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Seed Production Characteristics

of Some Introduced Warm-season Grasses

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Summary

Several very promising grasses have been introduced in the Southwestern United States but have not been used widely because of one or more limiting factors. Kleingrass, *Panicum coloratum* L., appears to be adapted to a wide range of soil and climatic conditions, but seed production is hampered by a severe seed-shattering characteristic. Pretoria 90 bluestem *(Dicanthium annulatum* (Forssk.) Stapf) makes very heavy forage yields but produces low quality seed and is not winter-hardy north of Central Texas. Other introduced bluestems have similar seed production and adaptation characteristics but generally are less productive than Pretoria 90.

Studies conducted over a period of 5 years concerned with seed production characteristics and management practices are reported.

Flowering and maturity in the kleingrass inflorescence progresses from the top to the base for several days. Seed shattering may occur at the top of the inflorescence before blooming is completed at the base. Harvesting 5-10 days following the first signs of seed shattering resulted in maximum seed yields and seed quality. If most of the seed heads are produced at the same time, peak seed yields are limited to a very few days. Seed heads may be initiated over a long period, especially in the fall, resulting in a longer period in which satisfactory seed yields are obtained. Yields of 50 to more than 100 pounds of seed material in each of two harvests varying in purity from 15 to 60 percent are obtained.

A fall seed crop of kleingrass was obtained 30 days after a hay harvest. Similar yields were obtained on stands not cut for hay. These results indicate that several seed crops might be obtained or that several harvests would be possible if the seed could be removed by agitation without cutting the plants.

The introduced bluestems produce a spring seed crop varying in yield from a few pounds to more than 125 pounds per acre. Quality also varies from as low as 10 percent purity to over 40 percent purity. Regrowth following the spring seed harvest reaches the stage for floral development in early August, but floral development occurs poorly and slowly. Removal (clipping) of the vegetative growth in August results in regrowth which initiates flowering within 30 days and seed maturity before frost. If the vegetative growth is not removed in August, floral initiation and maturity are frequently delayed until after frost. Two seed crops annually are possible with this management practice.

Irrigation of the introduced bluestems is necessary in dry years for fall seed production in the College Station area. However, unnecessary irrigation delays maturity and reduces seed yields.

Maximum seed yields of Pretoria 90 bluestem were obtained 2 to 5 days after the tips of approximately 50 percent of the heads would release seed with a gentle pull with the fingers.

Several experimental bluestem accessions have been evaluated for forage and seed production. Since Pretoria 90 is outstanding in forage production, it was used as a basis for comparing the newer lines. None of the experimental material was superior to Pretoria 90 in forage production. A few of the accessions produced higher yields of better quality seed but were unsatisfactory vegetatively. Thus, none of the lines show sufficient promise to warrant increase.

FORAGE AND SEED PRODUCTION OF INTRODUCED BLUESTEM ACCESSIONS, COLLEGE STATION, 1961-63

Accession or variety	Species	Forage production[1] 1961	1962	1963	Percent leaves[3]	Seed production[2] 1961 Pounds	1961 Percent seed set	1962 Pounds	1962 Percent seed set[4]	1963 Pounds
Pretoria 90	Dicanthium annulatum	3.4	1.5	2.6	27.1	90	8	42	11.7	70
Medio	Dicanthium caricosum	.9	.6	1.5	24.5	81	10	16	7.2	20
Gordo	Dicanthium annulatum	.6				101	53			
4080	Dicanthium annulatum	3.0	2.0	2.1	30.2	98	19	36	8.2	54
6141	Bothriochloa intermedia	2.3	1.8	1.8	17.6	113	44	18	12.8	53
T-20069	Dicanthium sp.	3.5	2.0	1.4	31.5	105	10	28	5.6	67
T-20299	Dicanthium sericeus	3.4	1.7	1.2	27.9	51	18	50	11.8	57
2660	Dicanthium caricosum	1.0				184	58			
4081	Dicanthium annulatum	.9				124	42			
3025	Dicanthium aristatum	.8				87	47			
T-4931	Dicanthium annulatum		2.2	1.8	23.9			59	8.6	105
3965	Bothriochloa intermedia		1.1	.8	16.2			18	19.4	35
5398	Dicanthium annulatum		.9	1.3	16.1			22	18.0	36
4099	Dicanthium annulatum		.4	1.7	16.6			16	15.0	36
5297	Bothriochloa intermedia		.3	1.2	16.1			10	12.4	16
55 x 485-2	Dicanthium annulatum		.7	1.0	14.0			20	14.9	29

