Coos County
Noxious Weed Control District
Advisory Board

2020 Coos County Herbicide Cost-Share Program
The Coos County Noxious Weed Control District Advisory Board (Advisory Board) provides assistance to control noxious weeds in Coos County. One initiative is to assist landowners through the Cost-Share Program. The County through the Weed Control District will provide up to 40% of the cost of the negotiated price of herbicide and surfactant for 2020. Each landowner is responsible for the cost of the application. The applicants share of the cost is shown on page two. Once the deadline for orders has passed you will receive a notification with your approved amount and instruction for payments. Approval is based on the acreage you will be treating, amount of applications and funding for the program.

The cost-share program assists landowners desiring to control noxious weeds. The targeted noxious weeds are referred to as “T” list weeds designated as noxious weeds determined by the Board and are the focus of the herbicide cost-share program. The “T” designated weed are species from either the A or B lists that are the focus for prevention and control within the county.

“A” List weeds are the highest priority for control and educational outreach. These weeds are targeted for early detection and eradication. “B” list weeds are weeds of known economic importance which occurs in the county in small enough infestations to make eradication/containment possible; or is not known to occur, but its presence in neighboring counties make future occurrence in Coos County seem imminent. The priority for “B” listed weeds is infestations are subject to eradication or intensive control when and where found.

Coos County “T” list weeds are shown in the table below along with the recommended herbicide active ingredient. More detailed information on management of noxious weeds is available in the Pacific Northwest Weed Management Handbook [https://pnwhandbooks.org/weed](https://pnwhandbooks.org/weed) or Weed Controls in Natural Areas [https://wric.ucdavis.edu/information/natural%20areas/natural_areas_common_A-B.htm](https://wric.ucdavis.edu/information/natural%20areas/natural_areas_common_A-B.htm). The weed profiles are also attached to this document to help property owners put a weed management plan together.

The herbicide products listed in this announcement are not an endorsement of particular brands or manufacturers. Instead, these are products that are available from the contract selected, and products with the same concentration of active ingredient and site registration, may be substituted. The Advisory Board has included the herbicides and surfactants based on the guidance from the Pacific Northwest Weed Management Handbook and confirmed by the contractor.

However, it is the landowner’s (or their applicator’s) responsibility to ensure compliance with all use and safety instructions on the label. The label is the law showing how the herbicide may be used and following the label will give best results.

Instructions and important dates for Cost-Share Program
1. **May 15, 2020 – Cost-Share Applications** – Applications are available for participates to fill out. If you have questions about the application you can contact Coos County Planning Department at 541-396-7770 or by email at planning@co.coos.or.us.

Applications may be obtained from:
- Website: [http://www.co.coos.or.us/Departments/BoardofCommissioners/CountyBoardsandCommittees/WeedBoard.aspx](http://www.co.coos.or.us/Departments/BoardofCommissioners/CountyBoardsandCommittees/WeedBoard.aspx)
- Calling the Coos County Planning Department 541-396-7770
- Emailing: planning@co.coos.or.us

Applications may be submitted through the following methods (Due by June 23, 2020):
- Mail: Coos County Planning, Attn: Cost-Share Application 250 N. Baxter,
Coos County Cost Share Application

Coquille OR 97423.

- Email: planning@co.coos.or.us
- Drop Off Location: Coos County Planning Department. Please contact the department for drop off details by email or phone at 541-396-7770.

2. **May 27, 2020 – Online GoToMeeting Help Session 5 p.m. to 7 p.m.** – A help session is offered at this time through GoToMeeting, which allows you to log on through your computer or call in to listen and asked questions. The Advisory Board strongly advises applicants to attend this session if you need assistance, but this is not a requirement.

   How to attend: Log on to the session at least five (5) minutes in advance of the meeting, using the information below or email for a direct link. If you don’t have computer or phone access, please contact the Coos County Planning Department at least 24 in advance for alternative options.

   **Title of Meeting:** Cost-Share Help Secession Wed, May 27, 2020 5:00 PM - 7:00 PM (PDT)

   **Please join my meeting from your computer, tablet or smartphone.**

   [https://global.gotomeeting.com/join/571910389](https://global.gotomeeting.com/join/571910389)

   **You can also dial in using your phone.**

   United States: +1 (646) 749-3112

   **Access Code:** 571-910-389

   New to GoToMeeting? Get the app now and be ready when your first meeting starts:

   [https://global.gotomeeting.com/install/571910389](https://global.gotomeeting.com/install/571910389)

3. **June 23, 2020 - Applications Deadline 5:00 p.m.** - All applications must be completed by the landowner or property manager and returned to the Coos County Planning Department or an Advisory Board Member no later than 5:00 p.m. (see deliver instruction in number one above) Applications may be submitted electronically. If you choose to submit the application electronically and an email confirmation is not received from the Planning Department, please call to verify your application was received. The email address is planning@co.coos.or.us.

4. **June 30, 2020 – Notification** – After the application deadline the Advisory Board will meet to review the application deadline has passed. Amounts will be allowed based on acreage treated and available funds. Property owners will learn the results by mail no later than July 10, 2020. Notifications will include the amount of herbicide cost-share granted and the final cost of herbicides and surfactants, as well as payment terms and conditions. If you have not received a notification please contact Coos County Planning Department at 541-396-7770 or by email at planning@co.coos.or.us. All Payments shall be received by August 1, 2020.

5. **July 15, 2020 – Required Training 6:00 p.m.** – Training will be held virtually this year but if you do not have a computer at home please contact the Planning Department as you may view the video in the Owen Building but there is limited attendance to ensure social guidelines is followed. A current applicator’s license may be substituted for required training (include applicator’s license number on application). A postcard with your order total and receipt will be mailed to you. Please bring your postcard to the pickup site as explained in number six below.

