications Nos. 28141/60, 17417/64, 17418/64 and 17419/64 (Serial Nos. 968,861, 968,663, 968,664 and 968,665).

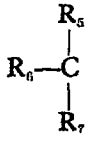
Certain of the 3-substituted uracils of formula I or II above are believed to be new compounds and as such form part of the present invention. One group of the new uracils has the general formula:



or the corresponding isomeric formula:



wherein R^1_1 is a cycloalkyl or cycloalkenyl group of 5 to 8 carbon atoms or a group of the formula:



wherein R_5 is a hydrogen atom or a methyl group,
R_6 is a methyl or ethyl group, and
R_7 is an alkyl radical of 1 to 5 carbon atoms;

R^1_2 is a chlorine or bromine atom; R_4 is as hereinbefore defined, except that it is not a methyl group; and X is oxygen or sulphur.

A second group of the new uracils has the general formula I or II as hereinbefore defined wherein

R_1 is a covalent organic radical of molecular weight 15 to 250 which is an alkyl group of 1 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 represents a halogen atom;
R_3 represents a methyl group; and
R_4 represents an acyl group.

5 - chloro - 3 - cyclohexyl - 1,6 - dimethyl uracil is also a new compound.

The invention is illustrated by the following Examples, in which parts and percentages are by weight except where otherwise noted. Certain of the uracils used as starting materials in the Examples are new compounds, but they can readily be prepared by the methods hereinbefore described.

EXAMPLE 1
1-acetyl-3-n-butyl-5-bromo-6-methyluracil

Ketene in nitrogen as a carrier gas was bubbled into 104 parts of 3-n-butyl-5-bromo-6-methyluracil in 1000 parts of acetone at room temperature. A mild exothermic reaction took place, after which the resulting solution was concentrated to an oil at room temperature and treated with cold water to give a solid which, after dissolving in ether and washing with 5% sodium hydroxide and with water, drying and recrystallizing from hexane, gave pure 1 - acetyl - 3 - n - butyl-5 - bromo - 6 - methyluracil melting at 54.5 to 55° C.

In the following Examples the uracil products were obtained by reacting the 3-substituted uracil reactant with reagents such as ketene, isocyanates and isothiocyanates, using the general technique of Example 1, or by reacting an alkali metal salt of the 3-substituted uracil reactant in an aqueous medium with reagents such as dialkyl sulphates, acyl halides, β-propiolactone, carbamyl chlorides, O,O-diethyl phosphoryl halides, formaldehyde and sulphenyl halides.

Ex.	Uracil Starting Reagent	Weight	Reactant	Weight	Product
2	3-(3,4-dichlorophenyl)-5,6-trimethyleneuracil	100	Dimethyl sulphate	126	1-methyl-3-(3,4-dichlorophenyl)-5,6-trimethyleneuracil
3	3-tert.butyl-5-,6-trimethyleneuracil	101	ketene	126	1-acetyl-3-tert.butyl-5,6-trimethyleneuracil
4	3-cyclohexyl-5-bromo-6-methyluracil	287	dimethyl sulphate	126	1,6-dimethyl-3-cyclohexyl-5-bromouracil
5	3-cyclohexyl-6-methyluracil	333	dimethyl sulphate	126	1,6-dimethyl-3-cyclohexyluracil
6	3-isopropyl-5,6-trimethyleneuracil	194	dimethyl sulphate	126	1-methyl-3-isopropyl-5,6-trimethyleneuracil
7	3-cyclohexyl-5-chloro-6-methyluracil	243	dimethyl sulphate	126	1-methyl-3-cyclohexyl-5-chloro-6-methyluracil
8	3-isopropyl-5-bromo-6-methyluracil	247	dimethyl sulphate	126	1,6-dimethyl-3-isopropyl-5-bromouracil
9	3-cyclohexyl-5-hydroxy-6-methyluracil	103	dimethyl sulphate	126	1,6-dimethyl-3-cyclohexyl-5-hydroxymethyluracil
10	3-isopropyl-5-chloro-6-methyluracil	141	dimethyl sulphate	126	1,6-dimethyl-3-isopropyl-5-chlorouracil
11	3-cyclohexyl-5-bromo-6-methyluracil	287	diethyl sulphate	154	1-ethyl-3-cyclohexyl-5-bromo-6-methyluracil
12	3-secondary butyl-5-bromo-6-methyluracil	261	~~2,4-dinitrobenzene-sulphenylchloride~~	235	1-(2,4-dinitrophenylthio)-3-secondary butyl-5-bromo-6-methyluracil
13	3-(3-n-amyl)-5-bromo-6-methyluracil	275	benzoyl chloride	140	1-benzoyl-3-(3-n-amyl)-5-bromo-6-methyluracil
14	3-cyclohexyl-5-bromo-6-methyluracil	287	β-propiolactone	79	3-cyclohexyl-5-bromo-6-methyluracil-1-propionic acid

PATENT OFFICE

2, 4 - dinitrobenzene sulphenyl chloride

Ex. No.	Uracil Starting Reagent	Alkylating Agent	Parts by Weight	Product
15	5-chloro-3-cyclohexyl-6-methyluracil	diethyl sulphate	154	5-chloro-3-cyclohexyl-1-ethyl-6-methyluracil
16	5-bromo-3-cyclopentenyl-6-methyluracil	diethyl sulphate	154	5-bromo-3-cyclopentenyl-1-ethyl-6-methyluracil
17	5-bromo-3-cycloheptyl-6-methyluracil	diethyl sulphate	126	5-bromo-3-cycloheptyl-1-ethyl-6-methyluracil
18	5-chloro-3-cyclopentyl-6-methyluracil	di-n-propyl sulphate	182	5-chloro-3-cyclopentyl-6-methyl-1-n-propyluracil
19	5-bromo-3-sec. butyl-6-methyluracil	dimethyl sulphate	126	5-bromo-3-sec. butyl-1,6-dimethyluracil
20	3-sec. amyl-5-bromo-6-methyluracil	diemthyl sulphate	126	3-sec. amyl-5-bromo-1,6-dimethyluracil
21	5-bromo-3-t-butyl-6-methyluracil	dimethyl sulphate	126	5-bromo-3-t-butyl-1,6-dimethyluracil
22	3-cyclohexyl-5,6-dimethyluracil	dimethyl sulphate	126	3-cyclohexyl-1,5,6-trimethyluracil
23	3-cyclopentenyl-5,6-dimethyluracil	di-n-propyl sulphate	182	3-cyclopentenyl-5,6-dimethyl-1-n-propyluracil
24	3-cyclohexenyl-5-ethyl-6-methyluracil	dimethyl sulphate	126	3-cyclohexenyl-1,6-dimethyl-5-ethyluracil
25	3-t-butyl-5,6-dimethyluracil	diethyl sulphate	154	3-t-butyl-5,6-dimethyl-1-ethyluracil
26	3-sec.butyl-5,6-trimethyleneuracil	diethyl sulphate	154	3-sec.butyl-1-ethyl-5,6-trimethyleneuracil
27	3-cyclohexyl-5,6-trimethyleneuracil	dimethyl sulphate	126	3-cyclohexyl-1-methyl-5,6-trimethyleneuracil

