TOBACCO SUCKER CONTROL

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Field of Search 71/78, 106, 118, 122

ABSTRACT

The control of undesirable secondary growth in plants is accomplished by applying thereto a composition comprising (1) N-alkyl acetamide having the formula:

\[
\begin{align*}
\text{CH}_3 &- \text{C}-\text{N} \cdots \text{R}_1 \\
\text{O} &- \text{R}_2
\end{align*}
\]

wherein \( R_1 \) and \( R_2 \) are independently hydrogen, methyl, alicyclic or acyclic alkyl groups having from 6 to 15 carbon atoms, with the total number of carbons in \( R_1 \) and \( R_2 \) being from 6 to 18; or the strong mineral acid salt of the N-alkyl acetamide; and (2) a surface active agent.

8 Claims, No Drawings
3,888,654

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TOBACCO SUCKER CONTROL

BACKGROUND OF THE INVENTION

Relevant prior art is disclosed in U.S. Pat. Nos. 3,458,304, 3,619,165; 3,506,433; and 3,663,629. In various plants, such as, for example, tobacco, tomato, cotton, soybean plants, etc., undesirable secondary growth, which is generally referred to as "suckers," creates a serious problem because the suckers develop rapidly to shade desired portions of the plant, compete for nutrients, and tends to lower the quality of such desired portions. In the tobacco plant, secondary buds form at the points where the leaf stems join the plant, and later after the flower is removed grow rapidly to form sucker growths extending over the leaves. The sucker growths can be removed manually, but this is a laborious and expensive proceeding. The use of sucker oil and chemicals, while effective in control of such secondary growth, nevertheless have in the past had serious disadvantages. The sucker oil tends to form leaf and stalk damage, causing soft spots that are attacked by microbes, and also there is a lack of control of the lower sucker stalks. The chemicals which have previously been used produce cellular changes in the leaf, tending to reduce the filling capacity of the treated tobacco for cigarette manufacture. Further, the cost of the chemicals has been high.

DESCRIPTION OF THE INVENTION

The composition of the invention, which is applied to plants to avoid the above disadvantages, comprises an N-alkyl acetamide and a surface active agent. The acetamide has the formula:

\[
\text{O} \quad \text{CH}_3\text{C-N-R}_1\text{R}_2
\]

wherein \( R_1 \) and \( R_2 \) are independently hydrogen, methyl, allylic, or acyclic alkyl groups having from 6 to 15 carbon atoms, with the total number of carbons in \( R_2 \) and \( R_2 \) being from 6 to 18. Additionally, by protonation of the disubstituted amido groups, salts of strong mineral acids may be formed. Such salts include, for example, the hydrohalide, (e.g., hydrochloride), phosphate and sulfate.

The second component of the composition is a surface active agent or emulsifier which serves in providing uniform dispersions of all formulation components of both solid and liquid types, and may be anionic, cationic, or non-ionic, and includes conventional soaps, such as the water-soluble salts of long chain carboxylic acids, the amine soaps such as the amine salts of long chain carboxylic acids, the sulfonated animal, vegetable, and mineral oils, quaternary salts of high molecular weight acids, rosin soaps such as salts of abietic acid, sulfuric acid salts of high molecular weight organic bases, algin soaps, ethylene oxide condensed with fatty acids and/or sorbitol esters, alkyl phenols and mercaptans, and other simple as well as polymeric compositions having both hydrophilic and hydrophobic functions so as to enable the mixing of otherwise immiscible ingredients. Generally, the surface active agents will be only a minor portion of the formulation as used, for example, less than 10 percent and frequently as low as 0.05 percent. In general, concentrations of from 0.5 to 5% are found to be optimum. Typical useful emulsifiers by trade name and chemical description are as follows: Antarox A-401, alkylarylpolystyrenylethylene glycol ether; Nonisol 210, polyethylene glycol oleate; Triton X45, alkylarylpolyethylenol; polyoxyethylene condensates of sorbitan fatty acids, e.g., Tween 20, Tween 60; and fatty acid esters of polyethylene glycol, e.g., Etholat 60/25 and Kessco PEG-600 monostearate.

Acetamides suitable for preparation of compositions of this invention include those wherein \( R_2 \) and \( R_2 \) are aliphatic or cycloaliphatic groups, and are exemplified as follows.

N-undecylacetamide
Mixtures of hexyl and heptyl straight chain N-alkyl acetamides
N-methyl-N-dodecylacetamide
N-cyclohexyl acetamide
N,N-dicyclohexyl acetamide
N-pentadecyl acetamide
N-methyl-N-dodecylacetamide hydrochloride
N-cyclohexyl acetamide hydrochloride
N,N-dicyclohexylacetamide sulfate
N-cyclodecylacetamide
N-cyclododecylacetamide

The compounds of the invention may be used for killing meristematic buds on ornamental and agricultural herbaceous, semiwoody, and woody plants such as chrysanthemum, cotton, azalea, apple, and tobacco. Meristematic buds include both terminal and axillary buds. The selective killing of terminal buds is an application for which the chemicals of the invention are particularly useful.

