Project Number: 90-U2

Vegetation Management Studies

In

Almond Orchards

A Progress Report - 1990

CAB Project 90-4

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Vegetation Management in Almond Orchard
Project No. 90-U2
1990 Progress Report of Applied Research Studies

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Summary

Maintenance of an effective vegetation management system on the orchard floor is essential for the profitable production and the efficient harvest of almonds. The control of weeds with herbicides such as Endurance (prodiamine) Goal (oxyfluorfan), Solicam (norflurazon) and Surflan (oryzalin) injected into the irrigation system, using low volume emitters, was clearly demonstrated.

Stinger (clopyralid), Envy (2, 4-D amine) Roundup (glyphosate) and Ignite (glufosinate) were evaluated for the postemergence control of perennial weeds.

Introduction

In orchards irrigated with low volume microjets or microsprinklers the soil persistent herbicides applied during the winter months do not provide seasonal weed control. Herbicide degradation through microbiological activity and hydrolysis is accelerated in the continually wetted areas. This results in excessive weed growth that can interfere with uniform water distribution and makes it difficult to monitor the proper functioning of the emitters. Several herbicides were injected into a low volume irrigation system equipped with microjets. At the same time the herbicides injected into the irrigation system were also applied with conventional boom sprayer to compare their effectiveness in controlling the weeds.

In Central California most almond orchards are under complete nontillage management. Soil persistent herbicides are used in a strip of soil, 4 to 8 feet wide, centered on the tree rows. In the middles cover crops are planted or the resident vegetation is allowed to grow;

to control them they are mowed periodically. Some orachardists use low rates of foliar applied herbicides, mainly Roundup, to keep the vegetation under control.

In orchards where clover is used as a cover crop, they tend to encroach onto the berms. Repeated applications of Roundup have not controlled them effectively. In those orchards where the resident vegetation is kept under control with repeated applications of Roundup, at low rates, a shift in the population of the vegetation is occurring. Some of these weeds invade the berms where soil persistent herbicides are used. Dandelion with its abundantly produced and readily dispersed seeds can be especially troublesome.

Procedures Used

Herbicides Injected

Soil persistent herbicides were applied 12/27/89 with a conventional sprayer to obtain weed control in a 10 foot strip of soil centered on the tree rows. The individual plots were 200 feet long replicated 5 times. Each plot contained 6 almond trees; 3 Mission and 3 Nonpareil varieties, as well as 3 of each of Nubiana plums and Flavor Crest peaches.

On March 26, 1990 the weed control ratings, from the winter treatment, ranged between 83% to 86% except in the plots treated with Ignite, a foliar applied herbicide without soil activity, the control averaged 10%.

April 17 and 18 herbicides were injected into the irrigation system with a positive displacement pump. The rate of application was calculated to treat the area wetted by the emitters. The duration of each herbicide application was 30 minutes followed by 30 minutes of flushing. The herbicides were injected in water suspension beyond the filters. The orchard was irrigated twice a week and the quantity of water applied was based on the calculated evapotranspiration (ET) rate.

At the same time the herbicides injected through the microjet sprinklers, some plots were treated with a boom sprayer using a constant pressure CO_2 sprayer. These treatments were applied on the areas treated with the foliar applied herbicide during the winter.

The herbicides used, rates of their application, soil type, method of evaluation and other pertinent information are given in Table 1 that also contains a summary of the evaluations.

Postemergence Trials

The postemergence trials to evaluate herbicides for the control of perennial weeds were conducted in two mature orchards. The dandelion control studies were conducted in an orchard where basin-flood irrigation was used and the berms were treated with soil persistent herbicides. The resident vegetation in the middles was controlled with periodic mowing.

The clover control trial was conducted in a sprinkler irrigated mature orchard. The berms were infested with perennial clovers planted two years earlier as a cover crop. The vegetation in the middles were controlled with repeated mowing. In this trial only Stinger (clopyralid) and Roundup (glyphosate) were used.

The herbicides in all of the postemergence trials were applied with a CO_2 constant pressure sprayer. Tables 2 through 8 contain a list of herbicides used, rates and dates of application and a summary of the evaluations.