Ex. No.	Uracil Starting Reagent	Alkylating Agent	Parts by Weight	Product
28	3-cyclohexyl-5,6-tetramethyleneuracil	dimethyl sulphonate	126	3-cyclohexyl-1-methyl-5,6-tetramethylene-uracil
29	3-ethyl-5,6-tetramethyleneuracil	dimethyl sulphonate	126	3-ethyl-1-methyl-5,6-tetramethyleneuracil
30	3-phenyl-5,6-trimethyleneuracil	di-n-propyl sulphate	182	3-phenyl-1-n-propyl-5,6-trimethyleneuracil
31	5-bromo-6-methyl-3-sec.octyluracil	dimethyl sulphate	126	5-bromo-1,6-dimethyl-3-sec. octyluracil
32	3-sec. hexyl-5-hydroxymethyl-6-methyluracil	diethyl sulphate	154	1-ethyl-3-sec. hexyl-5-hydroxy-methyl-6-methyluracil
33	5-bromo-3-cyclohexyl-6-ethyluracil	dimethyl sulphate	126	5-bromo-3-cyclohexyl-6-ethyl-1-methyluracil
34	3-cyclohexyl-6-methyluracil	diethyl sulphate	154	3-cyclohexyl-1-ethyl-6-methyluracil
35	3-cyclopentyl-6-methyluracil	di-n-propyl sulphate	182	3-cyclopentyl-6-methyl-1-n-propyluracil
36	3-cycloheptyl-6-methyluracil	dimethyl sulphate	126	3-cycloheptyl-1,6-dimethyluracil
37	3-cyclohexyluracil	dimethyl sulphate	126	3-cyclohexyl-1-methyluracil

PATENT OFFICE

No.	Uracil Starting Reagent	Reactant	Product
38	3-isopropyl-5,6-trimethyleneuracil	Ketene	1-acetyl-3-isopropyl-5,6-trimethyleneuracil
39	3-sec. butyl-5,6-trimethyleneuracil	Ketene	1-acetyl-3-sec. butyl-5,6-trimethyleneuracil
40	3-cyclohexyl-5,6-trimethyleneuracil	Ketene	1-acetyl-3-cyclohexyl-5,6-~~trimethyleneuracil~~ trimethyleneuracil
41	3-sec. butyl-5-bromo-6-methyluracil	Ketene	1-acetyl-3-sec. butyl-5-bromo-6-methyluracil
42	3-tert. octyl-5-bromouracil	Ketene	1-acetyl-3-tert. octyl-5-bromouracil
43	3-isopropyl-5-bromo-6-methyluracil	Ketene	1-acetyl-3-isopropyl-5-bromo-6-methyluracil
44	3-cyclohexyl-5-chlorouracil	Ketene	1-acetyl-3-cyclohexyl-5-chlorouracil
45	3-isopropyl-5-nitro-6-methyluracil	Ketene	1-acetyl-3-ispropyl-5-nitro-6-methyluracil
46	3-isopropyl-5-(2-hydroxyethyl)-6-methyluracil	Ketene	1-acetyl-3-isopropyl-5-(2-hydroxyethyl)-6-methyluracil
47	3-cyclohexyl-5-(hydroxymethyl)-6-methyluracil	Ketene	1-acetyl-3-cyclohexyl-5-(hydroxymethyl)-6-methyluracil
48	3-isopropyl-5-bromo-6-methyl-2-~~thiouarcil~~ thiouracil	Ketene	1-acetyl-3-isopropyl-5-bromo-6-methyl-2-thiouracil
49	5-bromo-3-ethyl-6-methyluracil	benzoyl chloride	1-benzoyl-5-bromo-3-ethyl-6-methyluracil
50	5-bromo-6-methyl-3-isopropyluracil	propionyl chloride	5-bromo-6-methyl-1-propionyl-3-isopropyluracil

Ex. No.	Uracil Starting Reagent	Reactant	Product
51	5-bromo-3-isobutyl-6-methyluracil	*o*-chlorobenzoyl chloride	5-bromo-1-[*o*-chlorobenzoyl]-3-isobutyl-6-methyluracil
52	5-bromo-3-t-butyl-6-methyluracil	diethylphosphoro-chloridate	5-bromo-3-t-butyl-1-diethoxy-phosphoro-6-methyluracil
53	3-sec. amyl-5-bromo-6-methyluracil	benzoyl chloride	3-sec. amyl-1-benzoyl-5-bromo-6-methyl-uracil
54	5-chloro-3-cyclohexyl-6-methyluracil	2,4-dichlorophenoxy-acetyl chloride	5-chloro-3-cyclohexyl-1-[2,4-dichloro-phenoxyacetyl]-6-methyluracil
55	3-sec. butyl-5-chloro-6-methyluracil	butyryl chloride	3-sec. butyl-1-butyryl-5-chloro-6-methyl-uracil
56	5-bromo-3-sec.butyl-6-methyluracil	2,3,6-trichlorobenzoyl chloride	5-bromo-3-sec.butyl-6-methyl-1-[2,3,6-tri-chlorobenzoyl]-uracil
57	5-bromo-3-cyclohexyl-6-methyluracil	2,6-dichlorobenzoyl chloride	5-bromo-3-cyclohexyl-1-[2,6-dichloro-benzoyl]-6-methyluracil
58	5-chloro-3-cyclohexenyl-6-methyl-uracil	α,α-dichloropropionyl chloride	5-chloro-3-cyclohexenyl-1-[α,α-dichloro-propionyl]-6-methyluracil
59	3-cyclohexyl-5,6-dimethyluracil	benzoyl chloride	1-benzoyl-3-cyclohexyl-5,6-dimethyluracil
60	3-cyclopentyl-5,6-dimethyluracil	2,4-dichlorobenzoyl chloride	3-cyclopentyl-1-[2,4-dichlorobenzoyl]-5,6-dimethyluracil
61	5-chloro-3-t-butyl-6-methyluracil	benzoyl chloride	1-benzoyl-5-chloro-3-t-butyl-6-methyluracil

