INVENTORY ON MANPOWER
AND
PHYSICAL FACILITIES AVAILABLE
FOR
IRRIGATION AND WATER MANAGEMENT
RESEARCH IN BANGLADESH
1981

SOILS AND IRRIGATION DIVISION

BANGLADESH AGRICULTURAL RESEARCH COUNCIL (BARC)
NEW AIRPORT ROAD, FARM GATE, DACCA—15
BANGLADESH

PN-AEH-058

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Dated, Dacca
November, 1981

BARC
Soils and Irrigation
Publication No.7

Preface

This publication updates and expands two 1979 BARC publications "Soil-Water Management Research Inventory and Problems in Bangladesh", and "Soil and Water Management Program For Bangladesh". It provides a resource base on which to conduct the much needed Soil and Water research in Bangladesh.

An important factor to increase foodgrain output as identified in the Second Five Year Plan (SFYP) concerns more efficient irrigation management which will make grain production less vulnerable to the uncertainties of rainfall. Surface and ground water resources are one of Bangladesh's greatest natural agricultural assets. Control and management of these assets can lead to substantial increases in land and labor productivity.

In recognition of the SFYP's goal of expansing the irrigated acreage from 3.2 million acres to 7.2 million acres, BARC will take the leadership in coordinating an expanded effort in irrigation and water management research.

This publication will serve to identify the resources currently available for irrigation and water management research. Upgrading and expanding the skills and level of competence of the human resources will strengthen the entire agricultural research effort towards increased food production.

Management of supplemental irrigation and drainage systems and rainfed agricultural practices addresses approximately 75% of Bangladeshi farmers who cultivate crop without irrigation facilities. This area also deserves special attention and this publication outlines the resource base from which such an effort will be based. Expansion and improvement of this base will contribute substantially to Bangladesh's capacity to reach and sustain food self-sufficiency goals.

(Dr.Kazi M. Badruddoza)
Executive Vice-Chairman
BARC

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Inventory on Manpower and physical facilities available for Irrigation & Water Management Research in Bangladesh.

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I INTRODUCTION

1.1 Background:

During 1978, the BARC Technical Working Group constituted four task forces consisting of scientists/engineers from different institutes/organisations engaged in Research and Extension Work in the field of Soils, Irrigation and Water Management. The terms of reference of these task forces were to review and prepare an inventory on Irrigation and Soil Water. In 1979 with the help of a World Bank consultant, Dr.M.C.Oswal,BARC prepared the following two comprehensive reports:

1. Soil-Water Management Research Inventory and Problems in Bangladesh, BARC,1979.
2. Soil and Water Management program for Bangladesh, BARC, 1979.

The present BARC Co-ordinated Irrigation and Water Management program evolved as a result of this Bank supported study. While these two publications remain relevant, the present task forces in preparing the following report have updated the National Inventory of manpower and physical facilities available at various institutes/organisations in the field of Irrigation and Water Management,as well as the available scientific manpower of on-going research. In addition, the four Task Forces were able to prioritize constraints in conducting sound water/irrigation research and recommended

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1/ Member-Director (S&I);

2&3/Senior Scientific Officers.

resolution strategies reported below:

1.2 Program Development Committees:

BARC convened a joint meeting of different research and extension organisations engaged in irrigation and water management research to review the present activities and to identify priority researchable areas on July 7,1981. In that meeting it was decided that the present inventory on manpower and physical facilities has to be updated in order to initiate more research projects in this field at various institutes/organizations. As a result, questionnaires were mailed to the concerned institutes/ organizations and collected, compiled and presented them in this inventory.

In order to findout the new researchable areas, the present status was reviewed in the above mentioned joint meeting. The gaps were identified and the following areas were proposed to incorporate in the present co-ordinated irrigation and water management project

1. Study on comparative efficiency of manually operated pumps in Barisal irrigation project.
2. Study to findout whether LLP could be substituted by manually operated devices in Chandpur irrigation project.
3. Improvement of manually and animal operated pumps.
4. Studies to be conducted in the field of institutional management on irrigation and water management.
5. Some pilot project studies on irrigation and water management to be taken up at farmers level in order to demonstrate water use efficiency and command area development.

To prepare specific research projects, following three program development committees were constituted on the basis of the research projects mentioned above.

a) Committee for manually and Animal operated pumps.

b) Committee for institutional management.

c) Committee for water use efficiency and command area development.

1.3 Recommendations:

The following sub-projects were suggested by the program development committees after detailed review and discussion.

1. Manually and Animal operated pumps:

   a) A comparative study on the various surface methods of irrigation in terms of mechanical management & economic efficiency.

   b) Studies on the screw type animal driven irrigation pumps to improve their performance under farmer conditions.

2. Institutional Management:

   a) Preparation of an inventory on the socio-economic/ institution aspects of irrigation and water management in Bangladesh (with assistance of Ford Foundation supported consultant Dr.Bottral).

   b) New project proposals will be suggested that emerge from (a) above early in 1982.

