Spray drift during the application of an aqueous mixture of glyphosate and an auxinic herbicide is reduced by incorporating certain tertiary amine or tertiary amine oxide surfactants into the aqueous solution or mixture to be sprayed.
AMINE AND AMINE OXIDE SURFACTANTS FOR CONTROLLING HERBICIDE SPRAY DRIFT


BACKGROUND

[0002] Agricultural spraying by economical and available technologies uses hydraulic spray nozzles that inherently produce a wide spectrum of spray droplet sizes. The potential for these spray droplets to drift from the initial, desired site of application is found to be a function of droplet size, with smaller droplets having a higher propensity for off-target movement. Significant research efforts, involving numerous field trials, wind tunnel tests and subsequent generation of predictive math models have led to a greatly enhanced understanding of the relationship between spray droplet size and potential for off-target drift. Although other factors such as meteorological conditions and spray boom height contribute to the potential for drift, spray droplet size distribution has been found to be a predominant factor. Teske et. al. (Teske M. E., Hewitt A. J., Valcore, D. L. 2004. The Role of Small Droplets in Classifying Drop Size Distributions. ILASS Americas 17th Annual Conference: Arlington Va.) have reported a value of <156 microns (μm) as the fraction of the spray droplet distribution that contributes to drift. Robert Wolf (Wolf, R. E., Minimizing Spray Drift, Dec. 15, 1997, Microsoft® PowerPoint Presentation, available at www.bnc.ksu.edu/faculty/wolf/drift.htm, last viewed Sep. 6, 2011) cites a value of <200 μm as the driftable fraction. A good estimation of droplet size likely to contribute to drift, therefore, is the fraction below about 150 μm.

[0003] The negative consequences of off-target movement can be quite pronounced. Some herbicides have demonstrated very sensitive phytotoxicity to particular plant species at extremely low parts per million (ppm) or even parts per billion (ppb) levels, resulting in restricted applications around sensitive crops, orchards, and residential plantings. For example, the California Dept of Pesticide Regulation imposes buffers of ½-2 miles for propanil containing herbicides applied aerially in the San Joaquin valley.

SUMMARY

[0004] Spray drift during application can be reduced by incorporating certain tertiary amine or tertiary amine oxide surfactants into an aqueous herbicidal spray mixture containing glyphosate and an auxinic herbicide. Methods and compositions to reduce spray drift during the application of an aqueous herbicidal spray mixture are described herein. The methods to reduce spray drift during the application of an aqueous herbicidal spray mixture containing glyphosate and an auxinic herbicide include incorporating into the aqueous herbicidal spray mixture from about 0.02 to about 2 weight percent of one of a tertiary amine surfactant of the formula:

[0005] wherein R¹ is a straight or branched chain (C₁₅-C₁₈) alkyl and R² and R³ independently are straight or branched chain (C₁-C₁₈) alkyl, or a tertiary amine oxide surfactant of the formula:

[0006] wherein R⁴ is a straight or branched chain (C₁₀-C₁₈) alkyl or an alkyletherpropyl or alkylamidopropyl of the formula:

[0007] wherein R⁷ is a straight or branched chain (C₁₀-C₁₈) alkyl, and

[0008] R² and R³ independently are straight or branched chain (C₁-C₁₈) alkyl or ethoxylates or propoxylates of the formula:

[0009] wherein n is an integer from 1 to 20, or mixtures thereof.

[0010] Additionally, aqueous concentrate compositions are described that include from about 5 to about 40 weight percent of a water soluble salt of at least one auxinic herbicide, about 5 to about 40 weight percent of a water soluble salt of glyphosate, and from about 1 to about 20 weight percent of one or more tertiary amine or tertiary amine oxide.

DETAILED DESCRIPTION

[0011] Methods and compositions to reduce spray drift are described herein. The methods and compositions reduce the amount of driftable fines of a herbicide spray in both aerial and ground spray applications. The methods include the use of compositions incorporating tertiary amine or tertiary amine oxide surfactants, or mixtures thereof, into aqueous herbicidal spray mixtures containing a water soluble salt of at least one water soluble auxinic herbicide salt. Particularly useful auxinic herbicides to which this method applies include clopyralid, triclopyr, 2,4-D, 2,4-DB, MCPA, MCPB, dicamba, aminopyralid, and picloram. The methods described herein are most particularly useful for the application of herbicides that are subject to restricted applications around sensitive crops such as spray mixtures containing glyphosate and 2,4-D, triclopyr or dicamba.