[1]Yields from upland farm near College Station; 1961 was from second-year stand, 1962 and 1963 were from a test established in 1962.
[2]Seed production data were taken from the forage plots after the final harvest and indicate fall production and not total seed production potential.
[3]Leaf percentage based on September 1962 forage harvest.
[4]Percent seed set in 1962 was based on weight rather than number and therefore is low but indicates accession differences.

Seed Production Characteristics of Some Introduced Warm-season Grasses

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NUMEROUS GRASSES have been introduced into Texas since the late 1930's. Many of these have come into common usage in areas of adaptation. These include King Ranch bluestem, buffelgrass, weeping lovegrass, blue panicgrass, Sorghum almum and perhaps others. Still other grasses have been shown to be adapted but have not been established extensively because of unavailability of seed or high seed costs. This may result from poor seed yields, low quality, difficulty of harvest or other seed production problems. Among the grasses which have shown some degree of adaptation but which are limited by seed production or poor seed production characteristics, are numerous members of the introduced bluestems, especially members of the *Dicanthium* complex. Some of these include Medio, Pretoria 90, Angleton and Kleberg bluestems. Kleingrass, *Panicum coloratum,* is another example of a promising grass which is restricted because of seed production characteristics.

This publication reports research studies concerned primarily with seed production problems of kleingrass, Pretoria 90 bluestem, Medio bluestem, Accession 4080 bluestem and other bluestem accessions.

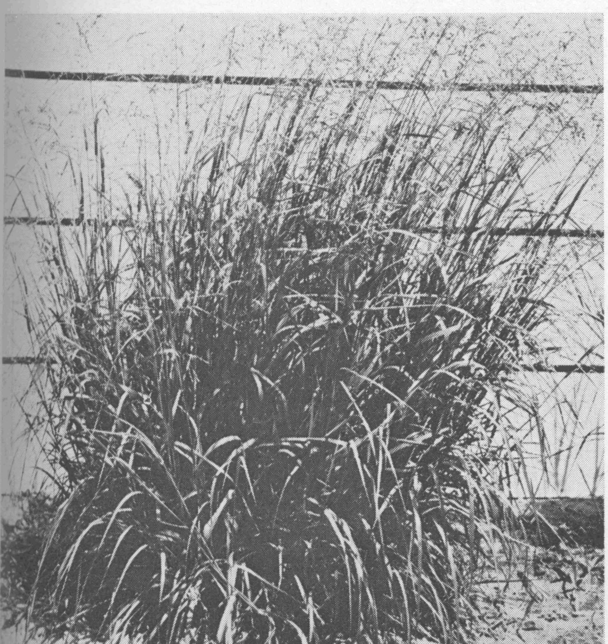

Figure 1. A plant of kleingrass showing growth habit and texture.

Kleingrass *(Panicum coloratum* L.), shown in Figure 1, is described as a perennial warm-season bunchgrass introduced from Africa and adapted to a fairly wide range of soil and climatic conditions. The stems are slender and very leafy, reaching a height of 3½-4 feet at maturity. Plants within the species vary from upright to stoloniferous in growth habit, from glabrous to densely pubescent and from light to dark green to bluegreen in color. Kleingrass initiates growth early in the spring and remains green late in the fall. Seed are produced on an open panicle and tend to drop from the panicle as they mature.

Pretoria 90 bluestem *(Dicanthium annulatum* (Forssk.) Stapf) is a tall, warm-season, perennial bunchgrass adapted to the heavier soils in Central and South Texas and the Gulf Coast. Plants are 4 to 5 feet high at maturity. The stems are somewhat coarse with broad leaves which carry high on the stems (Figure 2). Extremely high yields of leafy forage are produced. The foliage is a characteristic grey-green color.

