OKLAHOMA
AGRICULTURAL AND MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATION

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STILLWATER, OKLAHOMA

Sorghum Crops on the High Plains of Oklahoma

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SORGHUM CROPS ON THE HIGH PLAINS OF OKLAHOMA

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INTRODUCTION

In the area represented by the Panhandle Agricultural Experiment Station, winter wheat is the most important crop both from the standpoint of acreage normally sown and value of the grain produced. The sorghums grown for grain, forage and broomcorn constitute the next most important crop of this region.

On the lighter types of soil not well adapted to small grain production the sorghums are the predominating crop. This does not mean that they are adapted only to sandy soils, but indicates the economic preference felt by the majority of farmers for winter wheat. The sorghums are resorted to mainly as feed crops, as substitute crops on seasons unfavorable to small grains and on land too light in texture for small grain growing.

The disadvantages of combining sorghums with small grains in the farming system are that a separate outfit of machinery is necessary for their culture and that sorghums crops leave the soil in a poor fertility condition for wheat. On the other hand material advantage can be gained from a better seasonal distribution of labor and surety of production when sorghums are used.

It is the greater labor requirement per acre which makes sorghums a second choice crop to wheat, so the problem of utilizing these crops to the best advantage involves the development of varieties and methods capable of reducing the labor requirement to parity with wheat.

Possibiilties in this direction are promising. The devolepment of straight-necked, lodge resisting varieties suitable for combine harvesting has already been undertaken with success by the Woodward Field Station and others. The utilization of grain producing varieties by hogging down suggests an important means of eliminating harvest labor. Nearly all new varieties are being investigated for adaptability to close drill seeding to eliminate interculture. The development of any one of these methods into a satisfactory practice would increase the value of the sorghum crops in the high plains area.

The high desirabality of making sorghums capable of large scale production rests in the fact that they are a summer crop using moisture during the normally wet season of the year and are a more dependable crop from year to year than the small grains.

The information reported in this bulletin covers the growth habits and yields of twenty-three varieties of sorghums grown on silty clay loam soil at Goodwell, Oklahoma for a period of five years, 1924 to '28. Therefore, the results obtained apply specifically to the heavy type of soil used primarily for wheat production in this area. The suggestions arising from these experiments will be most helpful to the wheat farmer who desires to work into his system a somewhat greater diversification than is usually practiced. The performance of the varieties under these conditions will enable the selection of the best one for any purpose intended and indicate the most favorable method of culture in each case.

Plan of Experiments

Varietal trials at the Panhandle station have been divided roughly into two groups. The first and larger group, embracing all varieties made use of, has been planted on one date, two spacings, and a varying number of repetitions for each variety annually. The second and smaller group is composed of grain sorghums only. Seven varieties have been selected representative of all types of grain sorghums and planted at from two to five dates annually

according to the progress of seasonal conditions. Approximately, twenty-day planting intervals have been used. At various times this experiment has been further subdivided for seed treatment studies.

The data collected for a period of five years on twenty-three varieties consist of grain yields, field-cured forage yields, forage moisture content, time required for maturity, average height of plants, number of stalks per hill, and diary of culture for each variety in both regular and wide spaced plantings. In all cases uniform series of plots have been selected with uniform previous cropping and cultural conditions. A round-hole flat plate planter has been used for all varieties regardless of the size of seed. A calibration of the planter shows that 2.58 seeds per hill is dropped of Feterita, and 5.3 seeds per hill for Dawn kafir which represent the largest and smallest seeds encountered. Hill-spacing used has been thirty inches throughout the experiment and three and one-half foot rows for standard or regular width planting. Wide spacing has been seven feet between rows or double the regular width. Medium to shallow listing has been practiced in the planting of these plots and the cultivation carried out by whatever implements seemed to suit the field condition and weed control requirements.

Method of Measuring Grain Yield

Each variety has been treated independently in regard to the time of harvest so that as uniform condition of maturity might exist as possible. The grain has been headed by hand from the standing stalk or from shock, weighed in the head after being thoroughly field or bin-cured, and the yield reduced to the basis of threshed grain by a determination of the shelling per cent. Shelling per cent has been determined either by threshing the entire lot of grain or by threshing a carefully drawn sample of heads.

Forage Yields

Since it is impossible to cure the stover of all varieties to a common moisture content all have been weighed at the same time after having stood in the shock from five to ten weeks. The condition has ordinarily been suitable for stacking but certain lots were off condition at times. To eliminate the error of moisture variability moisture determinations were made.

Determination of Moisture

At the time of weighing the field-cured forage samples were taken from outside bundles of the shock but cut as a cross-section of the bundle from the unexposed side. The stalks and leaves were cut with a sharp hay knife in lengths fitting into a sixteen-ounce seamless tin sample can from a point on the bundle approximating the balance in weight. The samples were weighed without transfer into a controlled temperature oven and dried to constant weight at a temperature of 105 degrees Fahrenheit. This method has compared consistently with the use of whole representative stalks and the trial with quadruplicate samples shows a fair degree of sampling accruacy with duplicates from which the yields herewith reported have been calculated to the basis of forage dry matter.

It should be noted that the dry matter basis of reporting forage yields gives smaller acreage values than where a standard moisture content has been assumed or field-cured weights used. If values representing thoroughly-cured stover are desired, from 10 to 20 per cent should be added to the yields reported.

The time of maturity has been calculated from field notes on stage of growth and maturity which were taken at short intervals near the close of

the season. The maturity periods reported began with planting date rather than emergence date. When the later maturing varieties have been killed by frost in an immature stage the time of maturity has been counted as terminating the day before frost.

Height of Plants

Field measures were made on the standing crop a short time before maturity for minimum and maximum heights. This information is no more than an indication of the variability of varieties, and since no wide difference between varieties was noted it is not presented.

Independent measures of the average height of the plot are presented. This was obtained by the lowering of a target on a scale standing near the center of the plot to correspond with the average of the plants as seen by a distant observer.

Number of Stalks per Hill

This measure has been selected from a number of observations which are made bearing upon the regularity and thickness of stand as perhaps the best representation of the ground covering. The stand counts were made at any time during the fruiting period of the crop. The counts consist of the number of hills, the total number of stalks, and the number of stalks bearing heads. The average number of stalks per hill, calculated by dividing the total number of stalks per plot by the actual number of hills occupied is presented in Table Nos. 7 to 12. The area of the plot has been freely revised at harvest time where portions of the plot were not comparable in stand. In such cases portions of the plot with missing hills were cut off and the actual length harvested was measured. In this way only uniform stands have been used.

Diary of Culture

A complete record is kept of the soil condition at all times and the date and description of all field operations performed upon these plots. Special care has been taken to insure the completion of each cultivation on all plots of a series before interference of adverse weather conditions.

Table No. 1—Yields of Sorghums in Standard and Wide Spacings, 1924

Variety Name	TOTAL YIELD Lbs. per Acre		GRAIN YIELD Lbs. per Acre		STOVER YIELD Standard Moisture Lbs. per Acre		RANK IN		Favorable Grain Spacing
	3½' Rows	7' Rows	3½' Rows	7' Rows	3½' Rows	7' Rows	Grain Yield	Total Yield	
Imp. Dwf. Yel. Milo	3128	879	2020	709	1108	170	1	4	3½'
Dwf. White Milo	2665	1561	1690	1019	975	542	2	12	3½'
Dwf. Yellow Milo	2605	1716	1567	1010	1038	706	4	14	3½'
Yel. Str. Neck	1835	1934	585	1048	1250	886	11	23	7 '
Standard Yellow Milo	2928	1786	1582	1104	1346	682	3	6	3½'
Spur Feterita	2613	1202	1373	644	1240	558	6	13	3½'
Desert Bishop	2672	1026	1424	605	1248	421	5	11	3½'
Standard Feterita	2113	1242	1102	625	1011	617	10	17	3½'
Dawn Kafir	2946	1541	1127	768	1819	773	8	5	3½'
Clubhead Sorgo	2105	1023	867	577	1238	446	15	18	3½'
Hegari	2860	1753	518	585	2342	1168	21	7	7 '
J. K. M. Hybrid	1983	985	1108	557	875	428	9	21	3½'
Darso	2575	1467	1238	810	1337	657	7	15	3½'
Dwarf Blackhull Kafir	2031	1740	623	853	1408	887	16	20	7 '
Sunrise Kafir	2684	1640	975	853	1709	787	12	10	3½'
Black Amber	2048	1043	782	445	1266	598	17	19	3½'
Reed Kafir	2187	1845	595	690	1592	1155	20	16	7 '
Compton Hybrid	1972	1285	744	564	1228	721	18	22	3½'
Mex. Des. Sorgo	3132	1722	532	328	2600	1394	22	3	3½'
Shrock	2798	1549	898	754	1900	795	14	8	3½'
Sumac Sorgo	3117	1803	954	626	2163	1177	13	2	3½'
Red Kafir	2760	1703	709	624	2051	1079	19	9	3½'
African Millet	3354	1999	234	199	3120	1800	23	1	3½'

