

THE USE OF SOIL RESIDUAL HERBICIDES IN NORTHERN SAN JOAQUIN AND SACRAMENTO VALLEY ALFALFA PRODUCTION AREAS.

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Controlling winter annual weeds in established alfalfa can increase stand longevity, and can provide high quality weed-free at the first and subsequent cuttings. It must be emphasized at the beginning that the best method of weed control in alfalfa is a healthy vigorous crop that still has a good stand present. Chemical weed management is extremely difficult or is not adequate if the stand is weak and the alfalfa is not vigorous.

The soil-active herbicides registered for use in winter annual weed control in established alfalfa in the upper San Joaquin and Sacramento Valleys include:

Chemical	Trade name(s)	Typical use rate	Persistence	Leachability
Diuron	Karmex, Direx	1.5 - 2.4 lb/A	3-6 months	Moderate
Terbacil	Sinbar	0.4 - 1.2 lb/A	4-8 months	Low
Metribuzin	Sencor, Lexone	0.375 - 1.0 lb/A	2-4 months	Moderate
Hexazinone	Velpar	0.45 - 1.35 lb/A	3-6 months	Moderately high
Chlorpropham	Furloe	2.0 - 4.0 lb/A	1-3 months	Moderate

All these herbicides have restrictions concerning their use; these are spelled out on the label and must be adhered to.

Soil residual herbicides have advantages and disadvantages when considered in relation to foliar-active chemicals. The weed control obtained with soil-active herbicides is much longer lived, and in some cases can persist well into the summer harvesting period. The soil-active herbicides currently registered will not, however, persist throughout an entire harvest season at labeled use rates. In areas where terbacil can be used we have observed activity through about mid-summer. Likewise when higher rates of hexazinone have been used activity has been observed until the middle of the summer. Delaying application until late January has in several tests increased the control of early germinating summer grasses, but did result in less effective winter weed control. It is probably better to apply the soil-active compound at the best time to control winter annuals and to use a different set of treatments for control of summer annual grasses.

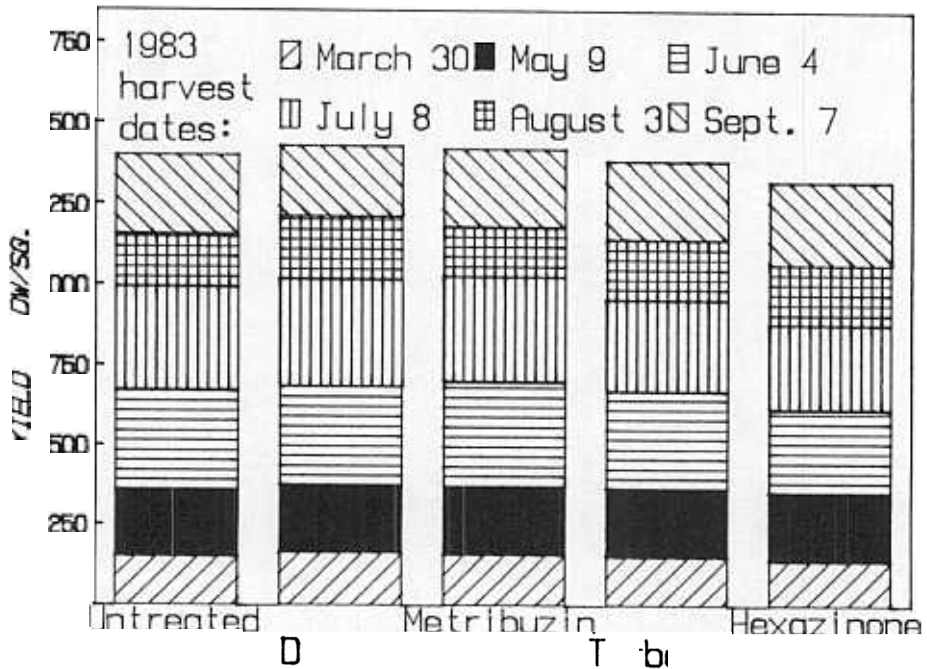
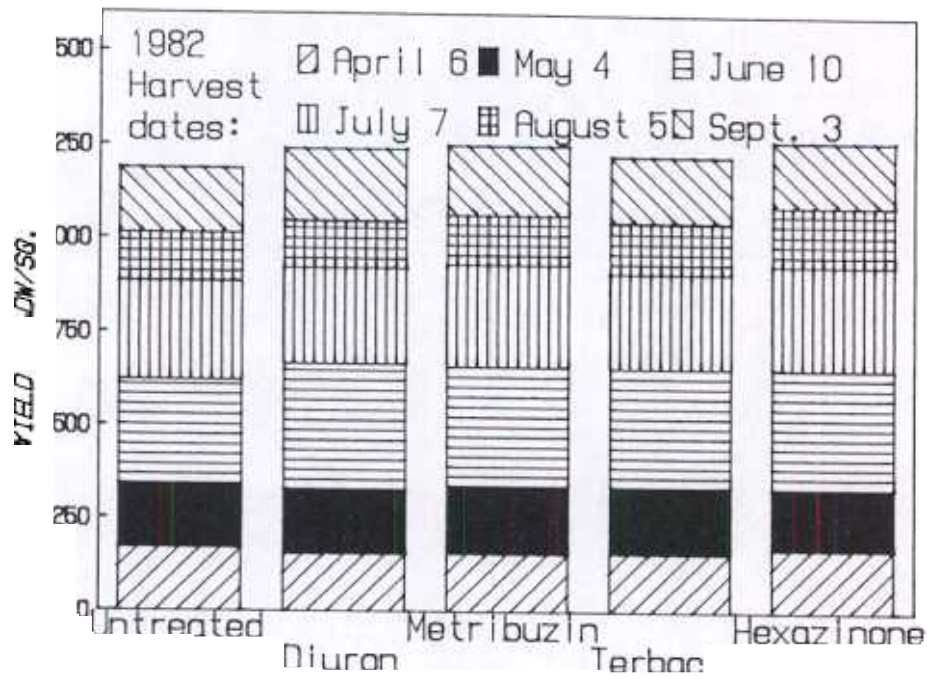
Soil residual herbicides have a special advantage if the alfalfa stand is weak. Under these conditions the competition from the crop is low and weeds will reinvade in open spaces if the herbicide does not continue to inhibit germination following application; contact-acting herbicides are less effective under these conditions.