6. **August 18, 2020 - Herbicide Pickup and Deliver** - On August 18, 2020 at the Coos County Solid Waste Facility (Beaver Hill Transfer Site) located at 55722 Highway 101, Coos Bay OR 97420 from 10:00 a.m. to 12:00 p.m. If you are not familiar with the location it is located ¼ mile south of milepost 253 on Highway 101 between Coos Bay and Bandon. Please bring with you the confirm order postcard. Due to distancing requirements we asked that you remain in your vehicle, provide your postcard to an Advisory Board Member and they will bring the herbicides to your vehicle and
you may exit the vehicle to obtain your order. If you have special requests, please contact the Planning Department prior to pickup.

This section covers the herbicides and surfactants pricing and brand names that are available for this year’s Cost-Share program pursuant to a contract with Nutrien Ag Solutions. The County does not endorse any specific brand. The recommendations are from the Pacific Northwest Weed Management Handbook. Surfactants are recommended based on the label of the product and confirmed by the contractor. The table below provides the type of herbicide, name brand available for purchase, quantity and the price per container that has been authorized to offer as part of the program. To qualify for the reduced cost, you shall comply with the requirements of the program as described in this application.

**Weed List and Recommended Herbicide and Product**

<table>
<thead>
<tr>
<th>Common name</th>
<th>Scientific name</th>
<th>Recommended Herbicide</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diffuse knapweed</td>
<td><em>Centaurea diffusa</em></td>
<td>2-methyl-4-chlorophenoxyacetic acid or Aminopyralid</td>
<td>MCPA or Milestone</td>
</tr>
<tr>
<td>Spotted knapweed</td>
<td><em>Centaurea stoebe</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meadow knapweed</td>
<td><em>Centaurea moncktonii</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biddy biddy</td>
<td><em>Acaena novae-zelandiae</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>English ivy, Atlanticivy</td>
<td><em>Hedera helix, H. hibernica</em></td>
<td>Triclopyr or Glyphosate</td>
<td>Vastlan, Garlon 3A, Element 3A or Roundup Custom</td>
</tr>
<tr>
<td>(all cultivars)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>False brome</td>
<td><em>Brachypodium sylvaticum</em></td>
<td>Glyphosate</td>
<td>Roundup Custom</td>
</tr>
<tr>
<td>Gorse</td>
<td><em>Ulex europaeus</em></td>
<td>Triclopyr</td>
<td>Vastlan, Garlon 3A, Element 3A</td>
</tr>
<tr>
<td>Himalayan Blackberry</td>
<td><em>Rubus bifrons (R. armeniacus, discolor)</em></td>
<td>Triclopyr</td>
<td>Vastlan or Garlon 3A, Element 3A</td>
</tr>
<tr>
<td>Jubata Grass (purple</td>
<td><em>Cortaderia jubata</em></td>
<td>Glyphosate or Imazapyr</td>
<td>Roundup Custom or Nufarm Polaris</td>
</tr>
<tr>
<td>pampas grass)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knotweed, Japanese</td>
<td><em>Polygonum cuspidatum</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Fallopia japonica)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knotweed, Giant</td>
<td><em>Polygonum sachalinesis</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Fallopia sachalinesis)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knotweed, Himalayan</td>
<td><em>Polygonum polystachyum</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knotweed, Bohemian</td>
<td><em>Polygonum bohemica</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thistle, bull</td>
<td><em>Cirsium vulgare</em></td>
<td>Aminopyralid</td>
<td>Milestone</td>
</tr>
<tr>
<td>Thistle, Canada</td>
<td><em>Cirsium arvense</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thistle, Italian</td>
<td><em>Carduus tenuiflorus</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thistle, milk</td>
<td><em>Silbyum marianum</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yellow flag iris</td>
<td><em>Iris psuedacorus</em></td>
<td>Imazapyr</td>
<td>Polaris</td>
</tr>
<tr>
<td>Type</td>
<td>Brand Name</td>
<td>Container Size</td>
<td>Applicant’s price per container</td>
</tr>
<tr>
<td>----------------------</td>
<td>------------------</td>
<td>----------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td><strong>Herbicides</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aminopyralid</td>
<td>Milestone</td>
<td>2.5 Gallon</td>
<td>$397.50</td>
</tr>
<tr>
<td></td>
<td>Milestone</td>
<td>1 Quart</td>
<td>$39.75</td>
</tr>
<tr>
<td>Aquatic Glyphosate</td>
<td>Roundup Custom</td>
<td>2.5 Gallon</td>
<td>$24.59</td>
</tr>
<tr>
<td>Aquatic Imazapyr</td>
<td>Nufarm Polaris</td>
<td>2.5 Gallon</td>
<td>$75.60</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-methyl-4-chlorophenoxyacetic acid</td>
<td>MCPA</td>
<td>2.5 Gallon</td>
<td>$24.68</td>
</tr>
<tr>
<td>Triclopyr</td>
<td>Vastlan</td>
<td>2.5 Gallon</td>
<td>$131.25</td>
</tr>
<tr>
<td></td>
<td>Element 3A</td>
<td>2.5 Gallon</td>
<td>$59.19</td>
</tr>
<tr>
<td></td>
<td>Garlon 3A</td>
<td>2.5 Gallon</td>
<td>$70.10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Surfactants</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Ionic Surfactant</td>
<td>Activator 90</td>
<td>2.5 Gallon</td>
<td>$27.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 Gallon</td>
<td>$10.80</td>
</tr>
<tr>
<td>Silicone+Seed Oil</td>
<td>Phase</td>
<td>2.5 Gallon</td>
<td>$54.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 Gallon</td>
<td>$21.60</td>
</tr>
<tr>
<td>Methylated Seed Oil</td>
<td>MSO</td>
<td>2.5 Gallon</td>
<td>$15.98</td>
</tr>
<tr>
<td>Crop oil concentrate</td>
<td>Herbimax</td>
<td>2.5 Gallon</td>
<td>$27.00</td>
</tr>
</tbody>
</table>

A surfactant is a combination of the phrase “surface active agent,” which is an organic compound that is soluble in chemical solutions or water and allows mixtures to blend, adhere and work better. They serve as an enhancement and help to break the barrier of hard to penetrate surfaces, like the waxy surface of a leaf.

