

Alfalfa

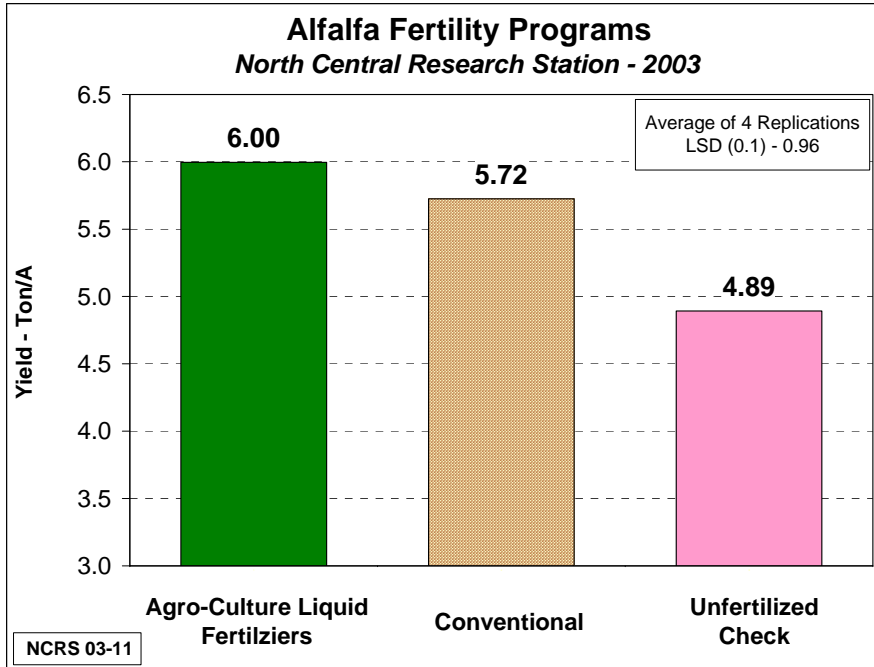


- Alfalfa Fertilizer Program Comparison (2003)
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Experiment: Alfalfa Fertilizer Program Comparison
Year: 2003 (03-11)
Date of Planting/Harvest: Fall 200 / 5-31, 6-2, 8-1, and 9-6
Plot Size: 17' x 285'

Soil Test Levels (ppm)

pH ~ 7.1 P1 ~ 56
 CEC ~ 13.7 K ~ 53
 OM ~ 2.6% (1.0% K)



Agro-Culture Liquid Fertilizers: 7 gal/A Sure- + 1 qt/A Micro 500 + 1 qt/A Sulfur + 1 pt/A Boron applied after each cutting on 4-6 inch regrowth.

Conventional: 300 lbs/A 0-0-60 + 55 lbs/A 18-46-0 + 12 lbs/A Sulfur + 1 lb/A Boron applied after the 1st cutting; 200 lbs/A 0-0-60 applied after the 3rd cutting.

Table 1. Feed Quality - 4th Cutting
North Central Research Station - 2003

	% protein	RFV	TDN	% Dry Matter
Dry	22.7	148.5	66.4	52.5
ACLF	26.4	180.5	70.1	78.8
LSD (0.1)	1.9	17.9	1.9	21.9

- Plots were cut and chopped, random samples were taken and weighed and dried to determine the percent dry matter. These numbers were then used to calculate ton/A at 15% moisture.
- Dried samples were sent to Midwest Labs to be analyzed for protein, relative feed value, and total digestible nutrients.
- Both fertilizer program increased alfalfa yields over the untreated check.
- The Agro-Culture Liquid Fertilizer Program yielded 0.28 ton/A higher than the conventional fertilizer program and 1.11 ton/A higher than the unfertilized check.
- Percent dry matter was significantly higher with the Agro-Culture Liquid Fertilizer program.
- All feed values including percent protein, relative feed value, and total digestible nutrients were higher using the Agro-Culture Liquid Fertilizers program as compared to the conventional dry fertilizer program.