PATENT OFFICE

Ex. No.	Uracil Starting Reagent	Reactant	Product
62	5-bromo-3-cyclohexyl-6-ethyluracil	O,O-diethylphosphoryl chloride	5-bromo-3-cyclohexyl-1-diethoxyphosphoro-6-ethyluracil
63	5-bromo-3-cyclohexyl-6-methyluracil	2,3,6-trichlorobenzoyl chloride	5-bromo-3-cyclohexyl-6-methyl-1-[2,3,6-trichlorobenzoyl]-uracil
64	3-cyclohexyl-6-methyluracil	2,3,6-trichlorobenzoyl chloride	3-cyclohexyl-6-methyl-1-[2,3,6-trichloro-benzoyl]-uracil
65	3-cyclohexyl-6-methyluracil	benzoyl chloride	1-benzoyl-3-cyclohexyl-6-methyluracil
66	3-isopropyl-5,6-trimethyleneuracil	propionyl chloride	1-propionyl-3-isopropyl-5,6-trimethylene-uracil
67	3-cyclohexyl-5,6-trimethyleneuracil	benzoyl chloride	1-benzoyl-3-cyclohexyl-5,6-trimethylene-uracil
68	3-cyclohexyl-5,6-tetramethylene-uracil	O,O-diethylphosphoryl chloride	3-cyclohexyl-1-diethoxyphosphoro-5,6-tetra-methyleneuracil
69	5-bromo-3-sec. octyl-6-methyluracil	benzoyl chloride	1-benzoyl-5-bromo-3-sec.octyl-6-methyluracil
70	5-bromo-3-cyclohexyluracil	propionyl chloride	5-bromo-3-cyclohexyl-1-propionyluracil
71	5-bromo-3-isopropyl-6-methyluracil	dimethylcarbamyl chloride	5-bromo-1-dimethylcarbamyl-3-isopropyl-6-methyluracil
72	5-chloro-3-cyclohexyl-6-methyluracil	diethylcarbamyl chloride	5-chloro-3-cyclohexyl-1-diethylcarbamyl-6-methyluracil

Ex. No.	Uracil Starting Reagent	Reactant	Parts	Product
73	3-cyclohexyl-5,6-dimethyluracil	Formaldehyde (40% aq.)	82.5	3-cyclohexyl-5,6-dimethyl-1-hydroxymethyluracil
74	3-cyclopentyl-5,6-dimethyluracil	Formaldehyde (40% aq.)	82.5	3-cyclopentyl-5,6-dimethyl-1-hydroxymethyluracil
75	3-cyclohexyl-5,6-trimethyleneuracil	Formaldehyde (40% aq.)	82.5	3-cyclohexyl-1-hydroxymethyl-5,6-trimethyleneuracil
76	3-cyclohexyl-5,6-tetramethylene-uracil	Formaldehyde (40% aq.)	82.5	3-cyclohexyl-1-hydroxymethyl-5,6-tetramethylene-uracil
77	3-cyclohexyl-5,6-pentamethylene-uracil	Formaldehyde (40% aq.)	82.5	3-cyclohexyl-1-hydroxymethyl-5,6-pentamethylene-uracil
78	5-bromo-6-methyl-3-isopropyluracil	benzene sulphenyl chloride	145	5-bromo-6-methyl-1-phenyl thio-3-isopropyluracil
79	3-sec.butyl-5-chloro-6-methyl-uracil	*p*-chloro benzene sulphenyl chloride	180	3-sec.butyl-5-chloro-1-[*p*-chlorophenyl thio]-6-methyl-uracil
80	5-bromo-3-t-butyl-6-methyluracil	2,4-dichlorobenzene sulphenyl chloride	216	5-bromo-3-t-butyl-1-[2,4-dichlorophenyl thio]-6-methyl uracil
81	5-bromo-3-isohexyl-6-methyluracil	benzene sulphenyl chloride	145	5-bromo-3-isohexyl-6-methyl-1-(phenyl thio)uracil
82	5-bromo-6-methyl-3-sec. octyl uracil	*p*-nitro benzene sulphenyl chloride	191	5-bromo-6-methyl-1-[*p*-nitrophenyl thio]-3-sec.octyl uracil
83	5-chloro-6-methyl-3-isopropyl-uracil	*p*-toluene sulphenyl chloride	159	5-chloro-6-methyl-3-isopropyl-1-(*p*-toluene sulphenyl)-uracil
84	5-bromo-3-sec.butyl-6-ethyluracil	2,4-dinitro benzene sulphenyl chloride	235	5-bromo-3-sec.butyl-1-[2,4-dinitro phenyl thio]-6-ethyl uracil
85	5-bromo-6-methyl-3-phenyluracil	benzene sulphenyl chloride	145	5-bromo-6-methyl-3-phenyl-1-(phenyl thio)uracil
86	5,6-dimethyl-3-isopropyluracil	2,4-dichloro-benzene sulphenyl chloride	216	5,6-dimethyl-1-[2,4-dichlorophenyl thio]-3-isopropyl-uracil
87	3-cyclohexyl-5,6-dimethyluracil	*p*-chloro benzene sulphenyl chloride	180	3-cyclohexyl-1-[*p*-chlorophenylthio]-5,6-dimethyluracil
88	3-cyclopentyl-5,6-dimethyluracil	*p*-toluene sulphenyl chloride	160	3-cyclopentyl-5,6-dimethyl-1-[*p*-toluene sulphenyl]-uracil

In the following Examples the other reactant is β-propiolactone.