Most of the soil residual herbicides have only limited activity against established plants. It is thus imperative that these materials, in contrast to paraquat or weed oil, be applied as early in the 'dormant' season as possible to assure that weeds are still in early seedling stages of growth or haven't even emerged. As a rule of thumb it is probably advisable to apply diuron, hexazinone, metribuzin, or terbacil prior to January 1. In numerous trials we have seen decreased activity from these materials when applied in mid- to late-January in average rainfall years. Under conditions of heavy late-winter rains better weed control has, in several instances, been obtained from applications applied in January.

Use of soil-active herbicides in alfalfa is not without hazard. The crop has no inherent biochemical mechanisms to provide selectivity to these herbicides. Selectivity is primarily due to the deep-rooted characteristic of the crop coupled with the relatively little leaching of the herbicide out of the soil surface. This results in shallow rooted weed seedlings taking up a lethal dose of herbicide but the deep rooted crop not taking up enough to cause serious damage. All of the soil-active herbicides, except chlorpropham, are inhibitors of photosynthesis, which can, and usually will, cause temporary yellowing of existing foliage following application. Healthy vigorous deep rooted alfalfa will rapidly outgrow this temporary injury. Any situation that causes the alfalfa to form

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Fig. 1  
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restrict the use of these herbicides on 'light' soils due to increased toxicity to the crop. Large amounts of water can also lead to increased leaching, and hence increased crop injury. In recent years it has been noted that severe injury occurred to alfalfa when treated with hexazinone and the field was then subjected to flooding due to heavy rainfall. No experiments have been conducted that accurately document why this occurs; work done in years with heavy rain but in which flooding did not occur did not experience the severe crop injury (see below).

Due to the inherent lack of biochemical selectivity by the alfalfa plant to the soil-active, photosynthesis inhibiting, herbicides two experiments have been conducted to establish the impact of these herbicides on the season-long production by the crop under weed free conditions.

The fields chosen for the experiments were located south of Madison, Yolo County, on a Capay silty clay in 1982, and on sandy loam at the University of California Animal Science farm at Davis in 1983. Both fields were in commercial production and all production practices, except weed management, were those used by the grower. The alfalfa varieties were SD 76 in 1982, and AS 13R in 1983. Both fields had mixed winter annual weed populations of plants such as common chickweed (Stellaria media (L.) Cyrillo), groundsel (Senecio vulgaris L.), shepherd's purse (Capsella bursa-pastoris L.), prickly lettuce (Lactuca serriola L.), speedwell (Veronica persica Poir.) and annual bluegrass (Poa annua L.). Paraquat was applied to all plots in both experiments prior to application of the soil active herbicides to kill all existing weeds; applications were made on December 22, 1981 and January 28, 1983 respectively. Almost complete control of existing weeds was achieved. The soil-active herbicides were applied at, or near, maximum label rates on January 8, 1982 and February 1, 1983 respectively. The herbicides applied were diuron at 2.4 lb/A, metribuzin at 1.0 lb/A, terbacil at 1.2 lb/A, and hexazinone at 1.5 lb/A. An untreated control was included which had received the paraquat application but which did not receive a soil-active herbicide treatment. The experiments did not have weed problems for the remainder of the growing season. Samples of the hay were removed by hand clipping 3 1/3 m<sup>2</sup> samples per plot in late February and mid-March in 1982, and in early March in 1983 to determine impacts of the herbicides prior to the first cutting. Sampling was continued throughout the growing season immediately prior to each normally scheduled commercial harvest.

Data for the samples taken prior to the first normally scheduled harvest are not presented; there was no significant effect of the herbicide treatments. There was no effect of any herbicide treatment on the yield of alfalfa either at individual cuttings or on a season total basis (Figure 1). No attempt has been made to convert the small plot samples to tons/A as relative differences are considered to be significant and not the ultimate yield (as a reference 1000 g dw/m<sup>2</sup> is approximately 5 tons/A at 10% moisture). Minor fluctuations in yield occurred between treatments at various cuttings, but there was no consistent trend for increased or decreased yield in either experiment in relation to the various herbicide treatments. It is concluded that under 'normal' growing conditions in the absence of weeds, and in the absence of flooding, that these herbicides do not have any long-term detrimental impact on alfalfa growth.

An interesting anomaly that must be considered when using any herbicide for winter annual weed control is to determine the severity of the summer grass problem, especially yellow foxtail (Setaria glauca (L.) Beauv.) or pigeon grass. Removal of winter annual weeds provides a more favorable germination and establishment site for the seedling grasses during the spring. Winter annual weeds compete with the seedling grasses, and also keep the soil surface cooler in the early spring, which reduces germination. Several farm advisors and myself have all observed increased infestations of yellow foxtail in the summer following application of contact or short residual soil-active herbicides for winter annual weed control. It is thus more important to consider how yellow foxtail control will be achieved if winter weed control is to be practiced.

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