AUTOMATIC RAIN SHELTER FOR SMALL OUTDOOR PLOTS

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INTRODUCTION

Precise control of water application is desirable in many irrigation studies. Under field conditions, differences otherwise obtainable from various irrigation schedules are often negated by rainfall. Results obtained from controlled conditions in a greenhouse or growth chamber cannot always be projected safely to field conditions because of differences in soil volumes involved and in climate. This gap that exists between experiments conducted in a controlled environment and those in the field can be largely overcome by sheltering field plots from rains.

Stansell and Sparrow (2) devised a battery-operated, automatic shelter. Fletcher and Maurer (1) built a plastic-covered shelter that was partially automatic. In 1966 a shelter was constructed at Lethbridge that was:

1. Completely automatic with provision for manual operation;
2. Strong and rigid to withstand high winds and to ensure permanence;
3. High enough to accommodate all field crops;
4. Large enough to provide appreciable space for plot area or lysimeters;
5. Made largely of prefabricated or readily available materials;
6. Relatively simple to operate.

EQUIPMENT AND PROCEDURE

Twin, simultaneously operating, automatic shelters were built over two 20-foot by 40-foot plots (figure 1). Concrete foundations and shallow concrete walls bordered the sides of each plot. In these foundations were anchored 3-inch-diameter

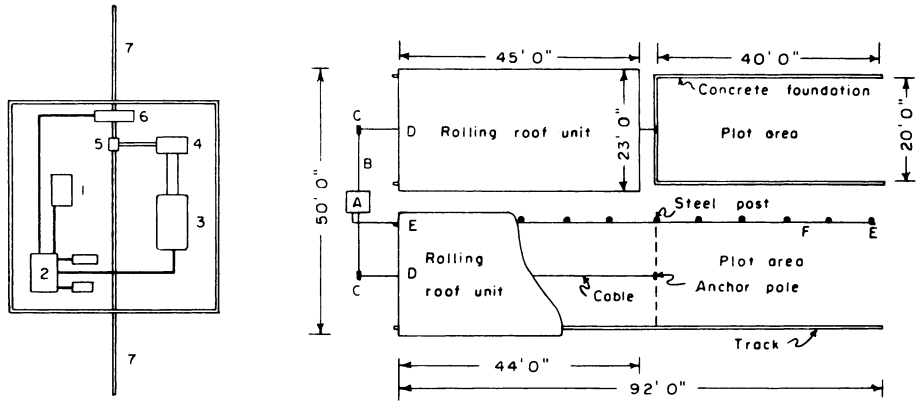

Figure 1. Plan of plot area, shelter assembly, and machinery house.

A - Machinery house
B - Main drive shaft to drum assembly
C - Cable drum assembly
D - Top cable attachment to shelter
E - Limit cancelling switch
F - Conduit for limit switch

1 - Circuit breaker
2 - Reversing magnetic switch and controls
3 - Three-phase (1½ hp) electric motor
4 - Gear reduction box (50:1)
5 - Main sprocket drive
6 - Single-throat, double-switch, float control
7 - Main drive shaft to drum assembly

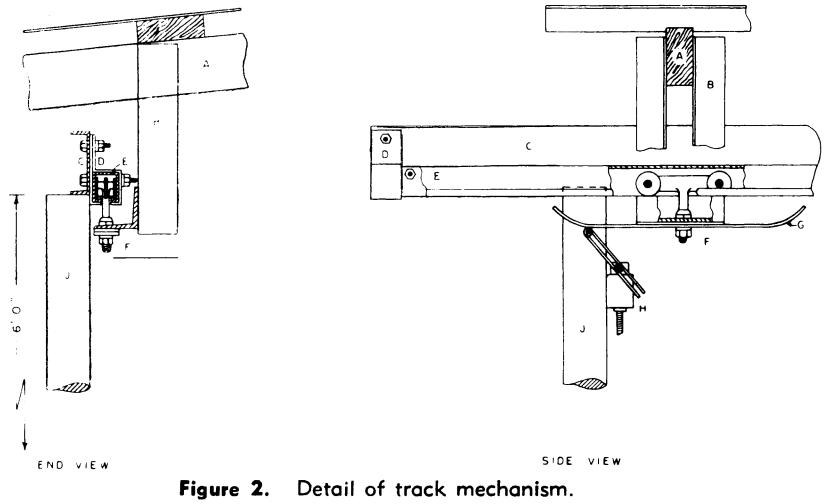

Figure 2. Detail of track mechanism.

A - Roof truss
B - Roof truss anchor
C - Four-inch standard steel channel
D - Track hanger
E - Barn-door track
F - Roller unit
G - Cancelling switch bracket
H - Limit cancelling switch
J - Steel pipe, 3-inch diameter

steel pipes extending 52 inches above the walls. The pipes supported a channel that housed a barn-door track. The track roller units were attached to the roof trusses (figure 2). The roller mechanism was thus completely under the roof and always protected from the weather.

The prefabricated roof trusses* covered a 20-foot span and had a 2-foot overhang. The trusses were spaced at 4-foot centres and were covered with corrugated aluminum sheeting. Light wooden framework covered with polythene sheeting and extending downward from the eaves was made to prevent rain from entering the plots from the sides. One end of the shelter facing the machinery house was sheeted with light plywood. The other end (facing south) was not closed. The 3-foot overhang provided adequate protection from the rain.

