ADJUVANT SELECTION

WHAT IS AN ADJUVANT?

An adjuvant is a spray mixture additive used to enhance the performance and/or physical properties of the desired chemical pesticide product. Using the correct adjuvant can have benefits such as reducing or eliminating spray application problems, which would improve the overall efficacy of the applied formulation.

Adjuvants are designed to perform specific functions involving the mixing and application of pesticides such as dispersing, emulsifying, spreading, sticking, and wetting. They can also reduce evaporation, foaming, spray drift, and volatilization. There is not one single adjuvant that can perform all of these functions, but different types of adjuvants can be combined to perform several different functions. As a result, using adjuvants can help reduce application problems while increasing pesticide efficacy.

It is important to remember that although adjuvants labels aren't regulatory like a pesticide label, they should be read and followed to avoid problems. Since adjuvants do not have pesticidal properties in their own right, they are not required to be registered by the U.S. Environmental Protection Agency (EPA), and distribution of adjuvants are rarely regulated by the states.

ADJUVANT TYPES

Adjuvants fall into two categories: **formulation adjuvants** and **spray adjuvants**. Formulation adjuvants improve pesticidal activity or application characteristics and are listed on the pesticide label as inert ingredients because they are added to the product by the manufacturer. Spray adjuvants are separate products added to the tank mix (according to label instructions) by the applicator.

Spray adjuvants can be further categorized into two groups: **activator adjuvants** and **special-purpose adjuvants**, also called utility adjuvants or spray modifiers.

Activator adjuvants are designed to improve the activity of the pesticide. This means physically altering the properties of the spray solution to increase absorption rate and reduce surface tension on the leaf. Activator adjuvants include surfactants, oils, and nitrogen-based fertilizers. Special-purpose or utility adjuvants are used to fix specific conditions that can negatively impact the application of the spray solution or the spray solution itself. Controlling or mitigating conditional factors impairing the spray solution can help maximize the efficiency and efficacy of the pesticide. There are two groups of special-purpose adjuvants. One group is used to modify the physical characteristics of the spray solution which includes adjuvants, such as drift control agents, defoaming agents, water conditioners and compatibility agents.

ADJUVANTS		
FORMULATION	SPRAY	
	ACTIVATOR	SPECIAL PURPOSE
	SURFACTANTS	DRIFT CONTROL
	OILS	BUFFERING | CONDITIONAL
	NITROGEN-BASED FERTILIZERS	COMPATIBILITY

NPM

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SURFACTANTS

Nonionic surfactants (NIS)

Organo-silicone surfactants

Anionic surfactants

Cationic surfactants

OILS

Crop oils

Crop oil concentrates (COCs)

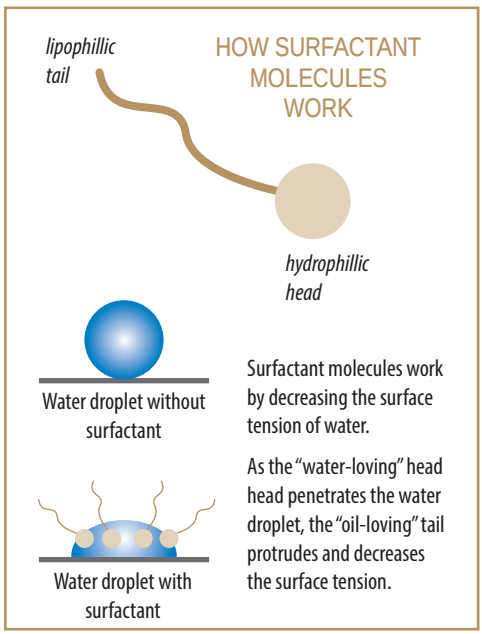
High-surfactant oil concentrates (HSOCs)

Modified (or methylated) seed oils (MSOs)

NITROGEN-BASED FERTILIZERS

Ammonium sulfate (AMS)

Urea ammonium nitrate (UAN)