[0012] Suitable cations contained in the water soluble salt of glyphosate and the water soluble salt of the auxinic herbicide used in the spray mixtures described herein include isopropyl ammonium, dimethyl ammonium, triethyl ammonium, monoethanol ammonium, diethanol ammonium, tri-
ethanol ammonium, dimethylethanol ammonium, diethylethylene glycol ammonium, trisopropyl ammonium, tetramethyl ammonium, tetraethyl ammonium, and choline.

**0013** The tertiary amine and tertiary amine oxide surfactants useful with the methods and compositions described herein may be prepared from petroleum derived raw materials or from naturally derived raw materials such as, for example, vegetable, animal, algae, or seed oils, or from combinations of petroleum derived or naturally derived raw materials.

**0014** As used herein tertiary amine surfactants refer to trialkyl amines of the formula

\[
R^1 NR^2 R^3
\]

wherein \(R^1\) is a straight or branched chain \((C_{12}-C_{18})\) alkyl and \(R^2\) and \(R^3\) independently are straight or branched chain \((C_{1}-C_{4})\) alkyls. Examples of useful tertiary amine surfactants include those found in products such as, for example, Armonex® DMTD (cocoalkylidimethylamine; AkzoNobel, Chicago, Ill.) and the like.

**0015** As used herein tertiary amine oxide surfactants refer to trialkyl amine oxides of the formula

\[
\begin{align*}
R^1 NR^2 R^3 & \quad \text{or} \\
R^1 NR^2 R^3 & \quad \text{or} \\
R^1 NR^2 R^3 & \quad \text{or}
\end{align*}
\]

wherein \(R^1\) is a straight or branched chain \((C_{16}-C_{18})\) alkyl or an alkyletherpropyl or alkylamidopropyl of the formula

\[
\begin{align*}
R^1 NR^2 R^3 & \quad \text{or} \\
R^1 NR^2 R^3 & \quad \text{or} \\
R^1 NR^2 R^3 & \quad \text{or}
\end{align*}
\]

wherein \(R^1\) is a straight or branched chain \((C_{16}-C_{18})\) alkyl, and \(R^2\) and \(R^3\) independently are straight or branched chain \((C_{1}-C_{4})\) alkyls or ethoxylates or propoxylates of the formula

\[
\begin{align*}
R^1 NR^2 R^3 & \quad \text{or} \\
R^1 NR^2 R^3 & \quad \text{or} \\
R^1 NR^2 R^3 & \quad \text{or}
\end{align*}
\]

wherein \(n\) is an integer from 1 to 20, or mixtures thereof. Examples of useful tertiary amine oxide surfactants include those found in the following products such as, for example, Ammonex® C \((R^4\) is cocoalkyl; \(R^5\) and \(R^6\) are methyl), Ammonex® MO \((R^4\) is straight chain \(C_{14}\) alkyl; \(R^5\) and \(R^6\) are methyl), Ammonex® MCO \((R^4\) is indicated to be predominantly a mixture of straight chain \(C_{12}\) and \(C_{14}\) alkyls; \(R^5\) and \(R^6\) are methyl), Ammonex® LO \((R^4\) is straight chain \(C_{12}\) alkyl; \(R^5\) and \(R^6\) are methyl) and Ammonex® CDO \((R^4\) is cocoamidopropyl; \(R^5\) and \(R^6\) are methyl) (the Ammonex® line of products are available from Stepan Company, Northfield, Ill.); Rhodamox® LO \((R^4\) is indicated to be predominantly a mixture of straight chain \(C_{12}\) and \(C_{14}\) alkyls; \(R^5\) and \(R^6\) are methyl) (Rhodia-Novacare; Cranbury, N.J.); Aromox® C12 \((R^4\) is cocoalkyl; \(R^5\) and \(R^6\) are 2-hydroxethyl) and Aromox® APA-T \((R^4\) is tallawalkylylamidopropyl; \(R^5\) and \(R^6\) are methyl) (the Aromox® line of products are available from AkzoNobel, Chicago, Ill.); and the Tomamine® AO series of surfactants such as, for example, Tomamine® AO-728 \((R^4\) is linear alkylketonepropyl; \(R^5\) and \(R^6\) are 2-hydroxyethyl) (the Tomamine® AO series of surfactants are available from Air Products, Allentown, Pa.).

