

# WEED MANAGEMENT OPTIONS FOR ALFALFA IN GROUND WATER PROTECTION AREAS

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## ABSTRACT

California Ground Water Protection Regulations went into effect May 2004, but many counties didn't start enforcing the regulation until they were able to administer the changes. In most cases the regulation was initiated January 2005. The determination of a ground water protection area is based on factors, such as soil type, climate and depth to ground water that is characteristic of areas where legally applied pesticides or their breakdown products have been detected and verified in ground water. The ground water protection list, or 6800(a) pesticides in this regulation included atrazine, simazine, bromacil, diuron, prometon, bentazon and norflurazon. Of the seven herbicides listed only two, diuron and norflurazon are registered for use on alfalfa. The statewide pesticide use report for 2003 shows only 230,000 acres of the states million acre alfalfa crop being treated with either diuron or norflurazon. There are a number of irrigation management practices that can be employed in either runoff or leaching ground water protection areas which would then allow the use of either diuron or norflurazon, but they are not a practical or feasible option. There are several herbicides that are registered for use in both seedling and established alfalfa that are viable options to these two herbicides which provide effective control.

**Keywords: alfalfa, ground water protection areas, diuron, norflurazon, broadleaf weeds, grass weeds, imazethapyr, hexazinone, clethodim, sethoxydim, metribuzin, EPTC, paraquat, 2,4-DB, Roundup Ready alfalfa.**

## INTRODUCTION

Ground water protection areas (GWPA) are geographically defined areas that are vulnerable to pesticide contamination, either by leaching or runoff. GWPA include all areas previously designated as PMZs, plus others based on soil types and depth to ground water of 70 feet or less. Seven herbicides, two of which are used in alfalfa (diuron and norflurazon) have been placed on the ground water protection list (6800(a) pesticides), and are limited for use in leaching and runoff areas unless certain irrigation management practices are used.

An understanding of the possible herbicide impacts on water quality is important in helping individual grower's make their herbicide use decisions with water quality in mind. There are several factors that influence an herbicide's potential to affect water quality, including soil properties (soil texture and organic matter), pesticide properties (sorptions to the soil, and half-life), climatic conditions (rainfall and temperature), and irrigation management practices.

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Despite all of these factors that can affect an herbicide's potential to impact water quality, it is the chemical properties of the herbicide that is likely to impact surface or ground water. Three factors, KOC, water solubility and soil half-life properties provide a potential indication to impact water quality.

The Soil Sorption Index, KOC, is an expression of the tendency of an herbicide to be absorbed by soil organic matter. Since organic matter is the most influential soil factor influencing absorption, the KOC is a very useful measure of its tendency to move with water in soil. The smaller the KOC the more herbicide will be in solution and the greater the leaching potential.

Water solubility is reported in PPMs. The more soluble an herbicide is, the more likely it will leach to ground water or move offsite in surface runoff, although there are exceptions. Paraquat and glyphosate are very soluble herbicides yet both have high KOCs and do not move once they come in contact with soil.

Persistence is measured in dissipation half-life, the time it takes the original concentration to be reduced in half. Half-life is the number of days it takes for half the herbicide to degrade in the soil. The longer the half-life, the more persistent an herbicide is and thus the more probable it is that it will move into surface or ground water.

A Ground Water Ubiquity Score (GUS) index is then calculated by using KOC and half-life to determine its potential for impact on water quality. A score greater than 2.8 indicates herbicides likely to be a leacher and those less than 1.8 are likely non leachers.

In summary then, when applying herbicides to a location where leaching or runoff is a concern, one should choose an herbicide with a short half-life, high KOC and low solubility. But, in the case of alfalfa, if either diuron or norfluazon still remains the chosen herbicide in a ground water protection area, then one of the following management practices must be used:

#### Runoff Protection Area

1. Within 7 days before the pesticide is applied, the soil to be treated shall be disturbed by using a disc, harrow, rotary tiller or other mechanical method.
2. Within 48 hours of application the pesticide shall be incorporated on 90 percent of the area treated by mechanical tillage or irrigation.
3. The pesticide shall be applied between April 1 and July 31.
4. Retain all runoff in the field for 6 months or,
5. Retain all runoff in a holding area off the field.

