

Experiment: Fertilizer Comparisons in Irrigated Alfalfa
Cooperator/Location: Irrigation Research Foundation
 Yuma, CO

Year: 2008

Plot Size: 20 x 400 ft (non-replicated)

Soil Test Levels (ppm)

pH: 7.4 C.E.C.: 6.2
 OM: 0.6% Bicarb P: 13 ppm
 S: 4 ppm K:131 ppm (5% BS)

Objective: Determine effects of fertilizer application timing and sources on alfalfa yield and quality.

The Irrigation Research Foundation is a private, non-profit, independent research and demonstration farm. The main purpose of the IRF is to promote proper water usage and to provide a location for testing important issues that affect the region's agricultural producers (from the IRF website). An experiment was conducted to evaluate several different Liquid fertilizer treatments for effect on alfalfa yield and quality. Liquid treatments were applied in strips. Liquid treatments were applied around 10 days after harvests which allowed for around 4 to 5 inches of regrowth. These treatments were broadcast applied with a ground sprayer. One of the treatments, trt 2 below, was applied in the early spring before any new growth had appeared, and was applied with stream-bar type nozzles. Comparisons were made against a dry fertilizer program. The dry program was applied in early spring. This is the third year of this experiment, and main treatments were kept in the same plot from year to year. The dry fertilizer application varied each year. There were four cuttings. Cutting dates for harvest were on 5/29, 6/28, 8/1 and 8/29. There was a bad hail storm prior to first cutting which affected yields. For yield determination, samples were collected from dried windrows and weighed. Samples were also collected and sent to Olsen's Agricultural Laboratory of McCook for quality analysis.

For 2008, the following treatments were applied:

<i>Table 1. Alfalfa fertilizer treatments.</i>	
Irrigation Research Foundation - 2008	
trt	Fertilizer applied (rates/A)
1	dry: one application of 188 lb of 5-21-32-5.3 (9.4 lb/A N; 40 lb/A P ₂ O ₅ ; 60 lb/A K ₂ O; 10 lb/A S)
2	one application in spring: 10 gal ATS* + 7 gal Pro-Germinator + 6 gal Sure-K + 2 qt Micro 500 + 1 qt Boron
3	3 applications after 3 cuttings: 4.5 gal AX-102 + 2 gal Sure-K + 21 oz Micro 500 + 11 oz Boron + 21 oz Sulfur
4	Spring and after 3 cuttings: 1.75 gal Pro-Germinator + 1.5 gal Sure-K + 16 oz Micro 500 + 8 oz Boron + 16 oz Sulfur
5	3 apps after 3 cuttings: 2.3 gal Pre-Germinator + 2 gal Sure-K + 21 oz Micro 500 + 11 oz Boron + 21 oz Sulfur
6	3 apps after 3 cuttings: 2.3 gal Pro-Germinator + 2 gal Sure-K + 21 oz Micro 500 + 11 oz Boron + 2 gal High-NRG-N
* - Ammonium Thio-Sulfate (12-0-0-26S)	
Dates of application: Spring: 4/4. Post harvest: 6/14; 7/8; and 8/11; following harvests on 5/29; 6/28 and 8/1.	

Each of these Liquid treatments (except trt 3) applied a total of 7 gal/A Pro-Germinator, 6 gal/A Sure-K, 2 qt/A Micro 500, 1 qt/A of Boron and 2 qt/A Sulfur (except trt 6). The treatment differences were the timings and additives:

Trt 2: one spring application plus addition of Ammonium Thio-Sulfate.

Trt 3: tested experimental fertilizer AX-102, a 4-11-1 analysis containing organic material.

Trt 4: applied the fertilizer over 4 applications: spring and after harvests

Trt 5: applied the fertilizer over 3 applications: after harvests

Trt 6: applied the fertilizer over 3 applications, and contained 2 gal/A High NRG-N, and no Sulfur.