3. Water use efficiency and command area development:

   There is an urgent need to establish defined area on farm soil water management projects with supported research at regional/sub-experiment stations.Such projects would primarily focus in non-irrigated regions to optimise rainfall and residual soil moisture by making systematic interventions into farmer managed soil water management practices.

a) Soil moisture studies for rainfed Agriculture:

i) Soil moisture profile studies on different benchmark soils during winter months of the year as well as into March and April.

ii) Crop adaptability including rootzone studies.

iii) Measurement of soil physical parameters relating to Soil-water-plant relationships.

b) Investigate systems of beds, ridges,sloping, furrow and surface drainages to maximise soil-water-plant relationships.

c) Studies on the cultural practices water conservation including plant population, planting dates and method of weed control.

d) Irrigation scheduling for major crops for some benchmark soils and different climatological situations.

e) Studies on harvested rain runoff and storage of monsoon water for limited irrigation.

f) Development of improved technology of saline affected soils of Bangladesh especially aimed to improve the productivity of the coastal region.

g) Establishment of a salinity laboratory costing Tk.34.00 lakh.

Note: Items f and g above apply equally well to irrigated as well as non irrigated lands which are Salt affected.

II INVENTORY ON MANPOWER,PHYSICAL FACILITIES AND RESEARCH PROJECTS.

2.1 Available manpower:

To solve problems in Irrigation and Water Management demands a multidisciplinary team of scientists including irrigation engineers, hydrologists,climatologists,crop scientists, soil physicists,

irrigation agronomists and social scientists. Few such qualified and experienced scientists/engineers are available in Bangladesh. A list of research personnel at various organisations in the field of irrigation and water management is given in Table 2.1. If one excludes the University the entire Research Institute network has but one Ph.D. in soil physics and one in Agricultural Engineering, none in agrometeorology, hydrology, or irrigation agronomy. Most of those with masters degrees would benefit immeasurably from short refresher course training in special on farm water management research while the most promising staff should be encouraged to pursue Ph.D. in the fields identified.

Table 2.1. Research personnel at various organisations in the field of irrigation and water management.

Organization	Engineering			Soil Science		Agronomy	Agril. Economics	Social Science
	AE	WRE	CE	SP	SF			
	a+b+c+d*		a+b+c+d	a+b+c+d	a+b+c+d	a+b+c+d	a+b+c+d	a+b+c+d
1	2	3	4	5	6	7	8	9
1. BARC								
a. Soils & Irrigation Division	0+1+0+0 (1+0+0+0)	-	-	-	1+2+0+0	-	-	-
b. Agricultural Engineering Division.	0+1+3+0 (1+0+0+0)	-	-	-	-	-	-	-
c. Agricultural Economics & Social Science Division.	-	-	-	-	-	-	3+0+0+0 (1+0+0+0)	0+1+0+0 (0+1+0+0)
2. BARI								
a. Soil physics section	-	-	-	1+3+1+0	-	-	-	-
b. Plant physiology section	-	-	-	-	-	0+5+0+0	-	-
c. Agricultural Engineering Division	0+1+3+0 (2+0+0+0)	-	-	-	-	-	-	-
3. BJRI								
a. Agronomy Division	0+0+1+0	-	-	-	-	0+8+0+4	-	-
b. Soil Science	-	-	-	-	1+4+0+1	-	-	-

*a+b+c+d indicates Ph.D.+M.Sc.+B.Sc.+ Diploma respectively, shown in numbers, persons under training are shown in the same order within parentheses.

AE = Agricultural Engineering
WRE = Water Resources Engineering
CE = Construction Engineering
SP = Soil Physics
SF = Soil Fertility

1	2	3	4	5	6	7	8	9
4. BAU								
a. Irrigation & Water Management Department	3+8+0+1 (2+4+0+0)	-	-					
b. Soil Science Department	-	-	-	1+1+0+0	4+2+2+0	-	-	-
c. Agril.Economics & rural sociology faculty	-	-	-	-	-	-	5+16+0+0	2+6+0+0
5. BWDB	0+0+3+0	0+0+70+0	0+10+787+400	-	0+57+15+0	0+13+18+290	-	-
6. BUET								
a. Water Resource Engineering Department.		3+6+4+0	-	-	-	-	-	-
7. BARD	0+1+0+1	-	-	-	-	1+2+0+0	0+2+0+0	0+22+0+0
8. CU								
a. Botany Department.	-	-	-	-	-	1+7+0+1	-	-
9. INA								
a. Irrigation & Water Management Division.	0+1+0+1 (0+2+0+0)	-	-	0+1+1+0		-	-	-
10. BADC	0+0+100+50	0+0+50+0	0+0+247+1356	-	-	0+242+1248+1803	-	-
11. BKB	0+1+13+15	-	-	-	-	0+20+13+0	-	-
12. IRDP	-	-	0+0+4+26	-	0+1+0+0	0+15+7+0	0+2+0+0	0+206+93+0
13. DU								
a. Soil Science Department	-	-	-	1+3+0+0	8+6+0+0	-	-	-

