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THE SORGHUMS FOR DRY-FARMING IN SOUTHERN ARIZONA.

The sorghums, including common or sweet sorghum, milo maize, kafir corn, and broom corn have become standard crops in the dry-farming regions of the Great Plains area. The sorghums afford more forage than any other genus of plants under the climatic conditions that prevail in these regions; and the nonsaccharine varieties can be depended upon for a yield of grain almost equal in feeding value to corn, under conditions of drouth and heat that reduce the yield of corn to little or nothing. All the sorghums are very drouth resistant and have the advantageous habit of rolling up their leaves during comparatively long seasons without rain, becoming partly dormant, and then beginning to grow again with recurrence of rainfall. This is especially true of kafir corn and milo, which have been known in western Kansas to stand seasons sixty days or more in length without rain and then make fairly good crops of grain on one or two good rains following the drouth.

The rainfall of southern Arizona differs from that of the Great Plains region where sorghums have been tested more thoroughly for dry-farming, in that here the greatest amount of precipitation occurs during the growing months of July and August, while there those months are the ones most likely to be deficient in rainfall. In southern Arizona we have two seasons of rainfall, one during the summer months, in which the precipitation occurs in local and often violent showers, and another during the winter months in which the precipitation is less violent but more general. The summer season begins in July and extends through July and August, sometimes being carried over into September and October. The winter rains occur during the months of December, January and February, and sometimes March. The months of March, April, May and June are nearly always dry, and the latter three are also hot. The months of October and November are also nearly always dry.

Averages covering more than thirty years show that about two-thirds of our annual precipitation occurs during the summer rainy season, and about one-third during the winter season. During the time covered by experiments in Sulphur Springs Valley a much greater proportion of the total precipitation has occurred during the summer season. In fact, the winter precipitation has not been sufficient to have any effect upon crop production and may be disregarded in considering our experimental results in dry farming in this valley. The summer rainfall, expressed in inches, has been as follows:

Year	June	July	August	September	October	Total
1909	0 00	2.70	3 92	0 41	0.12	7.24
1910	0 46	1.92	8 33	0.00	0.00	10 71
1911	0.94	3 13	1 73	3.25	2.04	11.09

Killing frosts usually occur during the first or second week in October

Varieties of sweet sorghums: Among the varieties of sweet sorghums grown in the United States are Amber, Sumac, Orange, Planter, Gooseneck, Honey, and Sapling Of these Sumac is recommended for the southern part of the sorghum growing region because of its larger yield of more leafy tohage; while Amber is advised for the northern part because of its early maturing habit We have tried only the Amber, or Early Amber as it is commonly called, under dry-farming conditions in Arizona. It is the only variety of sweet sorghum which has a growing season short enough to warrant any hope of success by purely dry-farming methods, although Sumac might succeed where supplementary water can be obtained to bring crops up three to four weeks before the rainy season begins.

Culture: The seed may be sown at any convenient time preceding the rainy season and it will lie in the ground unharmed until the rains penetrate to it when it will sprout and come up. It should not be covered too deeply, however, about two and one-half inches being the proper depth. It should be planted in rows and cultivated after every rain during the growing season, if possible. If sown thickly enough in this manner, the stalks will be so small as to produce a pretty good quality of hay. The seed may be sown with a press drill with some of the holes stopped up, leaving holes open at the proper intervals; or it may be sown with an ordinary corn drill, using a blank plate in which smaller and more numerous holes are drilled than in regular corn plates; or, it may be sown in the bottom of lister furrows, either by hand or by means of the corn drill. We have tested planting in the bottom of lister furrows with a corn drill more thoroughly than any other method. With our best results the planter plate contained twenty holes three-eighths of an inch in diameter and dropped from 16 to 24 pounds of seed

Crop	Year	Date planted	Date up	Rate of seeding, pounds per acre	Method of seeding	Stand
Early Amber sorghum	1909	July 4	July 10	24	Lister	Good
" " "	1909	July 4	July 10	24	"	Good
" " "	1910	June 10	July 27	7	"	Good
" " "	1910	June 10	July 27	7	"	Medium
" " "	1910	June 15	July 27	16	"	Good
" " "	1911	June 10	June 15	15	"	Good
" " "	1909	July 15	July 27	38	Broadcast	Good
Milo maize, standard	1909	July 4	July 10	32	Lister	Good
" " "	1909	July 4	July 10	32	"	Good
Milo maize, Dwarf	1910	June 15	July 27	10½	"	Very poor
" " "	1911	June 14	June 19	8	Press drill	Good
" " "	1910	June 10	June 15	12	Lister	Good
" " "	1910	June 10	June 15	16	"	Good
" " "	1911	June 11	June 16	20	"	Good
" " "	1911	June 11	June 16	25	"	Good

