PUBLICATIONS

1981

Forage Research in Texas

Departmental Technical Report No. 81-12

Department of Soil and Crop Sciences

PW - 0076

Project: H-6457

Workers: E.C. Holt
Mark Hussey
Richard Hendler

Location: College Station

(PERFORMANCE OF) EXPERIMENTAL VARIETIES OF KLEINGRASS (PANICUM COLORATUM L.)

OBJECTIVES:

To determine the yield, seedling vigor and forage quality of synthetic varieties of kleingrass selected for various traits.

BACKGROUND AND PROCEDURE:

Kleingrass is native to Africa and was first introduced by the Texas Agricultural Experiment Station in 1942. The first introductions and additional ones received in 1947 and 1948 did not show any promise. African introductions received after that time resulted in 'Selection 75' kleingrass which was released jointly by TAES,SCS and USDA SEA AR in 1968. Kleingrass 75 has been planted on more than 750,000 acres predominately in the Edwards Plateau, Rio Grande Plains, Rolling Plains, and Blacklands. Some of the same African introductions from which Kleingrass 75 originated and others obtained after that time are the sources of the experimental varieties in this report. Selection for increased seed size (weight) started in 1972 to enhance seed value for game birds and to increase seedling vigor. Open-pollinated seed were collected from approximately 4,000 individual plants originating from 30 plant introductions. The seed were separated in an air column calibrated to remove all but the heaviest seed. Approximately 70 plants were identified based on a combination of a high percentage of seed retained on the screen through which the air was passed and on seed weights. Two parent clones and 38 O.P. progeny were established from each selected plant. Seed weights of the parent clones and progeny were determined from three separate seed harvests. Based on the first seed harvest, the heritability estimate for seed weight was 68.2% with expected advance of 22.8% based on selection of the top 10% of the parent plants. The additional evaluations gave essentially the same results.

We established two polycross blocks; one based on 11 parent clones (74-23) and one based on the top 15 O.P. progeny (74-24) in the parent-O.P. progeny nursery. A replicated parent-polycross nursery was established and evaluated in three seed harvests using Kleingrass 75 as a check. Data in Table 1 indicate an 18.5 to 25.5% increase over Kleingrass

75. Because of the similarity in performance, the parents of both crosses were combined in a new cross (77-28) after eliminating six of the 26 parent plants based on progeny performance.

The top polycross progeny in 77-28 were used in a recurrent selection cycle designated as 77-30. The top progeny in 77-30 were intercrossed with totally unrelated plants from recent introductions evaluated for seed size resulting in 79-35.

Polycross progeny and parent clones of an experimental variety (67-12) selected for seed production were evaluated for in vitro dry matter digestibility (VDMD). Approximately 28 of the top plants were intercrossed and progeny tested. This cross has the experimental designation 75-25. Experimental 72-22 is an intercross of 29 plants from a broad base selected for superior IVDMD.

RESULTS AND DISCUSSION:

Observations have indicated that kleingrass is acceptable to game birds, especially quail, in that increases in bird populations have been reported repeatedly following establishment of kleingrass. Yet the seed are probably marginal in size for bird use in the field. Kleingrass has been shown to be of nutritional value to quail through controlled feeding. Caged quail, when given free choice between kleingrass and a standard game bird diet, voluntarily consumed 28% of their diet as Kleingrass with no significant difference in total dry matter intake or bird performance (weight gain) (Table 2). However, when given a choice only of perennial grass seeds (kleingrass, green sprangletop, and plains bristlegrass), bird performance was not as good on an all-grass seed diet as on a balanced diet. Quail may subsist for relatively short periods on kleingrass seed but probably require a varied diet from which to select for satisfactory performance and survival.

Forage yields are shown in Tables 3, 4 and 5. In a test established in 1977 and continued through 1980, only 70-17 differed significantly in yield from Kleingrass 75 and several other experimental selections. Experimental 70-17 is a selection for seed production. In a separate test established in 1977 involving only K-75 and 77-28 (Table 4) and harvested in 1978 using two frequencies of cutting, 77-28 produced more than Kleingrass 75 with more frequent harvesting and less with less frequent harvesting. A test including some of the newer selections was direct seeded in April 1980 and harvested one time in 1980 (Table 5). The results show little difference in forage yield except for 75-25 which appeared to produce less forage and 77-30 which appeared to produce more forage.

