COMPARISON OF PERFORMANCE OF BLOOM
WITH BLOOMLESS AND SPARSE-BLOOM
NEAR-ISOHYBRIDS OF SORGHUM

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Scope and Method of Study: Field studies were conducted to compare the performance of bloom with bloomless and sparse-bloom near-isohybrids of sorghum. The near-isohybrid pairs were planted in 1980 at Perkins and Goodwell, and in 1981, 1982 at Perkins, Mangum, and Goodwell. Agronomic data were analyzed for days-to-midbloom, plant height, threshing percent, test weight, and grain yield. A randomized complete block design with three replications was used at each location in each year. The objectives of this experiment were to study the comparative performance of bloom with bloomless and sparse-bloom near-isohybri pairs and to determine greenbug reaction and agronomic characteristics of the hybrids.

Findings and Conclusions: In 1980, 1981, and 1982 no significant differences were observed for bloom vs bloomless or bloom vs sparse-bloom for days-to-midbloom. For plant height the bloomless hybrids were significantly shorter than bloom counterparts at Goodwell in 1980, while sparse-bloom hybrids were shorter at both Perkins and Goodwell in 1980. In 1981 sparse-bloom hybrids were significantly taller than their bloom near-isohybrids at Goodwell. No significant differences occurred in 1982. From the data collected for threshing percent only one significant difference was observed. Bloomless hybrids were lower than bloom hybrids at Perkins in 1982. A significant difference in test weight was found for bloomless vs bloom hybrids at Perkins in all tests. In 1980, the bloomless had a higher test weight than their bloom counterparts. In 1981 and 1982 at Perkins and in 1982 at Goodwell the bloomless hybrids had lower test weights than the bloom hybrids. A differential effect of drought at the filling stage of plant growth could have played an important role in the test weight of the grain. In general, bloom hybrids produced higher yields than their bloomless isohybrids. Nevertheless some pairs performed similarly. Bloomless hybrids under moisture stress, produced less yield when compared to their bloom isohybrids (Perkins, 1981 & 1982). Under greenbug attack, bloomless hybrids were superior to their bloom counterparts (Goodwell, 1980). Generally, sparse-bloom hybrids under moisture stress condition did not perform as well as their bloom counterparts. However, under greenbug attack they performed similarly.

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CHAPTER I

INTRODUCTION

Sorghum [*Sorghum bicolor* (L.) Moench] exhibits a powdery coating of wax on leaves and stems which has been described as "bloom" or normal. "Bloomless" mutants do not contain the coating of wax, but they exhibited a high level of nonpreference to greenbugs. Sparse-bloom mutants are intermediate for bloom and nonpreference. The bloomless trait has been transferred to elite lines for possible use in the production of hybrids. However, there is a question about drought tolerance of the bloomless sorghums.

Ross (16) reported that bloom sorghums produced higher yields than their near-isogenic bloomless counterparts. Also, Webster and Schmalzel (17) determined that under both dryland and irrigation bloom lines produced higher yields than their bloomless isolines. However, there is considerable interest in the bloomless sorghums because of their high level of nonpreference to greenbugs. To accumulate additional information a test was conducted for three years at three locations with selected near-isohybrid pairs of bloom, bloomless and sparse-bloom hybrids to determine their comparative performance.

The objectives of this experiement were:

1. To study the yield comparison of bloom with their bloomless near-isohybrids.

2. To study the yield comparison of bloom with their sparse-bloom near-isohybrids.
3. To determine greenbug reaction and agronomic characteristics of the hybrids.

CHAPTER II

LITERATURE REVIEW

Ayyangar et al. (2) described the occurrence of bloom (waxy coating) on all normal sorghums as well as on several other crops. However, they reported different degrees of wax on sorghum plants such as heavy and sparse, where the former was termed as bloom or normal (a white waxy coating over almost all the plant) and the latter as sparse-bloom (a mutant with a light coating of wax, heavier in some areas than others). In additional research, Ayyangar and Ponnaiya (3) described a bloomless mutant of sorghum in the African variety "Vigage." The bloomless type was visually distinguishable from the bloom type since the white waxy coating was absent from the leaves and stem.

To study the inheritance of these traits, Ayyangar and Ponnaiya (3) crossed the bloomless type with both bloom and sparse-bloom types. From the crosses between bloom and bloomless all of the F_1's were found to have heavy bloom. The F_2 segregated into 252 plants having heavy bloom and 84 bloomless plants, indicating a 3:1 ratio and the complete dominance of bloom. The next crosses were made between the bloomless type and the sparse-bloom. The F_1's had bloom, but the F_2 segregated into a 9 bloom:4 bloomless:3 sparse-bloom ratio. As a result, they concluded that a single dominant gene (Bm) controlled the bloom formation while a recessive allele (bm) controlled the bloomless condition. A recessive gene (h) conditioned sparse-bloom, but it could not express itself in the presence of (bm).

Cummins and Dobson (7) studied the digestibility of bloom and bloomless sorghum by a modified in vitro technique. In the experiment they used three near isogenic bloom and bloomless sorghum lines and reported that the bloomless type had 22% higher digestibility than the bloom counterparts. They also concluded that the absence of the waxy (bloom) coating in the bloomless lines facilitated the penetration of the microorganisms in the rumen, whereas the wax-coating in the bloom lines slowed down the penetration process. Hanna et al. (8) applying a similar procedure to that used by Cummins and Dobson (7) also reported higher digestibility of bloomless lines. However, they indicated that the bloomless type had more water loss and was less drought tolerant due to the absence of the waxy bloom on the plant.

Martin (11) conducted a comparison of corn with sorghum for drought resistance. He demonstrated the superiority of sorghum over corn by its performance under drought stress. He pointed out that the waxy cuticle on sorghum was one of the important factors which was responsible for drought tolerance. Lambright and Maunder (10) indicated that the waxy cuticle played an important role in drought stress, and they reported that the bloom or normal type exhibited a higher resistance to stomatal diffusion. Maunder et al. (12) studied isogenic lines of Combine Kafir-60, Martin, and Redbine-60, and they reported that the bloomless type had 38.4% more stalk disease. However, a greater resistance to water loss was exhibited by the bloomless plants, and under stress conditions, stomata on bloomless plants closed faster. Blum (4) using two isogenic lines of sorghum conducted a study by electron microscope of epicuticular wax of sorghum. He reported that the epicuticular wax layer on stems and leaves can decrease the cuticular transpiration. He compared the bloom and bloomless genotypes under conditions of decreasing soil moisture. The bloom genotype had a higher water potential and a greater soil moisture extraction. The major contribution of epicuticular wax to drought resistance of sorghum plants resulted from the reduced solar energy load on the plants, and from more stomatal control over transpiration to avoid the reduction of leaf water potential. Blum (5) also reported that the waxy bloom played an important role in the water relations of the sorghum plant under moisture stress. Ross (16) compared the yield of Combine Kafir-60 with a near-isogenic line of bloomless sorghum. He reported that the bloomless lines yielded significantly less than normal bloom lines, and suggested that a better source of drought resistance might be obtained from geneotypes with heavier bloom formation than is now available. Studies were conducted by Chatterton et al. (6) on two pairs of near-isogenic lines of sorghum to measure the net carbon dioxide and water vapor exchange. They reported that the net carbon dioxide exchange and transpiration rates in bloomless sorghum were greater than in the bloom type. Webster and Schmalzel (17) studied yield trials of bloom and bloomless isogenic lines of Redbine-60 and Combine Kafir-60 lines, under irrigation and dryland conditions. They concluded that the normal types produced a higher yield than the bloomless types and that the yield advantage increased under drought conditions. Weibel (20) compared the yield of near-isohybrids of bloom, bloomless and sparse-bloom for two years at dryland and irrigated locations. At Perkins, in 1980, the bloom and bloomless hybrids were compared under severe moisture stress conditions. The results indicated an advantage for bloomless hybrids. At Goodwell (irrigated) under greenbug attack the bloomless hybrids performed significantly better than their bloom counterparts. At Perkins in 1980 the sparse-bloom hybrids on the average gave lower yields than their bloom isohybrids, however sparse-bloom and bloom hybrids performed similarly at Goodwell. Weibel (20) conducted a similar test including additional combinations of isohybrids in 1981. The results indicated a higher yield for bloom isohybrids at Perkins and Goodwell with no difference at Mangum.

Harvey and Hackerott (9) described a greenbug biotype (C) which damaged sorghum. Before 1968 two biotypes of greenbug (A, B) had been reported as pests of small grains. Porter et al. (15) reported a new biotype of greenbug (E) was discovered/found near Bushland, Texas in 1980. Biotype (C) and (E) were examined on several grain crop lines having resistance to the former biotype. The results showed the susceptibility of some of the lines to biotype (E). Porter et al. concluded that resistant sorghum lines PI220248 and "Capbam" as well as some other small grain lines could be used as a source of resistance to biotype (E). Painter (13) suggested that resistance consisted of three phases: tolerance, antibiosis, and nonpreference. An experiment was conducted by Peiretti (14) on the damage of greenbugs to F_2 progeny of two sorghums -- RWD3-"Weskan" (bloomless, susceptible), and "SA 7536-1" (bloom, resistant). He concluded that the bloomless plants were not tolerant to greenbugs. However, they showed nonpreference and this nonpreference in the bloomless plants increased as the plants increased in age. He also indicated that bloomlessness was a simply inherited recessive trait. Studies by Amini (1) on damage by greenbugs to the F_2 progeny of two sorghum varieties -- RWD3-Weskan (bloomless, susceptible) and "IS 809" (bloom, resistant) also indicated that the bloomless condition was a simply inherited recessive trait. Furthermore, he concluded that the bloomless type of resistance (nonpreference) and the normal type of resistance (tolerance) were regulated by independent genetic factors. As a result there should not be any difficulty in combining them to improve resistance. Weibel et al. (18) working in five pairs of adjacent bloom and bloomless sorghum plants in five F_3 segregating rows from each of four crosses concluded that the reduced leaf damage to the bloomless plants was the result of fewer greenbugs. In an additional study Weibel et al. (19) counted greenbugs on near-isogenic lines of sorghum for three and four weeks after emergence. They observed fewer greenbugs on the bloomless plants for both counts, indicating nonpreference at the early age. From the comparison of the two counts it was indicated that, unlike bloomless plants, the greenbugs were increasing on the bloom plants.

