Planting Date and Sorghum Flowering at Maricopa, 1997

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Abstract

A study was conducted at the Maricopa Agricultural Center to determine the influence of planting date on time to flowering of sorghum hybrids. Sorghum was planted on March 19, April 16, May 14, June 18, July 2, July 16, and July 30. A total of 17 sorghum hybrids varying in maturity groups from early to late were planted at each date. The number of days from planting to flowering was greatest at the March 19 planting date and decreased with each planting date thereafter. Growing degree days required to reach flowering likewise decrease as planting was delayed. In order to avoid the heat during pollination in the early part of the summer, early to medium maturity hybrids need to be planted in mid-March at Maricopa. July planting dates resulted in flowering occuring in late August and September.

Introduction

Sorghum acreage in Arizona has increased in recent years and current information on production practices is needed. The optimum planting date, in particular, has been questioned. The optimum planting date for sorghum grown in Arizona is detailed for various elevations in the state and for various sorghum maturity groups (Dennis, 1981). Sorghum can be grown in two seasons in Arizona: spring-summer or summer-fall. In the spring-summer season sorghum should be planted as soon as possible, usually in March, so that the crop pollinates before the hot, dry weather occurs in June. In the summer-fall season, sorghum is typically planted in July, and pollination occurs at the end of August or in September when the weather has cooled somewhat. The crop matures before cool temperature occurs in November. Since sorghum is often planted after small grains, much of the sorghum in the state is planted in the summer and grown in the summer-fall season. Sorghum is sometimes planted in June which is usually too early and the heads are subject to blasting, or in August which is too late and the crop does not have time to mature.

The original purpose of this study was to provide information on yield and maturity of sorghum as affected by planting date. However, severe bird damage forced us to abandon any hope of obtaining meaningful yield results, and the only reliable data we were able to obtain was date of flowering.

Procedure

A planting date experiment was conducted at the Maricopa Agricultural Center on a Casa Grande sandy loam soil. The previous crop was barley. The experimental design was a randomized complete block with 17 hybrids and 4 replications combined over 7 planting dates. Seeds were planted with a cone planter into flat dry soil in five rows spaced 24 inches apart in plots 10 ft x 25 ft. Seeds were planted at a rate of 1000 seeds per plot or 174,000 seeds per acre, which, at an establishment rate of 70% would result in a final stand of 122,000 plants per acre. The planting dates were March 19, April 16, May 14, June 18, July 2, July 16, and July 30. Germination irrigation was applied on the day of planting. Ammonim sulfate was applied preplant at a rate of 52 pounds of nitrogen per acre. UN32 was applied in the irrigation water at a rate of 35 pounds of nitrogen per acre for the first three post-emergence irrigations for a total nitrogen rate of 157 pounds of nitrogen per acre. Irrigation amount was about 6 inches per irrigation and the frequency was about every 10 days during the peak of growth. The irrigation schedule for each planting date was as follows: 1) March 19 - 3/19, 3/31, 5/2, 5/14, 5/30, 6/6, 6/17, 6/26, 7/7, and 7/16, 2) April 16 - 4/16, 5/15, 5/30,

6/6, 6/17, 6/26, 7/7, and 7/16, 3) May 14 - 5/14, 5/30, 6/6, 6/17, 6/27, 7/7, 7/16, and 8/5, 4) June 18 - 6/18, 7/9, 7/16, 7/25, 8/5, 8/14, 8/25, and 9/4, 5) July 2 - 7/2, 7/16, 7/25, 8/5, 8/14, 8/25, 9/4, 9/15, and 9/26, 6) July 16 - 7/16, 8/5, 8/14, 8/25, 9/4, 9/15, 9/26, and 10/9, and 7) July 30 - 7/30, 8/14, 8/25, 9/4, 9/15, 9/26, 10/9, and 10/31.

Flowering dates were noted for each plot. The flowering date corresponded to when about half of the heads are blooming or pollinating . Growing degree days were obtained from the Arizona Meteorological Network (AZMET), and were calculated using 50 F as a base temperature and 86 F as a ceiling temperature from a sine curve of maximum and minimum temperature.

Discussion

The growing season weather conditions are presented in Table 1. From July through October, which may be considered the normal sorghum growing season in Arizona, maximum temperature was below average, minimum temperature was above average, precipitation was below average, and growing degree days (GDD) were close to the average. During the spring-summer season, GDD accumulated faster than nomal and maxiumum temperature in June was below normal.