Experiment: Fertilizer Additives on Alfalfa
Year: 2004 (04-11)
Date of Planting/Harvest: 8-04 / 7-8, 8-9, 9-30
Plot Size: 15' x 423'

Soil Test Levels (ppm)

pH ~6.9 P1 ~ 22
CEC ~ 5.7 K ~ 98
OM ~ 1.2% (4.4% K)

Table 1. Alfalfa Fertilizer Programs
North Central Research Station - 2004
2nd-4th cutting

Fertilizer Program	Ton/A 15% moist	Dry Matter %	RFV	Protein %	TDN %	ADF %
Conventional Dry	3.9	30.4%	128	22.3%	60.5%	35.4%
Sure-K + Micro 500 + B + S	4.1	31.0%	114	21.5%	56.5%	39.1%
+ 9-24-3	4.0	32.6%	121	22.2%	58.4%	37.3%
+ 9-24-3 + High NRG-N	4.1	33.4%	120	22.4%	58.0%	37.1%
+ High NRG-N	4.1	32.1%	123	22.4%	59.4%	36.5%
No Fertilizer Check	3.6	35.3%	118	22.7%	58.8%	35.9%
<i>LSD (0.2)</i>	<i>0.36</i>	<i>2.4</i>	<i>6.14</i>	<i>0.81</i>	<i>1.46</i>	<i>1.68</i>

- Conventional Dry: 300 lbs/A 0-0-60 + 75 lbs/A 18-46-0 + 10 lbs/A Sulfur + 1 lb/A Boron (after 1st cutting); 200 lbs/A 0-0-60 (after 3rd cutting)
- Agro-Culture Liquid Fertilizers: 7 gal/A Sure-K + 1 qt/A Micro 500 + 1 pt/A Boron + 1 qt/A Sulfur (after each cutting)
- + 9-24-3: ACLF + 2 gal/A 9-24-3 (after each cutting)
- + High NRG-N: ACLF + 2 gal/A High NRG-N (after each cutting)
- + 9-24-3 + High NRG-N: ACLF + 2 gal/A 9-24-3 + 2 gal/A High NRG-N (after each cutting)
- Liquid Fertilizer was applied after each cutting on 4-6 inch regrowth allowing for adequate leaf surface area for nutrient uptake.
- All fertility programs significantly increased alfalfa yields over the untreated check.
- There was no yield increase when additional fertilizers were added to the Agro-Culture Liquid Fertilizers program.
- Relative feed value, percent protein, and total digestible nutrients were all increased with the addition of High NRG-N and 9-24-3 to the fertilizer program.
- Percent dry matter was significantly increased with the Agro-Culture Liquid Fertilizers compared to the conventional dry program.
- Applying fertilizer to the leaf tissue allows for greater uptake of nutrients increasing alfalfa yield and quality. Foliar fertilizer applications can also be mixed with most insecticide and herbicide applications reducing application costs.

Fertilization of irrigated alfalfa. Dell City, TX. (2001)

Dell City is located out in the desert approximately 80 miles east of El Paso. What makes this area unique is the abundance of relatively shallow well water. This has enabled growth of irrigated crops in an area surrounded by rocks and cactus. However, this water is high in sodium, so the crops that can be grown are somewhat limited by that factor. There is both overhead and flood irrigation. In fact, it is interesting to observe that the overhead irrigation here use the towers to support PVC pipe with sprinklers rather than use sprinklers in the metal pipe. This is because the high sodium content of the water will corrode the metal pipe and sprinkler fittings.

Alfalfa is a major crop grown in this area. It is primarily grown as feed for dairies in the El Paso – Las Cruces, NM area. An experiment was conducted to evaluate a fertility program using Agro-Culture Liquid Fertilizers against a typical dry fertilizer program for effects on alfalfa yield and quality.

A 116-acre field of second year alfalfa under center pivot irrigation was selected for this test. Soil samples were collected from around the circle in the spring. There was little variation between samples. Soil information appears in the following table.

