Effects of Aerially Applied Plant Growth Regulators on Alfalfa Quality and Yields

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Abstract

Plant growth regulators were aerially applied on April 26, 1996, to two alfalfa fields, one (Cibola) in its first year of production and the other field (CUF 101) in its third year. The first year field was approximately 50% through the cutting cycle and the third year field was approximately 30% through the cutting cycle when applications were made. No statistical differences were noted in hay tonnage the first cutting after application. Yield increases due to treatments were noted in the second cutting and maximum increases ranged from 277-461 lbs of hay per acre. No yield or quality differences were noted the third cutting after application. The two fields differed in their response. The lowest rates of plant growth regulators produced higher yields in the first year field, but these treatment rates had greatly lowered hay quality the previous cutting. These effects were not noticed in the thrid year stand field. Increased hay tonnage was noted in the third year field from the 16 oz/acre rates, but was not evident in the first year field. Hay quality was usually highest in the check the first two cuttings after treatment. It is unknown if the differences noted between the two fields are due to different age of plants, variety and/or stage of growth when treatments were applied.

Introduction

Little data exist in Arizona for the effects of plant growth regulators (PGRs) on alfalfa forage under low desert production conditions. The few data available come from companies marketing cytokinin based PGRs, and have not been replicated in the same field, allowing the validity of such results to be questioned. These results have shown that cytokinin based PGR products increased alfalfa hay production by 0.23 ton/acre over two cuttings to 3 bales/acre in a single cutting. No data were available on the simultaneous effects of PGRs on alfalfa quality and quantity.

This experiment was initiated to determine the effects of several cytokinin based plant growth regulator products and rates on alfalfa forage quality and quantity under Arizona low desert production conditions.

Methods and Materials

Two alfalfa fields located near Poston, AZ, on the Colorado River Indian Tribes Reservation and under production by Baldwin Farms were used for this experiment. One field was a first year stand of alfalfa (variety = Cibola), and was designated field #1 for this experiment. The other field (designated field #2) was in its third year of production (variety = selection from CUF 101).

Four treatments were aerially applied to both fields the morning of April 26, 1996. The treatments and rates of products per acre were: Foliar Triggrr - 8 oz; Cytokin - 8 oz; Cytokin 16 oz; and Cytokin 16 oz plus 5 lbs of 20-20-20. All treatments were applied with 4 oz/acre of Nu-Film-P in 5 gpa water and had been buffered to 7.3 pH. Field #1 was approximately 50% through its cutting cycle when treatments were applied while field #2 was approximately 30% through its cutting cycle.

Plot sizes and replications varied by field, with four replications of treatments in field #1 and three replications of treatments in field #2. Each treated plot in field #1 was 1.98 acres in size (70 ft wide by 1,235 ft long) while treated areas in field #2 ranged from 1.95-3.90 acres (70-140 ft wide x 1,215 ft).

Yield and quality data were obtained for three cuttings after treatments were applied. Field #1 was baled on May 17, June 16, and July 15. Field #2 was baled May 25, June 19 and July 18. Fields were cut approximately 7 days prior to baling in May, 5 days in June, and 4 days in July.

Quality samples were obtained from all three harvests after treatments were applied from field #1 and the fisrt and second harvests from field #2. Two hay bales from each plot were sampled with a Utah sampler. Samples from each treatment were then combined as a composite (all replications of a treatments from one field) and near infrared (NIR) analysis was completed by Stanworth Crop Consulting, Blythe, CA.

Yield data were collected by counting bales for each treatment, weighing 1-2 bales per windrow, and calulating yield for each windrow and for each plot. Yield data was collected for the second and third harvests after application from field #1, and the first and second harvests after application from field #2. Bale counts were collected from three replications from the first harvest after application in field #1 but bale weights were not obtained. Yield for the harvest from field #1 was not calculated.

Yields were calculated on a per acre basis, and data were statistically analysed.

Results

Quality Hay quality differed by harvest and field (Table 1), with quality similar among treatments for most harvests. Quality of hay (relative feed value) was highest in the untreated check for both fields in the May harvest and the June harvest of field #1. The relative feed value from the untreated check was second highest among the treatments in field #2 in the June harvest, but was lowest in the July harvest. The most quality reduction from PGR treatments was noted in the 8 oz/acre rates in the May harvest in field #1, with an average reduction of 27.2% compared with the untreated check.

Why did the lower rates of PGRs decrease quality further than the higher rates in field #1? One possibility may be that lower rates of plant hormones (PGRs) sometimes have a greater effect than higher rates. This has been noted with gibberelic acid on grapes (Butler, 1990) and with cytokinin on green beans (Rethwisch et al., 1996), which is a legume plant as is alfalfa. Products containing cytokinin are promoted as increasing flowers/fruit set. As alfalfa matures (begins producing flowers), its fiber content increases and and its energy value decreases (Bath and Marble, 1989). Crop maturity may also have been a factor, as field #1 was about 50% though its cutting cycle, while field #2 was approximately 30% through its cutting cycle. Diffferences in response may also have been due to differences in the two varieties involved in this experiment.

