

1058.382



PATENT SPECIFICATION

NO DRAWINGS

1058.382

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COMPLETE SPECIFICATION

Selective Control of Annual Grasses

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 the cyclohexanol ester of carbanilic acid.

It is well recognised by lawn owners that crabgrass is one of the most difficult weeds to eliminate from a lawn as its branching root system firmly anchors the plant in the soil. Minerals and water needed by lawn grasses are used for the growth of the crabgrass plants and the development of lawn grasses in the immediate area of the crabgrass is slowed. The planting of perennial grass seed in the spring therefore, usually results in the crowding out of the perennial grasses before they can become established by the crabgrass which as an annual plant begins its growth in the spring. We have now found that the growth of crabgrass and other annual weed grasses can be selectively controlled by the application of the cyclohexanol ester of carbanilic acid.

Accordingly the present invention provides a method of inhibiting the growth of crabgrass and other annual grass weeds at a locus where desirable plants are also growing which comprises applying to the locus an amount of the cyclohexanol ester of carbanilic acid which is sufficient to inhibit the growth of the crabgrass but insufficient substantially to inhibit the growth of the desirable plants.

By applying the carbanilic acid ester to an area in which there is growing crabgrass, foxtail, German millet, barnyard grass, cheatgrass

or Bermudagrass from seed and Johnsongrass from seed there results a marked growth retardation of the seedling grass plants. The ester retards the growth of crabgrass and like annular weed grasses by exerting an effect on the grass root system. The root system fails to grow and develop in a normal manner. Broadleaf plants such as dichondra and established perennial turf grasses such as *Poa pratensis*, Kentucky bluegrass; *Poa* spp., other bluegrasses; *Agrotis* spp., bentgrasses; and *Festuca* spp. fescues show no injury. Therefore, undesirable annular grasses, such as crabgrass, growing in a lawn treated with the ester are soon crowded out by desirable plants or destroyed by lack of an adequate supply of water, oxygen and minerals necessary to sustain life.

An additional advantage derived from the use of the ester is that annual grasses are selectively destroyed without disrupting the ecology of the surrounding area. This is accomplished because of the low rate of chemical needed to destroy the annual grasses and the absence of harmful effects on desirable plants from the ester even at high rates. Furthermore, the treated crabgrass growing in a well-watered lawn remains green until the desirable lawn grasses take over, so that the lawn owner is not plagued with objectionable brown patches which mar the beauty of his lawn. Previous methods of removing crabgrass, such as with pre-emergence or post-emergence crabgrass herbicides and hand picking, have not been able to accomplish this unexpected result.

For the purpose of this specification *Digitaria* spp., crabgrass; *Setaria* spp. foxtail and German millet; *Echinochloa* spp., barnyard grass; *Bromus secalinus*, cheatgrass; and related genera as well as *Sorghum halepense*,

[Price 4s. 6d.]

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bentgrasses

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disrupting

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Johnsongrass and Cyndon dactylon, and Bermudagrass, growing from seeds are considered to be annual grass weeds.

5 The compositions of the invention contain the ester as defined above together with an inert carrier, with the proviso that when the carrier consists of a liquid other than an oil, the composition also contains one or more surface-active agents or one or more com-
10 pounds known for use as plant nutrients, fertilizers, insecticides, fungicides, herbicides or nematocides. The compositions preferably contain a surface-active agent in any case.

15 The surface-active agents, also known as surfactants, which can be used in this invention, can be wetting, dispersing, or emulsifying agents. They may act as wetting agents for wettable powders and dusts, as dispersing agents for wettable powders and suspensions,
20 as emulsifying agents for emulsifiable concentrates and may also enhance the biological activity of the carbanilic acid ester used in this invention. Such surfactants, can include anionic, cationic and non-ionic agents as have heretofore been generally employed in plant control compositions of similar type, but anionic and non-ionic surfactants are preferred.
25 Suitable surface-active agents are set out, for example, in Searle United States Patent No. 2,426,417; Jones United States Patent No. 2,412,510; Lenher United States Patent No. 2,139,276; and British Specifications Nos. 691,403 and 692,589. A detailed list of such agents is set forth in "Detergents and Emulsi-
30 fiers Annual-1963" by John W. McCutcheon, Inc., and Bulletin E-607 of the Bureau of Entomology and Plant Quarantine of the United States Department of Agriculture.

