

## Overseeding as a pest management tool in alfalfa in the Sacramento Valley

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### Introduction

Alfalfa is a major industry in California with over a million acres grown throughout the state. To maintain high production, over 126 tons of insecticides and 500 tons of herbicides are applied annually to this crop to control the major insect pest, alfalfa weevil, and weeds. This chemical use is costly for environmental, health, economic, and political reasons. As an alternative pest control practice, we found in a 3 year research trial in the Sacramento Valley that overseeding forages into alfalfa can help mitigate pest and weed problems, reducing the need for chemical treatments.

### Overseeding treatments

The forage species that we used to overseed in alfalfa stands are described in the following table. Through our evaluations and the other research trials cited, we came up with the following management practices for overseeding the following forages in alfalfa.

Management practices associated with overseeding forages in alfalfa.

Treatment	Seed rate (lb/A)	Planting method & depth (in)	Fertility	Plant date Sacramento Valley	Time of 1st harvest
Berseem- annual <i>T. alexandrium</i>	8	Broadcast/ roll 0.25	inoculate	Oct-Nov	Feb-Mar
Red clover- perennial <i>T. pratense</i>	12	Broadcast/ roll/0.25	inoculate	Oct-Dec	Mar-Apr
Orchardgrass- perennial <i>D. glomerata</i>	6	Broadcast/ harrow 0.5	30-60 lbs nitrogen	Oct-Dec	Mar-Apr*
Oats- annual Montezuma	50	Broadcast/ harrow 1.5	30 lbs nitrogen/A	Nov-Jan	Mar-Apr*

\*Earlier cutting in the vegetative stage gives higher protein and lower acid detergent fiber.

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### Weed control

The following table shows the percent weeds and percent reduction for winter weeds (cut 1) and summer weeds (cut 5). These data come from a 3 year study in the Sacramento Valley (Reed et al., in prep.). Only orchardgrass and oats significantly reduced winter weeds in our trials; berseem consistently reduced weeds in all 3 years of our study, but this difference was not significant from the alfalfa control plots. Summer weeds were suppressed by orchardgrass and red clover.

Percent weeds in the overseed plots compared to alfalfa.

Treatment	Cut 1		Cut 5	
	% weeds	% reduction	% weeds	% reduction
Alfalfa	48	-	44	-
Berseem	38	20	39	11
Red clover	41	15	20	55
Orchardgrass	26	46	1	98
Oats	6	88	67	0

### Forage Dry Matter Yields

The following table summarizes the dry matter yields that can be expected from overseeding with the described forages, in the Sacramento Valley. Research has shown that berseem overseeded into alfalfa can boost yields by up to 2 tons/acre over alfalfa alone, mostly in the first 3 harvests. Red clover is a slow starting perennial, so maximum production may be realized in the second year. Since red clover is a cool season legume, yields are low during the summer months. Orchardgrass is also a slow growing perennial. Since this is a cool season grass, maximum yields are found in the spring and fall in the Sacramento Valley; our summer months are too hot for this grass. Oats will increase forage yields between 0.5 to 3 tons/acre in the first 3 cuts, depending on time of harvest.

Ranges of dry matter yields (tons/A) in the overseed plots compared to alfalfa.

Treatment	Cut 1-3 (tons/A)		Cut 4 - 5 (tons/A)	
	Yield	Increase	Yield	Increase
Alfalfa	3.0	-	2.0	-
Berseem	3.5 - 5	0.5 - 2	2.0 - slight*	0 - slight
Red clover	3.0 - 3.8	0 - 0.8	2.0	0
Orchardgrass	3.0 - 4	0 - 1	2.0	0
Oats	3.5 - 6	0.5 - 3	2.0	0

\*slight yield increase in 4th cutting in years with cool spring weather.

### Forage quality

The following table shows the ranges of forage quality (crude protein and acid detergent fiber, ADF) expected from alfalfa overseed mixtures. Mixtures of alfalfa with berseem and red clover are similar in quality to alfalfa and do not substantially change the nutritional value of the forage compared with alfalfa alone. Oats and orchardgrass mixtures are popular with the horse market because the lower protein is more appropriate for the horse diet.

Proper harvest timing is important in determining forage quality. For dairy markets, the crop should be harvested before the crop is overly mature to maintain forage quality. For alfalfa, berseem, and red clover, harvest in the late vegetative or early bud stage for dairy markets (higher protein). For orchardgrass and oats, harvesting in the boot stage before the plant is in flower and well before seed heads have formed is appropriate for dairy markets (higher protein); the later dough stage is more appropriate for horse or stock hay (lower protein).

Ranges of forage quality in the overseed plots compared to alfalfa.

Treatment	Forage Quality	
	Protein	ADF
Alfalfa (supreme)	22-26	<27
Berseem	16-22	32-36
Red clover	16-20	31-34
Orchardgrass	16-23	32-36
Oats	13-22	32-35

### Moisture at harvest and stand counts

Forage moisture at harvest will affect curing time in the field. If material is too wet, losses in yield and quality may occur before the crop can be removed from the field as hay. Growers may want to wilt forage for haylage, if harvest moistures are too high. Berseem/alfalfa mixtures consistently have higher moisture contents than alfalfa alone. Oats may also contain more moisture than alfalfa alone.

Berseem, orchardgrass, and oats may reduce alfalfa stand counts, particularly in weak alfalfa stands (<3-5 plants/ft<sup>2</sup>). In stronger growing, younger alfalfa stands, overseeding did not affect stand counts in our trials. The following table shows the percent moisture and stand count for the different overseed treatments in our trials.

Average percent moisture and stand counts in overseed plots compared to alfalfa.