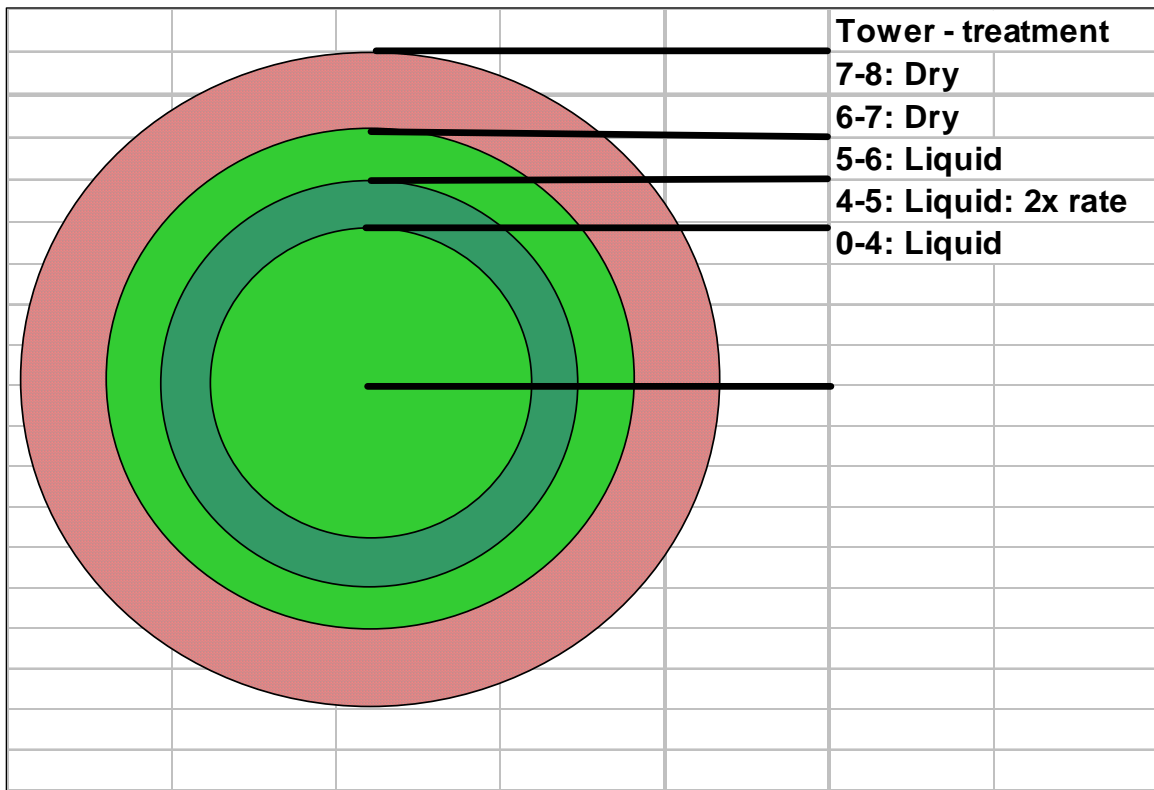
Fertilization of alfalfa, Dell City, TX						
Soil test report						
% O.M.	pH	P1 phosphorus	potassium	magnesium	calcium	sodium
1.3	7.9	6 ppm	127 ppm	>800 ppm	14,028 ppm	248 ppm
			<u>% Base Saturation</u>			
			%K	% Mg	% Ca	% Na
			0.4	8.8	89.4	1.4
S	Zn	Mn	Fe	Cu	B	
3 ppm	0.2 ppm	1 ppm	1 ppm	0.2 ppm	1.5 ppm	

Three fertilizer treatments were determined based on soil test:

1. Conventional Dry, applied in spring:
200 lb/A 11-52-0 + 250 lb/A 0-0-60 + 30 lb/A sulfur + micros (4 lb/A zinc + 2.5 lb/A manganese + 2 lb/A copper + 1.5 lb/A boron.)
2. ACLF – 1X rate, applied in spring and after each cutting to 4 in. re-growth:
2 gal/A each of High NRG-N + 9-24-3 + Sure-K + 1 qt/A Micro 500 + 1 qt/A Sulfur
3. ACLF – 2X rate, same fertilizers as #2, but at double the rate.

