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(54) METHODS AND COMPOSITIONS FOR CONTROLLING THE GROWTH OF TOBACCO SUCKERS

(71) We, AMCHEM PRODUCTS, INC., a Corporation organized under the Laws of the Commonwealth of Pennsylvania, United States of America, of Brookside Avenue, Ambler, Pennsylvania, 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 a process for controlling the growth of suckers in tobacco plants.

While methods of culture of tobacco differ somewhat regionally and with various tobacco types, the essential features are much the same. Thus, in general, seedlings are produced in hotbeds, and about 6 to 10 weeks after germination when they are about 4 to 6 inches in height the seedlings are transferred to the fields where they will develop, either by hand or by machine. The spacing of the individual plants varies according to the type of tobacco, but rows are generally spaced 3 to 4 feet apart with plants spaced 12 to 48 inches apart in the row. Cigar and burley tobacco rows are commonly spaced by 3 to 3½ feet with an individual spacing of 12 to 27 inches, while fire-cured tobacco is planted in hills which may be as much as four feet apart. Maryland tobacco is planted in hills 34"×34" or even closer, while flue-cured tobacco is usually spaced 2'×4'.

As a general rule when the plant has attained the desired size, usually at or before attaining flowering, it is debudded or topped, that is the terminal growth is removed. The number of leaves remaining on each plant commonly varies from 16 to 20 with the cigar, Maryland, burley and flue-cured types and 10 to 14 leaves with fire-cured and dark air-cured tobacco.

Following topping, suckers or lateral shoots develop along the stem and must be removed at more or less frequent intervals in order to increase leaf development. Topping is generally accomplished by mechanical means which involves removing or cutting away the stem apex including flowers and some top leaves. This process is usually carried out near the stage of plant maturity in order to stimulate development of the remaining leaves and to obtain the desirable physical and chemical properties for choice tobaccos. By removing the apex at flowering, the maximum number of harvestable leaves are present and the plant can then divert most of its energy into stimulating the development of these remaining leaves.

When the apex is left intact, most of the plant's energy is diverted to the flowering process, thus preventing expansion of leaves and decreasing yields. However, when the apex is removed this phenomenon of apical dominance is destroyed with a resulting stimulation of lateral bud or "sucker" growth from the leaf axils. Thus, where only one apex was present, there are now five to ten apices present which, if left uncontrolled, will further reduce yields. These axillary buds or suckers start to develop soon after the topping operation and prior to the discovery of sucker control agents these suckers had to be continuously removed by hand to achieve the purpose of topping, since otherwise the suckers themselves would grow at the expense of the development of the desired leaves.

The earliest and perhaps even now the most common method of controlling the growth of these suckers is to remove them by hand when they were 4 to 6 inches in

length. Since the developing suckers are not all in the same stage of growth, the field must be gone over four to six times. It is, therefore, evident that with the increasing cost and decreasing supply of available hand labor, more efficient methods are necessary for control.

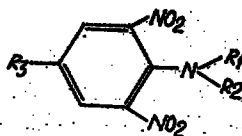
The need for commercial chemical tobacco sucker control agents developed as a result of the importance of this cultural practice of topping or removing the apex of the developing tobacco plant when in flower. Certain known chemical products when applied will inhibit the development of suckers or when applied to growing suckers will cause them to wither and inhibit further growth of the suckers. Even now, however, no entirely satisfactory method of sucker control has been developed.

The first attempts made at sucker control by chemical means were through the use of various mineral oil emulsions as well as car and used diesel oils. These compounds are quite injurious to leaf tissue and as a result had to be hand-applied to the cut stalk of each individual plant. Since these materials function mainly through contact activity, volume per plant is critical.

With the discovery and development of maleic hydrazide (MH-30), this compound today is probably the most widely used agent for controlling sucker growth. It is material which is readily translocated within plants and is active in inhibiting cell division in meristematic areas but not cell enlargement. Both timing and environmental conditions are important for maximum effectiveness. If applied too soon after topping, normal leaf expansion will not occur, thus reducing yields. If relative humidity is low or plants are in a wilted state, absorption and effectiveness are greatly reduced. The compound also reduces the specific volume or "filling power" as well as increasing the moisture absorption of the leaf.

The newest agents for sucker control are the fatty alcohols and fatty acid amines. These materials are contact in action, that is, they must come in direct contact with each axillary bud. Control is achieved by selectively killing the primary axillary bud meristem without damaging mature leaf tissue. Since no translocation occurs, subsequent axillary buds will develop into suckers. Therefore, commercial control is only achieved for a matter of 1 to 2 weeks. In practice these compounds have been shown to injure leaf tissue if recommended application methods are not followed closely. It is also evident that volume per plant is critical to insure complete contact with each leaf axil. Where chemical sucker control agents are used they are also sometimes unsuitable for the reason that they provide inadequate inhibition of sucker development or cause metabolic changes other than inhibition of suckers, which metabolic changes are undesirable in the tobacco plant. Moreover, there is also the question of the possibility of undesirable residues in the leaf tissue. It is, therefore, an object of this invention to provide new and suitable chemical control of tobacco sucker growth without the disadvantages of prior art chemical treatments.

Accordingly, this invention provides a process for inhibiting the growth of suckers in tobacco plants in which there is applied to the plant, an effective amount of a compound of the general formula



(I)

wherein R_1 and R_2 , which may be the same or different, each represents hydrogen or an alkyl, cycloalkyl, cycloalkyl-alkyl, alkenyl, aralkyl or halo-substituted alkyl group, no more than one of R_1 and R_2 being branched alkyl, cycloalkyl or branched alkenyl, and R_3 represents hydrogen or an alkyl, monocyclic cycloalkyl, cycloalkyl-alkyl, halo-substituted alkyl, mono- or dialkoxy alkyl, methylsulfonyl, sulfonamido, alkoxy, alkylthio, cyano, or mono- or dialkyl carbamyl groups, or is a halogen atom.

As used herein the term alkyl represents straight or branched chain saturated hydrocarbon groups having from 1 to 7 carbons, and the term alkenyl represents straight or branched chain aliphatic hydrocarbon groups containing from 2 to 7 carbon atoms and one or more double bonds. Preferably R_1 and R_2 together contain no more than 8 carbon atoms.

The term halo-substituted alkyl represents alkyl groups having one or more hydrogen atoms replaced by halogen atoms which can be on the same or different carbon atoms in the alkyl groups, such as for example, chloromethyl, bromomethyl,

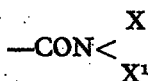
dichloromethyl, α,α -dichloroethyl trichloromethyl, β -chloroethyl and trifluoromethyl.

The term cycloalkyl as used herein denotes monocyclic hydrocarbon groups containing from 3 to 6 carbon atoms, such as for example, cyclopropyl, cyclopentyl and cyclohexyl.