Medio bluestem *(Dicanthium caricosum* (L.) A. Camus) is described as a variant of Angletongrass with fine stems and good seed production. The plants are fine stemmed, leafy, dark green and reach a height of 24-30 inches at maturity. The plants spread rapidly by prostrate stems to form a dense, solid ground cover (Figure 3). Medio is best adapted to clay soils or sandy soils with a shallow clay layer south of a line from Waco to San Angelo, Texas.

Figure 2. A plot of Pretoria 90 bluestem showing texture and stem enlargement (booting) in August.

Figure 3. A solid stand of Medio bluestem showing texture and stem enlargement (booting) in August.

Accession 4080 bluestem *(Dicanthium annulatum* (Forssk.) Stapf) is very similar to Pretoria 90 in growth habit and foliage characteristics.

The introduced bluestems were earlier classified as *Andropogon* species but extensive studies in Oklahoma[1] in recent years have led to their classification as *Dicanthium, Bothriochloa* and *Capillipedium* species. These classifications are utilized in this report. In the work at College Station, emphasis has been placed on the *Dicanthium* group because of better leafiness and forage characteristics, but the *Bothriochloa* species in general are more hardy.

[1]Celarier, R. P. and Harlan, J. R. 1955. Studies on Old World bluestems. Okla. Agri. Exp. Sta. Tech. Bul. T - 58.

Harlan, Jack R., Celarier, R. P., Richardson, W. L., Brooks, M. H., and Mehra, K. L. 1958. Studies on Old World bluestems II. Okla. Agri. Exp. Sta. Tech. Bul. T - 72.

Harlan, Jack R., de Wet, J. M. J., Richardson, W. L., and Chheda, H. R. 1961. Studies on Old World bluestems III. Okla. Agri. Exp. Sta. Tech. Bul. T - 92.

TABLE 1. SEED YIELD AND QUALITY OF KLEINGRASS, COLLEGE STATION, 1958-59

Year	Pounds of seed per acre			Percent seed set		
	June	August	Total	June	August	Weighed average
1958	127	74	201	30	35	32
1959	50	60	110	42	11	25

Kleingrass

Kleingrass seed yields vary from year to year depending on cultural treatments, harvest practice and, possibly, age of stand. Seed yields in 1958 and 1959 are presented in Table 1. Satisfactory yields were obtained in 1958 but not in 1959. Because of the seed shattering problem and indeterminate flowering, many seed are lost prior to harvest, and others are immature at the time of harvest. Anthesis (blooming) begins at the top of the inflorescence and on the tips of the branches of the inflorescence and progresses toward the base of the inflorescence. Frequently, shattering may be noted at the extremities of the inflorescence while florets near the base are in anthesis. Not all inflorescences develop at the same time. Thus, some inflorescences may be maturing at the time others are initiating anthesis. Because of these seed producing characteristics, management and harvest practices were studied in an effort to determine how and when maximum seed yields could be obtained.

Samples were harvested at frequent intervals in 1959 starting at the first indications of shattering on the earliest inflorescence and continuing until most of the seed had shattered. The study was conducted with both the first seed crop in late spring and the early fall seed crop. The results in Figure 4 indi-