	2	3	4	5	6	7	8	9
14. BRRI								
a. Agricultural Engineering Division	1+1+1+0 (0+1+0+0)	-	-	0+1+0+0	-	0+1+0+0	-	-
15. Soil Survey Department, Govt. of Bangladesh.	-	-	-	-	1+5+0+0	-	-	-
16. SRI	0+0+1+0	-	-	-	0+2+1+0	0+2+0+1	-	-
17. Directorate of Agriculture (Extension & Management).	-	-	-	-	-	0+0+590+5065	-	-
18. MCC	0+1+0+0	-	-	-	-	0+0+2+0	-	-
19. CARE-Bangladesh	0+0+0+8	-	-	-	-	0+0+0+4	-	-
20. RDRS	0+0+0+1	-	0+0+1+6	-	-	0+5+4+14	-	-

2.2 Physical facilities:

Laboratory facilities, equipment and farm implements and machinery are not adequate at most research organizations to carry out research activities in irrigation and water management. Institutes like BARI, BRRI, INA and BAU are trying to improve their facilities to undertake both Experimental Station and on-farm irrigation engineering research. BARI, BRRI, BARD and BADC have good workshop facilities to design, fabricate and test irrigation equipments and machineries. CU has good farm facilities to work on development and utilization of artesian aquifer. DU has good laboratory facilities to conduct some soil water management research at field level. More reliable and useful results will be obtained if such studies are conducted in collaboration with the research institutes having farm facilities. The Council is trying to extend its help in creating more physical facilities for all the concerned organizations/ institutes specially BARI, SRI, BAU,INA and BWDB. A list of the research facilities (laboratory equipment, field equipment and workshop) at various organisations in the field of irrigation and water management is given in Table 2.2. Short course in instrumentation, training of technical laboratory and field staff is needed to improve the reliability and validity of soil and water research. Concurrently repair and maintenance of irrigation and soil water equipment are urgently needed.

Table 2.2. Research Equipment (Laboratory, Field and Workshop) at various organisations in the field of irrigation and water management.

1. BARI, Joydebpur.

a) Soil physics section

Laboratory equipment:	Status
i) Oven	Workable
ii) Balance	"
iii) Moisture cup	"
iv) Soil hydrometer	"
v) Pressure plate apparatus	Not yet installed
vi) Electric soil shaker	Workable
vii) Muffle furnace	"
viii) Soil permeability apparatus	"
ix) Particle size analysis equipment	"
x) pH meter	"
xi) Set of seives and salt bridge	"

Field equipment:	
i) Tensiometer (gauge type)	Workable
ii) Infiltrometer	"
iii) Moisture probe	"
iv) Soil Auger (core sampler)	"
v) Soil thermometer	"

b) Plant physiology section

Laboratory equipment:	
i) Electric conductivity meter	Workable
ii) Oven	"

c) Agricultural Engineering Division

Workshop:	Status
i) Lathe machine	Workable
ii) Drilling machine	"
iii) Shaping machine	"
iv) Grinding machine	"
v) Casting facilities	"
vi) Welding machine	"

2. BJRI

a) Agronomy division

Laboratory equipment:

i) Oven	Workable
ii) Germinator	"
iii) Incubator	"
iv) Pressure bomb apparatus	"

Field equipment:

i) Tensiometer (Gauge and manometer type)	Workable
ii) Gypsum block	"
iii) Soil moisture meter	"
iv) Soil auger	"
v) LLP [illegible]	"
vi) Deep tubewell	"
vii) Shallow tubewell	"
viii) Tractor	"
x) Sprinkler	"

Workshop:	Status
i) Lathe machine	Workable
ii) Shaping machine	"
iii) Grinding machine	"
iv) Welding machine	"
v) Air compressor	"
vi) Drilling machine	"
vii) Power saw	"

b) Soil Science Division

Laboratory equipment:

i) Oven	Workable
ii) pH meter	"
iii) Kjeldahl's apparatus	"
iv) Colorimeter (Cecil)	"
v) Atomic absorption spectrophotometer	Yet to be installed
vi) Flame photometer	Workable
vii) Electric balance	"
viii) Centrifuge	"
ix) Muffle furnace	Not workable*
x) Hydrometer	Workable
xi) Bouyoucos cylinder	"

Field equipment:

i) Tensiometer (Manometer type)	Workable
ii) Soil actual volumometer	"
iii) Soil volume weight tester	"
iv) Plant moisture potential tester	"

*Repairable

3. Department of Soil Survey,
Government of Bangladesh.

Laboratory equipment:	Status
i) Pressure plate apparatus	Workable
ii) Haimes apparatus for low suction moisture retention	"
iii) Saturated permeability apparatus for soil core sample	"
iv) Temple pressure apparatus for low suction moisture retention	"
v) Muffle furnace	"
vi) Electric soil shaker	"
vii) Hydrometer	"
viii) Memilton beach shaker	"
ix) Micro kjeldahl distillation apparatus	"
x) Digestion apparatus	"
xi) Oven	"
xii) Sand and water bath	"
xiii) Sets of salt bridge for electrical conductivity determination	"
xiv) WRIST Action shaker	"
xv) Colorimeter	"
xvi) Centrifuge	"
xvii) pH meter	"
xviii) Flame photometer	"
xix) Analytical balance	"
xx) Vacuum pump	"