The influence of planting date on time to flowering averaged over the 17 hybrids is presented in Table 2. The number of days to reach flowering was greatest with spring planting dates and least with summer planting dates. Generally, the longer a crop is in the ground the greater the yield potential is due to the number of days available to capture sunlight and transform this energy into carbohydrates and yields. Of course, this yield potential may not be met if certain conditions are unfavorable, such as cold weather limiting stand establishment or high temperatures limiting pollination.

The number of growing degree days to reach flowering also varies with planting dates. Growing degree day or heat unit models of crop growth are notoriously specific to a certain season of growth or locality. Photoperiod and other factors affect crop development and growing degree days have some limitation in predicting crop development. Less growing degree days are required to reach maturity if planting occurs in the summer compared to the spring.

The hybrids are compared in Table 3 in terms of time to reach flowering averaged over planting dates. The time required for each hybrid to reach flowering at each planting date is presented in Table 4. In order to avoid flowering during the hot, dry weather that may start in mid-June or earlier, early to medium maturity hybrids should be planted in mid-March. If planting is delayed until mid-April, flowering will occur during the latter half of June for all hybrids. Mid-May planting dates resulted in flowering during mid-July and mid-June planting dates resulted in August flowering dates. For flowering to occur in September, planting dates of July are required.

Acknowledgments

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Reference

Dennis, R. E. 1981. Sorghum for grain in Arizona. Univ. Ariz. Coop. Ext, Tucson.

Table 1. Minimum and maximum temperature, precipitation, and growing degree days in 1997 compared to the long-term average.

Weather variable	Year(s)	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Max Temp. (°F)	1997	84	82	99	100	105	101	99	86	75
	1961-90‡	77	86	95	104	107	104	99	88	73
Min Temp. (°F)	1997	45	52	65	66	72	75	71	51	41
	1961-90‡	42	48	56	66	75	74	65	52	39
Ppt. (in)	1997	0.00	0.32	0.51	0.00	0.32	0.51	1.02	0.16	0.08
	1961-90‡	0.65	0.25	0.10	0.20	0.93	1.08	0.66	0.61	0.66
GDD	1997	481	512	873	861	983	979	925	568	320
	1987-97‡‡	363	542	755	876	994	989	850	609	290

‡ Averages based on data summarized by Western Regional Climate Center from 1961-1990.
‡‡ Growing degree day (GDD) averages from 1987-1997 using base temperatures of 50°F and ceiling temperature of 86°F using the sine curve calculation method from the Arizona Meteorological Network (AZMET).

Table 2. Planting date effect on growing degree days (GDD), date, and days to flowering averaged over 17 hybrids of various maturity groups.

Planting Date	GDD to Flowering‡	Flowering Date	Days to Flowering
19-Mar	1880	9-Jun	82
16-Apr	1976	22-Jun	77
14-May	1889	16-Jul	63
18-Jun	1958	18-Aug	61
2-Jul	1874	28-Aug	57
16-Jul	1816	9-Sep	56
30-Jul	1686	20-Sep	52

‡ Growing Degree Days (GDD) using base temperatures of 50°F and ceiling temperature of 86°F.

Table 3. Growing degree days (GDD), dates, and days to flowering for the 17 hybrids averaged over the 7 planting dates listed according to GDD to maturity.

Hybrid	Maturity Group	GDD to Flowering‡	Flowering Date	Days to Flowering
577 (Cargill)	Early	1635	28-Jul	57
X117 (Richardson)	Early	1651	28-Jul	57
KS310 (Novartis)	Med-Early	1593	27-Jul	55
T-E Eden (Mycogen)	Medium	1734	31-Jul	60
KS585 (Novartis)	Medium	1810	2-Aug	62
RS200E (Richardson)	Medium	1829	3-Aug	63
737 (Cargill)	Medium	1833	3-Aug	63
837 (Cargill)	Med-late	1853	4-Aug	64
Oro Xtra (Mycogen)	Med-late	1844	4-Aug	64
Y360 (Richardson)	Med-late	1893	5-Aug	65
K73-J6 (Novartis)	Med-late	1898	5-Aug	65
9300 (Richardson)	Med-late	1984	8-Aug	68
727 (Cargill)	Medium	1947	7-Aug	67
Oro G Xtra (Mycogen)	Med-late	1989	8-Aug	68
9344 (Richardson)	Med-late	2022	9-Aug	69
KS955 (Novartis)	Late	2131	13-Aug	73
877 (Cargill)	Med-late	2117	13-Aug	73

‡ Growing Degree Days (GDD) using base temperature of 50°F and ceiling temperature of 86°F.