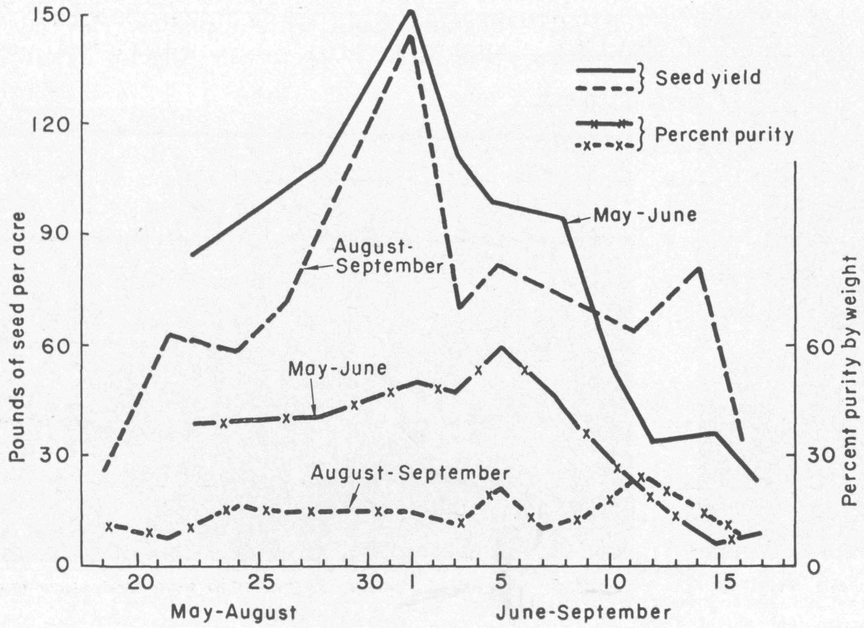

Figure 4. The influence of time of harvest on seed yield and purity of kleingrass, 1959. Initial sampling (harvest) was on date of first observed shattering.

cated a critical period for seed harvest in both the spring and fall seed crop of kleingrass in 1959. Peak spring yields occurred approximately 10 days following the first apparent seed shattering on May 22. Actually, there was a period of more than 8 days in which harvest of more than 100 pounds of seed material per acre was possible. The peak period in the fall occurred 12-14 days after first apparent seed shattering. A much shorter time existed in the fall in which harvest of more than 100 pounds of seed material was possible. However, there was a long period, approximately 20 days, in which yields averaged about 75 pounds per acre. Apparently the rate of seed maturity during this period approximated that of seed shattering.

Seed set ranged from 45 to 60 percent during a 10-day period in the spring. This period coincided with that in which yields amounted to 100 pounds or more per acre. The actual peak in seed quality was 4 days later than the peak in yield. Fall quality was low, averaging only about 15 percent with no significant peak.

Yields in these studies were determined by cutting, binding, drying and then threshing the seed. Thus, a much higher percentage of immature spikelets in the threshed seed would be obtained resulting in higher total yields but reduced purity. Field combining might be expected to result in less total yield but better quality because less of the immature material would thresh while green.

Seed purity and potential seed yields were determined at frequent intervals again in 1960 (Figure 5). Apparently, sampling was started too late in the spring since yields dropped to less than 20 pounds per acre 2 days after sampling started. The fall seed crop changed very slowly in yield and quality. However, harvest either at the time of first obvious shattering or during the following 10 days would have resulted in the best yield and quality. A second peak in yield and slightly improved quality occurred about

TABLE 2. KLEINGRASS SEED YIELDS WITH VARIOUS MANAGEMENT AND FERTILITY PRACTICES, AGRONOMY FARM, 1962

Fertilizer treatment	Clipping height,[1] inches	Cleaned seed per acre, pounds				
		9/21	9/25	10/2	10/5	10/11
40-40-40	2	19	33	16	8	2
	6	23	32	14	5	2
	24	33	41	11	5	1
	Not clipped	14	23	10	5	1
Average		22	32	13	6	2
0-0-0	2	16	20	11	5	1
	6	18	30	7	4	1
	24	24	28	10	2	2
	Not clipped	28	32	10	4	2
Average		21	28	10	4	2

[1]Clipped to stubble heights indicated on August 20, 1962.

25 days after initial shattering. Apparently inflorescence production continued even though the plants were not cut and the late developing inflorescences started maturing about 25 days after the first inflorescences matured.

Since the fall seed crop tends to mature more unevenly than the first crop in the spring, the effect of clipping at various heights in late summer was studied in 1962. Results are presented in Table 2. When fertilizer was applied at the time of clipping, yields were improved following clipping. Some seed were mature and started shedding approximately 1 month after clipping. Peak harvested yields were obtained 5 days after initial seed shattering. When fertilizer was not applied at the time of clipping, yields were as good without clipping as with clipping. Again, the peak harvested seed yields were 5 days after initial shattering on clipped plots.