SURFACTANT (SPREADER-STICKERS) ADJUVANTS

Surfactants, which comes from the phrase "surface acting agents" change the physical properties of the spray solution and droplets. They can help improve the efficacy of the pesticide's ability to emulsify, disperse, spread, and stick by reducing surface tension which increases a droplet's ability to remain in contact with the leaf surface for longer periods of time. Leaf surfaces, as well as pesticides, have a molecular charge. A surfactant's charge will determine how it bonds to a pesticide which in turn affects how the pesticide will interact with the leaf surface. The ultimate goal is to reduce surface tension, which increases a spray droplet's ability to remain in contact with the leaf surface longer, allowing more pesticide to be absorbed. The types of surfactants are based on their molecular (ionic) charge. Increasing the duration a droplet is able to stay on the leaf surface allows for more pesticide to be absorbed by the leaf. Overall effectiveness is based on several factors including environmental conditions, plant features, and interactions between the surfactant, pesticide, and carrier.

Surfactants are classified by the way they split apart (ionize) into smaller electronically charged molecules, called ions. Each ion is made up of a water-loving head (hydrophilic) and an oil-loving tail (lipophilic), which will either have a negative, positive, or neutral charge. This charge allows for the surfactant to bond with the spray droplets, allowing the droplet to stick and spread out over the leaf surface.There are four main types of surfactants, and they are classified by their molecular composition.

Nonionic surfactants (NIS) have a neutral charge and is the most commonly used type of surfactant. NIS are typically recommended for use with most registered pesticides to help with spray droplet retention, spray droplet spreading, and droplet penetration of leaf surfaces. NIS are composed of alcohols and/or fatty acids and typically are compatible with most pesticides.

Organo-silicone surfactants, the newest group of surfactants, are being used in place of, or in addition to, traditional nonionic surfactants. The use of silicone as the base for this product can help with reducing surface tension, increasing the spreading ability of the spray droplets, and improving rainfastness, or the amount of time needed between pesticide application and rainfall.

Anionic surfactants have a negative charge and are more often used with acids or salts. Anionic surfactants are not generally used with pesticides as its a more specialized product but the product has sometimes been used as a compatibility agent or dispersant in tank mixes. Consult the label before utilizing this adjuvant.

Cationic surfactants have a positive charge and are the least used surfactant in agriculture. Cationic surfactants have sometimes been used with glyphosate in tank mixes, but consult the label before utilizing this adjuvant.

OIL ADJUVANTS

Oil adjuvants can increase the penetration of spray droplets and also help reduce surface tension. There are four types of oil-based adjuvants: crop oils, crop oil concentrates, High-surfactant oil concentrates, and methylated seed oils.

Crop oils can promote the penetration of pesticide spray either through the waxy leaf cuticle or an insect's chitinous shell. Crop oils are made up of roughly 95 – 98% paraffin or petroleum oil and 1-2% surfactant or emulsifier. Traditional crop oils are more commonly used with insecticides and fungicides for disease control and rarely with herbicides. For example, crop oils are typically used with contact herbicides, like PPO inhibitors, to increase herbicide penetration within the plant and reduce surface tension for a more effective herbicide application.

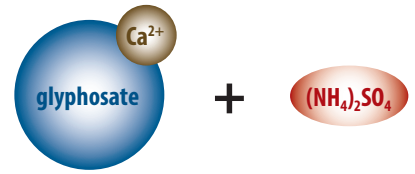
Crop oil concentrates (COCs) have the penetration properties of the oil but also the spreading power of a surfactant due to its composition. COCs can also be helpful making less-soluble herbicides more soluble in water. In general, COCs are made up of 80-85% emulsifiable petroleum-based oil and 15 – 20% Nonionic surfactant.

High-surfactant oil concentrates (HSOCs) contain 20 to 40% NIS with 60 to 80% of the specific type of oil. They are similar in composition to crop oil concentrates, except HSOCs contain higher levels of surfactants, allowing them to form a more stable spray solution. HSOCs were developed initially to improve pest control at lower use rates than COCs and MSOs. Furthermore, because HSOCs can improve control at lower use rates, their use in pesticide solutions to manage weeds has increased.