Adding just a touch of surfactant can increase the effectiveness of all your herbicides by breaking the surface tension of the herbicide and leaf surface. This allows the herbicide of choice to stick around and sit on the leaf surface long enough to be absorbed by the weed exponentially increasing the herbicides killing power and reducing the chances of the solution running off and effecting desired plants.

Some herbicides actually need surfactants in order to work, but other products might already have surfactants added in. This is why it is important to read product labels before adding or mixing anything with your selected herbicide. When choosing a surfactant to mix with your herbicide, most of the labels recommend a non-ionic surfactant.

Surfactants are sometimes referred to as “wetting agents” or “wetter spreaders,” which may bring about some confusion with adjuvants which are additives that affect how a herbicide or other chemical functions. Surfactants do qualify as an adjuvant but not all adjuvants are surfactants so be sure to do your homework before mixing and matching chemicals so you get the results you desire. The next document is portions of a document from the wholesaler that explains more about herbicides and surfactants. The full document is located on the website.


**WATERMAXX® 2 Agricultural Soil Surfactant** .......................... 71
**WIDESPREAd® MAX powered by BREAK-THRU®** .................... 72-73
**ACDIpHACTANT** .................................................. 74
‡ **E-Z MIX** ...................................................................... 74
**SPREADER 90** ............................................................. 74
‡ **THRUST®** ................................................................. 74
**LEAF LIFE® WIDESPREAd® ORGANIC** ............................... 74

**REFERENCE GUIDE**

**PROPER TANK MIXING PROCEDURES** ............................... 75-77
**WALES/DALES** ............................................................ 78
**NOZZLE OUTPUTS** .......................................................... 79
**AIRCRAFT CALIBRATION** ............................................... 80
**COMPUTING PLANT POPULATIONS AND YIELDS** ............ 80
**USEFUL MEASUREMENTS** ............................................. 81
**QUICK CONVERSIONS** ................................................ 81
**RESIDUE PRODUCED BY CROPS** ................................... 82
**MISCELLANEOUS CALCULATIONS** ................................. 82
**SOIL SAMPLING DEPTHS** ............................................. 82
**CONVERSION FACTORS** ............................................... 82

For more information on our full product line please visit
www.lovelandproducts.com

‡ This product is not approved in California or intended to be used in California with a pesticide product or pesticide spray mixture, and cannot be used as a spray adjuvant.

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**RATIONALE FOR ADJUVANT USE**

For decades, research has demonstrated the performance of pesticides, fertilizers and plant growth regulators is constrained by physical and environmental factors that may suppress their effectiveness. Using adjuvants with spray applications has proven to (a) improve or otherwise facilitate the physical handling characteristics of pesticides and nutritional sprays; (b) improve performance effectiveness and consistency of sprayables; and (c) legally comply with the labeled use requirements of pesticides and nutritionals. Many of the factors that limit spray performance can be alleviated or managed with specific adjuvant products.

**MANAGING CONSTRAINTS TO PESTICIDE PERFORMANCE WITH ADJUVANT PRODUCTS**

I. Water

A. pH (acidity/alkalinity) - Managed with ACIDIFICATION AGENT (ACIDIFIERS) OR ALKALINIZATION AGENTS.

B. Water hardness (mineral content) - Managed with WATER CONDITIONING AGENTS.

II. Spray droplet formation (atomization)

A. Size (small droplet component) - Managed with DRIFT REDUCTION AGENTS.

B. Size distribution within the droplet spectrum - Managed with DRIFT REDUCTION AGENTS and ADJUVANTS with droplet size management properties.

III. Drop impact behavior

A. Losses due to bounce, shatter and run-off - Managed with DEPOSITION/RETENTION AGENTS (STICKERS). Initial retention will also be affected by this type of adjuvant.

IV. Post-impact drop behavior

A. Spreading of individual droplets (influenced by surface tension of water) - Managed with SURFACTANTS / SPREADERS / WETTERS, utilized at low rates.

B. Retention (rainfastness) - Managed with DEPOSITION / RETENTION AGENTS (STICKERS).

C. Distribution of droplets upon the target surface - Managed with a variety of adjuvant products such as DEPOSITION / RETENTION AGENTS and some penetrating adjuvants such as LI 700® and Liberate®.

D. Penetration (passive) - Managed with ORGANOSILICONE SURFACTANTS (“SUPERWETTERS”), which reduce surface tension of water to very low levels.

V. The Target

A. Waxy cuticular surfaces (primary barrier to uptake and penetration) - Managed with PENETRATING AGENTS, which can actively disrupt the cuticle.

The following adjuvant types are utilized as penetrating agents:
ADJUVANT CLASSIFICATION

As a matter of convenience, adjuvants can be grouped into several distinct categories. The following is a list of these categories.

A. Wetting/spreading agents (surfactants):
Sometimes referred to as wetting agents or spreaders. Generally used for the purpose of improving coverage and penetration of agri-chemicals.