4. BWDB

Laboratory equipment:	
i) Electric Oven	Not workable*
ii) Analytical laboratory balance	Workable

Laboratory equipment:	Status
iii) Gas generator type AP 20 Airgas plant portable	Workable
iv) Desicator 240 mm and 210 mm	"
v) Muffle furnace	"
vi) pH meter	"
vii) Hot plate	"
viii) Distilling still	"
ix) Micro and macro kjeldahl apparatus	"
x) Water deionizer	"
xi) Electrical conductivity bridge	"
xii) Water bath	"
xiii) Electro photometer	"
xiv) Spectro-photometer	"
xv) Electric stirrer	"
xvi) Porous block	"
xvii) Hydrometer	"
xviii) Bouyoucus cylinder	"
xix) Thermometer	"
xx) Floater	"
xxi) Stainer	"
xxii) Boiler	"

Field equipment:	
i) Tractor	Workable
ii) Power Tiller	Not workable
iii) Japani plow	Workable
iv) Disk plow	"
v) Harrow Disk	"
vi) Mold Board plow	"
vii) LLP	"

Field equipment:	Status
viii) Deep Tubewell	Workable
ix) Shallow Tubewell	"
x) Weeder	"
xi) Power sprayer	"
xii) Hand sprayer	Not workable*
xiii) Parshall flume	Workable
xiv) Grass cutter	Not workable*
xv) Hasking machine	Not workable
xvi) Seed treater machine	"
xvii) Lysimeters	Workable
xviii) Tensiometer	"
xix) Soil auger	"
xx) Core sampler	"

5. BAU, Mymensingh.

a) Irrigation and water management department:

Laboratory equipment:

i) Multipurpose hydraulic Test rig	Workable
ii) Fluid friction apparatus	"
iii) Centrifugal pump test rig	Not workable*
iv) Flow meter calibration test rig	" *
v) Flow meter	" *
vi) Pelton turbine	" *
vii) Reynold's apparatus	Workable
viii) Air compressor	"
ix) Control turbine pump	Not workable*
x) Axial flow turbine pump	" *

Laboratory equipment:	Status
xi) Electrical balance	Workable
xii) Test facilities for mechanical properties of soil	"
xiii) Test facilities for chemical properties of soil and water	"
xiv) Sevies	"
xv) Electrical oven and accessories	"
xvi) Vacuum pump	"
xvii) Glass wares	"
xviii) 2½ feet flume	"

Field equipment:

i) Soil auger, samplers etc.	"
ii) Water flow measuring devices	"
iii) Full set of weather recording equipments and weather yard	"
iv) Moisture blocks, Tesiometers and other equipments	"

Workshop:

i) Electric welding set	"
ii) Gas welding set	"
iii) Power saw	"
iv) Grinding machine	"
v) Drill machine	"

b) Soil Science Department:

Laboratory equipment:

i) Hydraulic conductivity measuring unit	Workable
ii) Pressure plate apparatus	Not workable*

Laboratory equipment:	Status
iii) Core sampler	Workable
iv) Auger	"
v) Electric oven	"
vi) Salt bridge for measuring soluble salts	Not workable*
vii) Balance and weight	Workable
viii) Hydrometer	"
ix) pH meter	"
x) Unit for determining particle size distribution	"
xi) Soil consistency measuring unit	"
xii) Bulk density measuring unit	"
xiii) Particle density measuring unit	"
xiv) Facilities for determining the quality of irrigation water	"
xv) Spectro photometer	"
xvi) Flame photometer	"
xvii) Water distillation plant	"
xviii) Gas generator	"
xix) Kjeldahl's Distillation plant	"
xx) Centrifuge	"
xxi) Microscope	"
xxii) Sterilizer	"
xxiii) Colony counter	"

Field equipment:	
i) Lysimeter	"
ii) Tensiometer	"
iii) Infiltrometer	"
iv) Gypsum block	"

6. CU

Laboratory equipment:	Status
i) pH meter	Workable
ii) Spectrophotometer	"
iii) Flame photometer	"
iv) Autoclave	"
v) Centrifuge	"
vi) Kjeldahl apparatus	"
vii) Oven	"
viii) Electric balance	"
ix) Ordinary balance	"
x) Water bath	"
xi) Distillation plant	"

Field equipment:	
i) Power tiller	"
ii) LLP (BABICO)	Not workable*
iii) Hand sprayer	Workable
iv) Tensiometer (gauge type)	"
v) Soil temperature determiner	"
vi) Soil Testing kit	"

Workshop:	
i) A complete machine shop	"

7. BADC:

Workshop:	
i) Multipurpose lathe	Workable
ii) Bench lathe	"

