(農林)52—43

バングラデシュ農業普及計画

専門家(農業機械化)報告書

昭和52年8月

国際協力事業団
農業開発協力部

はじめに

バングラデッシュにおける農業発展の阻害要因としては、(1)自然的条件であるFlood Conditionでの Wator Contorol(乾期におけるIrrigation 雨期におけるDrainage)が出来得ない。(2)農業行政的欠陥である行政組織の弱体が2大要因であろう。

特に後者は、試験研究機関と、普及事業との連携が不十分で研究の成果が末端の農民に十分反映しない。このことは優秀な技術が、農業生産面で生かされず、農業開発における大きな課題となっている。

わが国政府は1974年, この課題に対して試験研究と普及を結ぶパイプ役的機関としてCentral Extension Resources Development Institute(CERDI)の設立援助を決定した。これには CERDI に必要な建物諸施設を無償援助で中味の機材供与等は技術協力で行う、いわゆる無償と技協とタイアップしたわが国初の協力事業である。

1975年、クーデター勃発により政局不安におちいり、着工が延々になっていたがようやく、昨年(1976 年)雨期明けの 10 月下旬から建物敷地の造成と圃場整備作業を開始した。

筆者は特に圃場整備作業を主体に実施して来た。作業期間も任期の関係上短期間であったがここに今までの作業経過と今後に残された作業量、問題点をあげ、報告としたい。

最後に圃場整備作業に協力いただいたCERDI中田正一リーダー、日本技術開発藤岡部長外多数の関係者に深甚の謝意を表します。

1977年8月

農業機械化専門家
松本栄市

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ＣＥＲＤＩ建設（特に圃場整備）事業中間報告

１９７６年６月既存のＦＭＴＩ（機械化訓練センター）が発展的解消し、ＣＥＲＤＩへ全面的移行した。

われわれ日本側派遣専門家は前年よりマスタープランの作成にとりかかっていたが、本格的には雨期明けである１９７６年 11 月からの、土木事業からスタートした。

私はこの現場作業、特に圃場整備を担当したので、今日までの進渉状況について報告する。

1. プロジエクトの概要

１）内　　容

当国の普及事業は普及員だけで行われ、専門技術員が全然なく、また実用化試験も行われていない。したがって、基礎研究と普及との連携が全然なく、研究の成果が、普及につながらない。また普及現場における問題点が研究へ持ち上がらず、そのことがこの国の農業発展の大きな障害となっている。

わが国はこの研究と普及の橋渡しをする機関としてＣｅｎｔｒａｌ Ｅｘｔｅｎｓｉｏｎ Ｒｅｓｏｕｒｃｅｓ Ｄｅｖｅｌｏｐｍｅｎｔ Ｉｎｓｔｉｔｕｔｅ （ＣＥＲＤＩ）の設立援助を決定した。

このＣＥＲＤＩの主要業務は次の項目を主体とする。

(1) 研究資料の集収分析

研究資料を国内、及び海外より集収し、それらを分析して普及の素材開発に供する。

(2) 普及のための農業技術の開発

実用研究を主体として、普及のための技術素材を開発する。

(3) 普及方法の開発

農業、農村事情にふさわしい普及方法や手段を開発する、そのために実験村を設定する。

(4) 農業技術者の研修

開発した技術素材や普及方法を用いて、地区農務官クラス以上の普及関係職員の研修訓練を行う。

(5) 情報活動

開発された素材を用いて普及員及び農民用印刷物を印刷、配布する。

(6) 農機具に関する普及素材の開発

a) バングラデッシュに適する農業機械・機具の開発研究

b) 輸入農業機械の適応試験

2) 場　所

Dacca より北へ約30㎞ 車で30分隣接に BRRI.(稲作試験場) ARI (農業研究所)があり、CERDIが完成すればA,B,C,コンプレックスとして、バ国農業研究と普及の中央機関の殿堂となる。

3) 現在の派遣専門家

チームリーダー	中田正一
普及	福里藤三郎(52年7月末帰国予定)
ソ菜	篠原捨吉
かんがい	渡辺喜一
機械	沼田正道
栽培	難波輝久
調整	和田欽次郎

2. 圃場整備事業

1976年雨期明け（ 10 月下旬）と共に建物予定地の土盛事業（約 4 万㎥）と圃場の整備が主要業務であった。

1）土盛事業

建物予定地への土盛はRh－33.5f を目標に 12 月上旬から現地業者に請け負わせ実施した。

建物建設開始（基礎工事）が今年 2 月からの予定であったため、わずか 2 ケ月間で 4 万㎥の土を動かすことは機械力のない現地業者にとっては非常に困難な業務であった。

結果は目標の約半分 2 万㎥（ 320f ）にすぎなかった。残りの 2 万㎥は今年の雨期明け後建物建後に影響しない所から 33.5 fまで盛土することになっている。

2）圃場整備事業

土盛作業と併行して、圃場内 Leveling, 区割、及農道造成作業を実施した。

この作業には下記供与機材の活用を十分行った。

イ）ショベルドーザー　　Levelling 作業

ロ）トラクター
及ダンプトレーラー　　土の運搬作業

ハ）トレンチャー　　排水路作成

作業量及作業図は次表のごとくである。

第 1 表　今までの圃場整備事業　（Oct., 76 June, 77）

1）農道建設	使用機械又は方法
a）92,750	ブルドーザー
b）38,062.5	トラクタ、トレーラー
c）38,062.5	労働者
d）43,650.0	

Totol 212,525 cft
（60205㎥）

2）溜め池埋立て

A　1,260.00cft
A′　1,080.00
B　2,880.00
B′　2,208.00

} ブルドーザー

Total　7,428.00
（210.42㎥）

3）排水路工事

7320cft
（207㎥）

} 労働者

4）　作り

2,625cft × 10
Total　2,625 cft
（743㎥）

} ブルドーザー
労働者

5）レンガ敷き
6,500cft

} 労働者

総土量合計　991,2681.2 cft
（2,801250㎥）

3. 今後の圃場整備事業

1977年の雨期明け（ 11 月上旬より）後に取りかからなければならない工事は次表のごとくである。

第2表　今後の圃場整備事業

1）排水路

1,455(2×1,5)×2　　8,730cft
1,455(2×1)×2　　5,820
Totol　14,550cft
(412 m^3)

2）農道・レンガ敷

Totol　44,210sft

3）カルバート（φ450 mm）

A　コルゲート　パイプ　　80.0ft　(24.4 m)
　　レンガ　　104.9cft　(2.96 m^3)

B　コルゲート　パイプ　　50ft　(11.3 m)
　　レンガ　　63.1cft　(18.0 m^3)

C　コルゲート　パイプ　　164.4ft　(50.2 m)
　　レンガ　　2323cft
　　(65.8 m^3)

4）園芸圃場への盛土

予定レベルは 33 ft として、総土量は 108,800cft (3,000 m^3)である。
（内容は、外からの搬入土　76,160cft
　　砂　32,640cft）

5）溜池の埋立工事

1）A池

L　W　D
150×30×30

135000cft
(3,824.3 m^3)

2） B池

L　W　D
160×100×10

160,000cft

（4,532.5㎥）

6） 農道作り

（A.R.I. サイド）

L　W　H
2650×35×4

3710,000cft

（10,510㎥）

附録 I. WORKING REPORT OF MR. E. MATSUMOTO

(FROM DECEMBER 1973 TO JUNE 1977)

ANNUAL REPORT OF MR. E. MUTSUMOTO

In December 1973, I came to the Farm mechanization Training Institute (EMTI) of Bangladesh as Farm Mechanization Expert by the dicission of Japan Government. At that time EMTI was under the Directorate of Extension and Management (E and M). My service in EMTI continued up to June 1976 until and unless it had not been converted to CERDI (Central Extension Rescources Development Institute) with separate Director, under the Ministry of Agriculture. In CERDI I was also serving as Farm Mechanization Expert till June 1977.

Working report during EMTI period

The following were the sums and substance of my total works during EMTI period:-

a. Training of UAA and Farmer's sons: The 1st job which had been performed by me in EMTI was the training of Union Agricultural Assistants (UAA) and Farmer's sons. 15 UAA and 10 Farmer's sons came from different places of Bangladesh and was together trained on farm machinary. The purpose of the training was to give some practical knowledges about farm machinaries. They had been trained for a period of 3 months, 15 December 1973 to March 1974. Their training was divided in two parts: i. Lecture and ii. Practical operation of machineries.

i. Lecture: First a lecture was prepared regarding fundamental knowledge on Farm machineries before going to have practical operation in the field. The lecture was mainly prepared on the kinds of Farm machinery, operation method of that machineries, different kinds of engines (diesel and petrol), their operation procedure and precautions.

ii. Operation: After completion of successful lecture the operation of such machineries were also practically done in the field so that the trainee could get a practical knowledge on it.

b. Training of AETI Instructors and Mechanic: Again in January, 1974 a group of AETI Instructors and Mechanics came from different AETI of Bangladesh, and trained on farm machineries. Total of 10 trainees, 1 (one) Instructor and I (one) Machanic taken from each Institute of Bangladesh were trained for a period of one month i.e. from January 1974 to February 1974.

c. Training of District Mechanic: Again in December 1974, 1 (one) Mechanic from each district who worked under DAO (District Agricultural Officer) was selected and trained specially on Plant Protection machinery and equipments. The total of 21 (Twenty one) trainee were trained for a period of 10 days in December 1974.

d. Training of AETI Mechanic: In January 1975 again training of AETI mechanic began. Total seven (7) mechanic taking 1 (one) from each Institute of Gangladesh trained for a period of 2 (two) months, January 1975 to February 1975. They were trained on the fundamental principles of diesel and petrol engines.

e. Visiting different AETI of Bangladesh: Starting from 1974 to 1976, I always tried to maintain an excellent practical programme. I visited each AETI of Bangladesh at least thrice in a year and trying to give some ideas about farm mechineries.