Yields Some yield trends were noted from treatments, with the responses differing between the two fields. Little if any increase was noted in the first harvest (with perhaps the exception of the 16 oz/acre rate of Cytokin) and no increase noted the third harvest after application. A trend of increased yields from all treatments compared with the check was noted in the second harvest (June) after application was made. Treatments increased hay yield by 63-277 lbs/acre (1.6-7.2%) in the first year field (field #1) and by 155-461 lbs/acre (5.1- 15.3%) in field #2, the third year field (Table 2), although these increases were not statistically significant. One possibility for the difference responses noted between the two fields is that younger plants (Field #1) have actively growing roots which produce

some cytokinin and other PGRs while the older roots may have slowed in their production. The greatest yield response to the PGR treatments was in the older field (Field #2).

In field #1, the 8 oz/acre treatment rates produced an average of 4,105 lbs/acre in the June harvest, while the 16 oz/acre treatment rates averaged 3,930 lbs/acre. The trend for increased yield noted in the 8 oz/acre rates in field #1 followed much lower relative feed values in the previous harvest when compared with the other treatments, perhaps indicitative of plants having increased maturity and storing carbohydrates that were available for the following harvest.

Literature Cited

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Acknowledgements

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Table 1. Quality components of alfalfa hay following April 26th application of plant growth regulator treatments.

Field #1

		May harvest			June Harvest			July Harvest		
Treatment	Oz/a	100% Protein	90% ADF(CA)	Rel. Feed Value	100% Protein	90% ADF(CA)	Rel. Feed Value	100% Protein	90% ADF (CA)	Rel. Feed Value
Triggrr	8	16.2	47.3	113.6	20.8	51.6	141.7	20.4	52.7	146.0
Cytokin	8	18.2	49.8	126.6	20.2	51.1	139.0	21.3	53.4	151.3
Cytokin	16	21.7	54.2	156.4	19.7	50.8	137.2	20.4	53.0	148.7
Cytokin + 20-20-20	16 5#	22.5	54.8	160.6	20.1	51.6	141.0	21.2	53.4	148.3
Untreated	---	22.3	54.9	164.9	20.7	52.7	151.2	20.5	52.6	145.9

Field #2

		May harvest			June Harvest			July Harvest		
Treatment	Oz/A	100% Protein	90% ADF(CA)	Rel. Feed Value	100% Protein	90% ADF(CA)	Rel. Feed Value	100% Protein	90% ADF(CA)	Rel. Feed Value
Triggrr	8	20.6	53.6	151.3	21.4	54.6	162.4	----	----	-----
Cytokin	8	19.6	52.7	146.0	19.8	52.7	149.4	----	----	-----
Cytokin	16	20.0	53.7	156.0	19.8	52.9	152.2	----	----	-----
Cytokin + 20-20-20	16 5 lb	19.9	52.6	145.2	19.7	52.7	152.1	----	----	-----
Untreated	---	21.1	54.2	156.2	20.2	53.6	157.2	----	----	-----

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Cytokin	16	21.7	54.2	156.4	19.7	50.8	137.2	20.4	53.0	148.7
Cytokin + 20-20-20	16 5#	22.5	54.8	160.6	20.1	51.6	141.0	21.2	53.4	148.3
Untreated	---	22.3	54.9	164.9	20.7	52.7	151.2	20.5	52.6	145.9

Field #2

		May harvest			June Harvest			July Harvest		
Treatment	Oz/A	100% Protein	90% ADF(CA)	Rel. Feed Value	100% Protein	90% ADF(CA)	Rel. Feed Value	100% Protein	90% ADF(CA)	Rel. Feed Value
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Untreated	---	21.1	54.2	156.2	20.2	53.6	157.2	----	----	-----

Table 2. Alfalfa hay yields following April 26th application of plant growth regulator treatments.

Treatment	Rate/acre	Harvest and yield (lbs hay/acre) May[1]	June	July	Yield Totals Harvests combined	Both fields combined
Field #1						
Triggrr	8 oz	-----	4,072a	3,086a	7,158a	13,551
Cytokin	8 oz	-----	4,137a	3,085a	7,222a	13,832
Cytokin	16 oz	------	3,923a	3,032a	6,955a	13,798
Cytokin + 20-20-20	16 oz 5 lb.	------	3,937a	3,082a	7,019a	13,718
Untreated Check	---	------	3,860a	2,962a	6,822a	13,097
Field #2						
Triggrr	8 oz	3,221a	3,172a	------	6,363a	
Cytokin	8 oz	3,301a	3,309a	-----	6,610a	
Cytokin	16 oz	3,403a	3,440a	------	6,843a	
Cytokin + 20-20-20	16 oz 5 lbs	3,221a	3,478a	-----	6,699a	
Untreated Check	-----	3,258a	3,017a	------	6,275a	

[1] Means in columns were not statistically different at the $p \leq 0.05$ level (Co-Stat 2.0).