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Timing Kerb Applications in Lettuce

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Abstract

Kerb (Pronamide) is often ineffective when it is leached below germinating weed seeds with sprinkler irrigation. Efficacy can be improved by making delayed aerial applications after the sprinklers have been started and before weeds have become established. Tests were conducted to determine the optimal time of application. Optimal times varied with the season and ranged from two to three days after the sprinklers had started during the early season (Sept.) to five to six days during the late season (January).

Introduction

Kerb (Pronamide) is one of the three main herbicides used in lettuce. Results of the Arizona Agricultural Statistics Service's 1998 chemical use survey indicated that 29 percent of the lettuce acreage in Arizona was treated with Kerb, followed by Balan (Benefin - 21%) and Prefar (Pronamide - 11%). Lettuce is grown in the low desert from September to April and growers must contend with winter annual, summer annual and perennial weeds. No herbicide will control all of these weeds all of the time but increasing complaints of poor weed control with Kerb occurred over the last 10 years.

Tests conducted over the past two years have demonstrated that the cause for many of the cases of poor weed control was the leaching of Kerb below germinating weed seeds with sprinkler irrigation. Kerb works by inhibiting root growth of developing seedlings. It has postemergence activity on some very small weeds but it is important that roots and shoots absorb a lethal dose of the herbicide before they are well developed. The location of the herbicide at the time of weed seed germination and early development will greatly effect the level of control that results.

Most weed seeds that emerge with the crop are located within the top $\frac{1}{2}$ inch of soil. It is a challenge to keep the herbicide in this region while applying enough water with sprinklers to germinate the crop and cool the soil. Kerb has commonly been applied after planting and prior to starting the sprinklers. One strategy to maintain the herbicide in the top $\frac{1}{2}$ inch of soil has been to delay the application until after the sprinklers have been started but prior to the germination and early development of the weed seeds. The purpose of this project has been to determine the best time of application.

Application Timing

The most effective weed control will be achieved when the herbicide is in the right place (the top $\frac{1}{2}$ of soil on the bed top) at the right time (when the weed seeds are germinating). Several factors will effect when weed seeds germinate after sufficient moisture is present. The most important of these are soil temperature and the temperatures at which the weeds that are present, germinate. As soil temperatures change from late summer, through the fall and winter and into the spring, the most effective time to apply Kerb will likely also change.

A test was conducted to evaluate how long it takes for certain common weeds to germinate after moisture is present. This test involved burying tea bags containing weed seeds in the seed row of eight commercial lettuce fields from August to February in Roll, the Gila Valley, the Yuma Valley and Bard, California. The test contained a winter annual grass, summer annual grass, two winter annual broadleaf weeds and three summer annual broadleaf weeds. The bags were buried 1/4 inch below the surface and checked every 24 hours. The time to germination appear in Table 1. The time to germination will vary considerably even within the same field due to variations in soil and micro climatology. Every year could be different and this test was intended to provide a general indication of germination times for various common weed seeds. The summer annual grass (barnyardgrass) took 24 hours to germinate in August and September, becoming longer in October (48 hours) to December (96 hours) with no germination in January. The winter annual grass (canarygrass) took 168 hours to germinate in September and dropped to 96 hours in December. The summer annual broadleaves took from 24 hours (purslane) to 96 hours (pigweed and nightshade) to germinate. The winter annual broadleaf weeds (lambsquarters and shepardspurse) took from 72 to 168 hours to germinate.

The weed seed germination test indicated that the best time to apply Kerb to minimize leaching and maximize the amount of herbicide in the zone where weed seed was germinating could be from 24 to 168 hours after the sprinklers had started.

Chart 1: Hours of Germination

WEEDS		Month					
		Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
Barnyardgrass		24	24	48	72	96	NG
Canarygrass		NG	168	96	96	96	NG
Lambsquarters		72	96	96	72	168	NG
Silverleaf Nightshade		96	96	72	96	NG	NG
Pigweed		48	72	48	72	96	NG
Purslane		24	24	24	48	96	168
Shepardspurse		NG	NG	168	96	168	NG

Tests were conducted to determine the best time to apply Kerb after sprinkler irrigation had started. Two tests were conducted during the early season (Aug. - Sept.), two tests during the mid-season (Oct. - Nov.), and one during the late season (Jan. - Feb.). All five tests were small plot tests (8 rows x 50 ft.) conducted at the University of Arizona Yuma Valley Agriculture Center. Treatments were applied manually with a backpack sprayer to simulate aerial application. Two pounds per acre of Kerb were applied either prior to starting the sprinklers or one to six days after they had been started. Each treatment was applied in a 20 gallon per acre spray volume and replicated four times. For the early season tests, common purslane was planted into the plots to insure a uniform infestation of weeds. Wild mustard was planted for the mid and late-season tests. Evaluations were made by visually estimating percent weed control.