Results and Discussions

Herbicides Injected

The feasibility of applying herbicides by injection into low volume sprinklers to maintain adequate season long weed control was clearly demonstrated.

The herbicides used provided comparable control as shown in Table 1. Cudweed (Gnaphalium spp.) and spotted spurge (Euphorbia spp.) were two weeds that survived and were most prevalent in all plots. Although 100% control was not obtained, it was commercially acceptable control.

The degree of control obtained with the herbicides applied with a conventional sprayer was comparable to the control obtained with the herbicides injected and applied through the low volume emitters.

Slight phytotoxicity was observed in those plots where the leaves on the low hanging branches were sprayed with Goal. No symptoms were observed from volatilization of any of the herbicides.

Before the application of herbicides can be recommended by injection through low volume emitters, additional studies need to be conducted to determine:

a. The rates of application that will provide the most effective economical control.

b. Whether single or multiple applications at low rates will provide the most effective control.

c. How uniform is the distribution of the herbicide through the system.

The water solubility of these soil active herbicides is low. The turbulence in the small diameter distribution lines may not be sufficient to keep them in suspension.

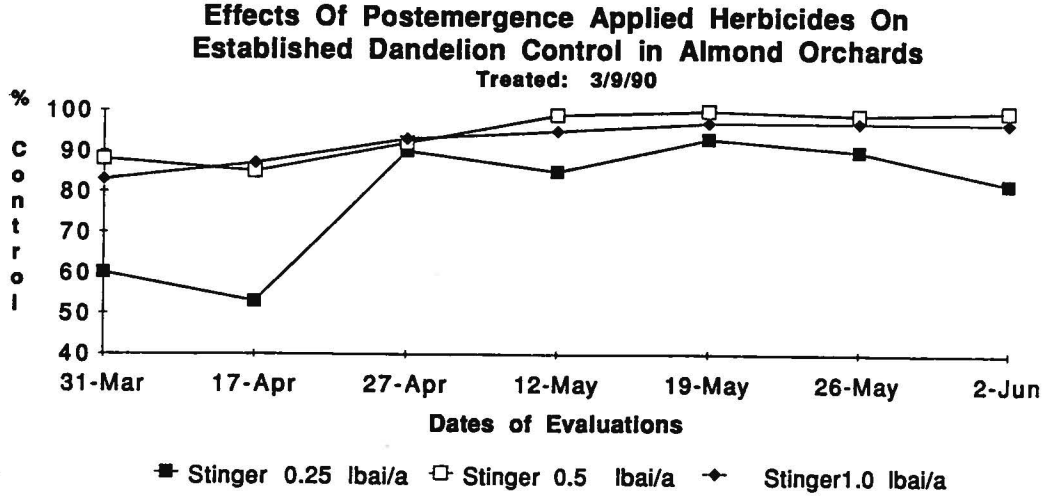
Postemergence Herbicides

Good control of established dandelion (Taraxacum officinale) was obtained with Envy (2, 4-D amine), Ignite (glufosinate) and Stinger (clopyralid). However, they differed in their residual activity in controlling seedling dandelion emerging following treatment.

Ignite provided the most rapid kill of the dandelion and other broadleaf weeds and grasses as shown in Tables 5, 6 and 7. However, seedling dandelion was numerous in the treated areas three weeks after treatment.