35 Suitable surfactants for use in compositions of this invention include polyethylene glycol esters with fatty acids and rosin acids, polyethylene glycol ethers with alkylated phenols or with long-chain aliphatic alcohols, polyethylene glycol ethers with sorbitan fatty acid esters, polyoxyethylene thioethers, amine,
40 alkali and alkaline earth salts of alkylaryl sulphonic acids, amine, alkali and alkaline earth salts of fatty alcohol sulphates, dialkyl esters of alkali metal sulphosuccinates, fatty acids esters of amine, alkali and alkaline earth isethionates, and taurates, amine alkali and alkaline earth salts of lignin sulphonic acids, methylated or hydroxyethylated cellulose, polyvinyl alcohols, amine alkali and alkaline earth
45 salts of polymerised alkyl naphthalene sulphonic acids, and long-chain quaternary ammonium compounds.

50 Preferred wetting agents are sodium alkyl naphthalene sulphonates, sodium dioctylsulphosuccinate, sodium dodecylbenzene sulphonate, ethylene oxide condensates with alkylated phenols such as octyl, nonyl or dodecylphenol, sodium lauryl sulphate, and trimethylnonyl polyethylene glycol. Preferred dispersing
55 agents are sodium, calcium and magnesium

lignin sulphonates, low viscosity methyl cellulose, polymerised sodium alkyl naphthalene sulphonate, sodium *N*-oleoyl or *N*-lauryl isethionates, sodium *N*-methyl-*N*-oleoyl taurate, sodium dodecylphenoxide disulphonate, and polyethylene oxide adducts to mixed fatty and rosin acids.

Preferred emulsifying agents are ethylene oxide adducts to lauric, oleic, stearic or palmitic acid esters of sorbitol, polyethylene glycol esters with lauric, oleic, stearic, palmitic or rosin acids, oil soluble alkylaryl sulphonates, oil soluble polyoxyethylene ethers with octyl-, nonyl-, and dodecylphenol, polyoxyethylene adducts to long-chain mercaptans and mixtures of these surfactants.

In general, up to 10% by weight of the surfactant will be used in compositions of this invention and ordinarily the amount of surfactant will be 1-5% but may even be less than 1% by weight.

Additional surfactants can be added to the above formulation to increase the ratio of surfactant:active agent up to as high as 5:1 by weight, so as to increase the growth retardant effect of the active compounds. When used at these higher rates it is preferred that the surfactant be present in the range of one-fifth to five parts surfactant for each one part of active agent.

Plant growth retardant compositions of this invention can contain, with or without a surfactant, finely divided inert diluents such as talcs, natural clays including attapulgitic clay and kaolinite clay, pyrophyllite, diatomaceous earths, synthetic fine silicas, calcium silicate, carbonates, calcium phosphates, sulphur, lime and such flours as walnut shell, wheat, redwood, soybeans and cottonseed. The amount of the finely divided inert solid diluent can vary widely but will generally range from 10 to 98% by weight of the growth retardant compositions. The particle size can vary considerably but will ordinarily be somewhat under 50 microns in the finished formulation.

Compositions containing such finely divided diluents and one or more of the above-mentioned surfactants can be in the form of wettable powders. Such wettable powders are prepared by mixing the ester, surfactants, diluents and other optional ingredients such as corrosion inhibitors, antifoam agents and pigments, in a blender, followed by grinding to obtain a product of fine particle size, suitable for dilution in water and subsequent application as a finely atomised aqueous spray. Such wettable powders can contain 20 to 90% active ingredients, 1/2 to 10% of surface-active agents, plus diluents and optional
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formulative additives. An active ingredient content of 35 to 85% is preferred. When the composition contains a pulverulent solid and no surfactant, as in dusts or granules, the amount of the ester is limited

to 0.5% to 10% by weight of the composition; however, if the ingredients are to be processed into extruded pellets, higher active ingredient levels, for example as high as 50%, can be used.

