PN-ABM-629
C 7-040

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US-ISRAEL COOPERATIVE DEVELOPMENT RESEARCH (CDR)

Title: PRODUCTIVITY ENHANCEMENT IN RAINFED AREAS BY WATER CATCHMENT STORAGE POOLS AND DRIP IRRIGATION

Project I.D. Number: C7-040

Six Month Report - July 1-Dec 31, 1988

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The week during this period was concentrated in three directions:

I. Field survey, and preparation for major field trial.

II. Greenhouse experiment with corn to determine relationship between available soil moisture, plant water potential and growth rate at two growing stages of the crop.

III. Greenhouse experiment with cotton to determine the dynamics of root system development under transient changes in soil moisture content.

I. The first step in order to conduct a satisfactory field experiment as outlined in the project was to conduct a detailed survey of the different possible field locations, soil properties, agricultural history of the various fields, climatic conditions etc. As we were interested in finding a field with minimal spatial variability, we decided to analyze the variability in infiltration rate and in productivity of the present crops. These crops varied among fields and were: cotton, tomato for processing, and sunflower. It was decided, on the basis of this analysis, to conduct our experimental work in a field at Bet-Dagan Experimental Farm with a previous sunflower crop. Wheat was then planted on this field following proper cultivation and basic fertilizer dressing. This crop is grown uniformly on the experimental field during the winter of 1988-89. The wheat crop will withdraw the entire residual soil moisture as well as the rainwater of the 1988-89 winter. The differential treatments will be started with the second crop which will be corn to be planted in the spring of 1989.

II. A greenhouse irrigation experiment was conducted during this period. This treatment was conducted in order to determine the relationship between soil moisture content (available moisture content), plant water potential, leaf expansion and growth. The changes in those parameters with time were continuously recorded and the final fresh and dry matter of different plant parts was also determined. The first part of this experiment was conducted during the stage of vegetative growth and the second part, which is very similar to it, is presently being conducted at the late vegetative and flowering stage.

In addition to the direct information of this experiment, it serves also as information which is important in planning the detailed tratments of the coming field trial.

III. The dynamics of root growth and development as depending on soil moisture status was determined with cotton plants grown in containers. In one experiment the growth of roots in a prewetted soil was measured as depending on soil moisture status. In a second experiment the regeneraton of a root system following different time periods of dry soil was determined. In a third experiment plant canopy growth and water use efficiency were determined as a function of the size of root volume. These experiments were concluded during the 9 months of this report and are presently being analyzed.

PROGRESS REPORT OF WORK IN THE PHILIPPINES

TITLE: Productivity Enhancement in Rain-Fed Areas By Water Catchment, Storage Pools and Drip Irrigation

PERIOD COVERED: July 1, 1988 - December 31, 1988

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RATIONALE:

With the increasing population and limited land and water resources the strategy for food production in the Philippines should now geared towards increase resource use efficiency. This means cropping intensification and the application of water by the most efficient way.

The agricultural practices in the Philippines have always been influenced by the rainfall pattern. In areas where distinct dry and wet seasons prevail, i.e. six (6) months wet and six (6) months dry, production of annual crops like cereals, legumes and vegetables is done during rainy season (June - November). During

dry season (January - May) most of the lands are in forced fallow period because there is no available water.

Yet, it is in dry season that most environmental factors are favorable for plant growth: high solar radiation due to cloudless skies, absence of typhoon, less incidence of pests and diseases. The only constraint is the lack of water.

During rainy season a large proportion of rainfall is wasted through surface runoff that goes to drainage canal. If this could be collected from a catchment and stored in a small reservoir, there will be water for use in the summer crops.

Our scheme is to divert runoff water to a storage pool and apply this water by drip method so that more crops could be watered.

OBJECTIVES:

1. To determine relationship between catchment area and pool size and between pool size and cropping area.
2. To assess the performance of simple drip irrigation techniques using stored water for various crops.
3. To develop irrigation management which will lead to the most economical and efficient use of the stored water.

PROCEDURE:

Survey of Experimental Site

The initial activity was to look for a suitable catchment for the proposed project. An ideal watershed would be one on

higher elevation and the cultivable field at the lower elevation in order to obtain a sufficient head for the operation of drip irrigation system. Moreover, the site should be within Type 1 climatic zone which is characterized by distinct wet and dry season prevailing during the year and also it should be close to UPLB. We finally settled on the site which, although does not satisfy all these requirements, is relatively near (about 60 km) from UPLB and within the Type 1 climatic zone. This is an experimental station which belongs to the Industrial Technology Development Institute (formerly NIST) of the Department of Science and Technology in Molino, Bacoor, Cavite.

A reconnaissance survey was made by our team composed of Crop Physiologist/Ecologist, Agronomist and Agricultural Engineer. The catchment boundary was delineated and its slope measured. Its total area is approximately 5 has. and with an average slope of 15%. About half of the area is predominantly grassland (Imperata cylindrica) and the other half covered by leguminous tree species (Gliricidia sepium). It was estimated that given a rainfall of 1,200 mm and a surface run-off of 25%, the 5-hectare catchment would yield about 18,750 cubic meter of rainfall which could readily satisfy the water requirement (evapotranspiration) of one hectare annual crop.

Storage Pool

A storage pool was excavated at the lower slope of the catchmnent. It has a dimension of about 15 m wide, 50 m long and 4 m depth. If this is fully filled up it will hold 3,000 cubic meters of run-off water. The size of the pool was based don the estimated water requirements of 1/2 ha. crops plus the surface evaporation. Loses due to seapage and percolation were assumed to be negligible on the basis of the structure of the reservoir bed which is composed of hard unconsolidated material with very low permeability. Excavation involved movement of huge soil and hard materials by Backhoe machine.

When the pool was finished it was already towards the tail end of the rainy season in November and so it was not fully filled up with water. At present the total water loss and surface evaporation are being monitored to determine the percolation loss. The rate of total water losses due to surface evaporation and percolation will help in determining whether it is necessary to increase further the storage volume for next year's use.

Preparation of Experimental Field

The experimental field is partly located in the catchment at about 50 meters away from the reservoir and a slopping elevation of about 5 m above the pond. A part of it lies outside the boundary of the catchment. It is mostly grassland with some shrubs and trees. These were uprooted and hauled outside the

fields to make it easier for the tractor to pass. Although only 1/2 hectare will be used for experiment an area of 1 hectare was plowed. The field was already plowed and harrowed once.

Since the cultivable field is about 5 m above the pond, the water has to be pumped in order to provide some pressure for the drip irrigation to operate. The process of selecting and purchasing locally available pump is now going on.

Meteorological Set-up

A standard USDA pan evaporimeter and a non-recording rain gauge were set up at the experimental station. A daily observation is made on these equipments since October 1988. The data from these instruments will be used to guide in determining the irrigation rate.

Experimental Design

Preparation is underway for the design of the field experiment. The initial crop to be used is sweet corn. A 4 x 2 factorial experiment in 5 replication is being contemplated.