CHAPTER III

MATERIAL AND METHODS

The experiments were conducted at Oklahoma State University Agronomy Research Stations at Perkins, Mangum, and Goodwell (Table I). The entries consisted of near-isohybrid pairs of bloom, bloomless, and sparse-bloom sorghum (Table II). The pedigrees, phenotype, and genotype for the near-isohybrid pairs grown in 1980, 1981, and 1982 may be found in Tables III, IV, and V, respectively.

At Perkins, the tests were planted in early June. The soil type was a Teller loam. Fertilizer was applied at the rate of 54 kg N and 46 kg K/ha in 1980 and 1981, while 46 kg N, and 50 kg K/ha was applied in 1982. The experimental units were single-row plots 12.2 m long and 91 cm apart. The plants in the rows were thinned to one plant every 15 cm approximately. Cultural practices were performed following the conventional methods for the location.

Blooming dates at Perkins were recorded as first-bloom (when flowering occurred at the tip of several panicles) and all bloom (when all of the panicles were flowering). Midbloom was calculated as the average of first-bloom and all bloom. Plant height was recorded from the soil surface to the tip of the panicle prior to the harvest. A portion of the row 8.8 m long was harvested for grain yield. Before threshing, plot head weight was determined. Threshing was accomplished with a Vogel-type plot thresher. The threshed grain was recorded as grain weight. Test weight

TABLE I

LOCATIONS AND YEARS

Year	Perkins	Mangum	Goodwell
	Dryland	Dryland	Irrigation
1980	*	--	*
1981	*	*	*
1982	*	*	*

*Data Collected

TABLE II

NUMBER OF NEAR-ISOHYBRID PAIRS FOR EACH YEAR AND LOCATION

Year	Number of Pairs					
	Perkins		Mangum[1]		Goodwell	
	Bloomless Bloom	Sparse Bloom	Bloomless Bloom	Sparse Bloom	Bloomless Bloom	Sparse Bloom
1980	12	5	-	-	12	5
1981	15	5	15	5	15	5
1982	13	7	13	7	13	7

[1] Data were not collected at Mangum, in 1980.

TABLE III

PEDIGREES OF BLOOM, BLOOMLESS AND SPARSE-BLOOM ENTRIES USED IN 1980

Entry No.	Pedigree Female	Male	Phenotype	Genotype
1	A bm_1-B8[a]	X F_3, 78X1EA-1-2, bm_1 X IS809[4]	Bloomless	bm_1 bm_1
2	do	X F_3, 78X1EA-1-3, Bm do	Bloom	Bm_1 bm_1
3	A bm_1-B8	X F3, 78X2E-1-3, bm_1 X BOK8-ShGr	Bloomless	bm_1 bm_1
4	do	X F_3, 78X2E-1-4, Bm do	Bloom	Bm_1 bm_1
5	A bm_1-B8	X F_3, 78X3E-1-2, bml X BOK8[3]	Bloomless	bm_1 bm_1
6	do	X F3, 78X3E-1-3, Bm do	Bloom	Bm_1 bm_1
7	A bm_1 -B8	X F_3, 78X10E-1-1-1, bm_1 X ROKY34[5]	Bloomless	bm_1 bm_1
8	do	X F3, 78X10E-1-1-2, Bm do	Bloom	Bm_1 bm_1
9	A bm_1-B8	X F3, 78X13E-1-2, bm_1 X ROKY35[4]	Bloomless	bm_1 bm_1
10	do	X F3, 78X13E-1-4, Bm do	Bloom	Bm_1 bm_1
11	A h_2[b]	X F3, 78X16E-1-1, h_2 X ROKY47[5]	Sparse	h_2 h_2
12	do	X F3, 78X16E-1-2, Bm do	Bloom	H_2 h_2
13	A bm_1-B8	X F3, 78X17E-1-1, bm_1 X ROKX47[6]	Bloomless	bm bm_1
14	do	X F3, 78X17E-1-6, Bm do	Bloom	Bm_1 bm_1
15	A bm_1-B8	X F3, 78X20E-1-1-1,bm_1X ROKY62[4]	Bloomless	bm_1 bm_1
16	do	X F3, 78X20E-1-1-2, Bm do	Bloom	Bm_1 bm_1
17	A h_2	X F3, 78X21E-1-3-1, h_2 X ROKY62[5]	Sparse	h_2 h_2
18	do	X F3, 78X21E-1-3-2, Bm do	Bloom	H_2 H_2
19	A bm_1-B8	X F3, 78X23-1-1, bm_1 X ROKY76[4]	Bloomless	bm_1 bm_1
20	do	X F3, 78X23-1-2, Bm do	Bloom	Bm_1 bm_1
21	A bm_1-B8	X F3, 78X25-1-1, bm_1 X BOK11[5]	Bloomless	bm_1 bm_1
22	do	X F3, 78X25-1-3, Bm do	Bloom	Bm_1 bm_1
23	A bm_1-B8	X F3, 78X28E-1-1, bm_1 X ShGr[4]	Bloomless	bm_1 bm_1
24	do	X F3, 78X28E-1-2, Bm do	Bloom	Bm_1 bm_1
25	A h_2	X F3, 78X29E-1-1, h_2 X ShGr[5]	Sparse	h_2 h_2
26	do	X F3, 78X29E-1-4, H do	Bloom	H_2 h_2
27	A bm_1-B8	X F3, 78X36E-1-1, bm_1 X TAM2568[3]	Bloomless	bm_1 bm_1
28	do	X F3, 78X36E-1-2, Bm do	Bloom	Bm_1 bm_1
29	A bm_1-B8	X F4, 77X9E-1-1-2, bm_1 X ROKY78[5]	Bloomless	bm_1 bm_1
30	do	X ROKY78, Bm	Bloom	Bm_1 bm_1
31	A h_2	X F4, 77X10E-1-1-2, h_2 X ROKY78[4]	Sparse	h_2 h_2
32	do	X ROKY78, H	Bloom	H_2 h_2
33	A h_2	X F3, 77X7E-2-2, h_2 X ROKY34[3]	Sparse	h_2 h_2
34	do	X F3, 77X7E-2-3, H do	Bloom	H_2 h_2
35	A h_2	X F4, 77X23E-2-1-3, h_2 X ROKY76[3]	Sparse	h_2 h_2
36	do	X ROKY76, H	Bloom	H_2 h_2