The yields are reported as cleaned or pure seed. While the yields are relatively low, the results suggest that frequent harvest is possible since mowing 30 days prior to harvest did not affect yield. Several harvests should result in pure seed yields in excess of 150 pounds per acre. A system of harvest whereby the plants were not cut but rather the mature seed

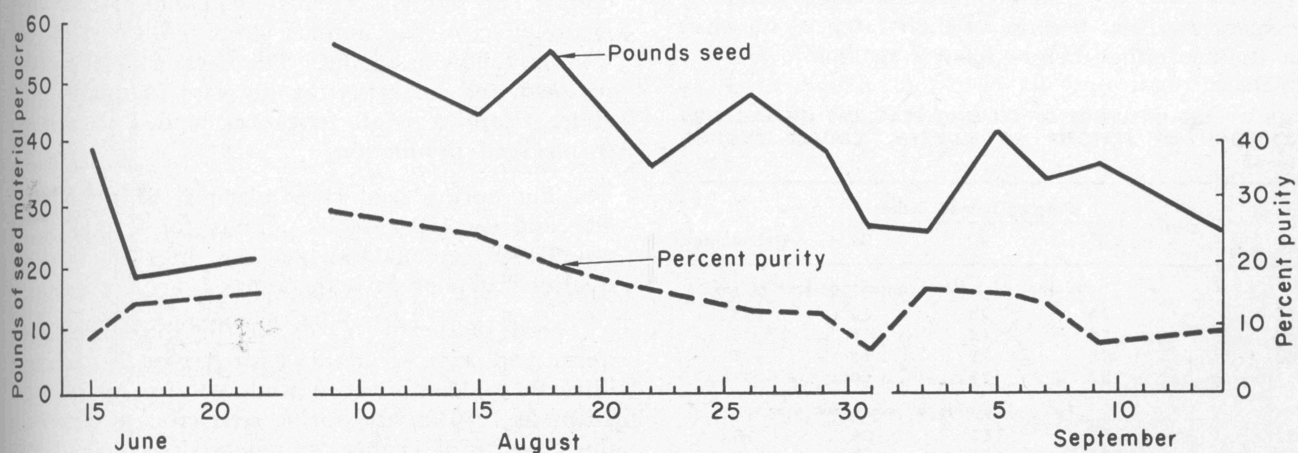

Figure 5. The influence of time of harvest on seed yield and purity of kleingrass, 1960. Initial sampling (harvest) was on date of first observed shattering.

removed by agitation at frequent intervals might increase yields still further. This is suggested also by the results in 1960 (Figure 5), in which a second peak in yield was obtained 25 days after initial maturity even though the plants had not been cut.

Introduced Bluestems

Pretoria 90 Bluestem

Pretoria 90 makes good vegetative growth in midsummer, but floral initiation and development occur only sporadically prior to October 1. A test was started in 1961 with Pretoria 90 bluestem and in 1962 with Accession 4080 bluestem in which a part or all of the top growth was removed by mowing. The mowing practices were conducted in combination with various fertilization and irrigation practices.

On August 20, 1961, Pretoria 90 plants were 36 inches high and showing some indication of booting. Plots mowed to stubble heights of 2 and 6 inches on that date had again reached the boot stage on September 20 with inflorescence emergence starting on September 25. Where the plants were clipped to 24 inches, or about 12 inches of the tops removed, sparse heading was noted on October 11. Nonclipped plants were not in full boot until October 14 with some emergence starting on October 17. Inflorescence counts made on all clipped plots on October 17 and 10 days later on unclipped plots are shown in Table 3. Clipping not only resulted in an increase in number of inflorescences but also in earlier maturity of the inflorescences. The later development of inflorescences with 24-inch clipping is indicated by the reduced yield. While unclipped plots finally headed, the inflorescences failed to mature in 1961; thus, no seed were produced.

A similar pattern of mowing was followed on the same plots in 1962 and 1963. Inflorescence production and seed yields followed approximately the same pattern as in 1961 (Table 3). Inflorescence counts were made at the same time on all plots in 1962 and 1963. Some inflorescences probably emerged later, but because of their lateness, they did not mature either before harvest or before frost.

