

# <u>Alfalfa Trials</u>

Alfalfa has long been used as a high quality food source in the milk and ranch industry. Today, the quality of alfalfa is now a science and continuous efforts are being taken to improve the plant quality while reducing water requirements, fertility costs and the pesticide impacts on soils and water tables.

3 Tier Technologies joined the effort through a series of different trials to measure the performance of its new NBN Product line against traditional nutrient programs. The purpose of the trials was to determine effective protocols for alfalfa propagation that are cost effective while producing a higher quality plant. Secondary issues measured were the effects on water usage, plant yield and animal impact.

The studies consisted of alfalfa establishment in the state of Oregon and Utah. Data collected included plant quality analysis, visual growth comparisons, yield comparisons, soil nutrient studies, water management issues, and cost comparisons.

The trial consisted of the establishment of two alfalfa fields in Northern Oregon, one using a conventional treatment of 32-0-0 liquid nutrient at a rate of 200# per acre (\$22.50 per acre) versus the 3 Tier protocol which included 24 ounces per acre of Establish 5-16-12 and Huma-Balance XL at a rate of 64 ounces per acre (\$21.88 per acre). Both applications were applied after field planting directly to the soil. The following is the current information available for this trial:

#### Plant Quality Analysis:

The following is the initial feed analysis report for the alfalfa after the first cutting. The analysis measured crude protein, fiber %, total digestible nutrients, NEL, and percentage of nitrogen in the plant.

Treatment	Protein	Fiber	TDN	NEL	Nitrogen
3 Tier Protocol	21.49	18.12	60.53	1.38	3.44
Conventional	18.56	19.26	59.67	1.35	2.97
+/- % Change	+16%	-6%	+1%	+2%	+16%

The positive increases in crude protein and total digestible nutrients were significant enough to have a positive effect on the quality, value and impact on feed conversions. The increase in nitrogen value denotes an improved transfer of nutrients to the plant that will be very beneficial as the plant matures and for better plant quality over a longer period. The decrease in fiber is good since that is a waste product of production and signifies higher leaf content and less stalk or waste. All these factors are critical for the increase of milk protein, production and animal health.

The growth of the plants was periodically checked prior to the first cutting of the fields. The attached photos show the increased growth and density of the NBN treated fields over the conventionally treated fields. The NBN treated field consistently outgrew the other field with a larger, denser plant. The overall plant color and health of the NBN field was also noted to be better.

In addition to the increased growth and density, the NBN treated field was ready for harvest 5 to 7 days earlier than the conventionally treated field.

After the first cutting, yield comparisons were measured. The NBN treated field generated an additional 9% yield per acre even though it was harvested 5 to 7 prior to the conventionally treated field.

In addition to the early harvest of the NBN treated field, the same field also recovered from the cutting faster than the other field. A second application of nutrients was applied to both fields 6 days after first harvest.

The NBN treated field again achieved cutting height faster than the conventional field and the yield results were also 9 to 10% greater. Tissue sampling also showed similar increases as before with the TDN increasing to slightly below 62%.



Conventionally Treated Alfalfa



3 Tier NBN Treated Alfalfa

For years, high levels of Nitrogen (N) fertilizer with little or no Phosphorus (P) and Potassium (K) has been used for the propagation of most crops in the United States. Though N is critical for the development and growth of a plant, P and K have been found to have a larger influence on the actual quality of the plant. In addition to this fact, many have questioned the levels of N that are contained in NBN products and the concern that the levels are not adequate for proper growth and yield. In an effort to better quantify the performance of one product over another, it was necessary to additionally monitor soil values.

Since it is clear that not only are our soils are being negatively impacted by the lack of balance in our nutrient blends, the sources of the N have also shown to have negative influences on our soil nutrient availabilities. Whether it is the increase of salt build-up from agricultural grade fertilizers or the inability of the soil to convert the applied nutrients into an available form, available soil nutrients have been influenced. Therefore, supplemental trials have been conducted to review the performance of NBN

Products versus conventional nutrients and the effects they have on the total nutrient availability in the soil. Various trials were conducted on crops, pastures and turf. The average results are attached in Exhibit B and Exhibit C.