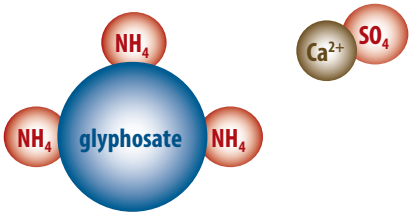
Modified (or methylated) seed oils (MSOs) are a combination of 80 – 85% crop-derived seed oil (soybean, sunflower, cotton, or linseed oil) and 15-20% nonionic surfactant. Unlike other adjuvant oils, the seed oil in MSOs have undergone a process called esterification, which changes the seed oil's characteristics so it is attracted to and can be dissolved in water, to ultimately improve their performance. MSOs work in similarly to traditional crop oil concentrates by increasing the pesticide's ability to penetrate target pests.

MSOs work similarly to traditional crop oil concentrates by increasing the pesticides ability to penetrate target pests. In most cases, MSOs are used in smaller volume than COCs in a tank mixture. For example, most COCs are needed in 1 – 2.5% v/v ratio of the spray solution, whereas MSOs are typically recommended at 0.25 to 1% v/v of spray solution. This may not always be the case, so consult the pesticide label before utilizing one of these adjuvants.

AMMONIUM SULFATE AND HARD WATER



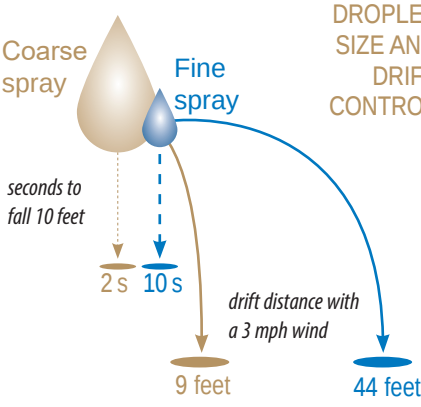
Ammonium sulfate or AMS [$(NH_4)_2SO_4$] can work as a hard water conditioner and nitrogen-based fertilizer adjuvant. When AMS is added to the tank mix, the sulfate bonds with the hard water cations (like calcium, iron or manganese). This frees-up the glyphosate molecule and allows it to bond with the ammonium N, which is then available for crop uptake.



NITROGEN-BASED FERTILIZER ADJUVANTS

The typical nitrogen-based fertilizers used as adjuvants are **ammonium sulfate (AMS)** and **urea ammonium nitrate (UAN)**. These fertilizers may replace some adjuvants, but, when used with systemic pesticide products, are usually included as part of the tank mixture with a surfactant and a crop oil concentrate. In some cases, ammonium sulfate is used to reduce problems with hard water. Many fertilizer-based adjuvants are available as a liquid, which is easier for mixing and can provide more consistent results. Nitrogen-based fertilizers should only be used when recommended by the pesticide label.

SPECIAL-PURPOSE ADJUVANTS



DRIFT CONTROL ADJUVANTS

Drift control adjuvants can improve the placement of pesticide sprays by increasing the average droplet size of the tank mixture. Thickening agents can also act as a means of drift control because thickeners increase the viscosity, or density, of the spray mixture. The increase in viscosity of the tank mixture can also help slow evaporation after pesticide application. Typically, these adjuvants bind with water molecules to form larger, more dense, spray droplets which reduces excess movement of the droplet by wind and increases the length of time the product is attached to the plant. This can be especially important when using systemic pesticides because it increases the length of time in which the pesticide can be absorbed by the plant, which can improve the efficacy of the application. One common spray mixture pairing is using a drift control agent with dicamba to reduce the risk of herbicide drift.