TABLE 3. THE INFLUENCE OF CLIPPING PRACTICES ON FALL SEED PRODUCTION OF PRETORIA 90 BLUESTEM, COLLEGE STATION, 1961-63

Year	Clipping height, inches			
	2	6	24	Not clipped
	Number of inflorescences per foot of row			
1961	24	27	30	21
1962	24	15	9	5
1963	18	18	14	8
Average	22	20	18	11
	Pounds of seed per acre			
1961	165	163	108	0
1962	120	100	81	69
1963	86	77	52	37
Average	124	113	80	35

TABLE 4. THE INFLUENCE OF IRRIGATION ON FALL SEED PRODUCTION OF PRETORIA 90 BLUESTEM, COLLEGE STATION, 1961-63

Year	Not irrigated	Irrigated to boot stage	Irrigated to maturity
	Number of inflorescences per foot of row		
1961	31	23	23
1962	19	[1]	9
1963	3	19	24
	Pounds of seed per acre		
1961	159	147	131
1962	95	[1]	91
1963	0	60	68

[1]Not included in 1962 test.

These data definitely indicate that summer growth should be removed about mid-August for improved fall seed production.

The effect of irrigation on fall seed production of Pretoria 90 bluestem is shown in Table 4. Response to irrigation depended largely on rainfall during the fall seed production period. This study was conducted on a shallow, light-textured soil; thus, rainfall distribution as well as total rainfall influenced response to irrigation. Rainfall for August, September and October totaled 10.8, 10.7 and 6.7 inches, respectively, in 1961, 1962 and 1963. Yields without irrigation were equal or superior to irrigated yields in 1961 and 1962, while in 1963 only erratic inflorescence production occurred on dry land, and then inflorescences failed to mature seed. Irrigation is necessary for consistent seed production in this area.

A fertilizer variable was included in these studies but responses were not consistent; thus, yields are not shown. In general, fertilizers are necessary for good plant growth on the light-textured soils, and good plant growth is necessary for seed production. At least 40 pounds of nitrogen per acre per seed crop should be applied, along with phosphorus and potassium as indicated by soil tests.

It is possible that close mowing in late summer might reduce vigor and therefore, the following seed crop. The results presented in Table 5 show little if any effect of late summer clipping on seed production the following spring. There was a slight increase in yield and an offsetting decrease in quality with closer clipping. Fall irrigation tended to decrease spring seed production.

The spring seed crop averaged 87 pounds per acre and the fall crop 92 pounds, for a total of 180 pounds of seed material per acre in 1962; however, quality was poor in both crops.

Seed shattering occurs in the introduced bluestems, and stage of maturity for harvest is sometimes difficult to determine. A study was run in 1959 and again in 1960 on the spring seed crop to determine the rapidity of change in potential seed yield with delay in harvest. Samples were harvested at frequent intervals beginning when the tips of approximately

TABLE 5. THE RESIDUAL EFFECTS OF PREVIOUS YEAR TREATMENTS ON THE SPRING SEED CROP OF PRETORIA 90 BLUESTEM, AGRONOMY FARM, 1962[1]

Irrigation (Fall, 1961)	Clipping treatment, fall 1961				Average
	2-inch height	6-inch height	24-inch height	None	
None	117	130	83	80	102
Irrigated to boot stage	115	100	64	101	95
Irrigated to maturity	56	65	70	67	63
Average	96	98	73	82	
Average percent seed set	10.0	11.6	12.7	14.9	

[1]All plots received a 40-40-40 fertilizer application when growth started in 1962.

50 percent of the heads would release seed with a gentle pull between the fingers. It is apparent from the results in Figure 6 that maximum seed yield is obtained within 2-4 days of this time. Expected harvested yields decrease rather rapidly following the optimum period.