The term cycloalkyl-alkyl denotes alkyl groups in which a hydrogen on one of the carbon atoms has been replaced by a cycloalkyl group as defined above. Such a cycloalkyl-alkyl group is the cyclopropylmethyl group.

The term halo as used herein includes all four halogens, namely chlorine, bromine, iodine and fluorine, with chlorine and fluorine being the preferred halogens.

The term alkoxy as used herein represents an alkyloxy group wherein alkyl is as defined above, and the terms mono- and dialkyl carbamyl groups are the



groups wherein X and X¹ represent hydrogen or alkyl as defined hereinabove. The term aralkyl as used herein denotes an alkyl group in which one or more hydrogen atoms is replaced by a phenyl group. Such aralkyl groups are, for example, benzyl, phenethyl and phenylpropyl.

The compounds of Formula I which are useful in the practice of the process of this invention are generally known compounds or readily obtained derivatives of known compounds. All of these compounds are readily obtainable by conventional synthesis methods well known to those skilled in the art. Preparative methods for synthesizing compounds of Formula I are disclosed, for example, as follows.

U.S. Patents 3,257,190 and 3,403,180 disclose the preparation of dinitroanilines of the type employed for use in the method of this invention wherein R₁ and R₂ in Formula I above can be C₁ to C₈ alkyl, C₂—C₈ alkenyl, halo-substituted C₂—C₈ alkyl or alkoxy lower alkyl and R₃ is hydrogen, alkyl, alkoxy, dialkylcarbamyl, halo or halo alkyl. Representative compounds of this group are for example:

N,N-di-n-propyl-3-chloro-2,6-dinitroaniline;
 N,N-di-n-butyl-4-fluoro-2,6-dinitroaniline;
 N,N-diethyl-4-trichloromethyl-2,6-dinitroaniline;
 N-ethyl-N-n-butyl-2,6-dinitroaniline;
 N-methyl-N-n-propyl-2,6-dinitro-p-toluidine;
 N-N-di-n-propyl-2,6-dinitroaniline;
 N,N-di-n-propyl-4-isopropyl-2,6-dinitroaniline;
 N-n-propyl-N-n-butyl-4(3-bromopropyl)-2,6-dinitroaniline;
 N-ethyl-N-n-propyl-4-isopropyl-2,6-dinitroaniline;
 N,N-di-n-propyl-4-bromo-2,6-dinitroaniline;
 N,N-diethyl-4-(2-chloroethyl)-2,6-dinitroaniline;
 N,N-di-n-propyl-4-trifluoromethyl-2,6-dinitroaniline; (trifluralin)
 N-ethyl-N-n-butyl-4-trifluoromethyl-2,6-dinitroaniline;
 N,N-dimethyl-4-trifluoromethyl-2,6-dinitroaniline;
 N-methyl-N-alkyl-4-trifluoromethyl-2,6-dinitroaniline;
 N,N-di-(3-butyryl)-4-trifluoromethyl-2,6-dinitroaniline;
 N-methyl-N-iso-butyl-4-trifluoromethyl-2,6-dinitroaniline;
 N-ethyl-N-iso-butyl-4-trifluoromethyl-2,6-dinitroaniline;
 N-n-butyl-N-n-propyl-4-trifluoromethyl-2,6-dinitroaniline;
 N-methyl-N-n-propyl-4-trifluoromethyl-2,6-dinitroaniline;
 N-methyl-N-allyl-4-trifluoromethyl-2,6-dinitroaniline;
 N,N-di-n-butyl-4-trifluoromethyl-2,6-dinitroaniline;
 N-allyl-N-ethyl-4-trifluoromethyl-2,6-dinitroaniline.

U.S. Patent 3,321,292 discloses the preparation of dinitroanilines of the type employed for use in the practice of this invention wherein R₃ in Formula I above is methylsulfonyl and R₁ and R₂ can be alkyl or alkenyl. Representative compounds of this group are for example:

4-(methylsulfonyl)-2,6-dinitro-N,N-diethylaniline;
 4-(methylsulfonyl)-2,6-dinitro-N,N-dipropylaniline;
 4-(methylsulfonyl)-2,6-dinitro-N,N-dibutylaniline;
 4-(methylsulfonyl)-2,6-dinitro-N-ethyl, N-propylaniline;
 4-(methylsulfonyl)-2,6-dinitro-N-ethyl, N-butyraniline;

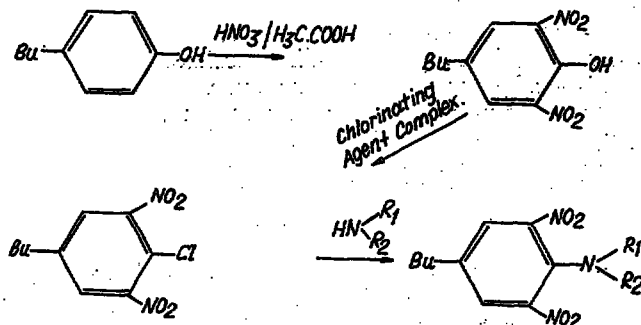
- 4-(methylsulfonyl)-2,6-dinitro-N-propyl, N-butylaniline;
 4-(methylsulfonyl)-2,6-dinitro-N-vinyl, N-ethylaniline;
 4-(methylsulfonyl)-2,6-dinitro-N-vinyl, N-propylaniline;
 4-(methylsulfonyl)-2,6-dinitro-N,N-diallylaniline;
 5 4-(methylsulfonyl)-2,6-dinitro-N-allyl, N-ethylaniline;
 4-(methylsulfonyl)-2,6-dinitro-N-allyl, N-propylaniline;
 4-(methylsulfonyl)-2,6-dinitro-N-allyl, N-butylaniline;
 4-(methylsulfonyl)-2,6-dinitro-N-(2-methallyl), N-ethylaniline;
 4-(methylsulfonyl)-2,6-dinitro-N-(2-methallyl), N-propylaniline;
 10 4-(methylsulfonyl)-2,6-dinitro-N-butenyl, N-allylaniline;
 4-(methylsulfonyl)-2,6-dinitro-N-butenyl, N-propylaniline.

U.S. Patent 3,546,295 discloses the preparation of dinitroanilines of the type employed for use in the practice of this invention wherein R_3 in Formula I above is hydrogen, alkyl, trifluoromethyl or alkylsulfonyl and R_1 and R_2 can be cycloalkyl, alkenyl or cyclo alkyl-alkyl.