It is noted that these treatments are applying more "equivalent" nutrition than the dry treatment. The dry treatment nutrient applications are in Table 1. In terms of actual nutrition applied, treatment 5, which has the base nutrients of most other treatments, applied 8.2 lb/A of N, 19.2 lb/A of P₂O₅; 5.9 lb/A of K₂O and 0.3 lb/A of sulfur.

For this report, harvest results for yield, crude protein and relative feed value are shown below. For comparisons, the treatments are ranked from top to bottom by either total or average for the measurements listed.

Yield. Alfalfa production as measured by the four cuttings is shown in Table 2.

<i>Table 2. Alfalfa fertilizer treatment yields (T/A)</i>						
Irrigation Research Foundation. Yuma, CO - 2008						
trt.	Harvest no.				total	Rank
	1	2	3	4		
1	0.36	0.9	0.95	1.02	3.23	6
2	0.49	1.08	1.2	1.22	3.99	4
3	0.49	1.44	1	1.22	4.15	2
4	0.67	1.44	1	1.12	4.23	1
5	0.43	1.44	1	1.22	4.09	3
6	0.36	1.26	1.1	1.22	3.94	5

- The hail storm essentially wiped out the first harvest.
- The top treatment was where the Liquid fertilizer was split into four applications: spring and then after each harvest. The damage from the hail makes assessment difficult for the first harvest, but perhaps some early nutrition is beneficial.
- The lowest yield is from the dry treatment which had the lowest yield at each harvest.

Alfalfa crude protein.

<i>Table 3. Alfalfa % crude protein by fertilizer treatment</i>						
Irrigation Research Foundation. Yuma, CO - 2008						
trt	Harvest no.				avg.	rank
	1	2	3	4		
1	21.6	23.3	20.4	24.3	22.4	3
2	22.4	23.7	20	23.6	22.4	3
3	21.5	23	21.9	24.8	22.8	1
4	22.4	21.9	21.2	25.3	22.7	2
5	20.7	21.9	21.6	24.4	22.2	5
6	20.3	23.3	20.7	24.4	22.2	5

- The overall average protein values are all similar. It is not clear why the protein numbers are all higher at the fourth harvest. But the top ranked treatment is where the test fertilizer AX-102 was applied.
- At the first cutting, the two highest protein values are where there was a spring application of Liquid fertilizer, trt 2 and 4.
- It was expected that addition of High NRG-N (trt 6) would have a greater effect on protein than seen here. This has been observed before.

Relative Feed Value.

<i>Table 4. Alfalfa Relative Feed Value by fertilizer treatment</i>						
Irrigation Research Foundation. Yuma, CO - 2008						
trt	Harvest no.				avg	rank
	1	2	3	4		
1	175	207.5	167.5	225.3	193.8	5
2	204.7	202.1	171.5	211.8	197.5	2
3	193.2	184	204.1	235.3	204.2	1
4	194.8	178	183.1	213.1	192.3	3
5	176.9	183.7	193.8	213.6	192.0	4
6	163.7	199.3	181.4	212.6	189.3	6

- The application of the Liquid fertilizer in one application with the Ammonium Thio-Sulfate (trt. 2) evidently had a large effect on RFV for the first harvest and possibly the second. It is not clear why there is a big jump in RFV for the dry fertilizer (trt. 1) at the second harvest.
- The AX-102 pushed RFV values upward in the third and fourth harvest, making trt 3 the top-ranked treatment. All values are higher at the fourth harvest, but especially the treatment with the AX-102.

Overall rankings for 2008.

<i>Table 5. Treatment rankings for alfalfa measurements</i>							
Irrigation Research Foundation. Yuma, CO - 2008							
trt.	T/A	rank	protein	rank	RFV	rank	avg rank
1	3.23	6	22.4	3	193.8	3	4.0
2	3.99	4	22.4	3	197.5	2	3.0
3	4.15	2	22.8	1	204.2	1	1.3
4	4.23	1	22.7	2	192.3	4	2.3
5	4.09	3	22.2	5	192.0	5	4.3
6	3.94	5	22.2	5	189.3	6	5.3

- The overall top-ranked treatment was where the experimental fertilizer AX-102 was applied. It produced the top average protein and Relative Feed Values, and was second for yield.
- Of current available products, the Liquid applied in four applications (trt. 4) was tops, and also produced the highest overall yield.

