NEW JERSEY GRAIN AND FORAGE JOURNAL

A COMPILATION OF RESEARCH AND EXTENSION PROJECTS IN CORN, SOYBEAN, SMALL GRAIN AND FORAGE

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PREFACE

This is the sixth edition of the New Jersey Grain and Forage Journal, an annual journal highlighting research and extension projects in field crops. Traditionally the publication has presented work conducted in New Jersey. This year articles from Delaware and Pennsylvania are included as a result of collaborative efforts by field and forage crop agents, specialists and researchers from the Mid-Atlantic region.

Grain and forage production represents the largest agricultural acreage in the Mid-Atlantic States, adding significantly to and supporting related industries. Not only does this support the local and regional economy, but also provides the benefits of open space to the residents of the region.

We would like to acknowledge and thank the New Jersey Soybean Board and Grain and Forage Producers' Association for their financial support. The Soybean Board allocates soybean checkoff funds for research and promotional activities that benefit the soybean industry. The Grain and Forage Producers' Association promotes research, marketing, legislation and education related to the grain and forage industry.

We hope that these results will be helpful to you as you plant and produce crops in the 2000 growing season and beyond. Your suggestions for research and educational projects are always welcome, as it is our desire to develop programs that serve you most important needs.

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Grass Species and Nitrogen Effects on Hay Yield, Quality, and Profitability

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Research Question

Grass hay fields in New Jersey are typically not managed for high yield and quality despite research that demonstrates increased net returns from improved management. Unlike alfalfa, a legume, grasses need nitrogen (N) fertilization for high yields. Topdressing grass hay fields can dramatically increase yield, and in most cases, if cutting interval is reasonably short, improve quality. The objectives of this study were to: (1) determine the extent of yield and quality differences between two cool-season grasses; (2) to quantify the species response to varying N levels, and; (3) to determine the economic return to N management.

Literature Review

Mislevy et al. (1974, 1977) reported that maximal seasonal yield of orchardgrass, timothy, and reed canarygrass were obtained when first harvest was cut between the boot and flowering growth stages. Fairey (1991) concluded that harvesting smooth bromegrass, timothy, or reed canarygrass at heading and taking only two harvests in a season increased yields more than harvesting earlier and taking more harvests per year. Despite greater dry matter (DM) yield from delayed harvest, forage quality losses result in a considerably lower quality product making it impossible to simultaneously harvest for maximum DM yield and forage quality (Bonin et al., 1968a; Mislevy et al., 1974, 1977; Marten et al., 1979). A compromise must be reached to balance forage DM yield and quality.

Hall (1998) evaluated four cool-season grasses at three cutting intervals under Pennsylvania conditions and found that the shortest cutting interval (35 day) produced the lowest DM yield compared to the 45 and 70 day cutting interval in years with below normal precipitation, yet no differences in net economic return existed. In years with average or above average precipitation, the 35 and 45 day cutting interval produced greater net economic returns than the 70 day interval for all grasses except timothy, which did not differ in economic return among cutting intervals (Hall, 1998). Klausner et al. (1998) evaluated reed canarygrass and timothy at two levels of cutting management and five N levels and found that economic N rates varied between grass species and were greater for the 4-cut vs. 3-cut system even though yields were greater in the 3-cut system.

The Rutgers Field Crop Production Guide recommends applying 50 lb/A N in the spring before green up, 50 lb/A N after first harvest, and 50 lb/A N after last harvest for established hay fields (Heckman et al., 1994). These recommendations assume a 4 ton per acre yield goal. Cornell University's equivalent production manual recommends applying 75 lb/A N in the spring at green up, and 25 to 50 lb/A N before each successive cutting (Cherney et al., 1999). A four cut system would receive a maximum of 225 lb/A N per year. Rutgers does not currently make recommendations regarding harvest schedules for perennial cool-season grasses. Cornell recommends harvesting grasses before alfalfa in the spring, particularly orchardgrass, if a dairy-quality feed is desired. However, there is a wide range in grass maturity with orchardgrass maturing earlier and timothy later. At the same stage of maturity (heading) there is essentially no difference in quality (Cherney et al., 1999). Additional cuttings after the spring harvest can be made every thirty to forty days if enough regrowth exists to justify a harvest, however, intensive cutting management may severely damage smooth bromegrass and timothy stands (Cherney et al., 1999).