Ex. No.	Uracil Starting Reagent	Product
113	5-bromo-3-isopropyl-6-methyluracil	5-bromo-3-isopropyl-6-methyl-1-uracil-propionic acid
114	3-cyclohexyl-5,6-trimethyleneuracil	3-cyclohexyl-5,6-trimethylene-1-uracil-propionic acid
115	3-phenyl-5-bromo-6-methyluracil	5-bromo-3-phenyl-6-methyl-1-uracilpropionic acid
116	3-(3,4-dichlorophenyl)-5,6-dimethyl-uracil	3-(3,4-dichlorophenyl)-5,6-dimethyl-1-uracil-propionic acid
117	5-chloro-3-sec. butyl-6-methyluracil	5-chloro-3-sec.butyl-6-methyl-1-uracil-propionic acid
118	3-isopropyl-5,6-tetramethyleneuracil	3-isopropyl-5,6-tetramethylene-1-uracil-propionic acid
119	3-isopropyl-5-bromouracil	3-isopropyl-5-bromo-1-uracilpropionic acid
120	3-isopropyl-5-bromo-6-methyl-2-thio-uracil	3-isopropyl-5-bromo-6-methyl-2-thiouracil propionic acid
121	3-tert. butyl-5-bromouracil	3-tert. butyl-5-bromo-1-uracilpropionic acid
122	3-tert.amyl-5-methoxy-6-methyluracil	3-tert.amyl-5-methoxy-6-methyl-1-uracil-propionic acid

EXAMPLE 123

1,3-di-iso-propyl-5-bromo-6-methyl-uracil

A suspension of the sodium derivative of 3 - isopropyl - 5 - bromo - 6 - methyluracil in dioxane is prepared under anhydrous conditions by gradual addition of 48 parts of sodium hydride (55% active in mineral oil) to a stirred solution of 247 parts of 3-isopropyl-5-bromo-6-methyluracil in 1000 parts of dioxane under an atmosphere of nitrogen. Formation of the sodium derivative may be followed by the evolution of hydrogen. When hydrogen ceases to be evolved, the first step is complete and the sodium salt suspension is heated to reflux and stirred as 123 parts by weight of isopropyl bromide is gradually added. Refluxing is continued until sodium bromide ceases to form. After cooling, the solution is cautiously diluted with water to precipitate the product. It is filtered, dried, washed with cold heptane to remove mineral oil and dried. The essentially pure 1,3-di-iso-propyl-5-bromo-6-methyluracil may be used as such or recrystallised from a suitable solvent if higher purity is desired.

In the following Examples equivalent quantities of the listed uracil starting reagents and alkyl halides are substituted for the 5-bromo-6-methyl-3-isopropyluracil and isopropyl bromide respectively in Example 123 above.

Ex. No.	Uracil Starting Reagent	Alkyl Halide	Parts by Weight	Uracil Product
124	5-bromo-3-cyclohexyl-6-methyluracil	isopropyl bromide	123	5-bromo-3-cyclohexyl-6-methyl-1-isopropyluracil
125	5-bromo-3-sec.butyl-6-methyluracil	isopropyl bromide	123	5-bromo-3-sec.butyl-6-methyl-1-isopropyluracil
126	3-isopropyl-5,6-dimethyluracil	isopropyl ~~bromide~~ bromide	123	5,6-dimethyl-1,3-diisopropyluracil

EXAMPLE 127

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

A solution of 41 parts of sodium hydroxide, 600 parts of water, 470 parts of isopropyl alcohol and 247 parts of 5-bromo-6-methyl-3-isopropyluracil was stirred and cooled to 6° C. To this rapidly stirring solution was added 186 parts of perchloromethylmercaptan. A white solid formed almost immediately. After stirring for 3—5 minutes the solid was filtered off, washed with water, dried, recrystallized twice from heptane and had a melting point of 96—100° C. After recrystallization from ethanol the m.p. was 103—105° C.

EXAMPLE 128

1-trichloromethylthio-3-cyclohexyl-6-methyluracil

A mixture of 104 parts of 3-cyclohexyl-6-methyluracil, 235 parts of isopropyl alcohol, 300 parts of water and 20.5 parts of sodium hydroxide was stirred until solution resulted. It was then cooled to 10° C. and 93 parts of perchloromethylmercaptan was added. The derivative precipitated almost immediately. It was recrystallized from a mixture of ethanol and water and melted at 129—131° C.

The following 1-trichloromethylthio uracils may be made by the procedure of Example 127 by substituting equivalent amounts of the appropriate uracil starting reagent for the 5 - bromo - 6 - methyl - 3 - isopropyluracil in Example 127.

PATENT OFFICE

Ex. No.	Uracil Starting Reagent	Reactant	Parts by Weight	Product
89	5-bromo-3-ethyl-6-methyluracil	benzene sulphenyl chloride	145	5-bromo-3-ethyl-6-methyl-1-(phenyl thio)uracil
90	5-chloro-3-cyclooctenyluracil	*p*-nitro benzene sulphenyl chloride	191	5-chloro-3-cyclooctenyl-1-[*p*-nitrophenyl thio]uracil
91	3-sec.amyl-5-bromo-6-methyluracil	benzene sulphenyl chloride	145	3-sec.amyl-5-bromo-6-methyl-1-(phenyl thio)uracil
92	3-ethyl-5,6-trimethyleneuracil	benzene sulphenyl chloride	145	3-ethyl-1-(phenyl thio)-5,6-trimethyleneuracil
93	3-isopropyl-5,6-tetramethylene-uracil	benzene sulphenyl chloride	145	1-phenyl thio-3-isopropyl-5,6-tetramethyleneuracil
94	3-cyclohexyl-5,6-tetramethylene-uracil	*p*-chloro benzene sulphenyl chloride	180	1-[*p*-chlorophenyl thio]-3-cyclohexyl-5,6-tetramethyl-eneuracil
95	5-bromo-3-cyclohexyl-6-methyl-uracil	2,4-dinitro benzene sulphenyl chloride	235	5-bromo-3-cyclohexyl-1-[2,4-dinitrophenyl thio]-6-methyluracil
96	5-chloro-3-cylopentenyl-6-methyl-uracil	*p*-chlorobenzene sulphenyl-chloride	180	5-chloro-1-[*p*-chlorophenyl thio]-3-cyclopentenyl-6-methyluracil
97	5-bromo-3-cyclooctenyl-6-methyl-uracil	benzene sulphenyl chloride	145	5-bromo-3-cyclooctenyl-6-methyl-1-(phenyl thio)-uracil
98	3-cyclohexyluracil	benzene sulphenyl chloride	145	3-cyclohexyl-1-(phenyl thio)uracil