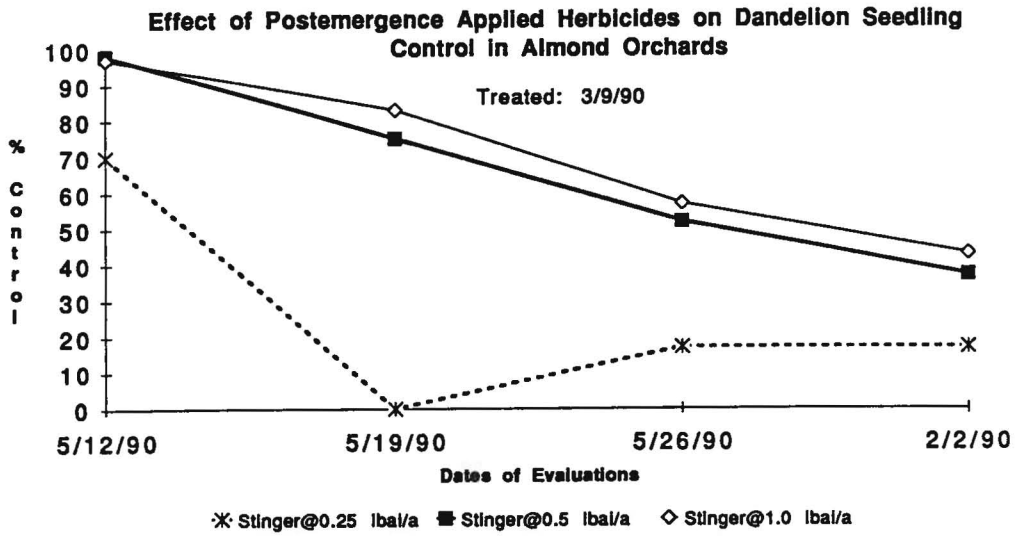
Stinger provided effective control of dandelion as shown in Figure 1 and in Tables 2 through 7. Applied at 0.5 and 1.0 lb ai/a the control was more rapid and more effective than at 0.25 lb ai/a.

Figure 1



The residual activity of Stinger at 0.5 and 1.0 lb ai/a was effective in preventing reinfestation of seedling dandelion for two months. Figure 2 illustrated the growth of dandelion seedlings in plots treated March 9.

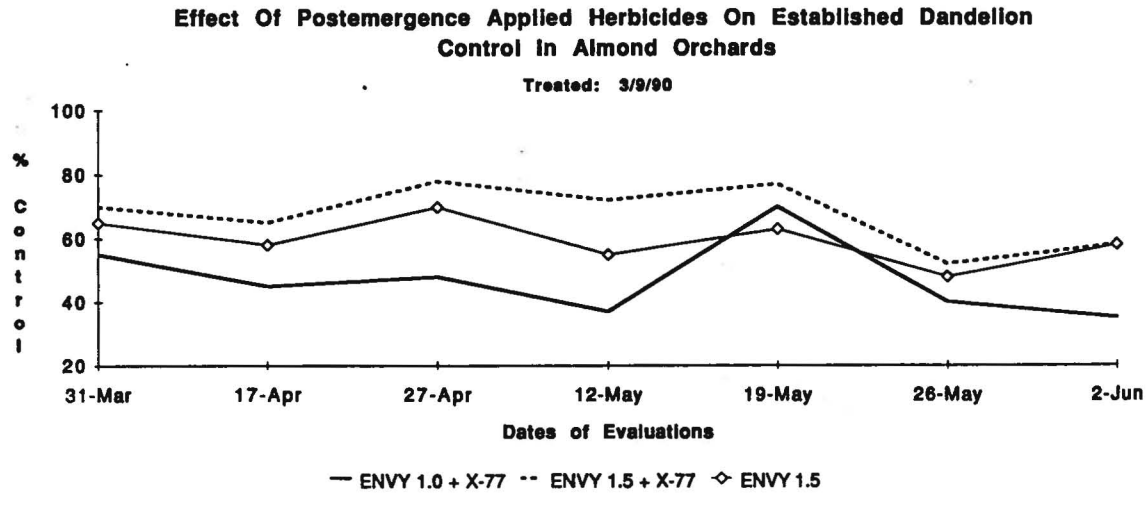
Figure 2



Stinger provided the most effective control of clovers of any herbicides evaluated. In the trial, summarized in Table 8, very effective control of clovers was obtained at 0.25 lb ai/a. Stinger did not control grasses, chickweed, filaree and other broadleaf weeds. See Tables 2 through 6. In combination with Envy, Goal and Roundup, its activity can be broadened to control a wide spectrum of weeds.

The dandelion control was marginal in the plots treated with Envy applied at 1.0 and 1.5 lb ai/a. The addition of an adjuvant (X-77) slightly hastened its activity as shown in Figure 3 below, and in Tables 2 through 7.

