# ALFALFA WEED CONTROL IN THE LOW DESERTS– 40 YEARS OF DISCOVERY AND INNOVATION

**Barry Tickes** [1]

## INTRODUCTION

Weeds have been serious economic pests in alfalfa since it was first introduced in the southwest in the early 1850's. There are few crops grown where the weeds are harvested and sold with the crop and the problems caused by the weeds have been debated. Weeds can contribute significantly to the weight of baled alfalfa and some weeds can also increase the nutritional value. Most producers recognize, however, that weeds can reduce crop yields, some are poisonous or have harmful burs, most effect proper curing of the crop and almost all weeds reduce the market value. Some weed seeds can germinate years or even decades after they are left in the field. Various techniques have been used to control weeds over the years although the past 40 years has been an especially remarkable period of herbicide discovery and innovation. This article will briefly summarize some of the highlights of this period.

## WEEDS IN THE SOUTHWESTERN DESERTS

Weeds are a problem wherever alfalfa is grown. There are some conditions that affect control strategies that are unique to the desert regions:

**Non-dormancy** – extremely non-dormant varieties are grown in the desert. Although growth is greatly reduced during the winter months, there is always green and growing foliage. This can affect crop safety from herbicides that can only be used when minimal foliage is present and can reduce soil deposition for herbicides that must reach the soil.

**Multiple weed emergences** – with mild climatic conditions and frequent year round irrigations, it is not uncommon for new weeds to emerge with each irrigation. This can reduce the effectiveness of herbicides that have no residual activity.

**Lack of distinct seasons** - moderate winter climatic conditions can allow some summer annual weeds to survive the winter and grow like biannuals and occasionally like perennials. Preemergent herbicides, for instance, will not be effective on summer annuals that are growing from established crowns rather than seed. A less frequent but occasional problem can occur when winter annuals survive the summer due to frequent irrigations and ground cover. The lack of distinct seasons can make preemergent herbicides less effective.

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[1]B.R. Tickes(btickes@ag.arizona.edu), Area Agent, Yuma County, 6425 W. 8th St. Yuma, AZ 85364; **In**: Proceedings, Alfalfa & Forage Symposium and Western Seed Conference, 2-4 December, 2008, San Diego, CA, UC Cooperative Extension, Agronomy Research and Extension Center, Plant Sciences Department, University of California, Davis 95616. (See http://alfalfa.ucdavis.edu for this and other proceedings).

**Cuticle absorption** – some weeds have a less permeable cuticle in the dry desert regions and this can reduce foliar absorption of some herbicides. Adjuvants can help overcome this problem but frequently reduce herbicide selectivity.

**Soil cracking** - soil active herbicides with preemergent activity need to reach and be incorporated into the soil. They form a barrier within the top inch of soil and kill weeds as they germinate within this region. Many of the fine textured soils in the deserts form cracks as they lose moisture. When this happens weeds often emerge through these cracks from below the layer where the herbicide is concentrated.

## NON-CHEMICAL WEED CONTROL PRIOR TO 1960

There are few crops in which non-chemical weed control practices are as effective as they are with alfalfa. Any cultural practice that gives the competitive edge to the alfalfa can be effective in controlling weeds. Many of these practices are the same as those used prior to the development of selective herbicides and include using weed free seed, planting between peak periods for annual weed germination, properly leveling fields, keeping borders, ditches and ditch banks clean and timing cuttings to enhance crop vigor. Summer fallow and cover crops were used prior to 1960 and are occasionally used today. Sheep grazing is a common practice during the fall and winter.

## CHEMICAL WEED CONTROL PRIOR TO 1960

There were various chemicals used to control weeds prior to the 1960's. These included salts, acids and oils that were non selective and used around rather than in fields. They were occasionally used for spot treatments within fields for particularly undesirable weeds such as dodder. Some of the earliest substances used as herbicides were salts including sodium chlorate and various ammonium salts. Oils were commonly used to non selectively control weeds even after some of the selective herbicides were developed. The rise in petroleum prices in the 1970's made this less desirable. Acids that were used included boric, sulfuric and carbolic acids. Rates varied by the type and size of weeds. Arsenicals, including sodium arsenite, arsenic trichloride and arsenic acids were also used. This was a fairly dangerous time to be working on a weedy farm.