Treatment 1 was applied with a fertilizer spreader truck, and treatments 2 and 3 were applied with a sprayer truck. The ACLF treatments would normally be applied through the irrigation, but was sprayed for the experiment. The cost of Treatments 1 and 2 are within a few dollars per acre of each other.

For ease of application and keeping track of yield, the different treatments were positioned within the tire tracks of different pivot towers:



Alfalfa was cut and windrowed, and then baled into large square bales. Bales from each treatment were weighed on a truck. Due to their close proximity, alfalfa produced from each treatment between towers 4 – 7 were used for yield determination. (23.4 acres for Trt. 1, 19.8 acres for Trt. 2, and 16.2 acres on Trt. 3.). Unfortunately at this time, only weights from cuttings 3 and 5 are available at this time. It is hoped that the rest can be obtained for a complete report. Yields from these cuttings:

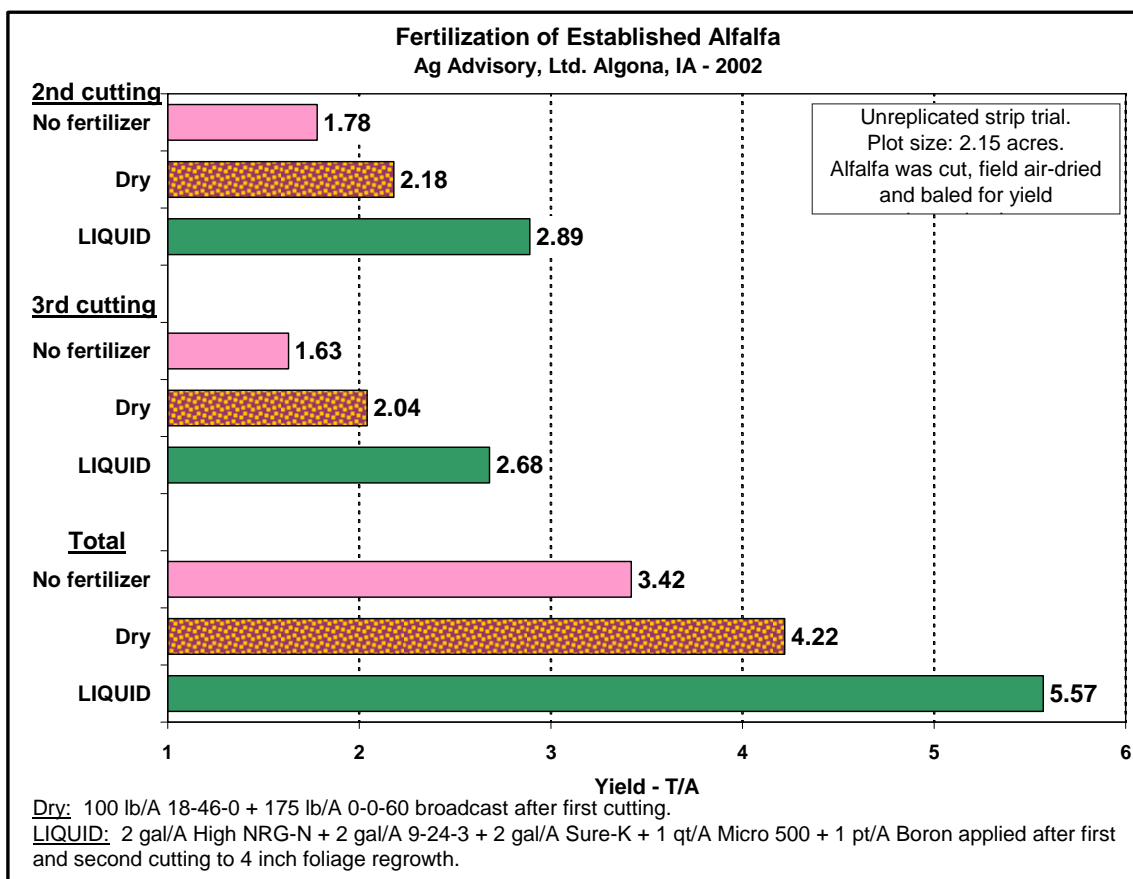
	3rd	5th	Total	RFV*
1. Dry fertilizer	1.45	1.55	3	120
2. ACLF (1X rate)	1.4	1.77	3.17	132
3. ACLF (2X rate)	1.53	1.8	3.33	132

* - Relative Feed Value from 5th cutting.