Table No. 2—Yields of Sorghums in Standard and Wide Spacings, 1925

Variety Name	TOTAL YIELD Lbs. per Acre		GRAIN YIELD Lbs. per Acre		STOVER YIELD Standard Moisture Lbs. per Acre		RANK IN		Favorable Grain Spacing
	3½' Rows	7' Rows	3½' Rows	7' Rows	3½' Rows	7' Rows	Grain Yield	Total Yield	
Imp. Dwf. Yel. Milo	1907	2676	537	1425	1370	1251	2	5	7 '
Dwf. White Milo	2160	2549	692	1404	1468	1145	3	9	7 '
Dwf. Yellow Milo	1915	1559	414	510	1501	1049	9	16	7 '
Yel. Str. Neck	2444	3198	159	1814	2285	1384	1	1	7 '
Standard Yellow Milo	2690	2813	210	967	2480	1846	5	3	7 '
Spur Feterita	2216	2794	382	830	1834	1964	6	4	7 '
Desert Bishop	1336	1508	100	467	1236	1041	10	21	7 '
Standard Feterita	1468	1661	178	628	1290	1033	7	20	7 '
Dawn Kafir	2050	1838	73	515	1977	1323	8	13	7 '
Clubhead Sorgo	1065	1006	142	214	923	792	15	23	7 '
Hegari	1868	1998	103	285	1765	1713	13	15	7 '
J. K. M. Hybrid	1267	1279	110	381	1157	898	12	22	7 '
Darso	2562	2477	133	1091	2429	1386	4	8	7 '
Dwarf Blackhull Kafir	2544	1557	78	389	2466	1168	11	10	7 '
Sunrise Kafir	2605	1555	142	192	2463	1363	17	6	7 '
Black Amber	2236	1180	0	0	2236	1180	23	12	---
Reed Kafir	2589	1323	119	195	2470	1128	16	7	7 '
Compton Hybrid	1813	1557	267	199	1546	1358	14	17	3½'
Mex. Des. Sorgo	2008	1745	123	109	1885	1636	21	14	3½'
Shrock	1690	1350	73	190	1617	1160	18	19	7 '
Sumac Sorgo	1763	1377	142	181	1621	1196	19	18	7 '
Red Kafir	1952	2934	73	174	1879	2760	20	2	7 '
African Millet	2335	1615	0	0	2335	1615	22	11	---

Table No. 3—Yields of Sorghums in Standard and Wide Spacings, 1926

Variety Name	TOTAL YIELD Lbs. per Acre		GRAIN YIELD Lbs. per Acre		STOVER YIELD Standard Moisture Lbs. per Acre		RANK IN		Favorable Grain Spacing
	3½' Rows	7' Rows	3½' Rows	7' Rows	3½' Rows	7' Rows	Grain Yield	Total Yield	
Imp. Dwf. Yel. Milo	1977	1652	247	922	1730	730	5	7	7 '
Dwf. White Milo	1294	1299	438	832	856	467	7	22	7 '
Dwf. Yellow Milo	1621	1915	471	1114	1150	801	2	11	7 '
Yel. Str. Neck	1261	1692	0	832	1261	860	6	17	7 '
Standard Yellow Milo	2024	1392	135	607	1889	785	13	4	7 '
Spur Feterita	1262	1785	0	990	1262	795	4	16	7 '
Desert Bishop	1534	1830	0	1023	1534	807	3	14	7 '
Standard Feterita	1030	1233	157	664	873	569	12	23	7 '
Dawn Kafir	1688	1655	114	706	1574	949	10	19	7 '
Clubhead Sorgo	1653	1642	298	697	1355	945	11	20	7 '
Hegari	1921	1723	0	270	1921	1453	20	10	7 '
J. K. M. Hybrid	1567	2056	0	1192	1567	864	1	3	7 '
Darso	1531	1929	0	0	1531	1929	23	9	---
Dwarf Blackhull Kafir	2006	1908	0	562	2006	1349	15	6	7 '
Sunrise Kafir	1959	1811	62	742	1897	1069	8	8	7 '
Black Amber	1912	1356	427	517	1485	839	16	12	7 '
Reed Kafir	1773	1809	0	731	1773	1078	9	15	7 '
Compton Hybrid	1692	1445	0	585	1692	860	14	18	7 '
Mex. Des. Sorgo	1454	1535	67	382	1387	1153	18	21	7 '
Shrock	1782	2015	0	157	1782	1858	22	5	7 '
Sumac Sorgo	1789	1834	79	444	1710	1390	17	13	7 '
Red Kafir	2086	2733	0	270	2086	2463	19	1	7 '
African Millet	2438	2307	0	225	2438	2082	21	2	7 '

Table No. 4—Yields of Sorghums in Standard and Wide Spacings, 1927

Variety Name	TOTAL YIELD Lbs. per Acre		GRAIN YIELD Lbs. per Acre		STOVER YIELD Standard Moisture Lbs. per Acre		RANK IN		Favorable Grain Spacing
	3½' Rows	7' Rows	3½' Rows	7' Rows	3½' Rows	7' Rows	Grain Yield	Total Yield	
Imp. Dwf. Yel. Milo	3444	2247	1496	800	1948	1447	1	10	3½'
Dwf. White Milo	2968	1931	1150	680	1818	1251	4	21	3½'
Dwf. Yellow Milo	3178	2102	1280	803	1898	1299	3	19	3½'
Yel. Str. Neck	3644	1764	624	520	3020	1244	12	7	3½'
Standard Yellow Milo	3332	2013	1096	539	2236	1474	5	16	3½'
Spur Feterita	3365	2308	728	360	2637	1948	11	14	3½'
Desert Bishop	3335	2069	992	570	2343	1499	7	15	3½'
Standard Feterita	3203	2054	824	440	2379	1614	9	18	3½'
Dawn Kafir	3403	2049	496	483	2907	1566	16	13	3½'
Clubhead Sorgo	3434	2401	852	836	2582	1565	8	12	3½'
Hegari	3551	2467	1328	1008	2223	1459	2	8	3½'
J. K. M. Hybrid	2960	1703	464	272	2496	1431	18	22	3½'
Darso	3435	1761	280	224	3155	1537	20	11	3½'
Dwarf Blackhull Kafir	4035	2771	560	440	3475	2331	13	3	3½'
Sunrise Kafir	4886	2423	500	304	4386	3119	15	1	3½'
Black Amber	3465	1985	1056	720	2409	1265	6	9	3½'
Reed Kafir	3256	2573	368	548	2888	2025	14	17	7 '
Compton Hybrid	3128	1839	476	384	2652	1455	17	20	3½'
Mex. Des. Sorgo	3808	1788	816	384	2992	1404	10	5	3½'
Shrock	3669	2270	304	360	3365	1910	19	6	7 '
Sumac Sorgo	3850	2395	256	272	3594	2123	21	4	7 '
Red Kafir	2904	1842	496	288	2408	1554	16	23	3½'
African Millet	4334	2980	240	464	4094	2516	22	2	7 '

Table No. 5—Yields of Sorghums in Standard and Wide Spacings, 1928

Variety Name	TOTAL YIELD Lbs. per Acre		GRAIN YIELD Lbs. per Acre		STOVER YIELD Standard Moisture Lbs. per Acre		RANK IN		Favorable Grain Spacing
	3½' Rows	7' Rows	3½' Rows	7' Rows	3½' Rows	7' Rows	Grain Yield	Total Yield	
Imp. Dwf. Yel. Milo	1675	2056	757	1201	918	855	6	18	7 '
Dwf. White Milo	2108	1258	989	696	1119	562	18	15	3½'
Dwf. Yellow Milo	2063	1281	1149	703	914	578	10	16	3½'
Yel. Str. Neck	2548	1453	1113	742	1435	711	11	9	3½'
Standard Yellow Milo	1894	1247	618	513	1276	734	23	22	3½'
Spur Feterita	2058	1308	1113	742	945	566	12	17	3½'
Desert Bishop	1980	1640	989	973	991	667	19	20	3½'
Standard Feterita	1917	959	1159	603	758	356	9	21	3½'
Dawn Kafir	2716	1696	1206	840	1510	856	5	6	3½'
Clubhead Sorgo	2198	1550	1020	817	1178	733	17	13	3½'
Hegari	2552	1228	1345	680	1207	548	2	8	3½'
J. K. M. Hybrid	2709	1389	1252	773	1457	616	3	7	3½'
Darso	3008	1876	1159	1026	1849	850	8	4	3½'
Dwarf Blackhull Kafir	2710	1981	1360	1051	1350	930	1	7	3½'
Sunrise Kafir	2310	1613	1049	752	1261	861	15	11	3½'
Black Amber	2144	1535	882	723	1262	812	22	14	3½'
Reed Kafir	2034	1765	975	1104	1059	661	13	19	7 '
Compton Hybrid	2336	1536	1020	757	1316	779	16	10	3½'
Mex. Des. Sorgo	3103	2178	1175	1066	1928	1112	7	3	3½'
Shrock	3214	1924	1221	896	1993	1028	4	1	3½'
Sumac Sorgo	2774	1798	927	943	1847	855	21	5	7 '
Red Kafir	2268	1953	975	956	1293	997	20	12	3½'
African Millet	3207	2319	634	1066	2573	1253	14	2	7 '

Table No. 6—Five-Year Average Yields of Sorghums in Standard and Wide Spacings, Goodwell, Oklahoma, 1924-1928

