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Desiccated Grass Mulch Irrigation Efficiency for

The use of dry grass mulch in cotton furrows substantially increased irrigation efficiency in recent tests at the U. S. Cotton Field Station, Shafter. The millet and sudangrass used in these tests was seeded in 8-inch bands down the furrows and then desiccated by oil-spraying when growth reached 10 to 18 inches high. Time required for irrigation water to flow down the furrows was nearly doubled by the sudangrass mulch. Infiltration rates were substantially increased by the grass mulches and a greater soil water content, following irrigation, was obtained. While cotton seed yields showed no significant differences in these tests, data indicated that both crop uniformity and yield improvements could result from use of grass mulches on soils with low infiltration rates.

THIS STUDY on the use of a desiccated grass mulch in furrows for improving efficiency of irrigation for cotton was conducted at the U. S. Cotton Field Station, Shafter, California, in 1959.

Water infiltration rates drop to low values following layby (the last summer cultivation) on the cotton soils used for this investigation. This coincides with the period of maximum water use by the cotton crop. Surface roughness of furrow bottoms is considered to be an important factor in determining infiltration rates. Increasing surface roughness delays the rate of advance and may increase the wetted perimeter in the furrow. The increased time and wetted surface increased the total water penetrating into the soil, as well as the measured rate of infiltration.

Alternate solutions

Alternate solutions to the problem involve reducing the rate of application or using tailwater systems and increasing the time per irrigation. These approaches, however, do not increase the infiltration rate. The desiccated grass mulch was investigated as a method of increasing surface roughness in irrigation furrows and improving irrigation efficiency.

Cotton was planted on high beds to facilitate early development of the furrow profile needed for irrigation. After the second cultivation in mid-June, when the cotton was 4 to 6 inches high, German millet and Piper sudangrass were planted at rates of 64 and 82 pounds per acre, respectively, in 8-inch bands in the furrows. A grass-free treatment was included in the experiment. All treatments, including the grass-free check, were given a light irrigation for germination of the grass seed. No cultivations were made after the grass was planted. The grass was allowed to grow until the sudan was 15 to 18 inches tall and the millet was 10 to 12 inches tall. The grass was then killed with an oil spray. Shields were used to protect the cotton. Within a few days after oiling, a dense mat of desiccated grass, still rooted to the furrow bottom, formed a mulch for reducing the rate of advance of irrigation water.

The rate of advance of water after the mulches were established was measured at each irrigation. The time required for the irrigation stream to reach the lower end of the field was nearly doubled by the sudan and significantly increased by the millet, as shown in the graph. Decreasing the rate of advance of water during post layby irrigations can be helpful in improving irrigation efficiency on soils with low infiltration rates or on excessive slopes.

Sudan, before oiling, grown in irrigation furrows between cotton rows.

Increases Cotton

The infiltration rate of irrigation water in these furrows was determined by measuring the rates of intake and runoff for individual furrows. The difference between these two measurements, reported as inches per hour, represents the rate that water enters soil during the irrigation. Infiltration measurements were made four times during the season and average values are reported in the table. The infiltration rates for the mulched treatments were significantly greater than for the grass-free treatment. The mulches probably increased the wetted perimeter in the furrow—which would increase the infiltration rate of irrigation water.

The water content of the soil profile immediately after irrigation is a reflection of the infiltration rate. Soil water was measured to a depth of four feet by collecting soil samples after each of three irrigations. The data in the table are means for the three dates of sampling. The greater soil water content for the sudan and millet plots is an indication of an improvement in irrigation efficiency and would permit a longer interval between irrigations.

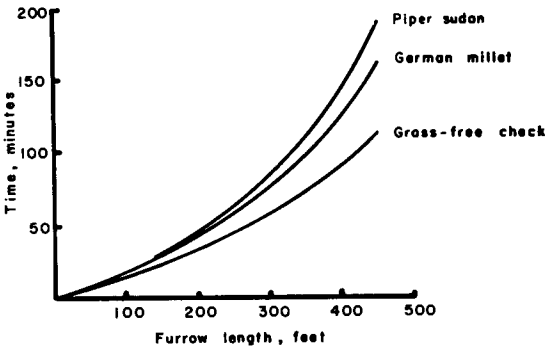
Sudan effective

Sudan appeared to be more effective than millet in improving irrigation efficiency. The improved efficiency is probably due to the better growth of sudan. The sudan was 5 to 6 inches taller than the millet at the time the grasses were killed, as indicated in the photos. The greater growth of sudan resulted in a more dense mat of dead grass that was more effective in slowing the rate of advance of water.

The yield of seed cotton on September 22, as reported in the table, shows no significant difference in production. This lack of a yield increase from the mulch treatments compared with no mulching may be due to the nearly adequate irrigation efficiency for the grass-free check or to the competitive effects of the grass. Improved cotton yields and crop uniformity could result from the use of mulches on soils with low infiltration rates of irrigation water.

INFLUENCE OF DESICCATED GRASS MULCHES ON INFILTRATION RATE OF IRRIGATION WATER, SOIL WATER CONTENT, AND COTTON YIELDS

Mulch treatment		Infiltr. rate (in./hour)	Soil water content (in./4 ft.)	Seed cotton yield (lbs./acre)
Grass-free check		0.170	6.96	2480
German millet		0.230	7.83	2420
Piper sudan		0.303	8.23	2250
LSD	.05	0.031	0.95	N.S.
	.01	0.047	N.S.	N.S.



Rate of advance of water in irrigation furrows with 7.6 gpm as influenced by desiccated grass mulches.

Millet, before oiling, grown in irrigation furrows between cotton rows.

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141