## CHEMICAL WEED CONTROL SINCE 1960

The period which began following WWII in the late 1940's has been a period of remarkable discovery and development of selective herbicides in alfalfa. Chart 1 illustrates that this period began with the availability of 5 new herbicides in the 1960's and that number has risen to the registration of 20 herbicides for the low deserts today. More registrations were acquired from 2000 to 2008 than during any 10 year period before (Table 1).

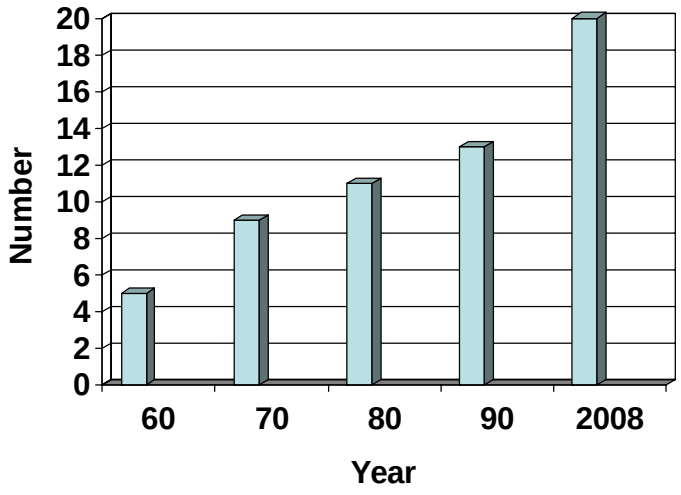


Chart 1. Alfalfa herbicides southwestern deserts 1960-2008

| 1960's | 1970's | 1980's | 1990's | 2000's |
|---|---|---|---|---|
| Eptam | Treflan EC | Buctril | Zorial/Solicam | Raptor |
| Balan | Tolban | Trifluralin 10G | Select/Prism | RR Alfalfa |
| Chem Hoe | Sencor | Kerb | Pursuit | Prowl H2O |
| Dinoseb | Gramoxone | Poast | | Velpar (Alfamax) |
| 2, 4-DB | | | | Chateau |
| | | | | Select Max |
| | | | | Sandea |

Table 1. Alfalfa herbicides southwestern deserts 1960-2008

**1960-1970**

Selective herbicides were in the developmental stages in the 50's although widespread registration and usage began in the 60's. Eptam, Balan and Chem Hoe were the first preemergent herbicides and 2, 4-DB and Dinoseb were the first postemergent herbicides.

Eptam, used both preplant and on established alfalfa, was the first herbicide registered for use applied in the irrigation water and was a standard application for the 20 year period from 1960-1980. It is still used today. Balan was introduced shortly after Eptam and could only be used preplant incorporated. It was the first dinitroanline herbicide registered in alfalfa and is still used today. Dinoseb (DNBP) and 2, 4-DB were the first postemergent herbicides used in alfalfa. Dinoseb was a contact herbicide while 2, 4-DB was a systemic growth regulator. Dinoseb was widely used from 1962 to 1987 when registrations were cancelled due to long term health effect. 2,4-DB was in use by 1960 and is still used today. It is weak on some broadleaf weeds such as malva and Shepardspurse and is often combined with other herbicides.

**1970-1980**

Eptam, 2, 4-DB, Dinoseb and Balan continued to become standard treatments during this 10 year period while new products were being tested and developed for the deserts. Treflan EC was registered under a special local needs registration (24c) for established alfalfa, bermudagrass and citrus. It allowed for water-run applications on runs less than 660 feet. Treflan does not stay in suspension well and application difficulties limited its use. This SLN was dropped by 1980. Sencor was registered during this period and is still used today on a limited scale. Crop safety has always been marginal with this herbicide on non dormant alfalfa grown in the deserts. Gramoxone is popular with growers seeking a quick burndown of weeds or spot treatments but the lack of selectivity has limited its use. Tolban was briefly registered during this period and was similar to Balan, another dinitroanline. Crop safety, like Balan, was an occasional problem.