Study Description

'Shawnee' orchardgrass and 'Climax' timothy were seeded at 10 lb/A in the fall of 1994 at the Rutgers University Snyder Research and Extension Farm near Pittstown, New Jersey. Fields were not managed for hay production from 1994 through 1997, but rather, were mowed with a rotary mower several times a year leaving the grass cuttings on the soil surface. In 1998, first cut hay yield and quality were measured at the boot to early-head growth stage (R0-R1, Moore et al., 1991). Plot size for all treatments was 0.2 acres. Plots were mowed with a mower/conditioner and allowed to field dry until a suitable moisture (less than 20%) was attained for safe storage. The plots were then baled and each bale was weighed to determine yield. Samples were randomly collected to determine quality. All yield data are presented at 12% moisture content. No N was applied in the spring at green up. After these fields were baled, N was applied at 0, 25, and 50 lb/A N and this procedure was repeated after each successive cutting in both species. Yield and quality sampling for all harvests was similar to the procedure for first cut.

Ammonium nitrate fertilizer (34% N) was used as the N source to minimize volatilization at a bulk cost of $215/ton. Assuming hay can be sold for $120/ton, and charging $7/Ato topdress N, return to N management for the three N levels for orchardgrass harvests one through four and timothy harvests one through three are presented. Gross returns are calculated as the product of yield and price. Returns are calculated as the gross return minus input and machinery costs.

Applied Question

How do yield, quality, and profitability vary between two grass species and three N levels?

Typically, first cut provides anywhere from 35 to 50% of total seasonal yield. Our first cut yields (Figure 1) were low because N was not applied in the spring (0.72 and 0.93 tons per acre for orchardgrass and timothy, respectively). Timothy first cut yield was greater than orchardgrass because harvest was delayed for 20 days to allow for harvest of both species at the same growth stage. However, orchardgrass neutral detergent fiber (NDF) levels (58.1) were lower than timothy (78.2) (Table 1). NDF is the plant fraction consisting of varying amounts of cellulose, hemicellulose, lignin, and other minor constituents. Lignin is the key component of the NDF fraction because it is the main factor responsible for limiting animal digestibility, and thus intake. As plant species mature, NDF values rise. Ideal NDF values range from 55 to 65 for non-lactating animals.

Second cut orchardgrass receiving 50 lb/A N yielded 177% greater and returned $77 (Table 1) more than the 0 N treatment. Third cut orchardgrass at the 50 lb/A N level yielded 370% greater and returned $66 more than the 0 N treatment. Timothy yields at the 0 and 25 lb/A N level at second and third cut were too low to justify mowing. Nevertheless, our goal was to demonstrate timothy's response to N and cutting interval. Timothy does not tolerate low soil moisture and/or high air temperature. However, even with sufficient moisture between first and second cut, timothy second cut in the 50 lb/A N treatment did not yield as high (0.6 tons per acre) as orchardgrass (1.30 tons per acre) or provide as great a return to N ($49 vs. $133).

Differences in quality were not observed until the third cutting for timothy and the fourth cutting for orchardgrass.

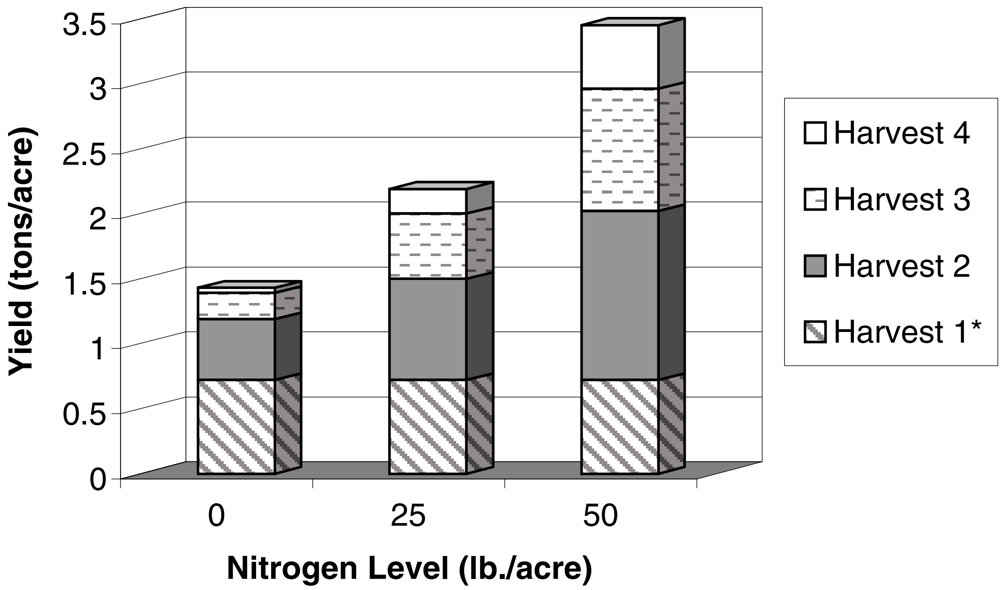
Apparently, there is a delay in the quality response for fields that have not been previously intensively managed. Crude protein levels increased as N input increased in third cut timothy and fourth cut orchardgrass. Generally, NDF levels declined as N input increased in third cut timothy and fourth cut orchardgrass. Total digestible nutrients (TDN) were generally similar after first cut across species and N level.