U.S. Patents 3,332,769 and 3,111,403 disclose the preparation of dinitroanilines of the type employed for use in the method of this invention wherein one of R_1 and R_2 in Formula I above is hydrogen and the other can be a straight or branched chain alkyl group and R_3 is hydrogen, alkyl, halogen or haloalkyl. Representative compounds of this group are for example:

- N-(sec-butyl)-2,6-dinitro-4-fluoroaniline;
 N-(3-pentyl)-2,6-dinitro-4-trifluoromethylaniline;
 N-(isopropyl)-2,6-dinitro-4-chloroaniline;
 N-4-(di-isopropyl)-2,6-dinitroaniline;
 25 N-(4-methyl-3-hexyl)-2,6-dinitro-4-bromoaniline;
 N-(2-heptyl)-2,6-dinitro-p-toluidine;
 N-(4-methyl-2-pentyl)-2,6-dinitro-4-ethylaniline;
 N-(isopropyl)-2,6-dinitroaniline;
 N-(3-pentyl)-2,6-dinitroaniline;
 30 2,6-dinitroaniline;
 4-methyl-2,6-dinitroaniline;
 N-ethyl-4-ethyl-2,6-dinitroaniline;
 N-methyl-4-isopropyl-2,6-dinitroaniline;
 4-chloro-2,6-dinitroaniline;
 35 N-n-propyl-4-trifluoromethyl-2,6-dinitroaniline;
 4-n-butyl-2,6-dinitroaniline.

Compounds not specifically disclosed in these references can be readily prepared by analogous procedures utilizing the ordinary skill of the art. In particular, a specifically effective tobacco sucker control agent as disclosed in this invention is the compound 4-t-butyl-N-sec-butyl-2,6-dinitroaniline which is easily prepared by the following reaction sequence.



Other compounds of this invention can also be prepared by analogous reaction sequences.

In using the compounds of Formula I above as chemical tobacco sucker control agents, the compounds are preferably applied to mature tobacco plants in the form of compositions such as solutions, emulsions, suspensions, dust formulations, pastes

and the like, these compositions containing from 0.06% to 0.72%, especially from 0.18% to 0.24% by weight of the compound. The most convenient method is by applying an aqueous emulsion of the compound in such a way as to contact the plant with active compound at a rate such that the liquid will run down the stem and reach the axillary buds to inhibit growth of the newly formed suckers; for example this can be conveniently accomplished by a directed spray which covers the upper plant area so that the active material will reach the leaf axil of the upper 3 and optionally the upper 5 leaves remaining after topping where the most harmful sucker growth would ordinarily occur.

The compositions of this invention are preferably applied to tobacco which has been topped at the early to full flower stage and before the new suckers are more than about 1 inch long. Preferably the compositions are applied at the time of topping or within about 3 days thereafter. If necessary, a second application may be applied 10 to 21 days after the first application.

The compound is preferably applied at a rate of from 1 to 3 lbs. active material per acre of tobacco in solution or dispersion in from 50 to 200 U.S. gallons of water. Greater or lesser amounts can of course be utilized depending on individual circumstances and the material can also be applied in more or less concentrated form depending upon the mode of application. The compounds of Formula I are preferably used in formulation with a wetting agent, particularly a non-ionic or an anionic wetting agent. Any of the conventional wetting agents such as the alkanol amines, alkylsulfonates, sulfonated amines and amides, ethoxylated alcohols and the ethoxylated alkyl phenols, ethoxylated amines and amides, ethoxylated fatty acids, ethoxylated fatty esters and oils, glycerol esters, phosphate derivatives, and others as well as mixtures of any of these can be utilized.

Particularly suitable wetting agents are for example, the Atlox surfactants prepared and sold by Atlas Chemical Industries, Inc., Wilmington, Delaware; the Gafac, Igepal and Emulphor surfactants manufactured and sold by GAF Corporation, 140 West 51st Street, New York, New York; the sulfonics manufactured and sold by the Jefferson Chemical Company, 1121 Walker Avenue, Houston, Texas; the Agrimuls, Lomar and Sellogen surfactants sold by Nopco Chemical Division, Diamond Shamrock Chemical Company; the Tritons manufactured and sold by Rohm and Haas Company, Independence Mall, West, Philadelphia, Pennsylvania; the Toximul surfactants sold by Stepan Chemical Company, Worthfield, Illinois; the T-mulz surfactants sold by Thompson-Hayward Chemical Company, Kansas City, Kansas; and the Emcol surfactants manufactured and sold by Witco Chemical Company, Inc., 122 East 42nd Street, New York (Atlox, Gafac, Emulphor, Triton, Toximul, Emcol and Panasol are all Registered Trade Marks). Other wetting agents can of course be used with equivalent results. Particularly good results have been obtained with the surfactant Triton—X—100 supplied by Rohm and Haas and the surfactant X—77 supplied by Colloidal Products.

The amount of surfactant used is not critical though ordinarily it should not be used in amounts greater than about 2% by volume of the final spray solution since higher amounts could cause leaf burn depending upon the particular surfactant employed. Preferably the surfactant will comprise about 0.1 to about 1.0% of the final spray volume and generally less than 0.5% will be sufficient. In the preparation of liquid concentrates or suspensions or wettable powder concentrates the surfactant will ordinarily be present in the formulated concentrate in amounts between about 1/3 to about 3 times the amount of active ingredient. In addition to the active material of Formula I and if desired a suitable surfactant liquid, solid or paste formulations in concentrate or ready-to-use form, can be prepared by methods known to the art employing conventional adjuvants such as finely divided solid carrier materials, e.g. talc, clays, flour, etc.; solubilizing agents, e.g., silicates, carbonates, etc.; non-aqueous liquids such as aliphatic and aromatic hydrocarbons; binding agents or adhesives such as rosin, albumen, etc.; thickening agents such as gums and the like; anti-foaming agents such as nonyl carbinol (decanol), etc. or other conventional excipients.

The compositions can, if desired, be formulated with other compatible active ingredients such as insecticides, fungicides and the like. Furthermore, although the dinitroaniline derivatives can be used on their own, they are very preferably formulated with other tobacco sucker control agents, such as maleic hydrazide, tertiary or secondary fatty amine salts, C_6 to C_{18} saturated and unsaturated fatty acid esters, and C_6 to C_{18} saturated fatty alcohols to form by admixture combination products useful in the method of the present invention. United States Patent No. 3,223,517 discloses the use of tertiary or secondary fatty amine salts for controlling tobacco sucker growth. Examples of the amine salts are dodecyldimethylamine acetate, dodecylmethylamine

acetate, and cocodimethylamine acetate. U.S. Patent No. 3,340,040 discloses the use of the lower alkyl esters of C_6 to C_{18} saturated and unsaturated fatty acids for controlling tobacco sucker growth. Examples of the fatty acid esters which can be employed are methyl caproate, methyl caprylate, methyl caprate, methyl laurate, and methyl stearate. U.S. Patent No. 3,438,765 discloses the use of C_6 to C_{18} saturated fatty alcohols. Typical examples of suitable fatty alcohols which can be employed herein are n-octanol, n-decanol, n-dodecanol, n-hexadecanol, n-tetradecanol, and n-hexanol. These tobacco sucker control agents are generally known compounds which are readily obtainable commercially or by conventional synthesis methods well known to those skilled in the art.