Three year summary. As indicated earlier, this is the third year of this experiment. Five of the six treatments have been the same for all three years. The exception was treatment 3 which tested the new fertilizer AX-102. In 2006 and 2007, treatment three was for a single springtime application of the entire Liquid fertilizer program. This was the lowest ranked Liquid treatment in those two years, so it was replaced in 2008 in order to test the new fertilizer. But otherwise, the same treatments were applied to the same plots. Data was summarized similar to that of 2008 and then averaged over all three years for final summarization. (Note: In 2006, yields were collected only on harvests 2,3 and 4)

Tables 6, 7 and 8 show the results by year for total yield (T/A), average % crude protein and average Relative Feed Value (RFV). Each of these values are ranked, and then an average rank

is given as before. There are only five treatments as previously explained, and the 2008 table (Table 5) is re-figured for this reason. Then Table 9 gives the three year average ranking for each measurement, and then the overall average ranking.

Table 6. Fertilizer effects on alfalfa for three harvests.
Irrigation Research Foundation. Yuma, CO - 2006

trt	total		avg.		avg.		avg.
	T/A	rank	%protein	rank	RFV	rank	rank
1	4.17	5	22.2	4	167.6	5	4.7
2	4.28	3	24.2	1	190.6	1	1.7
4	4.37	1	22.3	3	174.9	3	2.3
5	4.35	2	21.8	5	171.2	4	3.7
6	4.25	4	23.1	2	185.2	2	2.7

Table 7. Fertilizer effects on alfalfa for four harvests.
Irrigation Research Foundation. Yuma, CO - 2007

trt	total		avg.		avg.		avg.
	T/A	rank	%protein	rank	RFV	rank	rank
1	6.15	4	22.1	3	182.5	4	3.7
2	6.04	5	21.9	4	185.5	3	4.0
4	6.26	3	22.6	2	196.2	2	2.3
5	6.73	1	21.4	5	176.4	5	3.7
6	6.47	2	22.8	1	202.7	1	1.3

Table 8. Fertilizer effects on alfalfa for four harvests.
Irrigation Research Foundation. Yuma, CO - 2008

trt	total		avg.		avg.		avg.
	T/A	rank	%protein	rank	RFV	rank	rank
1	3.23	5	22.4	2	193.8	2	3.0
2	3.99	3	22.4	2	197.5	1	2.0
4	4.23	1	22.7	1	192.3	3	1.7
5	4.09	2	22.2	4	192.0	4	3.3
6	3.94	4	22.2	4	189.3	5	4.3

Table 9. Fertilizer effects on alfalfa: Average rankings.
Irrigation Research Foundation. Yuma, CO. 2006 - 2008

	total		avg.		avg.		avg
	T/A		%protein		RFV		rank
1	4.7		3		3.7		3.8
2	3.7		2.3		1.7		2.6
4	1.7		2		2.7		2.1
5	1.7		4.7		4.3		3.6
6	3.3		2.3		2.7		2.8

- Alfalfa research is difficult as there was a different overall top-ranked treatment each year.
- As indicated in the 2008 discussions, the treatment with High NRG-N (trt 6) did not fare as well in 2008 as it did in 2007, where it was the overall top treatment.

- The three-year top treatment was Treatment 4, where the Liquid treatment was split into four applications, including a spring application. This shows the benefits of even feeding. This treatment was the top yielder (T/A) in 2006 and 2008.



Alfalfa fertilizer test area at the Irrigation Research Foundation in Yuma, Colorado. Picture was taken on June 26, two days before the second cutting.