Name—Order of high grain production, ave. all spacings	TOTAL YIELD Lbs. per Acre		GRAIN YIELD Lbs. per Acre		STOVER YIELD Standard Moisture Lbs. per Acre		RANK IN		Mean Rank	Favorable Grain Spacing
	3½' Rows	7' Rows	3½' Rows	7' Rows	3½' Rows	7' Rows	Grain Yield	Total Yield		
Imp. Dwf. Yel. Milo	2426	1902	1011	1011	1415	891	1	11	1	---
Dwf. White Milo	2239	1719	992	926	1247	793	2	18	5	3½'
Dwf. Yellow Milo	2276	1715	976	828	1300	887	4	17	6	3½'
Yel. Str. Neck	2346	2008	496	991	1850	1017	3	15	4	7 '
Standard Yellow Milo	2573	1850	728	746	1845	1104	5	8	2	7 '
Spur Feterita	2303	1879	719	713	1584	1166	7	16	7	3½'
Desert Bishop	2171	1615	701	728	1470	887	6	20	10	7 '
Standard Feterita	1946	1430	684	592	1262	838	8	23	12	3½'
Dawn Kafir	2560	1755	603	662	1957	1093	9	9	4	7 '
Clubhead Sorgo	2091	1524	636	628	1455	896	12	22	14	3½'
Hegari	2551	1834	659	566	1892	1268	10	10	5	3½'
J. K. M. Hybrid	2097	1482	587	635	1510	847	13	21	14	7 '
Darso	2622	1902	562	630	2060	1272	14	7	6	7 '
Dwarf Blackhull Kafir	2665	1991	524	659	2141	1332	10	4	3	7 '
Sunrise Kafir	2889	1809	546	569	2343	1240	16	2	4	7 '
Black Amber	2361	1420	629	481	1732	939	15	14	11	3½'
Reed Kafir	2367	1863	411	654	1956	1209	11	13	8	7 '
Compton Hybrid	2188	1533	501	498	1687	1035	18	19	15	3½'
Mex. Des. Sorgo	2701	1794	543	454	2158	1340	17	3	5	3½'
Shrock	2630	1821	499	471	2131	1350	19	6	9	3½'
Sumac Sorgo	2659	1841	472	493	2187	1348	20	5	9	7 '
Red Kafir	2394	2233	451	462	1943	1771	21	12	13	7 '
African Millet	3134	2244	222	391	2912	1853	22	1	7	7 '

DISCUSSION OF VARIETIES

Improved Dwarf Yellow Milo

The average height attained by Improved Dwarf Yellow Milo when planted in 3½-foot rows was 43 inches, in double width rows it was 46 inches. The average grain yieeld, 1011 pounds per acre in both standard width and wide rows is the highest average made by any variety tested. The Improved Dwarf Yellow Milo holds an intermediate position in forage dry matter yield. The moisture content of the field-cured forage is low and does not differ materially from that of the other milo varieties compared to it. The time required for maturity averaged 103 days. It ranks first in grain yield and eleventh in total yield.

Dwarf White Milo

This variety grew to an average height of 40 inches and 44 inches in narrow and wide rows respectively. An average grain yield of 992 pounds per acre for regular width rows and 926 pounds in double width rows was recorded. This is greater than the average for all strains of Dwarf Yellow Milo used but less than that made by a choice selection of the yellow variety. The forage yield was the lowest for all milos in these tests. The time requirement for maturity was about 101 days. It ranks second in grain yield and eighteenth in total yield.

Table No. 7—Growth Data of Sorghum Varieties, 1924

Variety Name	% H_2O in Field-cured Stover*		Average Height of Plants		Average No. Stalks per Hill		Time of Maturity Days
	3½' Rows	7' Rows	3½' Rows	7' Rows	3½' Rows	7' Rows	
Imp. Dwf. Yel. Milo	37.5	37.5	42	40	3.7	2.7	122
Dwf. White Milo	50.4	50.4	39	40	4.4	3.8	119
Dwf. Yellow Milo	34.3	34.3	36	37	5.2	5.2	105
Yellow Str. Neck	79.6	79.6	43	44	2.4	2.3	145
Standard Yellow Milo	31.9	31.9	44	36	3.9	4.5	106
Spur Feterita	59.8	59.8	54	54	2.9	2.5	127
Desert Bishop	48.3	48.3	47	45	2.9	2.1	132
Standard Feterita	59.8	59.8	52	50	3.1	2.1	114
Dawn Kafir	113.5	124.7	49	48	3.4	3.1	140
Clubhead Sorgo	129.4	129.4	57	57	4.0	4.5	104
Hegari	135.4	135.4	46	50	2.4	3.1	143
J. K. M. Hybrid	67.9	67.9	43	43	3.6	3.4	136
Darso	55.1	55.1	46	49	5.2	4.4	106
Dwf. Blackhull Kafir	86.9	86.9	48	53	4.4	5.6	141
Sunrise Kafir	138.1	138.1	66	62	1.9	3.1	143
Black Amber	70.0	70.0	52	50	5.6	5.7	109
Reed Kafir	91.1	91.1	52	55	2.5	3.2	140
Compton Hybrid	108.4	108.4	46	48	2.4	2.7	140
Mex. Desert Sorgo	121.2	121.2	47	44	3.1	3.8	141
Shrock	77.9	77.9	47	45	1.8	2.5	145
Sumac Sorgo	102.5	102.5	61	63	5.3	5.4	129
Red Kafir	55.3	55.3	56	58	3.8	3.9	144
African Millet	99.8	99.8	54	52	2.6	2.4	145

Planted June 6, Frost Nov. 7, Season 154 Days.

*Composite samples excepting Dawn Kafir.

Dwarf Yellow Milo

The common Dwarf Yellow Milo such as is in general use throughout the country was included in the variety test. The stature is somewhat less than that of the strain giving the highest yield, being 39 inches in 3½-foot rows and 42 inches in 7-foot rows. The grain yields indicate a stronger preference for narrow spacing and also a smaller yielding capacityy than the other dwarf varieties. It is early maturing, averaging about 99 days. In grain yield it ranks fourth and in total yield seventeenth.

Yellow Straight Neck

(Fargo Milo)

Planting of this variety in wide rows markedly increased the height of the plant, the narrow and wide spacings averaging 43 and 53 inches respectively. There was also a difference in the reaction of Yellow Straight Neck and that of Milo in grain yield to spacing. All of the dwarf varieties of Milo average nearly the same in grain yield for the five years in 3½ and 7-foot plantings. Yellow Straight Neck has manifested an extreme sensitiveness to crowding, the yield in wide rows being approximately double that obtained from the regularly spaced plantings. Its moisture content has been a little higher than that of the milos, but it has not proved difficult to cure. The time required for maturity is much longer than any of the common varieties

Table No. 8—Growth Data of Sorghum Varieties, 1925

Variety Name	% H_2O in Field-cured Stover		Average Height of Plants		Average No. Stalks per Hill		Time of Maturity Days
	3½' Rows	7' Rows	3½' Rows	7' Rows	3½' Rows	7' Rows	
Imp. Dwf. Yellow Milo	62.7	126.0	---	53	---	4.5	98
Dwf. White Milo	61.2	146.6	---	53	---	4.5	95
Dwf. Yellow Milo	42.6	56.8	36	44	2.7	2.8	98
Yellow Str. Neck	98.9	215.0	40	63	2.8	3.5	131
Standard Yellow Milo	27.7	28.2	52	68	2.4	2.6	100
Spur Feterita	78.2	69.3	54	62	2.2	2.7	97
Desert Bishop	103.7	69.3	39	47	1.7	1.9	112
Standard Feterita	47.8	78.0	45	55	1.6	2.2	96
Dawn Kafir	116.2	151.2	42	54	3.1	3.7	110
Clubhead Sorgo	114.8	26.4	55	65	2.9	2.5	99
Hegari	95.5	96.8	42	47	2.5	3.2	122
J. K. M. Hybrid	102.9	112.6	36	47	3.0	4.3	100
Darso	73.0	154.7	43	52	3.9	5.3	124
Dwf. Blackhull Kafir	89.5	103.1	45	50	4.4	4.3	114
Sunrise Kafir	8.7	19.3	60	66	3.8	3.4	99
Black Amber	7.3	57.4	---	---	---	---	93*
Reed Kafir	79.4	78.9	53	63	3.8	3.1	110
Compton Hybrid	127.7	124.7	41	44	2.4	3.1	129
Mex. Desert Sorgo	114.1	117.2	44	47	3.9	6.2	122
Shrock	92.4	84.7	45	46	2.5	2.9	109
Sumac Sorgo	170.8	135.5	56	58	3.3	4.2	126
Red Kafir	58.8	64.2	43	54	3.2	4.8	135
African Millet	10.3	50.4	---	---	---	---	99*

Planted June 8, Frost Oct. 21, Season 135 Days.

*Died immature.

of milo, averaging 126 days for this experiment. This is barely within the range of varieties which may be regularly depended on to produce seed in this locality. It ranks third in grain yield and fifteenth in total.

Standard Yellow Milo

The difference in height attained by this variety in wide and narrow spacing is a little greater than with the other varieties of milos. The average height in regular width rows was 51 inches against 55 inches in 7-foot rows. The grain yield from both spacinngs was lower for Standard Yellow Milo than any of the other milo varieties. On heavy types of soil this variety behaves similarly to some of the later maturing hybrids of which Yellow Straight Neck is a typical example in that it lodges badly. As would be expected the Standard Yellow milo produces more forage dry matter than any of the other milos. It is, in fact, equal to Dawn Kafir in forage production. The moisture content of field cured forage is about equal to the other milos, comparing with Dawn Kafir as 44 to 87. The time requirement for maturity averaged about 100 days. It ranks fifth in grain yield and eighth in total.