A surprising aspect of this invention is that by utilizing these combination products, better than additive results are obtained. It has been discovered that when employing the combination product consisting of a 2,6-dinitroaniline derivative described herein and a tobacco sucker control agent selected from the group consisting of tertiary or secondary fatty amine, fatty acid ester, and fatty alcohol, on certain types of tobacco wherein higher rates of application are ordinarily necessary, the amount of each material employed to obtain the desired results is less than is necessary should each material be used alone. The combination has appreciably greater activity, thereby allowing the application of lower dosages per acre.

The use of these admixtures results in uniform control which is effective for longer periods of time and, since less of the materials are employed, there is also less probability that undesirable metabolic changes will be caused and there will also be less residue in the leaf tissue.

When an admixture of the dinitroaniline derivative, in combination with an agent selected from the group consisting of tertiary or secondary fatty amines, fatty acids, fatty acid esters, and fatty alcohols, is employed, the ratio of the active ingredients can vary within a broad range. In general, the optimum ratio will depend upon the type of tobacco to be treated, and the specific fatty acid ester, fatty amine, or fatty alcohol and particularly the length of the aliphatic moiety thereof. In general, the admixture should contain from about 1 to 10 parts by weight of the sucker agent selected from the group of tertiary and secondary fatty amine, fatty acid ester, and fatty alcohol, for each part by weight of dinitroaniline compound. In any given instance, the relative proportions of the active components utilized will vary, as noted above, upon the conditions of application. In all events, the combination has been found to result in better than additive effects than can be obtained when each material is separately employed. A preferred admixture, which when employed, will result in excellent sucker control, contains 4-t-butyl-N-sec-butyl-2,6-dinitroaniline and a commercially available combination of C_6 to C_{12} saturated fatty alcohols, (OFF-SHOOT-T, prepared and sold by Proctor & Gamble Co., Cincinnati, Ohio), in a weight ratio of fatty alcohol to dinitroaniline from about 4:1 to about 8:1.

The rate of application of the admixture should be within the range of from about 1 to about 18 lb/A of active ingredients. In using the admixtures, they may be applied to the mature tobacco plants in the form of solutions, emulsions, suspensions, dust formulations, pastes, and the like, as described hereinabove. The most convenient method of application is an aqueous emulsion as described hereinabove.

Should the agent to be mixed with the dinitroaniline derivative be insufficiently water soluble for convenient formulation into aqueous concentrations, a liquid emulsion can be prepared by dissolving both the dinitroaniline and the sucker control agent in a small amount of a nonphytotoxic solvent, then adding an emulsifier and water, to form the ready to use composition. Alternatively, the agent to be mixed with the dinitroaniline derivative can be mixed with an emulsifier, thereafter adding said emulsion to the already prepared emulsion containing the dinitroaniline derivative, thereafter adding water to form the ready to use composition.

As described hereinabove, the amount of surfactant used in the admixture is not critical, although ordinarily it should not be used in amounts greater than about 2% by volume of the final spray solution. Preferably, the surfactant will comprise about .1 to about 1% of the final spray volume. In the preparation of liquid concentrates or suspensions or wettable powder concentrates, the surfactant will ordinarily be present in the formulated concentrate in amounts between about 1/3 to 3 times the amount of active ingredient.

The admixture used in the method of this invention can be employed as a liquid spray, at an effective volume of application, of the ready to use admixture composition, when applied directly to the locus to be treated or when employed as a directed foliar spray, of from about 50 to 200 gallons per acre. As stated hereinabove, any suitable formulation can be employed such that the rate of application of active

material is from about 1 to about 18 lbs. per acre in the form of the suitable aqueous solution, emulsion, dust formulation, or the like. The precise amount of active material applied will depend upon the degree of response which is desired.

The preparation and biological activity of the dinitroanilines and the combination products employed in the method of this invention will be more fully understood from the detailed tests and results described hereinbelow. All reference therein to "gallons" are U.S. gallons.

Greenhouse Tests

The tobacco plant chosen for assay work was the Xanthii type. This is a dwarf tobacco obtaining a maximum height under greenhouse conditions of about 5 to 6 feet. It is day-neutral, and grows well under both low and high light intensities. It is also one of the more sensitive types to various chemicals. Seed are sown in potting soil and covered lightly with sand. In two months, the seedlings have emerged and have 2 to 3 leaves. At this time, they are placed in 3-inch peat pots with potting soil. One month later, the plants have attained a height of 8 to 12 inches and are then placed in 7-inch pots with potting soil. Approximately two months later the plants have attained a height of 5 to 6 feet and have floral buds just beginning to open.

At this time the apex of the plant is removed. Immediately after removing the apex the test compounds are ready to be applied. The standard rate used is 100 mg active ingredient in 10 cc solvent per plant. Application is with a hand gun with 5-10 lbs. pressure. Approximately 8 cc of the spray is directed at the leaf axils with the remaining 2 cc applied over top and on the upper leaf surface to check active ingredient in 10 cc solvent per plant. Application is with a hand gun with

Immediately after spraying the plants are placed in the greenhouse where they remain for a period of 2 to 3 weeks. After this time observations are taken on number and length of resulting suckers and expressed as percentage of lateral buds inhibited from growing compared to topped checks. Also, leaf injury or other effects are also noted and recorded.

During the entire growing period, normal watering, fertilizing and insect control are practiced.

Results

The following table illustrates the activity obtained with several of the substituted dinitroanilines in greenhouse tests;

TABLE I

Sucker Control with Substituted Dinitroanilines

Chemical	Rate (mg/plant)	% Control
α,α,α -trifluoro-2,6-dinitro-N,N-dipropyl-p-toluidine	100	98
4-(methylsulfonyl)-2,6-dinitro-N,N-dipropylaniline	100	25
4-t-butyl-N-mono-sec-butyl-2,6-dinitroaniline	100	99
N-isopropyl-4-t-butyl-2,6-dinitroaniline	100	92
4-t-butyl-N,N-diethyl-2,6-dinitroaniline	100	90
N-4-di-t-butyl-2,6-dinitroaniline	100	85

Tobacco Sucker Control Assay of Dinitroaniline Derivatives

Representative dinitroaniline derivatives of Formula I were tested in tobacco sucker control assay according to the following method.

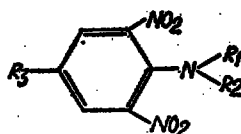
Tobacco plants (variety Xanthii) were grown in 7" pots until a height of approximately 2' was obtained. At this time the apex was removed and chemicals were applied.

