EFFECT OF PLANTING DATE ON LEAF NUMBER AND TOTAL LEAF AREA OF HYBRID GRAIN SORGHUM [SORGHUM BICOLOR (L.) MOENCH]

by

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INTRODUCTION

Most agronomic practices applied to increase yield of hybrid grain sorghum (Sorghum bicolor (L.) Moench) change directly or indirectly the shape or size of the crop's canopy. Leaves are the main photosynthate source and final grain yields are significantly affected by the total leaf area of the crop. By manipulating leaf area or leaf number of the sorghum plant, numerous characteristics of the crop can be changed. Maturity date of most hybrids is determined by the number of leaves the plant produces. The amount of evapotranspiration is directly related to leaf area; the quantity of solar radiation intercepted is affected by the density of the canopy; and ultimately the leaf area present affects the yield.

Most efforts to increase yields in the field require some type of input--addition of fertilizer, herbicide, insecticide, irrigation practices, a change in seeding rates or extensive development of new and improved varieties--to obtain a favorable response. Other manipulations of growth stages or crop factors do not always require inputs past the development of a variety that will respond favorably to the condition given that variety.

The following study was conducted at five Kansas locations during 1978 and is continuation of a rate and date of planting study at Kansas State University. Four hybrid grain sorghums, representing a maturity range ('NB-505', 'RS-626', 'RS-671', 'RS-702'), were planted at six dates at all locations and the effect of varying seeding date on leaf number and total leaf area of these hybrids was observed.

Since changing planting date has very little if any cost associated with it, by taking the planter to the field at the right time the farmer could better control a number of aspects of his sorghum crop, including yield. All agronomic advancement or improvements obtained by research must be weighed economically against the input. Is the gain greater than the cost to get the gain?

As early as 1916 Miller conducted a comparative leaf area study between sorghum and corn (Zea mays) and reported that full leaf development was obtained by the 10-week stage (half-bloom) in sorghum. Sieglinger (1936) noted that leaf number varied with date of planting, locality, season, and variety, demonstrating leaf number is influenced by environment. He also determined that leaves were produced until a floral bud was initiated. Variations of up to 3 leaves between planting dates were observed. That work was done with open pollinated varieties; since development of hybrids, leaf number has been assumed to be determinate in grain sorghum (Maas et al., 1977). Leaf number differs with sorghum genotype and is modified by temperature and photoperiod. Nutrient levels, however, did not seem to change leaf number (Hesketh et al., 1969). Caddel and Weibel (1971) found, while doing environmental studies involving three sorghum varieties, that changing planting date altered the photoperiod and temperature response in sorghum. They explored the effect of different photoperiods and temperatures on floral initiation. They also reported that day temperatures did not affect time to floral initiation significantly but daylength, night temperature, and variety each had a significant effect. Ten-hour days hastened floral initiation of all varieties under all combinations of temperatures and in all instances floral initiation was later under 14 hour photoperiod. Hesketh et al., (1969) supported this theory. Quinby et al., (1973) determined that lower temperatures hastened floral initiation in some varieties but delayed it in others. Hesketh et al., (1969) found that leaf numbers generally increased as temperature increased and the days became longer in an extensive study carried out in greenhouses in CERES in Canberra, Australia. Within temperature regimes, leaf number was correlated with dry weight, leaf area, plant height and maturity time. In the United States late planting is known to decrease the number of days to floral initiation, the growth stage that terminates leaf number development (Vanderlip, 1972). Early plantings increased the number of days from emergence to heading, which also increased yields (Blum, 1972). At this time, however, the reason for the yield superiority of the early plantings was not established, where tillering did not occur. Stickler and Pauli (1959) found that varying the planting date significantly affected yield, but leaf area did not change when no tillers were formed. Pauli, Stickler, and Lawless (1964) reported that date of planting greatly influenced time of half-bloom and physiological maturity. The later planted plots required less time from emergence to physiological maturity, however, the time from half-bloom to physiological maturity tended to increase. That allowed less time fo half-bloom and probably less time between emergence and floral initiation. Quinby and Liang (1969) found that as time to floral initiation was reduced in hybrids the leaf number was not affected. Quinby (1970) determined that hybrids did not have higher leaf areas, however, their growth rate was greater than that of the parents. Conversely, Liang et al. (1973) reported that hybrids had significantly greater total leaf-blade area, average leaf-blade area, average leaf length and width, and grain yields as compared to parents. However, hybrid vigor does not seem to increase leaf number (Quinby, 1974).

MATERIALS AND METHODS

Four hybrid grain sorghums, RS-702, RS-671, RS-626, and NB-505, selected to represent a maturity range from late to early, were planted at five locations in Kansas: Manhattan, Ashland Research Farm (Manhattan irrigated), St. John (irrigated and dryland), and Hutchinson, during 1978. Planting dates were approximately two weeks apart for twleve weeks beginning April 20 (Table 1). Row width was 0.76 meter and plot length was 9.14 meters. Plant population was 120,500 plants/hectare for both Manhattan locations and the irrigated site at St. John, while 98,800 plants/hectare were used at Hutchinson and the dryland study at St. John.

A modified split-plot design was used at all locations with six planting dates randomized in strips across the study and the four hybrids as subplots. At emergence two plants were marked in all plots at all locations to take leaf area data. Leaf number was obtained from marked plants at the St. John and Hutchinson studies. Leaf number was taken on an additional 18 plants marked at Ashland and Manhattan to determine growing point differentiation for other research being carried out on the same plots. Every 5th, 10th, 15th, etc., leaf from the bottom was punched so that a continual leaf count for each marked plant was maintained.

Total leaf area was determined for an individual plant by multiplying maximum width times maximum length times 0.747 for each leaf (Stickler et al., 1961). Krishmanurthy et al. (1974) supported the derivation of this constant with similar research.

Field superintendents maintained soil fertility, weed control, and irrigation schedules to maximize sorghum yields. Furadan Granules[1/] (11.21 kg/ha) was applied at planting to help control chinch bugs (Blissus lecucopterus) at all locations.

1/ disclaimer statement

Analyses of variance were performed on the data by the use of SAS (Barr et al., 1976). Means of leaf number and area among hybrids were compared using Fisher's LSD. Interactions were also explored between dates and hybrids. Plot yields were recorded and are discussed but not analyzed in this study because of losses and inaccuracies.

Mean weekly temperatures are also given for these two areas (Figure 13). Daylengths for the growing season in the St. John-Hutchinson area and the Manhattan-Ashland area were plotted for comparison with the date X hybrid interactions (Figure 14).

Table 1. Planting Dates and Locations for Hybrid Sorghum Studies

Location	Dates					
Hutchinson	Apr. 20	May 10	May 17	June 8	June 15	June 29
St. John (both studies)	Apr. 21	May 10	May 17	May 31	June 14	June 28
Manhattan	Apr. 26	May 11	May 29	June 9	June 23	July 6
Ashland	Apr. 26	May 15	May 25	June 9	June 26	July 7

RESULTS

Manhattan

Extremely cool, wet weather in late April and early May delayed emergence and reduced stands in the first two planting date plots. The remaining four dates' plants emerged without any significant delay or loss of stand. Rainfall was plentiful until mid-August when moisture stress reduced total leaf area of plants of the last two planting dates, especially the late maturing hybrids where total leaf area had not been fully developed. Some data were not collected on the RS-702 and RS-671 in the 6th date of planting when the last leaves failed to fully emerge.

A significant date X hybrid interaction (5% level) for both leaf area and leaf number was found for the Manhattan data (Figs. 1 and 2). Harvest proceeded as plots matured with considerable bird damage being done to scattered areas of the study. Freezing temperatures on Oct. 7, 14, and 15 reduced yields in the late planted, full season hybrids.

