

**NAME OF TEST:** The effect of self-shading on yield in forage sorghum plant populations.

**OBJECTIVE:** To determine the effect of removal of lower leaves at various stages of plant development on forage production in various plant populations of FS-22 hybrid forage sorghum.

**PROCEDURE:**

**Location:** Texas A&M Plantation near College Station

**Soil Type:** Miller Clay

**Fertilization:** 36-36-36 prior to planting

**Field Procedure:** The test was planted in early April but had to be replanted in mid-May because of a poor stand. FS-22 was seeded at two rates in three different row spacing combinations. The rates and row spacing combinations were: 4 and 8 pounds in 40" rows, 8 and 16 pounds in double rows on 40" centers, and 16 and 32 pounds in 10" rows. These rates should provide similar plant spacings within the row for all row spacings. Superimposed on these 6 treatment combinations were three leaf removal treatments. Six lower leaves of each plant were removed when plants were 48" high, boot stage and a check in which no leaves were removed. The purpose of the study was to determine if the lower leaves in dense populations are effective or if self-shading eliminates the effectiveness of the lower leaves.

A split-split plot design was employed with row spacing serving as main plots, seeding rates as sub plots and leaf removals as sub-sub-plots. Only one harvest was made in the soft dough stage.

**Results:** See table and chart

**DISCUSSION:** The yield data for plots in which no leaves were removed indicate no advantage to more than 4, 8 or 16 pounds of seed per acre in 40", 40" double or 10" rows, respectively. Similarly, double rows on 40" beds were superior to either single rows or 10" row spacings.

Response to removal of lower leaves varied depending on the method and rate of planting and the stage of plant development. In general leaf removal reduced yields in the thin plant population more than the thick planting. Also, early removal reduced yields more than later removal. These results definitely indicate that as plant populations increase, the lower leaves make less contribution to plant growth, no doubt because of increased shading in the denser populations. This could account at least in part for the general lack of response to

the heavier seeding rates. Specifically, it may be noted in both 40" row combinations that the effect of leaf removal in the smaller population was proportional to the stage of plant development. In the larger population early leaf removal reduced yield but boot stage removal did not affect yield. Apparently the plants had developed to such an extent that the lower leaves no longer contributed to growth after the boot stage. This is further indicated by the weight of the lower leaves at the time they were removed (Table 2). In the single 40" rows, weight of the lower leaves continued to increase to the boot stage. The same pattern followed to some extent in the smaller population in double rows, but in the large population in double rows lower leaves had reached a maximum at the first leaf removal stage. In 10" rows, weight of the lower leaves actually decreased from the first to the second leaf removal stage in the larger population.

These data indicate that self-shading in denser plant populations reduce or eliminate the effectiveness of lower leaves and thereby limit the response to increased seeding rate.

WORKER: E. C. Holt  
PROJECT: Hatch 721  
DATE: January, 1967

Table 1. The effect of self shading in sorghum (FS-22) on yield response to plant populations. A&M Plantation, 1966.

Method of seeding	Rate of Seeding Lbs./acre	Pounds of dry forage per acre <sup>1/</sup>			
		Stage of maturity when 6 lower leaves were removed			
		48" high	Boot	Mature	Avg.
40" Row	4	4610	5890	6380	5630
	8	5820	6240	6240	6100
Average		5215	6065	6310	5860
40" Double Row	8	7150	8300	9240	8230
	16	8330	8680	8430	8480
Average		7740	8490	8835	8360
10" Row	16	5920	6150	6690	6250
	32	7410	5260	6410	6360
Average		6665	5705	6555	6310
Average for seeding rate	1	6390	6480	7350	6740
	2	6690	7020	7120	6940
Stage average		6540	6750	7235	6840

<sup>1/</sup> Weight of severed leaves included in yield.

Table 2. Weight of six lower leaves of FS-22 sorghum at two stages of maturity in differing plant populations.