If the runoff is held in the field or an area off the field, the holding area shall not have a percolation rate of more than 0.2 inches per hour.

#### Leaching Protection Area

1. Shall not apply any irrigation water for six months following application.
2. Shall apply the pesticide to the planted bed or berm above the level of irrigation water for six months following application.
3. Irrigation shall be managed to apply a net irrigation requirement of 1.33 or less for six months following application.

## ALFALFA WEED MANAGEMENT OPTIONS

Chemical weed control is used on an estimated 75% of the alfalfa acreage on an annual basis in California. Herbicides are considered an integral component of a total weed-management system and when coupled with cultural practices weeds are efficiently and effectively controlled. Herbicides used can be grouped into categories based upon their application timing to seedling and established alfalfa. The following herbicides are effective options in the place of diuron and norflurazon.

### SEEDLING ALFALFA

#### **Pre Plant** (before weeds emerge)

*Benefin* and *EPTC* effectively control small seeded broadleaves and grasses. Benefin is generally considered to control weeds for 3 months and EPTC for 6 weeks. Benefin has a moderate soil life and may persist 3-5 months - the soil life of EPTC is much shorter.

EPTC controls many of the same grasses and broadleaf weeds as benefin and it also suppresses the perennial problem weed nutsedge. EPTC and benefin can be combined at reduced rates of each to expand the spectrum of weeds controlled.

#### **Post Emergence** (after weeds and alfalfa emerge)

*Bromoxynil* Buctril® - is a selective contact herbicide for broadleaf weed control. It is applied to alfalfa with two or more trifoliolate leaves. It is especially effective on fiddleneck mustards, common groundsel and annual sowthistle. With a diverse weed spectrum, numerous grass and broadleaf weeds, Buctril is often tank mixed with other herbicides to provide broad-spectrum control with a single application.

*2,4-DB* Butyrac, Butoxone® - is a broadleaf selective herbicide that translocates from the leaves to the rest of the plant. It is used for broadleaf weeds such as prickly lettuce, annual sowthistle and mustards and is also effective on the perennial weed curly dock. It is applied when alfalfa reaches the two-trifoliolate leaf stage. 2,4-DB is often tank mixed with other herbicides to broaden the spectrum of control.

*Sethoxydim/clethodim* Poast®/Prism® - are selective grass herbicides controlling both annuals and perennials. These herbicides work best on immature grasses up to the tillering stage that are vigorously growing and not drought stressed. Poast or Prism can be used between alfalfa cuttings to control summer grass problems including yellow and green foxtail, barnyard grass and perennial grasses.

*Paraquat* Gramoxone Extra® - is a non selective contact herbicide that controls a wide range of broadleaf and grassy weeds. Paraquat is injurious to alfalfa seedlings when applied before the three trifoliolate leaf stage or when an excessive rate is used. The rate is based on the size of the

alfalfa rather than weed size to maintain crop safety. Higher rates can be applied to larger alfalfa plants. Paraquat is commonly used when weeds become too large for other herbicides. It is often considered a rescue treatment to reduce the volume of weed canopy over-topping young alfalfa seedlings.

***Imathyzephyr Pursuit®*** - is a selective systemic herbicide that controls most broadleaf weeds and some grasses. Apply Pursuit after alfalfa has developed two trifoliolate leaves to small weeds that are not moisture stressed. Pursuit is very effective at controlling winter annuals such as mustards, shepherds purse, swine cress, chickweed and many more. It is in the family of ALS inhibitor herbicides and continual use beyond stand establishment or two years should be avoided to minimize the potential for herbicide resistance. Rotation plant-back intervals range between 6 and 40 months, which reduces long-term use in older established stands.

