17. WATER MANAGEMENT IN PHILLIPPINE IRRIGATION SYSTEM. TECHNICAL REPORT: *PHILLIPPINES*

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Introduction:

The paper devotes substantial emphasis on the National Irrigation Administration's (NIA) broad spectrum of experiences and activities in water management at the farm level.

NIA, fully aware that major portions of the potential irrigable areas under its network of irrigation systems are not being benefited despite the availability of water, established water management projects, to help overcome the existing problems. Some of the significant problems are:

1. excessive water losses due to conveyance and distribution;
2. farm water losses in paddy fields;
3. inadequate control, measuring devices and terminal facilities;
4. inadequate canal capacities to serve intended service area;
5. deficiency in over-all operation and management of the system itself; and
6. improper use of irrigation water by the farmer/end-user.

An understanding of the importance and significance of "water management" requires information which can be best provided by a multidisciplinary approach with the engineering, agronomic, economic and sociological fields playing major roles. Engineers, agronomists, economists and the sociologists must provide data on how irrigation water should be diverted, conveyed, regulated, measured, distributed and applied at the right time and amount including the removal of excess water from the farm, to achieve increased production in conjunction with improved cultural practices.

No acquire such data and information, NIA initiated water management projects in selected sites in the whole country, to handle research and development/operations activities. The projects are geared toward introducing and adopting innovations in water management practices, including the improvement of existing methods relative to effective irrigation water utilization, equitable distribution scheme, timely use of adequately tested production inputs, improved farm management and cultural practices.

NIA-ADB water management project:

From 1968–1970, NIA and the Asian Development Bank (ADB) implemented Water Management projects in eight (8) irrigation systems.

The project had four (4) primary objectives:

1. To obtain comprehensive data and technical information particularly in water management and water requirements of tropical lowland rice and other crops to be used as basis for immediate practical application in the eight (8) pilot areas and also for future expansion projects;
2. To improve and develop improved water management practices, water distribution schemes and water re-use at the farm level over system-wide areas by

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applying local findings and experiences gained;
3. To organize irrigators' associations for the successful implementation of a well-coordinated water distribution and cropping systems; and
4. To adopt the pilot areas as a socio-technical laboratory for on-the-job training of NIA personnel and farmers.

Project highlights were as follows:

A. Pilot Project Area Operation:
   1. Eight (8) pilot projects representing different agroclimatic conditions in the country were selected and detailed investigations and trial operations were undertaken to secure location-specific data and information needed to carry out water management practices. Various technical and scientific facilities as well as measuring devices were also installed.
   2. Data and information were gathered and collected on the following:
      a. rainfall
      b. evaporation
      c. ground water table
      e. cropping system
      f. production yield data
      g. soils—physical and chemical
      h. water losses—conveyance, distribution and farm waste

B. System-Wide Operations:
   1. Practical rotational irrigation services and cropping systems in two (2) irrigation systems were implemented and water use was efficiently maximized.
   2. Construction work such as improvement and/or construction of laterals, farm ditches, turnouts, gates, measuring devices, control facilities and drainage channels and structures were made.

C. Organization of rIrigations' Association:
   1. Formation of irrigators' association within pilot areas were instituted to provide the organizational mechanism of a successful water management project.
   2. Dissemination of the latest agricultural information to farmers for the promotion of water management and extension services were intensified.

D. Training and Demonstration:
   1. In-service training on water management for NIA field and central office technical personnel were undertaken.
   2. Demonstration on fertilizer and weed control were shown to farmers.

E. Water Management Manual:
   1. A Water Management Manual to serve as a technical guide to irrigation engineers in the field was published. The manual also summarized the knowledge and experience gained in the implementation of Philippine water management project.

NSDB-NIA water management improvement project:

The Water Management Project is basically an applied research undertaking and is geared towards maximizing the use of available irrigation water and rainfall, which in conjunction with improved cultural practices will promote increased crop production. The project coded as NSDB-NIA 7322 Ag. "Water Management Improvement in the Philippines", was started on September 1, 1973, with financial assistance from the National Science Development Board (NSDB). NIA is to undertake the project for a period of three (3) years in Regions 1, 2, 3 and 3-A.