Compositions containing the ester and inert solid diluent can also be formulated into granules and pellets. In such compositions the diluent will generally range from 65 to 99% by weight and the active ingredient can range from 1 to 35% by weight. It should be understood that it will not be necessary to include a surfactant in the granular composition. To prepare granules the active compound can be dissolved in a solvent and this solution can be sprayed over e.g. pre-formed clay granules or expanded vermiculite to distribute the active ingredient over and throughout the granular mass. Such granules can range in particle size of from +60 mesh to +4 mesh. An active ingredient content of 1 to 6% is preferred. It is also possible to make such granules by mixing the finely divided diluent and finely divided active ingredient, for instance by grinding together, and then forming granules by adding water, tumbling and drying the resulting product. In another embodiment the active ingredient can be included in granular fertilizer compositions. In addition to the diluents, granular composition can contain additives such as binders and surfactants.

The ester can also be formulated as densified pellets. For such compositions the active ingredient is mixed with a suitable clay or other binders, the mixture is ground and then compacted in a pug mill, screw extruder, briquetting or tableting machine or the like, and the densified product is broken up into pellets of desired size. If water is added to give the mass suitable plasticity for compaction, as is often desirable when pelleting clays are used and pellets are formed in a screw extruder or pug mill, a drying step is needed. Such compositions may include water soluble salts or surface-active agents to aid the disintegration of pellets and release of active ingredient after application. The active ingredient content of such pellet may range from 5 to 75%, 15-50% being preferred.

In addition to the formulation described above, sand ground formulations can be prepared using the method described in Hochberg U.S. Patent 2,581,414, issued August 19, 1948. Using the method described in this patent, fine particles of the ester will be dispersed evenly in a diluent.

Emulsifiable oil solutions can also be employed. In these plant growth regulant compositions, the surface-active agent and an oil form of liquid which can be conveniently poured and measured. Such solutions can be mixed with water at the point of application to form an emulsion containing the herbicide and the surface-active agent. Such compositions have the advantage that the oil will often act as a

foam inhibitor and thus reduce the tendency for large amount of surfactants to form objectionable foam. The oil used, such as toluene, kerosene, Stoddard solvent, xylene, alkylated naphthalenes, diesel oil and isophorone, should be preferably water immiscible and be of a type in which the active agent will be soluble in the amounts used in particular formulations.

In the emulsifiable oil concentrations, the ester will be present in amounts ranging from 10 to 35% by weight. Precise concentrations of active agent, of course, will depend on the intended use of the composition. When mixed with water at the point of application, the oil concentration will be diluted so that in the final formulation the active agent will be present in amounts ranging from 0.5% to 2% by weight.

It is, of course, also possible to use such oil solutions by extending them with other oils, for example, diesel oil and herbicidal oil.

The ester may be applied directly to the soil in pre-emergence or post-emergence treatment to foliage or can be mixed intimately with the soil. Rates of application can be in the range of $\frac{1}{2}$ to 20 pounds per acre and preferably will be used at the rate of 1 to 15 pounds per acre. Rates as high as 20 pounds have been used on tests on established turf grasses without undesirable injury.

More specifically, as a pre-emergence application on crop lands 2 to 8 pounds per acre of the compound used in this invention will retard the growth of annual grass weeds. There is a good safety margin to crop plants such as tobacco, corn, cotton, potatoes, flax, eggplants, red clover, ryegrass, tomatoes, peppers, soybeans, red beets, sugar beets, carrots, peanuts, okra, wheat and oat. After treatment, annual grass weeds usually emerge from the ground but then fail to develop, showing symptoms of severe growth retardation.