[a] Bloomless derivative of RWD3-Weskan X BOK8

[b] Sparse derivative of Redlan X Wiley

TABLE IV

PEDIGREES OF BLOOM, BLOOMLESS AND SPARSE-BLOOM ENTRIES USED IN 1981

Entry No.	Pedigree Female	Male	Phenotype	Genotype
1	A bm_1-B8[a]	X F3, 78X1EA-1-2, bm_1 X IS809[4]	Bloomless	bm_1 bm_1
2	do	X F3, 78X1EA-1-3, Bm do	Bloom	Bm_1 bm_1
3	A bm_1-B8	X F3, 78X10E-1-1-1, bm_1 X ROKY34[5]	Bloomless	bm_1 bm_1
4	do	X F3, 78X10E-1-1-2, Bm do	Bloom	Bm_1 bm_1
5	A bm_1-B8	X F3, 78X13E-1-2, bm_1 X ROKY35[4]	Bloomless	bm_1 bm_1
6	do	X F4, 78X13E-1-4-4, Bm do	Bloom	Bm_1 bm_1
7	A bm_1-B8	X F3, 78X17E-1-1, bm_1 X ROKY47[6]	Bloomless	bm_1 bm_1
8	do	X F3, 78X17E-1-6, Bm do	Bloom	Bm_1 bm_1
9	A bm_1-B8	X F3, 78X20E-1-1-1, bm_1X ROKY62[4]	Bloomless	bm_1 bm_1
10	do	X F3, 78X20E-1-1-2, Bm do	Bloom	Bm_1 bm_1
11	A bm_1-B8	X F3, 78X23E-1-1, bm_1 X ROKY76[4]	Bloomless	bm_1 bm_1
12	do	X F4, 78X23E-1-2-6, Bm do	Bloom	Bm_1 bm_1
13	A bm_1-B8	X F3, 78X28E-1-1, bm_1 X SHGr[4]	Bloomless	bm_1 bm_1
14	do	X F4, 78X28E-1-2-2, Bm do	Bloom	Bm_1 bm_1
15	A bm_1-B8	X F3, 78X36E-1-1, bm_1 X TAM2568[3]	Bloomless	bm_1 bm_1
16	do	X F3, 78X36E-1-2. Bm do	Bloom	Bm_1 bm_1
17	A bm_1-B8	X F4, 77X9E-1-1-2, bm_1 X ROKY78[5]	Bloomless	bm_1 bm_1
18	do	X ROKY78, Bm	Bloom	Bm_1 bm_1
19	A bm_1-Red[4b]	X F5, 78X10E-1-1-1, bm_1X ROKY34[5]	Bloomless	bm_1 bm_1
20	A Redlan Bm	X ROKY34 Bm	Bloom	Bm_1 Bm_1
21	A bm_1-Red[4]	X F5, 78X17E-1-2, bm_1 X ROKY47[6]	Bloomless	bm_1 bm_1
22	A Redlan Bm	X ROKY47 Bm	Bloom	Bm_1 Bm_1
23	A bm_1-Red[4]	X F5, 78X20E-1-2, bm_1 X ROKY62[4]	Bloomless	bm_1 bm_1
24	A Redlan Bm	X ROKY62 Bm	Bloom	Bm_1 Bm_1
25	A bm_1-Red[4]	X F5, 78X23E-1-2, bm_1 X ROKY76[4]	Bloomless	bm_1 bm_1
26	A Redlan Bm	X ROKY76 Bm	Bloom	Bm_1 Bm_1
27	A bm_1-B11[5c]	X F5, 78X20E-1-2, bm_1 X ROKY62[4]	Bloomless	bm_1 bm_1
28	A OK11	X ROKY62 Bm	Bloom	Bm_1 Bm_1
29	A bm_1-BOK11[5]	X F5, 78X23E1-2, bm_1 X ROKY76[4]	Bloomless	bm_1 bm_1
30	A OK11	X ROKY76 Bm	Bloom	Bm_1 Bm_1
31	A h_2[d]	X F3, 78X16E-1-1, h_2 X ROKY47[5]	Sparse	h_2 h_2
32	do	X F3, 78X16E-1-2, H do	Bloom	H_2 h_2
33	A h_2	X F4, 78X21E-1-1, h_2 X ROKY62[5]	Sparse	h_2 h_2
34	do	X F3, 78X21E-1-3, H do	Bloom	H_2 h_2
35	A h_2	X F4, 77X10E-1-1-2, h_2 X ROKY78[4]	Sparse	h_2 h_2
36	do	X ROKY78 H	Bloom	H_2 h_2
37	A h_2	X F3, 77X7E-2-2, h_2 X ROKY34[3]	Sparse	h_2 h_2
38	do	X F3, 77X7E-2-3, H do	Bloom	H_2 h_2
39	A h_2	X F4, 77X23E-2-1-3, h_2 X ROKY76[3]	Sparse	h_2 h_2
40	do	X ROKY76 H	Bloom	H_2 h_2

[a] Bloomless derivative of RWD3-Weskan X BOK8
[b] Bloomless derivative of Redan
[c] Bloomless derivative of BOK11
[d] Sparse derivative of Redlan X Wiley

TABLE V

PEDIGREES OF BLOOM, BLOOMLESS AND SPARSE-BLOOM ENTRIES USED IN 1982

Entry No.	Pedigree Female	Male	Phenotype	Genotype
1	A bm_1-B8[a]	X F_3, 78X36E-1-1, bm_1 X TAM2568[3]	Bloomless	bm_1 bm_1
2	do	X F_3, 78X36E-1-2 Bm do	Bloom	Bm_1 bm_1
3	A Redlan[b] bm	X F_7, 78X10E-6-1-1, bm_1 X ROKY34[5]	Bloomless	bm_1 bm_1
4	A Redlan Bm	X ROKY34 Bm	Bloom	Bm_1 Bm_1
5	A Redlan bm	X F_7,78X17E-1-2, bm_1 X ROKY47[6]	Bloomless	bm_1 bm_1
6	A Redlan Bm	X R OKY47 Bm	Bloom	Bm_1 Bm_1
7	A Redlan bm	X F_7, 78X20E-1-2, bm_1 X ROKY62[4]	Bloomless	bm_1 bm_1
8	A Redlan Bm	X ROKY62 Bm	Bloom	Bm_1 Bm_1
9	A Redlan bm	X F_7, 78X23E-1-2, bm_1 X ROKY76[4]	Bloomless	bm_1 bm_1
10	A Redlan Bm	X ROKY76 Bm	Bloom	Bm_1 Bm_1
11	A OK11[c] bm	X F_7,78X10E-1-1-1, bm_1 X ROKY34[5]	Bloomless	bm_1 bm_1
12	A OK11 Bm	X ROKY34 Bm	Bloom	Bm_1 Bm_1
13	A OK11 bm	X F7, 78X17E-1-2, bm_1 X ROKY47[6]	Bloomless	bm_1 bm_1
14	A OK11 Bm	X ROKY47 Bm	Bloom	Bm_1 Bm_1
15	A OK11 bm	X F7, 78X20E-1-2, bm_1 X ROKY62[4]	Bloomless	bm_1 bm_1
16	A OK11 Bm	X ROKY62 Bm	Bloom	Bm_1 Bm_1
17	A OK11 bm	X F6, 78X23E-1-2, bm_1 X OKY76[4]	Bloomless	bm_1 bm_1
18	A OK11 Bm	X ROKY76 Bm	Bloom	Bm_1 Bm_1
19	A Wheat[d] bm	X F7,78X10E-1-1-1,bm_1 X ROKY34[5]	Bloomless	bm_1 bm_1
20	A Wheat Bm	X ROKY34 Bm	Bloom	Bm_1 Bm_1
21	A Wheat bm	X F6,78X17E-1-2, bm_1 X ROKY47[6]	Bloomless	bm_1 bm_1
22	A Wheat Bm	X ROKY47 Bm	Bloom	Bm_1 Bm_1
23	A Wheat bm	X F6,78X20E-1-2, bm_1 X ROKY62[4]	Bloomless	bm_1 bm_1
24	A Wheat Bm	X ROKY62 Bm	Bloom	Bm_1 Bm_1
25	A Wheat bm	X F6,78X23E-1-2, bm_1 X ROKY76[4]	Bloomless	bm_1 bm_1
26	A Wheat Bm	X ROKY76 Bm	Bloom	Bm_1 Bm_1
27	A h_2[e]	X F_3, 77X7E-2-2, h_2 X ROKY34[3]	Sparse	h_2, h_2
28	do	X F3, 77X7E-2-3 H do	Bloom	H_2, h_2
29	A h_2	X F3, 78X16E-1-1, h_2 X ROKY47[5]	Sparse	H_2, h_2
30	do	X F3, 78X16E-1-1, H do	Bloom	H_2, h_2
31	A h_2	X F3, 78X21E-1-1, h_2 X ROKY62[5]	Sparse	h_2, h_2
32	do	X F3, 78X21E-1-3 H do	Bloom	H_2, h_2
33	A h_2	X F3, 77X10E-1-1-2,h_2 X ROKY78[4]	Sparse	h_2, h_2
34	do	X ROKY78 H	Bloom	H_2, h_2
35	A OK11[f] h_2	X F4, 80X7E-1-1,h_2 X ROKY34[5]	Sparse	h_2, h_2
36	A OK11 H	X ROKY34 H	Bloom	H_2, H_2
37	A OK11 h_2	X F_4, 80X9E-7-1,h_2 X ROKY76[7]	Sparse	h_2, h_2
38	A OK11 H	X ROKY47 H	Bloom	H_2, H_2
39	A OK11 h_2	X F4, 80X11E-1-1,h_2 X ROKY62[7]	Sparse	h_2, h_2
40	A OK11 H	X ROKY62 H	Bloom	H_2, H_2

a Bloomless derivative of RWD3-Weskan X BOK8
b Bloomless near-isoline of Redlan
c Bloomless near-isoline of BOK11
d Bloomless near-isoline of wheatland
e Sparse derivative of Redlan X Wiley
f Sparse near-isoline of BOK11

was determined using a 0.473 liter (1 pint) bucket with a Toledo scale. The grain weight was divided by the plot head weight in order to obtain threshing percent. Grain yield per plot was obtained by multiplying grain weight per plot (in kilograms) by a fraction of a hectare harvested. The factor was 1242. Although there was ample moisture at the beginning of the season at Perkins in 1980, plants endured severe drought at the crucial stages of growth. During the 1981 growing season, at the same location there was a moderate moisture stress. In 1982, plants suffered from a late season moisture stress. The yield trials were almost free of greenbugs.

At Mangum, the planting date was in early July on a Meno and loamy fine sandy soil. In 1981 nitrogen was applied at the rate of 46 kg/ha, while in 1981 17 kg N, 14 kg P and 7 kg K/ha was applied. The experimental units were single-row plots 13.7 m long and 101.6 cm apart. In 1981 7.9 m and in 1982 3.0 m per plot were harvested. After emergence, plants were thinned to one plant every 15 cm approximately. There was moisture stress throughout the 1981 and 1982 growing season. Plants were free of greenbug attack during the two growing seasons. Data were recorded as at Perkins except the factors for calculating grain yields were 1242 in 1981 and 3262 in 1982.