Accession 4080 Bluestem

Results with Pretoria 90 indicate that seed production can be enhanced by certain cultural, management and harvest practices. However, potential seed production of this excellent forage grass is still limited. Observations and yield trials with Accession 4080 indicated that it performed similarly to Pretoria 90 in forage yield, and seed set averaged 40 percent in a single-row nursery in the fall of 1961. Thus, Accession 4080 bluestem was evaluated for seed production since its vigor was approximately equivalent to Pretoria 90. A seed-production block established in rows in the spring of 1962 was clipped, watered and fertilized starting in August in 1962 and 1963 according to the scheme outlined for Pretoria 90. It is apparent that Accession 4080 responded to clipping similarly to Pretoria 90 (Table 6). As intensity of clipping decreased, both inflorescence production and seed yield decreased. These results definitely indicate that removal of vegetative growth which accumulates in the summer favors fall seed production.

TABLE 6. THE INFLUENCE OF VARIOUS CLIPPING PRACTICES ON FALL SEED PRODUCTION OF 4080 BLUESTEM, AGRONOMY FARM, 1962-63

Year	Clipping height, inches			
	2	6	24	Not clipped
	Number of inflorescences per foot of row			
1962	16	20	12	15
1963	19	23	11	12
	Pounds of cleaned seed per acre			
1962	67	60	37	49
1963	83	51	54	43

Irrigation had opposite effects in the 2 years on Accession 4080 bluestem (Table 7). Inflorescence production and seed yield were better in 1962 without irrigation, while in 1963, the few inflorescences produced without irrigation failed to mature seed. It is apparent that irrigation is critical for seed production. It must be available for consistent production, but if used when not absolutely necessary, irrigation may actually reduce seed yield. Rainfall in 1962 during August, September and October totaled 10.7 inches. In 1963 the total for the same period was 6.7 inches. The plants appeared to show moisture stress at times in 1962 and were irrigated, but apparently before it was actually necessary. Accession 4080 showed a greater reaction to irrigation in 1962 than Pretoria 90. Inflorescence production of Pretoria 90 was retarded, as indicated by counts made in October, but counts at the time of harvest in November were similar for plots with or without irrigation. Furthermore, Accession 4080 inflorescence production was lower on the day of harvest with irrigation. Apparently irrigation favored vegetative development over inflorescence production.

Medio Bluestem

Medio bluestem sometimes produces an excellent seed crop of satisfactory quality. At other times both yield and quality may be quite poor. Studies similar to those reported for Pretoria 90 and Accession 4080 were conducted with Medio, with the exception of mowing. Summer growth of Medio did not attain sufficient height to permit the mowing treatments.

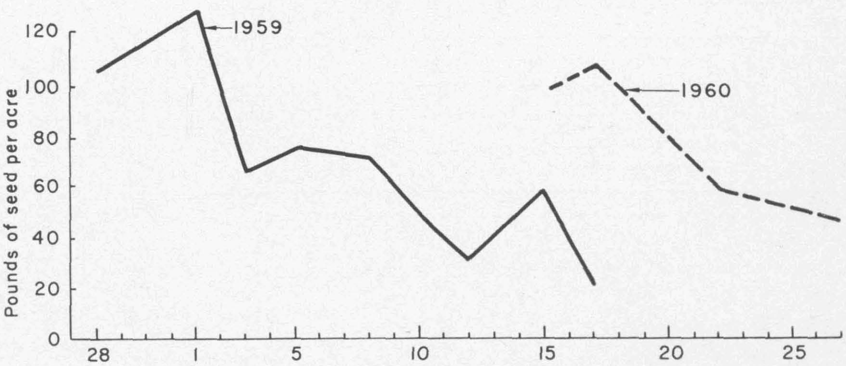

Figure 6. Seed yield of Pretoria 90 bluestem as influenced by the length of time after first maturity until harvest, College Station, 1959-60.

In 1958, seed were harvested from a small planting of Medio in June and December. The June harvest averaged 59 pounds per acre with 17 percent seed set, and the December harvest averaged 15 pounds per acre with only 8 percent seed set. The results in Table 8 show very good seed production in the fall of 1961. Yields were improved significantly with irrigation but quality was decreased. Apparently, the irrigation delayed maturity, resulting in reduced quality. Total yield in 1962 was 75-100 pounds from two seed crops. Quality of the spring seed crop was satisfactory, and the fall crop was not analyzed for quality.