The chemicals of the present invention may be applied to plants, which term includes various plant parts such as flowers, fruits, vegetables, roots, and foliage in various manners. In one embodiment of the invention, the composition is applied as an aqueous dispersion or emulsion. For example, the composition may be applied in a coarse water spray directed to the stem of the plant, and such spray application is found to give effective control. The chemicals may also be dissolved in organic solvents such as acetone, benzene, or kerosene (assuming these chemicals will not harm the plant), and the solutions of the chemicals can be emulsified in water with the aid of surface-active agents. The chemicals of the invention may be admixed with powdered solid carriers, such as mineral silicates, together with a surface-active agent so that a wettable powder may be obtained which may be applied directly to plants, or which may be shaken up with water for application to the plants in that form.

On a weight basis, the concentration of acetamide in the useful formulations (before dilution with water or other materials prior to application) may vary widely, e.g., from 10 to 75%. Following dilution to form an aqueous formulation, the concentration of the acetamide is from about 0.01 to 10%, which is effective for the control of undesirable secondary growth, and best results have been obtained using concentrations of from about 0.05 to 4%.

In the killing of meristematic tissue, a particularly advantageous embodiment of the invention is the use of an aliphatic alcohol in combination with the other chemicals of the composition. The resulting compositions exhibit reduced phytotoxicity and good control of meristematic tissue while using lower concentrations of active ingredients. The amount of alcohol employed,
based on the combined weight of the acetamide, surface active agent, and alcohol is from 40 to 80%.

Alcohols useful in the preparation of the compositions of this invention include hexanol, octanol, nonanol, decanol, undecanol, dodecanol, and mixtures thereof. They are commercially available products such as "Alfo 810" sold by Continental Oil Company, which is a mixture of octanols and decanols. Other useful alcohols are exemplified by mixtures (C_7 - C_9 - C_11) of alcohols sold under the designation of Oxo alcohols by the Monsanto Chemical Company. These alcohol mixtures contain, for example, about 30% branched-chain compounds which are generally 2-methyl substituted alcohols. Suitable C_7 - C_9 - C_11 mixtures contain, for example, about 40% C_7, 40% C_9, and 20% C_11. The alcohols employed include both straight and branched-chain alcohols and can be derived from synthetic or natural sources, e.g., paraffin and/or fatty acid esters. As employed in the invention, the alcohols contain from 6 to 12 carbon atoms and preferably contain from 8 to 11 carbon atoms. It is understood that small amounts of impurities such as fatty acids and hydrocarbons will be present due to the method of preparation of the alcohols employed, but this is generally undesirable and should be minimized where possible. Also, alcohols having less than 6 and more than 12 carbon atoms can be used with some benefit and indeed are frequently present as impurities. Suitable fatty acid sources for alcohols include caproic acid, caprylic acid, capric acid, and lauric acid and their corresponding esters with the alcohol being produced by reduction of the acid or ester by means well known in the art.

The acetamides employed in the invention may be prepared by the normal methods of amide formation. Several examples are set forth below.

**EXAMPLE A**

This example illustrates the preparation of a C_11 acetamide possessing tobacco suckering action. Two moles of a C_11 aliphatic amine having amino groups distributed on internal carbon atoms was reacted with five moles of acetic anhydride at 20° to 30° C. for about 18 hours. The reaction product was admixed with water and the organic portion was extracted with petroleum ether, washed with water and dilute caustic, and placed over Na_2SO_4 overnight to dry. The petroleum ether was subsequently stripped off using aspirator pressure and the product was further dried with benzene. The product analysis revealed 94.8% amide and 0.02% water. The yield was 94.6%.

**EXAMPLE B**

This example illustrates the preparation of N,N-

dicyclohexyl acetamide by reacting equal molar amounts of acetic anhydride and dicyclohexyl amine. By-product acetic acid was removed by distillation and the residue was added to 500 cc. of petroleum ether from which the product quickly crystallized out.

**EXAMPLE C**

This example illustrates the preparation of cycloalkyl acetamide by reacting one mole of cycloalkyl amine with 1.1 mole of acetic anhydride in the presence of benzene. The solid product was dissolved in hot benzene and was recrystallized to yield 215.5 grams of product analyzed as essentially 100% amide having a melting point of 141° to 142°C.

**EXAMPLE D**

This example illustrates the application of compositions of the invention to tobacco plants. As applied, the compositions were in the form of aqueous emulsions. These were applied to tobacco plants in the early button to early flowering stages, by spraying with a 3-nozzle sprayer and allowing the emulsion to drain down along the stem of the plant where meristematic and differentiating tissues are destroyed through contact. The emulsions were applied at a rate of approximately 30 to 50 gallons per acre.