Workshop:	Status
iii) Universal screw cutting	Workable
iv) Precision tool lathe	"
v) Surface grinding machine	"
vi) Crankshaft grinding machine	"
vii) Pedestal grinding machine	"
viii) Camshaft grinding machine	"
ix) Tools cutter grinding machine	"
x) Valve grinding machine	"
xi) Bench drilling machine	"
xii) Portable drilling machine	"
xiii) Piller type drilling machine	"
xiv) Radial drilling machine	"
xv) Hand operated shear	"
xvi) Shearing machine	"
xvii) Vertical boring machine	"
xviii) Portable boring machine	"
xix) Vertical honing machine	"
xx) Portable honing machine	"
xxi) Tool room milling machine	"
xxii) Vertical milling machine	"
xxiii) Hydraulic shaper machine	"
xxiv) Sheet bending machine	"
xxv) Mobile welding set (diesel)	"
xxvi) Mobile welding set (petrol)	"
xxvii) A.C. Arc welder	"
xxviii) Mobile generator	"
xxix) Hand operated press	"
xxx) Hydraulic press	"
xxxi) Air compressor (mobile)	"
xxxii) Washing machine	"
xxxiii) Injector testing unit	"
xxxiv) Fuel pump test bench	"
xxxv) Power Hacksow	"
xxxvi) Electric volcanizer	"

8. BKB.

Field equipment:	Status
i) Hand operated grinder	Workable
ii) Hand drilling machine	"
iii) Puller (Std. size)	"
iv) Ratchet spanner	"
v) Torque wrench	"
vi) Box wrench set	"
vii) Adjustable wrench	"
viii) Hand tachometer	"
ix) Valve seat cutter	"
x) Thread cutter	"
xi) Oil cane	"
xii) Pipe cutter	"
xiii) Socket wrench set	"
xiv) Bench vice	"
xv) Stud remover	"
xvi) Nozzle multi clean	"
xvii) Fuel pump tool kit	"
xviii) Cylinder bore gauge	"

Workshop:

i) Bench lathe	"
ii) Bench drill	"
iii) Gas welding set	"
iv) Electric welding set	"
v) Shear machine	"
vi) Nozzle tester	"
vii) Grinding machine	"

9. BRRI, Joydebpur.

Laboratory equipment:	Status
i) Soil pressure membrane apparatus	Workable
ii) Soil aggregation analysis apparatus	"
iii) Electric oven	"
iv) Electric shaker	"
v) Tripod supported centrifuges	"
vi) Planimeter	"
vii) Maximum water holding capacity dish	"
viii) Porous blocks	"
ix) Electric balance	"
x) Flame photometer	"
xi) pH meter	"
xii) Muffle furnace	"

Field equipment:	
i) Soil moisture meter, tensiometer	"
ii) Soil permeameter	"
iii) Water level recorder	Not workable*
iv) S-C-T meter	"
v) Irrigation water tester	Workable
vi) Hygrometer	"
vii) Soil auger	"
viii) Earth thermometer	"
ix) Levelling instrument	"
x) V-notch	"
xi) Parshall flume	"
xii) Evaporation pan	"
xiii) Lysimeter	"

Workshop:	Status
i) Lathe machine	Workable
ii) Milling machine	"
iii) Shaper machine	"
iv) Welding machine	"
v) Sheet metal cutter	"
vi) Power saw	"
vii) Drilling machine	"
viii) Spot welding machine	"
ix) Sheet bender	"

10. INA, Mymensingh.

Laboratory equipment:

i) Pressure plate apparatus	Not yet installed
ii) Electric oven	Workable
iii) Weighing balance	"
iv) Conductivity bridge	"
v) Spectrophotometer	"
vi) pH meter	Not workable
vii) Spectronic spectro photometer	Workable
viii) Specific ion meter	"

Field equipment:

i) Nutron moisture meter with all accessories	"
ii) Tensiometer	"
iii) Gamma density probe with all accessories	"
iv) Soil auger	"

Field equipment:	Status
v) Suction probe	Workable
vi) Soil core samplers	"
vii) Irrigation pump	"
viii) Field installation with all plumbing spares	"

Workshop:

i) Lathe machine	Not workable*
ii) Drill machine	Workable
iii) Power saw	Not workable
iv) Power grinder	Workable
v) Welder (ARC)	"

11. DU.

a) Soil Science Department:

Laboratory equipment:

i) Pressure bomb apparatus	Workable
ii) Speedy soil moisture tester	"
iii) Set of sieves for aggregate analysis	"
iv) Atterbug limit apparatus	"
v) Soil permeability measurement on core sampler	"
vi) Conductivity bridge for soluble salt determination	"
vii) Electric oven	"
viii) Analytical balance	"
ix) Distillation apparatus	"
x) Equipment for particle size analysis	"

Laboratory equipment:	Status
xi) Mettler balance	Workable
xii) pH meter	"
xiii) Grinding machine	"
xiv) Atomic absorption spectrophotometer	Not workable*
xv) Coleman spectrophotometer	Workable
xvi) Centrifuge	"
xvii) Hotplates	"
xviii) Kjeldahl's micro distillation apparatus	"
xix) Muffle furnace	"
xx) Water bath	"
xxi) Flame photometer	Not workable*

Field equipment:

i) Tensiometer	Workable
ii) Resistance meter with gypsum block	"
iii) Soil moisture tester	"
iv) Soil core sampler	"

12. BUET.

a) Water Resources Engineering Department.