BUFFERING | CONDITIONAL ADJUVANTS

Buffer adjuvants are used to stabilize pH of the water in the spray mixture while acidifier adjuvants lower the pH of the water in the tank mix. Most pesti-

cides perform better in slightly acidic conditions, though there are some exceptions. Pesticide mixtures with a pH level of 7 or above are at greater risk of breakdown. Many pesticides can lose efficacy relatively quickly in situations where the pH is not optimal.

Conditional adjuvants are used in situations where hard water is present as they reduce the issues caused by minerals found in hard water, such as calcium and magnesium. In most cases, the use of AMS in a spray solution will mitigate hard water issues. When AMS can't be used, water conditioning agents are available. It is important to remember that before using a buffer or conditioning agent, consult the label for specific requirements for the pesticide and test the water for pH and hardness.

COMPATIBILITY ADJUVANTS

Since pesticides are commonly mixed with fertilizers and other pesticides, not all combinations are physically or chemically compatible. Incompatibility can be seen by product separation or clump formation in the spray tank. As a result, incompatible mixtures can clog the pump, hoses, screens and nozzles and cause expensive cleanup and delay timely applications. Utilizing a **compatibility adjuvant** can help mitigate or eliminate these problems.

SIX STEPS FOR SELECTING THE RIGHT ADJUVANT

1. **Read the pesticide label <u>first</u>.**
2. Use only adjuvants that are labeled for agricultural or horticultural use, and read the adjuvant label when available. Adjuvants help enhance pesticide performance, but they can also lead to higher crop injury.
3. Adjuvants may not be necessary. A pesticide's label may not mention use of an adjuvant due to the manufacturer's research showing no benefit or even an adverse effect.
4. If a pesticide label specifies a brand of adjuvant, that brand must be used as the label directs; any substitution would be a violation of the label.
5. Adjuvant recommendations are subject to change due to alterations in pesticide formulation, so what you in the past may not be what's on the current label.
6. Buy products from a reputable dealer or with the Council of Producers and Distributors of Agrotechnology (CPDA) seal of certification.

When growers select CPDA certified adjuvant products, they have the assurance that the product meets the functionality claims indicated on the label according to a specified, uniform set of standards, and that ingredients used in the product meet EPA regulations for approved ingredients for use in pesticide tank mixes.

COMPATIBILITY TESTS

Pesticides are commonly mixed with adjuvants, fertilizers, and other pesticides. Some combinations of these products can be physically or chemically incompatible. Incompatible mixtures can result in thickening or clumping of the solution or product separation in tanks, which can result in expensive cleanup and repairs from clogged hoses and pumps. The compatibility of products should be tested before the solution is tank mixed and applied. A jar test can help reveal if a compatibility agent should be used while determining the overall stability of the mixture. A jar test simulates what occurs in a tank mixture and can demonstrate physical incompatibilities such as separation, settling, inversions, and oil residue buildup. Most pesticide labels will have instructions on how to conduct a jar test for their product.

How to conduct a jar test for compatibility of tank mixtures

Step 1: Measure 1 pint of carrier (water, liquid fertilizer) into a 1 quart jar. Use the same carrier or water source that will be used for the tank mixture.

Step 2: Add the proportionate amount of each product as intended for the tank mixture. Add these products one at a time, in the order specified on the label. If the order of products is not listed on the label, add ingredients in the order listed below. **Stir the mixture well after each individual product is added.**

1	**Compatibility agents** (if needed)	Buffers, Acidifiers
2	**Powder solubles & dry powders**	Ammonium sulfate (AMS), Water-Soluble packets (SP) , Wettable powders (WP), Dry flowables (DF), Water dispersible granules (WDG), Soluble powders (SP)
3	**Liquid flowables & suspensions**	Flowables (F), Suspension concentrates (SC), Drift retardants, Micro-encapsulated (ME) Suspension fertilizers , Micronutrients, Liquid fertilizers, Chelated micronutrients, Growth hormones
4	**Remaining Aadjuvants**	COC, HSOC, MSO, NIS, Water conditioning agents
5	**Emulsifiable Cconcentrates**	Emulsifiable concentrate (EC), Emulsions in water (EW), Oil dispersion (OD)
6	**Solutions**	Solutions (S) and Soluble liquids (SL)

Step 3: Shake jar vigorously and allow the solution to stand in a well-ventilated area for anywhere between 10 and 15 minutes before checking for signs of incompatibility. Signs of incompatibility include large flakes, gels, sludge, separation, and precipitation or signs of chemical reactions, like heat or odors.

