

ALFALFA, TIME OF PLANTING

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1977-78 Date of Planting Test

Alfalfa growers frequently debate the merits of fall versus spring seeding of alfalfa. There are a number of advantages and disadvantages to each time of seeding and weather conditions have considerable influence on successful stand establishment at either time of year. In order to test the influence of planting date on forage yielding ability of alfalfa, a test program was set up on the Northrup-King Research Farm near Woodland, California in the fall of 1977.

Soil type of the field chosen for the experiment was Capay Silty Clay. The previous crop was winter wheat. Following June wheat harvest, the field was disked, ridged and pre-irrigated to germinate crop seeds. A seedbed was prepared by cultivation in early September and benefin incorporated as a preplant weed control measure.

A completely randomized experimental design was used for the test with four treatments replicated five times. Plot size was 5 x 14' and the variety was Amador. Alfalfa seed was hand broadcast and covered by rolling or hand raking at each planting date.

The first seeding date was September 14. Hand move sprinklers applying .25 inches of rain per hour were operated for approximately five hours following planting. Air temperatures were in the range of 72° to 89° F (maximum) and 49° to 55° F (minimum) during the week following irrigation. Alfalfa seed germinated rapidly and cotyledons were completely emerged within four days of sprinkling.

The second planting was sprinkled on October 17. Air temperatures were in the range of 75° to 85° F (maximum) and 42° to 55° F (minimum) during the week following irrigation. On October 27 a storm deposited .44" of precipitation. Seed germination and seedling development were less rapid than with the September planting.

The final fall seeding was sprinkled up on November 16. Temperatures had dropped to 49° to 75° F (maximum) and 29° to 47° F (minimum) by the week of planting. A storm dropped 2.55" of precipitation on November 21 and 22. These seedlings emerged and grew very slowly

By December 2, (going into the winter season) alfalfa seedlings of each treatment had top growth as shown in Table I.

Table I. Top Growth of Seedling Alfalfa, December 2, 1977

<u>Date of Planting</u>	<u>Top Growth 12/2/77</u>
September 14	4 inches
October 17	1/2 inch
November 16	Cotyledons just emerged

The following February, alfalfa seedlings of each treatment showed top and root growth as depicted in Table II.

Table II. Top and Root Growth of Seedling Alfalfa, February 23, 1978

<u>Date of Planting</u>	<u>Top Growth 2/23/77</u>	<u>Root Growth 2/23/77</u>
September 14	6 inches	7 inches
October 17	2 inches	5 inches
November 16	1/2 inch	3 inches

A number of the November seedlings emerged and died during the winter season. Plant death was probably due to saturated soils and fungus diseases rather than frost since the 1977-78 winter was very warm and wet.

The spring planting was delayed until March 17, 1978, due to wet soil conditions. On March 21 and 22, .34" of precipitation fell and germinated the seed. Temperatures ranged 64° to 80° F (maximum) and 40° to 53° F (minimum) for ten days following seeding. A thick stand of seedlings were in the cotyledon or unifoliate leaf stage by April 5.

The first harvest of each treatment was delayed until alfalfa plants had produced three to four stems per crown. By May 11, the September and October seedlings were well enough developed for harvest. The November and March plantings were harvested for the first time on June 7 and July 7 respectively.

Plant density counts (plants/square foot) were made on July 10, following the third harvest date.

Table III. Alfalfa Density Count - July 10, 1978

Planting Date	Plants Per Square Foot	DMR .05 ^{1/}
October 17	57	a
March 21	54	ab
September 14	45	bc
November 16	38	c
LSD.05	11	
CV	16.3	

/ (Duncans Multiple Range Test for significance - 5% level of probability)

All treatments developed excellent stands. Twenty-five plants per square foot is considered a full stand for a first year planting. The November planting had the least number of plants per square foot, this is attributed to seedling death during the wet, cool December to February period. It is not known why the September planting should have less plants than that of the October seeding. A very dense stand of seedlings developed at the March planting and had not yet self-thinned.

Plants of the September and October seeding dates generally had larger crowns and roots than plants of the later plantings.

Alfalfa, sprinkled up on September 14, 1977, yielded 7.3 tons per acre through five cuttings as compared to 6.5 tons per acre for the October 17 planting, 5.6 tons for November 16, planted alfalfa, and 4.0 tons per acre for alfalfa planted on March 21, 1978. (Table IV)

Table IV. Hay Yield Comparisons of Alfalfa Planted on Four Dates in 1977-78

Planting Date	Yield in tons per acre by cutting and total -- 100% dry matter					Total Yield	DMR.05
	Harvest Dates 1978						
	(1) 5/11	(2) 6/9	(3) 7/7	(4) 8/7	(5) 9/7		
Sept. 14, 1977	1.56	1.54	1.31	1.59	1.28	7.28	a
17, 1977	1.27	.47	.14	.44	1.22	6.54	b
16, 1977		.88	1.18	1.43	1.12	5.60	
Mar. 21, 1978			1.57	1.36	.07	4.00	d
LSD.05	.10	.14	.24	.15	.15	.52	
CV	5.0	6.3	13.5	7.5	9.6	6.6	

Date of Planting Effect on Second Year Alfalfa

Since there was a definite trend for early fall plantings to maintain higher yields through the fifth cutting, the test was continued through a second season.