The study has five (5) major objectives:

1. To determine the consumptive use of some crops (rice), their water and

irrigation requirements;
2. To measure the common losses and efficiencies in irrigation of some crops and effectiveness of rain in supplementing irrigation water;
3. To compare different methods of rice irrigation under different agro-climatic conditions in four (4) NIA regional research stations;
4. To determine the comparative crop yield responses to different rates and intervals of water application; and
5. To gradually extend the practice of improved water management and its benefits from the four (4) pilot areas to the entire irrigable areas of the encompassing systems, and possibly, to other NIA systems.

The studies included the following:

1. Determination of water requirements of improved varieties of rice. Consumptive use (E_t) data using several improved rice varieties ranged from 4.31 to 7.22 mm/day during the 1973–1974 dry season crop. Percolation losses ranged from 0.91 to as high as 62.13 mm/day. Evapotranspiration and percolation rates were greatly affected by the different climatic periods and conditions obtaining durnig the period of raising the crop, and the different topographies characteristic of each site;
2. Growth and grain yield responses of improved rice varieties to different rates of irrigation application. The best growth and yield responses of improved varieties of rice was found in 60 mm. water depth treatment given every after 5 days in Agno, Angat and Sta. Cruz River Irrigation Systems. However, in terms of grains produced per mm. of water used, 25 mm. treatment was found to be the best. In Magat RIS the best response was observed in 85 mm. water level. The results indicate that intermittent irrigation produced the most grains for every mm. of water used, irrespective of the soil texture and climatic conditions prevailing in the four (4) regional research stations.
3. Comparison of three (3) irrigation methods in rice production. Results for continuous submergence with 10 days drainage starting from the 35th day after transplanting showed higher grain yields as compared with the continuous submergence and intermittent irrigation methods. Water savings in intermittent irrigation treatments (5 day interval), however, resulted in higher grain yield per mm. of water applied.
4. Determination of effective rainfall and water use efficiency. Effective rainfall (percent of rainfall used to supply the crops requirement) data ranged from 90 to 100% during the land soaking and land preparation activities and from 64 to 100% during the transplanting to maturity periods. Water use efficiency, however, ranged from 56–65% during the land preparation period and from 51 to 92% during the terminal period. Data show considerable surface drainage, seepage, and percolation losses. High surface drainage losses were generally associated with low water-use efficiencies.
5. Determination of conveyance and distribution losses. Data for conveyance losses ranged from 0.55 to 33% per kilometer in major canals and laterals in the four (4) sites. In terms of cubic meters per square meter per day, the values ranged from 0.17 to 8.7. The losses were affected by the length and soil texture of the canal section, physical condition of the canal, wetted perimeter, depth of water flowing in the canal, and the depth of water table.

PCAR-NIA water management improvement project:

A similar Water Management Improvement Project, funded by the Philippine Council for Agricultural Research (PCAR) was started on June 1, 1974, for implemen-

tation in four (4) selected NIA field sites. The sites (Regions 4, 5, 6, and 8-A) are located in different regions of the country and augment the NSDB sponsored project (Figure 1).

The project has been programmed for one year for two (2) cropping seasons, with possible extension for three (3) years. Expected benefits from the research project are:

1. Proper allocation of available irrigation water supply to irrigated areas to ensure higher production and income for the farmers;
2. To increase the present cropping intensity from 1.4 to at least two (2) times per agricultural year and in special cases to five crops in two (2) years;
3. To minimize drainage problems in the lower areas of the systems;
4. To update the knowledge, skills and practices of water-use authority at the farm level for efficient irrigation service;
5. To strengthen the irrigation extension technology of the NIA by disseminating up-to-date, valuable and workable information to the farmers; and
6. To enrich the "Data Bank" on irrigation information badly needed in the intensified irrigation development program of the NIA.

