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Moisture Control Techniques for Experimental Field Plots[1]

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COMPLETE and effective soil moisture control on plots or other specified areas cannot be attained unless the system used (a) covers the soil to intercept direct rainfall, (b) diverts surface runoff, (c) prevents lateral moisture movement in the soil layer, (d) provides a means of extracting surplus moisture, and (e) includes a method for adding water to the soil.

MATERIALS AND METHODS

The particular study from which information on moisture control was obtained required covering twenty 15- by 30-foot plots. All but one of the plots were covered with black polyethylene plastic of 4- or 6-mil thickness (figure 1). Black polyethylene was used because it lasts 2 to 3 times longer than clear plastic. Loose soil and sand bags were used to anchor the covers at the sides and ends. Sheet aluminum, attached to wooden frames mounted on wheels, was used to cover the remaining plot. Two frames, each covering an area 16 by 20 feet, were constructed and placed end to end to cover one plot.

The polyethylene was purchased from local farm-implement dealers and mail-order houses. The 4-mil thickness was available in 10½-foot, 16½-foot, and 20-foot rolls each 100 feet long. The 6-mil thickness was available only in 32-foot and 40-foot widths. The cost of 20-foot wide 4-mil polyethylene was 32½ cents per linear foot or $29.95 per 100-foot roll. The 6-mil was purchased in 40-foot widths at 98 cents per linear foot or $89.50 per 100-foot roll.

The 8-V crimp, 0.019-inch thickness, embossed aluminum roofing was also purchased from mail-order houses at $5.90 per 50-inch by 100-foot sheet or $94.40 per plot.

Surface runoff was diverted by constructing small berms with a tractor and grader blade on the upslope sides and around the ends of the plots. A berm on the downhill side is unnecessary and will pond water during precipitation.

Fifteen-pound-weight asphalt felt was placed vertically in a trench one foot deep to prevent lateral movement of moisture from the surrounding area (figure 2). Costs of trenching and asphalt felt were 5 cents and 1.6 cents per linear foot, respectively.

Water was added to the plots requiring high moisture content with pressure spraying equipment consisting of a small gasoline engine, pressure pump, and 7½-foot spraying boom.

Since low soil moisture content cannot be obtained by covering alone, it was necessary to devise a means of extracting moisture. Vegetation is about the only economical and practical means to use. Wheat and oats were allowed to grow until the desired moisture level was reached and then shaved off with a flat spade at the ground surface and removed.

RESULTS AND DISCUSSION

The desired moisture levels were 8, 13, 19, 24, and 28%. Actual average levels obtained from 4 replications of each level were 8.1, 11.2, 19.8, 22.0, and 25.2. Thus two levels (8, 19%) were excellent, two (13, 24%) were good, and one (28%) was fair. The 13% level could have been obtained by clipping the vegetation earlier. The lower actual values on the 24 and 28% plots can be partially attributed to loss of water by evaporation and some surface runoff. Moisture content of the plots at the initiation of the control procedures was 21%. The 8.1% level was reached on the silty clay loam soil in approximately 6 weeks. During this time there were 14 showers totaling 6.24 inches.

The methods used for diversion, lateral moisture movement, and moisture extraction seemed to be quite satisfactory, and few problems arose.

Several problems were encountered with the polyethylene covers. Temperatures beneath them during sunshine were sufficient to scald plants, hence all plots on which vegetation was growing had to be uncovered shortly after a rain. Another problem was that of anchoring. Occasionally on windy days, ballooning of the covers resulted in loose edges that had to be re-covered. Another hazard was punc-

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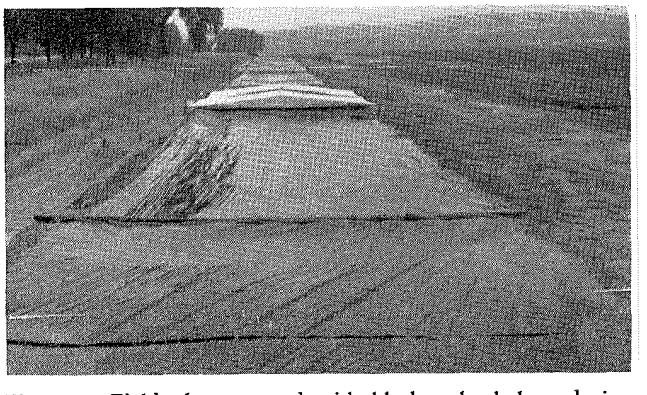

Figure 1—Field plots covered with black polyethylene during a rain shower. Aluminum roofing over wooden frame in foreground was used to cover one plot.

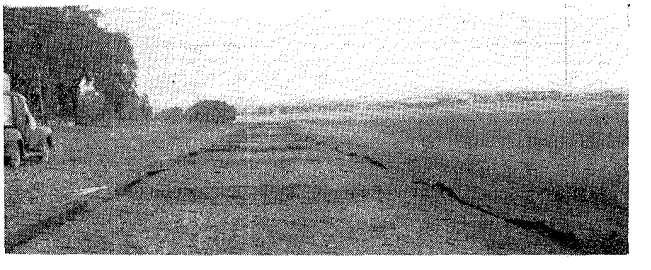

Figure 2—Asphalt felt placed 1 foot deep around plots to control lateral moisture movement.

tures by sharp stubble and rocks and damage caused by rodents, raccoons, and dogs. The 6-mil material suffered less such damage than the 4-mil. A special polyethylene tape and an electrical sealing device is available to patch this material. It appears that with these aids, one set of covers could be used successfully 2 or 3 seasons.

The aluminum covered frame on wheels proved very satisfactory. However, there are some limitations in using this type of cover. Two physical limitations are size and transportation. Since they cannot be transported easily, construction on site is necessary. They are also expensive. Therefore, this type of cover would be suitable only for permanent, longtime experiments.—LEON LYLES *and* N. P. WOODRUFF, *Agricultural Engineers, Western Soil and Water Management Research Branch, SWCRD. USDA. Manahattan, Kansas.*