Complete automation was accomplished by the use of a single-throat, double-switch float control (McDonald No. 80), a reversing magnetic switch, three-phase electric motor, and limit switches mounted at the ends of the track. The 4-foot by 4-foot roof of the building that housed the motor and controls (Detail A of figure 1) was a rain-gathering funnel. The float control was provided with an overflow outlet and a drain outlet. A hand valve permitted adjustment of the latter so that the shelter stayed over the plots for up to 15 minutes after rain ceased. Once the roof was wetted the net amount of rainfall required to trip the float was 1/160 of an inch (equivalent to 246 cc of water poured directly into the float chamber).

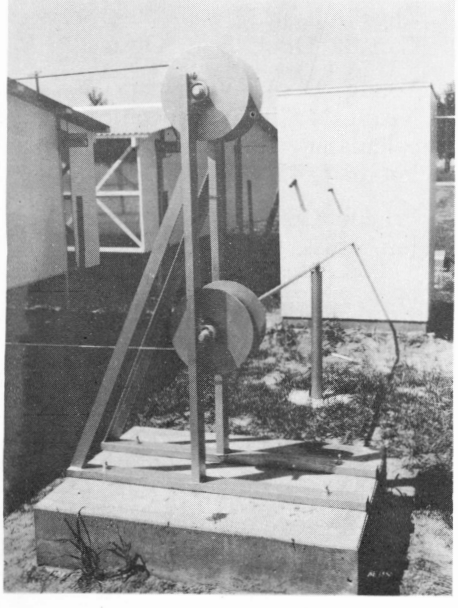

Figure 3. Detail of cable-drum assembly for rain shelter.

The electric motor (1½ hp) was connected to a reduction gear unit (50:1) and then by chain to the main drive shaft. The drive shaft was suspended on pillow block bearings. Cable drums connected with a roller chain drive were fitted to the ends of the drive shaft (figure 3). A strong anchor pole embedded in the end foundation facing the shelter supported an idler pulley. A flexible steel cable was passed through the pulley, fastened to the shelter, and fixed to the drums. The time required for the shelters to move fully in either direction was 35 seconds. The plot areas and completed twin shelters are shown in figure 4.

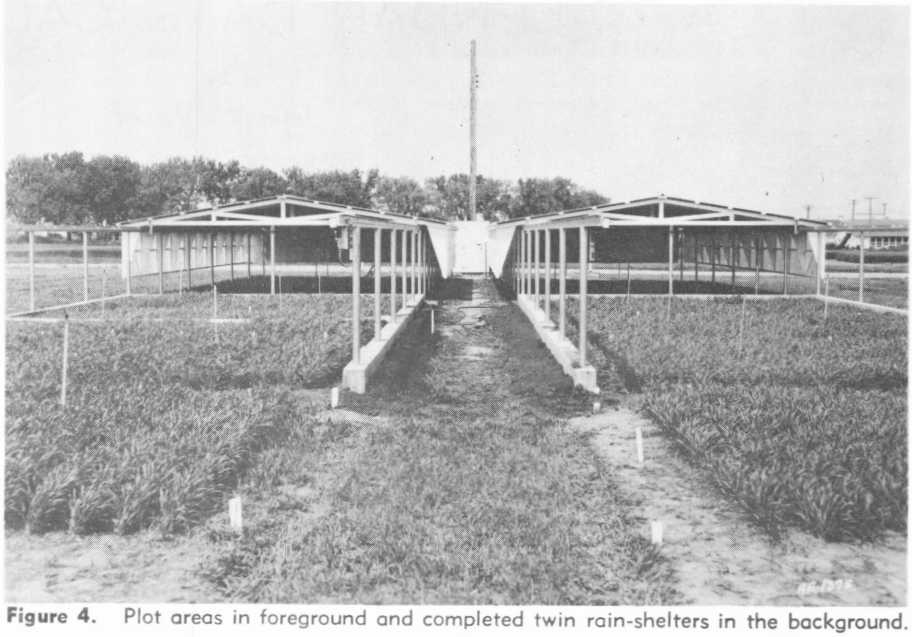

Figure 4. Plot areas in foreground and completed twin rain-shelters in the background.

SUMMARY

This fully automatic rain shelter has performed satisfactorily for two seasons. The plot area of about 1600 square feet has provided sufficient space to accommodate detailed experiments. Future studies should establsh the types of greenhouse results that can be extrapolated to the field. It may also be possible to substitute studies with outdoor plots provided with a rain shelter for some greenhouse experiments.

REFERENCES

1. Fletcher, H. F., and A. R. Maurer. 1966. A Movable Rain Shelter for Small Experimental Plots. Can. J. Plant Sci. 46:695-698.
2. Stansell, J. R., and G. N. Sparrow. 1963. Rainfall Controlled Shelter for Research Plots. Agr. Eng. 44: 318-319.

*"Truswell Kingpost (30 psf snowload)" supplied by Crestline Builders Market Ltd., Lethbridge; or equivalent.