**0016** The tertiary amine or tertiary amine oxide surfactant, and mixtures thereof, can be incorporated into the aqueous herbicidal spray mixture, for example, by being tank-mixed directly with the diluted herbicidal formulation. The tertiary amine or tertiary amine oxide surfactant, and mixtures thereof, may be incorporated into the aqueous spray mixture at a concentration from about 0.02 to about 2 weight percent of the final spray mixture, preferably from about 0.05 to about 1.0 weight percent of the final spray mixture, and most preferably from about 0.05 to about 0.2 weight percent of the final spray mixture.

**0017** The optimum spray droplet size depends on the application for which the composition is used. If droplets are too large, there will be less coverage by the spray, i.e., large droplets will land in certain areas while areas in between will receive little or no spray coverage. The maximum acceptable droplet size may depend on the amount of composition being applied per unit area and the need for uniformity in spray coverage. Smaller droplets provide more even coverage, but are more prone to drift during spraying. Thus, application parameters such as uniformity in spray coverage must be balanced against the tendency for smaller droplets to drift. For example, if it is particularly windy during spraying, larger droplets may be needed to reduce drift, whereas on a calmer day smaller droplets may be acceptable.

**0018** In addition to the physical properties of a particular aqueous composition, spray droplet size may also depend on the spray apparatus, e.g., nozzle size and configuration. The reduction in spray drift may result from a variety of factors including a reduction in the production of fine spray droplets (<150 μm minimum diameter) and an increase in the volume median diameter (VMD) of the spray droplets. In any event, for a given spray apparatus, application, and conditions, and based on the tertiary amine or tertiary amine oxide surfactant used, the median diameter of the plurality of spray droplets created using the compositions and methods described herein is increased above that of a spray composition that does not include the tertiary amine or tertiary amine oxide surfactants as described herein.

**0019** In addition to the methods described above, aqueous concentrate compositions are also described. As used herein aqueous concentrate compositions are solutions containing high concentrations of the aqueous herbicidal spray components described above, i.e., a water soluble glyphosate salt, one or more water soluble auxinic herbicide salts, and one or more tertiary amine or tertiary amine oxide surfactants. The aqueous concentrate compositions are intended to be diluted to provide aqueous herbicidal spray mixtures for use, for example, with the methods described herein. The aqueous concentrate compositions include from about 5 to about 40 weight percent of one or more water soluble salts of an auxinic herbicide, from about 5 to about 40 weight percent of a water soluble salt of glyphosate, and from about 1 to about 20 weight percent of one or more tertiary amine or tertiary amine oxide surfactants.
oxide surfactants. The aqueous concentrate compositions are preferably solutions containing the one or more tertiary amine or tertiary amine oxide surfactants, or mixtures thereof, dissolved or dispersed in the formulation containing the auxinic herbicide and glyphosate. Preferably the aqueous concentrate compositions contain about 10 to about 40 weight percent of the water soluble glyphosate salt; about 10 to about 40 weight percent of the one or more water soluble auxinic herbicide salts; and about 1 to about 18, about 1 to about 16, about 1 to about 14, about 1 to about 12, about 1 to about 10, about 1 to about 9, about 1 to about 8, about 1 to about 7, about 1 to about 6, about 1 to about 5, about 1 to about 4, about 1 to about 3, about 1 to about 2, or about 1 to about 1.5 weight percent of the one or more tertiary amine or tertiary amine oxide surfactants. Most preferably the aqueous concentrate compositions contain about 15 to about 30, about 20 to about 30, or about 25 to about 30 weight percent of the water soluble glyphosate salt; about 15 to about 30, about 20 to about 30, or about 25 to about 30 weight percent of the one or more water soluble auxinic herbicide salts; and about 1 to about 18, about 1 to about 16, about 1 to about 14, about 1 to about 12, about 1 to about 10, about 1 to about 9, about 1 to about 8, about 1 to about 7, about 1 to about 6, about 1 to about 5, about 1 to about 4, about 1 to about 3, about 1 to about 2, or about 1 to about 1.5 weight percent of the one or more tertiary amine or tertiary amine oxide surfactants. The aqueous concentrate compositions can be stored in suitable containers as will be readily recognized by one of skill in the art and can be, for example, solutions, emulsions, or suspensions. Additionally, compositions optionally containing one or more additional compatible ingredients are provided herein. These additional ingredients may include, for example, one or more pesticides or other ingredients, which may be dissolved or dispersed in the composition and may be selected from acaricides, bactericides, fungicides, insecticides, herbicides, herbicide safeners, insect attractants, insect repellents, plant activators, plant growth regulators, and synergists. Also, any other additional ingredients providing functional utility such as, for example, dyes, stabilizers, fragrants, viscosity-lowering additives, compatibility agents, and freeze-point depressants may be included in these compositions. The following Examples are presented to illustrate various aspects of the compositions and methods described herein and should not be construed as limitations to the claims.