Evaluation of the works: Evaluation of those work are shown in Annex-1.

Working report during CERDI period

In June 1976, the former FMTI was converted to CERDI Project under the Ministry of Agriculture according to the desire of the Government of Bangladesh and Japan. The site of this project was selected at Joydebpur where some acres of land also were alloted.

The following are the summary of works which have been performed by me during CERDI period:

a. At first in the beginging of the CERDI Project the construction areas were developed by earth and sand filling upto a desired RL - 33.5 with my own supervision. This work continued for a long period.

b. The land development work in the farm actually started from October 1976 where different kinds of work have been done. The Annex (annex-2) of these works is attached with this paper.

c. Future works for land development: I have also make a future plan and programm for land development work. The Annex (annex-3) of these works is also attached with this paper.

d. Working with machineries and equipment: The different kinds of farm machinery laying with EMTI and CERDI project are shown in Annex-4.

i. 4-wheel tractor: I used tractor having 35 and 25 horse power (hp) for land preparation of the farm area. In every season Aus, Aman and Boro I was engaged for land preparation with tractor. It gave good result during Aus cultivation. Puddling of Aman and Boro were done by Rotary Tiller. It is experienced that Disc and Bottom plough were not suitable like Rotary especially for this area of Bangladesh because the soil is much clay and silty.

From my 3.5 years experience I like to say that the tractor having so big horse power (hp) is not suitable for individual farmer of Bangladesh. Because the number of rich farmer is very limited. So my idea is to please make some arrangements for tractor having horse power (hp) less than 20.

ii. Power tiller: This is also an important farm machine implement which has been used by me at the time of land preparation during Aus, Aman and also in Boro season. But from my experience this Japanese power tiller is very complicated. Because its operation technic and maintainance is not so easy to every body. So my idea is to make some alternation of this which will make it more easy in operation and maintainance to every body.

iii. Thresher: Semi automatic, Automatic and Fuel moving thresher also used by me in the hervesting period of all paddy. It was very suitable for threshing of Aman paddy because of less moisture content. But in Aus and Boro seasons, where moisture content is higher in rice plant it is very difficult to thresh. Form my own experience these Japanese thresher as a whole is not suitable. It requires at least some necessary alternations especially for this country.

iv. Grain Drier: This is an important appliance for this country. It is most excential during harvesting period of Aus and Boro where farmer get very

little scope to dry their grain. During this time theentire period remain covered with frequent rain. Unfortunately I could use only uncirculating types of drier due to the unavailability of circulating drier. But circulating of drier is more essential because in rainy season the moisture percentage of grain remains very high (about 25%).

Conclusion: During my 3.5 years working in Bangladesh I thought that a fullscale project should be started by Japan Government which will mechanize the Agricultural system of this country and through which the standard of living of rural people will be raised. Fortunately my idea came fulfil in June 1976, when the present project of CERDI was started with the co-operation between Bangladesh and Japan. From my 1 (one) year service in CERDI I like to say that in future this project will bring a great hope-ful change in Agriculture. The construction work is now progressing vigorously and it is hoped that the work will be completed within the schedule time. Finally and lastly I like to express my heartfelt thanks to those persons of Bangladesh who have cordially co-operationd and helped in all steps of work during my stay in this country. Thanks also extended to the persons of Japan Embassy in Bangladesh who helped me in different ways.

附録 Ⅱ.　　TRAINING OF V.A.A. AND FARMER SON

JANUARY MARCH, 1974

Trainees	Marked Obtained.	
	Theory (50)	Practical (100)
1. A.K.M. Rahim Khan		40
2. Abdul Knaleque		55
3. A.K.M.Fazlul Hoq.		65
4. Shafiqul Ilan		56
5. S.K.Nurul Alam		54
6. Md.Shamsul Hoq.		62
7. Anwar Mish		45
8. Abdul Mannan		54
9. Liaqut Ali Khan		45
10. Kazi Shamsuddin		40
11. Abdul Kashem		72
12. Syedul Haq.		44
13. Shamsuddin		52
14. Nurul Islam Khan		57
15. Abdul Mannan		40
16. Mostak Ahmed		61
17. Shafiqul Alam		58
18. Abul Kalam Azad		59
19. S.K. Mahbulah		63
20. Shabullah Chowdhury		45
21. Md.Ibrahim		66

ANNEX I

January - March, 1976

Trainee-Farmer's sons.	Marks Obtained	
	Theory (50)	Practical Total (100)
1. Muzammel Haq	29	76
2. Rajab Ali Srker	28	73
3. Nurul Amin	32	65
4. Janaluddin	28	59
5. Shamsuddin Mondal	36	76
6. Abdul Jobbar	28	85
7. Mamunur Rashid	22	61
8. Atiar Rahman	16	42
9. Shahidul Islam	23	49
10. Shahidul	18	60
11. Hafizur Rahaman	20	61
12. Motazul Haq	20	58
13. Aminul Huq.	18	36
14. Mollah Shafiuddin	12	64
15. Md.Abbas Ali	19	62
16. Abdul Hamid	25	62
17. Abdul Mottablib	12	56
18. Nurul Islam	34	64
19. Mojibur Rahman	26	74
20. Mozzamel Huq.	23	61
21. Karamat Ali	23	70
22. Abdur Rashid	30	63
23. Tazul Islam	20	75
24. Abul Kashim	25	53
25. Mjibar Rahman	21	65
26. Mahiuddin Sarker	29	74
27. Bidhan Chandra Roy	24	86
28. Md.Habibullah	27	57
29. Zafrul Islam	21	68
30. Motiur Rahman	20	59
31. Altaf Hossain	25	54

14th January 1975 to 14th June 1975

Trainees.

A.E.T.I Mechanics - Cum work shop Officer.	Marks Obtained (Full Marks = 50)				
	Theory		Practical		Total
1. Mr. Kazi Sultan Ahmmed A.E.T.I. Gaibandha Rangpur	15	+	20	=	35
2. Mr. A.K.M. Wahab A.E.T.I, Natore Rajshahi.	11	+	15	=	26
3. Mr. S.H. Knan Lodi A.E.T.I, Tejgaon Dacca	7	+	20	=	27
4. Mr. Shaik Badruddin Ahmmed A.E.T.I., Daulatpur Khulha.	7	+	22	=	29
5. Mr. Md. Masud Hussain A.E.T.I., Sherpur Mymensingh.	9	+	21	=	30
6. Mr. Muzahed Ali A.E.T.I., Gouripur Mymensingh.	11	+	18	=	29

ANNEX II

Land Development work, month of Oct.'76 to June '77

1. Road Construction

a)	92750 cft.	by Bull dozer
b)	38062.5	Tractor
c)	38062.5	Labourer
d)	43650.0	

Total : 212525 cft.
(6020.5m^3)

2. Pond feeding.

A)	1,260.00 cft.
A')	1,080.00
B)	2,880.00
B')	2,208.00

Total : 7,428.00
(21042m^3)

3. Drainage Canal

7320 cft.
(207m^3) by Labourer

4. Boundary (Ail)

2625 cft. x 10 by labourer

Total : 26250 cft.
(743m^3)

5. Brick Soling

6500 cft.

Total : 9912681.2 cft.
2,8012.50m^3.

ANNEX III

Future work of Land Development at Joydebpur

1. Drainage Canal and Irrigation canal. (Pucca)

1455 (2 x 1.5) x 2	8730 cft.
1455 (2 x 1) x 2	5820
Total :	14550 cft. (412 m^3)

2. Brick Soling

Total :	44,210.00 sft.

3. Calvert

A. ϕ450 mm

Colgate Pipe	800ft. (24.4 m)
Brick	104.9 cft. (2.96 m^3)

B. ϕ450 mm

Colgate Pipe	50 ft. (11.3 m)
Brick	63.1 cft. (1.80 m^3)

C. ϕ450 mm

Colgate	164.4 ft. (60.2 m)
	232.3 cft. (6,58 m^3)

4. Filling to Horticulture field Hight level 33 ft.

Total feeding	108800 cft. (3,000 m^3)
(Soil from out side	76,160 cft
sand " " "	32,640 cft)

5. Pond

(A) Pond feeding

L W D
150 x 30 x 30

135,000 cft. (3,824.3 m^3)

(B) Pond

L W D
160 x 100 x 10

160,000 cft. (4,532.5 m^3)

6. Construction of Farm Road

which are A.R.I. side

L	W	D
2650	x 35	x 4

3,710,000 cft. (10,510 m^3)

ANNEX IX

LIST OF AGRIL. MACHINERY AND EQUIPMENTS

as Aid from Japan on 73-74

SI. No.	Name of items	Number of Unit
1.	Power tiller	12 Units
2.	Generating set ASK330	4
3.	Tractor 26 hp.	3
4.	Power thresher with engine	5
5.	Automatic thresher with engine	5
6.	Water pump with engine 6"	8
7.	Trailer for power tiller	12
8.	Jeep J200	4
9.	Station Wagon J34	1
10.	Type writer	1
11.	Copying machine	4
12.	Keeping cabinet	4
13.	Steel cabinet	4