Method of Seeding	Rate of seeding Lbs./acre	Stage of maturity	
		48' high	Boot
40" Row	4	186	398
	8	312	410
40" Double Row	8	521	595
	16	565	580
10" Row	16	402	450
	32	441	367

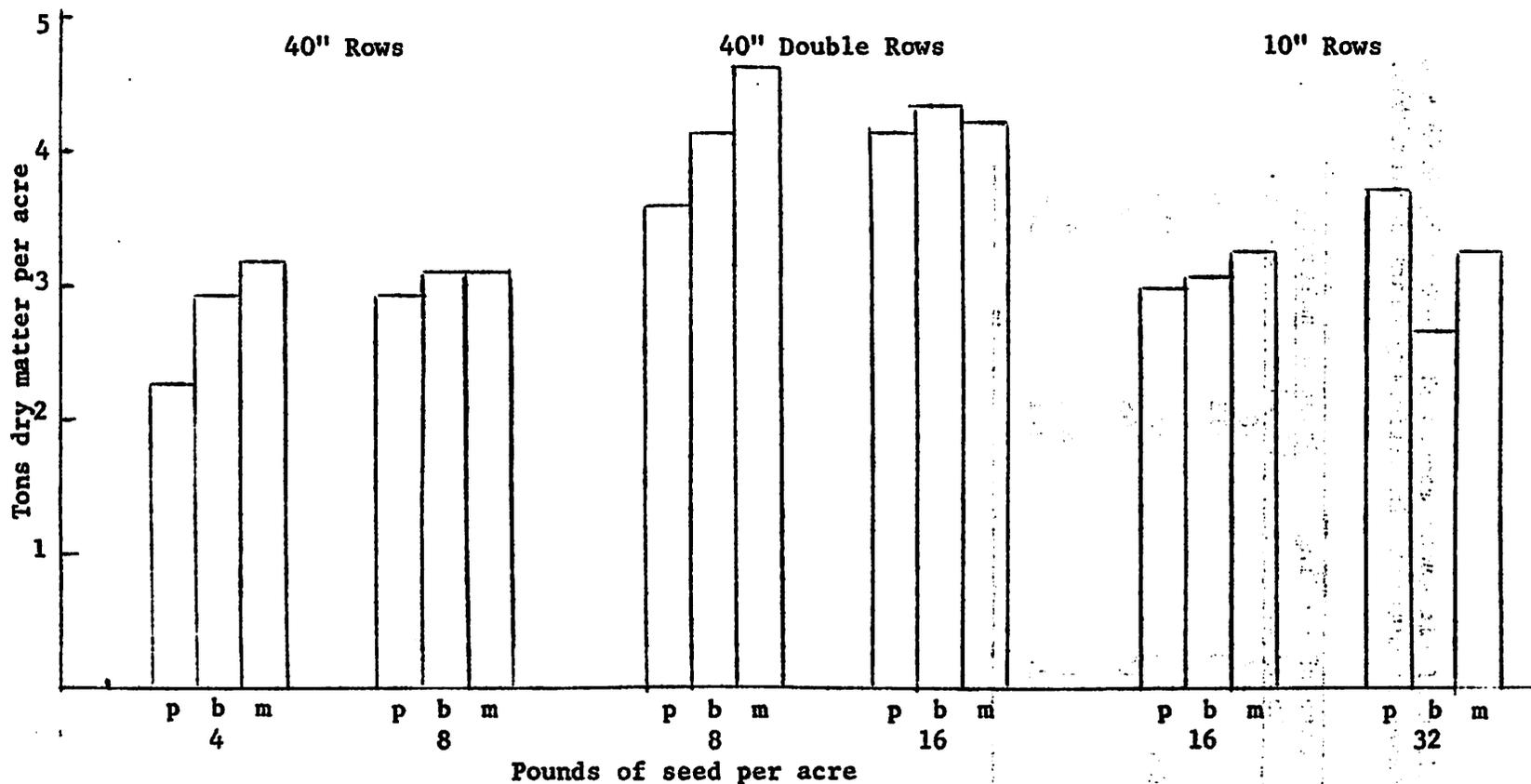


Figure 1. The effect of plant population and leaf removal on yield of FS-22 forage sorghum. A&M Plantation, 1966.