At Goodwell, the tests were planted in late May or early June on a Richfield clay loam soil. Nitrogen was applied at the rate of 112, 67 and 61 kg/ha in 1980, 1981, and 1982, respectively. Each plot consisted of two rows where each row was 8.5 m long and 71.1 cm apart. A total of 5.7 m was harvested per plot in 1980 and 1981. In 1982 3.0 m was harvested. The experimental plots were irrigated six times during the growing season. There was a severe infestation of greenbugs during

1980 and 1981. In 1980, there was an average of two to three dead leaves per plant on bloom hybrids as a result of greenbug attack before the plants were sprayed. The plots were sprayed with ethyl parathion for greenbug control in 1980, 1981, and 1982. During 1982, the infestation of greenbugs was much less severe and readings were not taken. However, the plots suffered slight foliar damage, a condition judged not to affect grain yield. Data were recorded at Perkins except the factors for calculating grain yields were 2471 in 1980 and 1981, and 4680 in 1982. The experimental design was a randomized complete block with three replications at each location. The number of near-isohybrid pairs involved in the experiment for each year are presented in Table II.

CHAPTER IV

RESULTS AND DISCUSSION

The analyses of variance for the agronomic variables days-to-midbloom, plant height, threshing percent, test weight, and grain yield are presented in Table VI for Perkins and Goodwell in 1980. There were significant differences (P=0.01) observed among Pairs for all variables at both locations. Also there were significant differences for Bm vs bm at both locations for plant height, at Perkins for test weight, and at Goodwell for grain yield. The significant interaction for Pairs X Bm vs bm for plant height at both locations and for test weight at Perkins indicated that the direction and/or magnitude of the differences between members of the pairs of bloom and bloomless near-isohybrids was not the same for all pairs.

Mean squares from the analyses of variance for five agronomic traits are presented in Table VII for three locations in 1981. Significant differences (P = 0.05) were observed among Pairs for all characters at all locations except for threshing percent at Mangum. Significant (P = 0.01) differences in means for Bm vs bm were obtained for test weight and grain yield at Perkins, and for plant height and grain yield at Goodwell. Significant (P = 0.01) Pair X Bm vs bm interactions were observed for all traits except threshing percent at Perkins, and for all traits at Goodwell. This indicated that the members of the pairs did not differ in the same way in each pair.

TABLE VI

MEANS SQUARES FOR FIVE AGRONOMIC VARIABLES, FROM THE ANALYSES OF VARIANCE AT PERKINS, AND GOODWELL, OKLAHOMA IN 1980

Source of Variation	d.f.	Days-to-Midbloom[1]	Plant Height	Threshing Percent	Test Weight	Grain Yield
		Days	cm	%	kg/L	kg/ha
Perkins						
Pairs	17	142.03**	296.88**	962.30**	0.00040**	1,770,933**
Bm vs bm	1	2.67	105.37*	0.29	0.00059*	58,800
Pairs X Bm vs bm	17	9.14	57.64**	37.87	0.00065**	75,402
Error	70	8.00	25.03	24.61	0.00013	47,351
Goodwell						
Pairs	17	107.94**	514.03**		0.00103**	1,276,910**
Bm vs bm	1	5.78	237.09**		0.00034	6,660,699**
Pairs X Bm vs bm	17	1.23	42.15*		0.00015	1,065,863
Error	70	1.84	23.25		0.00013	689,664

*,** Significant at the 0.05 and 0.01 levels of probability, respectively.

[1] At Perkins, days-to-first bloom was reported.

TABLE VII

MEANS SQUARES FOR FIVE AGRONOMIC VARIABLES, FROM THE ANALYSES OF VARIANCE AT PERKINS, MANGUM, AND GOODWELL, OKLAHOMA IN 1981

Source of Variation	d.f.	Days-to-Midbloom[1]	Plant Height	Threshing Percent	Test Weight	Grain Yield
Perkins		Days	cm	%	kg/L	kg/ha
Pairs	19	133.65**	294.35**	35.34*	0.00570**	2,915,594**
Bm vs bm	1	4.40	7.74	14.45	0.01123**	5,675,010**
Pairs X Bm vs bm	19	9.23**	139.60**	11.48	0.00190**	826,203**
Error	78	1.53	46.14	17.28	0.00106	202,781
Mangum						
Pairs	19	97.27**	230.40**	44.45	0.00323**	2,196,645**
Bm vs bm	1	16.13	86.02	0.09	0.00082	1,141,530
Pairs X Bm vs bm	19	28.95	52.94	48.50	0.00137	415,518
Error	78	19.27	69.22	41.14	0.00097	690,541
Goodwell						
Pairs	19	41.31**	407.14**		0.00098**	3,512,011**
Bm vs bm	1	0.13	7.74**		0.00027	2,167,603
Pairs x Bm vs bm	19	5.13**	190.19**		0.00015*	1,305,588**
Error	78	1.71	0.27		0.00008	445,180

*, ** Significant at the 0.05 and 0.01 levels of probability, respectively.
[1] At Perkins, days-to-first bloom is reported.

Mean squares from the analyses of variance for five agronomic trait are presented in Table VIII for the three locations in 1982. Significant differences (P = 0.01) were indicated for Pairs for all traits except threshing percent at Perkins, Mangum, and Goodwell, and for plant height and grain yield at Mangum. Significant (P = 0.01) differences among means for Bm vs bm were found for threshing percent, test weight, and grain yield at Perkins, and for test weight at Goodwell. The interactions were significant (P = 0.05) for plant height, and test weight at Perkins and for days-to-midbloom, plant height, and test weight at Goodwell. These interactions suggested that the members of the pairs of near-isohybrids did not vary the same way, but the interactions for days-to-midbloom and plant height have little meaning since they are associated with nonsignificant mean squares for Bm vs bm.

Days-to-Midbloom

The analyses described above were developed from the individual plot data collected at the stations each year (See Tables XIV, XV, XVI, XVII, XVIII, XIX, XX and XXI in the Appendix). The source of variation labelled "Pair" indicated all the pairs of bloom and bloomless and sparse-bloom near-isohybrids. It was deemed advisable to study the means of the bloom and bloomless pairs separately from the means of bloom and sparse-bloom pairs. Therefore, the data were developed for all variables. Data on days-to-midbloom are presented in Table IX. There were no significant differences between members of the pairs for any year or location for days-to-midbloom.

Severe drought during the vegetative stage of growth of sorghum

TABLE VIII

MEAN SQUARES FOR FIVE AGRONOMIC VARIABLES, FROM THE ANALYSES OF VARIANCE AT PERKINS, MANGUM, GOODWELL, OKLAHOMA IN 1982

Source of Variation	d.f.	Days-to-midbloom	Plant Height	Threshing Percent	Test Weight	Grain Yield
Perkins		Days	cm	%	kg/L	kg/ha
Pairs	19	27.01**	152.15**	63.98	0.00130**	764,105**
Bm vs bm	1	0.30	42.15	333.30**	0.00449**	3,655,426**
Pairs X Bm vs bm	19	3.84	69.65**	39.41	0.00058**	201,974
Error	78	3.41	19.71	37.87	0.00027	179,923
Mangum						
Pairs	19	52.84**	84.76	35.39	0.00149**	906,092
Bm vs bm	1	13.33	5.37	11.77	0.00216	419,647
Pairs X Bm vs bm	19	10.21	62.08	39.33	0.00041	569,577
Error	78	8.72	68.47	35.27	0.00040	743,238
Goodwell						
Pairs	19	50.20**	463.75**	24.34	0.00079**	3,822,387**
Bm vs bm	1	1.00	45.21	0.12	0.00124**	828,343
Pairs X Bm vs bm	19	15.31**	99.63**	10.76	0.00026*	1,037,546
Error	78	3.29	25.91	17.05	0.00013	1,043,883

*,** Significant at the 0.05 and 0.01 level of probability, respectively.

TABLE IX

COMPARISON OF BLOOM, BLOOMLESS, AND SPARSE-BLOOM FOR AVERAGED MEAN DAYS-TO-MIDBLOOM AT PERKINS, MANGUM, AND GOODWELL, OKLAHOMA IN 1980, 1981, AND 1982

	1980		1981			1982		
	Perkins[1]	Goodwell	Perkins[1]	Mangum	Goodwell	Perkins	Mangum	Goodwell
				days				
bm	70	57	51	74	61	60	65	75
Bm	69	57	50	74	61	60	64	75
h	77	63	53	75	64	61	65	75
H	78	63	54	77	63	61	66	75
L.S.D. (0.05)								
(bm, Bm)	NS	NS	NS	NS	NS	NS	NS	NS
(h, H)	NS	NS	NS	NS	NS	NS	NS	NS

[1] At Perkins (1980 and 1981) days-to-first-bloom was recorded.

generally delays maturity. Maturities at Perkins in 1980 were delayed more than 20 days by severe drought, when compared to 1981 (Table IX). Maturities were delayed also at Mangum in 1981 by drought when compared to Mangum in 1982. The extended vegetative period at Goodwell in 1982, however, was not due to drought, and it resulted in increased yields compared to the other years.

There was probably no evident trend for bloomless or sparse-bloom plants to be either earlier or later than their bloom near-isohybrids.