LIST OF AGRIL. MACHINERY EQUIPMENT

as Aid from Japan on 1974-75

SI. No.	Name of items	Number of Unit
1.	Cut model Engine	1
2.	Rice Harvester (F 700A)	1
3.	Rice Huller (ME 25)	1
4.	Sowing machine (TM 3)	5
5.	Power Sowing Machine	1
6.	Grain drill (TW 7)	1
7.	Power Sprayer (NS-18A)	1
8.	Hand Sprayer (59-10)	5
9.	Power Weeder	1
10.	Hand Weeker	10
11.	Combine Harvester	1
12.	Binder (BX-50)	1
13.	Rice Transplanter (PS-220)	1
14.	Air Conditioner	2
15.	Freezer (R-204-TD)	4
16.	Track Trailer	1
17.	Power Pump	3
18.	Tool Set	1
19.	Combination Tool Set	1
20.	Socket Wrench Set	1
21.	Torque Wrench Set	1
22.	Vice grip Wrench	1
23.	Driver Set	1
24.	Gear Puller	1
25.	Super Gear Puller	1
26.	Carbon Removing Brush	1
27.	V.A. Tester	1
28.	Volt Ignition Tester	1
29.	Engine R.P.M. Tester	1
30.	Diesel Engine R.P.M. Tester	1

Sl. No.	Name of items	Number of Unit
31.	R.P.M. Meter	4
32.	Circuit Tester	1
33.	Vernier Caliper	4
34.	Micro Meter	1
35.	Battery charger	1
36.	Piston Vise	1
37.	Piston ring Compressor	1
38.	Piston filler gauge	1
39.	Valve lifter	1
40.	Cylinder gauge	1
41.	Nozzle tester	1
42.	Tyre gauge	4
43.	Garrage jack 5 ton	1
44.	Garrage Jack 3 ton	1
45.	Air Compressor (2 ps.)	1
46.	Electric Grinder	1
47.	Electric Drill	1
48.	Cutting Grinder	1
49.	Taps and Dies set	1
50.	Truck Model T210FZH 3 tons Diesel Engine with 10% spear parts	1
51.	Jeep Model TOYOTA FJ40V Gasoline Engine 3800 c.c 155 hp. Top metal with 10% spare parts	1
52.	Station Wagon Engine 3800 c.c 155 hp. with 10% spare parts	1
53.	Sanckel D.P. (3 Kg x 8 bags) x 7 cases	7 cases
54.	M. Daifar H.P. (225g x 60 bags) x 1 cases	1 cases
55.	Baizit emulsifier (500 c.c. x 20 lb.) x 2 cases	2 cases
56.	Over head projector with screen (150 cm x 150 cm)	1 Unit
57.	Camera F.I.8	1

SI. No.	Name of items	Number of Unit
58.	Developing and Enlarging set with 17 accessories	1
59.	Slide projector AS-1000 T	1
60.	Developing medicine for film 650 c.c x 50 tins for printing 1000 c.c. x 50 tins	100 tins
61.	Fixing medicine	50 tins
62.	Acid for developing	50 tins
63.	Printing paper v-3 1/4 size ... 10 boxes v-3 Cabine ..... 10 boxes	20 boxes
64.	16 mm projector 16-A with screen	1 Unit
65.	16 mm film	2 roll
66.	Soil test kit FHK-3 with medicine	5 sets
67.	Calculating machine	1
68.	Typewriter 13"	1
69.	Typewriter 19"	1
70.	Recopy paper B-4 ..... 50 bags B-5 ..... 50 bags A-4 ..... 50 bags	150 bags
71.	Desk for office 700 mm x 16 mm x 700 mm	3 sets
72.	Chair for office	3
73.	Steel cabinet	3
74.	Locker	3
75.	Book shelf	3
76.	Report paper	30V
77.	Type paper	100V
78.	Graph paper	500 sheets
79.	Manuscript paper	30V
80.	Memo paper A-6	60V
81.	Stapler 10-JA with boxes of neel	10 boxes
82.	Jet pen	50 pec

Sl. No.	Name of items	Number of Unit
83.	Mazic pen	24 d
84.	Scotch tape	6 boxes
85.	Ruler	6 pec
86.	Envelop	150 sheets
87.	File	3 boxes
88.	Paper fastener	6 boxes
89.	Cutter	10 pec
90.	Curbon paper	6 boxes
91.	Pencil	10 d
92.	Pencil Sharpener	3 sets
93.	Punch	3

List of Agricultural Machinery and Equipments as Aid from Japan for 1975-76

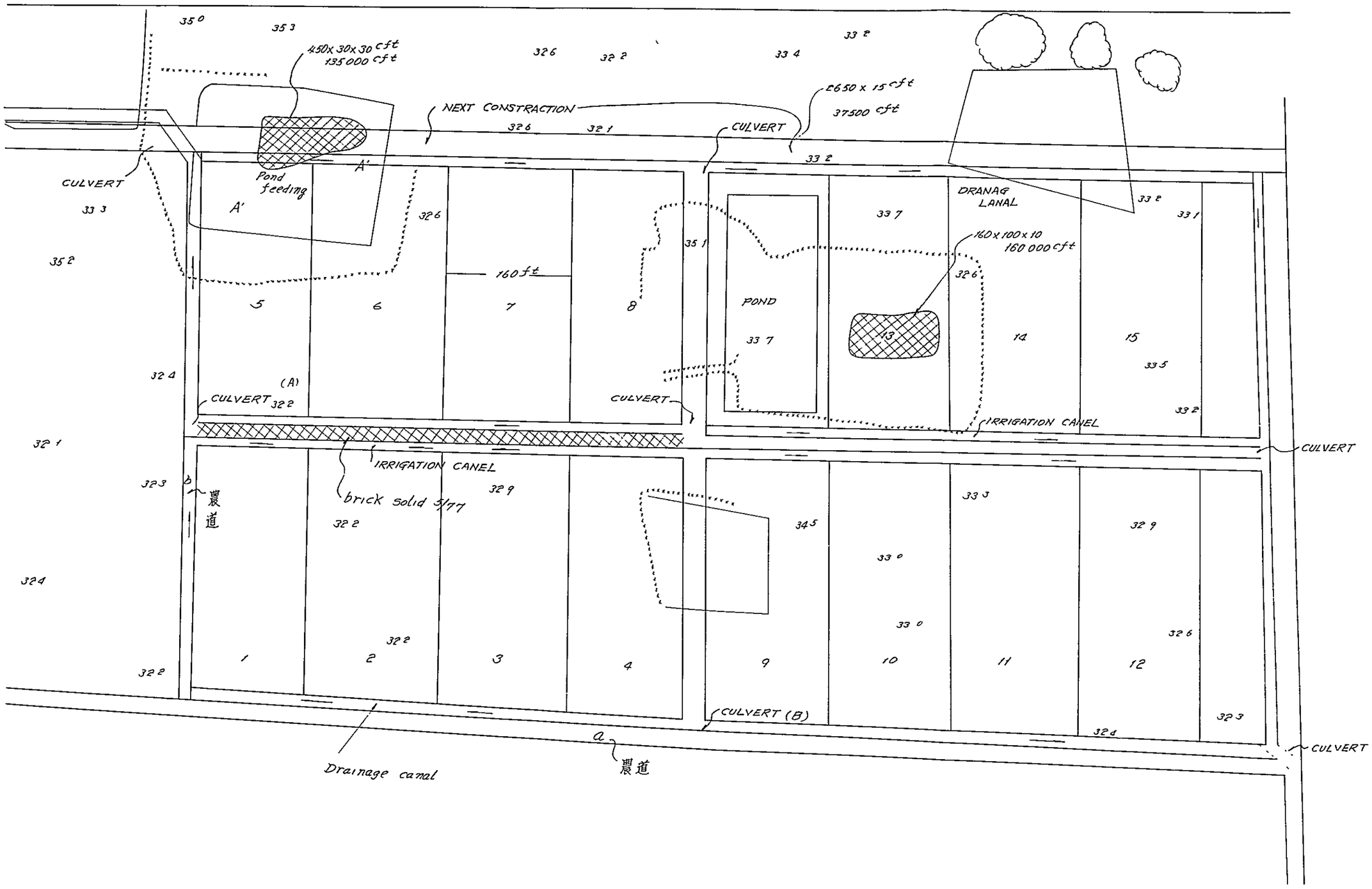
	Unit		¥	F.O.B. Tk
1. Bull dozer with attachment	1		10,200,000	447,478
1. Tractor 36 ps. 10%. s.p	3	1,226,000	3,678,000	15,993
Disc 1700 1900 mm	3	240,000	720,000	31,304
Rotavator 1700 mm	3	380,000	1,400,000	49,565
Dump trailer 2 ton (Kubota)	3	700,000	2,100,000	91,304
Diesel Engine				
2. Trencher II ps. One year S.P. (Kawabe)	1		1,793,400	77,974
3. Station Wagon 140 ps./5200 RPM 2565 c.c (Nisan CEDRICWI)-330V 10% spares parts	2	1,353,700	2,707,400	117,713
4. Jeep 130 ps. 4000 c.c. NIDAN PATROL HARD TOP K-604 10% spares parts	2	1,432,700	2,865,400	124,582
5. Motor Cycle 90 c.c. 10% s.p. (YAMAHA)	5	101,000	505,000	21,957
6. Fork Lifter Diesel Engine 45 ps. Model KOMATSU FORKED 25 c.	1		2,180,000	94,783
Mast 4500 mm	1		90,000	3,913
Fork 1500 Kg	1		100,000	4,349
Bakett 1300 Kg (0.7 m^3)	1		350,000	15,219
Winch	1		400,000	17,391
Fork (KOMATSU)	1		50,000	2,174
7. By-cycle Miyata 26Sw-1	10	27,500	275,000	11,957