Figure 3



The residual activity of Envy was short lived. Two months following treatment the plots were heavily infested with dandelion seedlings. When used in combination with Singer, Goal or Roundup, it provided more effective dandelion control as well as the control of a broader spectrum of weeds as shown in Tables 5, 6 and 7.

Although not included in these trials, Roundup applied at 2.0 lb ai/a or higher rates has provided effective dandelion control. However, in orchards were Roundup is used at lower rates to control the growth of the vegetation, often promoted as chemical mowing, the rapid increase and survival of dandelion was observed.

Conclusions

The feasibility of injecting herbicides into irrigation systems using low volume spray emitters was again demonstrated. However, before they can be recommended for use their labeling for this method of application is required. The midseason application of soil persistent herbicides, whether injected into the irrigation system or applied with conventional sprayer, was demonstrated to be effective to maintain season long weed control in frequently irrigated orchards.

The registration of Stinger and Ignite could provide almond growers with very effective chemical tools. They could enable them to effectively control a broad spectrum of weeds regardless of the vegetation management systems they use on the orchard floor. However, the proper selection and economical use of herbicides will hinge on the proper identification of the vegetation and keeping records of their presence in the orchards.

Orchardists should consider rotation of the herbicides to prevent shifts in the weed population. With the proper selection of herbicides they can selectively encourage the growth and/or survival of certain species of plants.

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Table 1
Evaluation of Two Application Methods of Herbicides in Deciduous Orchard

LOCATION: Kearney Agricultural Center
SOIL TYPE: Hanford sandy loam
PLANTED: 2/20/82
TREATED: 4/17, 4/18/90
METHOD OF APPLICATION: Hand applied, 4/17/90
Injected, 4/18/90

IRRIGATION: Low volume microjets
PLOT SIZE: 1344 ft^2, Reps. 3
VARIETY: Almond - Non-pareil
Almond - Mission
Plum - Nubiana
Peach - Flavorcrest
EVALUATED: 8/31, 9/15/90

			Weed Control Evaluations, Average of 3 Replications				
			8/31/90			9/15/90	
Herbicide		lbai/ acre	% Brdlf. Control	% Grass Control	Weeds Present*	% Weed Control	Weeds Present*
Injected into irrigation system							
A	Endurance	2.0	76	97	C,Cd,Cup,F,Ho,Ss	88	C,F,Gx,S,Ss
B	Endurance	4.0	80	99	Cd,Cup,Ho,L,Pv,Ss	87	Cd,F,L,S,Ss,Wh
C	Solicam	2.0	79	99	Cd,Cup,F,Ho,L,Ss	87	Cd,F,L.Ss
D	Solicam	4.0	93	100	Cl,Ho,Pv,S,Ss	83	E,F,S,Ss
E	Prowl Goal	2.0 1.0	95	100	Cd,E,F,Ho,S,Ss	95	L,S,Wh
Applied with conventional sprayer							
F	Endurance Goal	4.0 1.0	86	100	Cd,Dl,E,F,Ho,Ni, S,Ss	88	Cd,E,F,L,S,Ss
G	Prowl Goal	4.0 1.0	98	99	Cd,Cup,Ho,Ss	100	---
H	Surflan Goal	4.0 1.0	96	100	O,Ss	97	F,S,Ss

*Weeds Present: C=crabgrass, Cd=cudweed, Cl=clover, Cup=cupgrass, Dl=dandelion, E=catsear, F=filaree, Gx=green foxtail, Ho=horseweed, L=flaxleaved fleabane, Ni=nightshade, O=groundsel, Pv=puncturevine, S=sowthistle, Ss=spotted spurge, Wh=willowherb.