- Highest overall yield was with the ACLF 2X rate, but the closeness of the 1X rate and the same high relative feed value make the 1X rate the most economical.
- Alfalfa quality is much higher with the ACLF programs, due to lower salt index and even feeding over the season.

Experiment: Fertilization of Established Alfalfa. Ag Advisory, Inc. Algona, IA (2002)

An experiment was established to evaluate fertilizer programs in alfalfa. This was more of a demonstration as treatments were not replicated. However, the field was uniform and applications were typical for the area. Dry fertilizer was applied after the first cutting. Agro-Culture Liquid Fertilizers were applied to 4 inch re-growth after the first and second cutting. In addition to yield, samples were collected and sent to a lab (Belmond Labs of Belmond, IA) for hay quality evaluations. Yield and quality results



Appear below.

Cutting:	% Protein		RFV		TDN	
	2nd	3rd	2nd	3rd	2nd	3rd
No Fertilizer	17.9	16.2	157.3	134.7	67.8	63.5
Dry	18.0	16.8	160.8	143.2	68.3	65.7
LIQUID	18.3	17.9	162.1	149.2	69.7	66.2

- Foliar fertilization with Agro-Culture Liquid Fertilizers produced substantially more alfalfa with higher quality as measured by protein, relative feed value and total digestible nutrients.
- This production was obtained even though the Agro-Culture Liquid Fertilizers only applied a total of 30.76 lb/A of primary nutrients compared to 169 lb/A for the Dry, showing that it is the *quality* of nutrition that is important and not the amount applied.

Experiment: Fertilization of Irrigated Established Alfalfa

Location: Irrigation Research Foundation
Yuma, Colorado

Year: 2006

Plot Size: 20 x 400 feet per plot with 1 replication

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 content 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. Comparisons were made against a dry fertilizer program. The dry program applied in early February was actually for corn as this stand was originally going to be tilled up and planted to corn. But in order to accommodate this experiment, the alfalfa was kept even though a portion of the field had already had the dry fertilizer applied. Liquid treatments were

applied in strips to a portion of the field which had not received dry fertilizer. As seen from the picture, this seven year old stand was still in good production.



Alfalfa fertilizer test plots at the Irrigation Research Foundation in 2006

One of the objectives tested was fertilizer management in high pH and low soil-sulfur conditions that exist at the IRF. One practice currently in use in certain areas is the combination of ammonium thiosulfate (ATS, 12-0-0-26) with the Liquid fertilizer application. Due to the potential for foliage burn, this should be applied early

in the season before substantial foliage development. This can also be applied through stream bar nozzles to keep the fertilizer in concentrated bands. (Nozzles with 20 inch spacing apply fertilizer in 4 evenly spaced bands.) Another objective is to compare Liquid fertilizer application timing. Some producers want to apply all of the fertilizer early in the season in one application, while it is usually recommended to split apply after each cutting to allow for even feeding through the season. Treatments applied are in the following table. Treatments were not able to be replicated, but were instead applied in large strip plots. At harvest, four sub-samples were taken along the plot length for yield calculation and for forage analysis conducted by Olsen's Agricultural Laboratory, Inc of McCook, NE. This method correlated well with whole plot weight measurements.