Laboratory equipment:

i) Adjustable bed flume 70' long	Workable
ii) Adjustable bed flume 50' long	Not workable*
iii) Mobile bed flow channel	Workable
iv) Adjustable bed flow channel	Not workable*
v) Fluid friction apparatus	Workable

Laboratory equipment:	Status
vi) Series-parallel pumps test rig	Workable
vii) Multi purpose Testing apparatus (Orifice, notch, venturimeter etc.)	"
viii) Water hammer apparatus	Not workable*
ix) Permeability testing apparatus	Workable
x) Aquifer test apparatus	"
xi) Soil drainage apparatus	"
xii) Centrifugal pump	"
xiii) Physical river model	"
xiv) Pipe-friction measurement equipment	"
xv) Oven	"
xvi) Set of sieves	"

Field equipment:

i) Tensiometer	"
ii) Rain gauge	"
iii) Hygrometer	"
iv) Actinograph	"
v) Current meter	"
vi) Parshall flume	"
vii) Infiltrometer	"

Workshop:

A complete workshop facilities are available

13. IRDP.

Field equipment:

i) Rice mill	Not workable*

Workshop:	Status
i) Four workshops at four training centers	Workable

14. CARE-Bangladesh.

Field equipment:

i) Sprayer	Workable
ii) Weeder	"
iii) Moisture meter	"

15. SRI, Ishurdi.

Laboratory equipment:

i) Oven	"
ii) Hydrometer	"
iii) Hydrometer jar	"
iv) Mechanical shaker	"
v) Balance	"
vi) pH meter	"
vii) Spectro-photometer	"
viii) Water bath	"
ix) Soil stirrer	"

Field equipment:

i) Class A evaporation pan	"
ii) Raingauge	"
iii) Anemometer	"
iv) Sun shine recorder	"
v) Dry & Wet bulb thermometers	"

Field equipments:	Status
vi) Deep tubewell	Workable
vii) PVC pipes (6"dia)200'	"
viii) LLP [illegible] pump	"
ix) Soil auger	"

Workshop:

i) Welding set	"
ii) Grinding machine	"
iii) Lathe machine	"
iv) Drill machine	"
v) Battery charger	"
vi) Power saw	"
vii) Nozzle Tester	"

16. RDRS.

Field equipments.

i) Slump cone equipment (concrete)	"
ii) Boring rod	"
iii) Boring socket	"
iv) Hack saw	"
v) Pipe wrench	"
vi) Boring pipe	"
vii) Auger	"

Workshop:

i) Concrete mixer machine	"
ii) Poker vibrators	"
iii) Lathe machine	"
iv) Electric drill with stand	"

Workshop:	Status
v) Grinding machine	Workable
vi) Electric transformer	"
vii) Shearing machine	"
viii) Gas jar with meter	"
ix) Electric hand drill	"
x) Pipe cutter	"
xi) Foot torning machine with blower	"

2.3 Research projects:

At present BARC is co-ordinating 14 research sub-projects on water management with financial support provided from IDA and USAID funds. Most of the research organisations have some irrigation and water management research projects financed from their own research grants. Some aid giving agencies like, The Ford Foundation, DANIDA, FAO and ADB are also financing selected development projects under different research and extension organisations. A list of the research projects along with source of fund and achievements is given in Table 2.3

At an early date BARC plans to convene an irrigation/water management seminar/workshop to assess results and achievements of the last three years research. Attention will be given to identifying problems, compiling recommendations and packaging for ready transfer to extension and farmers, improved irrigation and water technology.

2.4 Constraints and Recommendations:

2.4.1 Constraints

It is perfectly apparent that among the Institutes and agencies concerned with research on irrigation and water management common constraints preclude necessary performance.

Inadequate equipment and facilities, and insufficient trained manpower are clearly identified factors which constrain effective irrigation and water management research. Non-availability of operational funds specially constrain on farm studies.

Situations exist where improved technology has been generated but it's transfer through Extension to farmers has not been carried out. Neither has improved irrigation technology been packaged nor have follow up training been implemented.

Table 2.3. Research projects at various organisations in the field of irrigation and water management.