Table 2
Effect Of Postemegence Applied Herbicides On Dandelion Control In Almond Orchards
06,44, 425, 145,10,90-1

LOCATION: 7767 E. Barstow
SOIL TYPE: Hanford sandy loam
VARIETY: Nonpareil
HERBICIDES APPLIED: 3/9/90

IRRIGATION: Basin flood
PLOT SIZE: 5' X 15', Reps. 3
PLANTED: Mature orchard
EVALUATED: Various, see below

		WEED CONTROL EVALUATIONS, AVERAGE OF 3 REPS.							
		3/31/90	4/17/90			4/27/90			
HERBICIDE	Lbai/ Acre	% Dand. Control	% Dand. Control	% Filaree Control	% Grass Control	% Dand. Control	% Grass Control	% Other Brdlf. Cont.	Weeds Present*
A Stinger 3EC	0.25	60	53	0	0	90	0	0	Chw,Dn,F,Sp
B Stinger	0.50	88	85	0	0	92	0	0	----
C Stinger	1.00	83	87	20	0	93	0	28	----
D Envy 3.8 EC X-77	1.00 1/2%	55	45	87	30	48	28	65	Bb,Chw,F,Mp,Sp,Y
E Envy X-77	1.50 1/2%	70	65	88	37	78	18	85	Chw,Y
F Envy	1.50	65	58	92	33	70	10	82	Ch,Chw,Ho

*WEEDS PRESENT: Bb = brass buttons, Ch = cheeseweed, Chw = chickweed, Dn = dead nettle, F = filaree, Mp = marsh parsley, Sp = shepherd's purse, Y = pineappleweed

Table 3

Effect Of Postemergence Applied Herbicides On Dandelion Control In Almond Orchards

06,44, 425, 145,10,90-1

LOCATION: 7767 E. Barstow
SOIL TYPE: Hanford sandy loam
VARIETY: Nonpareil
HERBICIDES APPLIED: 3/9/90

IRRIGATION: Basin flood
PLOT SIZE: 5' X 15', Reps. 3
PLANTED: Mature orchard
EVALUATED: Various, see below

		WEED CONTROL EVALUATIONS, AVERAGE OF 3 REPS.						
		5/12/90					5/19/90	
HERBICIDE	Acre	% Dand. Control Established	% Dand. Control Seedling	% Other Broadleaf Control	% Grass Control	Weeds Present*	% Dand. Control Established	% Dand. Control Seedling
A Stinger 3EC	0.25	85	70	17	0	A,Ch,Chw, F,M.bar.	93	0
B Stinger	0.50	99	98	20	27	Ch,Chw,F	100	75
C Stinger	1.00	95	97	58	30	Chw,F	97	83
D Envy 3.8 EC X-77	1.00 1/2%	37	17	80	30	Bb,Ch,Chw	70	0
E Envy X-77	1.50 1/2%	72	52	75	43	Ch,Chw	77	0
F Envy	1.50	55	57	45	18	Bb,Ch,Chw	63	0

*WEEDS PRESENT: A = annual bluegrass, Bb = brass buttons, Ch - cheeseweed, Chw = chickweed, F = filaree, M.bar. = Mediterrean barley.

Table 4
Effect Of Postemergence Applied Herbicides On Dandelion Control In Almond Orchards
06,44, 425, 145,10,90-1

LOCATION: 7767 E. Barstow
SOIL TYPE: Hanford sandy loam
VARIETY: Nonpareil
HERBICIDES APPLIED: 3/9/90
IRRIGATION: Basin flood
PLOT SIZE: 5' X 15', Reps. 3
PLANTED: Mature orchard
EVALUATED: Various, see below

WEED CONTROL EVALUATIONS, AVERAGE OF 3 REPS.

		5/26/90			6/2/90			
HERBICIDE	Lbai/ Acre	% Dand. Control Established	% Dand. Control Seedling	% Other Broadleaf Control	% Dand. Control Established	% Dand. Control Seedling		
A Stinger 3EC	0.25	93	0	85	70	17	0	A,Ch,Chw,F,M.bar.
B Stinger	0.50	100	75	99	98	20	27	Ch,Chw,F
C Stinger	1.00	97	83	95	97	58	30	Chw,F
D Envy 3.8 EC X-77	1.00 1/2%	70	0	37	17	80	30	Bb,Ch,Chw
E Envy X-77	1.50 1/2%	77	0	72	52	75	43	Ch,Chw
F Envy	1.50	63	0	55	57	45	18	Bb,Ch,Chw

*WEEDS PRESENT: A = annual bluegrass, Bb = brass buttons, Ch - cheeseweed, Chw = chickweed, F = filaree, M.bar. = Mediterrean barley.