- Activate 90
- Flame®
- Franchise®
- Freeway®
- LI 700®
- Liberate®
- Phase®
- Scanner®
- Spreader 90
- Strike Force®
- Tactic™
- Vader®
- Weather Gard Complete

B. Penetrating surfactants:

1. Soybean oil derivatives:
- Compadre®
- Franchise®
- LI 700®
- Liberate®

- MSO® with LECI-TECH®
- %Strike Force®
- Vader®
- Weather Gard Complete

ADJUVANTS - A LOOK TO THE FUTURE

The following points regarding adjuvant products are important and should be considered when they are being utilized with pesticides:

- **Adjuvants are not pesticides.** They should be considered as tools to assist the management of pesticide performance.
- **Adjuvants are not all alike.** They differ greatly in their properties (chemistry), function, dose requirements, specificity of use and quality.
- **Performance of pesticides is highly interactive with numerous factors.** Examples: method of application, environmental conditions and the target pest.
- **It is important to identify factors that constrain the performance of pesticides.** Many can be managed with the use of adjuvant products. Individual constraining factors (i.e. water pH) may be small, however it is important to realize that when several “small or seemingly insignificant” factors occur simultaneously, they can combine to produce an overall large effect.
- **Know the adjuvants you use.** Find out what properties they have and what dose is required to achieve optimum results. Reliable, creditable suppliers can provide you with the information you require or will be able to refer you to someone who can.

INTRODUCTION

Within the range of currently available agri-chemical products, there exists a unique group of products called adjuvants. These products have the ability to greatly influence the performance of pesticidal materials by working through means of both physical and chemical processes. Adjuvants should be considered as management tools that can enhance the level and consistency of performance. Improvement in these areas can be attributed to the ability of the adjuvant to compensate for the variables that impact performance.

The use of adjuvant products as management tools for agri-chemical application will provide measures to:

1. Improve or otherwise facilitate the physical handling characteristics of agri-chemicals.
2. Improve performance effectiveness and consistency by:
   a. Reduction or minimization of pesticide losses.
   b. Enhancing or maximizing the effect of pesticides.
3. Comply with legal requirements for their use.

Clearly, the expansion of world agriculture production will be one of the most demanding challenges of the future. The ability to improve production efficiency will be closely tied to agri-chemicals. As adjuvant products have demonstrated their utility in enhancing agri-chemical performance, there is little doubt that adjuvants will play an increasing role in the future.

Loveland Products will continue to be active in three areas with regard to adjuvants:

1. Research and development of unique and functional products to meet the specific and changing needs of the agri-chemical industry.
2. Manufacture of quality products according to state of the art procedures and adherence to strict quality control standards.
3. Distribution, both domestically and internationally, to organizations attuned to handling specialty products.

Loveland Products is dedicated to the support of its clientele by providing technical expertise, training and superior promotional efforts to the product line. Our company offers a full line of adjuvants and remains on the cutting edge of adjuvant development. The following sections will contain information regarding adjuvant categories, terminology and mode of action.
2. Methylated seed oils:
Occasionally referred to as methyl esters. The products in this group are specific in their adjuvant effect. They function exceptionally well with many herbicide chemistries. Vegetable seed oils all contain constituents called fatty acids. These organic acids may be transformed by a process called esterification by reacting with an alcohol. In methyl ester production, the fatty acids are esterified with methyl alcohol. The end result is a seed oil with new properties of solvency and water affinity.
Amigo®
Phase®
MSO® with LECI-TECH®
#Phase® II

3. Emulsified petroleum based oils:
Commonly called crop oil concentrates or oil surfactants. The usual ratio is 16 to 20% surfactant emulsifier and 80 to 84% petroleum based oil.
Herbimax®
Maximizer®

C. Organosilicone super wetters:
These products dramatically reduce surface tension to allow thorough penetration and maximum wetting and spreading properties on nearly all plant surfaces.
Freeway®
#Phase® II
Hi-Wett®
Tactic™
Phase®
Widespread® Max

D. Stickers:
This category name was chosen to designate an adjuvant that primarily imparts the property of adhesion of spray solutions. As a result of this property being added, spray droplets will have improved deposition and retention.
Attach®
Tactic™
Bond Max®

E. Water conditioning agents:
When certain herbicide chemistries, such as glyphosate, sulfonylurea, imidazolinone, and phenoxy are added to water, the negative charges in the herbicide molecules attract the positive ions (cations) in water (i.e. calcium, potassium, magnesium). The herbicide and these cations form a strong complex, which can prevent or hinder uptake of the herbicide into the plant, effectively reducing herbicide performance. Water conditioners sequester and chelate cations freeing the herbicide molecules to perform more effectively.
#Amaze Gold®
Choice® Weather Master
#Surfact®
Choice® Trio
#Strike Force
Flame®
Weather Gard Complete

F. Nitrogen containing adjuvants:
These products have historically been used with herbicides, and are sometimes regarded as anti-antagonism agents to be used in conjunction with surfactant adjuvants. Success with this type of product seems to be specific with certain herbicide chemistries, weed species and carrier volumes. The exact mode of action of this group is still being debated; however, it is generally felt that their use promotes uptake and/or translocation of the herbicide. There may be some activity related to reducing impact of certain aspects of minerals in the spray water.
#Amaze Gold®
#Quad 7
Flame®
#Surfact®
#Phase® II
#Thrust®

G. Basic N blend:
Basic blends provide a higher pH combination of fertilizer source and non-ionic surfactant, facilitating solubility of sulfonyleurea and stabilizing the mixture for micro rates on sugar beets.
#Quad 7

H. Droplet size management (drift reduction):
1. Polymers:
This category of adjuvant product is usually a viscoelastic (having both viscous and elastic properties) polymer that is added to spray solutions to reduce the production of fine droplets. It is known that very small droplets (usually under 150 microns in diameter) are most susceptible to non-application as well as off-target application. Drift reduction polymers tend to increase the size (and weight) of droplets produced by a spray nozzle and as a consequence, reduce opportunity for losses and off-target application.
Reign®
#Thrust®
Reign® LC
#Q