Ashland

Possibly because of soil type the early cool, wet weather had less of an effect on the irrigated Ashland study. Plant emergence and stand establishment from the early dates of planting were good. Excessive rainfall created standing water on part of the study early in the summer. This enhanced a downy mildew (Sclerospora manshurica) infestation which destroyed three replications of the fourth date of planting. No measurements were taken on this material. The remaining five planting date sites suffered no major problems during the growing season. Leaf area measurements were not taken on the late maturing hybrids (RS-702 and RS-671) in the last date of planting because the uppermost leaves did not emerge in some of the marked plants.

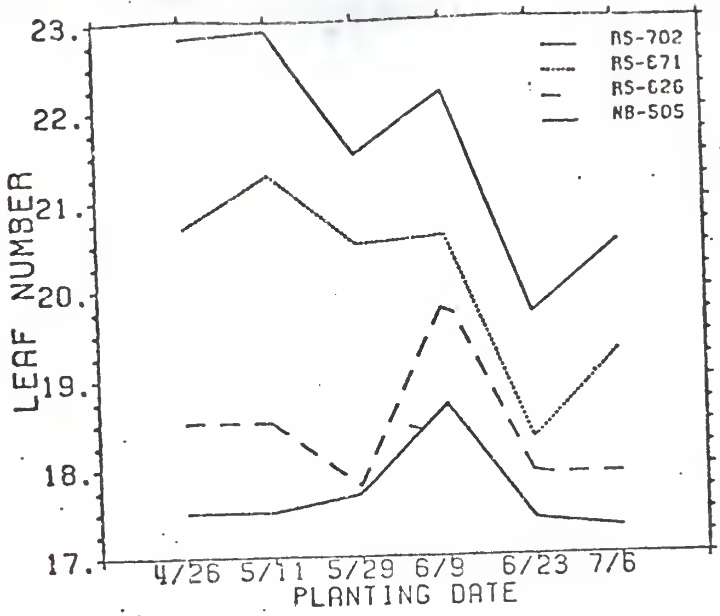

Figure 1. Mean leaf numbers versus planting date at the Manhattan Agronomy Farm.

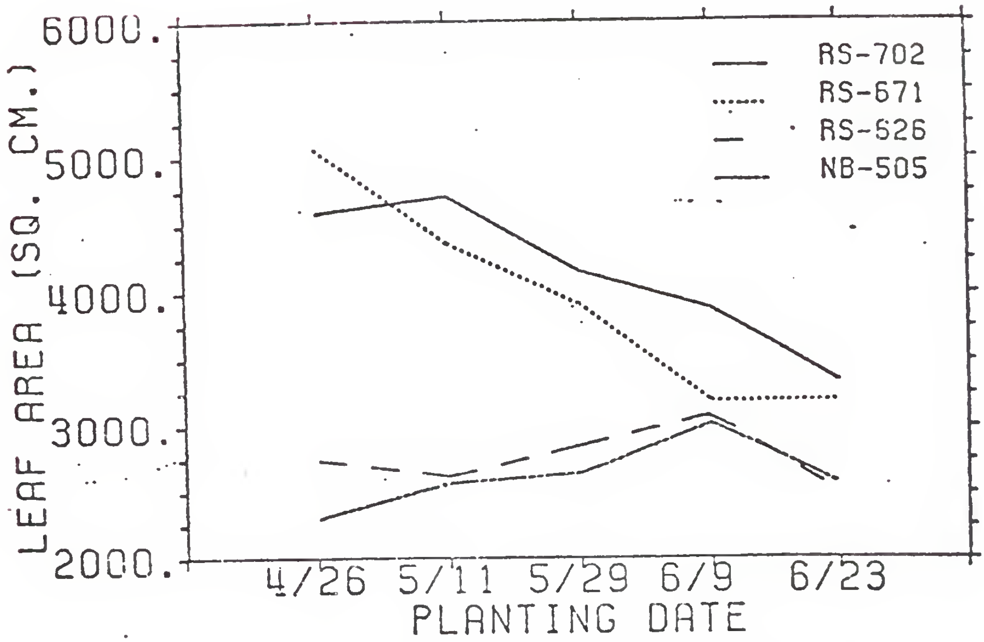

Figure 2. Mean leaf areas versus planting date at the Manhattan Agronomy Farm.

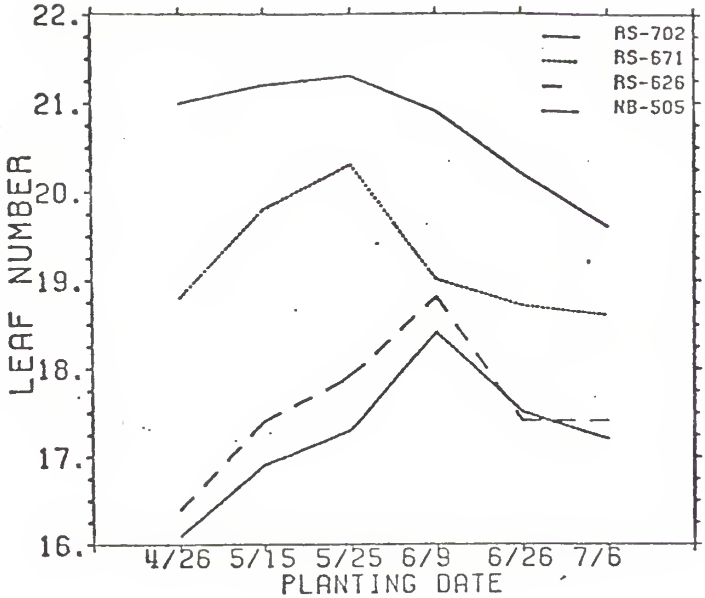

Figure 3. Mean leaf numbers versus planting date for the Ashland Research Farm (Manhattan irrigated).

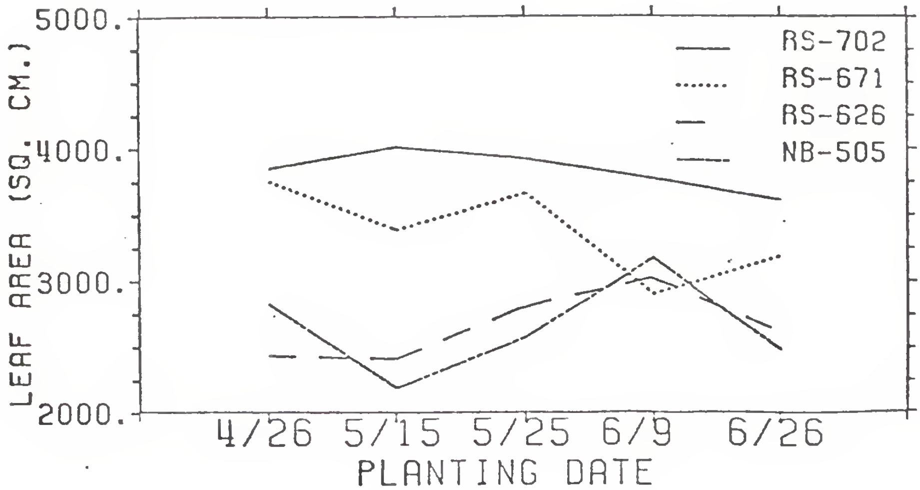

Figure 4. Mean leaf areas versus planting date for the Ashland Research Farm (Manhattan irrigated).

No significant interaction between date and hybrid was observed for leaf number or leaf area, however trends do exist (Figs.3 and 4).

Harvest proceeded as the plots matured. Birds destroyed the NB-505 and RS-626 plots in the first two planting dates at the soft dough stage of seed development. As more sorghum became mature in the area less damage was noticed.

St. John (dryland)

Rainfall was scarce at the Sandyland Experiment Station during the growing season and, combined with extremely cool temperatures in late April and early May, caused poor stand establishment for the first two dates of planting. Low plant density accounted for the increase in leaf area of the plants of the first date of planting. Plants from the fourth date of planting died immediately following emergence because of herbicide damage. Plants from the fifth date of planting reached the 10th leaf stage of growth and then became dormant due to extreme moisture stress in late August. All hybrids from that date failed to develope past that stage. Data were collected on the 1st, 2nd, 3rd, and 6th dates of planting, however, because of problems described little importance should be placed on this location's results.