Plant Height

The means in Table X showed significant (P = 0.05) differences between bloom and bloomless and bloom and sparse-bloom near-isohybrids for plant height in 1980 at both Perkins and Goodwell. The drought at Perkins in 1980 probably caused the short statured bloom and bloomless plants. Only one other case of a significant (P = 0.05) difference for plant height between pairs of near-isohybrids occurred between bloom and sparse bloom at Goodwell in 1981. The significant (P = 0.05) interactions for Pair X Bm vs bm for both Perkins and Goodwell in 1980 and for Goodwell in 1981 probably came about as a result of the desparity of magnitude of the members of the pairs. The additional significant interactions are associated with nonsignificant Bm vs bm mean squares and therefore have little meaning.

There did not seem to be a definite trend for bloomless or sparse-bloom plants to be either taller or shorter than their bloom near-isohybrids.

TABLE X

COMPARISON OF BLOOM, BLOOMLESS, AND SPARSE-BLOOM FOR AVERAGED MEAN OF PLANT HEIGHT AT PERKINS, MANGUM, AND GOODWELL, OKLAHOMA IN 1980, 1981, AND 1982

	1980		1981			1982		
	Perkins	Goodwell	Perkins	Mangum	Goodwell	Perkins	Mangum	Goodwell
	cm							
bm	69	114*	97	95	126	104	100	126
Bm	70	117	96	93	127	103	100	124
h	78*	121*	105	99	140*	105	100	132
H	82	126	106	98	134	104	102	131
L.S.D. (0.05)								
(bm, Bm)	NS	2.2	NS	NS	NS	NS	NS	NS
(h, H)	3.6	3.5	NS	NS	0.3	NS	NS	NS

* Significant at the 0.05 level of Probability

Threshing Percent

The means in Table XI for threshing percent showed only one instance of a significant (P = 0.05) difference between means of bloom and bloomless isohybrids. It was at Perkins in 1982. In 1980 at Perkins under severe moisture stress the means for threshing percent were low and ranged from 31 for a bloom hybrid to 73 percent for another bloom hybrid with an average of 53 percent, (Table XIV, Appendix). In 1981 in a better season the range was from 71 percent for a bloomless to 83 percent for bloom hybrids (Table XVI, Appendix). Threshing percent was lower again at Perkins in 1982, where a late season drought occurred.

There did not seem to be a definite trend for bloomless or sparse-bloom hybrids to be either higher or lower in threshing percent than their bloom near-isohybrids.

Test Weight

The means in Table XII for test weight showed significant differences between bloom and bloomless near-isohybrids at Perkins in 1980, 1981, and 1982, and at Goodwell in 1982. There was also a significant (P = 0.05) difference between bloom and sparse-bloom near isohybrids at Goodwell in 1981 and 1982. Test weights were relatively high at Perkins in 1980 and low in 1981, while threshing percentages were low in 1980 and high in 1981. Low threshing percent was expected for the droughty year at Perkins in 1980, but the high test weight was unexpected. Also having obtained a high threshing percent at Perkins in 1981, higher test weights were expected than were observed. Perhaps the grain that threshed out in 1980 was somewhat small but dense, and

TABLE XI

COMPARISON OF BLOOM, BLOOMLESS, AND SPARSE-BLOOM FOR AVERAGED MEAN OF THRESHING PERCENT AT PERKINS, MANGUM, AND GOODWELL, OKLAHOMA IN 1980, 1981, AND 1982

	1980		1981			1982		
	Perkins	Goodwell[1]	Perkins	Mangum	Goodwell[1]	Perkins	Mangum	Goodwell
				%				
bm	53	-	77	77	-	54*	69	59
Bm	53	-	78	78	-	59	68	60
h	69	-	80	81	-	60	69	62
H	71	-	79	79	-	61	69	60
L.S.D (0.05)								
(bm, Bm)	NS	-	NS	NS	-	2.77	NS	NS
(h, H)	NS	-	NS	NS	-	NS	NS	NS

* Significant at the 0.05 level of probability.

[1] Threshing Percent was not determined at Goodwell 1980, 1981.

TABLE XII

COMPARISON OF BLOOM, BLOOMLESS,AND SPARSE-BLOOM FOR AVERAGED MEAN TEST WEIGHT AT PERKINS, MANGUM, AND GOODWELL, OKLAHOMA IN 1980, 1981, AND 1982.

	1980		1981			1982		
	Perkins	Goodwell	Perkins	Mangum	Goodwell	Perkins	Mangum	Goodwell
	kg/L							
bm	0.7456*	0.7593	0.6657*	0.7269	0.7637	0.7116*	0.7457	0.7607*
Bm	0.7042	0.7546	0.6924	0.7282	0.7648	0.7300	0.7536	0.7670
h	0.7378	0.7602	0.6819	0.7232	0.7525*	0.7306	0.7362	0.7563*
H	0.7456	0.7611	0.6794	0.7404	0.7611	0.7319	0.7457	0.7635
L.S.D. (0.05)								
(bm,Bm)	0.0055	NS	0.0137	NS	NS	0.0075	NS	0.0053
(h, H)	NS	NS	NS	NS	0.0068	NS	NS	0.0072

* Significant at the 0.05 level of probability.

late rains in 1981 reduced the test weight of the grain while not affecting threshing percent. The interactions indicated that there were pairs of bloom and bloomless and of bloom and sparse-bloom in which the magnitudes of the bloomless or sparse-bloom member of the pair were larger and contrary to the trend.

There was a general tendency for bloomless and sparse-bloom hybrids to have lower test weight than their bloom near-isohybrids.

Grain Yield

According to the analyses of variance in Table VI for grain yield in 1980, at Perkins, there was no significant difference for Bm vs bm, and therefore no difference between members of the pairs of near-isohybrids. The bloomless hybrids, however, yielded more than the bloom hybrids, while the sparse-bloom hybrids yielded less than their bloom hybrids. The significant (P = 0.05) difference which was indicated between bloom and sparse-bloom hybrids at Perkins in 1980 (Table XIII) was not substantiated by the analyses of variance in Table VI. The low yields at Perkins in 1980 resulted from a severe drought throughout the growing season. At Goodwell (irrigated) in 1980, there was a significant (P = 0.01) difference between bloom and bloomless members of the pairs of near-isohybrids (Table XIII). The bloomless yielded more than bloom isohybrids because of a severe infestation of greenbugs which killed an average of two to three leaves per plant of the bloom hybrids. The nonpreference of the greenbug for the bloomless hybrids prevented them from damage and increased grain yield. The damage ratings and yields (ranging from 2727 to 9242 kg/ha)

TABLE XIII

COMPARISON OF BLOOM, BLOOMLESS, AND SPARSE-BLOOM FOR AVERAGED MEAN GRAIN YIELD AT PERKINS, MANGUM, AND GOODWELL, OKLAHOMA IN 1980, 1981, AND 1982

	1980		1981			1982		
	Perkins	Goodwell	Perkins	Mangum	Goodwell	Perkins	Mangum	Goodwell
				kg/ha				
bm	860	5752*	3093*	2312	5154	1684*	3627	7506
Bm	813	5091	3618	2236	5388	2184	3718	7903
h	1653*	7774	4069	3229	6115	2410	3794	8121
H	1889	7762	4233	2676	6488	2480	3963	7858
L.S.D. (0.05)								
(bm, Bm)	NS	391	189	NS	NS	178	NS	NS
(h, H)	159	NS	NS	NS	NS	NS	NS	NS

* Significant at 0.05 probability level of significant

may be observed in Table XV of the Appendix.

In 1981 the analyses of variance in Table VII indicated significant differences between members of pairs of bloom and bloomless near-isohybrids at Perkins and at Goodwell. In Table XIII the means for bloomless and sparse-bloom hybrids were observed to be lower than their bloom near-isohybrids, and significance was indicated for Perkins but not for Goodwell. In spite of a moderate attack of greenbugs at Goodwell in 1981, the yields of the bloom hybrids were higher than bloomless. The greenbug damage ratings at Goodwell in 1981 and the means for grain yield may be found in Table XVIII of the Appendix. The interaction of Pair X Bm vs bm at Perkins in 1981 was the result of inconsistent relative magnitudes of grain yield for the bloomless and sparse-bloom hybrids compared to their bloom near-isohybrid counterparts. Since the calculation of the least significant difference for Goodwell in 1981 did not show a significant difference, the interaction of Pairs X Bm vs bm will be ignored. At Mangum, in 1981, there was no significant difference between bloomless or sparse-bloom and their near-isohybrids for grain yield, but the average means for bloomless and sparse-bloom were higher.

There was a definite trend in 1981 for the yield of bloom hybrids to exceed their bloomless and sparse-bloom near-isohybrid counterparts at Perkins and Goodwell, although significance was indicated in only one comparison. At Mangum, the trend was reversed.

In 1982 grain yield of the bloomless hybrids was significantly ($P = 0.05$) less than it was for their bloom counterparts at Perkins (Table VIII and XIII). A late season drought occurred at Perkins in 1982. Other workers have reported that bloomless plants under moisture stress do not perform as well as bloom plants (16, 17). The data reported here would substantiate that theory.

In 1982 at Mangum and Goodwell there were no significant differences for grain yield, but in three of the four comparisons of means (Table XIII) the grain yields of the bloom hybrids exceeded their counterparts. Greenbugs were not a factor in grain yields at Goodwell in 1982.

Under ideal conditions of sufficient moisture and no greenbug attack, bloomless hybrids are expected to perform as well as their bloom isohybrids. This occurred in 1982, at Goodwell, but in the presence of greenbug attack such as in 1980 and 1981 at Goodwell the yields of the bloomless hybrids were expected to be higher. The data showed higher yields for the bloomless hybrids in 1980, but not in 1981 where the yields were close to being significantly lower.