These results and experiences indicate that when the environmental conditions are satisfactory, Medio will produce a good seed crop. At other times 25-50 pounds of seed per acre are obtained two or three times per year. Irrigation may be necessary for seed production, depending on the amount of natural rainfall, but late fall irrigation may result in reduced quality through delayed maturity.

TABLE 7. THE INFLUENCE OF IRRIGATION ON FALL SEED PRODUCTION OF 4080 BLUESTEM, AGRONOMY FARM, 1961-63

Year	Not irrigated	Irrigated to boot stage	Irrigated to maturity
	Number of inflorescences per foot of row		
1962	22	[1]	10
1963	2	28	21
	Pounds of seed per acre		
1962	74	[1]	33
1963	0	64	47

[1]Not included in test in 1962.

TABLE 8. THE INFLUENCE OF IRRIGATION PRACTICE ON MEDIO SEED PRODUCTION, COLLEGE STATION, 1961-62

Irrigation practice	November, 1961		June, 1962[1]		November, 1962
	Pounds seed	Percent seed set	Pounds seed	Percent seed set	Pounds seed
No irrigation	188	46	23	24	50
Irrigated to boot stage	199	28	25	27	50
Irrigated to maturity	217	26	26	24	77

[1]Irrigation variable applies only to fall seed crop as irrigation was not used in the spring.

TABLE 9. FORAGE PRODUCTION AND SURVIVAL OF INTRODUCED BLUESTEM ACCESSION, TEXAS A&M PLANTATION, 1958-60

Accession No. or variety name	Species	Forage yield (tons/acre) 1958	1959	1960[1]	Stand survival (percent)
Pretoria 90	Dicanthium annulatum	5.0	8.8	2.5	50
Medio	Dicanthium caricosum	2.2	4.9	1.7	100
Gordo	Dicanthium annulatum	2.5	4.9	1.1	40
T-20061	Dicanthium sp.	3.7	6.2	1.3	40
T-20299	Dicanthium sericeus	3.6	6.5	1.4	55

[1]Only one harvest was made in 1960 because of poor stand.

Experimental Accessions

Numerous experimental accessions of the introduced bluestem complex, many of them from the Oklahoma Agricultural Experiment Station, have been evaluated for various agronomic characteristics including seed production. The accessions were grown first in single rows and evaluated visually for desirable characteristics. The most promising types were then included in replicated tests and measured for forage and seed production.

Yields of five lines grown in the Brazos River bottom from 1958-60 are shown in Table 9. Obviously, none of the lines are superior to Pretoria 90 in total forage production. Medio, possibly because of its growth habit, persisted much better than the other types. In 1960, a test was established on the upland farm involving several additional lines which had shown promise in observation rows. The results indicate that most of these were less vigorous than Pretoria 90 (inside front cover table). It may be noted that most of the less virogous lines were superior for seed production. These included Gordo, 2660, 4081 and 3025. All of these had exceptionally good seed quality but did not persist in the yield which had to be abandoned.

In 1962 the replicated test was re-established, the weak lines eliminated and additional promising lines included. Accession 4080 was approximately equal to Pretoria 90 in forage production and quality during the 3 years of these tests. Its seed production and quality were better than Pretoria 90 in 1961 but poorer in 1962 and 1963. Accession 6141, a *Bothriochloa* species, produced an excellent seed crop in 1961 but was unsatisfactory in 1962 and 1963. Its forage yield was below the better *Dicanthium* lines, and forage quality as indicated by leaf percentage was very poor. Of the additional lines evaluated in 1962 and 1963, only Accession T-4931 showed any promise of satisfactory performance.

Pretoria 90 has not been produced on a large scale because of its limited seed production. Thus, it is not likely that any of the materials evaluated in these studies would be any more satisfactory. Among those accessions with satisfactory vigor and persistence, only Accessions 4080, 6141 and T-4931 show promise of being equal to Pretoria 90, and they do not exceed Pretoria 90 in seed production.