

Effects of Foliar Fertilizers and Carbohydrates on Alfalfa Yields and Quality During the Summer Slump Period

Michael D. Rethwisch and Mark Reay

Abstract

Six treatments containing carbohydrates and/or fertilizer were applied to alfalfa shortly after cutting in July 2002 to help ascertain if foliar applied carbohydrates would be helpful in overcoming summer slump of alfalfa hay production in the desert southwest. No significant differences were noted for any treatment for yield or quality when compared with the untreated check, although a trend for increased quality from treatments was noted. Highest yielding treatment was DC34, which increased tonnage by less than 0.1 tons/acre compared with the untreated check. DC34 was also among the highest in alfalfa quality. Alfalfa treated with Amaze® had the highest quality, but no affect on yield. As applications were made when little green foliage was available, most of the applied treatments did not actually contact green tissue but brown/dessicated alfalfa tissue or bare soil. Applying treatments during the regrowth cycle when more foliage is available may result in improved results as suggested by the trends noted from this experiment's treatments, however further testing will be necessary to verify such results.

Introduction

Alfalfa growth in the low desert often has a reduction in tonnage during the August harvest period, a condition referred to as "summer slump". This reduction in hay production is associated with high night-time temperatures which in turn result in overall high average daily temperatures for alfalfa. Alfalfa (a C₃ photosynthetic pathway or "cool season crop") metabolizes a great amount of root carbohydrates during these periods of high temperatures, resulting in increased stress upon the alfalfa plant. This stress not only results in a reduction in tonnage/acre but also an increase in bloom which is often correlated with lower feeding value of alfalfa hay.

Sugars, such as glucose (C₆H₁₂O₆) are one type of carbohydrate (that is, they contain carbon, hydrogen and oxygen and are neutral) as are starches and cellulose. There are several carbohydrates that readily available for usage such as dextrose and molasses. Dextrose is the right handed-form of glucose that occurs widely in nature and is the usual form in which carbohydrate is assimilated by animals. Molasses is the thick dark to light brown syrup that is separated from raw sugar in sugar manufacture.

This study was initiated to provide data to ascertain if providing carbohydrates and other fertility aspects can economically negate/overcome "summer slump" of alfalfa hay in the low desert?

Methods and Materials

Treatments were commercially applied the morning of July 24, 2002, with a SpraCoup 4640 sprayer (James and van Dyke, Inc., Blythe, CA) equipped with TeeJet 8008 tips to alfalfa grown on beds. Plots were eight beds wide by field length (1,160 ft) and treatments were replicated four times in a randomized complete block design. Applications were made at the rate of 25 gallons/acre at 65 psi. Regrowth was just beginning to "green up" at time of application, and the field had a brown appearance overall. Alfalfa field was irrigated immediately after treatments were applied.

Treatments consisted of the following:

A. Hydra-Hume Plus - 5% humic acid formulation and 25% molasses. Each gallon weighs 9.10 lbs. Helena Chemical Company, Collierville, TN.

B. HydraHume™ AN - 6% humic acid formulation and 10.4% seaweed extract derived from *Acscophyllum nodosum*. Each gallons weighs 9.10 lbs. Helena Chemical Company, Collierville, TN.

C. Amaze® fertilizer. 5-16-4 and 5% calcium (International Ag Labs., Inc. 800 W. Lake Ave., Fairmont, MN 56031). Each gallon weighs 12.2 lbs/gal.

D. Dextrose (dextrorotatory glucose). International Ingredient Corporation, P. O. Box 22106, St. Louis, MO, 63116

E. DC34. 4-3-0, 3% sulfur and long chain carbon source. Dune Company, Yuma, AZ.

F. A combination of Amaze® + Dextrose.

TriFol®, a buffering spray and acidification agent (25% aliphatic polycarboxylate and 3% calcium, WilburEllis Company) was added to the Amaze treatments at the rate of 2.5 pts/100 gallons of finished spray.

High temperatures during the experimental period averaged 100.9°F during the period of July 24-August 7 (range of 97-106°F), increased to 107.75°F Aug. 8-11, and cooled thereafter, with average high temperature of 96.7°F for Aug. 12-20.

Plots were swathed on August 20 and baled on August 23. Swathes (two/plot) were raked together to form windrows. Windrow ends were then marked with red spray paint to later determine exact amounts for each plot after baling. Bales in each plot were then counted and partial bales for each plot ascertained. Several bales were then weighed to determine average bale weight for each plot so that yields could be calculated. Quality samples were obtained utilizing a Utah sampler, by coring 4 consecutive bales in the plot. Only three of the replicates were sampled in this experiment for quality data however. Near infrared (NIR) analyses were conducted by Stanworth Crop Consultants in Blythe, CA, a 2002 certified facility for NIR testing by the National Forage Testing Association.

Means for yields and various quality factors were then analyzed with Fishers least significant difference to determine if significant differences existed between the various treatments.

Results

Yields

No treatment was significantly different than the untreated check, although significant differences existed between yields of some treatments (Table 1). DC34 had the highest yields, but only slightly more than 0.07 tons/acre than the check. At \$80/ton this would be valued at \$5.84/acre more than the untreated check based on tonnage alone as both were in the same quality class.