**EXAMPLES**

**Herbicide Spray Samples**

**Example 1**

Herbicide spray samples were prepared as described below using the following aqueous samples of the amine oxide surfactant:

1. Ammonyx® C, 30% w/w cocoalkyltrimethylamine oxide in water
2. Ammonyx® MO, 30% weight/weight (w/w) myristyltrimethylamine oxide in water
3. Ammonyx® MCO, 30% w/w (C14 and C16) linear alkyltrimethylamine oxide in water
4. Ammonyx® LO, 30% w/w laurytrimethylamine oxide in water
5. Rhodamox® LO, 30% w/w (C12 and C16) linear alkyltrimethylamine oxide in water
6. Aromox® C/12, 50% w/w dihydroxyethyl cocoalkylamine oxide in water
7. Ammonyx® DO, 30% w/w decyltrimethylamine oxide in water

**Rhodamox® products are available from Stepan Company (Northfield, Ill.); Ammonyx® products are available from Rhodia-Novocare (Cranbury, N.J.); and Aromox® C/12 is available from Akzo Nobel (Chicago, Ill.).**

**Example 2** A 50 milliliter (ml) volumetric flask was first charged with 23.5 g of a 48.35 wt % ae of a 2,4-D choline salt solution in water. To the volumetric flask, 3.0 g of propylene glycol was added and the liquids were then blended by hand shaking the flask until the contents were homogenous. Next, 24.52 g of a 48.95 wt % ae of a glyphosate DMA solution in water was added to the flask. The volumetric flask was once again hand shaken until the contents were blended and homogenous. Next, the tertiary amine oxide surfactant was added (3.60 g of Aromox® C/12 solution; 6.00 g for all others) and the flask was hand shaken until the contents were blended and homogenous. Lastly, deionized water was added to fill the volumetric flask to the 50 ml mark. The sample was then blended by shaking the solution by hand until the liquid was homogenous. Seven samples containing one each of the tertiary amine oxide surfactants listed above and one concen-
trate containing no tertiary amine oxide surfactant (i.e., control sample) were prepared in this manner.

Each of the herbicide concentrates were then diluted in water to make a 2.49% v/v spray solution of each by taking 11.21 mL of the herbicide concentrate, placing it into 438.80 mL of deionized water and then lightly shaking by hand until each spray sample was homogenous. The eight spray solutions were sprayed using a Teejet® 8002 flat fan nozzle (Teejet Technologies; Wheaton, Ill.) at 60 psi (276 kilopascals) and the spray drop size distribution measurement was performed with a Sympatec Helos/KF high resolution laser diffraction particle sizer with an R7 lens (Sympatec GmbH; Clausthal-Zellerfeld, Germany). The tip of the nozzle was situated 12 inches (30.5 centimeters) above the path of the laser beam of the Sympatec particle sizer. The percentage of driftable fines was expressed as the volume percentage of spray droplets below 150 μm volume mean diameter (VMD) as shown in Table 1.

### Example 2

**Herbicide Concentrates**

Herbicide concentrates containing 114 g ae/L 2,4-D DMA, 120 g ae/L glyphosate DMA, 30 g ae/L propylene glycol, and 18 g/L (dry weight basis) of the tertiary amine oxide surfactants listed in Example 1 were prepared as follows. A 100 mL volumetric flask was first charged with 20.56 g of a 55.44 wt % ae 2,4-D DMA salt solution in water. To the volumetric flask, 3.00 g of propylene glycol was added and the liquids were then blended by hand shaking the flask until the contents were homogenous. Next, 24.52 g of a 48.95 wt % ae glyphosate DMA salt solution in water was added to the flask. The volumetric flask was once again hand shaken until the contents were blended and homogenous. Next, the tertiary amine oxide surfactant was added (3.60 g of Aromox® C/12; 6.00 g for all others) and the flask was hand shaken until the contents were blended and homogenous. Lastly, deionized water was added to fill the volumetric flask to the 100 mL mark. The sample was then blended by shaking the solution by hand until the liquid was homogenous. Seven samples containing the tertiary amine oxide surfactants listed above and one concentrate containing no tertiary amine oxide surfactant (i.e., control sample) were prepared in this manner.