Spur Feterita

Spur Feterita grew to an average height of 58 inches in wide rows compared with 55 inches in regular width rows. While the average grain-yield of Spur Feterita was not high, it proved to be fairly consistent and did not

Table No. 9—Growth Data of Sorghum Varieties, 1926

Variety Name	% H_2O in Field-cured Stover		Average Height of Plants		Average No. Stalks per Hill		Time of Maturity Days
	3½' Rows	7' Rows	3½' Rows	7' Rows	3½' Rows	7' Rows	
Imp. Dwf. Yellow Milo	40.8	7.7			4.7	4.0	104
Dwf. White Milo	23.7	6.5			2.9	3.1	100
Dwf. Yellow Milo	39.1	25.3			4.4	4.6	101
Yellow Str. Neck	59.7	68.9			3.2	3.1	134
Standard Yellow Milo	37.4	16.6			3.9	4.7	102
Spur Feterita	49.0	58.1			3.5	4.1	114
Desert Bishop	74.9	67.1			3.3	3.5	125
Standard Feterita	27.3	74.8			3.6	4.2	105
Dawn Kafir	55.6	61.2	40	45	4.0	3.5	130
Clubhead Sorgo	84.1	60.5			5.2	5.1	99
Hegari	37.9	51.6			5.7	5.9	131
J. K. M. Hybrid	35.2	78.8			4.5	4.7	115
Darso	31.5	30.5			6.1	5.5	132
Dwf. Blackhull Kafir	42.6	57.7			11.3	10.2	135
Sunrise Kafir	38.6	63.5	48	58	6.4	5.6	110
Black Amber	44.4	45.2			7.1	7.5	100
Reed Kafir	62.7	51.2			4.4	3.4	135
Compton Hybrid	20.6	68.9			4.6	4.0	132
Mex. Desert Sorgo	83.3	127.5			6.2	4.5	120
Shrock	39.7	86.9			4.4	4.5	122
Sumac Sorgo	56.2	112.1			7.5	4.5	122
Red Kafir	29.5	12.8			7.2	7.1	138
African Millet	54.3	116.9			8.2	5.8	130

Planted June 8, Frost Oct. 24, Season 138 Days.

vary much between the wide and narrow spacings. The forage produced by Spur Feterita averaged about as dry as that of Black Amber. The most favorable spacing on the average was shown to be 3½-foot rows. Time required for maturity was 104 days. It ranks seventh in grain yield and sixteenth in total.

Desert Bishop

Desert Bishop grew a little taller than Dwarf Yellow Milo, averaging 45 inches in regular rows and 42 inches in double width rows. The yield was not high, but like the Spur Feterita proved consistent. It produced a forage, averaging somewhat more moisture than that of the milos but hardly as much as Blackhull Kafir. Time of maturity was slightly earlier than the Dawn Kafir. It required 114 days. Slight preference is shown for wide spacing. It ranks sixth in grain yield and twentieth in total.

Standard Feterita

The behavior of this variety in general was comparable to that of Spur Feterita but it was lower in yield and showed somewhat less ability to make up a full grain-yield when thinly spaced. Standard Feterita was lowest of all varieties tried in total yield. In moisture content it was about the same as Spur Feterita and the height only a little less, being 52 inches in close spacing and 56 inches in wide spacing. About four days less was required for maturity than the Spur Feterita, the average time being 100 days. It ranks eighth in grain yield and twenty-third in total.

Table No. 10—Growth Data of Sorghum Varieties, 1927

Variety Name	% H_2O in Field-cured Stover		Average Height of Plants		Average No. Stalks per Hill		Time of Maturity Days
	3½' Rows	7' Rows	3½' Rows	7' Rows	3½' Rows	7' Rows	
Imp. Dwf. Yellow Milo	72.9	95.7	50	51	5.2	6.6	91
Dwf. White Milo	72.9	95.7	47	47	5.1	6.5	90
Dwf. Yellow Milo	59.6	65.6	42	45	5.5	5.7	90
Yellow Str. Neck	60.9	87.1	47	62	4.2	3.9	110
Standard Yellow Milo	95.2	118.1	59	65	4.7	5.5	90
Spur Feterita	29.8	28.1	61	59	4.6	4.7	88
Desert Bishop	42.5	102.1	52	53	3.9	4.1	95
Standard Feterita	29.8	28.1	59	65	4.9	4.9	92
Dawn Kafir	53.4	70.2	54	56	4.8	4.7	105
Clubhead Sorgo	77.0	89.1	67	64	5.4	6.1	94
Hegari	72.7	27.4	52	53	5.5	6.2	105
J. K. M. Hybrid	76.9	64.3	51	55	5.1	4.4	98
Darso	78.7	70.9	52	56	4.4	3.7	100
Dwf. Blackhull Kafir	42.5	67.8	53	57	4.2	4.2	110
Sunrise Kafir	50.7	46.9	70	74	5.7	5.4	96
Black Amber	45.1	85.0	68	66	6.3	6.3	88
Reed Kafir	69.1	78.7	59	68	4.6	4.9	110
Compton Hybrid	79.3	47.6	58	59	4.0	3.8	110
Mex. Desert Sorgo	98.8	121.5	48	49	5.7	5.2	110
Shrock	91.1	82.1	52	60	5.3	4.7	105
Sumac Sorgo	77.1	87.1	63	67	5.8	5.9	110
Red Kafir	81.8	54.7	54	62	4.8	5.3	110
African Millet	77.0	121.0	59	71	7.4	7.2	110

Planted June 23, Frost Oct. 12, Season 111 Days.

Dawn Kafir

Dawn Kafir grew to a height of 47 inches in regular rows and 52 inches in wide rows. The most favorable spacing for grain yield is 7-foot rows. A difference of only about one bushel per acre was recorded. Although Dawn Kafir is more dwarf than any of the other kafir varieties, it required more time to mature than the Sunrise. One hundred and ninteen days was the average growing season for this variety. The moisture content of kafirs as a group is somewhat higher than that of the milos and Dawn Kafir is fairly representative of the kafir varieties in this respect. Dawn Kafir comes nearer to serving as an all-purpose crop than any other variety. While it has the same mean rank as Yellow Straight Neck its desirability for consistent yield in all spacings, high yield of total dry matter, and the ability to stand longer after maturity makes it preferred to the Yellow Straight Neck as a general purpose variety. It ranks ninth in grain yield and ninth in total.

Clubhead Sorgo

The average height of Clubhead Sorgo for regular width rows has been 61 inches and for double-width rows 63 inches. The forage yield has been among the lowest in both spacings. While it cannot be depended upon to make a big forage-yield it has been dependable in seed production not having failed to mature at any time under either spacing used. Moisture content of the forage is moderately high. In maturity it is very early, comparable in fact to the

Table No. 11—Growth Data of Sorghum Varieties, 1928

Variety Name	% H_2O in Field-cured Stover		Average Height of Plants		Average No. Stalks per Hill		Time of Maturity Days
	3½' Rows	7' Rows	3½' Rows	7' Rows	3½' Rows	7' Rows	
Imp. Dwf. Yellow Milo	15.1	9.6	36	39	5.9	5.4	101
Dwf. White Milo	14.0	21.5	35	35	5.7	7.4	99
Dwf. Yellow Milo	19.6	18.9	40	41	4.7	5.3	100
Yellow Str. Neck	17.4	25.7	40	44	3.4	3.2	111
Standard Yellow Milo	28.1	29.4	50	52	5.5	6.2	104
Spur Feterita	25.3	26.1	53	56	4.8	4.6	95
Desert Bishop	39.5	86.7	41	49	3.3	3.6	106
Standard Feterita	24.4	28.8	53	55	4.7	4.9	93
Dawn Kafir	50.5	80.3	45	50	3.3	4.2	109
Clubhead Sorgo	43.0	112.3	65	67	3.5	4.9	104
Hegari	45.9	95.6	46	51	5.2	5.7	107
J. K. M. Hybrid	16.3	42.4	41	46	4.7	4.7	105
Darso	22.0	89.0	43	47	3.4	3.4	105
Dwf. Blackhull Kafir	55.8	94.7	44	49	3.7	4.7	110
Sunrise Kafir	65.8	71.8	60	66	4.3	5.3	106
Black Amber	19.3	16.3	64	68	5.0	7.5	92
Reed Kafir	112.0	224.0	52	64	3.1	4.3	112
Compton Hybrid	37.6	42.3	44	47	3.2	3.3	110
Mex. Desert Sorgo	120.3	120.3	49	58	4.5	5.2	114
Shrock	22.1	57.4	44	53	3.8	4.1	108
Sumac Sorgo	105.8	187.9	62	70	4.5	5.0	110
Red Kafir	42.1	74.0	50	60	3.3	3.2	118
African Millet	84.1	95.6	55	68	4.9	5.9	109

Planted June 21, Frost Oct. 21, Season 122 Days.

dwarf milos, with an average seasonal requirement of 100 days. It ranks twelfth in grain-yield and twenty-second in total.

Hegari

Hegari averaged 46 inches in height in narrow spacings and 50 inches in spacings. This variety has a remarkable yielding capacity when given a continuously favorable growing season, but exhibits the corresponding disadvantage of being very sensitive to adverse conditions. An average yield of 659 pounds of grain in 3½-foot rows indicates a preference for narrow spacings over the wide in which it produced 566 pounds of grain per acre. It yields a fair quantity of forage about equal to Dawn Kafir in moisture content. Hegari required on the average about three days longer to mature than Dawn Kafir, the time being 122 days. It ranks tenth in grain-yield and tenth in total.