Exhibit B is an average soil test for areas that have received the recommended conventional nutrient program. The program consisted of a combination of both soluble and granular nutrients. Exhibit C is the average soil test for areas that received only NBN nutrient products over the same period of time. Both soils were tested prior to the start of the trial and had almost identical levels shown on Exhibit B. Several areas were treated for a period of three months and the average results compiled and the results are clear. Exhibit B showed that in all but two nutrient categories, conventional fertility programs failed to generate an improved or balanced soil nutrient environment. Exhibit C showed that the balance of the NBN programs achieved optimum levels of almost all valuable soil nutrients categories. The end result is healthier plants that will have greater stress tolerance, increased performance, faster recovery or development, and better quality.

As previously mentioned, the difference between the fertility programs is the modes of action. Conventional fertility will require either water, temperature, soil microbe activity or a combination all three to break nutrients down and become available to the plant. Water is the primary requirement. Water will dissolve the fertilizer and move the nutrients to the soil were they are converted or made available to the roots and thus the plant. If water is not available, the performance of the nutrient is hampered. In addition to this, different soil types and conditions can further impede the availability of the nutrients to the plant. An example is in clay soils. Many nutrients will be encapsulated by clay particles and become trapped. Heavy compaction will limit the ability for nutrients to penetrate the soil prior to evaporation or runoff. Finally, the presence of salt build-up or pesticide residue will hamper nutrient uptake. Therefore, the environment can limit the nutrient performance.

NBN Products require water only for application. The advanced technology behind our natural nutrients and the unique delivery platform makes our nutrients immediately available to the tissue of the plant or the soils. The nutrients are protected from soil encapsulation or are readily absorbed into the tissue of the plant. Water, temperature or soil microbial activity is not required to achieve maximum NBN nutrient efficiency. Therefore, higher nutrient response and performance is achieved without the need for water from irrigation or rainfall.

#### Water Management:

Water is a precious commodity. Each day, the use of water is limited by either cost or governmental restrictions. Methods to increase water efficiency are constantly being sought for all uses. Water is necessary for life to exist and is the same in plant production. The elimination of watering requirements with respect to nutrients results in significant savings to the producer.

NBN Products do not require water for the release or conversion of its nutrients. In addition, water utilization is increased with the use of NBN programs. The net effect is a dramatic reduction of water requirements. The average reduction of water usage averages 20 to 30%. The reason is our unique delivery platform for our nutrients also breaks down soil resistance to water, increases water retention capabilities of the soil and reduces the plants requirements for water through greater tissue moisture. Regular use of NBN programs also minimizes the effects of drought conditions.

Therefore, water becomes less of an expense and more of a tool. In areas where water savings can be stockpiled in reserves, income can be achieved through sales of water rights. In areas where water use is restricted, increased acreage can be treated due to maximum water efficiencies. Where water is not available, the dependence on rainfall is lessened and when it is available, maximum benefit and retention is achieved. Any or all of the above can help a producer achieve greater results from fewer resources.

#### Cost Comparison:

The average application cost for a conventional soluble nutrient like 32-0-0 applied at 200 pounds to the acre was \$20 per acre in 2004, today, with the rising cost of nitrogen rising to over \$400 a ton; this application will cost \$40 per acre. The average application cost for a conventional granular fertilizer applied at a 200 pound per acre rate was \$25; today the projected cost is \$44 per acre. The average retail application cost of most NBN nutrient programs range average \$28.00 to \$35.00 per acre (This is worst case scenario with no quantity discounts). Therefore, the initial savings for the user is \$8 to \$12 per acre. A simple savings of just \$8 per acre would result in an astounding 24% savings in material costs.

Now add the savings from reduced water requirements, whether that is a reduced fee for the water or energy savings by lower irrigation requirements. Now add the increased revenue from a higher quality or quantity yield. And less not forgot the improved soil conditions that will allow for better performing fields over time. What is all this worth?

The current statistical average for NBN users is approximately a 21 % reduction in product cost and just shy of a 10% increase in product quality and quantity per acre or an overall improvement of near 31% per acre. This takes into account only the production cost and yield and does not account for increased milk protein or production from higher quality feed or the improved weaning weights and overall health of cattle.

#### Summary:

Since these initial trials were completed, 3 Tier has continued to work with our growers to refine and improve our programs and products and have now developed a special alfalfa blend called Blue – Brown XL which is a combination of our Establish 5-16-12, Root & Groom 3-16-15 and our industry leading Huma-Balance XL with Bio-Cat Booster. This unique nutrient formulation drives quality and growth without the unnecessary nitrogen that these legumes do not require. The convenient combination blend delivers the critical components for proper growth and soil management in on easy to use tote or jug. This product is used at 1 gallon per acre for maximum results.