A date X hybrid interaction was observed (5% level, Figure 6) for leaf area. This trend also showed up for leaf number (Figure 5).

Very little bird damage occurred on the four dates' plots and all four were harvested.

St. John (irrigated)

Pre-plant irrigation provided adequate moisture for sufficient stand establishment at all dates of planting except the 6th, which failed to emerge when the seedbed dried out before germination.

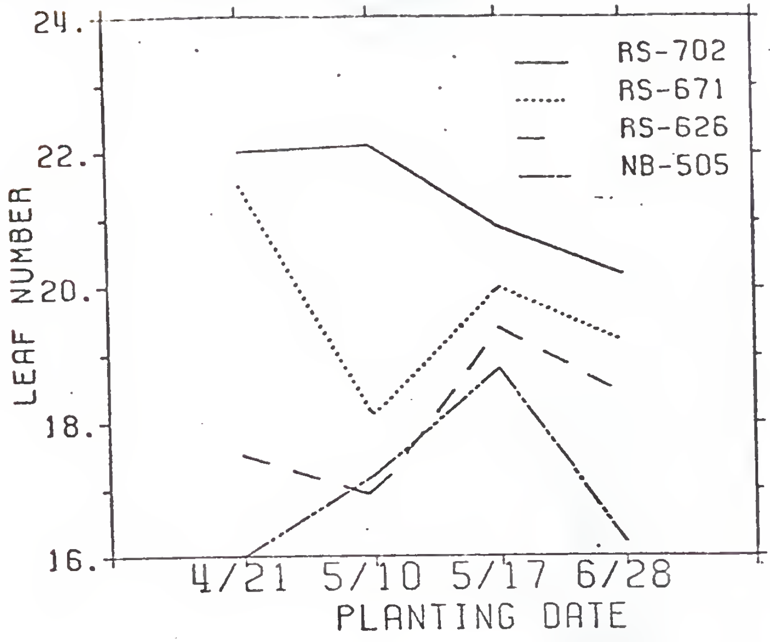

Figure 5. Mean leaf numbers versus planting dates for St. John dryland study (Sandyland Expt. Station).

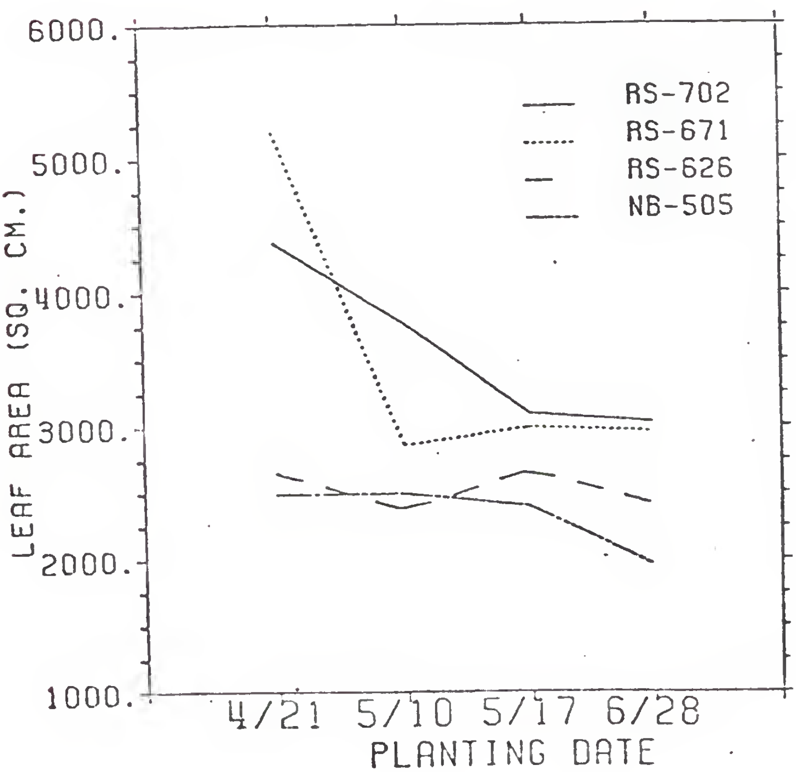

Figure 6. Mean leaf area versus planting date for St. John dryland study (Sandyland Expt. Station).

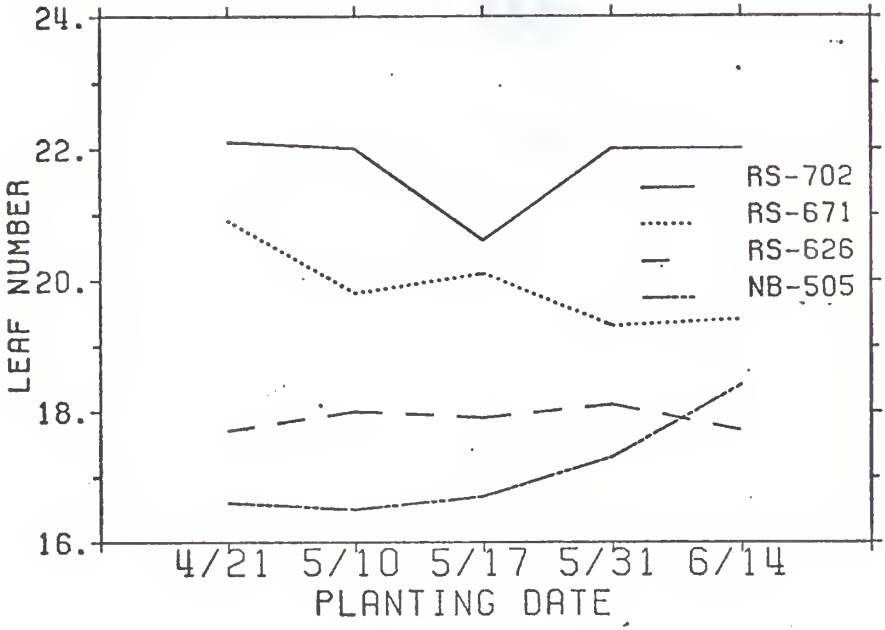

Figure 7. Mean leaf numbers versus planting date for St. John irrigated study (Sandyland Expt. Station).

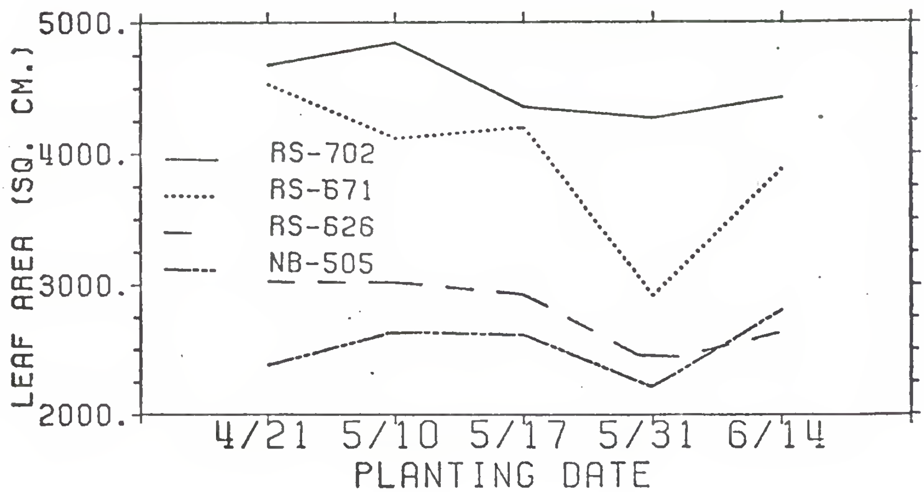

Figure 8. Mean leaf areas versus planting date for St. John irrigated study (Sandyland Expt. Station).

Crop development was inhibited in the 4th date of planting by severe competition from crabgrass (Digiteria sanguinalis), accounting for a significant reduction in leaf area.

At this study there was no significant date X hybrid interaction for leaf number or leaf area (Figs. 7 and 8).