Seedling vigor when measured as weight of the seedling above the soil surface at a fixed time interval following emergence has been shown to be related to seed size in Kleingrass (Figure 1), (Hussey, M.A. 1979. Selection for increased seed weight in Panicum coloratum L. and its

relationship to early seedling vigor. M.S. Thesis, Texas A&M University). In the test planted in 1980, both initial stand and seedling weight were fairly closely related to seed weight (Table 6). These weights also are fairly closely related to first cutting yields (Table 5) in the same test indicating some carryover effect of seedling vigor at least to first-cutting yield. Distinct differences in vigor were apparent initially in the field study, associated with seed size, but were not readily apparent visually six to eight weeks post emergence. However, measurable differences in production were present at the end of the first growing season. Seedling vigor of the same experimental lines was determined under controlled conditions (24C, 14/10 photoperiod, 1,000 mε m^{-2} sec^{-1}) at planting depths of 1, 2 and 3 inches. Seedling weights (Table 7) at 14 days post emergence follow the same pattern as the field study but the percentage increases over Kleingrass 75 were greater in the controlled environment. The study indicates even greater advantage of large seed for planting at depths greater than 3/4 to 1 inch.

Increased seed size should enhance kleingrass value for game birds under natural conditions. This thesis has not been confirmed under field conditions, but it is assumed that larger seeds would be easier to find and would have higher energy content.

Forage quality was evaluated from two harvests in 1978 in a test established in 1977 (Table 8). Selection 75-25 had the highest IVDMD. Similar performance of 75-25 was reported by Woodward[1]. Selection 77-28 was equal to or exceeded Kleingrass 75 by as much as four digestibility units and was essentially equal to high quality selections such as 75-25 and 72-22. In a second study involving only 77-28 and Kleingrass 75 in which each was repeatedly harvested at four and eight inch heights, 77-28(Verde) was not significantly different to Kleingrass 75 though it was higher at each frequency. It seems safe to conclude that 75-25 is superior to Kleingrass 75 in dry matter digestibility and that 72-22 and 77-28 are equal or slightly higher than Kleingrass 75.

Kleingrass produces adequate amounts of seed but shattering usually limits harvested yields to less than 100 pounds per acre. Total seed production was subject to selection pressure only in 70-17 and in the parental source of 75-25. In a test involving several lines in 1978 and 1979 (Table 10) there was no significant differences in seed yields. Harvested yields were quite low in the second year because of excessive shattering before harvest. In another study involving only 77-28 and Kleingrass 75 (Talbe 11), 77-28 appeared to out yield Kleingrass 75 especially in the spring.

Selection 77-28 has been approved for release as 'Verde' kleingrass on the basis of performance recorded in this report. Other selections, especially 77-30 and 79-35, appear to have larger seed and better seedling vigor but only preliminary performance data are available. Verde has not been tested at other locations, but since no selection pressure has been exerted for climatic adaptation, it is assumed that its area of

[1]Woodward, W.T.W. 1980. Evaluation of selected forage Species For South Texas, Texas Agric. Exp. Stn. MP - 1459. 9P.

adaptation will not be greatly different to Kleingrass 75. However, its primary contribution is expected to be dual use for quail and livestock in South and Central Texas until more extensive test results are available.

The causal agent for kleingrass photosensitization in sheep and goats has not been identified. There is no reason to assume that Verde is different to Kleingrass 75 in this respect. Thus, growers should be aware that Verde may cause photosensitization in sheep and goats.

- -

Table 1. Mean seed weight of kleingrass polycross progeny following selection for increased seed weight.

Source	Seed wt. mg/100 seed	% of Kleingrass 75
74-23		
Parents	100.6	120.9
Progeny	98.6	118.5
74-24		
Parents	106.0	127.4
Progeny	104.4	125.5
K-75	83.2	
77-28		
Parents	98.3	119.2
Progeny	98.2	119.0
K-75	82.5	

Table 2. Kleingrass seed consumption and bird performance of caged quail.