Legend Code: p - 6 lower leaves removed in preboot stage (48" high)  
 b - 6 lower leaves removed in boot stage  
 m - plants allowed to mature without leaf removal.

**TITLE:** The effect of seeding rate and row spacing on self-shading in sorghum

**OBJECTIVE:** To evaluate the effectiveness of lower leaves in plant growth in various types of plant populations of FS-22 hybrid forage sorghum.

**EXPERIMENTAL PROCEDURE:**

**Experiment No:** 048LO-25

**Location:** A&M Plantation near College Station, Texas

**Soil type:** Miller Clay

**Field Procedure:** Planted in early May, 1966 without previous fertilization. Top dressed with 30-0-0 after emergence. Rows were 12' long, 3' alley. A split plot design was employed with single rows serving as sub plots. Row widths consisted of (1) 40" rows, (2) Double rows 10" apart on 40-inch beds; (3) 10" rows. Seeding rates consisted of 4 and 8 pounds of seed per acre in 40" rows, 8 and 16 pounds in 40" Double rows, and 16 and 32 pounds in 10" rows. These rates should produce approximately the same number of plants per foot of row regardless of the row arrangement for each rate.

Approximately 6 lower leaves were removed from each plant at 48" high and in a second set of plots at the boot stage. A third treatment consisted of no leaf removal. The plots were harvested one time in the soft dough stage.

**Results:** In the absence of leaf removal, seeding in 40" Double rows increased yields significantly. Relatively little difference resulted from seeding rate if the plants were left intact.

Early leaf removal reduced yields in all three row combinations at the light seeding rate but only in 40-inch rows at the heavy seeding rate. Leaf removal in the boot stage reduced yields at the low seeding rate but not at the high rate. However, if the weight of the severed leaves were included with the boot stage - light seeding rate yields, not much if any reduction occurred. Not much change occurred in the weight of the lower leaves between 48" high and the boot stage.

**DISCUSSION:** These results indicate that the lower leaves are not effective in photosynthesis in dense populations of sudangrass hybrids. This would at least partially explain the general lack of response of sorghum to seeding rates. By the time the plants reach the boot stage, the canopy is such as to absorb essentially all of the light were at relatively low seeding rates. Apparently double rows on wide bids do make more efficient use of the light than single rows or closely spaced rows. The fact that

no loss was encountered from removing the lower leaves with the heavier seeding rates indicates that the optimum seeding rate likely has been exceeded.

Worker: E. C. Holt  
Project: 388  
Date: February, 1967.

Table 1. The effect of seeding practices and self-shading on forage yield of FS-22 sorghum, A&M Plantation, 1966.

Leaf removal stage <sup>1</sup>	Pounds of dry forage per acre							
	Light seeding rate <sup>3</sup>				Heavy seeding rate <sup>2</sup>			
	Row spacing (inches)				Row spacing (inches)			
	40	40 Double	10	Avg.	40	40 Double	10	Avg.
48" high	4610	7150	5920	5890	5820	8330	7410	7190
Boot stage	5890	8300	6150	6780	6240	8680	5260	6730
None	6380	9240	6690	7440	6240	8430	6420	7030
Average	5630	8230	6250	6700	6100	8480	6360	6980

	Weight of leaves removed						
48" high	190	520	400		310	565	440
Boot stage	400	595	450		410	580	370

- 1 6 lower leaves were removed from each plant at the stage of growth indicated.
- 2 Seeding rates were: 40" row - 4 and 8 pounds per acre  
40" Double - 8 and 16 pounds per acre  
10" row - 16 and 32 pounds per acre
- 3 Double row yields were significantly higher than either single row or 10" row yields.