Materials were used for each treatment with a solvent system of 50% acetone plus 50% water. 10 mg. per plant was applied to each of three replications in a volume of 5 cc per plant. The spray was directed from the cut apex to allow maximum rundown along the stem.

5 Since the volume used did not provide for complete rundown, the readings were taken from the upper five leaf axils only. 5

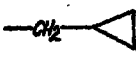
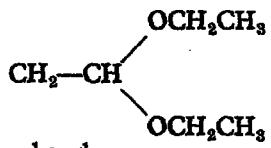
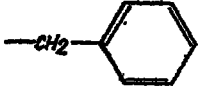
Two weeks after treatment a count was made of the number of suckers per plant over 1" in length along with the total weight per plant of these suckers. Results are expressed as percent reduction in fresh weight of the treatment compared to the control plants. Readings are averages of three replications per treatment with the checks being the average of six replications. 10 10

TABLE II



Compound	R ₃	R ₁	R ₂	% Tobacco Sucker Control
1	t-Bu	H	s-Bu	100
2	t-Bu	H	i-Pr	100
3	t-Bu	n-Pr	n-Pr	100
4	t-Bu	ethyl	ethyl	73
5	s-Bu	H	s-Bu	100
6	i-Pr	H	s-Bu	85
7	s-Bu	H	i-Pr	100
8	i-Pr	n-Pr	n-Pr	99
9	t-Bu	H	C ₂ H ₅	100
10	—CH ₃	H	H	98
11	t-Bu	H	n-Bu	100
12	t-Bu	H		100
13	s-Bu	H	s-Bu	100
14	t-Bu	H		100
15	t-Bu	Et	n-Bu	95
16	s-Bu	H	—CH ₃	100
17	s-Bu	H	Et	100
18	s-Bu	Et	n-Bu	100

TABLE II (Continued)

Compound	R ₃	R ₁	R ₂	% Tobacco Sucker Control
19	s-Bu	Et	Et	100
20	s-Bu	n-Pr	n-Pr	100
21	n-Bu	n-Pr	n-Pr	100
22	n-Bu	H	s-Bu	100
23	t-pentyl	H	H	100
24	t-pentyl	H	i-Pr	100
25	t-pentyl	H	s-Bu	100
26	t-pentyl	CH ₃	CH ₃	100
27	t-pentyl	—C ₂ H ₅	—C ₂ H ₅	98
28	t-pentyl	n-Pr	n-Pr	98
29	t-pentyl	H	CH ₃	100
30	t-pentyl	H	C ₂ H ₅	75
31	t-pentyl	H	cyclohexyl	95
32	t-Bu	H		100
33	t-Bu	H	CH ₂ CH=CH ₂	100
34	t-Bu	CH ₂ CH=CH ₂	CH ₂ CH=CH ₂	98
35	t-Bu	H	3-methoxypropyl	95
36	t-Bu	H		85
37	t-Bu	CH ₃		90
38	t-Bu	H	n-hexyl	100
39	t-Bu	H	H	99
40	t-Bu	H		100
41	CF ₃	n-butyl	n-ethyl	100
42	CF ₃	n-propyl	n-propyl	87
43	CH ₃ SO ₂ —	n-propyl	n-propyl	87
44	CH ₃	n-propyl	n-propyl	100

Field Trials

A field trial was established to determine effects on a commercial tobacco variety (Pennbel-cigar wrapper type). Applications were made at two rates on an individual plant basis, with different volumes and rates per plant. The following table shows results obtained.

TABLE III

Chemical	(mg/plant)	% Sucker Control	
		50	75
		cc/plant	cc/plant
α,α,α -trifluoro-2,6-dinitro-N,N-dipropyl-p-toluidine	75	—	68
	100	—	85
Dimethyl-dodecylamine acetate	100	46	—

Another field trial was established by spraying on a broadcast basis rather than on an individual plant basis. The method employed was as follows with the results as shown in Table V below.

Method

Tobacco plants (variety Pennbel) were transplanted to the field on July 11 with a mechanical transplanter. All plants received starter solution plus chlordane for cutworm control. Just prior to transplanting the entire area was treated with 6lb/A of diphenamid.

On August 12 plants were hand-topped, removing all growth to the first leaf being 6" wide. All suckers over 1" long were removed at this time. Plants were just starting to bloom at this time.

Immediately after topping, all chemicals were applied. Five plants per plot with two replications per treatment were sprayed. A single adjustable nozzle was used to deliver a coarse spray. Pressure was 20—25 lb.

All volumes sprayed resulted in good run-down to the soil line.

All plants received 1/2% overhead irrigation immediately after transplanting. For the duration of the test all plots received a 15.9" rainfall plus irrigation.

Final observations were taken on September 29 and are given below in Table IV as the averages of two replications, totaling ten plants.

TABLE IV

Percent Control

Compound	Rate Lb/A	Volume						.1% Triton X-100 in 100 gal/A
		100 gal/A			150 gal/A			
		%* Control	%** Red. of Sucker Length	%* Control	%** Red. of Sucker Length	%* Control	%** Red. of Sucker Length	
4-t-butyl-N-sec- butyl-2,6-dinitro- aniline	1/2	0	0	0	0	20	70	
"	1	0	0	15	10	65	55	
"	2	15	20	60	93	98	98	
α,α,α -trifluoro- 2,6-dinitro-N,N- dipropyl-p-toluidine	1/2	0	0	0	0	0	0	
"	1	0	0	0	0	0	0	
"	2	10	10	0	0	50	85	
Dimethyl dodecyl amine acetate	1-1/2	10***	30	—	—	—	—	
Maleic hydrazide	3	98	98	—	—	—	—	

*% Control — reduction in number of suckers over 4" in length.

**% Height reduction — % decrease in length of suckers of the plant.

***Applied in volume of 50 gal/A.

Although the mechanism involved in sucker control with these compounds is unknown, it would appear that effects are achieved by inhibiting growth of the sucker without killing it.

5 To obtain maximum efficiency from the substituted dinitroanilines it is preferred to use: 5

1. High volumes per acre (100 gal. and above) to insure adequate coverage and rundown to each leaf axil.
2. The addition of a surfactant, e.g. Triton X—100, at .1% volume.
- 10 3. Rates of about 2 lb./A.
4. Sprayer adjusted to deliver a coarse spray, thereby facilitating rundown with low pressures. 10

Field Test with Surfactant Added

15 Tobacco plants (variety Penbel) were transplanted to the field on June 10 with a mechanical transplanter. All plants received starter solution plus chlordane for cut-worm control. 15

Just prior to transplanting, the entire plot area was treated with 6 lb/A diphenamid.

On August 17, all plants were hand-topped, removing all growth to the first leaf being 6" wide. All suckers over 1" in length were removed at this time.