Ex. No.	Uracil Starting Reagent	R—NCX	Product
99	5-bromo-3-isopropyl-6-methyluracil	CH_3NCO	5-bromo-1-methylcarbamyl-3-isopropyl-6-methyluracil
100	5-bromo-3-sec.butyl-6-methyluracil	CH_3NCO	5-bromo-3-sec.butyl-1-methylcarbamyl-6-methyluracil
101	5-chloro-3-sec.butyl-6-methyluracil	CH_3NCS	5-chloro-3-sec.butyl-1-methylthiocarbamyl-6-methyl-uracil
102	5-bromo-3-cyclohexyluracil	CH_3NCO	5-bromo-3-cyclohexyl-1-methylcarbamyluracil
103	3-cyclohexyl-6-methyluracil	CH_3NCO	3-cyclohexyl-1-methylcarbamyl-6-methyluracil
104	3-cyclohexyl-5,6-trimethyleneuracil	CH_3NCO	3-cyclohexyl-1-methylcarbamyl-5,6-trimethyleneuracil
105	3-isopropyl-5,6-dimethyluracil	CH_3NCO	3-isopropyl-1-methylcarbamyl-5,6-dimethyluracil
106	3-isopropyl-5-bromo-6-methyluracil	EtNCO	3-isopropyl-1-ethylcarbamyl-5-bromo-6-methyluracil
107	3-tert.butyl-5-bromo-6-methyluracil	C_4H_9NCO	3-tert.butyl-1-n-butylcarbamyl-5-bromo-6-methyluracil
108	3-ethyl-5-bromo-6-methyluracil	ϕNCO	3-ethyl-1-carbanilyl-5-bromo-6-methyluracil
109	3-n-butyl-5-chloro-6-methyluracil	ϕNCS	3-n-butyl-1-thiocarbanilyl-5-chloro-6-methyluracil
110	3-isopropyl-5-bromo-6-methyluracil	$Cl_2\phi NCO$	3-isopropyl-1-(3,4-dichlorocarbanilyl)-5-bromo-6-methyluracil
111	3-isopropyl-5-nitro-6-methyluracil	C_3H_5NCS	3-isopropyl-1-allylthiocarbamyl-5-nitro-6-methyl-uracil
112	3-isopropyl-5-methoxy-6-methyluracil	CH_3NCO	3-isopropyl-1-methylcarbamyl-5-methoxy-6-methyl-uracil

PATENT OFFICE

Ex. No.	1,3-Disubstituted Uracil Product
129	5-chloro-3-ethyl-6-methyl-1-(trichloromethylthio)uracil
130	5-bromo-3-isobutyl-6-methyl-1-(trichloromethylthio)uracil
131	5-bromo-3-sec. butyl-6-methyl-1-(trichloromethylthio)uracil
132	5-bromo-3-t.butyl-6-methyl-1-(trichloromethylthio)uracil
133	5-bromo-3-sec. hexyl-6-methyl-1-(trichloromethylthio)uracil
134	5-bromo-3-cyclohexyl-6-methyl-1-(trichloromethylthio)uracil
135	5-chloro-3-cyclopentyl-6-methyl-1-(trichloromethylthio)uracil
136	5-bromo-3-cycloheptenyl-6-methyl-1-(trichloromethylthio)uracil
137	5-bromo-3-cyclooctyl-6-methyl-1-(trichloromethylthio)uracil
138	5-chloro-3-sec. butyl-6-ethyl-1-(trichloromethylthio)uracil
139	5-chloro-6-methyl-3-isopropyl-1-(trichloromethylthio)uracil
140	5,6-dimethyl-3-isopropyl-1-(trichloromethylthio)-uracil
141	5,6-dimethyl-3-cyclohexyl-1-(trichloromethylthio)-uracil
142	5,6-dimethyl-3-sec. butyl-1-(trichloromethylthio)uracil
143	3-isopropyl-5,6-trimethylene-1-(trichloromethylthio)uracil
144	3-sec. butyl-1-trichloromethylthio-5,6-trimethyleneuracil
145	3-t-butyl-5,6-tetramethylene-1-(trichloromethylthio)uracil
146	3-sec. amyl-5-bromo-6-ethyl-1-(trichloromethylthio)uracil
147	5-bromo-6-ethyl-3-isopropyl-1-(trichloromethylthio)uracil
148	6-methyl-5-nitro-3-isopropyl-1-(trichloromethylthio)uracil
149	5-hydroxymethyl-6-methyl-3-sec. octyl-1-(trichloromethylthio)uracil
150	3-isopropyl-1-(trichloromethylthio)uracil

PATENT OFFICE

Other typical 3-substituted uracils useful in the practice of the invention are the following:

3-sec. amyl-1-trichloromethylthio-5-bromo-6-methyluracil

3-phenyl-1-trichloromethylthio-5-bromo-6-methyluracil

3-benzyl-1-trichloromethylthio-5-chloro-6-methyluracil

3-cyclopentyl-1-trichloromethylthio-5-bromo-6-methyluracil

3-cyclohexyl-1-methyl-5-bromo-6-methyluracil

3-cyclohexyl-1-ethyl-5-bromo-6-methyluracil

3-cyclohexyl-1-trichloromethylthio-5-ethyl-6-methyluracil

3-isopropyl-1-trichloromethylthio-5,6-dimethyluracil

3-n-propyl-1-isopropyl-5,6-dimethyluracil

3-tert. octyl-1-ethyl-5-bromo-6-methyluracil

3-cyclohexyl-1-trichloromethylthio-6-methyluracil

3-cyclohexyl-1,6-dimethyl-5-chlorouracil

3-butyl-1-acetyl-5-bromo-6-methyluracil

3-tert. butyl-1-acetyl-5,6-dimethyluracil

3-phenyl-1-acetyl-5-bromo-6-methyluracil

3-ethyl-1-benzoyl-5-chloro-6-methyluracil

3-cyclohexyl-1-acetyl-5,6-trimethyleneuracil

3-sec. amyl-1-acetyl-5,6-trimethyleneuracil

3-n-propyl-1-chloroacetyl-5-chloro-6-methyluracil

3-phenyl-1-trichloroacetyl-5-bromo-6-methyluracil

3-phenyl-1,5,6-trimethyluracil

3-isopropyl-1-trichloromethylthio-5,6-trimethyleneuracil

3-cyclohexyl-5-hydroxymethyl-1-(trichloromethylthio)-6-methyluracil

3-cyclohexyl-1-methylcarbamyl-6-methyluracil

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

3-isopropyl-1-methylcarbamyl-5,6-dimethyluracil

3-isopropyl-1-(diethoxyphosphoryl)-5-chloro-6-methyluracil

3-sec. butyl-1-(diethoxyphosphoryl)-5-bromo-6-methyluracil

EXAMPLE 151
WETTABLE POWDER

A wettable powder is prepared by blending the following components, micropulverizing them until substantially all the particles are below 50 microns in size and then reblending:

5-bromo-1,6-dimethyl-3-isopropyluracil	80.00%
Alkyl naphthalene sulphonic acid, sodium salt	1.75%
Low viscosity methylcellulose	0.25%
Disodium phosphate (corrosion inhibitor)	0.80%
Attapulgite clay	17.20%

This wettable powder formulation is 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, goldenrod, evening primrose, pokeweed, ox-eye daisy, cocklebur, goose grass, crab grass, broom sedge, love grass, pigweed, chickweed, foxtail and barnyard grass is obtained.

The following compounds are formulated and used as described above.

5-bromo-1,3-diisopropyl-6-methyluracil
3-cyclohexyl-5,6-dimethyl-1-ethyluracil
3 - sec. amyl-5,6-dimethyl-1-hydroxymethyluracil

EXAMPLE 152
WETTABLE POWDER

The following powder is prepared in the same manner as Example 151, but in addition is passed through an air attrition mill, such as an air-reductionizer, to reduce the particle size to below 10 microns:

5-chloro-3-cyclohexyl-1,6-dimethyluracil	80.0%
Dioctyl sodium sulphosuccinate concreted with sodium benzoate (Aerosol OTB)	2.0%
Partially desulphonated sodium lignin sulphonate	1.0%
Calcined, non-swelling montmorillonoid type clay (Pikes Peak clay)	17.0%

This composition is used for pre-emergence application in agricultural crops such as corn, sugar cane, sorghum, asparagus, and safflower. It is dispersed in 40 gallons of water and sprayed with a pressure sprayer. When applied at 0.75 to 2.0 pounds of active ingredient per acre, excellent control of pigweed, lamb's-quarters, purslane, mustard, crab grass, foxtail, chickweed, seedling bindweed, and rye grass is obtained.

3 - cyclohexyl - 1,6 - dimethyluracil is also formulated and used in the manner described above.

EXAMPLE 153
AQUEOUS SUSPENSION

5-bromo-3-cyclohexyl-1,6-dimethyluracil	28.0%
Sodium lignin sulphonate	15.0%
Hydrated attapulgite	2.0%
Disodium phosphate	0.8%
Sodium pentachlorophenate	0.5%
Water	53.7%

The above ingredients are mixed and pebble-milled or sand-milled until the average particle size of the active material is substantially less than 5 microns. The resulting stable thixotropic suspension does not cake and can be readily diluted with water to form a dilute, very slow settling suspension which requires no agitation during application.

This aqueous suspension, applied as a directed post-emergence spray at 1 to 2 pounds of active ingredient per acre in 30 gallons of water, gives good pre-emergence control of crab grass, wild oats, lamb's quarters, chickweed, foxtail, annual morning glory and mustard in sugar cane, corn, broom corn and sorghum.

EXAMPLE 154
EMULSIFIABLE OIL SUSPENSION

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

The above components are mixed together and milled in a roller mill, pebble mill, or sand mill until the particles of the active component are substantially all 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 ~~right~~-of-way. Excellent control is obtained.

EXAMPLE 155
EMULSIFIABLE OIL

5-bromo-3-isopropyl-6-methyl-1-(trichloromethylthio)uracil	25%
Xylene	70%
Nonylphenoxypolyoxyethylene ethanol (Emulsifier)	5%

The emulsifiable oil is prepared by mixing the above components until a homogeneous solution results. It can then be emulsified in water for application.

This emulsifiable oil is useful for weed control in lumber yards, fire-control lanes, and along guard rails. When this composition is diluted with 100 gallons of water per acre and sprayed from a railroad spray car at 15—20 pounds of active ingredient per acre, mixed vegetation such as quackgrass, crab grass, nutsedge, Johnson grass, Bermuda grass, brome grass, ragweed, cocklebur, lamb's-quarters, and mare's tail is controlled for an extended period.

This formulation is applied in 60 gal. of diesel oil per acre to railroad ballast where it is unusually difficult to control weeds with most commercial herbicides. Excellent control of the above-listed weeds is obtained.

The following compounds can be formulated and used as above:

5 - bromo - 3 - sec.butyl - 6 - methyl - 1 - (trichloromethylthio)uracil

5 - chloro - 3 - tert.butyl - 6 - methyl - 1 - (trichloromethylthio)uracil

5,6 - dimethyl - 3 - isopropyl - 1 - (trichloromethylthio)uracil

3 - cyclohexyl - 1 - hydroxymethyl - 5,6 - trimethyleneuracil

EXAMPLE 156

GRANULES

5-bromo-1,6-dimethyl-3-isopropyl-uracil	10%
Anhydrous sodium sulphate	10%
Non-swelling sub-bentonite clay	80%

The components are blended and micropulverized, then moistened with water and granulated. The granules are then dried and screened.