Table 5
Effect Of Postemergence Applied Herbicides On Weed Control In Almond Orchards
06,44, 425, 145,10,90-2

LOCATION: 7767 E. Barstow
SOIL TYPE: Hanford sandy loam
VARIETY: Nonpareil
HERBICIDES APPLIED: 4/17/90

IRRIGATION: Basin flood
PLOT SIZE: 5' X 15', Reps. 4
PLANTED: Mature orchard
EVALUATED: Various, see below

			WEED CONTROL EVALUATIONS, AVERAGE OF 4 REPS.									
			4/27/90					5/12/90				
	HERBICIDE	Lbai/ Acre	% Dand. Control	% Filaree Control	% Grass Control	% Other Broadleaf Control	Weeds Present**	% Dand. Control Established	% Dand. % Control* Seedling	Other Broadleaf Control	% Grass Control	Weeds Present**
A	Envy 3.8 EC X-77	1.00 1/2%	57	60	30	40	----	80	63	77	83	A,Bb, Chw, Cl,F,Mp
B	Stinger 3 E X-77	0.25 1/2%	45	0	0	0	----	60	43	45	43	Bb,Chw,F
C	Stinger	0.50	43	0	0	0	Chw,Sp	78	73	48	38	Ch,Chw,F
D	Stinger	1.00	65	0	0	0	----	89	81	60	66	Chw,F
E	Stinger Envy X-77	0.25 1.00 1/2%	65	78	32	68	Bb,Sp	87	33	78	73	Bb,Chw,Sp
F	Roundup Envy	1.00 1.00	75	71	71	64	Bb,Mp,Sp	95	10	98	97	Mp
G	Envy Goal 1.6 EC X-77	1.00 1.00 1/2%	73	67	44	67	----	90	63	97	86	Chw,Cl
H	Envy X-77	1.50 1/2%	60	32	22	56	----	84	36	85	50	Bb,Chw
J	Ignite 1.67 EC X-77	1.50 1/2%	92	98	99	99	----	100	0	100	100	----

*Emerged after the herbicide application on 4/17/90.
**WEEDS PRESENT: A = annual bluegrass, Bb = brass buttons, Chw = chickweed, Cl = clover, F = filaree, Mp = marsh parsley, Sp = shepherd's purse.

Table 6
Effect Of Postemergence Applied Herbicide On Weed Control In Almond Orchards
06,44, 425, 145,10,90-2

LOCATION: 7767 E. Barstow
SOIL TYPE: Hanford sandy loam
VARIETY: Nonpareil
HERBICIDES APPLIED: 4/17/90

IRRIGATION: Basin flood
PLOT SIZE: 5' X 15', Reps. 4
PLANTED: Mature orchard
EVALUATED: Various, see below

			WEED CONTROL EVALUATIONS, AVERAGE OF 4 REPS.									
			5/19/90						5/26/90		6/2/90	
HERBICIDE		Lbai/ Acre	% Dand. Control Established	% Dand. Control Seedling	% Other Broadlf. Control	% Grass Control Established	% Grass Control* Seedling	Weeds Present	% Dand. Control Established	% Dand. Control* Seedling	% Dand. Control Established	% Dand. Control Seedling
A	Envy 3.8 EC X-77	1.00 1/2%	88	21	60	73	74	Bb,Cl,Mp,Ss	66	5	85	5
B	Stinger 3 E X-77	0.25 1/2%	78	33	33	29	60	----	75	0	66	5
C	Stinger	0.50	91	33	20	18	54	Bb,Chw,Mp,Ss	90	38	90	38
D	Stin ger	1.00	94	35	45	29	44	Bb,Chw,F,Mp	96	66	98	70
E	Stinger Envy X-77	0.25 1.00 1/2%	91	24	68	61	20	Ss	93	0	96	0
F	Roundup Envy	1.00 1.00	98	0	78	100	13	Mp	98	0	98	0
G	Envy Goal 1.6 EC X-77	1.00 1.00 1/2%	95	69	69	85	40	Be,Chw	88	18	94	59
H	Envy X-77	1.50 1/2%	90	9	68	36	23	Bb,Chw,Cl,Ss	90	0	81	0
J	Ignite 1.67 EC X-77	1.50 1/2%	100	0	100	100	10	----	97	0	100	0