20 On August 18 all treatments were applied. A single adjustable cone nozzle, set for a very coarse spray, was used with pressure held at 20—25 lbs. Treatments of maleic hydrazide were applied in a fine spray pattern. 20

Final observations were taken on September 11, 24 days after treatments were applied.

25 Readings are averages of 3 replications totaling 15 plants per treatment. 25

In all cases the 4 lb/gal. formulation of 4-t-butyl-N-sec-butyl-2,6-dinitroaniline was used, along with commercial formulations of trifluralin, maleic hydrazide (MH—30) and dimethyl dodecylamine acetate (Penar).

30 Volume of application did not appear to be critical within the ranges tested (100 gal/A; 150 gal/A; 200 gal/A) with control being essentially the same at 100 gal/A as with 200 gal/A. The 100 gal/A volume provided excellent rundown to the soil line. 30

TABLE V

Compound	Rate lb/A	Percent Control					
		No surfactant			0.1% Triton X-100		
		100 gal/A	150 gal/A	200 gal/A	100 gal/A	150 gal/A	200 gal/A
4-t-butyl-N-sec-butyl 2,6-dinitroaniline	1/2	28	22	38	65	69	67
"	1	29	21	55	81	72	83
"	1-1/2	40	58	71	91	86	88
"	2	57	68	65	88	92	92
"	3	76	84	74	90	99	99
α,α,α -trifluoro-2,6-dinitro- N,N-dipropyl-p-toluidine	1	—	48	—	—	79	—
"	2	—	60	—	—	74	—
"	3	—	81	—	—	90	—
Maleic hydrazide	3	66	—	—	—	—	—
Dimethyl dodecylamine acetate	1-1/2	62	—	—	—	—	—

Percent Control = percent by which treatment reduced sucker green weight compared with topped but not suckered check.

Field Tests with Combination Products

A field trial was established to determine the effects of the combination product consisting of a dinitroaniline derivative and a C₆ to C₁₂ fatty alcohol, on different tobacco varieties. Tobacco plants of the Burley type (Variety Burley 21), Flue Cured type (Variety Coker 254), Maryland type (Variety Maryland 10) and Cigar Filler type (Variety Penbel 69) were transplanted to the field with a mechanical transplanter. All plants received starter solution plus chlordane for cutworm control. Just prior to transplanting the entire area, it was treated with 6 lbs. per acre of diphenamid.

All plants were hand topped, removing all growth to the first leaf, being six inches wide. All suckers over one inch (1") in length were removed at this time.

Immediately after topping, all treatments were effected. A single adjustable cone nozzle, set for a very coarse spray, was used with pressure held at 15 lbs.

Final observations were taken after prolonged periods of time as follows:

- 25 days after treatment on the Burley type
- 45 days after treatment on the Flue Cured type
- 41 days after treatment on the Maryland type
- 30 days after treatment on the Cigar type

Readings are averages of 4 replications totaling 10 plants per treatment.

A 3 lb/gal. formulation of 4-t-butyl-N-sec-butyl-2,6-dinitroaniline was employed on control plants at the rates of application indicated in Table 6. A 4.7 lb/gal. formulation of a known commercial formulation (Off-Shoot-T) fatty alcohol tobacco sucker agent, having the following composition of active ingredients: C₆-5% by weight, C₈-42% by weight, C₁₀-56% by weight, C₁₂-1.5% by weight, was employed to control plants at the rates of application indicated in Table 6.

Formulations of 4-t-butyl-N-sec-butyl-2,6-dinitroaniline was used in combination with the C₆-C₁₂ fatty alcohol tobacco sucker agent. The admixture formulation was prepared by mixing the emulsifiable concentrate of the 4-t-butyl-N-sec-butyl-2,6-dinitroaniline to the emulsifiable concentrate of the fatty alcohol, and adding water to make the desired volume of ready to use emulsion. The volume of application was 50 gal/acre and the particular rates of application are listed in Table 6.

TABLE 6

Composition	Percent Control				
	Types of Tobacco				
	Rate lb/A	Burley	Flue Cured	Maryland	Cigar
4-t-butyl- N-sec-butyl- 2,6-dinitroaniline					
"	1/2	28	—	4	9
"	1	50	18	32	34
"	2	72	20	55	74
"	3	80	18	78	70
"	6	90	—	83	92
Fatty alcohol					
"	6	—	—	—	4
"	7	—	—	10	—
"	10	—	—	—	41
"	12	47	10	—	54
"	14	51	—	51	—
4-t-butyl- N-sec-butyl- 2,6-dinitroaniline + Fatty alcohol					
"	1/2 + 2	—	—	—	47
"	1/2 + 4	—	—	—	67
"	1/2 + 6	94	—	—	74
"	1 + 2	—	—	—	60
"	1 + 4	—	—	—	74
"	1 + 6	—	—	—	91
"	1 + 7	—	—	93	—
"	1 + 9	97	—	—	—
"	2 + 12	98	92	—	—

On each type of tobacco employed, it will be observed from Table 6 that a better than additive result is obtained by employing the admixture composition and for especially prolonged periods of time, i.e. at least 25 days after treatment, the sucker control is more effective than was previously observed by the use of either of the two agents alone.

A field test was effected to determine the activity of a combination product consisting of a dinitroaniline derivative and dimethyl-dodecylamine acetate. Tobacco plants of the Burley type (Variety Burley 21) and Cigar Filler type (Variety Penbel 69) were transplanted to the field with a mechanical transplanter. All plants received starter solution plus chlordane for cutworm control. Just prior to transplanting, the entire area was treated with 6 lbs./acre diphenamid.

All plants were hand topped, removing all growth to the first leaf being six inches wide. All suckers over one inch in length were removed at this time.

Immediately after topping, all treatments were effected. A single adjustable cone nozzle was used with pressure held at 15 lbs.

Final observations were taken 25 days after treatment for the Burley type and 30 days after treatment for the Cigar type. Readings are averages of 4 replications totaling 10 plants per treatment.

A 3 lb./gal. formulation of 4-t-butyl-N-sec-butyl-2,6-dinitroaniline was employed on control plants at the rates of application indicated in Table 6. A 4 lb./gal formulation of dimethyl-dodecylamine acetate (Penar) was employed on control plants at the rates of application indicated in Table 6.

Formulations of 4-t-butyl-N-sec-butyl-2,6-dinitroaniline in combination with dimethyl-dodecylamine acetate (Penar) was employed. The admixture formulation was prepared by mixing the emulsifiable concentrate of the 4-t-butyl-N-sec-butyl-2,6-dinitroaniline to the emulsifiable concentrate of the dimethyl-dodecylamine acetate, thereafter adding water to make the desired volume of ready to use emulsion. The volume of application was 50 gal/acre and the rates of application are listed in Table 7.