As a directed post-emergence application on crop lands at any time from the moment the weeds emerge to the 3-leaf stage, the plants being approximately 2.5 to 4 inches high, 4 to 10 pounds per acre of active ingredient will prevent the further development of such grasses as crabgrass, Bermudagrass from seed, foxtail, German millet, and barnyard grass. There is a good safety margin to crop plants such as cotton, potatoes, flax, beans, corn, eggplant, red clover, tomatoes, peppers, soybeans, red beets, sugar beets, tobacco, carrots, peanuts and okra.

In particular, the compound of this invention can be applied at the rate of 2 to 6 pounds per acre to a field of fall seeded wheat in order to give excellent pre-emergence growth retardation of cheatgrass.

As an application on established growing lawns before crabgrass appears, growth of the undesirable crabgrass is retarded with 2 to 10 pounds of active ingredient per acre. There



Compositions



methods



a

is no injury to established Kentucky bluegrass, bentgrasses or fescues. Crabgrass makes an appearance above the soil and then fails to develop.

- 5 As an application on lawn areas either before or after seeding lawn grasses such as bluegrass, bentgrass or fescue and before the lawn grasses and crabgrass have emerged, 2 to 8 pounds of active ingredient per acre prevents the development of crabgrass. There is no undesirable effect on the development of the lawn grasses.

- 10 As an application on newly-seeded lawns after such lawn grasses as bluegrass, bentgrass, fescues and crabgrass have appeared 2 to 8 pounds of active ingredient will prevent the further development of crabgrass. There is no perceptible injury to the desirable lawn grasses.

- 15 As an application on established lawns after the crabgrass appears at emergence to the 3-leaf stage, 3 to 16 pounds per acre of the active ingredient will prevent the further development of crabgrass without injury to the established grasses.

- 20 The ester can also be applied admixed or in common solution with other chemicals which are used in ~~agromic~~ and horticultural management and are compatible with the ester. Such chemicals may be, but are not restricted to, the classes of chemicals commonly known as plant nutrients, fertilisers, insecticides, fungicides, herbicides and nematocides. Typical of the insecticides that can be used are:

- 35 1,2,3,4,10,10 - hexachloro - 6,7 - epoxy - 1,4,4a,5,6,7,8,8a - octahydro - 1,4,5,8 - dimethanonaphthalene (Dieldrin),
1,2,4,5,6,7,8,8 - octachloro - 4,7 - methano - 3a,4,7,7a - tetrahydroindane (Chlordane),
40 1,1,1 - trichloro - 2,2 - bis(p - methoxyphenyl)ethane (Methoxychlor)
1,1,1 - trichloro - 2,2 - bis(p - chlorophenyl)ethane and
1 - naphthyl - N - methylcarbamate.

Based on the weight of the carbanilic acid ester, 0.02 to 10 parts by weight of insecticide will be present.

- 50 Fungicides ~~than~~ can be used in conjunction with the compounds of this invention include one or more of the following:

p - dimethylaminobenzenediazo sodium sulphate;

quinone oxyaminobenzenoxohydrazone;
tetraalkyl thiuramsulphides such as tetra- 55
methyl thiuram monosulphide or disulphide and tetraethyl thiuram monosulphide or disulphide;
metal salts of ethylene bisdithiocarbamic acid, e.g. manganese, zinc, iron and 60
sodium salts;
pentachloronitrobenzene;
dodecylguanidine acetate;
N - trichloromethylthio tetrahydro-
phthalimide (captan); 65
phenylmercury acetate;
2,4 - dichloro - 6 - (o - chloroanilino) - s - triazine;
N - methylmercury p - toluenesulphon-
anilide; 70
chlorophenol mercuri hydroxides;
nitrophenol mercuri hydroxides;
ethyl mercury acetate;
ethyl mercury 2,3 - dihydroxypropyl mer-
captide; 75
methyl mercury acetate;
methyl mercury 2,3 - dihydroxypropyl mer-
captide;
3,3' - ethylenebis(tetrahydro - 4,6 - di-
methyl - 2H - 1,3,5 - thiadiazine - 2 -
thione); 80
methyl mercury dicyandiamide;
N - ethyl mercury p - toluenesulphon-
anilide;
metal (e.g. iron, sodium and zinc), 85
ammonium and amine salts of dialkyl-
dithiocarbamic acids;
tetrachloronitroanisole;
hexachlorobenzene;
methyl mercury nitrile;
tetrachloroquinone; and
N - trichloromethylthiophthalimide.