J. K. M. Hybrid

This variety while exhibiting some desirable characteristics such as erect heads and dwarfness has proved seriously deficient in yielding power when compared to standard varieties. A slightly higher yield of grain was made in 7-foot rows than in the regularly spaced rows. Yield of forage has been low so that in mean rank it stands next to the bottom of the list. In maturity it stands between Dwarf Yellow Milo and Desert Bishop, requiring about 111 days. It ranks thirteenth in grain-yield and twenty-first in total.

Table No. 12—Growth Data of Sorghum Varieties, Five-Year Average, 1924-1928

Variety Name	% H_2O in Field-cured Stover		Average Height* of Plants		Average No. Stalks per Hill		Time of Maturity Days
	3½' Rows	7' Rows	3½' Rows	7' Rows	3½' Rows	7' Rows	
Imp. Dwf. Yellow Milo	45.8	55.3	43	46	4.87	4.64	103.2
Dwf. White Milo	44.4	64.1	40	44	4.52	4.86	100.6
Dwf. Yellow Milo	39.0	40.1	39	42	4.50	4.72	98.8
Yellow Str. Neck	63.3	95.2	43	53	3.20	3.20	126.2
Standard Yellow Milo	44.0	44.8	51	55	4.08	4.70	100.4
Spur Feterita	48.4	48.3	55	58	3.60	3.72	104.2
Desert Bishop	61.8	74.7	45	48	3.02	3.04	114.0
Standard Feterita	37.8	53.9	52	56	3.58	3.66	100.0
Dawn Kafir	77.8	97.5	47	52	3.72	3.84	118.8
Clubhead Sorgo	89.6	83.5	61	63	4.20	4.62	100.0
Hegari	77.4	81.3	46	50	4.26	4.82	121.6
J. K. M. Hybrid	59.8	73.2	43	48	4.18	4.30	110.8
Darso	52.0	80.0	46	51	4.60	4.46	113.4
Dwf. Blackhull Kafir	53.4	81.8	47	52	5.60	5.80	122.0
Sunrise Kafir	60.3	67.9	64	67	4.42	4.56	110.8
Black Amber	37.2	54.8	61	61	6.00	6.75	96.4
Reed Kafir	82.8	104.7	54	62	3.68	3.78	121.4
Compton Hybrid	74.7	78.4	47	49	3.32	3.38	124.2
Mex. Desert Sorgo	107.5	121.5	47	49	4.68	4.98	121.4
Shrock	64.6	77.8	47	51	3.56	3.74	117.8
Sumac Sorgo	102.4	125.0	60	64	5.28	5.00	119.4
Red Kafir	53.5	52.2	51	58	4.46	4.86	129.0
African Millet	65.1	96.7	56	64	5.77	5.32	118.6

*Average four years 1924, 1925, 1927, 1928.

Darso

Darso has not shown the same capacity for grain-yield in June plantings here that it has in other parts of Oklahoma, but stands well in total yield and mean rank. This variety shows a slight preference for 7-foot rows in which it produced 630 pounds of grain per acre over 562 in 3½-foot rows. The number of stalks per hill was no greater in wide rows than in narrow but the difference in height was about 5 inches. The moisture content of field-cured stover is about the same as kafir. The average time required for maturity was 113 days. It ranks fourteenth in grain yield and seventh in total. Attention is called to the response of Darso to early planting, Tables 14 to 16.

Dwarf Blackhull Kafir

The main difference observed in comparing this variety with the Dawn was its higher proportion for forage to grain and slightly longer growing period. The average height was 47 to 52 inches in narrow and wide rows respectively, being the same as Dawn Kafir. The number of stalks per hill averages somewhat more than the Dawn Kafir. Moisture content of the forage was very similar. It ranks tenth in grain yield and fourth in total.

Sunrise Kafir

Sunrise Kafir departs still more from the characteristics of Dawn than does the Dwarf Blackhull, having a still lower rank in grain yield and higher rank in total yield. A slight preference is shown for wide spacing in grain-yield but since the principal value of Sunrise lies in its rank as a producer of total grain and forage, close planting seems preferable. The average height attained by Sunrise Kafir was 64 inches in 3½-foot rows and 67 inches in 7-foot rows. It is the earliest maturing of the kafirs, requiring but 111 days. The moisture content of field cured forage is somewhat less than that of the other kafir varieties. It ranks sixteenth in grain-yield and second in total.

Black Amber

Black Amber is the earliest maturing variety of sorghum used in these trials, requiring only 96 days average time. The height did not vary between wide and narrow spacing. Highest yields of both grain and forage were ob-

Table No. 13—Monthly Rainfall, 1924-1928, Goodwell, Oklahoma

Year	Jan.	Feb.	Mar.	Apr.	May	June
1924	.30	.20	1.70	1.85	2.00	.41
1925	.20	.25	.04	1.43	.76	2.03
1926	.11	.15	1.47	2.32	4.09	5.03
1927	.00	.41	.25	1.52	T	1.86
1928	T	1.21	.86	1.41	6.48	2.92

(Continued)

Year	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1924	1.15	2.65	1.05	.62	.06	.13	12.12
1925	4.52	1.88	3.23	.45	1.07	.07	15.93
1926	.47	.99	1.81	.04	.23	.58	17.29
1927	5.19	5.04	1.73	.34	T	T	16.34
1928	3.57	1.85	.36	3.04	1.90	.70	24.30

tained from this variety when planted in 3½-foot rows. The moisture content of Black Amber forage is practically as low as that of the Feterita and Milo groups. The yielding power of this variety is low and it is not recommended where the average growing season is as long or longer than that of this station. It ranks fifteenth in grain-yield and fourteenth in total.

Reed Kafir

This variety which is a good grain crop at lower altitudes in Oklahoma has proved less reliable than the other commonly grown kafirs at Goodwell. When grown for grain a decided advantage can be obtained by giving the Reed Kafir ample spacing. It has grown rather tall, 54 inches in narrow rows and 62 inches in wide rows. One hundred twenty-one days were required for maturity. The moisture content of the forage was rather high averaging 83 and 105 per cent, dry basis. It ranks eleventh in grain-yield and thirteenth in total.

Compton Hybrid

Compton Hybrid is somewhat similar to the J. K. M. Hybrid in general characteristics, having straight thin heads and dwarfness. Its primary deficiency is lack of yielding power, being poorer in this respect than any of the varieties usually grown for grain. It did not differ greatly in average height between narrow and wide spacings, growing 47 inches in 3½-foot rows and 49 inches in 7-foot rows. The moisture content of the field cured forage was about the same as kafir. There was not much difference in the grain yields from the two spacings. It ranked eighteenth in yield and nineteenth in total yield.

Mexican Desert Sorgo

Mexican Desert grows only about 47 inches high on the average in 3½-foot rows and 49 inches in 7-foot rows. It has a short thick stalk which turns out a medium to high yield of forage dry matter per acre, being about equal to the Dwarf Blackhull Kafir. The grain-yield is about the same for both spacings used. It is similar to Sumac in high moisture content which is partly a result of the thicker stalk. One hundred twenty-one days were required to mature the Mexican Desert Sorgo on the average. It is seventeenth in grain yield and third in total.

Shrock—(Sagrain)

This is a dwarf variety growing a little taller than Dwarf Milo, 47 inches in 3½-foot rows and 51 inches in 7-foot rows. It shows a slight preference for close spacing. The yield of leafy forage is heavy which enables it to rank high in total yield. This variety is unsuited to grain production in this locality, but produces more forage dry matter than its dwarf growth would indicate. The average time required for maturity was 118 days, about the same as Dawn Kafir. It ranks nineteenth in grain yield and sixth in total.

Sumac Sorgo

The average height attained by this variety when grown in 3½-foot rows was 60 inches, and in 7-foot rows 64 inches. The moisture content of the field-cured forage is high. If the field weights be taken as a measurement of forage yield, Sumac Sorgo would be considered a high yielding variety but when yields are reduced to a dry matter basis several other varieties equal and exceed it. It has been found that date of maturity varies considerably with different

strains and selections of Sumac. The average time required, however, is about 119 days. It ranks twentieth in grain yield and fifth in total.

Red Kafir

Red Kafir is generally inferior for all purposes although it can perhaps be best used as a forage variety if at all. It grows to a height of 51 inches in narrow rows and 58 inches in wide rows. Low yields of 451 and 462 pounds per acre in narrow and wide spacings respectively places it in twenty-first place as a grain producer. Both an increased height and larger number stalks per hill when planted in wide rows enables Red Kafir to produce almost as much in wide spacing as in standard or regular rows. It is the latest maturing variety carried through the five-year test and frequently has produced very poor quality seed. One hundred twenty-nine days were required on the average to mature this variety. It ranks twenty-first in grain yield and twelfth in total.

African Millet (Sourless Sorgo)

This variety averaged 56 inches in heigth when ylanted in regular width rows and 64 inches in 7 foot rows. On the basis of forage dry matter it has given the highest yield in both the wide and narrow spacings. African Millet is very simliar if not indistinguishable from a group of varieties falling under the general name of Sourless Cane or Sourless Sorgo. It has yielded less grain than any other varieties thought to be adapted. Two times out of five the African Millet has failed to mature seed suitable for planting purposes. The average moisture content of the field cured forage is moderately low. The average time to mature African Millet has been about 118 days. It ranks twenty-second in grain yield and first in total.

Minor Varieties

During the five years these trials have been in progress a number of varieties have been tried out from one to three years and dropped because it was found impossible to reproduce seed in this locality. Those varieties which have demonstrated their reproductive capacities have been carried through the entire period. Varieties attempted and dropped at various times were Orange, Jap Cane, Dwarf Ashburn, Texas Seeded Cane, Goose Neck Cane, Honey Drip, and Bishop.