Harvest proceeded as the plots matured, however, birds destroyed the RS-626 and NB-505 from the first two dates of planting.

Hutchinson

Despite cool April and May temperatures, emergence and stand establishment were not inhibited. Data were collected from all six dates of planting. Lack of rainfall during August reduced leaf area at later dates of planting.

No date X hybrid interaction was observed for either leaf area or leaf number (Figs. 9 and 10).

Harvest was completed on the first five planting dates, while freezing temperatures late in the fall prevented maturation and yields were reduced in the full season hybrids in the 6th date.

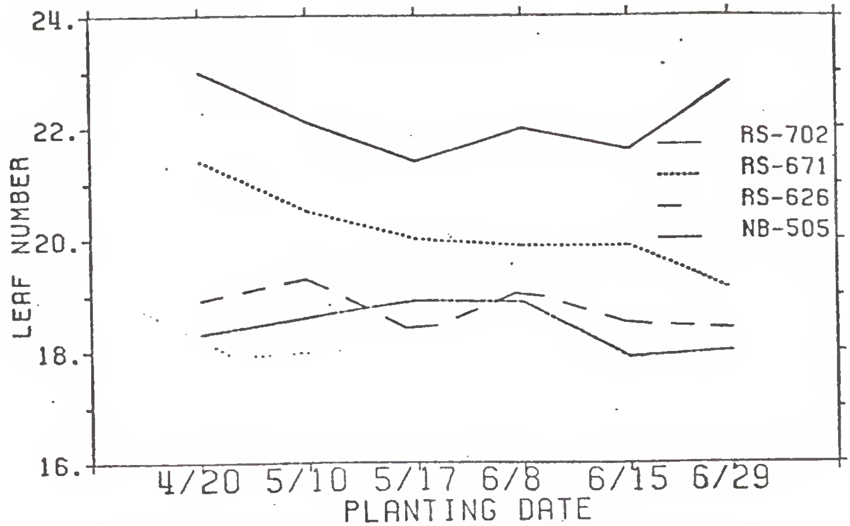

Figure 9. Mean leaf numbers versus planting date for Hutchinson (Southcentral Kansas Expt. Station).

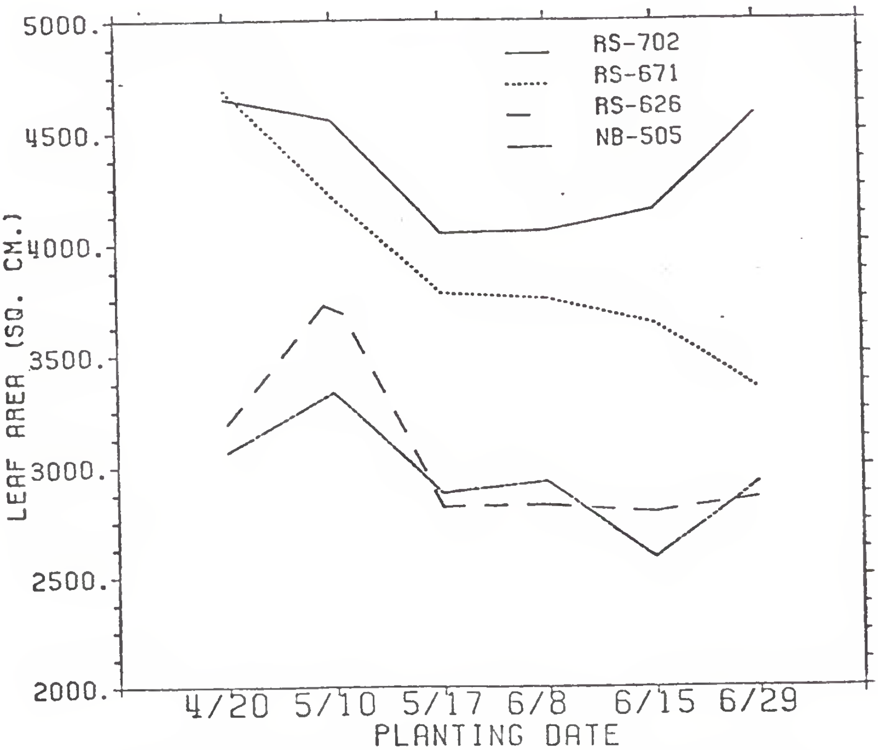

Figure 10. Mean leaf areas versus planting date for Hutchinson (Southcentral Kansas Expt. Station).

Leaf area was significantly correlated with leaf number (Table 2). Significant relationships between leaf area and date of planting also exist, although the differences are not consistant among hybrids (Appendix Figs. 5, 6, 7, 8). For each hybrid, regression analysis was performed and lines plotted for leaf area and number over relative planting date with means for all locations combined (Figs. 11 and 12).

Significant (5% level) linear relationship between leaf area and date and between leaf number and date occurred for RS-702 (Appendix Table 6). As the planting date was delayed leaf number and leaf area per plant decreased. The same relationship held true for RS-671, however, in RS-671 the significance level was 1% for both area and number (Appendix Table 6). No significant quadratic relationship exist for either hybrid for leaf area or number, although a quadratic trend shows up for RS-671. The r values for RS-626 for leaf area X date and leaf number X date were small and consequently when linear and quadratic regressions were calculated for these two measurements neither was significant (Appendix Table 6). Interestingly, a significant (5%) leaf number X date quadratic function occurs for NB-505, however, probably because of considerable variation in leaf number and area this significance does not apply to leaf area (Appendix Table 6).

Leaf number and area of all four hybrids were compared to a date 10 days after emergence instead of relative planting date. This procedure was an attempt to determine if a period during leaf development would be more representative than planting date since emergence and growing point differentiation are not always directly relative to planting date. Growing point differentiation information was not taken so the emergence

+ 10 days date was substituted to represent this period. An analysis of these data showed no significant changes in r values of leaf number X date or leaf area X date correlations and no significant changes in linear or quadratic relationships occurred.

In an effort to relate leaf area and number to daylength and mean weekly temperatures, correlation coefficients were calculated for leaf area versus leaf development date (emergence date + 10 days), leaf area versus mean weekly temperature for development date, and leaf area versus daylength for development date (Table 2). The same comparisons were made for leaf number.

In regression analysis, a temperature X daylength interaction was significant for leaf area of RS-702 and RS-671 (Appendix Table 7). This relationship does not occur for the early maturing hybrids (Appendix Table 7 a). Since May through July temperatures were basically a linear function for time (r=.918) a negative linear correlation resulted from RS-702 leaf area and number versus temperature. The quadratic daylength function correlated rather well with NB-505 leaf number as expected (Appendix Table 7 a). A quadratic temperature relationship occurs (5%) for leaf number of RS-671 and a temperature X daylength interaction (5% level) for the same hybrid's leaf area.

Table 2. Correlation Coefficients

(r values)

	NB-505	RS-626	RS-671	RS-702
LA X LEAF	.599**	.577**	.773**	.773**
LA X DATE-1	-.037	-.202	-.655**	-.453*
LA X DYL	-.014	-.238	-.459*	-.321
LA X TMP	-.035	-.215	-.443*	-.314
LEAF X DATE-1	.281	.215	-.547**	-.406*
LEAF X DYL	.253	.106	-.288	-.317
LEAF X TMP	.125	.077	-.477*	-.273
LEAF X DATE-2	.175	.133	-.550**	-.422*
LA X DATE-2	-.090	-.248	-.605**	-.452*

LA = leaf area

LEAF = leaf number

DYL = daylength

TMP = average°F of week of leaf development date

DATE-1 = relative planting date (1, 2, 3, 4, 5, 6)

DATE-2 = emergence date + 10 days (leaf development date)

*denoted 5% significance level.