In 1980 and 1982 at Perkins, there was moisture stress during the growing season, however, the results were somewhat contradictory (Table XIII). A possible explanation for this could be the stage of plant growth at which the drought occurred. In 1982, the late-season drought occurred when the grain was filling. As a result of this timing, the bloomless hybrids produced less grain yield than their bloom isohybrids in 1982. In 1980, there was a reversal of yield levels with the bloomless hybrids yielding more, but the overall yield level was lower during the season-long drought of 1980.

Outstanding Hybrids

In 1980, A bm_1-B8 X IS809, A bm_1-B8 X ROKY35, A bm_1-B8 X ROKY76, A bm_1-B8 X ROKY34 and A bm_1-B8 X ROKY62 were the five highest yielding bloomless hybrids at Perkins. These bloomless hybrids performed as well generally as their bloom isohybrids. At Goodwell, the same five bloomless hybrids also produced the highest yield. Furthermore, they had a higher performance than their bloom isohybrids. Hybrid A bm_1-B8 X ROKY35 produced the highest yield at the two locations. Among the high yielding sparse-bloom hybrids, A h_2 X ROKY62 produced the highest yield at both locations in 1980. The relative performance of sparse-bloom and their bloom isohybrids were similar at the two locations.

In 1981, pedigree A bm_1-BOK11 X ROKY62, was among the five highest yielding at three locations, A bm_1-BOK11 X ROKY76 was among the top five at Perkins and Mangum. A bm_1-Redlan X ROKY62 and A bm_1-B8 X ROKY62 were among the top five at Mangum and Goodwell. Among the sparse-bloom hybrids A h_2 X ROKY62, and A h_2 X ROKY47 were the highest yielding at Perkins, Mangum, and Goodwell in 1981. Generally, the relative performance of high yielding sparse-bloom and bloom isohybrids were similar except at Mangum, where, the sparse-bloom hybrids performed better than their bloom isohybrids.

Bloomless hybrid A bm_1-B8 X ROKY35 gave a high performance at Perkins in two years (1980 and 1981). Bloomless hybrids A bm_1-B8 X ROKY62, A bm_1-B8 X ROKY76, and A bm_1-B8 X IS809 produced high yields at Perkins and Goodwell in 1980 and 1981.

In 1982 bloomless hybrids A OK11 X ROKY47, A Wheat X ROKY76, A OK11 X ROKY62 and A Wheat X ROKY47 produced high yields at all locations (Perkins, Mangum and Goodwell). The relative performance of high yielding bloom and bloomless isohybrids was slightly in favor of bloom isohybrids (due to the drought stress in 1982 growing season). Among the sparse-bloom hybrids A h_2 X ROKY47, A h_2 X ROKY78, and A h_2 X ROKY62 produced the highest yields at Mangum and Goodwell in 1982. A similar performance of bloom and sparse-bloom isohybrids was observed at Perkins and Mangum, but at Goodwell the sparse-bloom hybrids were superior to their bloom isohybrids.

Bloomless hybrid A bm_1-BOK11 X ROKY62 produced a high yielding performance over locations in 1981 and 1982.

In all tests over three years, A h_2 X ROKY62 sparse-bloom hybrid had a very high yielding performance. Hybrid A h_2 X ROKY47 produced high yields at Mangum and Goodwell in 1981 and 1982. Bloomless and sparse-bloom versions of ROKY47 and ROKY62 appeared to be the most outstanding lines as measured by their performance in hybrids. (See Tables XIV, XV, XVI, XVII, XVIII, XIV, XX and XXI in the Appendix)

CHAPTER V

SUMMARY AND CONCLUSIONS

Field studies were conducted to determine the performance of bloom (*Bm Bm*) vs bloomless (*bm bm*) and sparse-bloom (*h h*) vs bloom (H H) near-isohybrids of sorghum. The trials were grown at the Agronomy Research Stations of Perkins, Mangum (dryland), and Goodwell (irrigated) in 1980, 1981, and 1982. In 1980, there were 34 entries consisting of 12 bloom and bloomless near-isohybrid pairs and 5 pairs of sparse-bloom and bloom. In 1981 and 1982 there were 40 treatments consisting of 15 bloom and bloomless and 5 sparse-bloom and bloom near isohybrid pairs in the former year, and 13 bloom and bloomless and 7 sparse-bloom and bloom near-isohybrid pairs in the latter year. A randomized complete block design with three replications was used for each experiment. Agronomic variables were analyzed for days-to-midbloom, plant height, threshing percent, test weight, and grain yield. The objectives of this experiment were to study the comparison of bloom with bloomless and sparse-bloom with normal near-isohybrid pairs and to determine greenbug reaction and agronomic characteristics of the hybrids.

In 1980, 1981, and 1982 no significant differences were observed between members of bloomless and bloom or sparse-bloom and bloom near-isohybrid pairs for days-to-midbloom at any of the three locations. In 1980 at Perkins the blooming dates were delayed due to moisture stress. The same held true for Mangum in 1981. Delayed maturities at Goodwell were not explained.

In 1980 sparse-bloom hybrids were significantly shorter than their normal isohybrids at Perkins and Goodwell. In 1981 and 1982 no significant differences were found between groups of isohybrids for plant height except for Goodwell in 1981. Because of a severe drought at Perkins in 1980 the plants were shorter than at any other location or year.

In 1982 at Perkins, the bloomless hybrids had a significantly lower threshing percent than their bloom near-isohybrids. This was the only significant difference observed in all tests. Low threshing percentages were observed in the 1980 drought year, and high threshing percentages were observed in 1981, a better year.

In 1980 the bloomless hybrids had significantly higher test weights than their bloom near-isohybrids at Perkins. In contrast in 1981 and 1982 at Perkins, the bloomless hybrids had a significantly lower test weight. A significantly lower test weight was observed for sparse-bloom at Goodwell in 1981 and 1982. In 1982 bloomless hybrids had a lower test weight than their bloom counterparts at Goodwell. Relatively high test weights for Perkins in 1980 were associated with low threshing percent, and low test weights for Perkins in 1981 were associated with high threshing percent. The differential effect of the seasons must have been responsible.

In 1980 at Perkins under drought, no significant difference was observed between the members of the bloom and bloomless near-isohybrid pairs for grain yield. However, the sparse-bloom isohybrids produced significantly lower yields than their bloom counterparts. At Goodwell under a severe infestation of greenbugs, bloomless hybrids produced significantly higher yields than their bloom isohybrids, indicating the high level of nonpreference of greenbugs for bloomless. In 1981 bloom hybrids were superior to their bloomless isohybrids at Perkins. No significant differences were found for grain yield at Mangum and Goodwell. In 1982 at Perkins under a late-season drought bloomless hybrids produced significantly less yield than their bloom counterparts. Nevertheless, no significant difference was detected in the Mangum and Goodwell tests.

In general, bloom hybrids in most tests produced higher yields than their bloomless isohybrids; nevertheless some pairs performed similarly. Bloomless hybrids under moisture stress produced less grain yield than their bloom isohybrids. Under greenbug attack, bloomless hybrids were superior to their bloom isohybrids. Sparse-bloom hybrids under moisture stress generally did not perform as well as their bloom counterparts. However, under greenbug attack, they performed similarly.

The bloomless and sparse-bloom traits did not seriously affect midbloom, plant height, threshing percent, or test weight. Even for grain yield the performance of the bloomless and sparse-bloom hybrids were often equal to their bloom near-isohybrids. It may be possible to select improved bloomless and sparse-bloom lines for stress tolerance that will produce hybrids with productive potentials equal to bloom hybrids.

LITERATURE CITED

1. Amini, I. 1976. A study of greenbug resistance in a progeny from "bloomless" sorghum. Master's Thesis, Oklahoma State University.

2. Ayyangar, G. N. R., V. Pandurango Rao, A. K. Nambiar and B. W. X. Ponnaiya. 1937. The occurrence and inheritance of waxy bloom on sorghum. Proceedings of the Indian Academy of Sci. 5:4-15.

3. Ayyangar, G. N. R., and B. W. X. Ponnaiya. 1941. The occurrence and inheritance of bloomless sorghum. Current Sci. 10:408-409.

4. Blum, A. 1975a. Effect of the Bm gene on epicuticular wax and the water relation of *Sorghum biocolor* (L.) Moench. Israel J. Bot. 24:50-51.

5. Blum, A. 1975b. Effect of the Bm gene on epicuticular wax deposition and the spectral characteristics of sorghum leaves. Sabrao J. 7:45-52.

6. Chatterton, N. J., W. W. Hanna, J. B. Powell, and D. R. Lee. 1975. Photosynthesis and transpiration of bloom and bloomless sorghum. Can. J. Pl. Sci. 55:641-645.

7. Cummins, D. G., and J. W. Dobson, Jr. 1972. Digestibility of bloom and bloomless sorghum leaves as determined by a modified *in vitro* technique. Agron. J. 64:682-682.

8. Hanna, W. W., W. G. Monson, and G. W. Burton. 1974. Leaf surface effects in *in vitro* digestion and transpiration in isogenic lines of sorghum and pearl millet. Crop Sci. 14: 837-838.

9. Harvey, T. L., and H. L. Hackerrott. 1969. Plant resistance to a greenbug biotype injurous to sorghum. J. Econ. Entomol. 62: 1271-1274.