Base Liquid fertilizer program:	
7 gal/A	Pro-Germinator
6 gal/A	Sure-K
2 qt/A	Micro 500
1 qt/A	Boron
13.75 gal/A	

Treatment list for Alfalfa Fertilization Test at the Irrigation Research Foundation		
1. Dry fertilizer already applied: 452 lb/A 31-2-18 (140-9-81)		
2.	Timing:	one application in spring prior to foliage emergence
	Method of application:	Stream bar nozzles. (Run close to ground to maintain stream spacing.)
	Rates:	10 gal/A Ammonium Thio-Sulfate +
		13.75 gal/A Base Liquid fertilizer
		23.75 gal/A
3. Timing: One application in spring just after greenup to 4 inch growth		
	Method of application:	Broadcast spray straight fertilizer (no dilution with water)
	Rate:	14.25 gal/A Base Liquid fertilizer + 2 qt/A Sulfur
4. Timing: 4 applications: 1) Just after greenup to 4 inch growth and 2,3,4) 7 days after first 3cuttings*		
	Method of application:	Broadcast spray: can dilute with water to spray 10 gal/A
	Rate:	3.5 gal/A Base Liquid fertilizer + 2 qt/A Sulfur applied in 4 applications
5. Timing: 3 applications: 7 days after each of the first 3 cuttings		
	Method of application:	Broadcast spray: can dilute with water to spray 10 gal/A
	Rate:	4.75 gal/A Base Liquid fertilizer + 2 qt/A Sulfur applied in 3 applications
6. Timing: 3 applications: 7 days after each of the first 3 cuttings		
	Method of application:	Broadcast spray: can dilute with water to spray 10 gal/A
	Rate:	4.5 gal/A Base Liquid fertilizer applied in 3 applications +
		2 gal/A High NRG-N wit each application
		6.5 gal/A per application

Yield and Forage Quality data are in the following tables.

Alfalfa Fertilizer Treatment Yields (Tons/A)						
Irrigation Research Foundation, Yuma, CO - 2006						
trt	1st	2nd	3rd	4th	total 1-4	total 2-4
1	2	1.4	1.2	1.6	6.2	4.2
2	2.2	1.4	1.2	1.7	6.5	4.3
3	2.4	1.4	1.2	1.6	6.6	4.2
4	2.4	1.5	1.2	1.7	6.8	4.4
5	*	1.5	1.2	1.7		4.4
6	*	1.4	1.2	1.7		4.3

* - Unfortunately it was not specified to take yield checks of first cuttings of Treatments 5 and 6 since first fertilizer applications were not applied until *after* the first cutting. Thus, total production could not be determined.

- All Liquid treatments did out-yield the dry treatment. For the treatments where all four cuttings were weighed, the multiple applications (Trt. 4) yielded higher than the single early applications (Trt. 2 and 3).

Fertilizer Effects on Alfalfa Relative Feed Value (RFV)						
Irrigation Research Foundation, Yuma, CO - 2006						
trt	RFV1	RFV2	RFV3	RFV4	avg 1-4	avg 2-4
1	179.8	157.3	179.4	166.0	172.2	168.4
2	165.8	191.1	209.2	171.4	184.4	190.6
3	164.5	156.6	166.3	164.3	162.9	162.4
4	174.3	166.3	209.2	149.3	174.8	174.9
5	*	142.3	194.6	176.6		171.2
6	*	187.4	187.7	180.5		185.2

- The dry treatment (Trt. 1) had a higher RFV at the first cutting likely due to the fact the application had been made nearly four months prior to cutting allowing time for nutrient effect. But in the following cuttings the effect was less pronounced compared to the Liquid treatments
- The single early application of ATS in combination with the Liquid treatment (Trt. 2) maintained effect on RFV throughout the season giving the highest overall average. However, addition of High NRG-N (Trt. 6), which contains sulfur, was close behind for forage quality.

Conclusion: It is more effective to split Liquid fertilizer applications through the season rather than to make a single early application. Addition of ammonium thiosulfate and High NRG-N increase hay quality as determined by relative feed value.