New Varieties

New varieties that have been added to the experiment and which show promise of adaptability but which have only been tried from two to three years are Red Amber, Beaver Milo, Double Dwarf Milo, Heilman Milo, Pink Kafir, and Dwarf Early Feterita. The partial data of these and certain minor varieties are not included in this bulletin but will be reported at another time.

RESPONSE OF VARIETIES TO SEASONAL CONDITIONS

The most important climatic factor causing variation in the performance of sorghums from year to year is the rainfall. The monthly rainfall at Goodwell for the period 1924 to 1928 is shown in Table No. 13. Initial soil moisture is second in importance.

Season of 1924

The year 1924 had a very even distribution of seasonal rainfall although the total was not large. Generally speaking, the sorghum crop made an un-

interrupted progress until mature and was harvested in good condition during the dry harvest season of October and November. Having a good supply of soil moisture at hand on the planting date and a moderate amount of seasonal rainfall well distributed, permitted a yield of both grain and forage considerably better than the average. The majority of varieties produced their highest grain-yield when planted in 3½-foot rows. There were four exceptions, however, noted, Yellow Straight Neck, Dwarf Blackhull Kafir, Reed Kafir and Hegari. These were all late-maturing varieties which required 140 days or more to mature during the long-growing season of 1924. The most productive varieties in grain-yield for this year were the milos followed closely by Desert Bishop, Spur Feterita, Darso, and Dawn Kafir. All of these varieties showed markedly increased yields in 3½-foot rows over the double width spacing.

The height attained by the dwarf grain-producing varieties was no greater than the average, but the forage varieties grew somewhat taller than usual and made exceptionally large total yields. African Millet, Sumac Sorgo, and Mexican Desert Sorgo produced the greatest total yields in 1924, being followed closely by Milos, Dawn Kafir, Hegari, and Shrock.

Season of 1925

The sorghum growing season of 1925 opened with the driest soil conditions on record, having been preceeded by nine months of drouth during which the total rainfall received amounted to but 4.54 inches, an average of about one-half inch monthly. During this year all varieties excepting minor and unproductive kinds produced the highest grain yield when planted in 7-foot rows. Complete failures in grain production were recorded by two varieties, the African Millet and Black Amber. New failures were made by more than half of the better grain-producing varieties, spaced in 3½-foot rows, but fair yields were produced from the wide-spaced plantings. The highest grain yields were made by Yellow Straight Neck, the Milos, Darso, and Spur Feterita, followed in order by Standard Feterita and Dawn Kafir.

Highest total yields were recorded in 1925 from Yellow Straight Neck, Red Kafir, Standard Yellow Milo and Spur Feterita, being followed in importance by the Sunrise Kafir, Reed Kafir, Darso and the other varieties of milo. Although a fairly long-growing season occurred this year many of the varieties ripened early due to the lack of moisture supply, the height of growth was in general about equal to the five-year average.

Season of 1926

Although excessive rains occurred during May and June, 1926, much of this was lost by surface runoff and only a fair store of moisture was available in the soil at the beginning of the sorghum growing season. Favorable planting season resulted in a somewhat larger number of stalks per hill than was produced the previous year and the rapid early growth resulted in a serious setback due to the almost complete lack of effective rains during July, August, September, and October. All varieties produced average yields of grain when planted in 7-foot rows except Darso but more than the varieties were a complete grain failure in the narrow spacing. The highest grain yielding varieties this year were the J. K. M. Hybrid, Dwarf Yellow Milo, Desert Bishop, and Spur Feterita, followed in order by the other varieties of Milo, Yellow Straight Neck, Sunrise, Reed and Dawn Kafirs.

The total yields were considerably below the five-year average in 1926, the highest being made by Red Kafir, African Millet, J. K. M. Hybrid, Standard Yellow Milo and Shrock, followed by the other varieties of kafir and milo. A measure of the height was not obtained this year excepting on two varieties of kafir, which indicated that considerably less than average height was the result of the mid-season drouth. This setback in the seasonal progress also

brought about a somewhat later maturity than usual, several of the varieties holding out until the frost of October 24.

Season of 1927

The growing season of 1927 began with somewhat less than an average amount of soil moisture present but was followed by excessive arins in July and August with a normal amount in September. This combination of unfavorable initial soil moisture conditions and favorable subsequent rainfall resulted in very nearly equal yields in the wide and narrow spaced plantings. The principal varieties to take advantage of the plentiful seasonal moisture were the earlier maturing kinds such as milo and feterita. These varieties showed a wider difference in yield from spacing than most of the others. All varieties produced a higher grain yield this year in the narrow spacing excepting Shrock, Reed Kafir, Sumac Sorgo and African Millet. The highest grain yields were made by Improved Dwarf Yellow Milo, Hegari and other varieties of milo, being followed in order by Black Amber, Desert Bishop, Clubhead Sorgo, and Mexican Desert Sorgo.

Total yields were almost without exception well above the average this year, the greatest being made by Sunrise Kafir, African Millet, Dwarf Blackhull Kafir, Sumac Sorgo, Mexican Desert Sorgo and Shrock. There was not as much difference in total yield between the high and low ranking varieties in 1927 as is usually observed. The uninterrupted progress of the crop resulted in a considerably taller growth than usual although the time of maturity was shorter than that shown by a five-year average. The number of stalks per hill was slightly above the average.

Season of 1928

A very small quantity of soil moisture was carried over during the winter of 1927-'28, but a heavy well-distributed rainfall during April and May provided an ample supply of soil moisture for the beginning of the sorghum growing season this year. The rainfall of the remainder of the summer and fall was about normal with the exception of September, but generally speaking, proved to be satisfactory for the closer spacings. All varieties made higher grain yields in close spacing excepting the Improved Dwarf Yellow Milos, Reed Kafir, Sumac Sorgo and African Millet. The highest grain-yields were recorded by Dwarf Blackhull Kafir, Hegari, J. K. M. Hybrid, Shrock, Dawn Kafir, and Yellow Milo, being followed closely by Mexican Desert Sorgo, Darso, Standard Feterita, Dwarf Yellow Milo, Yellow Straight Neck, Spur Feterita, and Reed Kafir.

Total yields this year were practically average, the highest being made by Shrock, African Millet, Mexican Desert Sorgo, Darso, Sumac Sorgo, Dawn Kafir, Dwarf Blackhull Kafir, J. K. M. Hybrid, Hegari, and Yellow Straight Neck. The heights attained were in some cases greater than the average but others were about normal. The length of season was somewhat shorter than usual due to late planting and early frost but good maturity was obtained on all varieties this year. The number of stalks per hill was somewhat greater in those varieties which tend to stool freely but was about equal to the average in most cases.

FAVORABLE SPACING FOR GRAIN PRODUCTION

A study of the five-year average results given in Table No. 6 showed a more or less definite tendency of the varieties to show adaptation for either wide or narrow spacing. The milos as a group show nearly equal results in grain yield from the two spacings. The same is true of Sour Feterita, Desert Bishop, Dawn Kafir, Clubhead Sorgo ad a number of the minor grain-

producing varieties, but a very marked preference for wide spacing is shown by Yellow Straight Neck, Dwarf Blackhull Kafir, and Reed Kafir. If these later maturing varieties are grown for grain production alone a definite program of wide planting could profitably be adopted. In the case of early maturing and more highly productive varieties the practice of varying the planting rate according to soil moisture indications is undoubtedly more feasable. (1) When a high total yield is desired to be used for roughage or silage purposes, the close spacing should always be used.

Choice of Varieties

The choice of variety will always depend upon the size and dependability of yield obtained and the quality of the product, bearing in mind the use to which it will be put. Several varieties possess high yielding capacity coupled with undesirable physical characteristics and particular varieties exhibit singularity of reaction to certain conditions which makes it necessary to be taken into account when used. There is not a great deal of choice permitted in picking a high grain producing variety since the high yielding group consists principally of the milos and milo related hybrids.

A much wider range of choice is possible in choosing a variety suitable for fodder production. Although forage production has usually been considered to be the exclusive field of the sweet sorghum group, the results obtained at Goodwell indicate that the kafirs as a group offer practically equal advantages both as to quantity of yield and quality of forage. (2).

(1) Oklahoma Bulletin Number 192. Initial Soil Moisture and Crop Yield.
(2) Panhandle Bulletin Number 3. Kafirs as Forage Sorghums.

DATES OF PLANTING GRAIN SORGHUMS

This division of the study began with seven representative grain-producing varieties and has had others added as the newer varieties became available. Only the grain yield is beign reported since it is the grain-yielding response to time of planting with which this question is mainly concerned.

No attempt has been made in the field work to plant on designated dates but the successive plantings have fallen into groups representing seasonal periods. From time to time drouth or excessive moisture has prevented certain plantings from being made. No plantings were made when the soil was too dry to germinate the seed. This was the case in April 1925, both April and May 1927 and April 1928. No plantings were made when the fields were kept muddy for extended periods by excessive rains. Occasions of this kind occurred the latter part of June 1926, July 1927, and the early part of June 1928.

The ommitted plantings gives the data of Tables 14 and 15 a rather incomplete appearance but the experiences of these five years represent very accurately the conditions as they exist.

In 1925, 1927, and 1928 the date of planting tests were planted in the same series with the main variety test and the yields are directly comparable. In 1924 and 1926 the plots used were prepared by different preceeding crops and methods of culture. The tests of 1924 were on particularly exhausted soil which combined with a low seasonal rainfall resulted in the complete failure of the 3½-foot row plantings. The general variety test in 1924 was on a better prepared plot and gave good yields from the close spacing.