Table 4. Growing degree days (GDD), dates, and days to flowering for the 17 hybrids.

Planting Date	Hybrid	GDD to Flowering‡	Flowering Date	Days to Flowering
19-Mar	577 (Cargill)	1496	27-May	69
19-Mar	KS310 (Novartis)	1522	28-May	70
19-Mar	X117 (Richardson)	1522	28-May	70
19-Mar	T-E Eden (Mycogen)	1791	6-Jun	79
19-Mar	RS200E (Richardson)	1815	7-Jun	80
19-Mar	KS585 (Novartis)	1815	7-Jun	80
19-Mar	737 (Cargill)	1815	7-Jun	80
19-Mar	K73-J6 (Novartis)	1925	11-Jun	84
19-Mar	Oro Xtra (Mycogen)	1866	9-Jun	82
19-Mar	Y360 (Richardson)	1925	11-Jun	84
19-Mar	9300 (Richardson)	2032	15-Jun	88
19-Mar	837 (Cargill)	1955	12-Jun	85
19-Mar	9344 (Richardson)	2008	14-Jun	87
19-Mar	727 (Cargill)	2058	16-Jun	89
19-Mar	Oro G Xtra (Mycogen)	2087	17-Jun	90
19-Mar	KS955 (Novartis)	2149	19-Jun	92
19-Mar	877 (Cargill)	2180	20-Jun	93

Table 4. Con'd.

Planting Date	Hybrid	GDD to Flowering‡	Flowering Date	Days to Flowering
16-Apr	X117 (Richardson)	1792	16-Jun	71
16-Apr	KS310 (Novartis)	1792	16-Jun	71
16-Apr	T-E Eden (Mycogen)	1883	19-Jun	74
16-Apr	577 (Cargill)	1766	15-Jun	70
16-Apr	RS200E (Richardson)	1945	21-Jun	76
16-Apr	837 (Cargill)	1974	22-Jun	77
16-Apr	KS585 (Novartis)	1945	21-Jun	76
16-Apr	9300 (Richardson)	2061	25-Jun	80
16-Apr	737 (Cargill)	1945	21-Jun	76
16-Apr	Oro Xtra (Mycogen)	1945	21-Jun	76
16-Apr	Y360 (Richardson)	1945	21-Jun	76
16-Apr	K73-J6 (Novartis)	1974	22-Jun	77
16-Apr	877 (Cargill)	2208	30-Jun	85
16-Apr	Oro G Xtra (Mycogen)	2003	23-Jun	78
16-Apr	KS955 (Novartis)	2235	1-Jul	86
16-Apr	727 (Cargill)	2031	24-Jun	79
16-Apr	9344 (Richardson)	2151	28-Jun	83
14-May	577 (Cargill)	1595	7-Jul	54
14-May	X117 (Richardson)	1625	8-Jul	55
14-May	T-E Eden (Mycogen)	1774	13-Jul	60
14-May	KS310 (Novartis)	1625	8-Jul	55
14-May	837 (Cargill)	1836	15-Jul	62
14-May	KS585 (Novartis)	1902	17-Jul	64
14-May	RS200E (Richardson)	1936	18-Jul	65
14-May	737 (Cargill)	1869	16-Jul	63
14-May	KS955 (Novartis)	2099	23-Jul	70
14-May	K73-J6 (Novartis)	1902	17-Jul	64
14-May	Oro Xtra (Mycogen)	1902	17-Jul	64
14-May	Y360 (Richardson)	1936	18-Jul	65
14-May	9300 (Richardson)	2003	20-Jul	67
14-May	9344 (Richardson)	2003	20-Jul	67
14-May	877 (Cargill)	2099	23-Jul	70
14-May	Oro G Xtra (Mycogen)	2003	20-Jul	67
14-May	727 (Cargill)	2003	20-Jul	67