10. Lambright, L. E., and A. B. Maunder. 1974. Study of drought tolerance relative to stomatal diffusive resistance. Sorghum Newsl. 17:96.

11. Martin, J. H. 1930. The comparative drought resistance to sorghum and corn. Agron. J. 22:993-1003.

12. Maunder, A. B., D. H. Smith, and B. W. Judah. 1971. Bloom and bloomless isogenics as related to charcoal rot and diffusive resistance. Sorghum Newsl. 14:20-21.

13. Painter, R. H. 1951. Insect resistance in crop plants. MacMillan, New York, N.Y.

14. Peiretti, R. A. 1976. Some aspects of greenbug resistance in sorghum as related to "bloomless" character. Master's Thesis, Oklahoma State University.

15. Porter, K. B., G. L. Peterson, and O. Vise. 1982. A new greenbug biotype. Crop Sci. 22:847-850.

16. Ross, W. M. 1972. Effect of bloomless (bl bl) on yield in Combine Kafire-60. Sorghum Newsl. 15:121.

17. Webster, O. J., and C. Schmalzel. 1979. Yield trials of isogenic lines, normal vs. bloomless. Sorghum Newsl. 22:24.

18. Weibel, D. E., K. J. Starks, and R. A. Peiretti. 1976a. Greenbug damage ratings of bloom and bloomless plants in F_3 segregating rows. Sorghum Newsl. 19:119.

19. Weibel, D. E., K. J. Starks, and R. A. Peiretti. 1976b. Greenbug damage ratings of bloom and bloomless plants in near-isogenic lines. Sorghum Newsl. 19:119.

20. Weibel, D. E. 1981. Comparison of bloom, bloomless and sparse-bloom sorghums for grain yield. Sorghum Newsl. 25:28-29.

APPENDIX

TABLE XIV

MEANS FOR DAYS-TO-FIRST BLOOM, PLANT HEIGHT, THRESHING PERCENT, TEST WEIGHT, AND GRAIN YIELD AT PERKINS, OKLAHOMA IN 1980

Entry[1] No.	Days-to-first-bloom	Plant Height	Threshing Percent	Test Weight	Grain Yield
	Days	cm	%	lbs/bs	kg/ha
2	71	66	56	53.3	933
1	72	74	62	55.3	1269
4	69	65	46	--	354
3	70	61	31	--	242
6	67	63	32	--	205
5	70	62	29	--	186
8	67	65	54	52.6	690
7	68	68	58	54.6	896
10	71	77	62	56.0	1325
9	73	75	64	57.3	1269
12	80	73	68	57.6	1941
11	80	84	73	58.0	1941
14	69	78	57	55.6	1064
13	71	67	60	57.0	1194
16	72	72	66	56.6	1381
15	73	73	61	56.0	1064
18	82	79	72	58.0	1810
17	83	78	69	57.6	1456
20	71	77	64	57.3	1288
19	69	75	67	56.3	1269
22	74	73	39	--	298
24	62	67	60	55.6	952
23	63	68	55	53.6	877
26	70	90	64	57.3	1456
25	68	83	63	57.3	1232
28	63	64	50	49.0	578
27	69	66	56	52.6	858
30	68	70	52	52.3	690
29	66	64	61	54.6	952
32	79	89	71	57.6	2128
31	74	78	65	56.6	1680
34	73	86	72	58.0	1608
33	76	73	68	56.6	1456
36	76	84	71	57.6	1960
35	72	79	67	57.0	1736
L.S.D.					
(0.05)=	4	8	8	1.4	354
(0.01)=	6	10	10	1.9	470

[1] Refer to Table III for pedigree, phenotype, and genotype of the entries.

TABLE XV

MEANS FOR DAYS-TO-MIDBLOOM, GREENBUG DAMAGE RATING, PLANT HEIGHT, TEST WEIGHT, AND GRAIN YIELD AT GOODWELL, OKLAHOMA 1980

Entry[1] No.	Days-to-Midbloom	Greenbug Damage Ratings[2]	Plant Height	Test Weight	Grain Yield
	Days	No.	cm	lbs/bu	kg/ha
2	52	1	118	58.3	5859
1	53	3	112	58.0	6964
4	55	1	114	59.0	4316
3	56	2	105	59.3	2867
6	57	1	102	59.0	2727
5	56	4	106	58.3	3494
8	57	1	116	59.3	4671
7	57	5	117	60.3	5643
10	59	1	122	59.0	4854
9	61	5	122	59.6	7205
12	64	5	117	59.3	7603
11	64	5	118	59.6	8478
14	58	1	116	60.0	6362
13	58	4	112	59.3	7266
16	60	1	115	59.0	6053
15	61	5	108	59.3	6576
18	65	5	117	59.3	8477
17	66	6	118	59.6	9242
20	58	1	120	57.6	5648
19	57	4	123	59.3	6405
22	64	1	118	59.0	4776
21	66	5	109	58.6	5071
24	50	1	125	55.0	5160
23	50	5	124	57.0	5566
26	56	4	143	57.0	6061
25	56	3	143	58.0	7010
28	55	2	111	59.6	4658
27	57	5	116	59.3	5735
30	57	1	124	57.0	5905
29	57	5	121	57.6	6232
32	62	4	143	58.3	8261
31	62	5	130	58.0	7664
34	61	5	128	60.0	7431
33	60	6	121	59.3	6750
36	61	5	128	58.0	7039
35	63	5	119	58.0	6733
L.S.D.					
(0.05) =	2		8	1.0	1352
(0.01) =	3		9	1.5	1795

[1] Refer to Table III for pedigree, phenotype, and genotype of the entries

[2] Greenbug Damage Ratings

0 = No evaluation possible
1 = No red spots
2 = Red spots
3 = A portion of one leaf killed
4 = one leaf killed
5 = Two leaves killed
6 = Four leaves killed
7 = Six leaves Killed
8 = Eight leaves killed
9 = Dead Plant

TABLE XVI

MEANS FOR DAYS-TO-FIRST-BLOOM, PLANT HEIGHT, THRESHING PERCENT, TEST WEIGHT AND GRAIN YIELD AT PERKINS, OKLAHOMA IN 1981

Entry[1] No.	Days-to-First-bloom	Plant Height	Threshing Percent	Test Weight	Grain Yield
	Days	cm	%	lbs/bu	kg/ha
2	43	101	78	50.1	3434
1	44	94	74	50.3	2576
4	47	84	80	53.1	3490
3	46	83	78	52.0	2501
6	50	45	77	52.3	2818
5	53	46	78	54.3	3434
8	48	96	79	52.8	3173
7	50	91	77	52.6	3173
10	51	91	73	52.6	2501
9	53	94	75	54.3	3601
12	47	88	78	54.1	3080
11	47	89	81	53.6	3266
14	44	101	71	62.6	3304
13	45	98	76	54.0	2781
16	48	97	78	47.6	3117
15	51	96	75	44.0	3322
18	47	92	82	53.6	3546
17	48	95	80	53.3	2818
20	50	91	80	54.1	3360
19	49	95	78	51.8	2650
22	56	104	80	54.6	4797
21	55	100	79	51.8	3304
24	60	110	79	57.8	5469
23	54	90	77	51.3	3117
26	52	103	79	52.6	3397
25	32	102	74	52.3	2613
28	62	97	77	53.6	5077
27	62	101	74	49.3	4162
30	51	94	82	52.8	3714
29	59	115	77	49.0	3621
32	55	105	82	49.8	5245
31	55	112	83	51.1	4498
34	60	108	81	54.6	5338
33	58	112	80	54.3	4629
36	54	114	80	51.6	4200
35	53	103	82	51.6	4405
38	49	103	74	54.0	3229
37	50	93	77	53.5	3584
40	51	100	75	53.1	3154
39	52	106	76	53.6	3229
L.S.D.					
(0.05)=	2	11	6	4.0	731
(0.01)=	5	15	8	5.5	969

[1] Refer to Table IV for pedigree, phenotype, and genotype of the entries

TABLE XVII

MEANS FOR DAYS-TO-MIDBLOOM, PLANT HEIGHT, THRESHING PERCENT, TEST WEIGHT, AND GRAIN YIELD AT MANGUM, OKLAHOMA IN 1981

Entry[1] No.	Days-to-Midbloom	Plant Height	Threshing Percent	Test Weight	Grain Yield
	Days	cm	%	lbs/bu	kg/ha
2	65	91	75	49.6	1810
1	69	89	77	51.6	1810
4	76	73	62	56.8	1213
3	67	88	78	57.6	2034
6	73	106	79	57.1	2034
5	77	95	74	56.6	2240
8	68	90	82	57.8	2408
7	73	94	80	56.0	2296
10	74	85	78	58.1	2445
9	75	87	77	58.5	2594
12	71	91	81	53.6	2576
11	76	97	67	58.6	1624
14	64	93	77	57.8	1474
13	65	91	78	55.5	1493
16	71	85	78	54.3	2016
15	70	93	81	56.1	2818
18	73	88	74	55.8	1680
17	73	93	76	56.3	1997
20	74	103	82	59.3	2930
19	73	99	78	57.8	3528
22	78	96	76	56.6	2314
21	78	93	71	56.0	1866
24	81	100	78	57.8	3285
23	70	98	81	57.6	2986
26	79	95	79	57.3	1773
25	76	95	73	56.3	1549
28	84	93	76	57.3	3042
27	82	97	76	55.5	2986
30	76	102	79	57.0	2538
29	78	113	80	54.8	2856
32	77	97	76	56.8	2763
31	76	97	82	57.8	3770
34	80	97	77	58.6	2818
33	74	103	80	57.8	4106
36	78	101	80	55.4	2800
35	73	103	81	56.8	3173
38	75	100	81	58.8	2762
37	73	97	80	57.6	2781
40	74	97	79	57.1	2240
39	78	95	79	50.1	2314
L.S.D.					
(0.05)=	7	13	10	3.9	1349
(0.01)=	9	18	14	5.2	1789