Plant counts taken in February 1979 showed that all alfalfa stands had thinned appreciably (Table V).

Table V. Alfalfa Density Count - 1977-78 Planting
February 9, 1979

<u>Planting Date</u>	<u>Plants Per Square Foot</u>	<u>DMR .05</u>
October 17, 1977	22.3	a
March 21, 1978	19.2	ab
September 14, 1977	18.5	b
November 16, 1977	16.9	b
LSD.05	3.5	
CV	13.7	

By late April 1979, weather conditions were favorable for hay making and a regular harvest schedule was initiated on this second year alfalfa. Six harvests were completed by October 11, 1979. The two early fall (1977) seedings continued to produce greater yields of hay than late fall (November) or early spring (1978) planted alfalfa.(Table V.)

Table VI. Hay Yield Comparisons of Alfalfa Planted on Four Dates in 1977-78
Second season yields in tons per acre by cutting and total -- 100% dry matter
Harvest Dates

<u>Planting Date</u>	<u>Harvest Dates</u>						<u>Total Yield</u>	<u>DMR .05</u>
	<u>4/25</u>	<u>5/25</u>	<u>6/27</u>	<u>7/26</u>	<u>8/24</u>	<u>10/11</u>		
Sept. 14, 1977	1.11	1.46	1.64	1.78	1.22	.98	8.19	a
Oct. 17, 1977	1.11	1.35	1.50	1.72	1.20	1.00	7.88	a
Nov. 16, 1977	1.07	1.29	1.41	1.65	1.10	.91	7.44	b
Mar. 21, 1978	1.00	1.27	1.36	1.53	1.17	1.00	7.33	b
LSD.05	.08	.17	.12	.12	NS	NS	.39	
CV	5.7	9.3	6.1	6.0	6.5	6.5	3.8	

Yield advantages of spring planted alfalfa were statistically significant on cuttings one through four and for the season as a whole. Differences were not as great as occurred in the year of stand establishment but were still in the area of one half ton per acre. It is speculated the continued yield differences may be due to greater root development of early fall planted alfalfa but this was not documented.

When first and second season yields are combined (Table VII) there is an overall advantage of from 1.4 to 2.4 tons per acre for the early fall plantings as compared to late fall or early spring seedings. This yield advantage should more than pay for additional cost of sprinkling up early fall planted alfalfa.

Table VII. Hay Yield Comparison of Alfalfa Planted on Four Dates in 1977-78
Total Yield, Two Seasons - 1978 and 1979 in tons per acre - 100% dry matter

<u>Planting Date</u>	<u>Total Cuttings</u>	<u>Total Yield Two Seasons</u>	<u>DMR .05</u>
Sept. 14, 1977	11	15.47	a
Oct. 17, 1977	11	14.42	b
Nov. 16, 1977	10	13.04	c
Mar. 21, 1978	9	11.33	d
LSD.05		.80	
CV		4.42	

1978-79 Date of Planting Test

To verify results of the 1977-78 test, an identical experiment was planned and carried through during the 1978-79 season. Principal differences between the two tests were planting dates and weather conditions during germination and seedling growth periods

The 1978 early planting was made on September 22, eight days later than the previous year. Sprinklers were operated for four hours on September 22 and 4 hours on September 23 to germinate seed. Soil temperatures reached a maximum of 90° F in the top inch at 4 p.m. on this seeding date. Alfalfa cotyledons emerged within 72 hours of sprinkling. Within seven days of sprinkling the seedlings were showing a unifoliate leaf and on October 5 the first true leaf was unfolding.

The second planting was sprinkled on October 24. Temperatures in the top inch of soil reached a maximum of 80° F. Alfalfa cotyledons emerged within 96 hours of sprinkling. Strong, drying north winds caused slight crusting and plots were re-sprinkled on November 7. October seedlings reached unifoliate leaf stage within 21 days of sprinkling, and the first true leaf unfolded 31 days after germination. Minimum air temperatures of 30, 29 and 32 were recorded 19, 22 and 24 days following the October planting.

The third seeding was planted into a moist seedbed on November 27, 1978. Maximum soil temperatures in the top inch were 63° F at this seeding date. A few seedling cotyledons emerged within 11 days of planting, unifoliate leaves appeared 53 days after planting and the first trifoliate leaves appeared 71 days following planting. Seventeen days of below freezing (32° F) air temperatures were recorded at Woodland during December. Some alfalfa seedlings were killed by frost during this period.

By February 6, 1978, alfalfa seedlings of each treatment had top growth as shown on Table VIII.

Table VIII. Top Growth of Fall Planted Seedling Alfalfa

<u>Date of Planting</u>	<u>Top Growth 2/6/79</u>
September 22	8 inches
October 24	2 inches
November 27	Cotyledon and Unifoliate leaf

The spring seeding was planted on February 9, 1979, maximum temperatures in the top 1 inch of soil averaged 71° F. A rainy period occurred during the next 23 days and a total of 5.77 inches of rain fell in the Woodland area. By March 12 it was evident that seedlings of the February planting had been killed by excess soil moisture and seedling diseases.