A portion of the July planting of 1928 was lost due to the inroads of stray livestock although a good stand was secured at that time. All seeds used in these tests were tested for germination and required to give 80% or better, but no allowance has been made for irregular stands since the occurrence of adverse seedbed conditions is accepted as one of the hazards of untimely planting.

Table 14 gives the grain yields from all dates of planting of both wide and narrow spacing for the five-year period. In Table No. 15 an attempt has been made to equalize the values for averaging irregular groups of years by expressing the yield in percentage of the annual group mean. The actual date variety average indicates the most favorable planting period for each variety, Table No. 16, but does not take into account the fact that certain dates had unfavorable planting conditions which made it impossible to utilize the period represented each year. The latter part of Table No. 16 shows the five-year average counting the unfavorable planting periods the same as failures. This gives the best measure of the all-'round dependability of varieties when planted at different dates.

Milo and Desert Bishop show the greatest range of adaptability of all varieties. The results with Milo indicate a strong preference for planting about June 20 with little difference shown between the next best dates, early June and early July. Desert Bishop shows a slight preference for May and early June planting over June 20. It is not so well adapted to extremely early or late planting as the Milo. This shift in planting date preference is just about equal to the difference in time required for maturity of these two crops. The Milo matured in 103 days while Desert Bishop required 114. Desert Bishop is a Milo related hybrid and is similar in all growth habits to the Milo excepting time of maturity.

The results from Darso indicate its particular adaptation to early planting with the maximum yields obtained from April plantings, although early June gave the best average.

Late June plantings of Darso did not yield as well as extremely early plantings and it fell very low in July. Yellow Straight Neck showed about the same reaction to planting dates as Darso but with less difference between May and early June dates.

Feterita indicated a rather strong preference for early June planting with late June as second choice. Both extremely early and late plantings were unsatisfactory for Feterita.

Dawn Kafir, Pink Kafir and Hegari showed similar reactions to dates of planting with general preference for June planting. None of these varieties were successful when planted as late as the first of July.

In the light of these results it is evident that the main variety test which has been planted from June 6 to June 23, while it represents the optimum period for the majority of the group, discriminates seriously against such varieties as Darso and Yellow Straight Neck which seem to be capable of doing their best only when planted early. On the other hand the fact that early planting is not always possible prevents advantage being taken of these varieties every year.

There are many reasons why June planting is preferred to earlier dates. The uncertainty of weather conditions makes definite planning of April planting impracticable for nearly all varieties. Planting in May has produced less than either planting in April or June. The reason for this depression is not clearly understood. Late planting posseses the advantages of a shorter row cultivation period and the assurance of more uniform stands especially of the white seeded varieties..

Conclusions cannot be drawn from the date of planting results except to say that they point out possibilities of the adaptation of certain varieties to extreme planting dates which must be further investigated. More varieties are adapted to June planting than any other period. The variation between the varieties used was less during this planting period than any other and the average yield for the entire group was highest. One handicap which is experienced by the white seeded varieties when matured earlier than is common in a locality is their attraction for birds. Many of the brown and yellow seeds escape bird injury where there are white seeded varieties present in the same locality. In the present experiments, however, particular care has been

Table No. 14—Grain Yields from Date of Planting Tests, 1924-1928, Wide and Narrow Spacing Expressed in Pounds per Acre

Variety Year	April 21 to April 30		May 9 to May 22		June 3 to June 15		June 20 to June 23		July 1 to July 10	
	3½'	7'	3½'	7'	3½'	7'	3½'	7'	3½'	7'
1924										
Yellow Milo	0	517	0	423	0	432	0	634	0	385
Darso	0	1067	0	493	0	597	0	902	0	0
Pink Kafir	0	620	0	550	0	832	0	728	0	0
Dawn Kafir	0	644	0	517	0	376	0	738	0	0
Hegari	0	315	0	244	0	611	0	329	0	0
Feterita	0	446	0	517	0	409	0	338	0	0
Desert Bishop	0	338	0	728	0	564	0	550	0	0
1925										
Yellow Milo	Dry		260	220	222	408	222	360	273	240
Darso			141	288	101	1032	17	18	0	0
Pink Kafir			158	336	50	158	34	34	0	0
Dawn Kafir			67	124	33	384	138	163	0	0
Hegari			0	0	84	158	168	34	91	17
Feterita			0	0	280	527	175	252	0	17
Desert Bishop			83	69	107	442	224	208	73	76
1926										
Yellow Milo	352	282	158	212	158	158	Wet		229	123
Darso	846	758	255	617	299	511			0	0
Pink Kafir	176	379	0	212	158	423			176	141
Dawn Kafir	71	211	35	424	264	511			0	0
Hegari	88	106	114	176	229	396			0	0
Feterita	264	370	264	299	546	405			0	0
Desert Bishop	158	388	810	687	723	528			520	318
Yellow Str. Neck	617	652	617	617	617	617			0	0
1927										
Yellow Milo	Dry		Dry		1125	826	1280	803	Wet	
Darso					447	450	280	224		
Pink Kafir					484	574	736	496		
Dawn Kafir					480	562	496	483		
Hegari					1012	743	1328	1008		
Feterita					267	253	728	360		
Desert Bishop					934	545	992	570		
Yellow Str. Neck					1007	647	624	520		
Beaver Milo					1158	714	1216	704		
1928										
Yellow Milo	Dry		418	124	Wet		1149	703	1069	---
Darso			1379	232			1159	1026	---	---
Pink Kafir			821	155			896	881	---	---
Dawn Kafir			1007	248			1206	840	---	---
Hegari			666	77			1345	680	---	---
Feterita			155	0			1113	742	---	---
Desert Bishop			1100	573			989	973	545	---
Yellow Str. Neck			806	310			1113	742	---	---
Beaver Milo			403	170			898	891	601	---

Table No. 15—Grain Yields from Date of Planting Tests, 1924-1928, Expressed in Percentage of Annual Group Mean

Variety Year	April 21 to April 30		May 9 to May 22		June 3 to June 15		June 20 to June 23		July 1 to July 10	
	3½'	7'	3½'	7'	3½'	7'	3½'	7'	3½'	7'
1924										
Yellow Milo	0	228	0	186	0	190	0	280	0	170
Darso	0	471	0	217	0	263	0	398	0	0
Pink Kafir	0	274	0	243	0	367	0	321	0	0
Dawn Kafir	0	284	0	228	0	166	0	326	0	0
Hegari	0	139	0	107	0	269	0	145	0	0
Feterita	0	197	0	228	0	180	0	149	0	0
Desert Bishop	0	149	0	321	0	249	0	243	0	0
1925										
Yellow Milo	Dry		169	143	145	266	145	235	178	156
Darso			92	188	66	674	11	11	0	0
Pink Kafir			103	219	32	103	21	21	0	0
Dawn Kafir			44	81	21	250	90	106	0	0
Hegari			0	0	54	103	109	21	59	11
Feterita			0	0	183	344	114	164	0	11
Desert Bishop			54	45	69	288	146	135	47	49
1926										
Yellow Milo	116	93	52	70	52	52	Wet		58	46
Darso	281	251	85	204	99	169			76	40
Pink Kafir	58	125	0	70	52	140			0	0
Dawn Kafir	23	70	11	140	87	169			0	0
Hegari	29	35	37	58	76	131			0	0
Feterita	87	122	87	99	181	134			0	0
Desert Bishop	52	128	269	228	240	175			172	105
Yellow Str. Neck	204	216	204	204	204	204			0	0
1927										
Yellow Milo	Dry		Dry		161	118	183	115	Wet	
Darso					64	64	40	32		
Pink Kafir					69	82	105	71		
Dawn Kafir					68	80	71	69		
Hegari					145	106	190	144		
Feterita					38	36	104	37		
Desert Bishop					134	78	142	81		
Yellow Str. Neck					144	92	89	74		
Beaver Milo					166	102	174	101		
1928										
Yellow Milo	Dry		80	23	Wet		219	134	204	---
Darso			264	44			221	196	---	---
Pink Kafir			157	29			171	168	---	---
Dawn Kafir			192	46			230	160	---	---
Hegari			127	14			257	130	---	---
Feterita			29	0			213	142	---	---
Desert Bishop			210	109			189	186	104	---
Yellow Str. Neck			154	59			213	142	---	---
Beaver Milo			77	32			171	170	115	---

taken to prevent as much damage from birds as possible and careful estimate has been made of that which proved to be unavoidable. It should be pointed out that this hazard is one which would be experienced by farmers in general as well as by the experiment station if early planting were adopted. A special study is being instituted to determine the feasability of exploiting the peculiar planting time adaptations of such varieties as the Darso and Yellow Straight Neck.