[1] Refer to Table IV for pedigree, phenotype, and genotype of the entries

TABLE XVIII

MEANS FOR DAYS-TO-MIDBLOOM, GREENBUG DAMAGE RATING, PLANT HEIGHT, TEST WEIGHT, AND GRAIN YIELD AT GOODWELL, OKLAHOMA IN 1981

Entry[1] No.	Days-to-Midbloom	Greenbug damage Ratings[2]	Plant Height	Test Weight	Grain Yield
	Days	No.	cm.	lbs/bu	kg/ha
2	59	1	127	58.6	4629
1	57	2	127	58.3	5712
4	59	1	122	60.6	5301
3	62	3	119	61.0	5413
6	61	1	137	60.0	5264
5	62	3	134	59.6	5450
8	60	1	114	59.6	5450
7	60	3	122	59.6	5338
10	60	1	114	59.0	5562
9	62	3	124	59.6	5786
12	59	1	134	60.6	4368
11	60	3	134	60.3	5749
14	56	1	137	59.6	3509
13	56	2	131	58.0	4032
16	59	1	121	60.0	3733
15	59	4	114	60.6	4816
18	60	1	134	58.3	6010
17	60	3	127	58.3	5413
20	62	1	129	59.3	6496
19	60	3	127	60.3	5152
22	65	1	124	59.6	6906
21	62	4	122	60.0	4666
24	65	1	137	58.6	6757
23	62	4	111	59.3	5488
26	63	1	142	59.0	4928
25	62	5	127	58.6	4405
28	66	1	116	58.0	6570
27	65	5	122	57.3	5562
30	62	1	122	58.0	5301
29	66	4	152	56.6	4330
32	65	2	124	57.6	6794
31	65	3	134	58.3	6346
34	66	1	132	59.6	6421
33	66	4	135	59.1	6496
36	63	1	147	58.0	6682
35	62	3	147	57.0	6085
38	60	2	132	60.0	6458
37	61	3	142	59.0	6832
40	61	2	137	59.6	6085
39	61	4	142	58.3	4816
L.S.D.					
(0.05)=	2		0.8	1.1	1083
(0.01)=	3		1.1	1.5	1437

[1] Refer to Table IV for pedigree, phenotype, and genotype of the entries
[2] Greenbug damage rating
0 = No evaluation possible
1 = No red spots
2 = Red spots
3 = A portion of one leaf killed
4 = One leaf killed
5 = Two leaves killed
6 = Four leaves killed
7 = Six leaves killed
8 = Eight leaves killed
9 = Dead Plant

TABLE XIX

MEANS FOR DAYS-TO-MIDBLOOM, PLANT HEIGHT, THRESHING PERCENT, TEST WEIGHT, AND GRAIN YIELD AT PERKINS, OKLAHOMA IN 1982

Entry[1] No.	Days-to-Midbloom	Plant Height	Threshing Percent	Test Weight	Grain Yield
	Days	cm	%	lbs/bu	kg/ha
2	55	105	51	54.6	1512
1	57	10	53	55.8	1306
4	58	102	55	56.3	1754
3	58	112	53	5610	1848
6	61	106	61	57.5	2258
5	61	104	54	56.3	1698
8	62	101	59	56.6	2221
7	59	101	65	55.5	2053
10	59	120	57	55.3	1866
9	62	106	49	52.5	1400
12	59	99	62	56.0	2240
11	58	110	51	55.3	1568
14	61	100	59	57.0	2426
13	63	110	60	54.8	2258
16	61	95	62	58.3	2650
15	62	98	50	53.0	2016
18	60	105	57	55.5	2090
17	62	110	51	54.6	1362
20	57	96	63	57.0	2314
19	58	97	56	55.8	1904
22	60	104	61	56.6	2576
21	61	97	56	55.5	1642
24	64	101	59	58.3	2501
23	62	96	52	57.1	1437
26	57	107	56	56.3	1978
25	59	110	51	54.6	1400
28	60	111	57	58.0	2053
27	58	115	62	57.3	2389
30	61	107	68	56.5	2576
29	60	100	59	57.0	2221
32	64	106	61	58.6	2725
31	63	104	57	58.0	2333
34	59	117	60	55.3	2389
33	58	109	56	53.0	2146
36	59	103	57	55.1	2277
35	58	106	59	56.3	2314
38	62	99	61	55.8	2874
37	61	110	63	57.3	2893
40	65	96	61	57.6	2464
39	64	100	61	57.5	2576
L.S.D.					
(0.05)=	3	7	10	2.0	688
(0.01)=	4	9	13	2.7	913

[1] Refer to Table V for pedigree, phenotype, and genotype of the entries

TABLE XX
MEANS FOR DAYS-TO-MIDBLOOM, PLANT HEIGHT, THRESHING PERCENT, TEST WEIGHT, AND GRAIN YIELD AT MANGUM, OKLAHOMA IN 1982

Entry[1] No.	Days-to-Midbloom	Plant Height	Threshing Percent	Test Weight	Grain Yield
	Days	cm	%	lbs/bu	kg/ha
2	56	96	68	59.5	3055
1	59	99	65	59.6	3449
4	67	101	67	58.6	3055
3	66	98	56	59.3	2464
6	67	96	68	59.3	3893
5	68	108	75	58.0	3942
8	63	106	71	58.0	4139
7	63	100	75	58.5	3597
10	67	115	65	58.0	3351
9	62	105	76	56.3	3893
12	63	101	72	59.0	3844
11	63	96	72	59.6	3992
14	67	104	68	58.3	4336
13	67	102	69	57.3	3991
16	69	96	70	57.0	3449
15	65	103	67	55.0	3499
18	66	102	68	56.3	3302
17	60	104	68	57.0	3548
20	63	94	70	58.6	3844
19	65	98	71	59.3	3351
22	65	98	71	59.0	4189
21	63	98	66	56.1	3942
24	67	97	66	58.3	4681
23	62	96	69	58.0	3055
26	62	96	65	59.3	3203
25	64	96	70	57.8	4435
28	61	104	67	59.3	3597
27	62	111	70	57.5	3597
30	67	99	66	59.1	3745
29	64	102	70	58.1	4238
32	70	105	70	56.8	3991
31	65	101	68	58.3	3844
34	66	109	67	57.6	4879
33	67	95	74	56.8	4435
36	61	101	65	59.0	4090
35	60	97	66	58.6	3449
38	64	100	73	56.6	3203
37	65	93	66	57.1	3597
40	70	95	99	56.0	4238
39	71	103	66	52.8	3400
L.S.D.					
(0.05)=	5	13	9	2.5	1400
(0.01)=	6	18	12	3.5	1856

[1] Refer to Table V for pedigree, phenotype, and genotype of the entries

TABLE XXI

MEANS FOR DAYS-TO-MIDBLOOM PLANT HEIGHT, THRESHING PERCENT, TEST WEIGHT, AND GRAIN YIELD AT GOODWELL, OKLAHOMA IN 1982

Entry[1] No	Days-to-Midbloom	Plant Height	Threshing Percent	Test Weight	Grain Yield
	Days	cm	%	lbs/bu	kg/ha
2	68	117	57	59.6	6081
1	67	122	61	59.6	6788
4	74	129	59	60.3	8060
3	73	130	60	61.6	7424
6	74	132	62	59.6	7424
5	73	131	57	59.6	7141
8	77	132	63	59.0	7353
7	70	110	63	59.3	5798
10	73	135	59	59.0	8060
9	79	145	57	58.6	7566
12	74	116	58	60.3	8061
11	73	128	59	61.0	6717
14	76	120	62	57.6	6929
13	80	133	59	58.3	7141
16	82	121	62	59.3	8485
15	78	120	61	58.0	7848
18	74	128	59	58.3	8061
17	78	140	59	57.0	8626
20	75	115	59	60.0	8343
19	75	117	58	59.6	7283
22	77	122	62	59.6	10040
21	72	122	56	57.6	8980
24	77	125	61	60.6	8414
23	76	116	62	58.0	7707
26	74	123	56	59.3	7424
25	78	120	56	58.0	8555
28	70	133	58	60.0	7283
27	73	131	63	59.0	7778
30	76	134	58	59.6	7990
29	74	135	60	58.6	9546
32	76	138	63	59.6	8626
31	78	142	63	59.6	8414
34	72	152	64	57.6	8697
33	72	147	66	57.3	8909
36	73	119	59	60.3	6646
35	70	117	60	59.0	6434
38	76	121	62	58.0	8414
37	76	126	61	59.0	7849
40	79	122	56	59.0	7354
39	79	126	60	58.0	7919
L.S.D.					
(0.05)=	3	8	7	1.4	1659
(0.01)=	4	11	9	1.9	2200

[1] Refer to Table V for pedigree, phenotype, and genotype of the entries

VITA 2

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