Preliminary results include the following:

1. Growth and yield responses of high yielding varieties of rice to different rates of irrigation. Plots applied with 60 mm. water level every five (5) days gave the highest grain yield. In terms of grain yield conversion, plots applied with 25 mm. of water over 5 days produced more grains for every mm. of water used.
2. Determination of conveyance and distribution losses. Irrespective of prevailing climatic conditions the water losses due to conveyance and distribution were greatly influenced by soil texture of the canal section, physical condition and surroundings and depth of water flowing in the canal.
3. Determination of effective rainfall and water use efficiency. Results showed that among others the cultural practice employed influenced the amount of effective rainfall. Water use efficiency was also greatly affected by the amount of water applied and drained, and rate of evaporation specially during the period of land soaking and land preparation. Data further show that more water was used in sandy clay loam soils than in clayey soils.

Other water management projects:

1. NIA Systems

a. Installation of Measuring devices in all National Irrigation Systems for Water Management. Per NIA MC# 46 and MC# 46-A, s. 1974, installation in all National systems of one rain gage per watermaster division and one direct reading measuring device (staff gage) per ditchender or gatekeeper section were required. The move is deemed necessary for the implementation of water management.

b. Water Management on Pilot Area basis. NIA is now implementing water management activities on a pilot area basis. Distribution of water in accordance with a schedule taking into consideration water requirement for land soaking, land preparation and paddy irrigation. Irrigators' Association or compact farms are being formed on the "turn-out" level to train farmers on the various aspects of water management.

2. NIA Special Projects, Upper Pampanga River Project (UPRP)

The UPRP project is the largest single infrastructure being undertaken by

the Philippine government today. The multi-purpose project will control, regulate, and use the irregular flows of the Pampanga River and its tributaries for year-round irrigation, domestic water supply, hydroelectric power, flood control, and will provide facilities for recreation and fish conservation.

To irrigate the project area adequately, rotational irrigation will be used along the main farm ditch. Increased use of rainfall will be emphasized.

Water balance studies are being conducted to establish benchmark data for water use, and determine the improvement necessary in existing irrigation systems and the assistance farmers need in the implementation of a new scheme of water delivery, and provide a measure of rainwater use in the area.

3. Angat-Magat Integrated Agricultural Development Project (AMIADP)

The Angat-Magat Integrated Agricultural Development Project is another scheme the National Irrigation Administration is doing in the development of existing national irrigation systems. This project is financed out of a loan from the Asian Development Bank with a counterpart from the Philippine government. It is being undertaken by the NIA but agencies involved in agricultural development are all involved. In other words, the developmental approach is integrated and interdisciplinary.

Major items of the project are the improvement of the main canals of the systems; drainage for the swamp area; drainage system; service roads improvement and construction, along main canals and laterals; improvement of water management at the farm level; and expansion of the service area of the Angat System in Bulacan and Pampanga and of the Magat System in Isabela.

4. National Irrigation Systems Improvement Study (NISIS)

The National Irrigation Systems Improvement Study (NISIS) will inventory existing NIA systems for use in the selection of systems that will be upgraded and improved from loans that will be secured possibly from the IBRD (World Bank). The level of facilities provided in UPRP would be taken as the standard and depending on factors which vary from system to system.

5. International Rice Research Institute (IRRI)

Cooperative joint water management projects are being undertaken with IRRI. Some of the studies include:

a. Land preparation in lowland rice: Its speed in relation to rate of water supply.
b. Tropical lowland rice: Some findings regarding its water requirements and yield losses due to draught.
c. Effect of moisture stress periods in relation to irrigation systems.
d. An evaluation of the alternative of water sharing among farmers.
e. A technical comparison of rotational and continuous irrigation in the Upper Pampanga River Project.
f. An extentive project on water management.

Summary and Conclusion:

The task of water management at the farm level is given top priority in the overall irrigation development program of NIA. We can not over emphasize its importance and significance.

We take cognizant, however, of the fact that good water management is not the panacea to the multifarious problems besetting irrigated Philippine agriculture.