Treatment	% Moisture Cuts 1-3	Stand count plants/ft <sup>2</sup>
Alfalfa	78	5.6
Berseem	83	4
Red clover	78	4.2
Orchardgrass	78	3.8
Oats	79	4

## Weevils

The following table shows the number of weevils per sweep and percent damage to alfalfa and the clovers in the overseed plots. Overseeding consistently reduced the number of weevils per sweep by up to 50% compared to the untreated alfalfa control plots; however, weevil damage to alfalfa remained the same. The oat plots had the highest level of weevil damage and the fewest weevils because we could not get the sweep net in the oat canopy to sample the alfalfa plants. Weevil damage to the berseem and red clovers averaged about 5%; indicating some type of resistance by these plants to this insect pest.

Average number of alfalfa weevils/sweep and percent damage to alfalfa and clovers.

Treatment	Weevils/sweep	% alfalfa damage	% clover damage
Alfalfa untreated	9	37	-
Alfalfa treated*	0.4	16	-
Berseem	4	38	6
Red clover	6	35	5
Orchardgrass	6	37	-
Oats	2	50	-

\*Lorsban

## Economic Analysis

Although overseeding did not significantly reduce alfalfa weevil numbers or damage to alfalfa in the overseed plots, our yield data shows that berseem clover can mitigate losses from weevil damage in alfalfa and eliminate the need for pesticide applications. Berseem yields were higher than our alfalfa weevil treated plots, despite not using any insecticides for weevil control. Berseem filled in the plots and made up for the loss in damage by the weevils to the alfalfa. Berseem also provided some winter weed control, so we did not use any herbicides in these plots. The following table describes the costs for overseeding berseem in alfalfa compared with conventional management costs. Net returns for overseeding with berseem are higher than for the alfalfa weed and weevil treatments.

Estimated costs for overseeding berseem into alfalfa compared with conventional management costs.

Treatment	Costs/A (\$)	Weevil Damage (%)	Tons/A (cut 1-3)	Net return (\$/A) (@\$100/T)
Alfalfa untreated	0	37	1.9	190
Alfalfa treated *	58	0	3.0	242
Berseem**	53	6	3.8	327

\*Insecticide and herbicides

\*\*Seed (8 lbs/A @ \$1.85/lb), planting, & irrigation

### Market considerations

Because the species chosen for the mixed alfalfa forage will influence the end market, growers should define their forage quality and market goals before they decide which species to use. The following table describes the primary or preferred markets for different alfalfa mixtures.

Primary markets for mixtures of alfalfa with various species\*.

Market	Berseem	Red clover	Oats	Orchardgrass
High producing dairy cows	x	x		
Dairy cows- late lactation	x	x		x
Dry cows and heifers			x	x
Beef cattle			x	x
Horses	x	x	x	x
Sheep			x	x

\*Forage quality of mixed forages is highly dependent on cutting schedules. Changes in cutting schedule will have a large impact on potential markets.

### Summary

For vigorous, weed-free alfalfa, there is no need to mix it with other crops. However, with older or weakened stands, yields are lowered when counts fall below 4-6 plants/ft<sup>2</sup>. Overseeding can be used to extend stand life, increase yields, give growers new opportunities to market a crop in its last year of production, and provide an alternative pest and weed control strategy. The following table summarizes the advantages and disadvantages of overseeding with berseem, red clover, orchardgrass, and oats in the Sacramento Valley.

Treatment	Advantages	Disadvantages
Berseem	<ul style="list-style-type: none"> <li>• Good forage quality</li> <li>• Good spring yields</li> <li>• Some winter weed control</li> <li>• Resistant to weevils</li> <li>• Moderately alkali tolerant</li> <li>• Tolerates heavy, wet soils</li> <li>• Does not cause bloat</li> </ul>	<ul style="list-style-type: none"> <li>• Increased drying time at harvest</li> <li>• Annual-persists for 4 cuttings</li> <li>• May reduce alfalfa stands</li> <li>• Finding a market</li> </ul>
Red clover	<ul style="list-style-type: none"> <li>• Good forage quality</li> <li>• Tolerates heavy, wet soils</li> <li>• Resistant to weevils</li> <li>• Some summer weed control</li> </ul>	<ul style="list-style-type: none"> <li>• Slow growing perennial</li> <li>• May reduce alfalfa stands</li> <li>• Finding a market</li> </ul>

Orchardgrass	<ul style="list-style-type: none"> <li>• Good horse hay market</li> <li>• Good yields in inter-mountain area</li> <li>• Good summer weed control</li> <li>• Partial winter weed control</li> </ul>	<ul style="list-style-type: none"> <li>• Low forage quality</li> <li>• Cool season grass (low yielding in Central Valley)</li> <li>• Perennial, so slow to get started</li> <li>• Susceptible to rust</li> <li>• Fertilizer input</li> <li>• Finding a market</li> </ul>
Oats	<ul style="list-style-type: none"> <li>• Good yield in first cutting</li> <li>• Good winter weed control</li> <li>• Possible reduction in alfalfa weevils</li> </ul>	<ul style="list-style-type: none"> <li>• May have some reduction in alfalfa growth (first cutting)</li> <li>• Increased drying time at harvest</li> <li>• Fertilizer input</li> <li>• Finding a market</li> </ul>

### References

- Bendixen, W. E. and W. T. Lanini. 1994. Interplanting cereals and grasses into the last year of an alfalfa stand. *Proc. Western Soc. Weed Sci.* 47:91-95.
- Canevari, M., D. Putnam, T. Lanini, R. Long, S. Orloff, B. Reed, R. Vargas. 1998. Overseeding, and companion cropping in alfalfa. Manuscript in preparation.
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