**NAME OF TEST:** Response of cool-season plants to light intensity.

**OBJECTIVE:** To determine if several cool-season forage plants (annuals) differ in their response to light intensity.

**PROCEDURE:**

Five cool-season forage plants (Gulf ryegrass, Elbon rye, Zora barley, Ora oats and Atlas 66 Wheat) were planted in 5-inch plastic low-profile pots in Norwood fine sandy loam soil. The pots were placed in two growth chambers operating at alternating day-night temperatures of 60 and 72° F. Maximum light intensity was maintained in one chamber and light in the other chamber was reduced approximately 40%. Wave lengths of 550 and 600 mμ produced light energy levels of 30 and 26 μw/cm<sup>2</sup>/sec, respectively, in the full-light chamber and 19 and 16 in the reduced light. The day and night periods were 12 hours each. Two 5x5 Latin Square blocks were established in each chamber. Following emergence the plants were thinned to 25 plants per pot, the plants trimmed to a uniform 2-inch height and uniformly watered with a liquid complete fertilizer.

When the plants reached an approximate height of 6 inches they were cut to a 2-inch stubble height and the clippings dried and weighed. The stubble from one Latin Square in each chamber was removed at the soil surface, dried and weighed and the pots discontinued. Two blocks from the remaining Latin Squares were switched to balance various light effects. The pots were again watered with a complete nutrient solution and the plants allowed to grow to a height of 6 inches followed by a second harvest.

**Results:** See tables and figures

**DISCUSSION:** Elbon rye and Gulf ryegrass showed the least effect of light level on yield. These also were the lowest yielding varieties. Stubble weight was reduced by reduced light in all cases indicating a lack of carbohydrate storage in the presence of limited light. In the regrowth Atlas Wheat showed the least effect of reduced light followed by Gulf ryegrass.

Previous light level definitely influenced regrowth following cutting. Maximum yields were obtained from plants maintained throughout at high light. Reduced light had approximately the same effect on regrowth whether the reduced light was with the initial growth or the regrowth. Apparently the effect of reduced carbohydrate content of the stubble with reduced light was about as great as reduced light on regrowth. Regrowth from plants maintained at reduced light throughout was only approximately 65% as great as from plants maintained throughout at high light.

These data do not suggest any major differences among the varieties in response to limited light. The barley and oat varieties may have been slightly more sensitive

than wheat, rye and ryegrass. Ryegrass showed slightly less overall effect. Since the same number of plants were utilized in all cases, the reduced yield of ryegrass would be expected because of the smaller plant size.

WORKER: E. C. Holt  
PROJECT: 1532  
DATE: January, 1967

Table 1. The influence of light level on growth and regrowth of winter annual crops.

Crop	First cutting		Second cutting	
	Low light	High light	Low light	High light
	Weight of tops (gms per pot)			
Elbon rye	.1944	.1993	.0963	.1164
Gulf ryegrass	.1256	.1318	.1285	.1400
Zora barley	.2521	.2858	.1147	.1561
Ora oats	.2848	.2963	.2407	.2703
Atlas wheat	.2655	.2735	.1457	.1473
	Weight of stubble (gms per pot)			
Elbon rye	.0863	.1249		
Gulf ryegrass	.0555	.0896		
Zora barley	.1026	.1539		
Ora oats	.1376	.1878		
Atlas wheat	.0737	.1055		

Table 2. The average effects of light level on growth of winter annual crops.

First Cutting		Second cutting	
Light <sup>1/</sup>	Yield <sup>2/</sup>	Light	Yield
High	.2420	High	.1840
		Low	.1586
Low	.2255	High	.1541
		Low	.1252

<sup>1/</sup> Light was reduced approximately 40% in the low light chamber.