Infrastructure inputs, inputs of scientific or technical knowledge, management inputs, and the farmers' input must balance good management of irrigation projects. The farmer, end-user of irrigation water, is singled out as one of the most important factor that must be at par with any technological innovations in water management. Farmers must be able to depend on getting the water when be needs it, if the irrigation system is to be effective.

The farmers must therefore be considered as partners in the gigantic task of irrigated agriculture development.

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Question and Answer

T. Kimura, Japan: Reference page 4 and 5 of your report. "Data for conveyance losses ranged from 0.55 to 33%/km in major canals". Is it 33%/km or 3.3%/km?

Answer: Results of studies tend to show 33%/km as the maximum, but this is not yet conclusive. I myself doubt very much this data. So, we still have to do several studies more along this line.

T. Saito, Japan: I understand that without taking part of individual farmer any good water management can not be expected. My question might be rather

ironical but I hope you don't misunderstand. What kind of merits does the indivisual farmer consider regarding good water management in your country? I am afraid if a farmer whose paddy fields are located upper part of the irrigation project area sometimes he needs more labour, weedicides and insectcides in order to employ the good water management. It means saving water method. Does he expect any merits if he employed good water management?

Answer: Studies along this line tend to show that with improved water management, coupled with improved farming methods give better yield per unit area to the farmer.

S. Okabe, Japan: (1) Do the irrigation improvement projects you have listed up in your report involve realignment or readjustment of the farmers' land in their implementation programs?

(2) Who has a responsibility to develop on-farm works at grass-root level; the central or local governments, the local farmers or other bodies? Are the on-farm works at village levels financially assisted by the Government in the Philippines?

Answer: (1) In the irrigation improvement projects in the Philippines, realignment of the farmers' land is not yet considered. Terminal facilities are being put up without readjustment of farmers' field.

(2) The national government is the doing this farm-level introduction of terminal facilities in the Philippines national irrigation projects/systems. For communal projects, national government helps farmers in terms of long term soft loans.

N. Yamada, Japan: In your report, 10 NIA regional research and development stations are shown. I understand that these stations belong to NIA. I would like to know how these stations are related to agricultural experiment stations which belong to BPI. Are they located at the same place of BPI's stations or completely separated from them? What is the cooperation or relation between NIA-stations and BPI-stations?

Answer: The NIA research stations are located separately from BPI's stations.

BPI's stations undertake studies on various crops. NIA's station undertake studies on water management especially for rice crops, that is applied studies. So our cooperation with BPI and other agricultural colleges, is to get information from them on agronomic data and used them in our applied research. The Philippine Council for Agricultural Research (PCAR) is coordinating all agricultural research in the Philippines so there is no overlapping of functions, but there is closed coordination of research activities.

M. Goto, Japan: Rotational irrigation should be modified to the condition of soil in individual area. So I would like to know what rotational irrigation has been found to be successful from your experiment and also how the soil condition where the investigation had done?

Answer: Our experience is that after knowing daily water requirement of paddy rice, we can design for rotational irrigation.

Rotational irrigation by canal section, is found practicable in existing NIA systems. Soil is silty clay loam with water table depth of 0.6 to 0.8 m., more or less. I am sorry I don't have the exact data with me, in Japan.

S. Okabe, Japan: You have mentioned about your future program of the development of farmers' owned irrigation systems. I would think that at usually gives a fairly heavy financial load for the small farmers to participate in the program. My questions are; (1) are they enforced to participate in the government program, if the areas are selected for the program? and (2) does the government have any special plan for encouraging the local participation?

Answer: (1) The farmers are not being forced, but rather the farmers are

one initiating the move. However, this are for small areas only which are called communal irrigation projects with areas ranging from 30–100 has., more or less.

(2) The government provides soft loans to group of farmers that organized themselves into an Irrigation Association. The loan is payable from 10–15 years. The irrigation system is turned-over to the association for them to operate and maintain. The government feels that the farmers will maintain this system better because it belongs to them. It is not a dole out to them but rather they invested money and labor before the irrigation system came into being. Of course the success or failure of this approach still remains to be seen after some years.