Early Season (Aug. - Sept.)

Soil Temperatures (Top 4")

Yuma Valley, 2000: 87 to 100°F

Common weeds during this time period

Summer annual grasses

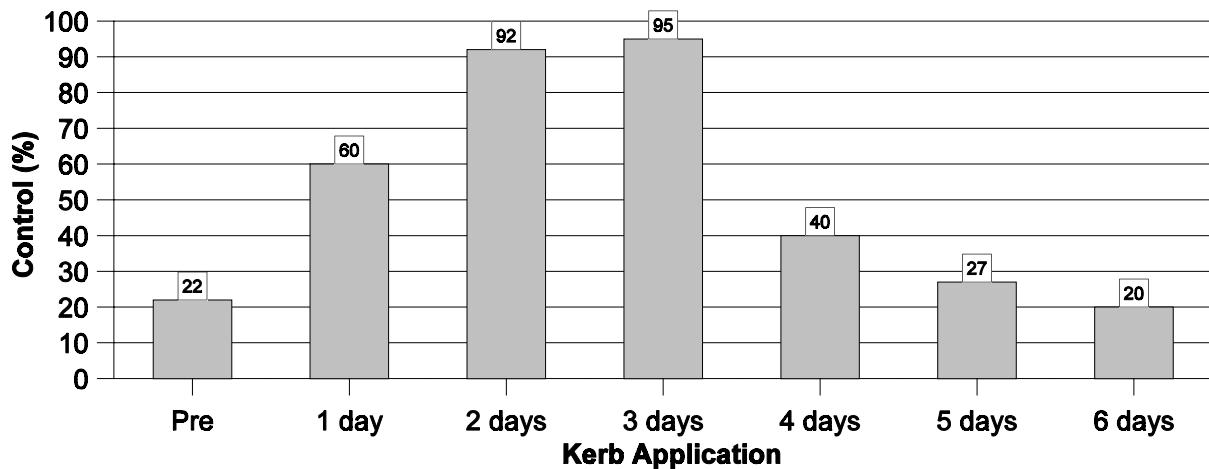
Pigweed

Purslane

Sunflower

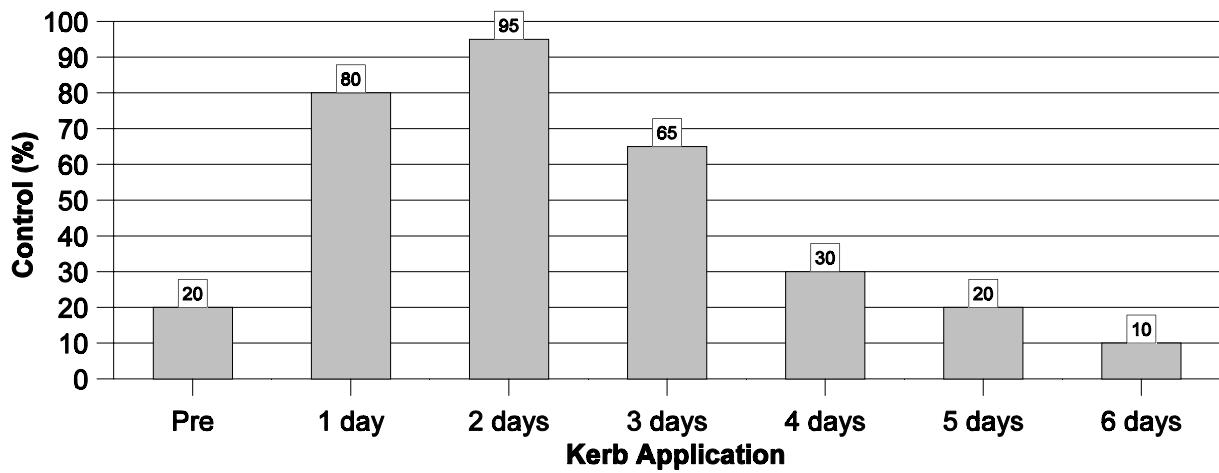
Groundcherry
Spurge

1999/Sept. 1 - 7



Likely time from irrigation to germination 24 to 96 hours

2000/Sept. 12 - 18



Mid-Season (Oct. - Nov.)