A second seeding was planted on March 13 and germinated by rainfall on March 14, 1979. Maximum temperatures in the top inch of soil averaged 74° F. Alfalfa cotyledons were emerging the fifth day following rainfall. Within 19 days the first trifoliate leaves were appearing and a dense stand of seedling alfalfa was established.

On April 24, plants were taken from each of the treatments for measurements on top and root growth (Table IX).

Table IX. Top and Root Growth of Seedling Alfalfa
April 24, 1979

<u>Date of Planting</u>	<u>Plant Height (in inches)</u>	<u>Root Length (in inches)</u>	<u>Root Diameter (in millimeters)</u>
September 22, 1978	22	14	5-6
October 24, 1978	17	6	3-4
November 27, 1978	13	6	2-3
March 14, 1979	4	3	1

September seeded alfalfa plants were well established by April with greater top and root growth than plants of other treatments. Roots of many October and November seedlings were unable to penetrate a clay layer at 6 inches and some plants showed symptoms of root rot. The March planting was in the seedling stage at this time.

By May 17, the September seeding was ready for first harvest. Other plantings had less than three stems per crown and judged not well enough established for cutting. By June 13th, October and November plantings were ready for harvest and all treatments were harvested by third cutting on July 19. Plant density counts (plants/square foot) were made following fourth harvest (Table X).

Table X. Alfalfa Density Count - 1978-79 Planting

<u>Planting Date</u>	<u>Plants Per Square Foot</u>	<u>DMR .05</u>
March 14, 1979	77	a
October 24, 1978	59	b
September 22, 1978	34	c
November 27, 1978	32	c
LSD.05	9.5	
CV	14.0	

As in the earlier experiment, all treatments developed excellent stands

The date of planting experiment was harvested five times during the 1979 season. Hay yields are shown in Table XI.

Table XI. Hay Yield Comparisons of Alfalfa Planted in Four Dates in 1978-79
Yield in tons per acre by cutting and total
Harvest Dates 1979

<u>Planting Date</u>	<u>5/17</u>	<u>6/13</u>	<u>7/19</u>	<u>8/15</u>	<u>10/2</u>	<u>Total Yield</u>	<u>DMR. 05</u>
September 22, 1978	1.77	1.75	1.86	1.45	1.22	8.05	
October 24, 1978		1.50	1.57	1.33	1.11	5.51	b
November 27, 1978		1.2	1.51	1.30	1.10	5.11	c
March 14, 1979			1.47	1.27	.91	3.65	d
LSD.05		.20	.16	.10	.13	.38	
CV		9.92	7.54	5.68	9.12	5.01	

Yield comparisons for the 1978-79 season show an even greater advantage for September planting than in the 1977 experiment. October and November plantings were more nearly alike in yield, both showing considerable advantage over the spring seeding.

All fall (1978) plantings were later, by a week to ten days, than in 1977. In addition, the 1978-79 winter season was much colder (37 days with minimums of 32° F or lower) than the previous year (4 days with minimums of 32° F or lower). As a consequence, the September planting with its early start had a substantial growth advantage over later plantings.

Discussion

Early to mid-September planting of alfalfa has shown a first year yield advantage of 2.1 to 3.8 tons per acre over late fall or early spring seeding in two Woodland area experiments. Yield advantages carried through the second season of the 1977-78 test. If alfalfa growers are able to prepare seedbeds during early summer and have access to sprinkler systems, irrigating up seedling alfalfa in early September appears advantageous. Several items should be considered when planning early fall plantings.

It is desirable to pre-irrigate in August to sprout weed or volunteer cereal seed and to wet the soil to at least a foot in depth.

2. If winter weeds are anticipated, incorporation of a pre-plant herbicide may be desirable during final seedbed preparation.
3. Alfalfa seed may be drilled or broadcast but should not be planted deeper than one-half inch. Shallow planted seed will emerge rapidly when sprinkled.
4. Sprinkler nozzles should apply a fairly fine spray to avoid packing of soil and subsequent crusting. Some soil types are much more likely to crust than others. A grower must know his own soil and decide whether sprinklers can be used effectively.
5. Sprinklers should be shut off before the point of surface water runoff. It may be necessary to operate sprinklers for two short intervals rather than one long set. Runoff will cause puddling of soil and crusting.
6. Sprinklers should not be operated in strong winds. Wind driven water will cause severe crusting.
7. If winds do occur, it may be necessary to resprinkle within three to four days to prevent soil drying, crusting and seedling death.
8. Weeds, such as bur clover, can be a serious problem with early fall planted alfalfa. Bur clover will germinate and grow rapidly in the early fall and can smother alfalfa seedlings. No herbicides are available to remove bur clover from alfalfa. Ryegrass, wild oats and other grassy weeds will smother alfalfa if not controlled in the seedling stage.
- 9 The grower must decide whether the increased yields will pay the cost of sprinkling.
10. Finally, September planting is not a panacea that guarantees perfect stands. Each alfalfa grower must decide for himself if this method of stand establishment fits into his operation.