Feed offered	Amount consumed g/bird/day	% kleingrass	Final bird wt (g)
Standard Diet	17.3	0	208
Standard & kleingrass	18.1	28.6	203

TABLE 3. DRY MATTER YIELD OF KLEINGRASS SELECTIONS, 1978-80, UNIVERSITY FARM

Selection	Pounds of dry forage per acre								
	6/16/78	8/16/78	9/29/78	7/16/79	8/28/79	5/27/80	7/21/80	9/23/80	Average
77-28	6830	820	5420	4110	1920	4030	3240	2830	3650a
75-25	5670	1260	4570	4560	2410	5330	3340	2840	3748a
K-75	6360	1540	4590	4630	2430	4520	3310	4020	3925a
72-22	6690	1280	4990	4990	2500	5030	2820	3640	3993a
70-17	5470	1310	4880	4150	1760	3450	1870	2900	3224b

Table 4. Forage yield of kleingrass varieties cut monthly, University Farm, 1978

Selection	Pounds of dry forage per acre		
	4-inch Stubble height	8-inch Stubble height	Average
K-75	7395	8794	8094
77-28	8909	8385	8647

Table 5. Forage yield of kleingrass selections[1], 1980

Selection	Pounds dry forage/acre
77-28	2197
77-25	1580
K-75	1948
77-30	
79-35	2291

[1]Test planted April 25, 1980 and harvested September 22, 1980

TABLE 6. SEED SIZE RELATIONSHIPS TO STAND EMERGENCE AND SEEDLING WEIGHT (VIGOR) IN KLEINGRASS, 1980

Selection	Seed wt. (mg/100 seed)	Stand rating[1]	Seedling wt[2] (mg/plant)
77-28	90.9	7.38	12.37
77-30	100.9	7.50	13.15
79-35	107.8	7.00	13.60
75-25	66.1	4.13	7.64
79-34	61.6	4.25	9.83
K-75	70.1	4.75	11.26

[1]Visual rating: 0= no stand to 10 = 100% stand

[2]Weight of above ground seedling at 4 weeks post emergence

TABLE 7. WEIGHT OF KLEINGRASS SEEDLING PRODUCED UNDER CONTROLLED CONDITIONS[1]

Selection	Seedling weight - mg/seedling[2]		
	Planting depth (inches)		
	1	2	3
77-28	1.25	.95	.92
77-30	1.58	.99	.97
79-35	1.42	1.13	.65
75-25	.75	.54	.28
79-34	.76	.63	.39
K-75	.88	.50	.47

[1]24C, 14/10 Light/dark photoperiod, 1,000 mε m^{-2} sec^{-1}.

[2]14 days post emergence.

TABLE 8. FORAGE QUALITY OF KLEINGRASS SELECTIONS, UNIVERSITY FARM, 1978

Selection	% In vitro dry matter digestibility		
	Aug 16	Sept. 29	Average
77-28	62	53	58
75-25	63	54	59
K-75	61	49	55
72-22	63	51	57
70-17	61	50	56

TABLE 9. MEAN DRY MATTER DIGESTIBILITY OF KLEINGRASS VARIETIES CUT MONTHLY, UNIVERSITY FARM, 1978

Selection	% IVDMD 4-inch stubble ht.	8-inch stubble ht.	Average
K-75	58 ± 3.1	57 ± 3.1	57.5
77-28	60 ± 2.9	59 ± 3.5	59.5

TABLE 10. SEED YIELD OF KLEINGRASS VARIETIES, UNIVERSITY FARM, 1978-79

Selection	Pounds of seed per acre 6/27/78	10/18/78	Total 1978	7/13/79	10/10/79	Total 1979
77-28	73	10	83	33	8	41
75-25	67	22	89	28	9	37
K-75	75	25	100	28	10	38
72-22	68	21	89	26	12	38
70-17	73	32	105	33	15	48

TABLE 11. PEAK[1] HARVESTED SEED YIELD IN STANDS PERMITTED TO MATURE SEED IN SPRING, SUMMER AND FALL AT COLLEGE STATION, 1978

Selection	Periods of clean seed per acre Spring	Summer	Fall
K-75	95	64	33
77-28	175	70	54

[1]Seed was harvested weekly by sampling a different location each week during the seed maturation period in spring, summer and fall; values represent the maximum seed harvested within each season.