TABLE 7

Composition	Rate lb/A	Percent Control Types of Tobacco	
		Burley	Cigar
4-t-butyl- N-sec-butyl- 2,6-dinitroaniline			
"	1/2	28	9
"	1	50	34
"	2	72	74
"	3	80	70
"	6	90	92
Dimethyl- dodecylamine Acetate			
"	1/4	—	0
"	1/2	—	0
"	3/4	—	29
"	1	—	27
"	1—1/2	46	33
"	3	78	55
4-t-butyl- N-sec-butyl- 2,6-dinitroaniline + Dimethyl- dodecylamine Acetate			
"	1/2 + 1/2	—	39

TABLE 7. (Continued)

Composition	Rate lb/A	Percent Control	
		Types of Tobacco	
		Burley	Cigar
4-t-butyl- N-sec-butyl- 2,6-dinitroaniline			
+			
Dimethyl- dodecylamine			
Acetate			
"	1/2 + 3/4	—	39
"	1 + 1/4	—	56
"	1 + 1/2	—	31
"	1 + 3/4	—	54
"	1 + 1	90	—
"	2 + 1—1/2	93	—

The preparation and use of the compounds of general formula I in the process of this invention will be further understood from the following specific examples which are intended by way of illustration only, and do not form part of the invention claimed hereinafter.

Example 1.

Following the method of Dutton, et al, (Canadian Journal of Chemistry, Volume 31, p. 685, 1953), 200 grams (1.32 moles) 4-t-butylphenol was dissolved in 480 ml. glacial acetic acid and added dropwise over a period of one hour to a stirred solution of 320 ml. of 90% nitric acid and 600 ml. of glacial acetic acid at -10 to -15° C. After complete addition the temperature rises to 0 to -5° C. The reaction mixture is then allowed to come to room temperature and maintained there for one hour. The mixture is then poured onto cracked ice, diluted with water and cooled. The product is then filtered, washed with H_2O , dried and recrystallized from hot hexane to give 180 grams of 2,6-dinitro-4-t-butylphenol in the form of fine yellow needles melting at $94-95^{\circ}$ C.

180 grams (.75 mole) of 2,6-dinitro-4-t-butylphenol thus prepared was placed in a mixture of 113 grams (.95 mole) thionyl chloride, 55 grams (.76 mole) dimethylformamide and 300 ml. of dry toluene. The mixture was stirred and heated to reflux temperature for 15 hours after which time the thionyl chloride, DMF and toluene were removed under reduced pressure until a slush remained. Hexane was then added to the reaction vessel, the mixture cooled and filtered. The product was then recrystallized from boiling hexane to give 168 grams 2,6-dinitro-4-t-butylchlorobenzene in the form of light yellow needles melting at $114-116^{\circ}$ C.

Example 2.

One gram of 2,6-dinitro-4-t-butylchlorobenzene was allowed to react with one gram of sec-butylamine by adding the amine dropwise to a refluxing mixture of 50 ml. dry toluene, and the 2,6-dinitro-4-t-butylchlorobenzene. After complete addition, the mixture was refluxed eight hours, cooled to room temperature, the amine hydrochloride filtered off, and toluene and unreacted amine were removed under reduced pressure. The thick material that resulted was dissolved in hot ethanol and the product

was crystallized upon cooling to yield N-sec-butyl-2,6-dinitro-4-t-butylaniline melting at 60—62° C.

Example 3.

Two and six-tenths grams (.01 mole) of 2,6-dinitro-4-t-butylchlorobenzene was reacted with 3.1 grams of 40% aqueous solution of dimethylamine in 50 ml. ethanol. The temperature was slowly increased as follows: 30° C. for one hour, 40° C. for one hour, 50° C. for one hour, then 80° C. for five hours. When the reaction was complete about 100 ml. H₂O was added, precipitating the product. This was filtered, washed with portions of H₂O and upon recrystallization from ethanol yielded 2.5 grams of N,N-dimethyl-2,6-dinitro-4-t-butylaniline in the form of orange-yellow needles melting at 101—102° C.

Following the above procedure, two grams of 40% aqueous solution of methyl amine was reacted with 2.6 grams of 2,6-dinitro-4-t-butyl-chlorobenzene to give N-methyl-2,6-dinitro-4-t-butylaniline as orange needles melting at 129—130° C.

Following the above procedure, two grams of a 70% aqueous solution of ethylamine was reacted with 2.6 grams (0.01 mole) of 2,6-dinitro-4-t-butyl-chlorobenzene to yield 2 grams of N-ethyl-2,6-dinitro-4-t-butylaniline as orange needles melting at 70—73° C.

EXAMPLE 4

2 lb/gal Emulsifiable Concentrate

Chemical	Lbs.	% by Wt.
N-s-butyl-4-t-butyl-2,6-dinitroaniline	2.02	23.40
Atlox 3387	1.00	11.59
Panasol AN—3	5.61	65.01

Specific Gravity: 1/.037 at 20°C.

Manufacturing Directions: Combine ingredients and stir to a homogeneous solution.

EXAMPLE 5

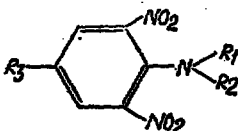
Chemical	Lbs.	% by Wt.
N-s-butyl-4-t-butyl-2,6-dinitroaniline	4.244	50.48
Toximul D	0.420	5.00
Dimethylformamide	0.999	11.88
Xylene (0.868 at 20°C.)	2.745	32.64
	8.408	100.00

Specific Gravity: 1.010 at 20°C.

Manufacturing Directions: Add ingredients and stir until solution is achieved and specific gravity is correct.

WHAT WE CLAIM IS:—

1. A process for inhibiting the growth of suckers on tobacco plants, in which there is applied to the tobacco plants an effective amount of a compound of the general formula



(I)

(in which R_1 and R_2 , which may be the same or different, are each a hydrogen atom, an alkyl group containing 1 to 7 carbon atoms, a monocyclic *cycloalkyl* group containing 3 to 6 carbon atoms, a *cycloalkyl* group in which the *cycloalkyl* portion is monocyclic and contains 3 to 6 carbon atoms whilst the alkyl portion contains 1 to 7 carbon atoms, an alkenyl group having 2 to 7 carbon atoms, a phenyl-substituted alkyl group in which the alkyl portion contains 1 to 7 carbon atoms or a halogen-substituted alkyl group containing 1 to 7 carbon atoms, with the proviso that only one of R_1 and R_2 is a branched-chain alkyl group, a *cycloalkyl* group, a *cycloalkyl*-alkyl group or a branched-chain alkenyl group; and R_3 is a hydrogen or halogen atom, an alkyl group containing 1 to 7 carbon atoms, a monocyclic *cycloalkyl* group containing 3 to 6 carbon atoms, a *cycloalkyl*-alkyl group in which the *cyclo*-alkyl portion is monocyclic and contains 3 to 6 carbon atoms whilst the alkyl portion contains 1 to 7 carbon atoms, a halogen-substituted alkyl group containing 1 to 7 carbon atoms, a mono- or dialkyl-alkoxy-substituted alkyl group, in which the alkoxy groups each contain 1 to 7 carbon atoms and the alkyl group contains 1 to 7 carbon atoms, a methyl-sulfonyl group, a sulfonamido group, an alkoxy group containing 1 to 7 carbon atoms, an alkylthio group containing 1 to 7 carbon atoms, a cyano group or a mono- or dialkyl-carbamyl group in which each of the alkyl substituents contains 1 to 7 carbon atoms).