If no signs of incompatibility occur after steps 3, put the pesticide mixture into the spray tank. Rinse all jars and utensils used for the test and pour rinse water (rinsate) into the spray tank and apply to sites. Please do not use jars and utensils for any other purposes once they have been used with pesticides and other pesticide products.

STORAGE CONSIDERATIONS

Though adjuvants are not regulated by the United States Environmental Protection Agency (EPA), environmental impacts are still a concern when adjuvant products are misused or handled incorrectly. Storage of adjuvant products can be stored along with pesticide products in your designated pesticide storage facility or area. Proper handling and storage is important in maintaining the shelf-life of the product and reducing the risk of environmental contamination.

The storage area for your pesticides should be in a secure location. It is advised to keep the area locked when not in use to prevent unauthorized entry (especially children or animals) from reaching the hazardous chemicals. If possible, store only pesticide containers, which includes adjuvant and other tank mix products, equipment, and spill clean-up materials in the storage area. Use nonporous materials in your storage area which includes non-porous flooring material, like concrete, and nonabsorbent shelving, like plastic or metal. These non-porous materials can help retain spilled materials on the surface and help prevent any environmental implications if a spill did occur. Store products off the ground on raised shelves or pallets to minimize and prevent potential water damage and condensation. Water or condensation can ruin containers, cause labels to peel or become unreadable, and degrade the products themselves. Water is not the only environmental factor to consider when storing pesticides and other products. Regulating ventilation and storage room temperature can help maintain product shelf-life and minimize the amount of noxious vapor buildup from the products in storage. Lastly, it is important the storage area has adequate lighting to read labels and notice any spills.

There are many benefits to proper storage of pesticides and adjuvants which include, allowing for better inventory control, reducing chance of environmental contamination, and preventing product damage from temperature extremes and excess moisture.

ADJUVANT CALCULATIONS

Pesticide labels typically recommend adjuvant tank mix rates as either:

1. **Percentage of spray mixture (% volume/volume)**
2. **Volume/acre**
3. **Adjuvant rate as quarts/100 gallons of water or for dry additions like AMS, pounds/100 gallons**

1. For percentage of the spray mixture, use the calculation:

Gallons of adjuvants needed = (% spray mix × gallons spray mix) ÷ 100

For example, the pesticide label requires a non-ionic surfactant (NIS) be added to the tank mix at a rate of 0.5%. The tank mixture is 250 gallons total.

Gallons of adjuvants needed = (0.5% × 250 gallons) ÷ 100

Gallons of adjuvant needed = 1.25 gallons

2. For adjuvant rates expressed as volume/acre, use the calculation:

Pints (or quarts) of adjuvant needed = pints per acre × acres treated

For example, the pesticide label states 1-2 pints per acre of a crop oil concentrate (COC) should be added to the spray solution. The total number of acres being sprayed is 100 acres.

Assuming the intermediate rate of 1.5 pts/acre is used:

Pints of adjuvant needed = 1.5 pints per acre × 100 acres

Pints of adjuvant needed for 100 acres = 150 pints

This is equivalent to 75 quarts or 18.75 gallons

3. For adjuvant rates expressed in quarts/100 gallons, use the calculation:

Quarts of adjuvants needed = [quarts/acre × gallons of spray mix] ÷ 100

For example, the pesticide label states the use of a methylated seed oil (MSO) at 4-8 pints/100 gallons.The total tank mixture is 250 gallons.