<sup>2/</sup> Grains of dry matter per pot

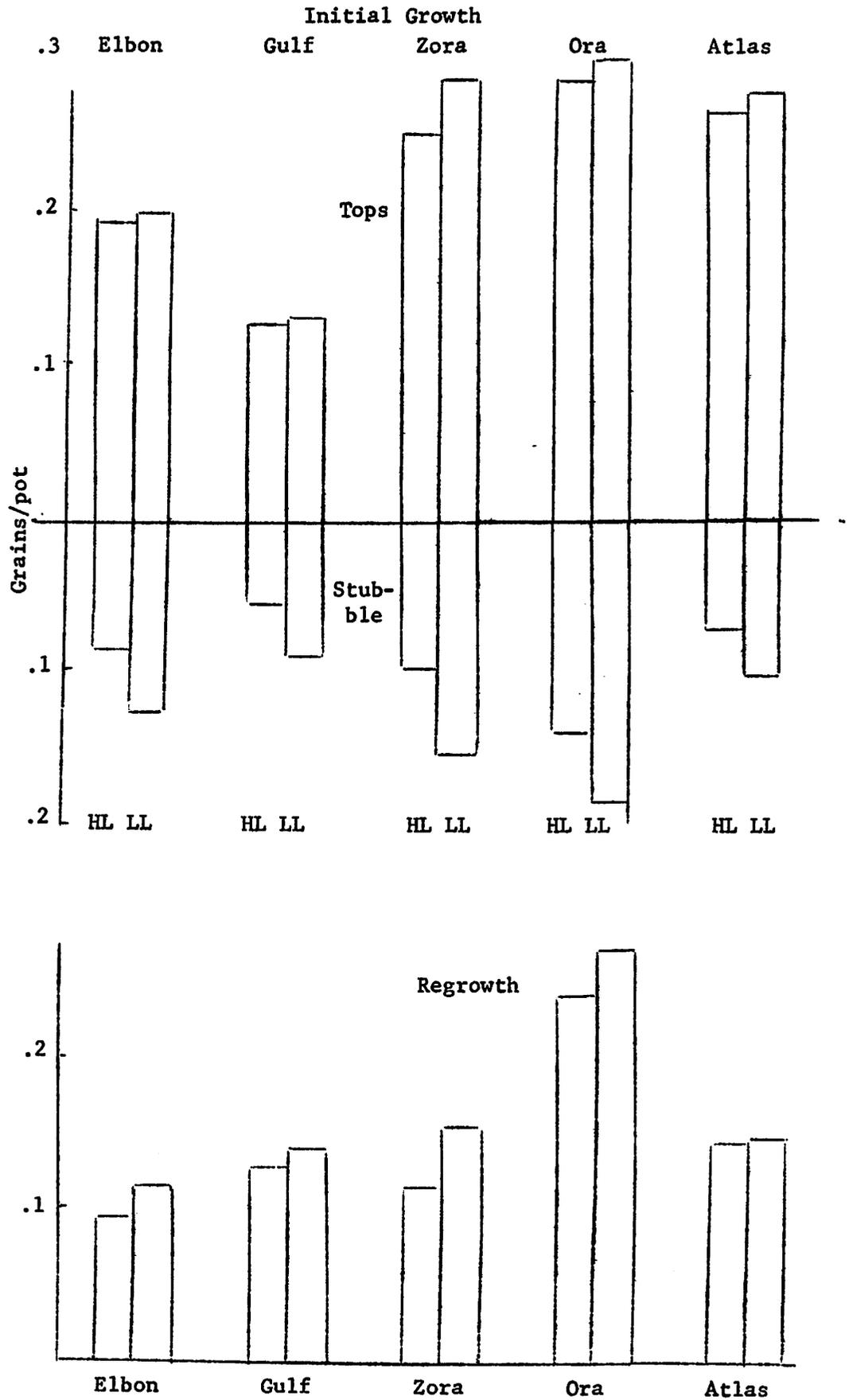


Figure 1. The influence of light level on growth of winter annual crops.