Generally, one can use 0.2 to 10 parts of fungicide by weight based on the carbanilic acid ester. 90

The control of crabgrass with the cyclohexanol ester of carbanilic acid often can be advantageously accomplished together with the use of conventional herbicides in situations where crabgrass is growing with weeds controlled by the second herbicide. 95

Illustrative of herbicides that can be used in conjunction with the ester in sprays and granular formulations to take weeds out of other desirable plants are the following: 100
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agronomie



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lb./acre 1—3	Herbicide	Desirable Plants
	2,4 - dichlorophenoxyacetic acid	sugar cane and roadside turf grasses
0.3—1	2,4,5 - trichlorophenoxyacetic acid	roadside turf grasses
5 0.5—1.5	2,4,5 - trichlorophenoxypropionic acid	roadside turf grasses
2—4	3 - amino - 2,5 - dichlorobenzoic acid	soybeans
1—4	2,4 - bis(isopropylamino) - 6 - methyl- mercapto - s - triazine	soybeans, cotton and sugar cane
1—4	1 - n - butyl - 3(3,4 - dichlorophenyl) - 1 - methylurea	ornamentals and lawn turf grasses
10 1—3	2 - chloro - 4,6 - bis - (ethylamino) - s - triazine	ornamentals
1—4	2 - chloro - 4 - ethylamino - 6 - isopropyl - amino - s - triazine	sugar cane and pineapples
15 1—4	3 - (p - chlorophenyl) - 1,1 - dimethylurea	pineapple and sugar cane
0.5—2	4 - (2,4 - dichlorophenoxy)butyric acid	alfalfa and other legumes
0.5—2	2 - methyl - 4 - chlorophenoxybutyric acid	alfalfa and other legumes
1—4	3 - (3,4 - dichlorophenyl) - 1,1 - dimethyl- urea	sugar cane, pineapple, grass seed crops and alfalfa
20 1—4	N - (3,4 - dichlorophenyl) - methacryl - amide	cotton
1—3	3 - (3,4 - dichlorophenyl) - 1 - methoxy - 1 - methylurea	soybeans
1—4	1,2 - dihydropyridazine - 3,6 - dione	roadside turf grasses
25 1—4	2 - ethylamino - 4 - isopropylamino - 6 - methyl - mercapto - s - triazine	sugar cane
1—3	sodium 2,4 - dichlorophenoxyethyl sulphate	soybeans

Where the added herbicides are acids, they may be in the form of salts or non-volatile ester formulations. Also contact herbicides may be included, such as cacodylic acid, potassium cyanate, dinitro-sec.-butyl phenyl, 1,1' - ethylene, 2,2' - bipyridylum dibromide (diquat), 1,1' - dimethyl - 4,4' - bipyridylum dichloride (paraquat), disodium methylarsonate, amine methylarsonates and others well known to the art.

Granular compositions can also include mixtures of the active ingredient on or in fertiliser granules such as are conventionally used for dry application to lawns and golf courses, (e.g. fairways, greens). In such compositions the active ingredient content can range from 0.5 to 10% by weight and can be applied to the surface of previously granulated fertiliser or distributed throughout the fertiliser mass prior to granulation. As an example, a conventional 20:10:10 turf food on vermiculite can be treated with a spray containing a solution of the retardant at a rate to give 4% to 8% by weight of active ingredient in the finished product. This yields a composition application in standard lawn spreaders at a rate, for example, of 25 pounds per 5,000 square feet to provide a simultaneous fertilisation and long term crabgrass control.

