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Selection and Evaluation of Heavy Seed Weight Synthetic Cultivars of Kleingrass

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SUMMARY

Selection for heavy seed in kleingrass, Planicum coloratum L., has resulted in an increase in seed weight of 53 percent over the base population with three cycles of selection. Evaluation of large seeded synthetics has shown them to be superior to Kleingrass 75 and to the other experimental synthetics tested in stand establishment characteristics.

Yield data from 1981 indicate no statistical difference in forage production between Kleingrass 75 and the heavy seed weight selections. Forage yields from this test ranged from 7300 to 9500 pounds of dry matter per acre. There appeared to be little difference between the selections for in vitro dry matter disappearance, although two makarikariense types of Panicum coloratum tended to have lower IVDMD values at all harvest dates.

The first two years of this study at College Station have indicated that Verde Kleingrass is superior to Kleingrass 75 in stand establishment and early growth, but does not differ from Kleingrass 75 in forage quality or in dry matter production.

Introduction

Kleingrass is an important warm season perennial grass adapted to most regions of Texas (4). Although the species does not possess the yield potential of some of the other introduced species, it does produce favorable dry matter yields in the drier regions of the state. Grazing studies at both Beeville and McGregor have indicated a greater average daily gain for calves grazing kleingrass than for those grazing Coastal Bermudagrass (Cynodon dactylon (L.) Pers.), demonstrating the importance of kleingrass in many areas of Texas (1).

Kleingrass has generally been reported to have good forage quality when compared to other warm season grasses and has also been shown to be important to wildlife. In areas in which kleingrass has been planted quail populations have also shown subsequent increases. Studies at Texas A&M have confirmed that kleingrass seed is acceptable to quail. In a feeding trial quail were found to consume kleingrass seed as 28% of their diet when given a free choice between kleingrass seed and a standard game bird mix (2). One limiting factor

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which has been cited in the use of kleingrass seed as a potential food source for gamebirds is the small size of the kleingrass seed which may make it more difficult for birds to locate adequate seed to meet their nutritional requirements.

Recent work at College Station has focused on improving seed size in kleingrass. Improvements in seed size have been shown to be releated to improved seedling vigor in many small seeded species (3, 5), and has also been shown to have potential in improving stand establishment characteristics in kleingrass. Improved stand establishment characteristics coupled with the potential value of larger seed for gamebirds has made selection for heavy seed an important objective in the kleingrass breeding program.

Materials and Methods

Selection for improved seed weight in kleingrass has been carried out for three generations by selecting both within and among half-sib families. Each cycle of selection has involved hand harvesting individual plants within the nursery. The inflorescences from each of these plants were then threshed seperately by rubbing the seed on a rub board. The seed were blown in a constant air stream to remove all the chaff and then the seed were counted. Two lots of one hundred seed each were counted from each plant and then weighed to the nearest one-tenth milligram. The average of these two weights were used to represent the weight of each plant. Selection pressure was placed on the populations only for seed weight without respect to any other characteristic.

To evaluate the effect of selection for seed weight on forage yield and quality, six experimental synthetics, Kleingrass 75, and Verde Kleingrass (Table 1) were planted in a test in the spring of 1980 at College Station on a Norwoood silty clay loam soil. Each line was planted at a rate of 44 pure live seed per square foot (3 lbs. per acre based on Kleingrass 75). The seed were planted using a belt planter into 100 square foot plots (5 x 20 ft.) at a depth of 0.5 - 1.0 inches. The plots were fertilized with 50 lbs. of N, P, and K four weeks after planting and with an additional 50 lbs. of nitrogen per acre in July. Similar fertilization occurred in 1981.

Evaluation of seedling growth was made 28 days after planting in the spring of 1980, by harvesting two feet of row from each plot and counting the number of seedlings present. These seedlings were dried for 48 hours at 60^{o} C to determine the average weight per seedling. Plot yields were determined by harvesting a 3 x 17 foot swath from each plot with a flail type mower. Samples for *in vitro* analysis were harvested prior to the six week yield harvest and whole plant digestibilities were calculated by taking the sum of the IVDMD's of the leaf and stem fractions.

Results and Discussion

Three cycles of selection for heavy seed have been successful in increasing seed weight in kleingrass from a mean weight of 79.3 mg/100 seed in the base population to 121.6 mg/100 seed in cycle 3. This increase in seed weight has resulted in the reduction in the

standard deviation for seed weight in this population (Table 2), and an average increase in seed weight of 17 percent per cycle of selection.

