BUFFELGRASS FORAGE AND SEED PRODUCTION RESPONSES TO N AND P FERTILIZATION

W.R. Ocumpaugh[1], M.A. Hussey[2], and B. L. Burson[3]

[1]Texas A&M University Agricultural Research Station, Beeville, Texas 78102 USA [2]Soil and Crop Sciences Dept., Texas A&M University, College Station, Texas [3]USDA-ARS and Soil and Crop Sciences Dept., Texas A&M University, College Station, Texas

ABSTRACT

Forage and seed production responses to nitrogen (N) and phosphorus (P) fertilizer of Common buffelgrass (*Cenchrus ciliaris* L.) were evaluated for three years (1991-93). An incomplete factorial set of five rates of N and P were applied each year. Seed data were collected by hand stripping mature seed followed by a forage harvest. Seed quality characteristics were determined on each seed sample. No response to N fertilizer was observed in 1991 nor to P in any year. In 1992, there was a linear forage yield response to N fertilizer. In 1993, both the linear and quadratic effects of N fertilizer were significant. There was no consistent fertilizer response for any seed trait. Seed yields were higher in spring than autumn harvests. Mean weight per caryopsis declined with time of the year. Number of caryopsis per 100 involucres was greater in the spring/early summer than autumn and mid-May was greater than mid-June.

KEYWORDS

Cenchrus ciliaris L., buffelgrass, forage yield, seed yield, seed quality, fertilizer response

INTRODUCTION

Buffelgrass is a warm season perennial bunchgrass native to southern Africa that is extensively used in the semiarid areas of the world with mild winters. Buffelgrass is grown extensively in South Texas and Mexico and is seeded on more hectares in the region than any other species. Limited data is available on buffelgrass forage production responses to fertilizer (Wiedenfeld *et al*., 1985); however, the literature is void of any data on seed production or seed quality responses to fertilizer. Seed yield and seed quality influences the profitability of commercial seed production enterprises. Seed quality can affect the success rate of establishing pastures.

The objectives of this research were to evaluate the forage and seed production traits of Common buffelgrass when grown under an incomplete factorial set N and P fertilizer treatments.

METHODS

Field plots were established 4 Apr. 1991 with greenhouse grown seedlings at the Texas A&M University Agricultural Research Station at Beeville, Texas (28°N, 97°W). The soil was a Parrita sandy clay loam (fine, mixed, hyperthermic, shallow Petrocalcic Paleustolls) with a pH of 7.9. Soil analysis revealed low N, moderate P and high potassium (K) levels. Each plot was planted with three rows of well developed seedlings with 50 cm between rows and 25 to 30 cm between plants within the row. Fertilizer treatments included an incomplete factorial set of plots with 0, 50, 100, 150 and 200 kg N ha^{-1} and 0, 20, 40, 60 and 80 kg P_2O_5 ha^{-1}. Each fertilizer treatment was replicated twice, except the 100 N/40 P_2O_5 treatment, which was replicated four times. Fertilizer treatments were reapplied to the same plots on 10 May 1991, 8 Apr. 1992 and 8 Apr. 1993.

Forage was harvested in 1991 on 27 June, 20 Aug. and 12 Nov.; in 1992 on 9 Apr., 30 June and 5 Oct.; and on 30 June 1993. Forage was harvested from the entire plot leaving a 10-12 cm stubble. Total weights were recorded and subsamples were taken to determine forage dry matter content of each plot. Samples were dried at 65°C.

Prior to the June forage harvests each year and prior to the August, 1991 and October, 1992 forage harvests, mature seed was hand stripped from the center row of each plot. Seed traits measured included seed involucre or bur yield per hectare, number of caryopsis per 100 involucres and mean caryopsis weight.

The resulting data was analyzed with PC-SAS using the response surface regression procedure to determine the N by P effects. The regression procedure was used to determine the linear and/or quadratic effects of N fertilizer.

RESULTS AND DISCUSSION

Forage yield. No P fertilizer or N by P interactions were observed for forage yield in any year.

In 1991, the mean forage yield was 13,794 kg ha^{-1} with no effect of N or P fertilizer on forage yield. The lack of response to N and P fertilizer was likely due to the response to mineralized N following an extended drought at the site and a moderate level of P indicated by the soil test.

In 1992, the mean forage yield was 10,709 kg ha^{-1}. In 1992, there was a linear response to N fertilizer [DM Yield = 7710 + 30(N), r^2 = 0.75].

In 1993, only one harvest was taken. The area received little rain after the June harvest. The mean forage yield was 4,171 kg ha^{-1}. The linear and quadratic effects of N fertilizer significantly influenced the yield [DM Yield = 2267 + 33(N) - .09(N^2), R^2 = 0.75]. In a 4-year study conducted by Weidenfeld et al. (1985), N fertilizer had a major effect on buffelgrass yield, while P effects were significant in 2 years and then only at high N levels.

Seed yield and quality. No consistent seed production or seed quality trait response to fertilizer was observed throughout the study. A significant seed yield response to increased N fertilizer was observed, but it was a poor fit. The most interesting data collected was the effect of harvest date on seed yield and quality characteristics.

The effect of season of harvest on seed yield was evident in both 1991 and 1992. At the June, 1991 harvest, seed yield was 140 kg ha^{-1}, whereas only 36 kg ha^{-1} was harvested in August. In 1992, seed yields were lower with 34 and 1 kg ha^{-1} harvested in June and September, respectively.

The number of caryopsis per 100 involucres declined from about 170 in mid-May of 1991 to less than 50 in mid-June. By the late August harvest, it had increased to just over 100. In 1992, samples were only taken on two dates, with the June harvest having 87 caryopsis per 100 involucres while the September harvest had only 53.

The weight of each caryopsis was also affected by sampling date. In 1991, mean caryopsis weight declined from 0.6 mg in mid-May to

about 0.5 mg in mid-June. Mean caryopsis weight declined to less than 0.5 mg in August. In 1992, mean caryopsis weight was 0.5 and 0.4 mg in the June and September harvests, respectively.

In a follow-up study in the spring of 1994, we only evaluated seed quality. Caryopsis per 100 involucres declined from about 120 in early May to about 80 in mid-June. Caryopsis weight declined from above 0.6 mg to less than 0.5 mg over the period.

At this time, we are uncertain as to why these seed quality traits decline with delayed harvest date, but this decline has a dramatic effect of seed purity [PLS (pure live seed)] if seed harvest is delayed for any reason. Seed yield and seed quality are generally better in the spring/early summer than in late summer, and the earlier in the spring the better the quality (larger seed and higher PLS).

REFERENCES

Wiedenfeld, R.P., W.T.W. Woodward and R.R. Hoverson. 1985. Forage responses of buffelgrass and 'Petoria 90' bluestem to nitrogen and phosphorus fertilization in a subtropical climate. J. Range Manage. **38**: 242-246.