### Example 3

**Tank-Mixed Spray Solution Containing Dicamba Diglycol Ammonium (DGA) Salt, Glyphosate Isopropyl Ammonium (IPA) Salt, and a Tertiary Amine Oxide Surfactant**

A tank-mixed spray solution containing dicamba diglycol ammonium (DGA) salt, glyphosate isopropyl ammonium (IPA) salt, and a tertiary amine oxide surfactant was prepared. A sample container was first charged with 276.73 mL of deionized water and then 4.56 g of 30% w/w Ammonyx® LO solution was added and mixed. Next, 11.22 mL of Rodeco® herbicide concentrate (commercial 4 pounds acid equivalent per gallon (lb ae/gal) glyphosate IPA salt solution from Dow AgroSciences, LLC) and 7.49 mL of Clarity® herbicide concentrate (commercial 4 lb ae/gal dicamba DGA salt solution from BASF) Corporation (Florham Park, N.J.) were added and the sample was then shaken by hand until the mixture was homogenous (<1 minute). The sample was sprayed using the same procedure and technique described in Example 1. The results, along with that for a control spray sample mixed the same way, but containing no tertiary amine oxide surfactant are shown in Table 3.

### Example 4

**Tank-Mixed Spray Solution Containing Triclopyr Triethyl Ammonium (TEA) Salt, Glyphosate Isopropyl Ammonium (IPA) Salt, and a Tertiary Amine Oxide Surfactant**

A tank-mixed spray solution containing triclopyr triethyl ammonium (TEA) salt, glyphosate isopropyl amnio-
A sample container was first charged with 275.48 mL of deionized water and then 0.79 g of 30% w/w Ammonoxyl® LO solution was added and mixed. Next, 8.73 mL of Rodeo® herbicide concentrate (commercial 4 lb ae/gal glyphosate IPA salt solution from Dow AgroSciences, LLC) and 15.0 mL of Garlon 3A® herbicide concentrate (commercial 3 lb ae/gal triclopyr TEA salt solution from Dow AgroSciences, LLC) were added and the sample was then shaken by hand until the mixture was homogeneous (<1 minute). The sample was sprayed using the same procedure and technique described in Example 1. The results, along with that for a control spray sample containing no tertiary amine oxide surfactant are shown in Table 4.

<table>
<thead>
<tr>
<th>Tertiary Amine Oxide Surfactant</th>
<th>Spray Droplet VMD, µm</th>
<th>Volume Percent Drivable Fines &lt;150 µm VMD</th>
</tr>
</thead>
<tbody>
<tr>
<td>none (control)</td>
<td>158</td>
<td>47.2%</td>
</tr>
<tr>
<td>Ammonoxyl® LO</td>
<td>240</td>
<td>24.1%</td>
</tr>
</tbody>
</table>

Example 5
Herbicide Concentrate Containing Armeen® DMTD Dimethyltallowalkylamine

A herbicide concentrate containing 225 g ae/ℓ of 2,4-D DMAE (dimethylethanol ammonium), 225 g ae/ℓ of glyphosate DMA, 51 g ℓ of propylene glycol, and 56 g ℓ of Armeen® DMTD dimethyltallowalkylamine (AzkoNobel; Chicago, Ill.) was prepared as follows: 14.72 mL of a glyphosate DMA stock solution (40.5 wt % ae, density-1.208 g/mL), 14.98 mL of a 2,4-D DMAE/propylene glycol stock solution (40.3 wt % ae, 2,4-D DMAE: propylene glycol, 9.1 wt % propylene glycol, density-1.192 g/mL), and 2.25 mL (1.80 g, density-0.80 g/mL) of Armeen® DMTD were combined and swirled to yield a clear, homogeneous concentrate.

The resulting herbicide concentrate was then diluted in deionized water to make a 4% (vol/vol) spray solution in a similar manner as described in Example 1. The spray solution was sprayed using the same procedure and technique described in Example 1. The results are shown in Table 5.