**denotes 1% significance level.

DISCUSSION

Leaf number is indeterminate in grain sorghum and changes as hybrids are exposed to different daylengths and temperatures during leaf development. As expected the more time required for maturation the greater the leaf number and the larger the leaf area per plant (Table 3). The early maturing hybrids (NB-505 and RS-626) have the lowest leaf areas (Table 3) and consequently the yields tend to be lower (Appendix Table 8). Leaf number was directly affecting sorghum yields in all hybrids. Since sorghum is a short-day plant one would expect a longer daylength to delay floral initiation and increase leaf number if only daylength were responsible. This phenomena did not show up with the data taken from RS-702 and RS-671 in this study, however, it did partially hold true for RS-626 and NB-505 (Figure 11). Temperature interacting with daylength probably was affecting leaf numbers as Caddel and Weibel (1971) also reported.

As planting date was delayed RS-702 and RS-671 showed a reduction in leaf number, leaf area and consequently a reduction in yield (Appendix Table 8). RS-626 and NB-505 remain somewhat more constant in leaf area and number as the planting date changed. This coincides with work done by Stickler and Pauli (1959). The leaf numbers and areas of all four hybrids appear more similar in value as the planting date was delayed. An optimum planting date for maximum leaf number was observed for the early maturing hybrids.

Critical daylengths and precise day-night temperatures should have been used in determining the time of growing point differentiation which affects leaf number.

As planting date was delayed evidence indicates seeding rate should be increased when using the full season hybrids (RS-702 and RS-671) to compensate for the reduction in leaf area and to bring yields up. Seeding also should take place as early as possible to maximize yields when using these hybrids. As planting takes place later in the season the selection of an early maturing hybrid may not be an advantage as once thought especially in regard to leaf area. However, maturation of late maturing hybrids at late planting dates is usually inhibited by freezing fall temperatures. If all hybrids reach physiological maturity, yields of the late maturing hybrids seemed to be as high as the early hybrids (Appendix Table 8).

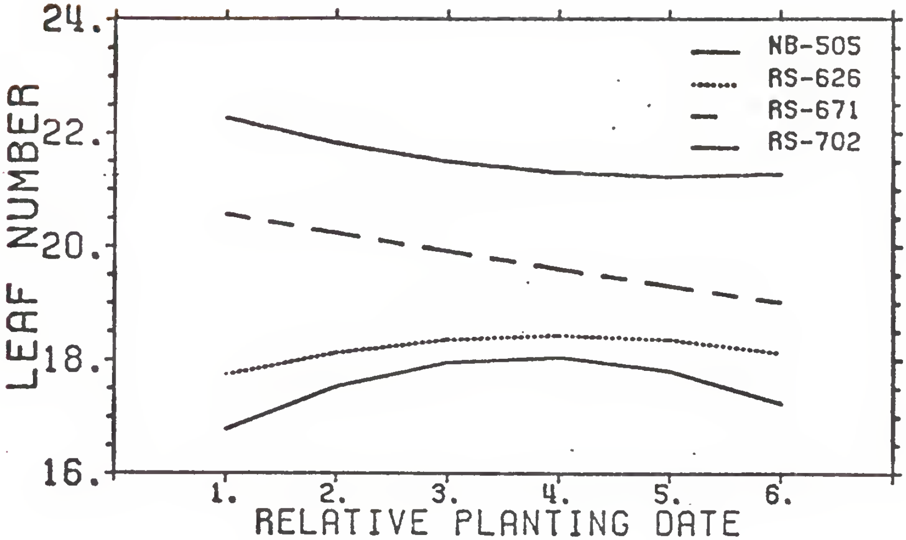

Figure 11. Relationship of hybrid leaf number and relative planting dates for all locations combined.

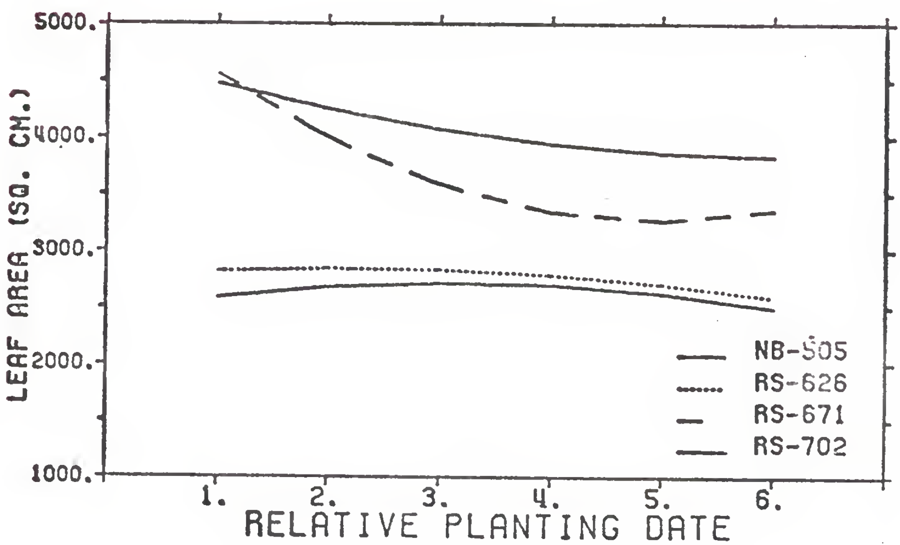

Figure 12. Relationship of hybrid leaf area and relative planting dates for all locations combined.

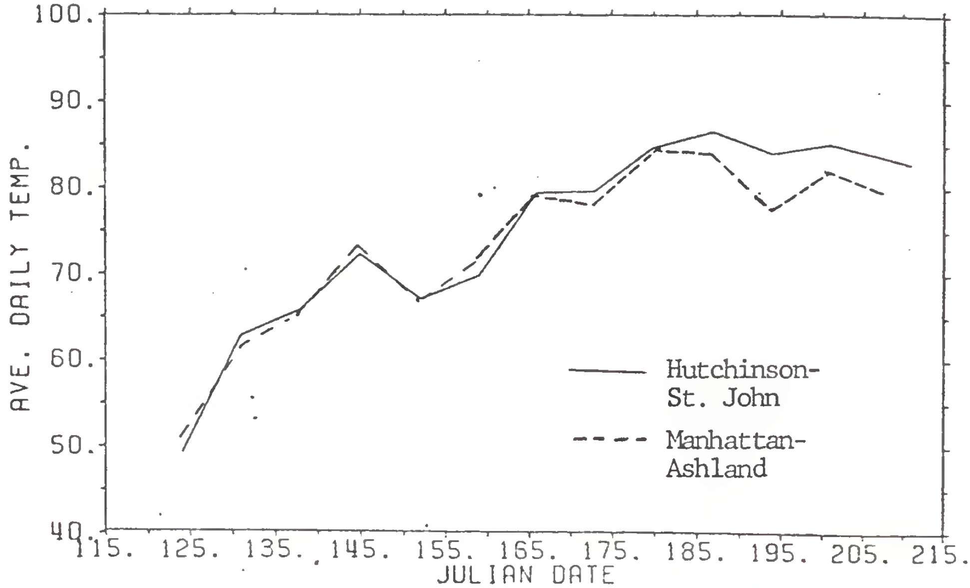

Figure 13. Mean weekly temperatures for the Hutchinson-St. John and Manhattan-Ashland areas during the growing season.

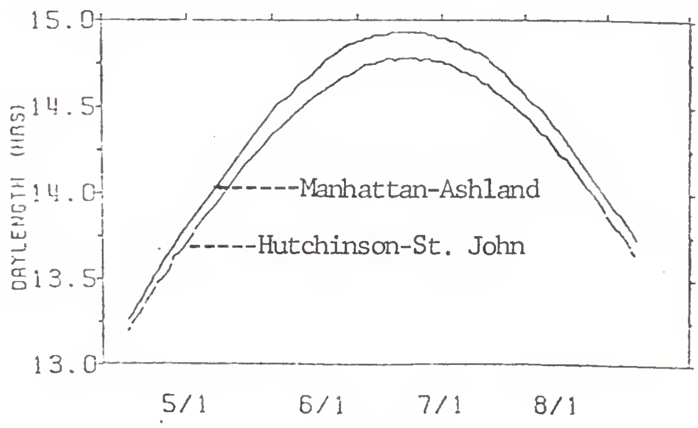

Figure 14. Daylengths for the Hutchinson-St. John and the Manhattan-Ashland areas during the growing season.