Soil Temperatures (Top 4")

Yuma Valley, 2000: 58 to 87°F

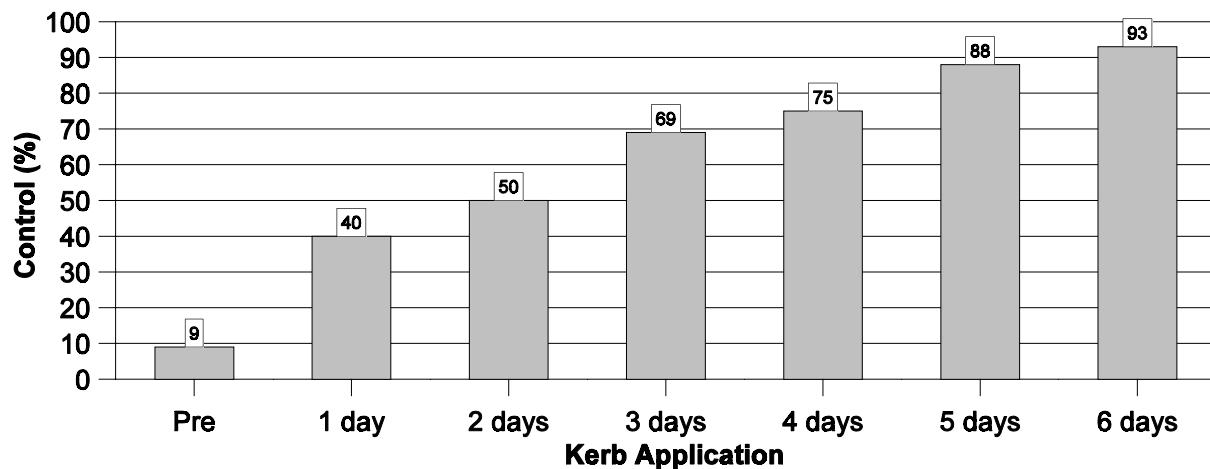
Common weeds during this time period

Lambsquarters
Goosefoot
London Rocket
Shepardspurse
Prickly Lettuce
Knotweed
Sowthistle
Wild Mustard

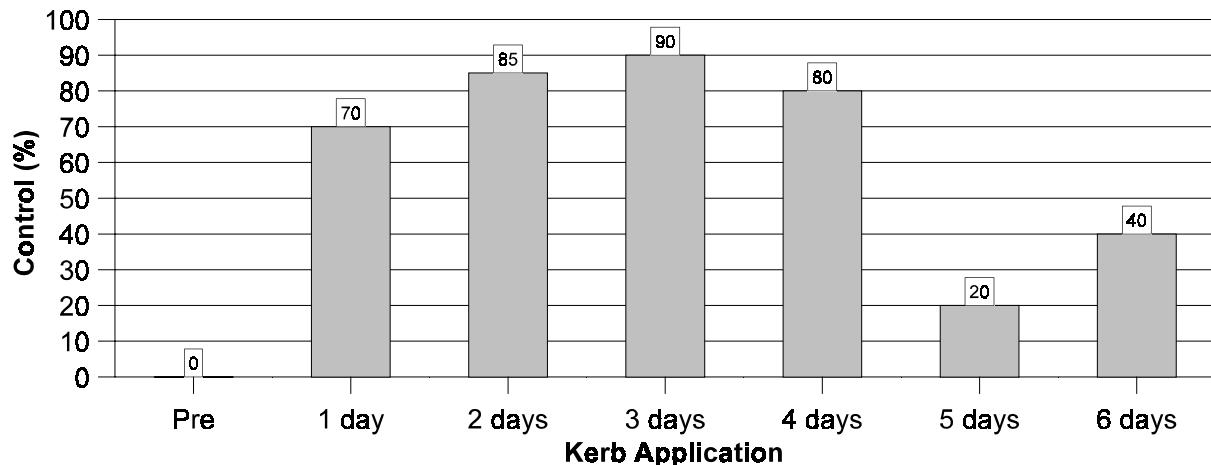
* Summer annual weeds possible in October
72 to 168 hours

Likely time from irrigation to germination

1999/Oct. 27 - Nov. 3



2000/Nov. 2 - 8



Late Season (Jan. - Feb.)