Amount of thinning	Amount of irrigation and when applied	Previous crops or treatment of soil	Date harvested or killed by frost	Length in days of growing season	Available rainfall during whole year	Yield in pounds per acre	
						Total crop	Grain
None	None	Cropped 2 yrs.	Oct. 7	90	7.9 in	3528	None
To stalks 12 in. apart.	None	Cropped 2 yrs.	Oct. 7	90	7.9 in	3056	286
None	None	Cropped 2 yrs. and fallowed 1 yr	Oct. 8	73	10.07 in	5120	None
None	None	Cropped 3 yrs.	Oct. 8	73	10.07 in	2520	None
None	Some flooding from rains	Fallowed 1 year	Oct. 3	66	10.07 in	6556	None
None	3½ inches in Feb. and 1¼ in. in Aug.	Cropped 2 yrs.	Oct. 8	114	11.32 in	6680	340
None	None	Native prairie thin sod.	Oct. 8	73	7.9 in	1000	None
¾ of stalks thinned out.	None	Cropped 2 yrs	Oct. 7	90	7.9 in	4780	240
To stalks 12 inches apart	None	Cropped 2 yrs.	Oct. 7	90	7.9 in	2760	270
None	None	Cropped 3 yrs.	Oct. 8	73	10.07 in	1880	None
To stalks 6 in. apart	None	Cropped 1 year and fallowed 1 yr	Oct. 17	123	11.32 in	4285	1675
To stalks 6 in. apart	4 inches during winter	Cropped 1 year	Oct. 8	114	10.07 in	5220	2808*
To stalks 6 in. apart	4 inches during winter	Cropped 1 year	Oct. 8	114	10.07 in	2792	1160*
To stalks 6 in. apart	3½ inches in Jan. and 3 in. in Aug.	Cropped 2 yrs.	Oct. 17	126	11.32 in	5050	2000
To stalks 6 in. apart	3½ inches in Jan. and 1⅓ in. in Aug.	Cropped 2 yrs.	Oct. 17	126	11.32 in	3865	1340

* Estimated.

to the acre, depending upon the cleanness of the seed. The writer would not recommend more than sixteen pounds to the acre and would suggest that twenty holes be bored in the blank plate, each five-sixteenths of an inch in diameter. A plate was filled with the holes one-fourth of an inch in diameter, but it did not plant quite thickly enough, especially when the seed was not thoroughly clean. Sowing broadcast did not give as good results as by seeding in furrows and cultivating, either on the Station dry farm in Sulphur Springs Valley, or on the farms of neighbors. The crop should be cultivated shallow with any convenient implement, after every rain if possible, and at least four times during the season. We have used the John Deere two horse walking cultivator and the Planet Junior 14 tooth harrow. The larger cultivator is better where the ground is liable to bake after heavy rains, but the 14 tooth harrow gives good results in mellow land not too weedy. In harvesting, the crop is cut and made into small bundles which are shocked and allowed to stand three or four weeks, when the hay may be baled or fed at the convenience of the grower.

Varieties of kafir corn and milo maize: Of the nonsaccharine or grain-sorghums, we have tested red kafir corn, black hulled white kafir corn, standard milo maize and dwarf milo maize, on the Sulphur Springs Valley dry farm. The summers are too short for kafir corn to mature by purely dry farming methods and, after two years, experiments with it were discontinued. The experiments with milo maize, however, were more successful and this crop will probably become a standard grain crop for the dry farming regions of the State. The rainy season averages long enough to mature fairly good crops of forage, milo maize outyielding sorghum in this respect when grown under similar conditions; while there is always a considerable amount of grain which may be more or less immature according to the length of the growing season. *Dwarf milo maize* has proven better than the standard because it produces a greater proportion of grain to forage and it will also grow low enough in Sulphur Springs Valley to allow cutting with the header.

Culture of milo maize: Milo maize is seeded in the same manner as sorghum, except that where grain is wanted it should be sown thinner. The best results, by purely dry farming methods in Sulphur Springs Valley, were obtained by seeding with a press drill at the rate of 8 pounds per acre. The stand, however, was considered too thick and the plot was thinned to one stalk every six inches. This then stooled out until it averaged three stalks in each place. Six pounds per acre should be an abundance of seed under our conditions. We have u nally seeded too thickly in order to insure a stand, and have then thinned to the desired stand. One stalk every six inches is about right and this can be secured by seeding six pounds to the acre. For forage, one stalk

every two inches will give best results. We have obtained a good crop of forage with the lister method of seeding but extra care should be taken not to cover the seed too deeply in the bottom of the furrow, as a violent rain may wash dirt into the furrows covering the seed so deeply as to ruin the stand. One and a half inches will be deep enough to cover the seeds, when planted by this method.

Supplementary irrigation: Milo maize should have an uninterrupted growing season of at least 105 days to mature seed in Sulphur Springs Valley. As the season will often not be as long as this, on account of late rains, the crop can be made much more certain by using a sufficient amount of irrigating water to bring the plants up about June 15, and maintain them until the rains begin. The field should be irrigated for this purpose before planting, and the best method of applying the water is in furrows, plowing in the furrows and harrowing thoroughly afterwards. If the capacity of the pumping plant is small, irrigation may be begun three or four months before planting and if about four inches deep of water is applied to the land, and the ground thoroughly harrowed to produce a dust mulch, enough of this water will be saved to bring the crops up and keep them growing until the rains begin. Should a dry season occur in the middle of the summer, two or three inches more water may be added with excellent results. In 1910 a yield of 50 bushels of milo maize an acre was obtained by adding two inches of water to the ground at intervals from December to May, and two inches during the latter part of May, the plot being planted the first week in June. In 1911, a yield of 37.5 bushels per acre was obtained by applying three and one-half inches of water in February, planting June 10 and applying three inches more of water during a drouth in the latter part of August. These results were obtained on light sandy loam. It would probably be necessary to apply somewhat more water on the heavier types of soil in Sulphur Springs Valley. This supplementary irrigation has proved extremely valuable with other crops as well as milo maize. In 1910, 732 pounds of tepary beans per acre were grown by applying four inches of water during the winter, and in 1911 an average of 775 pounds was grown by the application of three and one-half inches of water about two months before planting. We have obtained from eleven to sixteen bushels of Indian corn per acre by supplementary irrigation, applying three and one-half to four inches of water before planting; but corn is not so sure a crop as milo maize or tepary beans.

The following table of yields will indicate the possibilities of growing sorghum and milo maize by purely dry farming methods in southern Arizona and by supplementing rainfall with small quantities of water before planting.

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