2. A process as claimed in claim 1, in which the compound applied is one in which R_1 and R_2 are each an alkyl group containing 1 to 7 carbon atoms or an alkenyl group containing 2 to 7 carbon atoms.

3. A process as claimed in claim 2, in which the compound applied is one in which R_1 and R_2 together contain not more than 8 carbon atoms.

4. A process as claimed in any of claims 1 to 3 in which the compound applied is one in which at least one of R_1 , R_2 and R_3 is a chloro- or fluoro-substituted alkyl group.

5. A process as claimed in any of claims 1 to 4, in which the compound applied is one in which R_1 and/or R_2 is a chloromethyl, bromomethyl, dichloromethyl, α,α -dichloroethyl, trichloromethyl, β -chloroethyl, trifluoromethyl, cyclopropyl, cyclopentyl, cyclohexyl, cyclopropylmethyl, benzyl, phenethyl or phenylpropyl group.

6. A process as claimed in any of claims 1 to 5, in which the compound applied is one in which R_3 is a chloromethyl, bromomethyl, dichloromethyl, α,α -dichloroethyl, trichloromethyl, β -chloroethyl, trifluoromethyl, cyclopropyl, cyclopentyl, cyclohexyl, cyclopropylmethyl group, a chlorine or fluorine atom or a benzyl, phenethyl or phenylpropyl group.

7. A process as claimed in any of claims 1 to 6, in which the compound applied is any one or more of the specific compounds of general formula I mentioned hereinbefore.

8. A process as claimed in any of claims 1 to 6, in which the compound applied is or includes 4-*t*-butyl-N-sec-butyl-2,6-dinitroaniline.

9. A process as claimed in any of the preceding claims in which the compound of general formula I is applied to the plants at a rate of from 1 to 18 lb/A (1.09 to 19.7 Kg/Ha).

10. A process as claimed in any of the preceding claims, in which the compound of general formula I is applied to the plant in the form of a composition containing from 0.06% to 0.72% by weight of a compound of general formula I in association with a solid or liquid carrier.

11. A process as claimed in claim 10, in which the composition is in the form of an aqueous emulsion or suspension.

12. A process as claimed in claim 10 or claim 11, in which the composition is sprayed at a rate of 50 to 200 U.S. gallons per acre.



13. A process as claimed in any of claims 9 to 11, in which the composition also contains a wetting agent.

14. A process as claimed in claim 12, in which the composition contains from 0.33 to 3 parts by weight wetting agent per part by weight of compound of general formula I.

15. A process as claimed in claim 13 or claim 14 in which the wetting agent is present in an amount from 0.1 to 1% by weight of the composition.

16. A process as claimed in any of the preceding claims, in which there is applied to the tobacco plants, besides the compound of general formula I, another compound known to be capable of inhibiting the growth of suckers on tobacco plants.

17. A process as claimed in claim 16, in which the other compound known to be capable of inhibiting the growth of suckers on tobacco plants is a secondary or tertiary fatty amine salt and/or an alkyl ester of a C_6 to C_{18} saturated or unsaturated fatty acid, and/or a C_6 to C_{18} saturated fatty alcohol.

18. A process as claimed in claim 17 in which there is applied to the plants from 1 to 10 parts by weight of the tertiary or secondary fatty amine, and/or fatty acid ester, and/or fatty alcohol, per part by weight of compound of general formula I.

19. A process as claimed in any of the preceding claims and substantially as herein described, with reference to the Examples.

20. A composition for the inhibition of sucker growth in tobacco plants, which contains from 0.06% to 0.72% by weight of a compound defined in any of claims 1 to 8, together with another compound known to be capable of inhibiting the growth of suckers on tobacco plants, in association with a liquid or solid carrier.

21. A composition as claimed in claim 20, which contains from 0.18% to 0.24% of the compound defined in any of claims 1 to 8.

22. A composition as claimed in claim 20 or claim 21 which also contains a wetting agent.

23. A composition as claimed in claim 22, in which the wetting agent is a non-ionic or anionic wetting agent.

24. A composition as claimed in any of claims 22 or 23, in which the wetting agent is any one or more of the following:—alkanolamines, alkylsulfonates, sulfonated amines and amides, ethoxylated alcohols and ethoxylated alkylphenols, ethoxylated amines and amides, ethoxylated fatty acids, ethoxylated fatty esters and oils, glycerol esters and phosphate derivatives.

25. A composition as claimed in any of claims 22 to 24 in which the weight of wetting agent present is from 0.33 to 3 times the amount of compound of formula I.

26. A composition as claimed in any of claims 22 to 25, in which the wetting agent is present in an amount of from 0.1 to 1.0% by weight of the composition.

27. A composition as claimed in claim 26, in which the wetting agent is present in an amount of from 0.1% to 0.5% by weight of the composition.

28. A composition as claimed in any of claims 20 to 27, in which the carrier is any one or more of the following: talc, clays, flour, silicates, carbonates, aliphatic and aromatic hydrocarbons.

29. A composition as claimed in any of claims 20 to 28, in which the other compound known to be capable of inhibiting the growth of suckers on tobacco plants is maleic hydrazide and/or a tertiary or secondary fatty amine salt and/or a C_6 to C_{18} saturated or unsaturated fatty acid ester and/or a C_6 to C_{18} saturated fatty alcohol.

30. A composition as claimed in claim 29, in which the tertiary or secondary fatty amine salt, saturated or unsaturated fatty acid ester or saturated fatty alcohol is any one or more of the following: methyl caproate, methyl caprylate, methyl caprate, methyl laurate, methyl stearate, n-octanol, n-decanol, n-dodecanol, n-hexadecanol, n-tetradecanol, n-hexanol, dodecyltrimethylamine acetate, dodecylmethylamine acetate and cocodimethylamine acetate.

31. A composition as claimed in claim 29 or claim 30, in which there is from 1 to 10 parts by weight of secondary or tertiary fatty amine salt and/or saturated or unsaturated fatty acid ester and/or saturated fatty alcohol per part by weight of compound of general formula I.

32. A composition as claimed in any of claims 20 to 31 and substantially as hereinbefore described.



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