It is understood that the compound and compositions used in this invention are applied to the "locus" of the grass growth. The term "locus" as used herein means the plant itself when visible above the ground or the immediate area of soil where the grass plant itself is developing.

It will be apparent to one skilled in the art that certain of the secondary herbicides listed above cannot be applied where it is necessary to preserve the life of desirable grasses.

The following Examples, in which all percents unless otherwise specified are by weight, illustrate the invention.

EXAMPLE 1

The following granular formulation can be used. A wettable powder is first prepared by micropulverising the following ingredients:

cyclohexanol ester of carbanilic acid	50%
attapulgit clay	48%
dioctyl sodium sulphosuccinate	1%
sodium lignin sulphonate	1%

The wettable powder is distributed over the surface of #4 vermiculite by tumbling together. To make the combination more adherent the mix is sprayed with a mixture of ethylene glycol and water. The final ratio of ingredients is as follows:

50% active wettable powder	4%
#4 vermiculite	86%
ethylene glycol	5%
water	5%

In a modification of the above formulation the ethylene glycol can be replaced by a mixture of the sodium sulphates of mixed long chain alcohol fatty acid esters and diethylene glycol acetate in a ratio between 1:10 and 10:1 by weight.

The granular formulation described above has utility as a pre-emergence treatment for

retarding the growth of crabgrass in an established Kentucky bluegrass-creeping red fescue lawn. The material is applied with a granule spreader at the rate of sixteen pounds of active ingredient per acre prior to the germination of crabgrass. Such excellent retardation of crabgrass is obtained that it presents no competition to the established lawn.

EXAMPLE 2

The following wettable powder can be diluted with water and applied as a post-emergence spray or it may be made up as a tank mix in conjunction with 0.2—5 parts of trimethyl nonyl polyethylene glycol ether per part of active ingredient:

15	cyclohexanol ester of carbanilic acid	84%
	montmorillonite clay	13%
	dioctyl sodium sulphosuccinate	2%
20	partially desulphonated sodium lignin sulphionate	1%

This wettable powder formulation is sprayed at the rate of twelve pounds of active ingredient as a pre-emergence spray to crabgrass and foxtail in a newly-seeded lawn.

Excellent retardation of both weedy grasses is obtained. Upon examination of the weeds, severe retardation of the root system is noted. There is no noticeable effect on dichondra, Kentucky bluegrass, creeping red fescue and colonial bentgrass turfs.

EXAMPLE 3

The following components are blended and micropulverised until homogeneous and then rebled:

35	cyclohexanol ester of carbanilic acid	25.00%
	alkyl naphthalene sulphonic acid, Na salt, in which the alkyl group contains less than five carbon atoms	1.00%
40	low viscosity methyl cellulose	0.25%
	attapulgitic clay	73.75%

The wettable powder formulation described above is applied pre-emergence at the rate of sixteen pounds of active ingredient per acre in 100 gallons of water for the control of growth of crabgrass in an established bluegrass-fescue lawn. Excellent retardation of crabgrass is obtained without noticeable damage to the desirable turf grasses.

EXAMPLE 4

The following ingredients are blended and micropulverised to pass a 60-mesh screen

55	cyclohexanol ester of carbanilic acid (technical grade)	52.6%
	attaclay	33.0%
60	Alkyl naphthalene sulphonic acid, Na Salt, in which the alkyl group contains less than five carbon atoms	4.0%

Hi Sil 233* 10.0%
Methocel 15 (low viscosity methyl cellulose) ("Methocel" is a Registered Trade Mark) 0.4%

This wettable powder formulation in the amount of four pounds of active ingredient is added to 80 gallons of water in a spray tank. A surfactant such as trimethyl nonyl ether of polyethylene glycol with ethylene oxide, is added to this mixture at the rate of six pounds. This tank spray mixture is applied to one acre of Kentucky 31 fescue lawn which is infested with crabgrass in the one to two leaf stage. Excellent retardation of crabgrass is obtained. It turns dark green, shows very slow growth, and the root system fails to develop normally. The crabgrass offers poor competition and is crowded out by the Kentucky 31 fescue. The fescue shows a slightly reduced rate of growth without injury.