2. Soybean-Based:
It is now known that many of the polymer-based products suffer degradation and loss of function following circulation through typical spraying machinery. Additionally, it is recognized that polymers can negatively alter the functionality of spray nozzles, especially in the area of flow rate and nozzle pattern angle. Loveland Products discovered that the phospholipid/lecithin-based chemistry, being used in several of their adjuvant products, did not produce attendant losses of function. Loveland Products’ lecithin adjuvant products have consistently shown outstanding results in field crop and patternator (spray equipment) trials. These products possess properties capable of managing droplet size. Ideally, an adjuvant helps provide a spray particle distribution that contains fewer small (<150 microns) and large (>500 microns) droplets. Lecithin-based products actually improve the spray pattern and reduce drift by maintaining the proper (uniform) spray pattern as designed by the nozzle manufacturer.
Compadre®
MSO® with LECI-TECH®
Franchise®
#Strike Force®
LI 700®
Vader®
Liberate®
Weather Gard Complete
I. Acidification agents:
Products that are added to spray solutions for the purpose of lowering the pH are called acidification agents. Lowering the pH of spray mixtures will improve the stability of certain pesticides and can also prevent certain incompatibilities.
Acidiphactant LI 700®
Gunsmoke®
Vader®

J. Compatibility agents:
These products have utility when tank mix combinations of pesticides or pesticides and fertilizers are prepared. Problems with compatibility usually result in non-homogenous mixtures or non-applicable mixtures. Compatibility agents, which are generally heavy-duty emulsifier blends, can assist mixture problems in two ways: (1) their use may allow mixtures to be made that otherwise would be incompatible, and (2) their use may allow some ability to salvage mixtures already incompatible into sprayable condition. The best advice is to prevent incompatibility problems by pre-testing the combination.
†E-Z Mix

K. Soil Surfactants:
Soil surfactants are designed to reduce crop and turf physiological stresses found in inherently droughty soils by positively affecting the wetting, rewetting and infiltration rates of soils treated.
Freeway®
WaterMaxx® 2
†Infuse®

L. Antifoam/defoaming agents:
Antifoam and defoam agents are products that are typically siloxane emulsions. They will have dual functionality in that they can be utilized to eliminate foam that has already developed (defoam) or to prevent foam under conditions where a history of foaming is known (antifoam). The presence of foam in spray mixtures can seriously impact mixing and also affect calibration of spray equipment.
Compadre®
Unfoamer®

M. Miscellaneous:
1. Tank decontaminating agents / Tank cleansers
All Clear®
Tank & Equipment Cleaner
2. Emulsified vegetable oils
Amigo®
3. Foam markers
Trekker Trax®
Tuff Trax®

ADJUVANT FUNCTIONALITY AND EFFECT
Adjuvant formulations are designed to possess certain properties, which affect the functionality of an adjuvant. Functionality can be specifically determined by (1) the chemistry of the components, (2) the proportions of the components, and (3) the dose or quantity used.

As adjuvant products are considered management tools, it will be important for users to know what properties are needed in an adjuvant and what particular adjuvant can provide those properties. Users should also be aware that, in certain situations, the addition of adjuvant properties may not produce an effect.

Obtaining an effect from the use of an adjuvant with an agri-chemical will depend on the following:
- adjuvant property added and in what amount
- pesticide used and in what amount
- intended target
- application efficacy
- environmental conditions

The graph on the right represents the dose responsive nature of the pesticide and pesticide/adjuvant combination. The point should be observed that the adjuvant effect is inversely related to the pesticide dose. That is, a greater effect will be observed at lower rates. The effect of the adjuvant can be represented by the difference between the two lines.

SURfactant PROPERTIES AND BEHAVIOR
While it is recognized that not all adjuvants are surfactants, it is well accepted that the contribution surfactants make to the functionality of many adjuvants is extremely important. Because of this fact, the following section will be a bit larger and in more detail than other categories of adjuvant products.
The single most unique feature of a surfactant is not its chemistry but its two-part structure. Every surfactant molecule will have a distinct portion that is, to some degree, water-soluble and a portion that is, to some degree, oil soluble. It is this dual set of diverse properties that will determine its behavior and functionality. General pictorial representations of surfactant molecules are usually as follows:

A numerical scale has been established to express the relative effect of the individual portions (hydrophilic and lipophilic) of a surfactant on the overall physical and chemical properties of the molecules. The scale is called the HLB and represents the Hydrophilic Lipophilic Balance for a single surfactant molecule. The scale runs from 1 to 20 with 1 being the most lipophilic and 20 being the most hydrophilic. By knowing the molecular weights of the two portions of the molecule, the HLB can be mathematically calculated.
The limitations of the usefulness of an HLB rating are as follows:
1. Applicable to non-ionic surfactants only
2. Accurate only for single surfactant molecules
3. Not useful for mixtures of surfactants
4. Not useful for use when surfactants are used above the critical micelle concentration

The most obvious and familiar property imparted to aqueous solutions by surfactants is that of surface tension reduction. Surface tension is a phenomenon caused by an unbalanced force of attraction due to cohesion. Surface tension of liquids manifests itself by phenomena such as the curved shape of liquids in containers (the meniscus) and the fact that a liquid will draw itself into a spherical shape on a non-wettable surface. Surface tension is also responsible for the “elastic-like” nature of the liquid surface.

As illustrated in the graph on the right, there will be a concentration point for every surfactant at which maximum surface tension depression is achieved. Surfactant added above this concentration will not depress the surface tension further, and will be represented by the beginning of the flat portion of the graph.

The point described previously is called the Critical Micelle Concentration or CMC. When surfactants are mixed with water, the “head” portion attaches itself to water molecules due to the polar nature of both the “head” and the water molecule. Surface tension of water is reduced and is dependent on concentration of surfactant. Reduction will be non-linear until a maximum depression is achieved. Beyond this point, the addition of more surfactant does not result in further surface tension depression.