Table 3. Mean leaf areas and leaf numbers for hybrids at all locations.

Location	NB-505	RS-626	RS-671	RS-702	LSD (.05) (.01)
		Leaf area (cm^2/plt)			
Manhattan	2602	2761	3935	4157	386 444
Ashland	2554	2593	3452	3843	398 527
St. John (irr)	2534	2797	3957	4517	333 441
St. John (dry)	2359	2529	3577	3566	330 438
Hutchinson	2952	3013	3904	4342	246 323
		Leaf number (leaves/plt)			
Manhattan	17.7	18.4	20.1	21.6	0.75 0.86
Ashland	17.1	17.4	19.2	20.7	0.73 0.97
St. John (irr)	17.1	17.9	19.9	21.7	0.69 0.91
St. John (dry)	17.0	18.0	19.8	21.3	0.88 1.17
Hutchinson	18.4	18.7	20.1	22.1	0.56 0.74

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Finally I would like to thank my wife Janice for her patience and moral support.

APPENDIX

Table 1. Analyses of Variance for leaf area and leaf number, Manhattan.

Source	DF	Mean Squares Leaf area	Mean Squares Leaf number
REP	3	408567.8	0.10
DATE	4	2496238.1	19.55
ERROR (A)	12	644590.1	2.43
HYB	3	10082321**	90.75**
DATE X HYB	12	1524883*	6.80**
ERROR (B)	85	589265	2.61

*denotes significance at 5% level.
**denotes significance at 1% level.

Table 2. Analyses of Variance for leaf area and leaf number, Ashland.

Source	DF	Mean Squares Leaf area	Mean Squares Leaf number
REP	3	727428.1	1.365
DATE	4	463399.6	10.64
ERROR (A)	9	732712.55	2.489
HYB	3	6929700.6**	44.95**
DATE X HYB	12	384705.3	2.93
ERROR (B)	97	613141.33	2.07

**denotes significance at 1% level.

Table 3. Analyses of Variance for leaf area and leaf number, St. John dryland.

Source	DF	Mean Squares Leaf area	Leaf number
REP	3	1139867.9	0.820
DATE	3	6831715.4	10.020
ERROR (A)	9	1174491.2	4.143
HYB	3	12785484.3**	110.45**
DATE X HYB	9	2203291.1**	11.349**
ERROR (B)	93	401004.3	2.860

**denotes significance at 1% level.

Table 4. Analyses of Variance for leaf area and leaf number, St. John irrigated.

Source	DF	Mean Squares Leaf area	Leaf number
REP	3	1881511.9	11.506
DATE	4	2418565.8	1.272
ERROR (A)	12	1268092.7	3.171
HYB	3	33895561.3**	167.750**
DATE X HYB	12	473476.48	3.204
ERROR (B)	117	537532.95	2.281

**denotes significance at 1% level.

Table 5. Analyses of Variance for leaf area and leaf number, Hutchinson.

Source	DF	Mean Squares Leaf area	Leaf number
REP	3	440654.1	1.434
DATE	5	2256278.9	3.767
ERROR (A)	15	252754.4	.716
HYB	3	19657484.9**	122.94**
DATE X HYB	15	417979.8	2.095
ERROR (B)	136	342590.5	1.787

**denotes significance at 1% level.

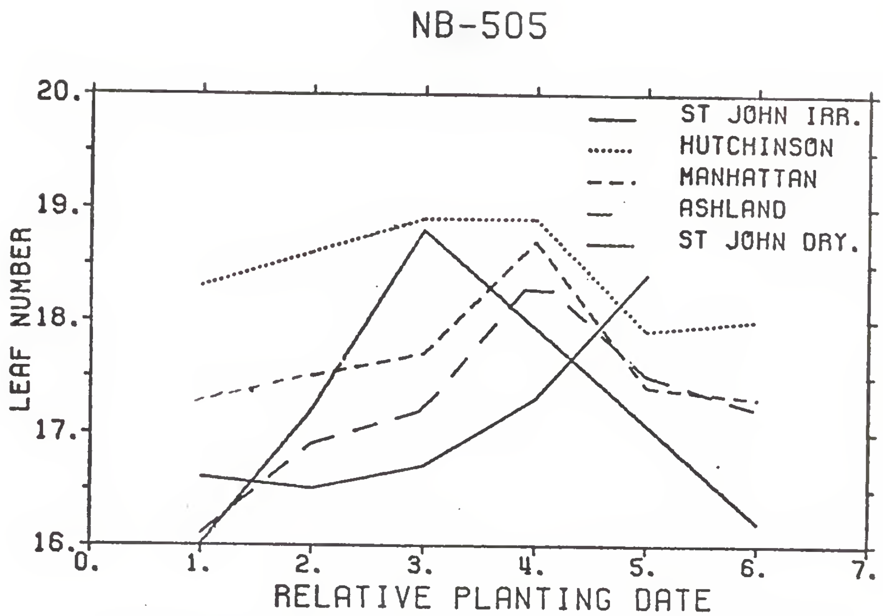

Figure 1. Mean leaf numbers versus relative planting date for all locations.

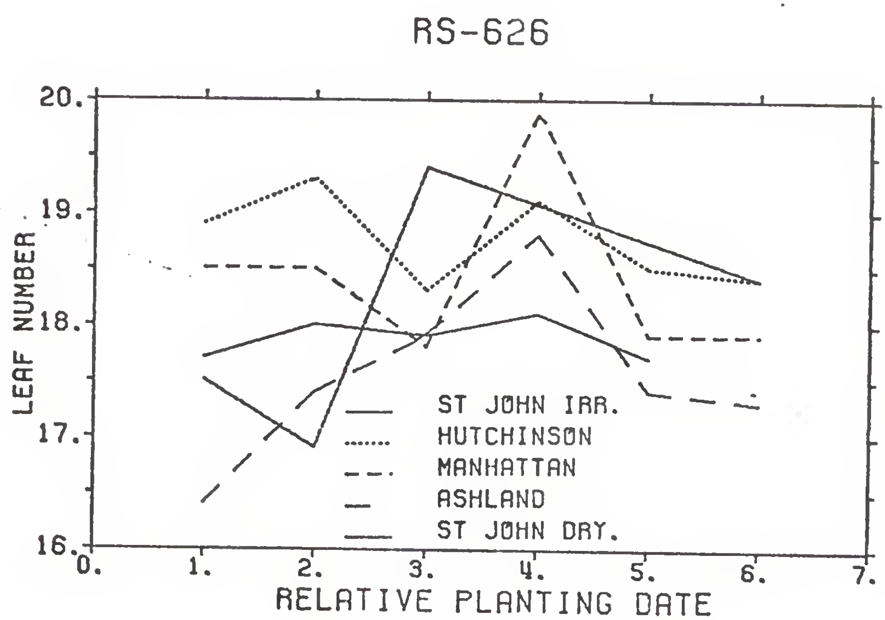

Figure 2. Mean leaf numbers versus relative planting date for all locations.