REMARK.· W.P. - Wettebe - powder Emul - - Emalgigiable

	Unit		¥	F.O.B. Tk
8. Rear car two wheel	10	26,500	265,000	11,521
9. Rear car one wheel	10	5,900	49,000	2,130
10. Flat Hoe	20	2,200	44,000	1,915
11. Three tooth Hoe	20	2,850	57,000	2,475
12. Hoe	20	2,950	59,000	2,565
13. Grass sickle	50	1,100	55,000	2,391
14. Picker (for Rice harvest)	20	350	7,000	304
15. Hand shoved A type	20	2,500	50,000	2,174
16. Busket 22 e	20	1,150	23,000	1,000
13 e	20	1,150	23,000	1,000
17. Paper pot 7.5 cm x 7.5 cm	200		35,000	1,522
18. Potassium 54,60%	2 ton		182,700	7,943
19. T.S.P. 45%	2 ton		217,300	9,448
20. Suempu W.P. 1 Kg	50	1,480	74,000	33,217
21. Sutam Emul 500 c.c.	50	900	45,000	1,957
22. Tsumassid Powder	24	400	9,600	417
23. Sumichion W.P. 200 g	40	305	12,200	530
24. Sumichion Emulye	15		44,000	1,913
25. Sumichion Powder	100	480	48,000	2,087
26. Baigiddo 100 c.c.,	150	260	39,000	1,435
27. Daiaginon granule 3 Kg	24	1,375	33,000	1,435
28. " W.P. 250 g	60	350	21,000	913
29. Diagron Emale 100 c.c.	60		11,000	478
30. Tsumasaid powder 3 Kg	100	370	37,000	1,609
31. Deptelees powder 3 Kg	100	480	48,000	2,087
32. Daiherdan w.p 500 g x 40	2	60,500	121,000	5,261
33. Fuenagin w.p. 100 g x 100	1		40,000	1,739
34. Sunkel w.p. 500 g x 40	1		44,000	1,913
35. Kusumin 3 Kg	100	540	54,000	2,348
36. Kitagine 100 c.c.	60	200	12,000	522
37. Hinozan Emule	60		13,000	565

		Unit		¥	F.O.B. Tk
38.	Kasumin 100 g	200		28,000	1,217
39.	Sunkel powder 3 Kg x 8	13		77,000	3,348
40.	Manneb 100 g	100		25,000	1,087
41.	O.M.P Model H.P. - 260	8		278,000	12,086
42.	Attachment of O.M.P			170,000	7,391
43.	V.T.R. Model Vo. - 3800 (Covy)				
44.	Video Camera Model 1 Dxc. - 1600	1		850,000	36,957
45.	Video moniter Model 1 O.V.M. - M 20			207,000	9,000
46.	Attachment of V.T.R.			602,000	26,173
47.	Steam cleaner 800 e/n Man sai K.K. Insalated	1		404,000	17,565
48.	Cord for motor 3 phase 50 m Single phase 50 m	 1 1		7,000	304
49.	Microscope Olympia se MSC	10	43,400	434,000	18,870
50.	Balance 100 Kg	3	88,000	88,000	3,826
51.	Table balance 500 g " 300 g	3 3	7,000	42,000	1,862
52.	Transit	2	138,500	277,000	12,043
53.	Leveller	5	95,500	191,000	8,304
54.	Hand Leveller	5	2,600	13,000	565
55.	Plane Table	5	16,200	81,000	3,522
56.	Poll	10	1,900	19,000	826
57.	Box measure 4 m	3		17,000	739
58.	" - 30 m	5	3,200	16,000	696
59.	(Rope) 100 m	6	4,400	22,000	957
60.	Printing Fax 290 mm x 364 mm Model H-300 Vs	1		378,000	16,435
61.	Printer	1		224,000	9,739
	Total : -			25,620,000	1,113,913

附録 Ⅲ. LAND DEVELOPMENT OF C.E.R.D.I



参考資料　LAND USE AND TECHNICAL PROGRESS

From "Agriculture in East Pakistan"

by KALIMUDDIN AHMED, 1965.

LAND USE

Land is extensively cultivated in East Pakistan. East pakistan has an area of 346.50 lakh acres, [72] of which the area excluding rivers comprises 325.98 lakh acres. Out of this area, 216.60 lakh acres are under cultivated crops while 59.75 lakh acres are under forests mostly owned by Government. This means that about 85% of the total land area of the Province is under agricultural crops including forests. About 4% of the cultivated area remains fallow every year due to unfavourable climatic conditions and other difficulties and draw-backs e.g., want of cattle, finance etc. and this area is known as current fallow. The province has 19.08 lakh acres of culturable wastes including small forests under farm holdings. Culturable wastes constitute about 5% of the total area of the province and the farmers own about one-half of these culturable waste lands. However, it will be evident from table 49 that the land area of the province is greatly utilized. The extent and pattern of utilizations vary from place to place depending on land situation and some socio-economic factors. Forests are mostly confined to a few districts such as Khulna, Chittagong Hill Tracts, Sylhet, Chittagong, Mymenshingh, Dinajpur etc. Comparatively large areas of culturable waste lands are available in the districts of Rangpur, Sylhet, Barisal, Rajshahi Jessore, Dinajpur and Mymensingh. The waste lands of Sylhet and Mymenshingh mostly consist of haors and Government have recently launched special programme to utilize these lands in winter by means of power pump irrigation. The waste lands of Chittagong Hill Tracts, Chittagong, Sylhet Dinajpur etc., which generally consist of uneven high lands, are being reclaimed with the help of tractors supplied by Government. The district of Chittagong Hill Tracts has smallest area under cultivation while Mymensingh possess the largest cultivated area. The present position of land utilization in different districts have been shown in table 49.

Table 49

Land utilization in East Pakistan[73]

Unit in lakh acres.

	1955-56	1956-57	1957-58	1958-59	1959-60	1960-61
1. Forest.	54.56	54.61	54.65	54.65	54.65	54.65
2. Area not available for cultivation.	55.46	55.85	55.98	56.07	56.10	56.08
3. Culturable waste lands[74].	19.94	19.63	19.36	19.23	19.16	19.08
4. Total cultivatd area.	216.55	216.42	216.52	216.55	216.59	216.69
(*a*) Net area sown.	204.52	204.55	203.07	198.78	205.75	208.48
(*b*) Current fallow.	12.03	11.87	13.45	17.77	10.84	8.21

According to the Pakistan Census of Agriculture 1960, total area of land owned by farmers is 217.3 lakh acres which is 66.5% of the total land are of the province. Of the total area owned by the farmers, 191.4 lakh acres, that is, 88% are cultivated, and the remaining 12% of the area consists of the following groups: 8% unculturable area, 2% forest area owned by farmers and 2% culturable wastes (see table 50). The culturable waste lands comprise 4.7 lakh acres and these are not within the reach of easy methods of reclamation as these involve sufficient capital investment and proper planning. Farmers who have some means

hardly keep any culturable land uncultivated. As a matter of fact, villages have little land unused, and the ovservation of the Bengal Land Revenue Commission in 1940 that "there is hardly any land to go round" is truer now.

Table 50

Utilization of farmers' land, 1960 [75]

	Area in lakh acres	Per cent
Total area.	217.3	100
A. Cultivated area.	191.4	88
(i) Net sown.	188.4	87
(ii) Current fallow.	2.9	1
B. Uncultivated area.	25.9	12
(i) Forest.	5.1	2
(ii) Culturable waste.	4.7	2
(iii) Unculturable area.	16.1	8

Distribution of crops

The province grows a wide variety of crops which are broadly classified as kharif crops and rabi crops. Crops grown in the rainy season are known as kharif crops [77] and these occupy 80% of the total cropped area. The winter crops locally known as rabi crops [78] occupy only 18% and fruit crops occupy 2% of the cropped area (See table 52)

Though 77% of all farms grow rabi crops, extent of their cultivation on an average farm is very small. Rabi crops occupy only 22.5% of the total area under kharif crops, but number of rabi crops is by far bigger than that of kharif crops. Cultivation of crops in the province is dependent on rainfall and so most of the cultivated area is utilized in the rainy season.

Food crops especially rice are the most important crops grown here (See table 54). The physical conditions of the province as well as peculiar food habits of the people have favoured rice cultivation to dominate in the provinces' agriculture. Rice can stand many odd conditions and can be grown almost any where with some care. It can also be grown all the year round. The Pakistan Census of Agriculture 1960 reveals that rice is gorwn

Table 51

Districtwise land utilization in East Pakistan, 1960-61. [76]

(in thousand acres)

Dist.	Forest.	Not available for cultivtion	Culturable waste.	Current fallow.	Net cropped area.	Total area of district.
1	2	3	4	5	6	7
1. Dacca.	67.9	382.7	18.4	66.5	1219.0	1754.5
2. Mymensingh.	191.3	374.5	145.0	40.5	3035.9	3987.2
3. Faridupur.	...	239.4	32.5	5.4	1376.4	1653.5
4. Chittagong.	716.8	185.3	29.0	1.5	711.8	1644.4
5. Chittagong Hill Tracts.	2769.3	176.0	65.3	1.0		3204.6
6. Noakhali.	...	178.2	13.1	36.6	795.0	1022.9
7. Comilla.	1.0	269.9	14.1	18.3	1318.2	1619.5
8. Sylhet.	203.9	831.5	279.8	82.3	1726.9	3124.4
9. Rajshahi.	0.3	505.2	180.4	14.0	1629.2	2329.1
10. Dinajpur.	13.3	299.0	171.9	55.2	1083.1	1622.5
11. Rangpur.	2.6	439.2	280.0	132.5	1458.7	2367.0
12. Bogra.	...	95.5	18.1	27.0	803.8	944.4
13. Pabna.	...	159.2	24.8	67.5	916.8	1168.3
14. Khulna.	1482.6	379.4	147.0	110.5	959.1	3078.6
15. Barisal.	15.7	435.7	249.0	12.4	1872.9	2585.7
16. Kushtia.	...	141.3	65.0	50.1	621.1	877.5
17. Jessore.	...	264.1	175.0	99.8	1127.1	1666.0
Provincial total	5464.7	5608.1	1908.4	820.9	20848.0	34650.1

Table 52

Number of farms and areas under the main crops, classified by season [79]