Experiment: Fertilizer Programs Effects on Alfalfa Yield
Year (Experiment Number): 2007 (07-301)
Date of Harvests: May 31, June 28, August 2, September 5
Variety: WL 325
Plot Size (replications): 15 ft x 423 ft (3 reps)

Soil Test Levels (ppm)	
pH: 6.8	C.E.C.: 6.1
OM: 1.7%	P1: 17 ppm
K: 76 ppm (3.1% BS)	

An alfalfa stand was established in the summer of 2003, with plot work beginning the summer of 2004. For the 2007 season, different fertility programs were established to determine the best fertilizer sources and rates for alfalfa yield and quality. The standard application of Agro-Culture Liquid Fertilizers consisted of 24 gal Sure-K + 6 gal Pro-Germinator + 3 pt Micro 500 + 3 pt Boron. This program was split applied at various applications and mixed with other fertilizer additives based on treatment. See Table 1 for the complete list of fertilizer treatments, rates and timing of application. Liquid fertilizers were applied with a Hagie sprayer to 4" inch regrowth unless otherwise noted. Agro-Culture Liquid Fertilizers was compared to a conventional program consisting of potash, 18-46-0, sulfur and zinc applied broadcast after harvest. Harvest was done at 1/10 bloom, roughly every 30 days. Alfalfa was laid down with a mower, after drying for 2-3 hours it was then made into round bales. Each plot had one bale, which was then picked up and weighed on a scale. Samples were collected for dry matter and quality. Quality samples were sent to Olsen Laboratories and analyzed for Relative Feed Value (RFV), results appear on Chart 1. Yields were calculated and adjusted to tons per acre of 15% moisture alfalfa, results appear on Chart 1.

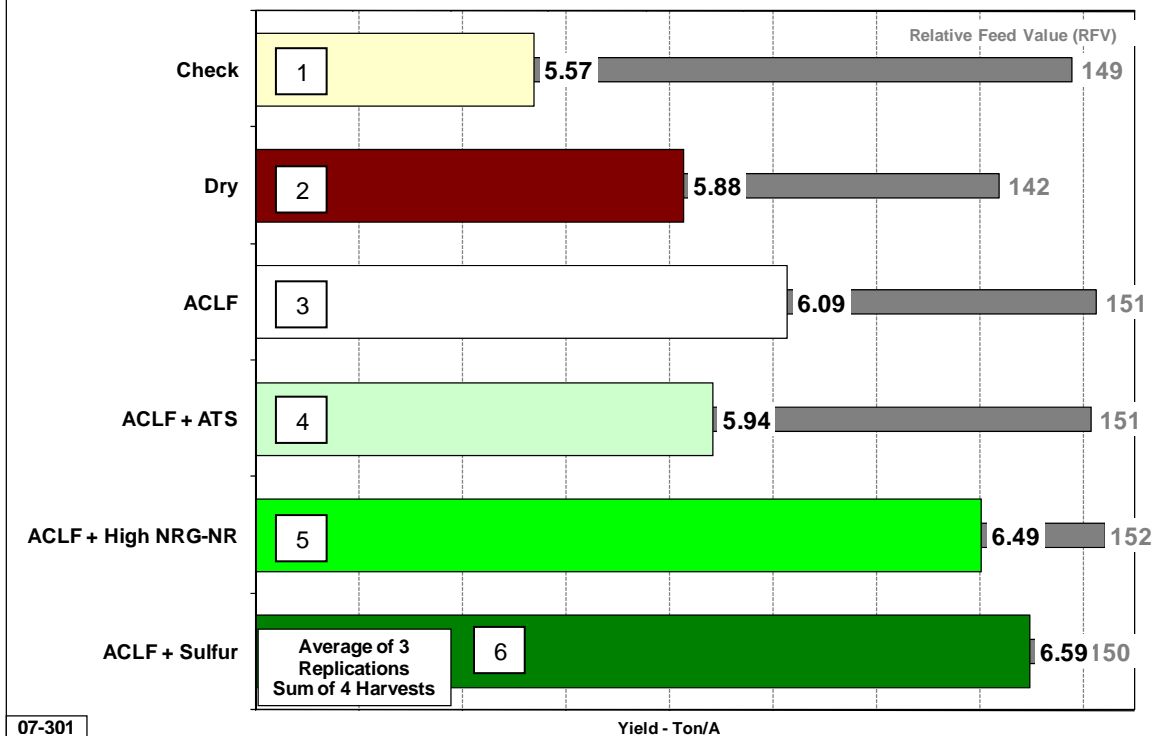
Table 1. Alfalfa Fertility Programs, Rates, and Timing of Applications