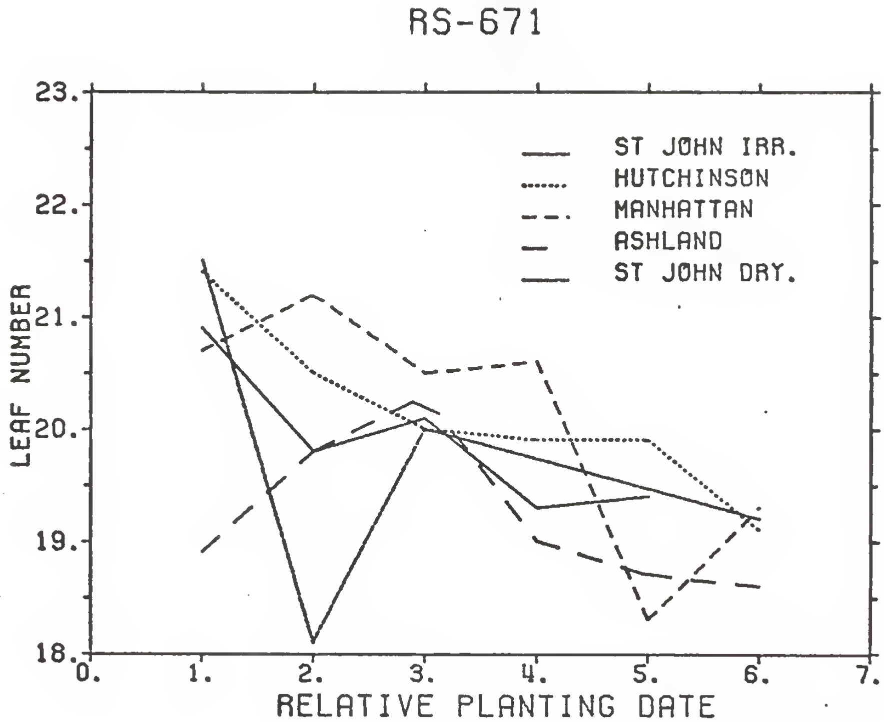

Figure 3. Mean leaf numbers versus relative planting date for all locations.

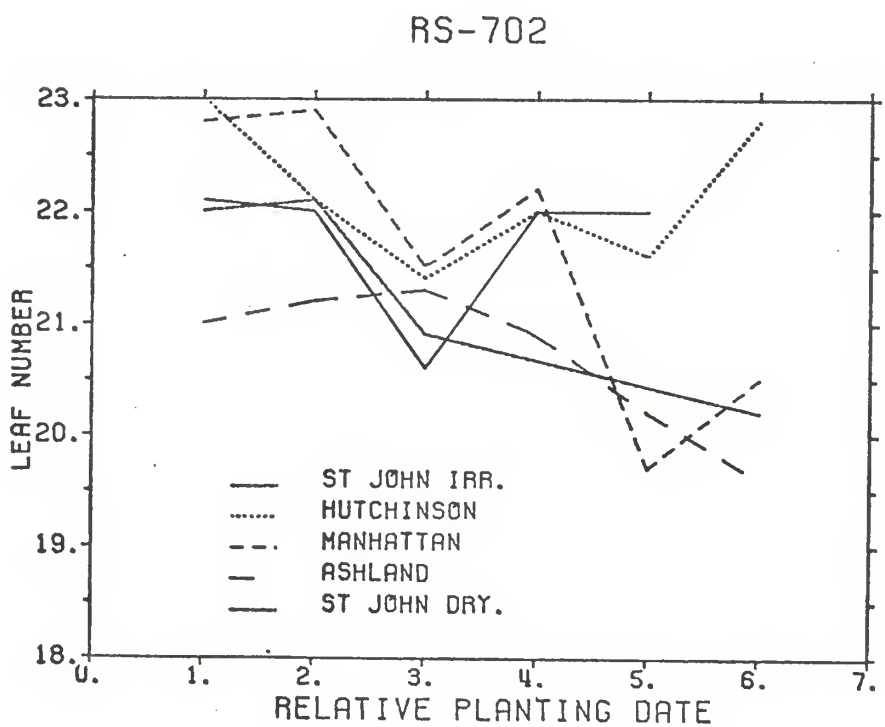

Figure 4. Mean leaf numbers versus relative planting date for all locations.

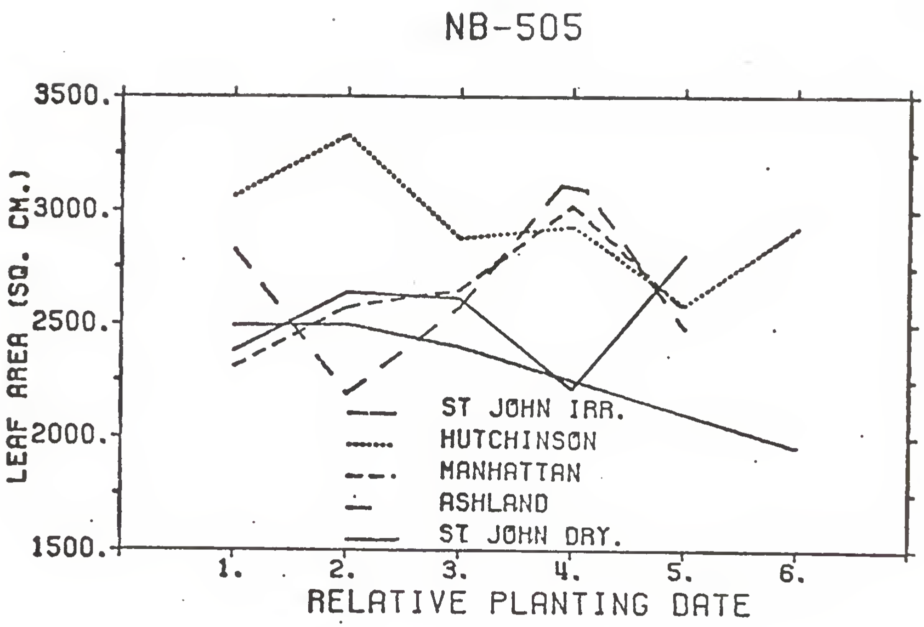

Figure 5. Mean leaf areas versus relative planting date for all locations.

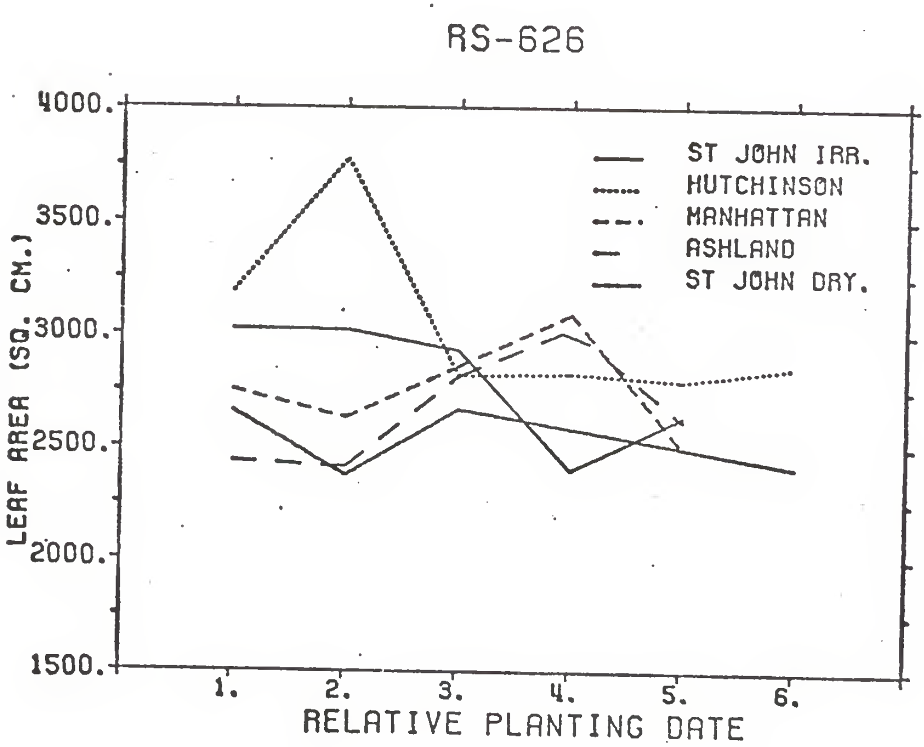

Figure 6. Mean leaf areas versus relative planting date for all locations.

