

OBSERVATIONS ON SOIL CONDITIONS AND A FOOT AND ROOT-ROT DISEASE* OF DARSO DURING 1940**

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It was noted that in two fields of darso (a grain sorghum) on the Oklahoma Agricultural Experiment Station Farm at Stillwater, certain soil conditions apparently were favorable to the development of a foot- and root-rot disease during the growing season of 1940. These fields were planted on the level, under quite favorable conditions, near the end of the first week in May.

The disease was much more prevalent on areas where soil moisture was quite favorable during the growing season. It developed very early in the case of a nearly level field where darso had been grown continuously for several years. In this field, soon after the seedlings emerged, the leaves developed a purplish red color, particularly at the tips and along the edges. Afterward they took on a brown color similar to that of drought-stricken plants. The plants died later. Throughout the growing season, other plants succumbed to the attack. The symptoms could easily be mistaken as due to chinch bug injury if no close examination of the stalks were made. Some few plants either through resistance or lack of exposure to the disease survived. At the beginning of the season, the plants were thickly spaced in the row, probably not over two inches apart. No thinning was done in this field except that due to disease. At the end of the season, there was approximately one stalk of darso in every 10 feet of row. The entire root system was not killed on all of the diseased plants, as a very limited number of the original plants developed suckers though the tops had died.

In the case of darso grown in a rotation (cotton, oats, cowpeas, and darso), the disease did not show up as early in the life of the sorghum. However, it became very severe on some of the plots when the darso was about 10 to 16 inches high. With these larger plants, the first observations showed the leaves to have a scorched appearance beginning with the top leaves and progressing downward. The plants lingered for probably 10 days to two weeks before death ensued. Other plants were destroyed throughout the entire growing season. In some instances the plants reached the boot or head stage before being stricken. The first plants to indicate the presence of the disease were (1) on some lower upland which had ideal moisture content and was in a high state of fertility, and (2) on somewhat more sloping land which had received limestone once every four year since the start of this fertility experiment in 1916.

The soil in each field is classified as Kirkland loam to silt loam and is in a fair to good state of fertility. Table I shows a summary of conditions.

The disease was more generally prevalent in the rotation field where limestone had previously been applied. The limed plots could be readily picked out in the field by their disease injury. Plots which have yielded well in previous years showed greater injury than the check or non-fertilized plots. The plots which had received manure were badly infected. Since

* At present the identity of the specific disease or diseases has not been definitely established.

** A contribution from the Oklahoma Agricultural Experiment Station.

TABLE I.

Soil conditions and their influence on the prevalence and the effect of disease in darso

Treatment	Topography	Soil moisture conditions in early growth stages	pH range	Stand injury ¹	Yield per acre
Continuous darso	"Level"	High optimum	5.7-5.9	%	lbs.
Rotation	Low upland	High optimum	5.8-6.1	90	Nil
	at lower end of slope			60-75 ²	2640 ³
Untreated	Slight slope	Optimum	5.7-6.5	0-10 ³	5018
Limed only	Slight slope	Optimum	7.7	Uniformly high over entire plot	2120 ⁴
Lime plus other fertilizers	Slight slope	Optimum	6.9-8.0	17-80 ⁵	3487
Unlimed plus other fertilizers	Slight slope	Optimum	5.4-6.1	2-30 ⁶	4585

¹ Estimates made on July 15, 1940.

² This yield is largely from the higher part of the three plots. Practically no darso survived on the lower portions. At no time, however, was there a great excess of moisture that would cause drowning.

³ Average of nine plots=3.4%.

⁴ The adjoining check plot yielded 4760 pounds. The average yield of the two closest check plots was 5100 pounds.

⁵ Average of eleven plots=44%.

⁶ This includes four plots, one of which was manured and showed approximately 30 percent stand injury and yielded only 2900 pounds.

all except one of the manured plots had either received limestone or been influenced by the moisture factor, the exact effect of manure could not be determined. However, the one manured plot thought to be comparable yielded only 2900 pounds of total air-dry product while a nearby untreated plot yielded 6060 pounds. The plot that was treated with limestone alone had the lowest yield. The stand on this plot was more nearly destroyed than on any of the others. Where moisture was the only apparent factor, high spots in the plots usually showed fair stands, but on the limed areas the stand was thinned throughout the plot. The data presented show that the soil reaction is another factor to be considered. Adjoining the plot which had received limestone alone was a plot which had received gypsum only. The limed plot had a pH 7.7 and yielded 2120 pounds, while the gypsum plot had a pH 6.1 and yielded 5240 pounds. In both cases, the soil must have been well supplied with calcium. It was estimated that the gypsum plot showed a stand injury of 7 percent. This injury could not be considered significantly worse than that in the adjoining check plot, which showed a stand injury of 5 percent, since all the plots started out with a uniform stand. The rows were three and one-half feet apart, and the plants were thinned to approximately 12 inches in the row. Where terraces crossed the field usually some what more injury was observed among plants growing in the terrace causeway.

Late in the season of 1939 and following a dry, late summer and fall, Crain observed considerable lodging in darso. This occurred after the sorghum had headed out. His observations, reported elsewhere in these Proceedings, exhibit certain variations from those recorded in this paper. These differences serve to indicate the complexity of the disease or diseases involved, and emphasize a need for exacting thoroughness in future research on the problem.