<table>
<thead>
<tr>
<th>Tertiary Amine Surfactant</th>
<th>Spray Droplet VMD, µm</th>
<th>Volume Percent Drivable Fines &lt;150 µm VMD</th>
</tr>
</thead>
<tbody>
<tr>
<td>none (control)*</td>
<td>159</td>
<td>50.2%</td>
</tr>
<tr>
<td>Armeen® DMTD</td>
<td>268</td>
<td>15.7%</td>
</tr>
</tbody>
</table>

*The control sample was prepared using glyphosate DMA and 2,4-D DMA.

Example 6
Concentrate Containing Tomamine® AO-728 Special

A glyphosate/2,4-D concentrate formulation was prepared by blending 22.01 g of 2,4-D choline concentrate (44.30 wt % acid equivalent (ae)), 3.0 g propylene glycol, 21.22 g of glyphosate DMA concentrate (48.30 wt % ae), 3.53 g of Tomamine® AO-728 Special (50% active linear alkylpropylamine oxide, 1.77 g active; AirProducts; Allentown, Pa.), and sufficient water to charge a 50 mL volumetric flask. The formulation contained 205 g/L glyphosate DMA (ae) and 195 g/L 2,4-D choline (ae).

The resulting herbicide concentrate was then diluted in deionized water to make a 4.38% (vol/vol) spray solution in a similar manner as described in Example 1. The spray solution was sprayed using the same procedure and technique described in Example 1. The results are shown in Table 6.

<table>
<thead>
<tr>
<th>Tertiary Amine Oxide Surfactant</th>
<th>Spray Droplet VMD, µm</th>
<th>Volume Percent Drivable Fines &lt;150 µm VMD</th>
</tr>
</thead>
<tbody>
<tr>
<td>none (control)*</td>
<td>148</td>
<td>51.1%</td>
</tr>
<tr>
<td>Tomamine® AO-728 Special</td>
<td>201</td>
<td>34.0%</td>
</tr>
</tbody>
</table>

*The control sample was prepared using glyphosate DMA and 2,4-D choline.

We claim:
1. A method to reduce spray drift during the application of an aqueous herbicidal spray mixture containing glyphosate and an auxinic herbicide comprising incorporating into the aqueous herbicidal spray mixture from about 0.02 to about 2 weight percent of one of a tertiary amine surfactant of the formula:

\[ R^1 \quad ^{\text{R1}} \quad ^{\text{R2}} \quad ^{\text{R3}} \]

wherein \( R^1 \) represents a straight or branched chain \((C_{12-14})\) alkyl and \( R^2 \) and \( R^3 \) independently represent a straight or branched chain \((C_{1-16})\) alkyl,
or a tertiary amine oxide surfactant of the formula:

\[
\begin{align*}
\text{R}^4 & \text{N} \text{R}^6 \text{O} \\
\end{align*}
\]

wherein \( \text{R}^4 \) is a straight or branched chain (C\(_{10}-\)C\(_{18}\)) alkyl or an alkyletherpropyl or alkylamidopropyl of the formula:

\[
\begin{align*}
\text{O} \text{R}^1 \text{S}_{\text{y}} - \text{y} \text{H} \\
\end{align*}
\]

wherein \( \text{R}^1 \) represents a straight or branched chain (C\(_{15}-\)C\(_{18}\)) alkyl, and \( \text{R}^2 \) and \( \text{R}^3 \) independently represent a straight or branched chain (C\(_1-\)C\(_{18}\)) alkyl or ethoxylates or propoxylates of the formula:

\[
\begin{align*}
\text{CH}_2\text{O} \text{H} \text{H} \text{H} \text{H} \\
\end{align*}
\]

wherein \( n \) is an integer from 1 to 20, or mixtures thereof.

2. The method of claim 1, wherein the auxinic herbicide is a water soluble salt of 2,4-D, a water soluble salt of triclopyr, a water soluble salt of dicamba, or mixtures thereof.

3. The method of claim 1, wherein the auxinic herbicide is a water soluble salt of 2,4-D.

4. The method of claim 1, wherein the auxinic herbicide is 2,4-D choline salt.

5. The method of claim 1, wherein the auxinic herbicide is 2,4-D dimethyl ammonium salt.

6. The method of claim 1, wherein the auxinic herbicide is 2,4-D choline salt or 2,4-D dimethyl ammonium salt and the glyphosate is glyphosate dimethyl ammonium salt or glyphosate isopropyl ammonium salt.