Recommendations

The goal of this demonstration was to produce a profitable, high quality hay product under intensive management. Clearly, grass hay yield in New Jersey is responsive to N fertilizer. In order for intensively managed hay fields to pay for additional inputs, producers must obtain premium prices for higher quality hay.

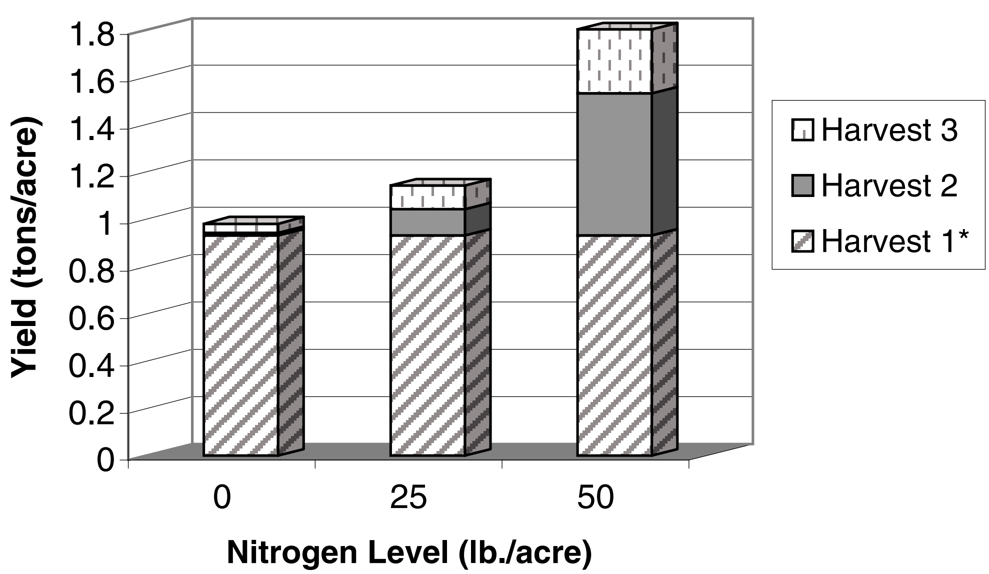
The results presented from this demonstration were not replicated. Therefore, no specific recommendations are presented. However, a grass hay research experiment was initiated in 1999 at the Rutgers University Snyder Research and Extension Farm evaluating timothy, orchardgrass, and smooth bromegrass yield and quality at different N levels.

Figure 1. Orchardgrass yield by harvest at three nitrogen levels



* Harvest 1 at 0 N rate; all treatments imposed after this harvest

Figure 2. Timothy yield by harvest at three nitrogen levels



* Harvest 1 at 0 N rate; all treatments imposed after this harvest

Table 1. Cutting interval, precipitation between cuttings, total digestible nutrients (TDN), crude protein (CP), neutral detergent fiber (NDF), and return to nitrogen (N) per acre for multiple harvests in two grass species and three N levels.						
Treatment	Cutting Interval (days)	Precip (inches)	TDN (%)	CP (%)	NDF (%)	Return to N $/acre
			1st Cut			
Orchardgrass						
0 N	5/14 R0-R1		59	9.1	58.1	86
Timothy						
0 N	6/3 R0-R1		54	8.6	78.2	112
			2nd Cut			
Orchardgrass						
0 N	34	4.0	58	11.4	62.7	56
25 N	34	4.0	57	11.6	65.6	79
50 N	34	4.0	59	10.8	59.8	133
Timothy						
0 N	37	4.1	61	15.9	52.8	1
25 N	37	4.1	59	14.3	57.0	-2
50 N	37	4.1	59	16.8	57.3	49
			3rd Cut			
Orchardgrass						
0 N	33	1.4	58	13.1	63.8	24
25 N	33	1.4	58	12.9	63.6	45
50 N	33	1.4	58	14.3	63.8	90
Timothy						
0 N	40	1.6	59	10.1	59.6	5
25 N	40	1.6	59	13.5	57.5	-3
50 N	40	1.6	60	23.2	56.1	10
			4th Cut			
Orchardgrass						
0 N	41	2.7	58	15.2	64.1	5
25 N	41	2.7	59	17.2	60.3	8
50 N	41	2.7	58	20.7	62.7	36

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