Soil Temperatures (Top 4")

Yuma Valley, 2000: 55 to 67°F

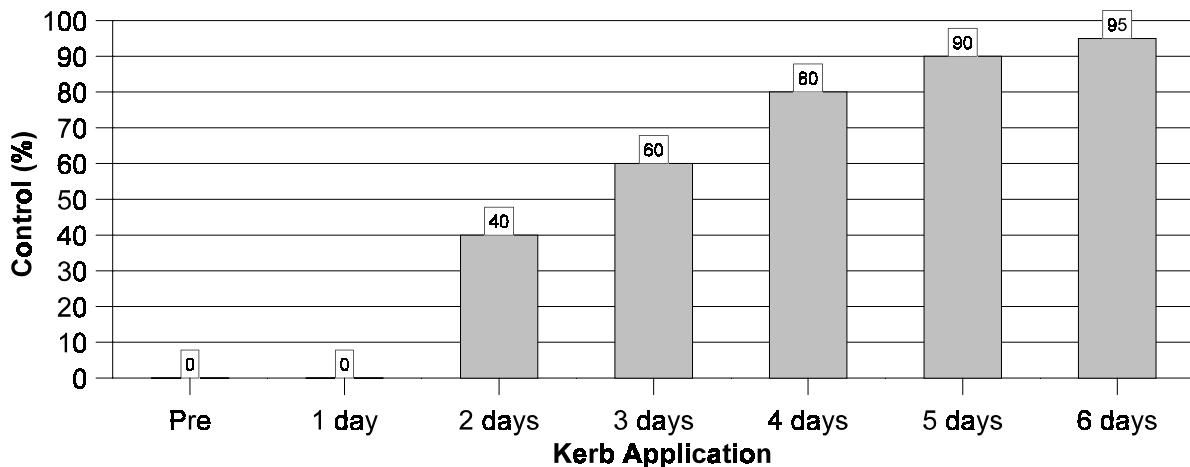
Common weeds during this time period

Mainly winter annuals, summer annual weeds possible in Feb.

Likely time from irrigation to germination

unclear

2001/Jan. 18 - 24



Crop Injury

The delayed application of Kerb is a method of concentrating the herbicide in the area where the lettuce seed is germinating. Any method that concentrates the herbicide in this region will increase the possibility of crop injury. Crop injury sometimes occurs with all three of the preemergent herbicides used in lettuce.

Lettuce can tolerate Kerb and other herbicides when growing conditions are favorable. Anything that puts the crop under stress during stand establishment lowers this tolerance. This includes heat, cold, salts, disease, insects, poor nutrition and weak or inappropriate varieties. Primed and unprimed seed were compared in this year's test to evaluate this as a potential cause of crop injury. Priming did not cause increased injury in these tests. The only injury that has been observed has been from the treatments that were applied after the lettuce had emerged and when conditions were not favorable for rapid growth.

Delaying Kerb applications requires that aerial application be made. Aerial applications are generally less precise than ground applications and overlaps and skips are more likely. Where overlaps occur, a 2x rate is applied and injury more likely.

Conclusions

Lettuce is grown from August to April in the low desert and subject to varied and interrelated environmental conditions. The effects of delaying Kerb applications to improve weed control will vary from season to season, year to year and field to field. It is possible, however, to draw some general conclusions:

1. Kerb is ineffective when applied prior to starting sprinklers except on some of the most sensitive weeds.
2. Kerb should be applied 1 to 3 days after starting sprinklers in early-season plantings (Aug. - Sept.).
3. The most effective time to apply Kerb during mid-season (Oct. - Nov.) varied from 3 to 6 days after the sprinklers were started.
4. The most effective time to apply Kerb in the late season (Jan.) was 5 to 6 days after the sprinklers had started.