Organisation	Project title	Source of fund	Achievement if any.
1. BARI, Joydebpur.			
a) Soil physics section.	a) Study of soil and water management practices for crop production.	BARC/USAID	
b) Plant physiology section.	a) Grading of Brackish water for irrigation and its influence on the change of soil properties associated with crop management.	BARC/IDA	
	b) Effect of drainage system on root and shoot development and yield of maize.	BARI	
c) Agricultural Engineering Division.	a) Manually operated two cylinder piston pump.	BARI	
2. BJRI.			
a) Agronomy division	a) Effect of different amount of pre-monsoon irrigation on the improved varieties of capsularies.	BJRI	
3. Department of Soil Survey, Government of Bangladesh.	a) Characterisation of soil moisture and physical properties of soil.	GOB/FAO	
	b) Water use and deep percolation measurement for aus paddy in basin soils.	GOB/FAO	

Organisation	Project title	Source of fund	Achievement if any.
4. BWDB.	a) Determination of the level of technology in practices at DND project.	BARC/IDA	
	b) Water requirement of HYV paddy and wheat in G.K. Project Area.	BARC/IDA	
	c) Studies on Brackish water management for crop production.	BARC/IDA	
	d) Study on Economics of water management by adoption of appropriate water loss control measures.	BARC/IDA	
5. BAU, Mymensingh.			
a) Irrigation & water management department.	a) Improvised devices for low lift irrigation in Bangladesh.	BARC/IDA	
	b) Control measures for avoiding water losses to achieve water distribution at farm level irrigation system.	BARC/IDA	
	c) Field Research in Irrigation and water management.	Ford Foundation	
	d) Irrigation requirement of mustard.	BARC/IDA	
	e) Water requirement of cotton for optimum yield under different cultural practices.	BARC/IDA	

Organisation	Project title	Source of fund	Achievement if any.
b) Soil Science Department.	a) Studies on irrigation requirements of rice and jute crops under field and lysimetric condition to be correlated to evapotranspiration.	BARC/IDA	
6. CU.	a) Agronomical, Horticultural and physiological studies for wheat, rice, legumes, cabbages, lemon and orange under irrigated conditions.	CU	
7. BARD.	a) An integrated Action Research on irrigation and domestic water supply through local institutions.	BARD	
8. MCC	a) Power pump for hand Tubewell Irrigation.	MCC	Economic comparison of Rower pump and MOSTI and, performance evaluation of Rower pump, MOSTI and Treadle pump.
	b) Cropping system irrigated research.	MCC	
9. BADC.	a) Survey and Investigation schemes of irrigation projects.	IDA/GOB/ ADB	
10. BRRI, Joydebpur	a) Study on effect of ground water level.	BRRI	i) In boro season about 60 inches of water is required in total for rice.
	b) Consumptive use of water by lysimetric method.	BRRI	ii) Seepage and percolation rate at farm level is 1.6 mm/day.

Organisation	Project title	Source of fund	Achievement if any
	c) Analysis of irrigation water.	BRRI	iii) 54% increased yield was recorded with 2" of supplimental irrigation.
	d) Study on application efficiency of irrigation.	BRRI	iv) Water use efficiency varies from 50-60% (BRRI farm)
	e) Fertilizer efficiency under different water management practices.	BRRI	v) It is possible to grow Aus and T.Aman without suffering from moisture stress by managing proper levee size.
	f) Impact of drainage on growth and yield of rice.	BRRI	vi) Low coverage of deep tubewell. Average discharge 1.39 cusec/tubewell and average area under irrigation 30.48 acres/tubewell
	g) Impact of effective rainfall.	BRRI	
	h) Comparison of conveyance effeciency of earthen canal lining.		
11. INA	a) Irrigation requirement of different crops (wheat, chickpea, lentil, maize potato, etc.)	BAEC & BARC	Some information on irrigation requirement of wheat and chickpea are available and more experiments and trials are being conducted.
12. DU			
a) Soil Science Department	a) Grading of Brackish water for irrigation and its influence on the change of soil properties associated with crop management.	BARC/IDA	

Organisation	Project title	Source of fund	Achievement if any.
	b) Water requirement of crops.	UGC	
13. BUET			
a) Water Resources Engineering Department.	a) Development of on-farm water distribution structure, canal lining and improvement of manual water lifting devices-'Don'	BARC/IDA	
	b) Study seasonal soil moisture flux of benchmark soils, check against probability rainfall and potential evapotranspiration to suggest appropriate cropping under rainfed agriculture.	BARC/IDA	
14. IRDP	a) Area Development Projects:		
	i) RD-I project	IDA	
	ii) SIRDP project	ADB	
	iii) NIRDP project	DANIDA	
	iv) Training	BTA	
15. SRI, Ishurdi	a) Determination of water requirement and critical growth stage responsive to irrigation of sugarcane.	BARC/IDA	
16. RDRS	a) Low cost mannual irrigation (using bamboo pipe and stainer) pump.	LWF/RDRS	a) Bamboo tubewells are widely accepted by small and medium farmers.

Command area management cooperation among agencies concerned with irrigation management and technology has been less than satisfactory so that farmers cannot benefit significantly from irrigation.

2.4.2 Recommendations:

1. A minimal set of soil moisture and irrigation water measurement equipment and facilities should be established at selected regional centers sufficient to conduct priority field research.

2. In-country Training Programs in Water Management Research including use of field equipment should be planned and implemented at an early date.