Field evaluations of heavy seed weight synthetics and other selected experimental lines were conducted in 1980 and 1981. In the establishment year, the heavy seed weight synthetics were superior to Kleingrass 75 in early growth (Table 3). While no significant difference in plant number was observed, the heavy seed weight genotypes had superior seedling vigor as measured by seedling weight and a visual score.

Dry matter yields for 1981 are shown in Table 4. There were no significant differences in yield between any of the lines at the three-week harvest frequency. Although some differences were observed at the six week harvest frequency, only 78-31 which yielded 9500 lbs./acre was significantly different in yield from Kleingrass 75.

Data from *in vitro* analysis of each synthetic were not statistically analyzed (Table 5), although there appeared to be little difference in IVDMD's among the synthetics tested. Only the makarikariense forms of *Panicum coloratum* appeared to have a lower digestibility than Kleingrass 75. Kleingrass 75-25, a synthetic selected on the basis of high *in vitro* dry matter digestibility, did appear to be slightly higher in DMD at all harvest dates than the other synthetics in the test.

Initial results from this study are promising in that they indicate selection for large seed in kleingrass (Verde Kleingrass) has not resulted in any change in the quality or yield, but has resulted in a new cultivar superior to Kleingrass 75 in stand establishment characteristics. Further research is presently being conducted throughout Texas to determine the area of adaptation and persistence of these heavy seed weight synthetics.

Literature Cited

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Table 1. Experimental Kleingrass Synthetics. Seed Evaluation Data.

Synthetic	Seed Weight (mg/100 seed)	Protein Content %	Seed Per Pound	Basis of Selection
75-25	66.1	13.8	687000	High DMD
79-34	61.6	14.4	737000	High DMD
Klein 75	70.1	15.0	648000	----------
Verde	90.9	15.3	500000	Large Seed Size
78-30	100.9	15.0	450000	Large Seed Size
79-35	107.8	14.4	421000	Large Seed Size
78-31	98.8	13.1	460000	makari type
78-32	89.2	12.5	509000	makari type

Table 2. Summary of Three Cycles of Selection for Heavy Seed in Kleingrass

	Cycle 0	Cycle 1	Cycle 2	Cycle 3
Mean	79.3[1]	100.8	102.6	121.6
Range	25.0-131.6	63.7-144.1	74.9-138.1	84.7-165.2
Std. Dev.	13.7	11.0	10.8	7.1
Klein 75	----	83.2	81.0	81.3
% Increase	----	27.1	1.8	18.5
Parent-Progeny Corr.	0.61	0.78	0.28	0.29

[1] All values expressed as mg / 100 seed.

Table 3. Stand Establishment of Kleingrass Synthetics. College Station-1980.

Synthetic	Plant Number[1]	Seedling Weight mg / seedling	Visual Rating[2]
75-25	17.0 A[3]	8.9 BC	4.0 C
79-34	14.7 A	10.1 ABC	4.3 C
Klein 75	19.0 A	11.3 AB	4.8 BC
Verde	25.9 A	13.5 AB	7.8 A
78-30	25.5 A	13.5 AB	7.5 A
79-35	25.9 A	13.7 A	7.0 A
78-31	23.9 A	6.6 C	5.0 BC
78-32	22.4 A	9.7 ABC	5.8 B

1 Number of plants per 2 ft. of row.

2 Visual rating 1=no stand 10=100% stand

3 Means within a column followed by the same letter do not differ at the 0.05 level as determined by Duncans Multiple Range Test.

Table 4. Seasonal Dry Matter Production of Experimental Kleingrass Synthetics Harvested at Three and Six Week Intervals. College Station-1981.

Synthetic	3 Week[1]	6 Week
75-25	5433 A [2]	7509 BC
79-34	5249 A	8072 BC
Klein 75	6236 A	7932 BC
Verde	6522 A	8688 AB
78-30	6053 A	7194 C
79-35	6142 A	7767 BC
78-31	4591 A	9499 A
78-32	5295 A	7757 BC

1 All values are pounds of dry matter / acre.

2 Means within a column followed by the same letter do not differ at the 0.05 level as determined by Duncans Multiple Range Test.

Table 5. *In vitro* Dry Matter Disappearance (IVDMD) of Experimental Kleingrass Synthetics. College Station-1981.

Synthetic	6-12	8-4	9-16	Seasonal Average
75-25	56.2	61.9	64.0	60.7
79-34	56.5	57.5	61.7	58.6
Klein 75	54.4	59.0	63.7	59.0
Verde	57.1	60.6	61.8	59.8
78-30	58.4	59.7	56.7	58.3
79-35	58.0	58.4	62.2	59.5
78-31	54.8	53.8	54.6	54.4
78-32	56.5	57.7	57.1	57.1