Quality

Alfalfa quality of all alfalfa was similar, although treated alfalfa had slightly improved quality data when compared with untreated alfalfa (Table 2). Untreated alfalfa had the lowest relative feed value score (135.0), and numerically the highest percentage of acid detergent fiber (32.8%) of all the treatments in this experiment. Average percentage digestible protein and crude proteing were lowest in plots treated with Hydra-Hume AN. All other treatment averages for these factors were slightly higher than the untreated check. The untreated check also had a higher average percentage of modified crude fiber and neutral detergent fiber as well as a lower total digestible nutrient level than those noted from any of the treatments in this experiment. Alfalfa treated with Amaze[®] had the best quality based on the laboratory analyses, however this treatment was almost identical to the untreated check in yield. The reason for the quality improvement when compared to the untreated check is unknown.

Increases in hay quality due to treatments were not statistically different, however, nor were thought to provide much economic advantage in this experiment (especially when application cost is included) as all alfalfa hay was in the same quality class (fair). The Amaze[®] treatment had the lowest average acid detergent fiber (ADF) percentage (31.97) and could potentially be considered to be classified as “good” based on ADF value alone (29-32 = good). Relative feed value for this treatment (140.5) and other quality criteria indicate that ‘fair’ is the proper classification.

Summary

These treatments were applied when very little green foliage was available, therefore most of the applied treatments did not actually contact green tissue but brown/dessicated alfalfa tissue or bare soil. In light of this, experimental results indicated that all treatments slightly increased alfalfa hay quality, with some of the treatments also resulting in slightly increased tonnage when compared with the untreated check. Applying treatments during the regrowth cycle when more foliage is available for may result in quite improved positive results, although further testing will be necessary to determine if such positive increases actually occur and are economical.

Acknowledgements

This experiment was made possible through the cooperation of Fisher Ranches, Blythe, CA, as well as that of Chad Elliot. We thank International Ag Labs., Inc, for supplying the dextrose in addition to Amaze[®], as well as thanking all companies with products in this experiment for supplying them for testing.

Table 1. Alfalfa hay yields following application of various carbohydrates/fertilizers on July 24, 2002, to early regrowth stage alfalfa.

| <u>Treatment</u> | <u>Rate/ acre</u> | <u>Yield Tons/acre</u> | <u>Value/acre @ \$80/ton</u> |
|----------------------------------|-----------------------|----------------------------|----------------------------------|
| DC34 | 2 qts | 1.662a | \$132.96 |
| Dextrose | 3 lbs | 1.656a | \$132.48 |
| Hydra-Hume AN | 2 qts | 1.611ab | \$128.88 |
| Untreated Check | ---- | 1.589ab | \$127.12 |
| Amaze [®] | 2 qts | 1.584ab | \$126.72 |
| Hydra-Hume Plus | 2 qts | 1.571ab | \$125.68 |
| Amaze [®] + Dextrose | 2 qts 3 lbs | 1.551 b | \$124.08 |

Means in columns followed by the same letter are not significantly different at the $p \leq 0.05$ level (Fishers LSD test)

Table 2. Alfalfa quality parameters following application of various carbohydrates/ fertilizers on July 24, 2002, to early regrowth stage alfalfa.

| Treatment | Rate/ acre | Fiber percentages | | | | Protein % | | Relative Feed Value |
|----------------------------------|-----------------------|--------------------------|------------------------|------------------------|------------------------|------------------|----------------|--------------------------------|
| | | ADF¹ | NDF² | MCF³ | TDN⁴ | Crude | Digest. | |
| Amaze [®] | 2 qts | 32.0a | 42.4a | 24.5a | 52.5a | 21.4a | 15.0a | 140.5a |
| DC34 | 2 qts | 32.2a | 42.7a | 24.7a | 52.4a | 21.2a | 14.8a | 139.1a |
| Amaze [®] + Dextrose | 2 qts 3 lbs | 32.3a | 42.9a | 25.0a | 52.3a | 21.0a | 14.7a | 138.4 |
| Dextrose | 3 lbs | 32.2a | 43.3a | 25.2a | 52.3a | 21.4a | 14.9a | 137.2a |
| Hydra-Hume Plus | 2 qts | 32.6a | 43.2a | 25.0a | 52.1a | 21.1a | 14.7a | 136.8a |
| Hydra-Hume AN | 2 qts | 32.7a | 43.5a | 25.1a | 52.1a | 20.6a | 14.4a | 135.6a |
| Untreated Check | ----- | 32.8a | 43.7a | 25.5a | 51.9a | 20.8a | 14.6a | 135.0a |

Means in columns followed by the same letter are not significantly different at the $p \leq 0.05$ level (Fishers LSD test)

¹Acid detergent fiber, reported at 100% dry matter level.

²Neutral detergent fiber percentage, reported at 100% dry matter level.

³Modified crude fiber percentage, reported at 100% dry matter level.

⁴Total digestible nutrients percentage, reported at 90% dry matter level.