Emerged after the herbicide application on 4/17/90.
**WEEDS PRESENT: A = annual bluegrass, Be = bermudagrass, Bb = brass buttons, Chw = chickweed, Cl = clover, F = filaree, Mp = marsh parsley Ss=spotted spurge.

Table 7
Effect Of Postemergence Applied Herbicides On Dandelion Control In Almond Orchards
06,44, 425, 145,10,90-3

LOCATION: 7767 E. Barstow
SOIL TYPE: Hanford sandy loam
VARIETY: Nonpareil
HERBICIDES APPLIED: 4/28/90

IRRIGATION: Basin flood
PLOT SIZE: 5' X 15', Reps. 4
PLANTED: Mature orchard
EVALUATED: Various, see below

		DANDELION CONTROL EVALUATIONS, AVERAGE OF 4 REPS.							
		5/19/90		5/26/90		6/2/90		6/20/90	
HERBICIDE	Lbai/ Acre	% Control Established	% Control Seedling*	% Control Established	% Control Seedling*	% Control Established	% Control Seedling*	% Control Established	% Control Seedling
A Stinger 3EC	0.50	70	96	80	90	81	95	95	97
X-77	1/2%								
B Stinger	0.50	71	96	73	93	78	96	98	91
C Stinger	0.50	74	88	81	79	91	94	97	99
Roundup	0.50								
D Envy 3.8 EC	1.50	78	69	84	45	85	43	98	0
X-77	1/2%								
E Envy	1.00								
Goal 1.6 EC	1.00	94	98	94	93	94	100	97	89
X-77	1/2%								
F Ignite 1.67 EC	1.00	93	30	94	24	95	30	93	18
X-77	1/2%								
G Stinger	0.50								
Envy	1.00	83	93	93	90	98	95	99	65
X-77	1/2%								
H Envy	1.00	75	30	73	43	90	33	95	0
X-77	1/2%								

*Emerged after the herbicide application on 4/28/90.

TABLE 8

Effect Of Postemergence Applied Herbicides On The Control Of Clover In Almond Orchard

06, 44, 425, 146, 10, 90-4

LOCATION:	N.W. corner Kamm and Chestnut	IRRIGATION:	Sprinkler
SOIL TYPE:	Delhi loamy sand	PLOT SIZE:	10' X 24', Reps. 3
VARIETY:	Non-pareil, Thompson	PLANTED:	Established orchard
TREATED:	6/6/90	EVALUATED:	6/15, 6/19, 7/14/90

			6/15/90	6/19/90	7/14/90			
	Herbicide	Lbai/ Acre	% Clover Control	% Clover Control	% Clover Control	% Spotted Spurge Control	% Nut-sedge Control	% Horse-weed Control
A	Stinger 3EC X-77	0.25 1/2%	51	56	95	0	0	50
B	Stinger X-77	0.50 1/2%	56	60	94	0	---	75
C	Stinger X-77	1.00 1/2%	73	71	100	0	---	60
D	Stinger Surfel	0.50 1 qt.	65	66	100	0	0	55
E	Stinger Roundup 4EC	0.50 0.50	71	73	98	22	37	20
F	Untreated	----	0	0	0	0	0	0

Remarks: The horseweed in the Stinger treated plots show quite severe symptoms. The terminals are somewhat chlorotic and twisted and it has not grown since the treatment. However, some of the plants, especially the larger ones, were not killed. In the areas outside the trial area treated with Stinger, 1/2 lb. Roundup and Surfel provided very good control of the clover and other weeds; however, the spotted spurge is beginning to reinvade these areas.