The granules are applied conveniently by hand for "spot treatment" of undesirable bunch grasses, for example orchard and brome grass, growing in agricultural areas. An application of 15 to 20 pounds of active ingredient per acre gives good control.

Other compounds which are formulated and used as above are:

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

1 - acetyl - 3 - cyclohexyl - 5,6 - trimethyleneuracil

EXAMPLE 157

GRANULES

1-acetyl-5-bromo-3-butyl-6-methyl-uracil	15%
Granular 8—15 mesh attapulgite clay	85%

The granular composition is prepared by dissolving the active ingredient in acetone and spraying this solution on the attapulgite granules while they are tumbling. The granules are then dried.

These granules are applied by hand or by special spreaders at 10 to 25 pounds of active ingredient per acre. They control peppergrass, seedling, Bermuda grass, 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 bill-boards.

Other compounds which may be used as above are:

3 - isopropyl - 5 - bromo - 6 - methyl-1 - methylcarbamyluracil

3 - cyclohexyl - 1 - (trichloromethylthio)-uracil

EXAMPLE 158

PELLETS

3-sec. butyl-1-trichloromethylthio-5-chloro-6-methyluracil	25%
Anhydrous sodium sulphate	10%
Sodium lignin sulphonate	10%
Ca, Mg bentonite	55%

The components are blended and micropulverized, then moistened with 18—20% water and extruded through die holes. The extrusions are cut as formed to give pellets and dried.

These pellets are useful for weed control along highway guard rails, around bridges, cyclone fences, and in utility rights-of-way when applied at rates of 15—30 lbs. of active material per acre.

EXAMPLE 159

PELLETS

5-bromo-3-isopropyl-6-methyl-1-(trichloromethylthio)uracil	25%
Alkyl naphthalene sulphonic acid, Na salt	1%
Anhydrous sodium sulphate	10%
Non-swelling montmorillonoid type clay (Pike Peak clay)	64%

The components are blended and micropulverized, then wetted with 18—25% water and extruded through a die. The extrusions are cut into 1/8 inch pellets as they emerge. These pellets are then dried.

This formulation is used for dry application to the soil for control of undesirable woody plants in fence rows and utility rights-of-way. A basal application of one tablespoonful on the ground at the base of each brush cluster gives excellent control of birch, box elder, wild cherry, privet, willow, dogwood, oak, sweetgum, poplar, and spruce.

Other compounds which can be formulated and used as above are:

3 - cyclohexyl - 1,6 - dimethyluracil

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

EXAMPLE 160

OIL SUSPENSION

3-cyclohexyl-6-methyl-1-(trichloromethylthio)uracil	40%
Soya lecithin	3%
Substantially aliphatic, low viscosity mineral oil, e.g. kerosene or Diesel oil	57%

The oil suspension is prepared by pregrinding the active material and mixing with the other components with agitation, or by blending all the components together, then pebble-milling or sand-milling them to reduce the particle size of the active component. The product is suitable for dilution with weed oils to form an oil spray.

This formulation is diluted with 80 gallons of a herbicidal oil such as Lion Herbicidal Oil No. 6 and applied at 10 to 20 pounds of active ingredient per acre for general overall weed control along cyclone fences and railroad ballast.

Good control is obtained for an extended period. Quack grass, pigweed, ryegrass, mustard, foxtail, flower-of-an-hour, cheat, witch grass, buttonweed, and jimson weed are controlled.

Other compounds which are equally effective when formulated and used as above are:

1 - acetyl - 3 - cyclohexyl - 5 - bromo-6 - methyluracil

1 - acetyl - 3 - sec. butyl - 5 - chloro - 6 - methyluracil

3 - isopropyl - 5 - chloro - 6 - methyl-1 - trichloroacetyluracil

3 - tert. butyl - 5 - chloro - 6 - methyl-1 - propionyluracil

EXAMPLE 161

AQUEOUS SUSPENSION

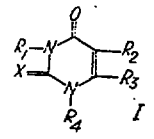
5-bromo-3-cyclohexyl-1,6-dimethyluracil	30.00%
Sodium lignin sulphonate	15.00%
Hydrated attapulgite	1.75%
Anhydrous disodium phosphate	0.80%
Sodium pentachlorophenate	0.50%
Water	51.95%

The above components are mixed together and pebble-milled or sand-milled until substantially all 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 in corn, sorghum, sugarcane, safflower and asparagus.

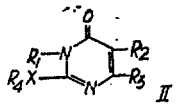
WHAT WE CLAIM IS:—

1. A herbicidal composition comprising a 3-substituted uracil which is a compound 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;

associated with a compatible diluent which is at least in part an oil.

2. A herbicidal composition comprising a

EXAMPLE 160

OIL SUSPENSION

3-cyclohexyl-6-methyl-1-(trichloromethylthio)uracil	40%
Soya lecithin	3%
Substantially aliphatic, low viscosity mineral oil, e.g. kerosene or Diesel oil	57%

The oil suspension is prepared by pregrinding the active material and mixing with the other components with agitation, or by blending all the components together, then pebble-milling or sand-milling them to reduce the particle size of the active component. The product is suitable for dilution with weed oils to form an oil spray.

This formulation is diluted with 80 gallons of a herbicidal oil such as Lion Herbicidal Oil No. 6 and applied at 10 to 20 pounds of active ingredient per acre for general overall weed control along cyclone fences and railroad ballast.

Good control is obtained for an extended period. Quack grass, pigweed, ryegrass, mustard, foxtail, flower-of-an-hour, cheat, witch grass, buttonweed, and jimson weed are controlled.

Other compounds which are equally effective when formulated and used as above are:

1 - acetyl - 3 - cyclohexyl - 5 - bromo-6 - methyluracil

1 - acetyl - 3 - sec. butyl - 5 - chloro - 6 - methyluracil

3 - isopropyl - 5 - chloro - 6 - methyl-1 - trichloroacetyluracil

3 - tert. butyl - 5 - chloro - 6 - methyl-1 - propionyluracil

EXAMPLE 161

AQUEOUS SUSPENSION

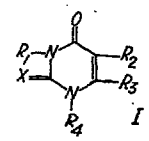
5-bromo-3-cyclohexyl-1,6-dimethyluracil	30.00%
Sodium lignin sulphonate	15.00%
Hydrated attapulgite	1.75%
Anhydrous disodium phosphate	0.80%
Sodium pentachlorophenate	0.50%
Water	51.95%

The above components are mixed together and pebble-milled or sand-milled until substantially all 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 in corn, sorghum, sugarcane, safflower and asparagus.