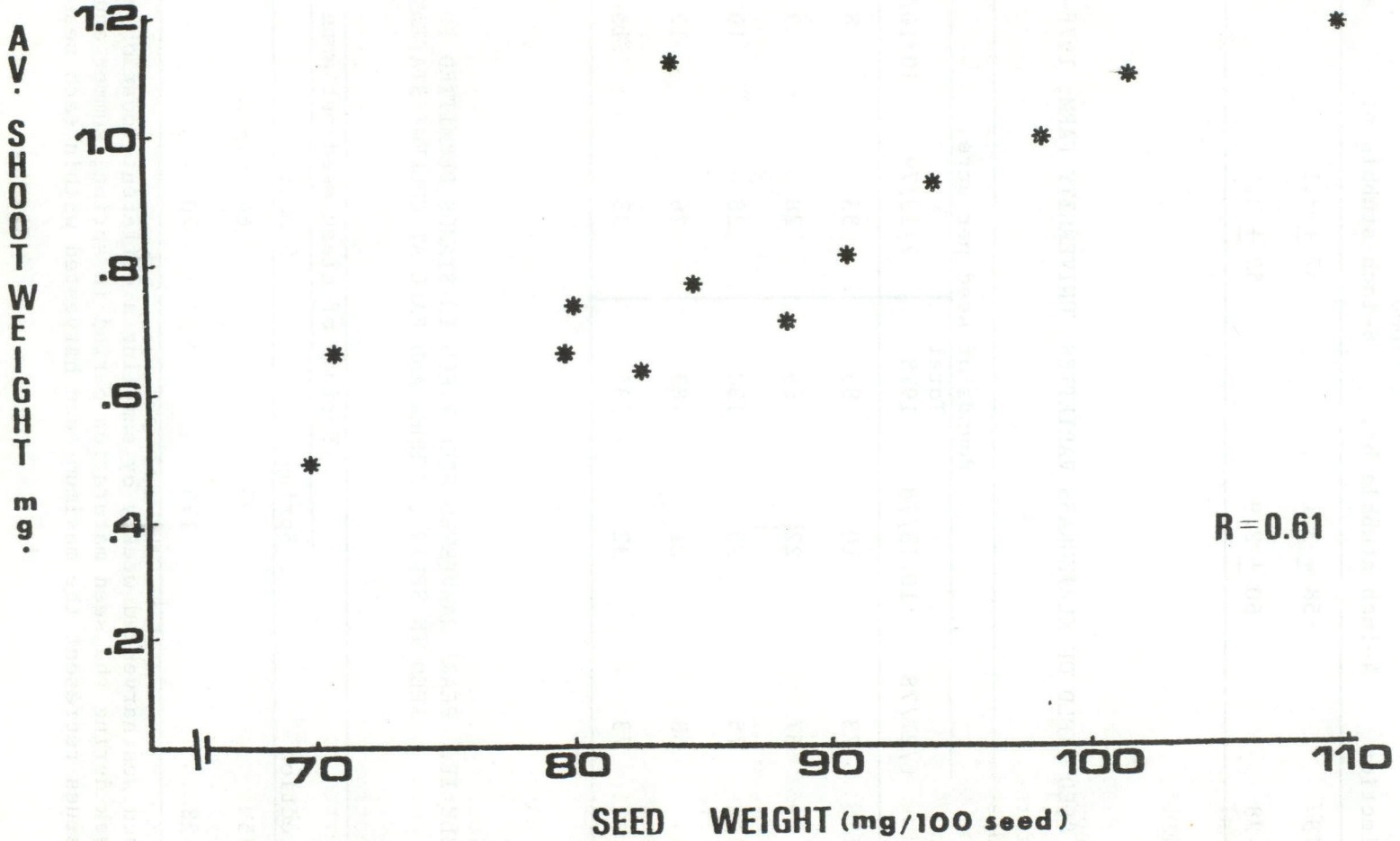

Fig. 1. Seed weight versus average shoot dry weight of kleingrass seedlings planted at 6.5 cm.