To illustrate the effect that surfactant surface tension reduction has on spray droplets, the following is used:

As illustrated, surfactants will cause droplets to collapse under their own weight and increase dramatically the area of contact. This is one of the main reasons surfactants are used with pesticidal materials; that is, to improve physical coverage over the surface of the intended target.

Indicated earlier in this section was the fact that surfactants exhibit a point at which no further surface tension depression is experienced. This point is simply the limit of aqueous solubility of the surfactant. This point is marked by another phenomena known as micelle formation. This means that the surfactant molecules no longer function and behave as monomers (single molecules). At this point, surfactant molecules clump together to form aggregate units called micelles. If the micelles are in water, they will orient themselves with their hydrophilic portion outward and their lipophilic portions inward.

SURFACTANT MOLECULAR BEHAVIOR IN WATER

When a solution reaches/exceeds its Critical Micelle Concentration (CMC), the surface of the liquid can no longer accommodate additional surfactant molecules. At this concentration, the excess surfactant molecules will migrate away from the surface and aggregate to form micelles.

Micelles may have impact on pesticide activity by providing increased uptake into the target. The exact mechanism may be linked to solubilization of the waxy layer of leaves by micelles. This will be dependent on the number of micelles present and the HLB of the surfactant monomers. Other actions that may be attributable to micelles are: pesticide concentration effect, partitioning of the pesticide and the maintenance of a hydrated state of the target surface.

As illustrated, no significant surfactant enhancement of penetration occurs until after CMC is reached. Further shown is the relationship of increased dosage (beyond CMC) on uptake. With this information, it becomes clear that surface tension reduction alone does not significantly do anything beyond spreading or coverage enhancement. As CMC for virtually all surfactants is at or below a dose of 0.1% v/v (12.8 oz/100 gallons), it also becomes apparent as to why doses of 0.25 to 0.50% v/v are commonly recommended on many herbicide labels. These are the doses that are sufficient to accomplish penetration improvement. This fact might also lead one to ask why some adjuvant manufacturers recommend doses of surfactant significantly below CMC for products that must be taken into plants.
All of the discussion thus far has been typical of conventional surfactant chemistry. In the past 30 years, research has been ongoing into the attributes and functionality of a special group of surfactants called organosilicones. This chemistry brings to surfactant behavior some unique occurrences such as ultra-low surface tension. Conventional surfactants will produce surface tensions down to 28-29 dynes/cm while organosilicones such as Widespread® Max, considered to be a “super wetter,” can reach down to the lower 20s. **This means that extreme spreading of droplets can be achieved.** Spread factors of over 20 times that of conventional surfactants are common with organosilicones at the same use rate. Another unique result of sprays applied at very low surface tension is the phenomena known as stomatal entry. Simply stated, the spray solution is capable of entering leaves through naturally occurring openings called stomata.
Modified Vegetable Oil and Surfactant Blend

PRINCIPAL FUNCTIONING AGENTS
Methylated vegetable oil, alcohol ethoxylate, phosphatidylcholine .............................................................. 100%

MSO® Concentrate with Leci-Tech® is a methylated seed oil containing the highest quality components available. The premium emulsifiers, along with Leci-Tech technology, will provide uniform mixing for excellent performance as well as drift reduction, enhanced penetration and droplet adhesion. MSO Concentrate with Leci-Tech is designed for use with post-emergent herbicides and has consistently demonstrated increased penetration over conventional crop oil concentrates.

Benefits
- **TO**: Drift reduction with performance-sized droplets
- **ON**: Droplet retention by adhesion and spreading
- **IN**: Increased penetration without cuticle disruption
- MSO Concentrate with Leci-Tech provides increased plant uptake vs. standard methylated seed oil formulations
- MSO Concentrate with Leci-Tech provides improved crop safety vs. standard methylated seed oil formulations

General Use Rates*
1 to 2 pints per acre

Methylated Seed Oils (MSOs) are utilized when superior cuticle penetration is needed. Methylated seed oils are often used with herbicides during hot, dry conditions. During these stressful environmental conditions, plants will develop thick waxy cuticles in an effort to conserve moisture. The demonstration above compares the differences in activity of water, crop oil and MSO Concentrate with Leci-Tech. The ability of methylated seed oils to solubilize a waxy cuticle is shown in the chart below.

**Clethodim Trial on Barnyardgrass**
Colorado State University; 2006.

*Always read and follow the label directions attached to the product container. Scan QR code with your mobile device for current specimen label and SDS information.
90% Non-ionic Surfactant, Penetrant, Antifoaming Agent

**PRINCIPAL FUNCTIONING AGENTS**
Alkylphenol ethoxylate, alcohol ethoxylate, and tall oil fatty acid................................................................. 90%
Constituents ineffective as spray adjuvant................................................................. 10%

Activator 90 is the premier non-ionic surfactant available on the market today. This high quality, high concentration, low-foaming formulation allows the product to increase the performance of a wide range of chemicals.

**Benefits**
- 90% active, non-ionic formulation that is biodegradable and non-flammable.
- Exceeds chemical manufacturers’ recommendations.
- The high HLB level of Activator 90 is highly water soluble and won’t gel in your spray tank.
- The unique blend of ingredients in Activator 90 break through natural barriers that affect pesticide performance.

**General Use Rates**
1 to 4 pints per 100 gallons

*NOTE: Do not use on roses*
Herbimax is a premium oil/surfactant that increases penetration and the activity of post-emergence herbicides.

**Benefits**
- Premium multi-component oil/surfactant system.
- Premium, fertilizer-compatible emulsifier stabilizes solution in the spray tank.
- Increases herbicide activity and penetration of the plant surface.
- Easy-to-use, non-foaming formulation allows easy mixing of chemicals and complete clean out of the spray tank.
- Can be applied by ground or air.

**General Use Rates***
1 to 4 pints per acre

*Always read and follow the label directions attached to the product container.