Table 4. Con'd

Planting Date	Hybrid	GDD to Flowering‡	Flowering Date	Days to Flowering
18-Jun	577 (Cargill)	1665	9-Aug	52
18-Jun	X117 (Richardson)	1698	10-Aug	53
18-Jun	KS310 (Novartis)	1665	9-Aug	52
18-Jun	T-E Eden (Mycogen)	1893	16-Aug	59
18-Jun	837 (Cargill)	1798	13-Aug	56
18-Jun	KS585 (Novartis)	1893	16-Aug	59
18-Jun	Oro Xtra (Mycogen)	1924	17-Aug	60
18-Jun	K73-J6 (Novartis)	1924	17-Aug	60
18-Jun	737 (Cargill)	1924	17-Aug	60
18-Jun	Y360 (Richardson)	1954	18-Aug	61
18-Jun	RS200E (Richardson)	2019	20-Aug	63
18-Jun	9300 (Richardson)	2087	22-Aug	65
18-Jun	Oro G Xtra (Mycogen)	2121	23-Aug	66
18-Jun	727 (Cargill)	2019	20-Aug	63
18-Jun	9344 (Richardson)	2221	26-Aug	69
18-Jun	877 (Cargill)	2221	26-Aug	69
18-Jun	KS955 (Novartis)	2254	27-Aug	70
2-Jul	KS310 (Novartis)	1572	19-Aug	48
2-Jul	577 (Cargill)	1707	23-Aug	52
2-Jul	T-E Eden (Mycogen)	1707	23-Aug	52
2-Jul	KS585 (Novartis)	1741	24-Aug	53
2-Jul	X117 (Richardson)	1673	22-Aug	51
2-Jul	Oro Xtra (Mycogen)	1807	26-Aug	55
2-Jul	RS200E (Richardson)	1807	26-Aug	55
2-Jul	Y360 (Richardson)	1873	28-Aug	57
2-Jul	737 (Cargill)	1840	27-Aug	56
2-Jul	837 (Cargill)	1873	28-Aug	57
2-Jul	K73-J6 (Novartis)	1903	29-Aug	58
2-Jul	727 (Cargill)	1950	31-Aug	60
2-Jul	9300 (Richardson)	1996	2-Sep	62
2-Jul	Oro G Xtra (Mycogen)	2028	3-Sep	63
2-Jul	9344 (Richardson)	2028	3-Sep	63
2-Jul	877 (Cargill)	2157	7-Sep	67
2-Jul	KS955 (Novartis)	2190	8-Sep	68

Table 4. Con'd.

Planting Date	Hybrid	GDD to Flowering‡	Flowering Date	Days to Flowering
16-Jul	KS310 (Novartis)	1516	31-Aug	46
16-Jul	T-E Eden (Mycogen)	1562	2-Sep	48
16-Jul	577 (Cargill)	1660	5-Sep	51
16-Jul	KS585 (Novartis)	1723	7-Sep	53
16-Jul	X117 (Richardson)	1723	7-Sep	53
16-Jul	RS200E (Richardson)	1723	7-Sep	53
16-Jul	737 (Cargill)	1756	8-Sep	54
16-Jul	837 (Cargill)	1822	10-Sep	56
16-Jul	Y360 (Richardson)	1854	11-Sep	57
16-Jul	Oro Xtra (Mycogen)	1756	8-Sep	54
16-Jul	Oro G Xtra (Mycogen)	1918	13-Sep	59
16-Jul	K73-J6 (Novartis)	1918	13-Sep	59
16-Jul	727 (Cargill)	1854	11-Sep	57
16-Jul	KS955 (Novartis)	2111	19-Sep	65
16-Jul	9300 (Richardson)	1950	14-Sep	60
16-Jul	9344 (Richardson)	1984	15-Sep	61
16-Jul	877 (Cargill)	2048	17-Sep	63
30-Jul	T-E Eden (Mycogen)	1526	15-Sep	47
30-Jul	X117 (Richardson)	1526	15-Sep	47
30-Jul	KS310 (Novartis)	1460	13-Sep	45
30-Jul	577 (Cargill)	1558	16-Sep	48
30-Jul	RS200E (Richardson)	1558	16-Sep	48
30-Jul	KS585 (Novartis)	1653	19-Sep	51
30-Jul	K73-J6 (Novartis)	1737	22-Sep	54
30-Jul	837 (Cargill)	1711	21-Sep	53
30-Jul	737 (Cargill)	1684	20-Sep	52
30-Jul	Oro Xtra (Mycogen)	1711	21-Sep	53
30-Jul	Y360 (Richardson)	1762	23-Sep	55
30-Jul	9300 (Richardson)	1762	23-Sep	55
30-Jul	727 (Cargill)	1711	21-Sep	53
30-Jul	Oro G Xtra (Mycogen)	1762	23-Sep	55
30-Jul	9344 (Richardson)	1762	23-Sep	55
30-Jul	KS955 (Novartis)	1877	27-Sep	59
30-Jul	877 (Cargill)	1907	28-Sep	60

‡ Growing Degree Days (GDD) using base temperature of 50°F and ceiling temperature of 86°F.