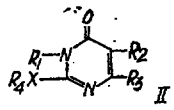
WHAT WE CLAIM IS:—

1. A herbicidal composition comprising a 3-substituted uracil which is a compound 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;

associated with a compatible diluent which is at least in part an oil.

2. A herbicidal composition comprising a

3-substituted uracil which is a compound of general formula I or II 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 a 3-substituted uracil which is a compound of general formula I or II as defined in Claim 1 associated with a diluent which is a liquid other than an oil and a surface active agent.

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

7. A herbicidal composition comprising at least one 3-substituted uracil which is a compound of general formula I or II as defined in Claim 1, in association 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.

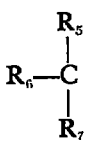
9. A herbicidal composition according to any one of Claims 1 to 8 which contains, in addition to the 3-substituted uracil, another compound having herbicidal properties.

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

11. A herbicidal composition according to any one of Claims 1 to 10 in the form of a concentrate which requires dilution before use as a herbicide.

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

13. A herbicidal composition according to any one of the preceding claims, wherein R_1 is a cycloalkyl or cycloalkenyl group of 5 to 8 carbon atoms or a group of the formula:



wherein R_5 is a hydrogen atom or a methyl group,
R_6 is a methyl or ethyl group, and
R_7 is an alkyl radical of 1 to 5 carbon atoms;

R_2 is a chlorine or bromine atom; and R_3 is a methyl group.

14. A herbicidal composition according to Claim 13 wherein R_1 represents a cyclohexyl group.

15. A herbicidal composition according to any one of Claims 1 to 11 wherein the 3-substituted uracil is 3-cyclohexyl-5-bromo-1,6-dimethyl uracil.

16. A herbicidal composition according to any one of Claims 1 to 11 wherein the 3-substituted uracil is 3-cyclohexyl-5-chloro-1,6-dimethyl uracil.

17. A herbicidal composition according to any one of Claims 1 to 14 wherein R_4 is a hydroxymethyl group, a carboxyethyl group, a substituted carbamyl group, a substituted thiocarbamyl group, a diethyl phosphoryl group, a chloromethylthio group, a phenylthio group, a halogenophenylthio group, a nitrophenylthio group, a dinitrophenylthio group, a tolylthio group or an acyl group.

18. A herbicidal composition according to Claim 17 wherein R_4 is a substituted carbamyl or thiocarbamyl group which is substituted by one or two alkyl groups.

19. A herbicidal composition according to Claim 17 wherein R_4 represents a hydrocarbyl acyl group.

20. A herbicidal composition according to Claim 17 wherein R_4 represents a hydrocarbyl acyl group substituted with one or more halogen atoms.

21. A herbicidal composition according to any one of Claims 1 to 12 and 17 to 20 wherein if R_1 is a substituted alkyl group it is substituted by an alkoxy group or chlorine atom; if R_1 is a substituted phenyl group it is substituted by one or more alkyl, cyano, hydroxy, alkoxy or nitro groups or halogen atoms; and if R_1 is a substituted aralkyl group it is substituted by one or more alkyl, methoxy or nitro groups or chlorine atoms.

22. A herbicidal composition according to any one of Claims 1 to 11 wherein the 3-substituted uracil is one of the compounds specifically hereinbefore named.

23. A herbicidal composition according to Claim 1, 2 or 5 substantially as described in any one of the foregoing Examples 151 to 161.

24. A herbicidal composition according to Claim 1, 2 or 5 substantially as hereinbefore described.

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 which is a compound of general formula I or II as defined in Claim 1.

26. A method according to Claim 25 wherein the 3-substituted uracil is 5-chloro-3-cyclohexyl-1,6-dimethyl uracil.

27. A method according to Claim 25 wherein the 3-substituted uracil is 5-bromo-3-cyclohexyl-1,6-dimethyl uracil.

28. 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, where appropriate after dilution.

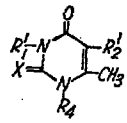
29. A method of controlling the growth of weeds according to Claim 25 wherein the growth of the weeds specified in any one of Examples 151—161 is controlled by the appli-

cation of the 3-substituted uracil specified in that Example.

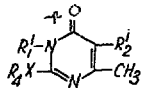
30. A method according to Claim 29 wherein the 3-substituted uracil is applied at the rate specified in the Example.

31. A method of controlling the growth of weeds according to Claim 25 substantially as hereinbefore described.

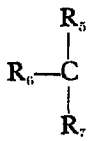
32. As new compounds, 3 - substituted uracils of the general formula



or the corresponding isomeric formula:



wherein R^1_1 is a cycloalkyl or cycloalkenyl group of 5 to 8 carbon atoms or a group of the formula:



wherein R_5 is a hydrogen atom or a methyl group,
R_6 is a methyl or ethyl group, and
R_7 is an alkyl radical of 1 to 5 carbon atoms;
R^1_2 is a chlorine or bromine atom; R_4 is as defined in Claim 1 except that it is not a methyl group; and X is oxygen or sulphur.

33. As new compounds, 3 - substituted uracils which are compounds of the general formula I or II as defined in Claim 1 wherein

R_1 is a covalent organic radical of molecular weight 15 to 250 which is an alkyl group of 1 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 represents a halogen atom;
R_3 represents a methyl group; and
R_4 represents an acyl group.

34. As new compounds, 3 - substituted uracils according to Claim 33 in which R_4 represents a hydrocarbyl acyl group.

35. As new compounds, 3 - substituted uracils according to Claim 33 in which R_4 represents hydrocarbyl acyl group substituted with one or more halogen atoms.

36. As a new compound, 5 - chloro - 3 - cyclohexyl - 1,6 - dimethyl uracil.

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h. T.

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