Scan QR code with your mobile device for current specimen label and SDS information.

**Emulsion Stability**
After sitting for 10 minutes, Herbimax, on the right, holds a spray mixture together; competitive product’s emulsion, left, broke down.

Herbimax won’t leave sticky residues in the spray tank. Herbimax cleans out much easier than standard crop oil concentrates. Easy clean-out alleviates worries about crop injury when switching from one crop application to another.
Phase® is a high performance proprietary formula that provides spreading and coverage of a non-ionic surfactant and the penetration of a methylated seed oil.

**Benefits**
- Combined spreading ability of organosilicone surfactant with penetrating ability of a methylated seed oil makes Phase an ideal tank mix partner for a wide variety of pesticides.
- Methylated seed and crop oil performance with non-ionic adjuvant use rates.
- Rapidly spreads across and penetrates plant tissue carrying sensitive pesticides into the plant cuticle protecting them from UV breakdown.
- Maximizes coverage and penetration for quick complete control.
- Can be used with a variety of insecticides, herbicides and fungicides.

**General Use Rates***
1 to 4 pints per 100 gallons

*Always read and follow the label directions attached to the product container. Scan QR code with your mobile device for current specimen label and SDS information.
**ADJUVANTS**

**Tank & Equipment Cleaner** is a tough, hardworking cleaner that comes through when others fail. Tank & Equipment Cleaner will keep machinery working right and looking good.

‡ **Thrust®** is a highly processed, sprayable-grade ammonium sulfate/polymer adjuvant designed to improve the efficacy of post-emergence herbicides requiring ammonium sulfate. Thrust also contains a drift reduction/deposition aid, which reduces spray fines and improves deposition on plant vegetation.

**Leaf Life® Widespread® Organic** is a new generation, highly effective organic non-ionic wetting, spreading, penetrating surfactant. Leaf Life Widespread Organic will promote uniform spreading at very low concentrations.

‡ These products are not approved in California or intended to be used in California with a pesticide product or pesticide spray mixture, and cannot be used as a spray adjuvant.

### PROPER TANK MIXING PROCEDURES

Every year when application season rolls around, the number of customer calls concerning tank mix compatibility problems increases. In most cases these issues can be traced to simple product management practices that will eliminate most concerns. The most common issues are:

- Incorrect product mixing order.
- Incomplete mixing of product prior to adding a second product.
- Lack of agitation of product: inadequate bulk storage tank or mini-bulk tank recirculation before use, package product not shaken well, no agitation action in spray tank.
- Spray tank contamination or not clean.
- Product sitting overnight in the spray tank.

Other factors that can make mixing more difficult are cold temperatures of the carrier (water, liquid fertilizer) that is common during early spring seasons. Under these conditions, it is important to maintain adequate agitation to ensure proper suspension of the product. Lack of carrier volume may cause problems while mixing products.

### OTHER TANK MIX GUIDELINES

- If a known product compatibility issue exists or the water or fertilizer carrier is cold, a compatibility agent may be used to help with mixing problems. COMP-AIDE or E-Z Mix work well.
- UNFOAMER® may be used if excessive foam is a problem. Surfactant loaded glyphosate products or organo-silicone surfactant products may cause excessive foaming.

### MIXING WITH GLYPHOSATE OR GLUFOSINATE FORMULATIONS

The following guidelines can be utilized throughout the season to avoid tank mixing problems:

- Fill the spray tank half full with carrier (water or fertilizer). Make sure the agitation system is engaged and working properly.
- If glyphosate or glufosinate (Liberty®) is to be mixed, a water conditioning agent should be added to the spray tank first, such as WeatherGard Complete or Choice® Trio.
FORMULATION ABBREVIATIONS

- DF – Dry Flowable
- EC – Emulsifiable Concentrate
- EW – Emulsion in Water
- F – Flowable liquid
- ME – Micro-encapsulated
- OD – Oil Dispersion
- S – Solution
- SC – Suspension Concentrate
- SG – Soluble Granule
- SP – Soluble Powder
- WDG – Water Dispersible Granule
- WSP – Water Soluble Packet

LOVELAND PRODUCTS MIXING ORDER
EXAMPLES

EXAMPLE: Crop – Corn
APPLICATION TIMING: Post-emerge @ V5
PRODUCTS OF CHOICE: Makaze Yield Pro®, Satori®, Black Label® ZN, WeatherGard Complete

MIXING ORDER:

1. Fill spray tank ¼ to ½ full of carrier
2. Add WeatherGard Complete
3. Use proper agitation
4. Add Makaze Yield Pro® glyphosate
5. Add Satori® fungicide
6. Add Black Label® ZN last
7. Fill remainder of spray tank with remainder of needed carrier and continue agitation.
8. Spray field

EXAMPLE: Crop – Soybean
APPLICATION TIMING: Post emerge @ R3
PRODUCTS OF CHOICE: Satori®, Swagger®, Re-nforce® K, Black Label® ZN, Franchise®

MIXING ORDER:

1. Fill spray tank ¼ to ½ full of carrier
2. Use proper agitation
3. Add Satori® fungicide
4. Add Swagger® insecticide
5. Add Franchise® adjuvant
6. Add Black Label® ZN
7. Add Reinforce® K
8. Fill remainder of spray tank with remainder of needed carrier and continue agitation.
9. Spray field

EXAMPLE: Crop – Wheat
APPLICATION TIMING: Post-emerge @ 4 leaf to tillering
PRODUCTS OF CHOICE: Hat Trick®, Fitness®, Tombstone™ Helios®/Warhawk®, LI 700®

MIXING ORDER:

1. Fill spray tank ¼ to ½ full of carrier
2. Use proper agitation
3. Add Hat Trick® herbicide
4. Add Fitness® fungicide
5. Add Tombstone™ Helios®/Warhawk®
6. Add LI 700®
7. Fill remainder of spray tank with remainder of needed carrier and continue agitation.
8. Spray field
WALES/DALES

MIXING ORDER FOR CHEMICAL FORMULATIONS

Pesticides should be added to the tank using the WALES or DALES method to help avoid mixing issues.