After 9 days, the effectiveness of the spray treatment was determined by weighing the number of suckers remaining after treatment and comparing with the weight of suckers present in a control plot wherein the tobacco was untreated. The degree of sucker control was then expressed as the percentage formed by suckers from the treated plot as compared with suckers in the control plot, e.g., if the total weight of suckers from the treated plot was 25 percent less than the total sucker weight from the control plot, the degree of sucker control was 25 percent.

Attention was also given to the degree of plant injury accompanying application of the sucker-control agents of the invention. Injury was determined by visual estimate. Slight injury means that visual observation indicated only occasional necrotic light spotting on foliage of less than 5 percent of the plants. Light injury was spotting or browning on 5 to 20 percent of the plants. Moderate injury was roughly 20 to 50 percent spotting or browning, and heavy damage was considered to be anything in excess of 50 percent.

The results of the applications as described above are set forth in the Table.

**TABLE**

<table>
<thead>
<tr>
<th>Example</th>
<th>Composition</th>
<th>% Act. Ingredients Conc. Soln.</th>
<th>% Sucker Control (after 9 days)</th>
<th>Plant Injury</th>
<th>Type of Tobacco</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>C_9 - C_11 alkyl acetamide</td>
<td>1.0% Isopropyl alcohol**</td>
<td>5.0% Sorbitan Ester</td>
<td>2.0% Water</td>
<td>92.0%</td>
</tr>
<tr>
<td>2</td>
<td>C_9 alkyl acetamide</td>
<td>20.0% Sorbitan Ester</td>
<td>75.0% Sorbitan Ester</td>
<td>5.0%</td>
<td>95.0%</td>
</tr>
<tr>
<td>3</td>
<td>C_9 alkyl acetamide</td>
<td>20.0% Sorbitan Ester</td>
<td>75.0% Sorbitan Ester</td>
<td>5.0%</td>
<td>95.0%</td>
</tr>
<tr>
<td>4</td>
<td>N-methyl-N-dodecylacetamide</td>
<td>1.0% Sorbitan Ester</td>
<td>2.0% Sorbitan Ester</td>
<td>0.25</td>
<td>90</td>
</tr>
</tbody>
</table>
In the above examples, the sorbitan ester employed as an emulsifier was a condensation product of approximately equal molar amounts of sorbitol and coconut fatty acid and about 20 moles of ethylene oxide. Such esters are widely available on a commercial basis, e.g., Armac Company sells this sorbitan ester as Armanol PML-20.

The C₆ - C₁₃ alkyl alcohol employed in a number of the examples is available commercially as Alfo 810, a product of the Continental Oil Company.

Comparison of example 4 with examples 5 and 6 demonstrates the use of the acetamide alone (example 4) in contrast with the use of the acetamide with the C₆ - C₁₃ alkyl alcohol. From example 4, it can be seen that the use of the acetamide alone results in acceptable suckering action. It should also be noted that the level of suckering action is also related to the amount of acetamide employed, i.e., as the concentration (as applied to the plants) is reduced, suckering action may vary. With regard to examples 1 and 8, only slight suckering action was achieved. However, once it is known that the acetamides possess tobacco suckering action, the concentration of the acetamide can be adjusted to produce the desired results.

What is claimed is:

1. Composition for controlling the growth of suckers in tobacco plants, consisting essentially of:
   a. from about 10 to about 75 percent by weight of a member of the group consisting of an N-substituted acetamide of the formula:

   \[
   \text{CH}_3 - \text{C} - \text{N} - R_1
   \]

   \[
   \text{R}_2
   \]

   in which Rᵢ is selected from the group consisting of hydrogen, methyl, and cyclohexyl; R₂ is selected from the group consisting of alkyl having 6 to 15 carbon atoms, cyclohexyl, and cyclodecyl; and the soluble mineral acid salts thereof selected from the group consisting of the hydrochloride, phosphate and sulfate:

   b. from about 0.05 to about 10 percent by weight of a surface active agent; and

   c. from about 40 to about 80 percent of the total weight of the composition of an alkanol having 6 to 12 carbon atoms:

2. The composition of claim 1 in which the acetamide is N,N-dicyclohexyl acetamide.

3. A composition as in claim 1 wherein the acetamide is N-undecyloacetamide.

4. A composition as in claim 1 wherein the acetamide is N-methyl-N-dodecylacetamide.

5. A composition as in claim 1 wherein the acetamide is N-cyclohexyl acetamide.

6. A composition as in claim 1 wherein the surface active agent is a sorbitol lauric acid ester of polyethylene glycol containing about 20 ethoxy moieties per molecule.

7. The composition of claim 1 in the form of an aqueous dispersion in which the concentration of the N-substituted acetamide is between about 0.25 and about 10 percent by weight.

8. Method for controlling suckers in tobacco plants which comprises applying to a tobacco plant an amount of the composition of claim 1 effective to inhibit the growth of suckers thereon.