7. The method of claim 1, wherein the tertiary amine oxide surfactant is lauryldimethylamine oxide.

8. The method of claim 1, wherein the auxinic herbicide is 2,4-D choline salt or 2,4-D dimethyl ammonium salt, the glyphosate is glyphosate dimethyl ammonium salt or glyphosate isopropyl ammonium salt, and the tertiary amine oxide surfactant is a lauryldimethylamine oxide.

9. The method of claim 1, wherein the auxinic herbicide is 2,4-D choline salt, the glyphosate is glyphosate dimethyl ammonium salt, and the tertiary amine oxide surfactant is a lauryldimethylamine oxide.

10. The method of claim 1, wherein the auxinic herbicide is a water soluble salt of 2,4-D and the weight ratio of the water soluble 2,4-D salt to the glyphosate salt is from about 2.3:1 to about 1:2.3.

11. An aqueous concentrate composition comprising from about 5 to about 40 weight percent of at least one auxinic herbicide, about 5 to about 40 weight percent of a water soluble salt of glyphosate, and from about 1 to about 20 weight percent of at least one of a tertiary amine or a tertiary amine oxide surfactant.

12. The aqueous concentrate composition of claim 11, wherein the tertiary amine or tertiary amine oxide surfactant comprises a tertiary amine or tertiary amine oxide surfactant of the formula:

\[
\begin{align*}
\text{R}^1 & \text{N} \text{R}^3 \text{O} \\
\end{align*}
\]

wherein \( \text{R}^1 \) represents a straight or branched chain (C\(_{15}-\)C\(_{18}\)) alkyl and \( \text{R}^2 \) and \( \text{R}^3 \) independently represent a straight or branched chain (C\(_1-\)C\(_{18}\)) alkyl or an alkyletherpropyl or alkylamidopropyl of the formula:

\[
\begin{align*}
\text{O} \text{R}^1 \text{S}_{\text{y}} - \text{y} \text{H} \\
\end{align*}
\]

wherein \( \text{R}^1 \) is a straight or branched chain (C\(_{10}-\)C\(_{18}\)) alkyl, and \( \text{R}^2 \) and \( \text{R}^3 \) independently are straight or branched chain (C\(_1-\)C\(_{18}\)) alkyl or ethoxylates or propoxylates of the formula:

\[
\begin{align*}
\text{CH}_2\text{O} \text{H} \text{H} \text{H} \text{H} \\
\end{align*}
\]

wherein \( n \) is an integer from 1 to 20, or mixtures thereof.

13. The aqueous concentrate composition of claim 11, wherein the auxinic herbicide is a water soluble salt of 2,4-D.

14. The aqueous concentrate composition of claim 11, wherein the auxinic herbicide is 2,4-D choline salt.

15. The aqueous concentrate composition of claim 11, wherein the auxinic herbicide is 2,4-D dimethyl ammonium salt.

16. The aqueous concentrate composition of claim 11, wherein the auxinic herbicide is 2,4-D choline salt or 2,4-D dimethyl ammonium salt and the glyphosate is glyphosate dimethyl ammonium salt or glyphosate isopropyl ammonium salt.

17. The aqueous concentrate composition of claim 11, wherein the tertiary amine oxide surfactant is lauryldimethylamine oxide.
18. The aqueous concentrate composition of claim 11, wherein the tertiary amine oxide surfactant comprises from about 0.02 to about 2 weight percent of a final spray mixture.

19. The aqueous concentrate composition of claim 11, wherein the auxinic herbicide is 2,4-D choline salt or 2,4-D dimethyl ammonium salt, the glyphosate is glyphosate dimethyl ammonium salt or glyphosate isopropyl ammonium salt, and the tertiary amine oxide surfactant is a lauryldimethylamine oxide.

20. The aqueous concentrate composition of claim 11, wherein the auxinic herbicide is 2,4-D choline salt, the glyphosate is glyphosate dimethyl ammonium salt, and the tertiary amine oxide surfactant is a lauryldimethylamine oxide.

21. The aqueous concentrate composition of claim 11, wherein the auxinic herbicide is a salt of 2,4-D and the weight ratio of the 2,4-D salt to the glyphosate salt is from about 2.3:1 to about 1:2.3.