	No. of farms (in lakh acres)	%	Total cropped area (in lakh acres)	%
Total Farms.	61.4	100	278.8	100
Kharif crops.	57.7	94	224.1	80
Rabi crops.	47.2	77	50.0	18
Fruit crops.	21.1	34	4.7	2

in 56.54 lakh farms which constitute 92% of the total farms of the province. More than three-fourths of the total cropped area is under this crop. It will be evident from the following particulars that amongst all rice crops, Aman rice is grown by the highest number of farmers and Boro rice is grown by the smallest number of rice farmers[80]

Total farms.	61.4	Lakh	100%
Farms reporting any rice crop.	56.5	,,	92%
Farms reporting Aus rice.	47.3	,,	77%
Farms reporting Aman rice.	52.4	,,	85%
Farms reporting both Aus and Aman rice.	44.3	,,	72%
Farms reporting Boro rice.	7.3	,,	12%

Jute which is the most important cash crop of the Nation, occupies only 5% of the total cropped area, distributed over 44% farms. Sugarcane is also an important kharif crop which occupies 2.5 lakh acres distributed over 6.4 lakh farms. Amongst other crops, the important ones are pulses, oil seeds, wheat, vegetables, fruits and tobacco (see table 54). It will be evident from table 54 that a good number of crops are grown in the

Table 53

Area under important crops in East Pakistan (1947-1961)[81]

unit in lakh acres

Crops	1947-48	1948-49	1949-50	1950-51	1951-52	1952-53	1953-54
Aus	49.00	47.53	46.73	52.59	54.48	54.99	66.24
Aman	133.47	138.59	140.13	139.47	140.27	144.42	148.52
Boro	7.59	8.12	8.42	8.01	8.26	8.37	8.41
Wheat	0.85	0.95	0.94	0.94	0.96	0.98	0.98
Barley	0.73	0.85	0.87	0.82	0.82	0.86	0.85
Masur	1.61	2.64	2.64	2.50	2.51	2.52	2.56
Mung	1.77	1.10	1.09	1.11	1.09	1.11	1.10
Mashkalai	1.64	1.08	1.13	1.31	1.32	1.35	1.34
Gram	2.08	2.06	2.01	2.00	2.01	2.02	2.03
Rape & Mustard	4.32	4.63	4.77	4.88	5.02	5.07	5.05
Sesamum	1.26	1.28	1.30	1.44	1.33	1.39	1.49
Chillies	1.46	1.52	1.67	1.71	1.71	1.85	1.85
Onion	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Sugarcane	2.14	2.25	2.27	2.26	2.29	2.46	2.62
Jute	20.59	18.77	15.61	17.11	17.79	19.07	9.65
Tea	0.70	0.73	0.74	0.75	0.75	0.74	0.75
Tobacco	1.31	1.26	1.28	1.28	1.30	1.31	1.31
Banana	N.A.	N.A.	N.A.	N.A.	0.87	0.91	0.91
Cocoanut	0.16	0.15	0.15	0.15	0.46	0.46	0.46
Other fruits	3.20	3.51	3.58	3.60	3.56	3.49	3.50
Potato	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Winter vegetables	4.61	4.60	4.67	4.63	4.64	4.64	4.66
Summer vegetables	0.64	0.77	0.79	0.74	0.69	0.73	0.75

(Continuation of Table 53)

Crops	1954-55	1955-65	1956-67	1957-58	1958-59	1959-60	1960-61
Aus	60.33	58.20	59.92	57.87	56.46	59.45	63.00
Aman	144.45	129.98	133.77	136.32	131.46	142.89	145.78
Boro	8.58	6.88	6.86	8.16	8.51	9.17	10.07
Wheat	1.03	0.94	1.33	1.07	0.99	1.38	1.40
Barley	0.86	0.88	0.73	0.57	0.60	0.64	0.74
Masur	2.67	2.04	2.09	1.79	1.90	1.59	1.55
Mung	1.14	0.66	0.57	0.41	0.40	0.41	0.38
Mashkalai	1.39	1.26	1.22	1.35	1.43	1.26	1.38
Gram	2.16	1.76	1.65	1.36	1.41	1.33	1.49
Rape & Mustard	5.21	5.43	4.68	3.98	5.54	5.78	5.58
Seasamum	1.46	1.53	1.53	1.16	1.39	1.42	1.33
Chillies	1.90	1.89	1.94	1.70	1.60	1.53	1.75
Onion	N.A.	N.A.	N.A.	0.39	0.40	0 47	0.55
Sugarcane	2.64	2.59	2.55	2.54	2.44	2.81	2.79
Jute	12.43	16.34	12.30	15.62	15.28	13.76	15.18
Tea	0.74	0.77	0.76	0.76	0.76	0.78	0.79
Tobacco	1.35	1.13	1.09	1.07	1.11	1.10	1.02
Banana	0.69	0.60	0.48	0.58	0.53	0.60	0.75
Cocoanut	0.45	0.46	0.44	0.37	0.38	0.39	0.41
Other fruits	3.52	3.56	4.07	2.96	2.25	N.A.	N.A.
Potato	N.A.	0.64	0.72	0.77	0.88	1.16	1.38
Winter vegetables	4.75	4.50	4.75	4.35	3.38	N.A.	2.06
Summer vegetables	0.74	0 83	0.56	0.78	0.72	0 82	0.79

Table 54

Number of farms and areas under different crops, 1960[82]

Crops	No. of farms (in lakhs)	%	Cropped area (in lakhs acres)	%
All crops	61.4	100	278.8	100
Total rice	56.5	92	211.2	76
(*i*) Aus	47.3	77	72.5	26
(*ii*) Aman	52.4	85	128.8	46
(*iii*) Boro	7.3	12	9.9	4
Jute	27.3	44	13.0	4.7
Sugarcane	6.4	10	2.5	0.9
Wheat	6.5	10.5	2.3	0.8
Fruits[83]	21.1	34	4.7	1.7
Rabi pulses	20.9	34	16.1	5.7
Kharif pulses	3.2	5	1.5	0.5
Fodder	5.9	9.6	3.8	1.3
Other crops :	...	...	23.6	8.4
(*i*) Rabi sweet potato	6.6	10.7	1.01	0.36
(*ii*) Kharif sweet potato	1.1	1.7	0.17	0.06
(*iii*) Potato	11.3	18.4	1.40	0.50
(*iv*) Onion	8.6	14.0	0.96	0.34
(*v*) Rabi vegetables	8.4	13.6	0.94	0.33
(*vi*) Kharif vegetables	4.7	7.6	0.51	0.18
(*vii*) Mustard	15.3	24.9	7.55	2.71
(*viii*) Ground nut	0.5	0.8	0.30	0.10
(*ix*) Sunhemp	0.7	1.1	0.28	0.10
(*x*) Other rabi crops	23.3	39.9	6.46	2.31
(*xi*) Other Kharif crops	7.4	12.0	4.00	1.43

province and the farmers adopt mixed farming. The average farmers produce crops (except jute) mostly for their family consumption and they can hardly avoid any important crop; but the production is far below the internal requirement. As a result, though there is a tendency to increase production, the areas under important crops do not greatly differ from year to year. This is because significant increase in the total cultivated area has not annually been possible and suitable facilities to bring large areas under cultivation in the dry season are not yet sufficiently available to increase cropping intensity and change the cropping pattern to a visible extent. Whatever change is now noticed in acreage under a crop in different years is mostly determined by climate Only the cash crops particularly jute are influenced by price in addition to climatic factors. However, inspite of climatic hindrance a trend of slow increase in acreage is noticed in respect of some important food crops such as rice, wheat, mustard etc. The area under fruit crops which are being gradually replaced by some quick growing crops, tends to decrease. The annual change in acreage under different crops may be revealed from table 53.

The province does not possess wide regional differences and so each district can produce most of the crops of the province. In fact, all important crops of the province are grown in each district except Chittagong Hill Tracts, though their extents of cultivation are different in different districts. However, due to some differences mainly in topography and soil, conditions highly favourable for some crops are available in some tracts and as a result, these crops are more extensively grown in these tracts than in other parts of the province. Cultivation of orange is confined to the Sylhet district and pineapple is mostly cultivated in the districts of Sylhet, Dacca, and Comilla. Broadcast Aman and white jute are mainly grown in the lowlying districts while transplanted Aman and Tossa jute are largely grown in the medium type of lands. Sylhet and Mymensingh are the most important Boro growing districts of the province. Tea is cultivated only in the hilly areas under the districts of Sylhet, Comilla, Chittagong and Chittagong Hill Tracts. Similar regional importance may be

Table 55

Area under important crops in different districts (average for 5 years ending 1959-60)