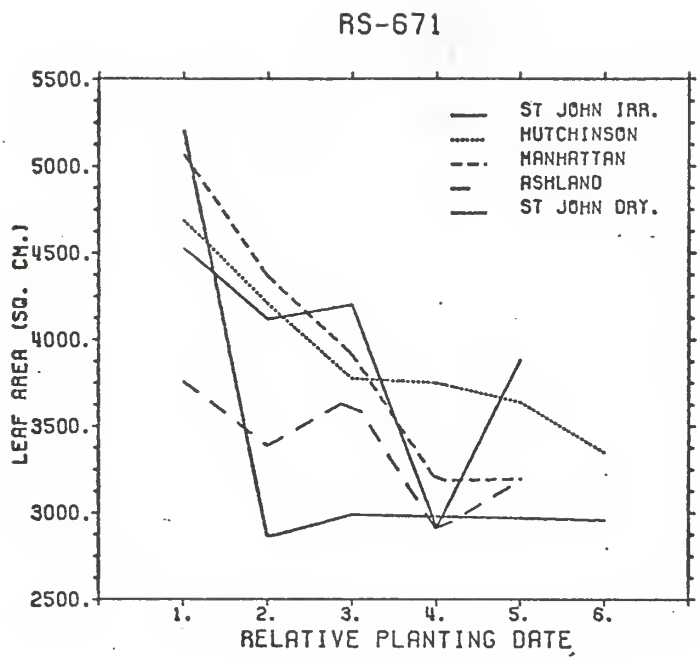

Figure 7. Mean leaf areas versus relative planting date for all locations.

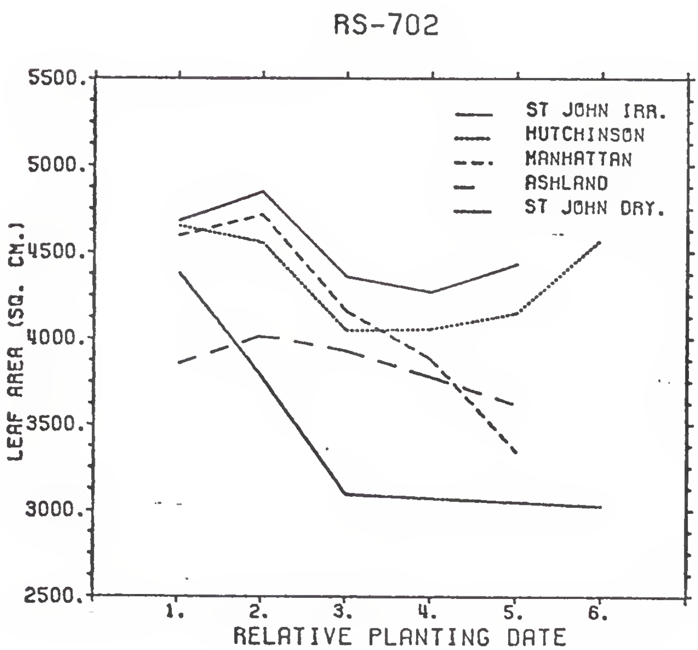

Figure 8. Mean leaf areas versus relative planting date for all locations.

Table 6. Regression Analyses of Hybrids

SOURCE	DF		HYBRIDS (mean squares)			
			RS-702	RS-671	RS-626	NB-505
		leaf number				
DATE	1		3.067*	6.103**	0.705	1.563
ERROR	23		0.675	0.620	0.632	0.793
$(DATE)^2$	1		0.505	0.004	0.803	3.648*
ERROR	22		0.683	0.649	0.624	0.663
		leaf area				
DATE	1		1206856*	4703681**	96247	3486
ERROR	23		202655	271576	98202	110929
$(DATE)^2$	1		81685	934629	40064	103411
ERROR	22		20817	241438	100845	111271

* denotes significance at 5% level

** denotes significance at 1% level

By the use of a stepwise regression analysis (1), leaf area and leaf number were analyzed for each hybrid for the following five independent variables: daylength (DYL), daylength^2 (DYLSQ), mean weekly temperature (TMP), mean weekly temperature^2 (TMPSQ), and daylength X mean weekly temperature (DYLTMP). The best combination of these variables is used in each analysis. An alpha level of 0.50 is used.

MODEL: leaf number, leaf area = DYL TMP DYLSQ TMPSQ DYLTMP

Table 7. Regression analyses of late maturing hybrids

		RS-702	
source	DF	MS	F
		(leaf number)	
DYL	1	1.86	2.56
ERROR	23	0.73	
		(leaf area)	
DYLTMP	1	645822.3	2.84
ERROR	23	227048.2	
		RS-671	
source	DF	MS	F
		(leaf number)	
TMPSQ	1	4.65	6.79 *
ERROR	23	0.68	
		(leaf area)	
DYLTMP	1	2418319.8	6.52 *
ERROR	23	370940.4	

* denotes significance at 5% level

Table 7a. Regression analyses of early maturing hybrids

RS-626

source	DF	MS	F
	(leaf number)		
no variables met the 0.50 significance level for entry into the model			
	(leaf area)		
DYL	1	362392.2	4.28
DYLSQ	1	358512.3	4.23
ERROR	22	84695.1	

NB-505

source	DF	MS	F
	(leaf number)		
DYLSQ	1	1.29	1.60
ERROR	23	0.80	
	(leaf area)		
no variables met the 0.50 significance level for entry into the model			

Table 8. 1978 Sorghum Yield Data (Means) Kg/Ha

location hybrid	relative planting date 1	2	3	4	5	6
Manhattan						
NB-505	5688	4475	5441	4679	3177	2654
RS-626	6889	7142	5901	5356	3211	4471
RS-671	7264	6029	6685	5211	2883	2958
RS-702	5820	5901	6933	5558	3204	877
Ashland						
NB-505	3553	5018	4307	5083	3461	3707
RS-626	6276	6597	6175	7583	4984	5157
RS-671	6736	6151	6405	6989	4340	4042
RS-702	6145	5755	7349	6088	4554	4301
St. John (dryland)						
NB-505	1415	1102	901	----	----	1844
RS-626	2781	1647	1589	----	----	2498
RS-671	2357	1282	1582	----	----	1815
RS-702	2678	1312	1774	----	----	----
St. John (irrigated)						
NB-505	----	----	3717	2818	2035	----
RS-626	----	5610	7222	4271	2581	----
RS-671	6249	6708	6746	4100	2602	----
RS-702	6657	6708	6744	3460	2533	----
Hutchinson						
NB-505	2047	1749	1992	2617	1845	2925
RS-626	3085	2781	2589	2267	1133	2768
RS-671	3147	2931	2143	2293	1782	----
RS-702	1784	1665	1228	2907	----	----

EFFECT OF PLANTING DATE ON LEAF NUMBER AND TOTAL LEAF AREA OF HYBRID GRAIN SORGHUM [SORGHUM BICOLOR (L.) MOENCH]

by

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AN ABSTRACT OF A MASTER'S THESIS

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Most agronomic practices applied to increase yields of hybrid grain sorghum [Sorghum bicolor (L.) Moench] change directly or indirectly the shape or size of the crop's canopy. By manipulating leaf number or leaf area of the sorghum plant, a number of crop factors and hopefully yield, could be controlled.

A date of planting study was conducted at five Kansas locations [Manhattan, Ashland (Manhattan irrigated), Hutchinson, and St. John (irrigated and dryland)] during 1978. Four hybrids representing a maturity range ('NB-505', 'RS-626', 'RS-671', 'RS-702') were planted at six dates at all locations and the effect of planting date on leaf number and total leaf area of these hybrids was observed. Planting dates were approximately two weeks apart for twelve weeks beginning April 20.

As planting date was varied the leaf number changed in all hybrids, however, all hybrids did not respond similarly. As planting date was delayed, the late maturing hybrids (RS-702 and RS-671) produced fewer leaves and less leaf area. An optimum planting date maximized leaf number and area of the early maturing hyrbids (NB-505 and RS-626).

Late maturing hybrids had less leaf area and lower yields if planting date was delayed. Seeding rate should be increased to compensate for a reduction in leaf area as full season hybrids are planted later. Delaying planting decreased differences in leaf areas and grain yields among the four hybrids, indicating differences in performance between early and late maturing hybrids, at later planting dates, may not be as significant as once thought.