WHAT WE CLAIM IS:—

1. A method of inhibiting the growth of crabgrass and other annual grass weeds at a locus where desirable plants are also growing which comprises applying to the locus an amount of the cyclohexanol ester of carbanilic acid which is sufficient to inhibit the growth of the crabgrass but insufficient substantially to inhibit the growth of the desirable plants.
2. A method according to Claim 1 wherein the said desirable plants are perennial grasses.
3. A method according to Claim 1 wherein the said locus is an established lawn of perennial grasses.
4. A method according to any one of the preceding claims wherein the cyclohexanol ester of carbanilic acid is applied at a rate of 2 to 8 lb. per acre.
5. A method according to Claim 1 substantially as hereinbefore described.
6. A method according to Claim 1 substantially as described in any one of the foregoing Examples.
7. A composition for inhibiting the growth of annual grasses comprising the cyclohexanol ester of carbanilic acid in association with an inert carrier which is at least in part an oil.
8. A composition for inhibiting the growth of annual grasses comprising the cyclohexanol ester of carbanilic acid in association with an inert carrier which is at least in part a solid.
9. A composition for inhibiting the growth of annual grasses comprising the cyclohexanol ester of carbanilic acid in association with an inert carrier and at least one other compound known for use as a plant nutrient, fertiliser, insecticide, fungicide, herbicide or nematocide.
10. A composition according to Claim 7, 8 or 9 containing a surface-active agent.
11. A composition for inhibiting the growth

*Hi Sil 233 is a mixture comprising by weight 87% SiO₂, 0.5% CaO, 0.2% Fe₂O₃, 0.6% Al₂O₃ and 1.0% NaCl.



* C L M S *

- retarding the growth of crabgrass in an established Kentucky bluegrass-creeping red fescue lawn. The material is applied with a granule spreader at the rate of sixteen pounds of active ingredient per acre prior to the germination of crabgrass. Such excellent retardation of crabgrass is obtained that it presents no competition to the established lawn.

EXAMPLE 2

- The following wettable powder can be diluted with water and applied as a post-emergence spray or it may be made up as a tank mix in conjunction with 0.2—5 parts of trimethyl nonyl polyethylene glycol ether per part of active ingredient:
- | | |
|---|-----|
| cyclohexanol ester of carbanilic acid | 84% |
| montmorillonite clay | 13% |
| dioctyl sodium sulphosuccinate | 2% |
| partially desulphonated sodium lignin sulphionate | 1% |

- This wettable powder formulation is sprayed at the rate of twelve pounds of active ingredient as a pre-emergence spray to crabgrass and foxtail in a newly-seeded lawn.

- Excellent retardation of both weedy grasses is obtained. Upon examination of the weeds, severe retardation of the root system is noted. There is no noticeable effect on dichondra, Kentucky bluegrass, creeping red fescue and colonial bentgrass turfs.

EXAMPLE 3

- The following components are blended and micropulverised until homogeneous and then rebled:

- | | |
|--|--------|
| cyclohexanol ester of carbanilic acid | 25.00% |
| alkyl naphthalene sulphonic acid, Na salt, in which the alkyl group contains less than five carbon atoms | 1.00% |
| low viscosity methyl cellulose | 0.25% |
| attapulgitic clay | 73.75% |

- The wettable powder formulation described above is applied pre-emergence at the rate of sixteen pounds of active ingredient per acre in 100 gallons of water for the control of growth of crabgrass in an established bluegrass-fescue lawn. Excellent retardation of crabgrass is obtained without noticeable damage to the desirable turf grasses.