Unit in thousand acres

Name of crops.	Dacca	Mymensingh	Faridpur	Bakarganj	Chittagong	Ctg. Hill Tracts	Noakhali	Comilla	Sylhet
Aus	297.4	856.6	479.3	283.6	278.2	88.7	296.9	455.3	238.8
Aman	766.8	1603.0	880.3	1541.7	687.3	91.3	566.2	106.9	1103.0
Boro	54.9	253.4	41.8	5.6	1.7	...	3.1	48.9	335.8
Wheat	6.4	6.0	9.3	0.1	0.1	...	0.2	3.3	0.3
Barley	4.0	5.9	8.0	...	0.4	...	...	0.3	...
Maize	0.1	0.2	0.1	...	0.1	0.9	0.2	...	...
Other cereals	28.5	13.7	29.5	5.2	...	...	0.6	21.1	1.3
Musur	7.6	12.1	14.1	3.9	0.9	0.2	3.4	6.2	1.2
Mung	3.9	5.7	2.8	6.5	1.4	0.2	4.8	4.9	1.2
Mashkalai	13.8	22.2	8.5	0.1	1.9	0.2	2.3	9.5	2.0
Gram	4.6	5.5	9.4	1.7	0.1	...	0.6	0.8	0.2
Rahar	0.4	0.5	0.3	...	...	0.1	0.1	...	0.1
Other pulses	34.7	24.5	22.0	30.4	7.3	0.4	12.6	258.4	1.4
Rape & mustard	41.8	112.2	32.0	3.4	1.3	13.3	1.7	2.2	10.9
Seasamum	15.9	12.1	21.0	13.6	0.2	30.2	0.9	7.3	0.6
Linseeds	4.1	1.5	6.7	0.4	...	...	4.7	3.1	3.2
Other oil seeds	3.8	20.0	4.1	0.3	0.1	...	0.4	1:8	0.7
Chillies	10.2	21.0	17.6	29.6	13.5	2.0	15.9	18.9	8.3
Onion	5.7	7.4	7.8	1.1	0.4	0.1	0.5	4.4	0.1
Other spices	5.4	6.9	14.6	6.6	4.6	5.3	2.8	4.3	4.6
Sugarcane	24.1	25.6	18.5	18.0	3.5	1.1	3.5	1.9	4.0
Jute	16.0	391.8	127.6	32.2	0.2	1.2	33.5	146.2	32.0
Sunhemp	...	3.3	4.2	1.1	1.0	...	0.2	0.4	0.8
Tobacco	4.6	9.2	7.4	4.7	1.8	1.4	0.2	1.9	4.8
Tea	...	...	...	...	4.5	0.1	...	0.1	74.1
Banana	2.9	4.0	2.4	4.1	2.3	2.2	2.1	2.0	4.5
Cocoanut	0.6	0.4	1.3	17.4	0.6	...	4.0	0.9	0.3
Other fruits	38.0	11.1	18.8	26.4	4.8	8.4	25.7	9.4	9.2
Winter vegetables	68.1	134.4	20.4	22.5	7.8	3.3	14.7	17.4	13.7
Sumer vegetables	2.9	3.4	13.8	12.5	2.9	4.2	0.7	6.8	3.6
Potato	5.6	12.2	0.9	0.4	2.6	0.6	0.9	2.9	4.4

(Continuation of Table 55)

Name of crops	Rajshahi	Dinajpur	Rangpur	Bogra	Pabna	Kushtia	Jessore	Khulna
Aus	313.4	173.6	772.4	170.6	297.6	322 5	449.6	63.5
Aman	950.7	712.5	977.2	522.4	451.7	228.6	565.9	774.0
Boro	29.9	1.3	4.3	0.7	2.5	0.4	0.4	7.0
Wheat	24.3	3.4	25.1	2.8	14.8	14.6	3.5	0.1
Barley	10.9	4.7	18.6	0.4	10 5	2.7	2.0	...
Maize	2.3	1.7	0.8	0.1	0.1	0.2	...	...
Other cereals	15.9	3.8	20.3	8.5	21.0	5.4	9.2	2.5
Masur	30.4	4.5	23.1	13.3	23.9	15.8	21.2	6.4
Mung	1.3	1.7	3.7	2.6	0.9	0.9	4.0	2.2
Mashkalai	13.7	3.3	11.9	6.3	16.5	13.8	3.0	1.4
Gram	19.2	3.5	8.8	5.0	11.3	64.7	14.5	0.5
Rahar	2.8	0.7	3.0	0.4	0.4	7.4	0.3	...
Other pulses	32.6	3.9	23.0	13.0	37.4	9.0	19.5	1.9
Rape & mustard	3.5	54.3	80.4	25.5	33.4	10.8	27.9	6.5
Seasamum	6.7	1.4	1.7	1.0	16.0	1.7	8.3	2.3
Linseed	4.0	0.3	1.1	0.5	10.0	12.9	4.5	...
Other oil seeds	0.9	0.3	0.6	0.4	2.7	1.4	5.4	1.0
Chillies	4.0	3.7	7.8	9.0	3.6	1.9	3.6	2.7
Onion	1.5	1.5	2.7	1.8	2.9	0.8	2.0	0.9
Other spices	5.9	2.0	2.6	3.6	6.8	3.2	2.1	5.7
Sugarcane	32.8	47.5	23.6	11.1	5.6	24.1	11.5	2.1
Jute	64.6	49.4	199.2	62.7	70.4	20.5	57.2	17.1
Sunhemp	0.8	...	0.1	0.3	4.2	0.1	0.3	...
Tobacco	1.1	2.6	64.0	1.5	1.0	0.6	1.0	2.2
Tea	...	...	...	...	...	...	...	...
Banana	3.4	3.6	9.3	3.5	2.3	1.5	1.7	3.9
Cocoanut	0.8	0.1	0.1	...	0.1	0.7	2.6	10.9
Other fruits	37.4	11.2	18.8	16.4	10.6	15.2	36.8	24.5
Winter vegetables	21.7	14.0	44.1	18.9	13.1	7.8	14.4	12.3
Sumer vegetables	3.7	3.1	0.8	3.6	3.7	2.8	2.8	2.8
Potato	9.9	9.8	14.5	15.3	1.6	0.2	0.7	0.9

noticed in respect of some other crops. Distribution of areas under different crops has been shown for different districts in the table 55.

Cropping Pattern

Cropping pattern in East Pakistan is mainly determined by the rainfall and the topography of land. Thus most of the agricultural land is occupied by the major crops such as paddy, jute, sugarcane etc. during the rainy months from May to October. From December to March land remains mostly vacant. Rabi crops are grown on limited areas where the soil can retain natural moisture to support crop growth or where some irrigation is provided. A good number of cropping patterns are found in the province and amongst these, six are important. These patterns are :

1. High and medium lands' single Aman
2. Medium land's Aus-or-jute jute and transplanted Aman
3. High and medium land's Aus-or jute and rabi crops.
4. Low land's broadcast Aman-or-jute-and rabi crops.
5. Medium and high land's sugarcane.
6. Very low land's Boro crop.

Pattern 1 is mainly followed in some high and medium lands of Dacca, Mymensingh, Rajshahi, Bogra, Dinajpur, etc. where peculiar soil texture and lack of irrigation facilities make it difficult to grow any crop other than transplanted Aman paddy. This is single cropped pattern.

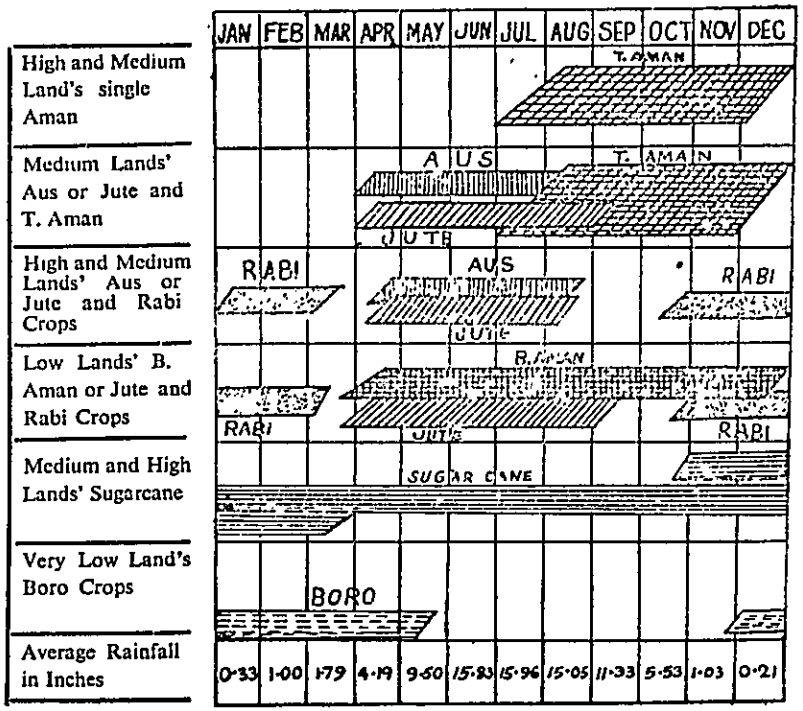
Pattern 2 is the most important system prevailing in East Pakistan. This pattern is followed in the medium lands where water movement can be controlled by making ridges arround the fields. Transplanted paddy is graown after horvest of Aus paddy or jute.

Pattern 3 is very much like pattern 2 except that in preference to Aman crop, the land is utilized for vegetables and winter crops after harvesting Aus or Jute. This pattern includes

some high and medium lands having natural moisture or irrigation facilities.

Lands under pattern 4 are lowlying. The soil is fertile and rich and is replenished every year by fresh deposits of silt carried by flood water. In this pattern broadcast Aman paddy is the most important crop and the next important crops are white jute and Aus.. This pattern actually consists of two patterns viz: (a) broadcast Aman and rabi crops and (b) jute and rabi crops. In some cases, Aus is grown as a mixed crop with broadcast Aman paddy while in some rare cases, jute is also grown as a mixed crop with broadcast Aman paddy. In rabi season, lands under this pattern produce some kinds of pulses, oil seed crops and vegetables.

Important Cropping Patterns



The lands occupied by sugarcane under cropping pattern 5 are medium and high. When any crop rotation is followed then the cropping pattern on these lands after harvest of sugar cane becomes same as in 2 and 3.

Under pattern 6 the land can not be utilized for any other crop except Boro paddy. This is because these lands have high water level during monsoon. When water level comes down in the winter, Boro paddy is produced before advent of the rainy season.