Table No. 16—Date Variety and Five-Year Averages of Yields Expressed in Percentage of Annual Group Means*, 1924-1928

Date Variety Average	April 21 to 30	May 9 to 22	June 3 to 15	June 20 to 23	July 1 to 10	Variety Average
Milo	109	90	124	164	117	120.8
Darso	250	136	174	113	19	138.4
Pink Kafir	114	102	105	109	0	86.0
Dawn Kafir	94	92	105	131	0	84.4
Hegari	50	43	110	124	12	67.8
Feterita	101	55	136	115	2	81.8
Desert Bishop	107	154	154	140	66	124.2
Yellow Str. N.	210	155	161	129	0	131.0
Group Average	128	103	133	123	24	
Five-Year Average						
Milo	43.7	72.3	98.4	131.1	90.5	87.2
Darso	100.3	109.4	139.9	90.9	18.5	91.8
Pink Kafir	45.7	82.1	84.5	71.0	0	56.6
Dawn Kafir	37.7	74.2	84.1	105.2	0	60.2
Hegari	30.3	34.3	88.4	99.6	8.7	52.2
Feterita	40.6	44.3	109.6	92.3	1.2	57.6
Desert Bishop	32.9	123.6	123.3	112.2	51.5	88.7
Yel. Str. Neck	70.0	103.4	107.3	86.3	0	73.4
Group Average	51.2	80.4	104.4	98.5	21.3	

*The annual group mean is the average of all varieties and spacings for all the dates planted during the year The indiivdual date variety values are the mean of two spacings.

CULTURE OF THE SORGHUMS

Seed Selection

Mass field selection of sorghum seeds is necessary if purity of variety is to be maintained in a locality where many different varieties are grown. It is also possible to secure a better germination and greater seedling vigor if hand-picking is practiced, but the possibilities of improving the inherent productivity are very limited.

Most fields of ordinary country-run seed contain what might be termed a mixed population of the particular variety in that it is composed of numerous families or strains which have for many generations inter-crossed with each other. Hybrid progeny partaking of the general characteristics of the variety in hand also creep into the mixed population unobserved. It is possible to obtain from such a field different strains with more or less marked differences in certain plant characters, but so much information is lacking on the meaning of these variations as related to yielding power that it would seem presumptious to attempt to outline detailed instructions on what to select for increased production.

A moderately fruitful method of obtaining superior varieties is the selection test wherein large numbers of parent-plants are tested for high yield and the more productive ones used to establish pure lines regardless of plant characteristics. The results obtained in this way depend largely on the accident of fortune which may or may not afford an outstanding strain in the group studied. Selection testing is not creative but is merely a search for the best which already exists though it is often but little better than the average.

A better although more difficult method is that of combining varieties with several strong points in common, but which have one or more undesirable characteristics on one side to eliminate, through hybridization. Successful crossing to obtain a specific aim requires not only a full knowledge of the material in hand but years of patient endeavor.

The producer of sorghums can gain most immediately by the wise choice of varieties already established and tested for a term of years. Productivity can be maintained at a high level by reasonable precautions to preserve purity.

Seed Treatment

The sorghums are susceptible to attacks from numerous bacterial and fungous diseases. Kernel smut is probably the most common and also the most easily controlled. The greatest losses from this disease usually occur among the varieties of kafir and sorgo, although recently forms of this disease have been discovered which attack varieties hitherto thought to be immune. The spores which produce kernel smut are carried upon the seed and the disease may be effectively controlled by the use of appropriate disinfectants.

Head smut is less prevalent in the Panhandle area and is rarely observed to have done much damage to sorghum crops. It is recognized by the formation of smut balls somewhat similar to common corn smut which usually consumes the entire head, destroying the spikelet structure. The spores of this disease remain in the soil and attack the plant regardless of seed treatments which may be applied.

All varieties of sorghum seeds are subject to the attack of a miscellaneous group of organisms in the seedbed prior to the completion of the germination period which may result in the decay of the seed and a partial or complete loss of stand. Serious loss from the rotting of seed in the soil ordinarily does not occur when germination conditions are favorable, but low temperature and excessive moisture sometimes delay germination so that unsatisfactory stands result. The varieties suffering the greatest loss of stand from unfavorable seedbed conditions are, generally speaking, the white seeded kinds including Feetrita, Hegari, Bishop and White Kafirs. A portion of this loss may be prevented by the use of proper seed disinfectants. Treating the seed to save the stand is practicable for early plantings of the varieties named but usually does not give marked increases of stand late in the planting season when seedbed conditions are favorable.

Dust treatments are preferred for sorghums. A number of effective kinds are now on the market and most of those which use copper carbonate or an organic mercury compound as an active principle have proved effective both for controlling kernel smut and protecting the germination of seed from adverse soil conditions.

Soil Preparation

The factors entering into the state of preparation for a crop may roughly be classified under the heads of previous cropping and culture. The previous crop has very much to do with the fertility condition and should always be taken into consideration in laying out the crop plans. Unsatisfactory yields are often obtained during most favorable moisture conditions due to the

exhaustion of available plant food and the presence of undecayed crop residues. Sorghum follows another sorghum crop ordinarily with poorer yields than when it follows a small grain. The principal reason for this is that more time has been allowed between small grain harvest and sorghum planting time in which soil recovery may take place. Available plant food accumulates more rapidly when the topsoil is warm, moist, and undisturbed. The depleting effect of a previous crop is due to the exhaustion not only of available fertility but also of available moisture and the most unproductive condition of the soil exists immediately following the harvest of a small grain or sorghum crop.

Cultural methods used in the preparation of the land for the next crop must be planned with the view of restoring a satisfactory fertility and moisture condition as soon as possible and with the least labor possible.

It is desirable to secure the rapid decay of straw and stalks which may be left as residues from the previous crop so preparation can often very well begin in the fall. Little is gained, however, from plowing or listing to cover residues in the fall unless considerable topsoil moisture is present since the winter season cannot be relied upon to supply enough moisture to start the rotting of residues. Moisture used in promoting the decay of residues during the fall may be considered well spent. As the planting season approaches, however, the choice and timing of operations must take into consideration the effects that will be felt in the accummulation of moisture for the use of the oncoming crop. Deep tillage immediately preceeding the planting time is likely to be wasteful of moisture present in the top-soil. Cultural operations during the spring season should be designed primarily to effectively control weeds with as shallow tillage as possible.

Time of Planting

Time of planting is concerned with the use to be made of the crop and the adaptation of the variety used. Such varieties as Milo and Desert Bishop do fairly well under a long range of planting dates but most of the early maturing grain producing varieties make most efficient use of the entire moisture season when planted at a moderately late date.

Varieties grown for forage alone may easily produce a second cutting if planted early. This method is less practical when the crop is bound than when hay-making methods are used and immature cutting desired.

The late planting of grain producing varieties has the advantage of shortening the period of row cultivation, insuring uniform stands and slightly increasing the moisture using efficiency of the crop. In the case of late planting it is highly important that thorough weed control be practiced during the spring preparatory period.

Method of Planting

Lister planting perhaps combines more advantages than any other method. Medium to shallow listing, however, is advised especially for early plantings because of the slow growth usually observed in deep furrows. When deep listing is used the seedling has to overcome both low temperature and infertile soil conditions during a period of growth in which it is least able to compete with weeds which will have started at the same time on the warm fertile sides and tops of the lister ridges.

By a careful husbanding of the middle soil in the cultivation which follows planting plenty of soil will usually be available for covering young weeds in the drill rows. For forage production close spacing is uniformly preferred with the better adapted varieties. When grain production is the primary object, the record of the variety used should be consulted and the most productive spacing adopted. The milos are an exception to this rule in that a variation of spacing determined by the initial soil moisture better enables

the crop to withstand extreme moisture shortage or make the most of an especially favorable moisture accummulation. An examination of the moisture condition at planting time can well determine the spacing of milos which should be wide if soil moisture is low. Wide spacing can be accomplished either by the use of double-width rows or thin planting in regular rows with the same net results of moisture utilization.

Cultivation

Since the fewest and least costly cultivations whereby weeds can be effectively controlled after the crop is on the ground will return the greatest profit from the operations the timing and method of cultivation is highly important. When cultivation is neglected the effort required later to secure the same result is often multiplied and the waste of moisture and plant food is greatly increased. The memory of experiences in which a portion of a field received timely cultivation and another portion of the same field was neglected should be sufficient to make every farmer realize the primary importance of timeliness. In regard to the type or style of implement used there is perhaps the greatest controversy and all to the least purpose. There is no such thing as a best implement for all times and kinds of work. A diversification of implements is fully as desirable as is a diversification of farm enterprises because the efficiency of an operation very frequently depends upon a change of implements. For each operation the implement should be chosen which will kill weeds most effectively and at the time require the least power and man labor. Disc machines handle hard or trashy ground to the best advantage. Tooth, shovel or sweep implements work best on loose or clean land. If the weeds are completely controlled further cultivation is apt to prove more of a detriment than an advantage.

Harvesting

More thought is being given at this time to improved methods of harvesting the grain sorghums than any other phase of sorghum production. In the high plains region where the combine, harvest-thresher, is more commonly used, methods enabling this machine to be used for sorghum as well as small grain are especially important. In the kafir growing districts the mechanical difficulties can be easily overcome. The greatest impediment is the unfavorable field-curing conditions. In the less humid areas of higher altitude where field-curing conditions are more favorable, the varieties adapted to highest grain yield belong to the milo group. The goose-neck characteristic of milo presents a rather formidable mechanical difficulty solution of which is being attempted by the development of sturdy straight-necked varieties.

Six varieties of hybrid origin have been included in the variety tests at the Panhandle station for a period of four years. None of these has compared favorably with the common Dwarf Yellow Milo in grain-yield under diverse seasonal conditions. Two varieties have approached the milo yield where special methods favorable to the particular varietal characteristics have been used but both have defects capable of improvement. There is no question but that combined harvesting is practicable from the climatic standpoint in the high plains region and the harvesting problems for the moment resolve themselves largely into a search for high yielding, straight-neck, lodge resisting varieties. Harvesting by livestock is a method which deserves greater usage, but better fencing facilities are necessary before it can be generally adopted.