EXAMPLE 4

- The following ingredients are blended and micropulverised to pass a 60-mesh screen
- | | |
|--|-------|
| cyclohexanol ester of carbanilic acid (technical grade) | 52.6% |
| attaclay | 33.0% |
| Alkyl naphthalene sulphonic acid, Na Salt, in which the alkyl group contains less than five carbon atoms | 4.0% |

- | | |
|--|-------|
| Hi Sil 233* | 10.0% |
| Methocel 15 (low viscosity methyl cellulose) ("Methocel" is a Registered Trade Mark) | 0.4% |

This wettable powder formulation in the amount of four pounds of active ingredient is added to 80 gallons of water in a spray tank. A surfactant such as trimethyl nonyl ether of polyethylene glycol with ethylene oxide, is added to this mixture at the rate of six pounds. This tank spray mixture is applied to one acre of Kentucky 31 fescue lawn which is infested with crabgrass in the one to two leaf stage. Excellent retardation of crabgrass is obtained. It turns dark green, shows very slow growth, and the root system fails to develop normally. The crabgrass offers poor competition and is crowded out by the Kentucky 31 fescue. The fescue shows a slightly reduced rate of growth without injury.

WHAT WE CLAIM IS:—

1. A method of inhibiting the growth of crabgrass and other annual grass weeds at a locus where desirable plants are also growing which comprises applying to the locus an amount of the cyclohexanol ester of carbanilic acid which is sufficient to inhibit the growth of the crabgrass but insufficient substantially to inhibit the growth of the desirable plants.
2. A method according to Claim 1 wherein the said desirable plants are perennial grasses.
3. A method according to Claim 1 wherein the said locus is an established lawn of perennial grasses.
4. A method according to any one of the preceding claims wherein the cyclohexanol ester of carbanilic acid is applied at a rate of 2 to 8 lb. per acre.
5. A method according to Claim 1 substantially as hereinbefore described.
6. A method according to Claim 1 substantially as described in any one of the foregoing Examples.
7. A composition for inhibiting the growth of annual grasses comprising the cyclohexanol ester of carbanilic acid in association with an inert carrier which is at least in part an oil.
8. A composition for inhibiting the growth of annual grasses comprising the cyclohexanol ester of carbanilic acid in association with an inert carrier which is at least in part a solid.
9. A composition for inhibiting the growth of annual grasses comprising the cyclohexanol ester of carbanilic acid in association with an inert carrier and at least one other compound known for use as a plant nutrient, fertiliser, insecticide, fungicide, herbicide or nematocide.
10. A composition according to Claim 7, 8 or 9 containing a surface-active agent.
11. A composition for inhibiting the growth

*Hi Sil 233 is a mixture comprising by weight 87% SiO₂, 0.5% CaO, 0.2% Fe₂O₃, 0.6% Al₂O₃ and 1.0% NaCl.

- of annual grasses comprising the cyclohexanol ester of carbanilic acid in association with a surface-active agent and an inert carrier which is at least in part a liquid other than an oil.
- 5 12. A composition according to Claim 10 or 11 containing up to 10% by weight of the surface-active agent.
- 10 13. A composition according to Claim 12 containing 20 to 90% by weight of the said ester and $\frac{1}{2}$ to 10% by weight of the surface-active agent.
- 15 14. A composition according to Claim 13 containing 35—85% by weight of the ester.
- 15 15. A composition according to Claim 12 or 13 in the form of granules or pellets.
- 20 16. A composition according to Claim 15 containing 65—99% by weight of the inert solid carrier and 1—35% by weight of the active ingredient.
17. A composition according to Claim 16 containing 1—6% by weight active ingredient.
18. A composition according to Claim 12 or 13 in the form of densified pellets.
19. A composition according to Claim 18 25 containing 5—75% by weight active ingredient.
20. A composition according to Claim 12 or 13 in the form of an emulsifiable oil solution. 30
21. A composition according to Claim 20 containing 10—35% by weight of active ingredient.
22. A composition for selectively controlling the growth of annual grasses substantially as 35 hereinbefore described.
23. A composition for selectively controlling the growth of annual grasses substantially as described in any of the Examples.

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