**1980-1990**

Many herbicides were tested during this decade and a couple of them have had significant impacts upon alfalfa weed control. The selective postemergence grass herbicides were developed during this period. Poast was registered in 1985 and gave growers their first opportunity to control most grasses postemergence with excellent crop safety. Trifluralin 10% granules were registered about this same time and offered growers more effective control of annual grasses than any previous herbicides including the EC and early granular formulations of this herbicide. Kerb was registered during this period but it leaches below germinating weed seeds with flood irrigations of 5-6". It is a standard on leafy vegetables but difficult to use effectively on alfalfa. Buctril was also registered during this period and has been used effectively as a contact treatment on small weeds. Lack of crop safety in the deserts has reduced its utility.

**1990-2000**

The registration of new herbicides slowed during this decade but the products that were registered had significant impacts on alfalfa weed control. Pursuit was registered in 1993 and was one of the first of a new class of herbicides, the imidazolinones, that became a standard treatment in alfalfa. Pursuit could be used on seedling alfalfa and selectively

controlled a broad spectrum of weeds both pre and postemergence. Select or Prism was also registered in this period and was one of the newer grass specific herbicides. It controlled a couple grasses, annual bluegrass and sprangletop, that were missed by Poast. Zorial was registered during this period, briefly as a granule called Evital and later as Solicam. It was approved as a water run treatment in 2008.

## 2000-PRESENT

Although some have the perception that the 80's and 90's were the peak period for new herbicide registrations and that that period has passed, there have been more new products registered in the last 8 years than during any previous decade.

***Raptor***

Raptor was registered around 2000. It is similar to Pursuit but has less soil residual activity and is more effective on some weeds including lambsquarters and grasses. It fits better than Pursuit with growers wanting the flexibility to rotate to sensitive crops.

***Roundup Ready Alfalfa***

Roundup ready alfalfa seed was available briefly in the mid 2000's and is now under embargo. A very limited acreage was planted in the low deserts. When it is again available it will be a valuable addition to the list of available herbicides but it should be used with caution. Roundup is well known as a broad spectrum herbicide and some view it as an easy to use replacement for a diversified weed management program. Roundup does not control all weeds and these will be selected for if only Roundup is used. The multiple flushes of weeds in the low deserts will require multiple applications of this herbicide which has no soil residual activity. Because alfalfa is a perennial crop grown for 3 to 5 years in most areas, multiple applications will be required over multiple years if only this herbicide is used. This is a prescription for herbicide resistance which has already become a problem in some areas.

***Velpar***

Although Velpar has been a valuable herbicide in many regions it has been restricted from use in the low deserts where it was felt that it caused unacceptable crop injury. Trials conducted in western Arizona in 2001 indicated that it could be used with greater crop safety than previously thought. Subsequent trials further demonstrated that it could be used safely only during the winter months on established alfalfa when minimal crop regrowth was present. The low desert restriction was dropped in 2006 and it has been used with good success.

***Prowl $H_2O$***

Prowl has been registered on various crops since the 70's and on alfalfa for seed production only for about 10 years. The Prowl $H_2O$ formulation was registered in 2006 for use in alfalfa hay production. This registration is particularly useful because it allows for water run applications. This product is very effective in controlling annual grasses and some broadleaf weeds when applied in flood irrigation systems. It is difficult, however, to drip Prowl $H_2O$ into flood irrigation in the same manner as Eptam 7E normally is. This is a thicker water based formulation that must be diluted and kept in agitation the entire time of the application.

***Sandea***

Halosulfuron has been developed under various commercial names by Gowan Company for certain field and vegetable crops and turf. It was registered in 2007 for alfalfa. It is well known for its activity on nutsedge but also controls a number of broadleaf weeds both pre and postemergence. It can cause severe injury to alfalfa if applied during periods of rapid growth and when much regrowth is present. Its greatest utility in the deserts will be when applied in the late summer when alfalfa is in the "summer slump" period.

***Chateau***

Chateau (flumioxacin) was first registered in 2001 by Valent for use in peanuts and soybeans. It was later registered in cotton, field corn, fallow beds, certain fruit and nut crops, potatoes and mint. A section 18 emergency exemption registration was granted in 2006 for the control of common groundsel in alfalfa grown in La Paz County, Arizona. It is sold as Valor in some crops. Chateau will be valued as a preemergent treatment for the control of broadleaf and grass weeds with short plantback restrictions. It is effective on some tough to control weeds including malva, groundsel and pigweed.