Chart No. 1 shows the most common cropping patterns of the province. A study of patterns will indicate that farmers try to produce more than one crop from the same land as far as possible under the existing socio-economic conditions. The medium and low lands have greater intensity of cropping than other types of land. And crop rotations followed in these areas are more diverse than in other areas. In the low lying tracts specially those lying within reasonably short distances from rivers, 2 crops are generally produced from the same fields. Rotations commonly made in these areas are as follows: broadcast Aman followed by pulses or oil seeds or vegetables or sweet potato ; Jute followed by vegetables including potato or chillies or pulses or oil seeds. In some medium types of land having proper irrigation facilities, even 3 crops are grown in a year and some common rotations adopted in these cases are as follows: transplanted Aman-pulses-Aus ; transplanted Aman-pulses or oil seed or vegetables-jute. Some farmers produce even 3 rice crops a year from the same lands with irrigation.

East Pakistan has one of the best lands in the world and so it is capable of producing a large number of crops. Due to peculiar climatic and physical condition of the province, it may not be easily possible to bring about profitable change in the cropping pattern during the kharif season. But rabi season which now possesses crops only on 18% of the total cropped area, has vast potentiality. If irrigation facilities along with finance and technical know-how are provided, it will be possible not only to

bring most of the cultivated area under rabi crops, but also to grow some crops of great economic importance on very large scales. As a matter of fact, with the increased availablity of irrigation facilities, the existing cropping pattern will greatly change particularly in the robi season and this will increase cultivation and agricultural production.

Cropping Intensity and intensity of land use

The average area of agricultural land per farm house-hold is only 3.5 acres of which 3.1 acres are cultivated. And of the total farms 51 % are under 2.5 acres. This situation accompanied by the ever increasing population has necessiated intensive cultivation. But its degree varies with topography of land, availabitily of soil moisture and density of population. The average area of cultivated land per farm house-hold in Rajshahi and Dinajpur districts is 4.4 acres and 4.9 acres respectively and that in the Comilla and Noakhali districts is 1.6 acres and 1.8 acres respectively. The intensity is, therefore, higher in the southern regions than in the northern regions which consit of medium and high lands and have poor sources of surface water in comparison to the southern areas. Cropping intensity is higher in the medium and low lands than in other types of land.

As a result of multiple use of farm land in the province, the total cropped area exceeds considerably the net sown area. According to the Pakistan Census of Agriculture 1960, the sown area of the farmers of the province was 188.9 lakh acres whereas total cropped area amounted to 278.8 lakh acres. The cropping intensity for the province as a whole was, therefore, 148% which means that 48% of the net sown area was sown more than once during that year. In this respect the province may be compared with Japan where the planted area exceeded the cultivated area by 49% in 1955. The cropping intensity in Bengal in 1928-29 was about 120 percent, as revealed by the then Banking Inquiry Committee. The present cropping intensity of 148%, may, therefore, appear to be a good increase. But when judged from qualitative point of view, this intensity does not indicate a substantial increase. This is because most of the second crops except paddy consist of those crops which can be grown without irrigation and without much attention. Most of these crops are minor crops and give poor yeilds.

According to the statistical reports of the provincial Department of Agriculture, the cropping intensity of East Pakistan in 1960-61 was 132 percent. In fact, experience will lead one to beleive that the cropping intensity of the province, as estimated by the Pakistan Census of Agriculturel has been on the high side. Some authorities consider that the area under double crops is about 25% of the total cultivated area (that is, net cropped area plus current fallows) and the area under triple crops is very small. However, for obvius reasons the cropping intensity is higher in the small farms as will be evident from the following particulars furnished by the Pakistan Census of Agriculture, 1960 :

Size of farms	Cropping intensity
A. Small farms (under 2.5 acres)	167%
B. Medium farms (2.5 to 12.5 acres)	148%
C. Large farms (12.5 and over)	130%
D. Farm over 40 acres	117%

According to the Pakistan Census of Agriculture, 1960 there are in all 196 lakh acres of culturable land (total cultivated lands plus culturable waste lands) under farms, of which 188.5 lakh acres are reported as net sown. Thus the intensity of land use comes to 96%. But this intensity will be higher if the area under farm forests comprising 5.1 lakh acres, which supply valuable materials to the farmers, is considered as utilised.

When the farms are clasified by tenure, it will reveal that cropping intensity is higher in the farms cultivated by the owners than in those operated by the tenants. But the intensity of land use is higher in the farms operated by the tenants than in those operated by the owners. The average intensity of land use for

all farms is 96% whereas the corresponding intensity for the tenant operated farms is 98% (See table 56). According to Department of Agriculture, total culturable area of the province is 235.79 lakh acres comprising 19.08 lakh acres of culturable waste lands, 8.21 lakh acres of current fallows and 208.48 lakh acres of net cropped lands in 1960-61.[84] Therefore, when the total culturable lands of the province (including those lands which are not owned by the farmers but excluding the Government forests) are taken into account, the intensity falls at 88%.

Table 56[85]

Intensity of cropping and land use as classified by tenure, 1960

	Owner farm	Owner cum tenant farm	Tenant farm	Average for all farms
Intensity of land use	95%	97%	98%	96%
Intensity of cropping	148%	148%	144%	148%

It may be noted that in proportion to total land available, extent of land utilisation is greater in East Pakistan than in West Pakistan (See table 57). Though East Pakistan is about 15% of the total area of Pakistan it represents more than 34% and 41% of the total cultivated area and cropped area of the country respectively. Besides, Jute and Tea which are important cash crops of

Table 57

Land utilization in East and West Pakistan, 1958-59[86]

million acres

	East Pakistan	West Pakistan
1. Total area	34.65	198.44
2. Forest area [87]	5.46	3.21
3. Not available for cultivation	5.61	50.14
4. Culturable waste lands	1.92	19.61
5. Current fallows	1.78	9.19
6. Net area sown	19.88	32.00
7. Total cultivated area (5+6)	21.66	41.19
8. Area sown more than once	5.36	3.89
9. Total cropped area (6 +8)	25.24	35.89
10. Area not reported	...	84.28

the Nation are exclusively grown in East Pakistan. More than 87% of the total acreage of the nation under rice crops is in East Pakistan (see table 58)

Table 58

Acreage and production of some important crops in Pakistan and East Pakistan. 1961—62[88]

Crops	Pakistan		East Pakistan	
	Area (lakhs acres)	production (lakh tons)	Area (lakh acres)	production (lakh tons)
Rice	239.6	105.7	209.63	94.66
Wheat	125.7	40.6	1.45	0.39
Barley	5.4	1.3	0.83	0.18
Sugarcane	13.9	186.0	2.90	44.1
Rape and mustard	17.0	3.1	5.90	1.03
Seasamum	2.5	0.4	1.42	0.26
Jute	20.6	12.4	20.6	12.4
Cotton	34.9	3.2	0.39	0.03
Tea	0.79	0.26	0.79	0.26
Tabacco	2.19	0.99	1.08	0.31

TECHNICAL PROGRESS

Technical programme for the development of agriculture in East Pakistan is not very old. During the period of the East India Company and in the subsequent years under British rule, no importance worth mention was given to this. In the beginning of Governmental attempt to develop agriculture, the Director of Land Records was entrusted with the job of looking after agriculture. However, only with the appoinment of the first Director of Agriculture in the year 1906, some attention was given to the technical aspect of agriculture and as a result, the agricultural research laboratories were established and opened in Dacca in the year 1910. But the work was carried on in a very small scale. Fund available with the Agriculture Department was too inadequate to conduct elaborate research programmes. In the beginning research programmes were, therefore, not extensive. It was rather concentrated only on the major crops such as rice, jute, sugarcane, etc. However, the agrucultural research programme has been drawing increasing attention since Independence. Agricultural researches now cover all important aspects of agriculture viz: Agricultural Chemestry, Agronomy, Crop Botany, Entomology, Mycology, Agricultural Engineering, Soil Survey and Soil Conservation. Besides, independent research programmes for each of jute, sugracane, cotton, tea, cocoanut etc. are now in operation. In addition, seperate laboratories for research work in the fields of Animal Husbandry, Fishery and Forestry have also been established. Inspite of many handicaps faced in the early stages, considresble progress in research has been made during the period of 50 years and it has been proved that if the research findings now available are successfully applied in the farmer's fields, this province can make remarkable progress in agriculture. Practical utilisation of research findings has already been started and this has also reflected on the crop production. In 1928-29 per acre yeild of rice in Bengal was only 8 mds., and it has increased to 9.6 mds.in 1947-48 and to 12.2 mds. in 1961-62 in East Pakistan. Per acre yeilds of jute and sugarcane in 1947-48 were 16.2 mds. and 397.4 mds. respectively against 14.8 mds. and 310 mds. in 1928-29; and the corresponding figures for 1956-57 were 21.8 mds. and 417.5 mds. respectively. Similar increase will be noticed in other fields also. Fish producotin increased from 27.78 millions mds. in 1949-50 to 43.43 millions mds. in 1956-57. Extraction of timber from forests rose from 4.78 million cft. in 1951-52 to 13.34 million cft. in 1959-60. But this province has a long way to go as its agricultural production is yet one of the lowest in the world.

Plant Improvement

(i) Plant Introduction

East Pakistan's agriculture has been enriched by a good number of plants introduced from other countries. Introduction of these plants which include a wide variety of economic crops and which have been very successfully acclimatized here, started long back. The Portuguese traders did remarkable work in this respect. Rocords indicate that a considerable number of plants such as guava, groundnut, sopeta, custard-apple, bullock's hearts, cashewnuts, carambole, sunflower, tuberose, pit karabi, mukut, foreign basil, marigold, cauliflower, cabbage, gardenpea etc. were first brought here by them form Latin America, Europe and other countries mostly during the period from 1540 A.D. to 1610 A.D. The following extract may indicate the extent to which some countries played part in introducing useful plants in the province.