Assuming the lowest rate of 4 pts/acre is used:

4 pints/acre = 2 quarts

Quarts of adjuvants needed = (2 quarts × 250 gallons) ÷ 100 gallons

Quarts of adjuvants needed = 5 quarts

Assuming the highest rate of 8 pts/acre is used:

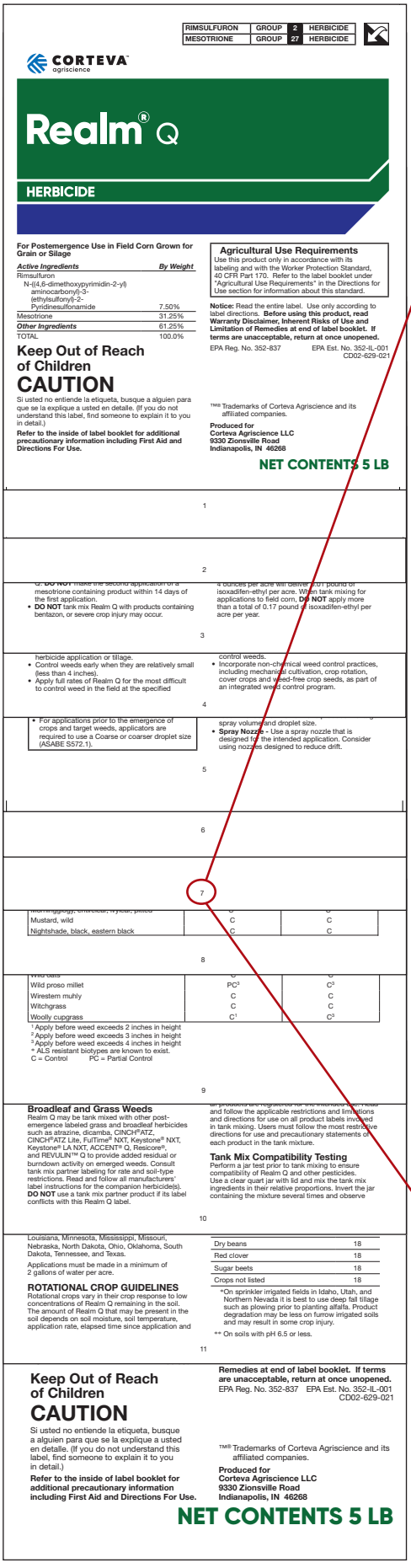
8 pints = 4 quarts

Quarts of adjuvants needed = (4 quarts × gallons) ÷ 100 gallons

Quarts of adjuvants needed = 10 quarts

EXAMPLE PESTICIDE LABEL

When selecting an adjuvant, the first step is to always read the pesticide label. The example shown here is for an herbicide selected at random for explanation purposes only. Labels can be rather long so it is important to take the time to read the label prior to application. In the example, the adjuvant information is on page 7 of the label.



RIMSULFURON GROUP 2 HERBICIDE
MESOTRIONE GROUP 27 HERBICIDE

CORTEVA agriscience

Realm® Q

HERBICIDE

For Postemergence Use in Field Corn Grown for Grain or Silage

Active Ingredients	*By Weight*
Rimsulfuron N-((4,6-dimethoxypyrimidin-2-yl) aminocarbonyl)-3-(ethylsulfonyl)-2-Pyridinesulfonamide	7.50%
Mesotrione	31.25%
Other Ingredients	61.25%
TOTAL	100.0%

Keep Out of Reach of Children

CAUTION

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle. (If you do not understand this label, find someone to explain it to you in detail.)

Refer to the inside of label booklet for additional precautionary information including First Aid and Directions For Use.

Agricultural Use Requirements
Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR Part 170. Refer to the label booklet under "Agricultural Use Requirements" in the Directions for Use section for information about this standard.