3. On-farm water management research under the co-ordinated BARC soil water/Ag.Engineering Program involving multidisciplinary, inter institutional/scientists should be rapidly and systematically expanded.

4. Task Forces should where necessary be reactivated to accomplish implementation and monitoring of the above 3 recommendations.

5. Improved water management technology which has been farm tested should be packaged and stratagies developed to transfer it to farmers.

III SUMMARY

3.1 Problem Analysis:

In 1979 the Soil and Water Management Task Forces mobilized by the Council and consisting of the Nation's recognized inter-institutional scientists/engineers presented in BARC Soil and Irrigation Publication No.3, priority problems and noted that more than 85 percent farm land was not irrigated.

Rainfed farming problems include:

1. Ineffective control of excess water resulting in flooding and unsuitable soil drainage for many cropping systems.

2. A lack of improved technology to provide the farmer alternatives to meet aberrant weather conditions during premonsoon and monsoon seasons.

3. Inadequate measures to conserve and efficiently utilize soil moisture during the post monsoon period.

4. Induced plough pans that restrict both rooting and sub-soil moisture utilization.

5. Too few cropping system alternatives that could maximize crop production in areas of little or no supplimental irrigation.

6. An inadequate plant genetic bank from which to select drought tolerant varieties into farmer acceptable cropping systems.

Additional priority on farm problems are cited as major constraints to crop production under irrigation.

7. Inefficient on farm water lifting devices, storages, conveyance distribution and application systems.

8. Inadequate information concerning irrigation scheduling at critical stages of crop water requirements and important irrigation x fertility x cultural practice interactions.

9. A lack of economic analysis relative to the costs and returns from irrigation under different cropping systems on benchmark soils.

10. Too little information relative to comparative economics, social/institutional factors and impact of irrigation provided by different irrigation systems.

3.2 Gaps in Improved On Farm Water Technology:

The history of on farm water research in Bangladesh has been at best fragmentary. It is more accurate to state that resource allocation to on farm water resource has been grossly inadequate.

Scrutiny of past accomplishments of on farm water research as well as present available facilities and scientific officers reveals serious gaps which require immediate remedy if priority on farm water management problems are to be resolved: succinctly stated:

1. Planning, coordination, monitoring and funding of a pragmatic Soil/Water research program to generate improved on farm water management technology is essential.

2. A systematic multidisciplinary training and manpower development effort should be initiated to design, implement and evaluate critical research on regionally specific on farm water problems.

3. Physical facilities equipment and funding to support and conduct on farm water studies will require urgent installations and/or acquisitions.

3.3 Future:

Generating improved Technology, its packaging and transfer for adoption to upgrade on farm water management will challenge the entire Research System.

<u>The program is by nature multidisciplinary and inter-institutional.</u>

* The role of BARC in coordinating/monitoring the accelerated water research program both from a Technological and budget management control standpoint is vital. Manpower development, training at all levels in most disciplines involving many scientist/engineers from different institutes will be required to successfully address the on farm water management problems. Oft times Team work will be necessary.

* Packaging of research results and effective transfer for adoption by farmers will require (1) the two way flow of information, that is farmer to scientists and scientists to farmer through a strong extension delivery system. Thus the Research - Extension Linkage must be strengthened.

* Pay off from on farm water research will, among other factors, depend considerably on the cooperation and active support from different Cabinet Ministers.Communication channels not only among the Scientific Technical community but particularly at high level of govt. should be established to ensure awarness, understanding and significance of a National Effort to urgently solve on farm soil water problems through co-ordinated Research - Extension and Development Programs.

G L O S S A R Y

ADB	- Asian Development Bank.
BADC	- Bangladesh Agricultural Development Corporation.
BAEC	- Bangladesh Atomic Energy Commission.
BARC	- Bangladesh Agricultural Research Council.
BARD	- Bangladesh Academy for Rural Development.
BARI	- Bangladesh Agricultural Research Institute.
BAU	- Bangladesh Agricultural University.
BJRI	- Bangladesh Jute Research Institute.
BRRI	- Bangladesh Rice Research Institute.
BTA	- British Technical Assistance.
BUET	- Bangladesh University of Engineering and Technology.
BWDB	- Bangladesh Water Development Board.
CARE	- Common American Relief Every Where.
CU	- Chittagong University.
DANIDA	- Danish International Development Agency.
DU	- Dacca University.
FAO	- Food and Agriculture Organization.
GOB	- Government of Bangladesh.
IDA	- International Development Agency.
INA	- Institute of Nuclear Agriculture.
IRDP	- Integrated Rural Development Program.
LLP	- Low Lift Pump.
LWF	- Lutheran World Federation.
MCC	- Mennonite Central Committee.
NIRDP	- Noakhali Integrated Rural Development Project.
RD	- Rural Development.
RDRS	- Rangpur-Dinajpur Rehabilitation Service.
SIRDP	- Sirajgong Integrated Rural Development Project.
SRI	- Sugarcane Research Institute.
UGC	- University Grant's Commission.
USAID	- United States Agency for International Development.