NBN protocols have demonstrated superior performance and the following benefits:

- All natural nutrients with no burn potential
- Reduced cost in comparison to conventional programs
- Improved yield and quality
- Improved water efficiency and soil conditions
- Improved plant performance and stress tolerance in most conditions

Contact 3 Tier Technologies for a specific evaluation of your needs.

### <u>Exhibit B</u>

MDS Harris				624 Peach Street Lincoln, NE 68502			Tel: 402-476-2811 www.ag.mdsharris.com				PLANT ANALYSIS						
Submitted By 3 Tier	y: Teci	h/Al	Werne	r	Submitted For: 3 TIER TECH/AL WERNER							Plant Information Sheet No. 13088					
P.O. BO	X 1	88 CA	92321										aborator 61	<u>y Sampi</u> 1646	e NO.		
Date Reported: 23-Aug-2004 Laboratory Turnaround: < 3 DAYS																	
					RES	SULTS (	OF LAB		Y ANAL	YSIS					444		
TEST RES		3.53	0.23	1.35	0.14	0.35	0.02	0.20	22	29	8	477	4	1	411		
ELEMEI	NT	Nitrogen %	Phosphorous %	Potassium %	Magnesium %	Calcium	Sodium	Sulfur %	Zinc	Manganese ppm	Copper ppm	Iron ppm	Boron ppm	MO <sub>ppm</sub>	Aluminum ppm		
		3 91	GRAP	HIC RA	TING OF	VOUR	RESUL	TS COM	PARED	TO NOP	RMAL R. 16	ANGES	21				
NORMA RANG	AL E	<b>TO</b> 4.50	то 0.50	<b>TO</b> 3.50	то 0.50	то 0.75	то 0.16	то 0.40	то 60	<b>TO</b> 80	то 20	то 175	то 40	то	то		
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				Second Second			DRIS	INDEX							S. S. Law		
Likely	>+30																
Possible	+20																
	+10																
Normal . Range	0				~												
	-10																
Possible	-20																
Likely	<-30																
Index																	
Rating		N	Р	K	Mg	Ca	Na	S	Zn	Mn	Cu	Fe	В		Al		
NO OPT	IMUI	1 RAN	GE LE	VELS J	AVAIL	ABLE	FOR M	o,Al,	CEAD	CU							

## <u>Exhibit C</u>

MDS Harris					624 Peach Street Tel: 402-476-2811 Lincoln, NE 68502 www.ag.mdsharris					om PLANT ANALYSIS						
Submitted By: 3 Tier Tec	Submitted For: 3 TIER TECH/AL WERNER							Plant Information Sheet No. 13088								
P.O. BOX 188 Cedar Glen CA 92321					Laboratory Sample N 611645								e No.			
Date Reported:   23-Aug-2004   Laboratory Turnaround:   < 3 DAYS										4						
				RE	SULTS (	OF LABO	DRATOF	RY ANAL	YSIS							
LABORATORY TEST RESULTS	3.29	0.48	2.49	0.23	0.66	0.05	0.41	46	57	16	657	9	1	237		
ELEMENT	Nitrogen %	Phosphorous	Potassium %	Magnesium %	Calcium	Sodium %	Sulfur %	Zinc	Manganese ppm	Copper ppm	lron ppm	Boron	MO ppm	Aluminum		
	and the second															
		GRAF	HIC RA	TING OF	YOUR	RESUL	IS CON	IPARED	TO NOF	RMAL R	ANGES	0.1				
NORMAL	3.91 TO	0.30 TO	2.50 TO	0.25 TO	0.50 TO	0.01 TO	0.26	41 TO	41 TO	TO	126 TO	ТО	то	то		
RANGE	4.50	0.50	3.50	0.50	0.75	0.16	0.40	60	80	20	175	40				
											XXXX XXXX					
HIGH							XXXX				XXXX XXXX					
OPTIMUM		XXXX			XXXX	WWWW	XXXX	WWWW	VVVV	vvvv	XXXX					
LOW		XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX					
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Likely >+30																
Possible +20																

Possible	+20														
Normal	+10														
Bange	0				~										
Thungo	-10														
Possible	-20														
Likely	<-30														
Index															
nating		Ň	Р	K	Mg	Ca	Na	S	Zn	Mn	Cu	Fe	В	-	Al

NO OPTIMUM RANGE LEVELS AVAILABLE FOR MO,Al, NORMAL RANGES ARE OBTAINED FROM UNIVERSITY RESEARCH.