Notice: Read the entire label. Use only according to label directions. **Before using this product, read Warranty Disclaimer, Inherent Risks of Use and Limitation of Remedies at end of label booklet. If terms are unacceptable, return at once unopened.**

EPA Reg. No. 352-837 EPA Est. No. 352-IL-001 CD02-629-021

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Produced for
Corteva Agriscience LLC
9330 Zionsville Road
Indianapolis, IN 46268

NET CONTENTS 5 LB

1

2

- **DO NOT** make the second application of a mesotrione containing product within 14 days of the first application.
- **DO NOT** tank mix Realm Q with products containing bentazon, or severe crop injury may occur.

4 ounces per acre will deliver 0.21 pound of isoxadifen-ethyl per acre. When tank mixing for applications to field corn, **DO NOT** apply more than a total of 0.17 pound of isoxadifen-ethyl per acre per year.

3

herbicide application or tillage.
- Control weeds early when they are relatively small (less than 4 inches).
- Apply full rates of Realm Q for the most difficult to control weed in the field at the specified

control weeds.
- Incorporate non-chemical weed control practices, including mechanical cultivation, crop rotation, cover crops and weed-free crop seeds, as part of an integrated weed control program.

4

- For applications prior to the emergence of crops and target weeds, applicators are required to use a Coarse or coarser droplet size (ASABE S572.1).

spray volume and droplet size.
- **Spray Nozzle** - Use a spray nozzle that is designed for the intended application. Consider using nozzles designed to reduce drift.

5

6

7

Mustard, wild	C	C
Nightshade, black, eastern black	C	C

8

Wild proso millet	PC[3]	C[3]
Wirestem muhly	C	C
Witchgrass	C	C
Woolly cupgrass	C[1]	C[3]

[1] Apply before weed exceeds 2 inches in height
[2] Apply before weed exceeds 3 inches in height
[3] Apply before weed exceeds 4 inches in height
* ALS resistant biotypes are known to exist.
C = Control PC = Partial Control

9

Broadleaf and Grass Weeds
Realm Q may be tank mixed with other post-emergence labeled grass and broadleaf herbicides such as atrazine, dicamba, CINCH®ATZ, CINCH®ATZ Lite, FulTime® NXT, Keystone® NXT, Keystone® LA NXT, ACCENT® Q, Resicore®, and REVULIN™ Q to provide added residual or burndown activity on emerged weeds. Consult tank mix partner labeling for rate and soil-type restrictions. Read and follow all manufacturers' label instructions for the companion herbicide(s). **DO NOT** use a tank mix partner product if its label conflicts with this Realm Q label.

and follow the applicable restrictions and limitations and directions for use on all product labels involved in tank mixing. Users must follow the most restrictive directions for use and precautionary statements on each product in the tank mixture.

Tank Mix Compatibility Testing
Perform a jar test prior to tank mixing to ensure compatibility of Realm Q and other pesticides. Use a clear quart jar with lid and mix the tank mix ingredients in their relative proportions. Invert the jar containing the mixture several times and observe

10

Louisiana, Minnesota, Mississippi, Missouri, Nebraska, North Dakota, Ohio, Oklahoma, South Dakota, Tennessee, and Texas.

Applications must be made in a minimum of 2 gallons of water per acre.

ROTATIONAL CROP GUIDELINES
Rotational crops vary in their crop response to low concentrations of Realm Q remaining in the soil. The amount of Realm Q that may be present in the soil depends on soil moisture, soil temperature, application rate, elapsed time since application and

Dry beans	18
Red clover	18
Sugar beets	18
Crops not listed	18

*On sprinkler irrigated fields in Idaho, Utah, and Northern Nevada it is best to use deep fall tillage such as plowing prior to planting alfalfa. Product degradation may be less on furrow irrigated soils and may result in some crop injury.

** On soils with pH 6.5 or less.

11

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Remedies at end of label booklet. If terms are unacceptable, return at once unopened.
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to weed sizes greater than those listed on this product label may result in incomplete control. Grass and broadleaf weed competition due to incomplete control may reduce corn yields.