***Imazamox Raptor®*** - is a selective translocated herbicide that controls broadleaf and grass weeds. The weed spectrum controlled is similar to Pursuit except it is far more effective on grasses - especially winter annual grasses. Raptor is applied to alfalfa with two or more trifoliolate leaves. Combining Raptor with other broadleaf herbicides can broaden the spectrum of weeds controlled - especially for weeds not adequately controlled with Raptor such as prickly lettuce, annual sowthistle and fiddleneck. The addition of a nitrogen fertilizer with a surfactant greatly enhances control of marginally sensitive weeds. Crops rotation guidelines are half of those for Pursuit and the PHI is 20 days which allows for applications between cuttings.

## **ESTABLISHED ALFALFA**

### **Preemergence - Soil Active**

***Hexazinone Velpar®*** - controls a range of broadleaf and some grass weeds, including common groundsel, chickweed, miner's lettuce and annual bluegrass. It also suppresses some biennials and perennials like dandelion, plantain and speedwell.

Many crops cannot be planted for 18 months following treatment without yield damage.

### **Postemergence (after weeds emerge)**

***Paraquat Gramoxone Extra®*** - is used as a "burn down" herbicide and is the herbicide of choice when weed populations have germinated and are 2" to 4" tall. Apply Gramoxone alone or in combination with soil-active herbicide hexazinone for extended residual control. Alfalfa cannot be harvested or grazed within 60 days of application. Gramoxone is often used the last year of an alfalfa stand.

***Imazethapyr Pursuit®*** - can be applied post emergence to established alfalfa, but as with other soil residual herbicides it cannot be used during the last year because of plant-back restrictions, which are a minimum of 12 months. Sugar beets are especially sensitive to Pursuit residual and cannot be planted for 40 months after application. Pursuit is rarely used on established alfalfa because herbicide activity is slow in winter months, less effective on large weeds and grasses than other herbicides for dormant alfalfa.

***Imazamox*** Raptor® - is in the same chemistry family as Pursuit but has a shorter soil life and the pre harvest interval is only 21 days, which makes it a useful product for use during the growing season. Can be applied between cuttings to control a variety of broadleaf and some grassy weeds.

***Trifluralin*** Treflan TR10® - summer grasses in established alfalfa are most commonly controlled with trifluralin granules. Apply in the winter or early spring before grasses germinate. January to mid February is the best time to apply trifluralin in the San Joaquin Valley because the summer annual foxtails germinate as early as mid February. At least 0.5 inches of rainfall or sprinkler irrigation is needed within three days after application to incorporate the herbicide.

***EPTC*** Eptam® - liquid is applied in irrigation water or applied as a broadcast granular just ahead of irrigation can also control summer grasses. Best results are obtained when fields are properly leveled allowing irrigation water to be uniformly applied. As with trifluralin, EPTC must be applied before grasses emerge in mid February. One application controls grasses for 30 to 45 days so repeated applications are necessary for season-long control.

***Sethoxydim/Clethadium*** Poast®/Prism® - are also used in fields where summer grasses have already emerged or escaped an earlier trifluralin application. Apply the herbicide after the first or second cutting before grasses become too large and well tillered. The best timing is after bale removal and within 2 to 4 days after the field has been irrigated, as these herbicides do not perform well on moisture-stressed weeds.

### **Roundup (glyphosate) Ready Alfalfa**

Roundup Ready alfalfa is now available to growers which provides an additional weed management option providing flexibility and broad-spectrum weed control. Glyphosate can be applied to both seedling and established alfalfa with a 5-day PHI allowing applications between cuttings. Control of difficult to control perennial weeds such as bermudagrass, nutsedge and dandelion can be improved with glyphosate. The continuous use of glyphosate in Roundup Ready alfalfa systems can lead to weed species shifts or weeds developing resistance to glyphosate. Preventing weed shifts and/or developing resistance will require integrating resistant management strategies into the production system.

### **CONCLUSION**

The California Ground Water Protection Regulations are designed to protect ground water from being contaminated with various herbicides (6800(a) ground water protection list). The two herbicides on the list that effect alfalfa weed management are diuron and norflurazon. With only 20 percent of the alfalfa acreage being treated with either of these herbicides in 2003, there may not be a considerable deleterious effect to alfalfa weed management programs. Although it is becoming a challenge to use herbicides while maintaining water quality there are a number of alternative herbicides available that provide effective control with no effect to ground water quality.