- Fill spray tank ¼ to ½ full with carrier. Be sure agitation system is in working order.
- Add water conditioner and any compatibility agents if needed.

W or D

Dry formulations should be added to the tank first such as: wettable powders (WP/W), water dispersible granules (WDG), water soluble packets (WSP), dry flowable (DF). Be sure dry products are thoroughly dissolved prior to adding other products.

A

Agitation should be continuous and provide enough action to “roll” the surface of the carrier.

L

Add liquid (L), flowable (F), soluble concentrate (SC), formulations next.

E

Emulsifiable Concentrates (EC) should be added next. Micro-encapsulated (ME) formulations should be added after the EC product.

S

Add surfactants and other adjuvants last. This would include NIS, crop oils, MSO, drift control agents, etc. Final step is to fill the tank with the remainder of the needed carrier and continue agitation.

- When adding a nutritional product, add to the tank last.
- Always do a jar test if there are any concerns about product mixes.

NOZZLE OUTPUTS

(20-INCH NOZZLE SPACING*)

<table>
<thead>
<tr>
<th>Output</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gal. per minute</td>
<td>0.05</td>
<td>0.06</td>
<td>0.08</td>
<td>0.10</td>
<td>0.11</td>
<td>0.13</td>
</tr>
<tr>
<td>Ounces per minute</td>
<td>6.4</td>
<td>8.6</td>
<td>10.8</td>
<td>12.9</td>
<td>15.1</td>
<td>17.2</td>
</tr>
</tbody>
</table>

5 gal per acre

| Gal. per minute         | 0.06         | 0.08         | 0.10         | 0.12         | 0.14         | 0.16         |
| Ounces per minute       | 7.8          | 10.3         | 12.9         | 15.5         | 18.1         | 20.6         |

6 gal per acre

| Gal. per minute         | 0.071        | 0.094        | 0.118        | 0.141        | 0.165        | 0.189        |
| Ounces per minute       | 9.0          | 12.1         | 15.1         | 18.1         | 21.1         | 24.2         |

7 gal per acre

| Gal. per minute         | 0.081        | 0.108        | 0.135        | 0.162        | 0.189        | 0.216        |
| Ounces per minute       | 10.3         | 13.8         | 17.2         | 20.7         | 24.1         | 27.6         |

8 gal per acre

| Gal. per minute         | 0.091        | 0.121        | 0.152        | 0.182        | 0.212        | 0.242        |
| Ounces per minute       | 11.6         | 15.5         | 19.4         | 23.3         | 27.1         | 31.0         |

9 gal per acre

| Gal. per minute         | 0.101        | 0.135        | 0.168        | 0.202        | 0.236        | 0.269        |
| Ounces per minute       | 12.9         | 17.2         | 21.5         | 25.9         | 30.1         | 34.4         |

10 gal per acre

| Gal. per minute         | 0.152        | 0.202        | 0.253        | 0.303        | 0.354        | 0.404        |
| Ounces per minute       | 19.4         | 25.9         | 32.3         | 38.8         | 45.2         | 51.8         |

15 gal per acre

| Gal. per minute         | 0.202        | 0.269        | 0.337        | 0.404        | 0.472        | 0.538        |
| Ounces per minute       | 25.9         | 34.5         | 43.1         | 51.8         | 60.2         | 69.0         |

20 gal per acre

* Data also applies if every other outlet is plugged and two nozzles are used per drop, as is often the case in post-emergence herbicide application. The table may be used to:

1. Determine gallonage per acre at given ground speed and nozzle output.
2. Select proper ground speed when operating at a given nozzle pressure and output.
3. Select new nozzles when range of gal. per acre and ground speed is known.
The rate of application in gallons or pounds per minute is calculated by multiplying the acres per minute by the number of gallons or pounds per acre to be applied. Take for example a 100-mile-per-hour aircraft that has a 50-foot effective swath. The chart indicates that the plane has a coverage of 10 acres per minute. If spray is to be applied at a rate of 2 gallons per acre, the unit should be calibrated to dispense 20 gallons per minute (2 X 10 = 20). If 7.5 pounds of dry material is to be applied per acre, the unit should be calibrated to dispense 75 pounds per minute (10 X 7.5 = 75).

The basic formula for calculating acres per minute is:

\[
\text{Swath width \times 2 \times miles per hour} / 1,000
\]

**COMPUTING PLANT POPULATIONS AND YIELDS**

<table>
<thead>
<tr>
<th>Row Width</th>
<th>Length of Row in 1/1000 Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 inches</td>
<td>13-ft., 1-in.</td>
</tr>
<tr>
<td>38 inches</td>
<td>13-ft., 9-in.</td>
</tr>
<tr>
<td>36 inches</td>
<td>14-ft., 6 in.</td>
</tr>
<tr>
<td>30 inches</td>
<td>17-ft., 5-in.</td>
</tr>
<tr>
<td>20 inches</td>
<td>26-ft., 2-in.</td>
</tr>
<tr>
<td>15 inches</td>
<td>34-ft., 10-in.</td>
</tr>
</tbody>
</table>

**Determining Plant Population**

1. Measure off 1/1000 acre row.
2. Count number of plants; then multiply by 1000 to determine plants per acre.

**Determining Yields**

1. Harvest grain from 1/1000 acre row.
2. Weigh harvested grain then multiply by 1000 to get pounds of grain per acre.
3. Determine moisture content then divide pounds per acre by pounds per bushel for adjusted moisture.

* Average three or more 1/1000 acre rows for more accurate estimate of field populations and yields.