On "Roundup Ready" corn, glyphosate products including ABUNDIT® Edge or Durango® DMA® may be applied with Realm Q after weeds emerge but before they reach the maximum size listed on the glyphosate herbicide label.

On "Liberty Link" corn, glufosinate may be applied with Realm Q after weeds emerge but before they reach the maximum size listed on the glufosinate herbicide label.

Realm Q is rainfast in 4 hours.

Sequential Application - Preemergence

Realm Q may be used as a sequential application in a planned postemergence weed control program in corn following a preemergence herbicide.

Apply preemergence herbicide products including ALLUVEX™, BASIS® Blend, Cinch® ATZ, Cinch® ATZ Lite, FulTime® NXT, INSTIGATE™, Keystone® NXT, Keystone® LA NXT, LEADOFF®, PREQUEL®, Resicore®, RESOLVE® Q, and Surpass® NXT herbicides. Refer to the preemergence herbicide label for use restrictions, application information, rotational crop guidelines, and cautionary statements prior to applying Realm Q. Follow the most restrictive product labeling.

DO NOT apply Realm Q to corn that exhibits herbicide injury from previous applications made to the current or preceding crop.

Spray Adjuvants

For control of emerged weeds, applications of Realm Q must include a crop oil concentrate or a high surfactant oil concentrate (HSOC).

The use of a nonionic surfactant (NIS) instead of a COC or HSOC is allowed, but the weed control achieved with COC or HSOC is consistently better than NIS. **The use of methylated seed oil (MSO) adjuvants or MSO blend adjuvants may cause severe crop injury to occur. MSO adjuvants are not advised.**

In addition to COC or HSOC, always add spray grade UAN (e.g., 28%) to the spray solution or AMS, except if precluded elsewhere on this label.

When applied in tank mix combination with a glyphosate that contains a built-in adjuvant including ABUNDIT® Edge or Durango® DMA®, ensure the total adjuvant load is equivalent to the specifications on this label. Select adjuvants authorized for use with both products.

Consult local company fact sheets, technical bulletins or supplemental labels prior to using other adjuvant systems. Products must contain only EPA-exempt ingredients.

DO NOT use with spray additives that alter the pH of the spray solution below 5.0 or above 9.0 as rapid product degradation can occur. Spray solutions of pH 6.0 – 8.0 allow for optimum stability of Realm Q.

Petroleum Crop Oil Concentrate (COC)
- Apply at 1% (1 gallon per 100-gallon spray solution), or 2% under arid conditions.
- Oil adjuvants must contain at least 80% high quality, petroleum (mineral) oil with at least 15% surfactant emulsifiers.

High Surfactant Oil Concentrate (HSOC)
- Apply at 0.5% (2 quarts per 100 gallons spray solution).

Nonionic Surfactant (NIS)
- Apply at 0.25% v/v (1 quart per 100-gallon spray solution).
- Surfactant products must contain at least 60% nonionic surfactant with a hydrophilic/lipophilic balance (HLB) greater than 12.
- **DO NOT** use liquid nitrogen fertilizer as the total carrier solution for postemergence applications.

Ammonium Nitrogen Fertilizer
- Use 2 quarts per acre of a high-quality urea ammonium nitrate (UAN) such as 28%N or 32%N, or 2 pounds per acre of a spray-grade ammonium sulfate (AMS).

Special Adjuvant Types
- Combination adjuvant products may be used at doses that provide the required amounts of NIS, COC, and/or ammonium nitrogen fertilizer. Consult product literature for use rates and restrictions.

In this example, a COC or HSOC must be included for emerged weeds.

It also warns of the risk of crop injury with an MSO adjuvant.

Always read the whole section to ensure proper use of the adjuvant.

This section lists the recommended rates

ADDITIONAL RESOURCE

To learn more, click on the link below or scan the QR code:
Surfactants in Agriculture
10.1007/978-94-007-6836-9_7

NPM

This publication is available from the Nutrient and Pest Management Program. For more information, email us at npm@hort.wisc.edu or visit our website at ipcm.wisc.edu

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