Label	Fertilizer Program and Rates	Spring	After	After	After
			1st	2nd	3rd
1	Check	No Fertilizer			
2	Dry	200 lbs 0-0-60 + 65 lbs 18-46-0 + 10 lbs S + 1 lb B 200 lbs 0-0-60	6/8		8/3
3	ACLF	8 gal Sure-K + 2 gal Pro-Germ. + 1 pt Micro 500 + 1 pt Boron	6/11	7/6	8/10
4	ACLF + ATS (12-0-0-26) (1st app. with streambars)	8 gal Sure-K + 2 gal Pro-Germ. + 1 pt Micro 500 + 1 pt Boron + 10 gal ATS 12 gal Sure-K + 1 qt Micro 500 + 1 qt Boron	4/10		7/6
5	ACLF + High NRG-NR	8 gal Sure-K + 2 gal Pro-Germ. + 2 gal High NRG-NR + 1 pt Micro 500 + 1 pt B	6/11	7/6	8/10
6	ACLF+ Sulfur	12 gal Sure-K + 6 gal Pro-Germ. 1 qt Micro 500 + 1 qt Boron + 1 qt Sulfur 12 gal Sure-K + 1 qt Micro 500 + 1 qt Boron	5/2		7/6

* Total ACLK Program - 24 gal Sure-K + 6 gal Pro-Germ. + 3 pt Micro-500 + 3 pt Boron

Note: ATS is Ammonium Thiosulfate 12-0-0-26

Chart 1 Alfalfa Fertility Programs
North Central Research Station - 2007



Conclusions:

- All fertilizer treatments yielded higher than the untreated check.
- The standard ACLF (Agro-Culture Liquid Fertilizer) program yielded 6.09 ton/A, 0.58 tons higher than the untreated check (5.57 ton/A) and 0.21 tons higher than the dry conventional program (5.58 tons/A).
- The addition of High NRG-NR increased yield 0.4 ton/A (6.49 ton/A) over the standard ACLF program. (6.09 ton/A)
- The addition of 2 qt/A Sulfur split into two applications yielded the highest, 6.59 ton/A, an increase of 0.5 tons over the standard program and 1.02 tons over the untreated check. This is an increase on 18.3%.
- Lowest Relative Feed Value (RFV) was recorded with the dry conventional program, however very little difference was seen in feed values between the different fertilizer treatments.

Another way to evaluate fertilizer response is to look at the increase per pound of nutrients applied. This is done by dividing the pounds of fertilizer nutrients applied by the increase in yield over the check. Table 2 below shows these increases.

**Table 2. Yield Per Pound of Nutrient Applied
07-301 Alfalfa**

	Fertilizer Treatment	Pounds of Nutrients Applied	Yield Increase Per Nutrient Applied
1	Check	0	0.0 bu
2	Dry	293	2.1 bu
3	ACLF	44	23.6 bu
4	ACLF + ATS	74	10.0 bu
5	ACLF + NR	59	31.2 bu
6	ACLF + S	45	45.3 bu

Conclusions:

- Lowest yield increase per nutrient applied was seen with the dry program (trt 2), with high rates of fertilizers being applied.
- The ACLK program with Sulfur (trt 6) provided the greatest increase per nutrient applied.

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.

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.

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	rank	avg.	rank	avg.	rank	avg.
	T/A		%protein		RFV		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	rank	avg.	rank	avg.	rank	avg.
	T/A		%protein		RFV		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	rank	avg.	rank	avg.	rank	avg.
	T/A		%protein		RFV		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	rank	avg.	rank	avg.	rank	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.