"The Mediterrean countries have supplied cabbage, carrot, lentil, methi, kshira, onion, garlic, linseed, cumin, etc. From central Asia have come turnip, beet spinach, opium,

Indian hemp, mustard etc. Bean, tok palam, castor, niger, China rose, tamarind, pomogranate, gold mohr etc. have come from Africa. Karpur, litchi, cowpea, olat-kambal, rakta karabi etc. have come from China and Japan. Chapa, chalta, deodar, aparajita, basil, babui tulsi, pomelo, himsagar etc. have come from south-east Asia and tabacco, chilli, maize, potato, pineapple, tuberose, amra, custardapple, bullock's-heart, shialkata etc. have come from America (mostaly Latin America)".[89]

Snice then the number of introduced plants has been increasing. Rev. William Cary introduced a considerable number of exotic plants into the province and in fact, a good number of the so-called English vegetables have been introduced here by him and the Agri-Horticultural Society established by him in 1820. In the recent past some verieties of wheat, sugarcane, rice, mango, litchi, flax, cotton, tabacco, cocoanut, potato etc. were introduced from U.S.A., Japan, India, Ireland, Burma, Holland, Ceylone, Malaya, West Pakistan and other regions. Experiments are going on to acclimatize some newly introduced plants of which peaches, plums, avacado, pekannut coffee, casava, black-pepper and grapes are important.

According to the geographical surveys of the genetic variations in the crop plants of the world by Vavilov, a Russian scientist and his co-workers, East Pakistan along with the adjoining regions to the east and south east, is considered to be the centre of origin of the following domesticated plants:[90]

Oryza Sativa (rice), Corchorus Olitorius (jute), Gossypium arboreum (tree cotton), Cajanus Cajan (arhar), Vigna Sinensis (Cowpea), Dolichos Biflorus (horse gram), Phaseolus Calcaratus (rice bean), phaseolous aconitifolius(moth), Mangifera indica (mango), Solanum Melongena(egg plant), Cucumis Sativus (cucumber), Amarantus Paniculatus (amaranth), Raphanus Caudatus (rates' tale radish), Colocasia Antiquorum (taro-yam), Cannabis Indica (hemp), Indigofera Tinctoria(indigo),

There are, of course, some other crops which have also originated in this region. But the province now grows a bigger number of crops of economic importance and this has been possible due to the introduction of plants from various parts of the world.

(ii) Plant breeding

Since the establishment of the agricultural research stations, programmes for plant breeding and allied reaserch work have been going on for qualitative improvements of crops. Initially the object of the programme was to evolove only high yeilding varieties, but gradually the programme was expanded and as a result, it was then possible to obtain varities which were high yeilding, disease resistant and of better market qualities. In these reaserch programmes, rice received more attention than any other crops. There are about 8,000 indigenous varieties of rice grown in the Indo-Pakistan sub-continent and East Pakistan has more than 4,000 of them. Genetically, these varieties are of poor quality. And it was a terribly difficult job to find out varieties superior to this huge number of indigenous ones and to maintain their desired characteristics. However, in the beginning, indigenous varieties of rice were collected from different parts of the province and these were purified and classified. Thus a good number of pure lines were established which were classified mostly on the basis of morphological character. Total number of pure lines established up to 1925 was close to 2,000 and it rose to 3,000 in 1960[91]. Selection was made from the pure lines on the basis of higher yeild and other desirable characteristics. The first recommanded Aus variety was Kataktara and the first transplanted Aman paddy was Indrasail, which have uptil now retained their superiority of the germ plasm. A good number of rice varieties have been evolved since then by the selection method. Besides, varieties of rice introduced from different parts of the world, have also contributed much to the rice breeding programme of the province. Amongst the recommanded varieties of rice, Latisail, Nigersail Da—29 and Bluestick were brought from Karimgonj (Assam), Nigeria (Africa), Indian Union and U.S.A. respectively. Some recent introductions from Indonesia, Thailand, U.S.A., Phillip-

pines, Formosa and Japan, have been found to be promising. Hybridization work to get better varieties of rice with respect to yeild, adaptability, earliness, stiff-straw, flood resistance, salt resistance, pest resistance and quality was taken up since 1920. In the early part of this programme, two Aus varieties viz; Dular (Dumahi x Larkoch) and Pusur (Pukhi x Surjamukhi) and one transplanted Aman Paddy, Daudin (Daudkhani x Indrasail) were developed and recommanded. Other prominent hybrids recommanded were Chitraj (Chittagong x Rajshahi), IxP (Indrasil x Patnai), JxL ((Jhingasail x Latisail), L x D(Latisail x Dudhsar) etc. Research on vernalization has indicated that earliness to the extent of 15-20 days can be induced to some Aus varieties.

Till now about 5 dozens of varieties of improved rice have been evolved by the rice research workers and these varieties give 5 to 20% increased yeild over the local varieties and possess other desirable characteristics. These varieties include all three major kinds of rice viz: Aus, Aman and Boro. A good number of these varieties are adapted to particular areas or to other special conditions such as land situations in relation to depth of standing water etc. Selection of lodging resistant, early maturing and salinity resistant varieties has been important acheivement in the rice breeding programme. Efforts are going on to find out varieties which are resistant to and respond to heavy manuring, like high yeilding Japonica varieties.

In respect of jute, valuable progress has been made in evolving better varieties. The varieties, D—154 under Corchorus Capsularis (White jute) and Chinsurah Green (C.G.) under Corchorus Olitorius (Tossa Jute) have been giving satisfactory results since 1919 and 1915 respectively. Later on some other varieties such as C—212 (1940) and C—412 (1942) were evolved. After Independence a few high yeilding varieties under both C. Olitorius and C. Capsularis have been found out. These have compratively higher disease resisting power and give about 20% increased yield over the local races.

Sugarcane has now a good number of recommanded varieties. In the past selection of improved varieties was made from some foreign stocks particularly from the Coimbatore varieties of India. Today East Pakistan possesses many other improved varieties in addition to the Coimbatore varieties. In wheat, some varieties introduced from West Pakistan, India and Japan have been recommanded to be suitable for the province. One local variety, Jamili-24 gives good yeild and is found more resistant to disease than other varieties.

The plant breeding programme has also developed a good number of improved varieties for pulses, oil seeds and other crops. Below is given a list of a few recommanded varieties of some improtant crops.

crops	Important recommanded varieties
1. Aus rice (high land)	Kataktara, Surjamukhi, Charnok, Pukhi, Atlai, Panbira, Dharial, Kumari, Pusur, Pashpai, Dular, Marichbati, Hashikalmi, Harinmud, Dhalasaita.
2. Aus rice (low land)	Patuakhali.
3. Transplanted Aman rice	Indrasail, Bluestick, T.Kachari, Jesso balam, Hatisail. Latisail, Daudin, Dhepi, Chingrighusi, Khirajali, Banshful, Nizersail, Patnai-23, Liaquat sail (LXD), Bhasamanik, Badshabhog, Dudashar, Daudkhani, Jhingasail, Jinnahsail, Rupsail, Chitraj, Rajasail, Isasail (1xp), S.R.26, DA-29.
4. Broadcast Aman rice	Baishbish, Gabura, Maliabhangar, Katyabagdar, Godalaki, Dhola Aman
5. Boro rice	Topaboro, Khaia boro, Banajira, Pashusail, Amanboro (Habigong vii), Boro-Boro (Habigong Viii).

6. Wheat	I.P-52, jamili-24, 9-0, C-228, C-591, I.P-125 Konozo, W.R,-165.
7. Oat	Dacca No. 1
8. Jute	(a) Under C.Olitorius (Tossa): C.G., O-2, O-3, O-4, and O-5.
	(b) Under C.Capsularis (White): D-154, C-2, C-3, C-4 and C-6.
9. Cotton	Garo (.G.arboreum var. cernum), Ashmoni (Egyptian), S.I.V.-24 (Egyptian), S.I.V.-135 (Egyptian), D-5 (Dacca-American), C.O.-3 (Dacca-American), C.O.-4 (Dacca-American), D-8(Dacca-American).
10. Sugar-cane	50-9, 33-35, 89-54, 154-54, 116-55, C.O.-27, C.O.-637, C.O.-633, 249-54
11. Mustard	Tori no. 7, Rai No. 6, Rai No. 5, Rai Beldanga.
12. Groundnut (peanut)	Early Spanish, Large Ekola, Small Japan, Dacca No. 1.
13. Gram	Saboor No. 4, Patnai, Bhangora-45.
14. Lentil	No. 5, Barisal var., Mukida.
15. Onion	Patnai, Chanchi.
16. Sunhemp (Crotolaria Juncea)	Faridpur, Kanpur, Ahmadpur, Rajshahi,
17. Tobacco	Mathihari, Bhengi, Naokhal and T-28 for hukha; Nepni, Gandio, Bidi-52012 for bidi; Sumatra, Manila, Connecticut and Ohio for cigar; Harrisons Special, Varginia Gold, and Yellow Special for cigarette.
18. Mung	Kishorgong Sona mung, Faridpur I, Faridpur II, Faridpur III, Faridpur IV, Jamalpur.
19. Arhar(cajanus indicus)	60.6 X. 20.
20. Banana	Amritsagar, Safri, Champa, Singapur.
21. Pineapple	Honey queen, Giant kew.
22. Litchi	China No. 3, China No. 1, Muzaffar puri, Kashba, Purabi.
23. Mango	Fazli, Lengra, Gopal bhug, Shadwal, Rani passand, Khirshapati, Bhawani-Chowras, Begum-Phuli, Sakar-Kand, Sree Dhan, Ambajin, Mitua-Patna, Konapahari, Ghila.

(iii) Seed production and utilisation

Seed production in the province on scientific lines is at a very initial stage. Almost every individual farmer keeps some portion of his produce as seed and he is aware of its importance. But it is not given as much care as it deserves. As a result, seed kept by the average farmer, which has not received due care at the time of its production, preservation and utilization, does not give satisfactory results in the long run. Most of these seeds are of inferior inherent quality, susceptible to pests and diseases and contain poor percentage of purity and germination. This state of affairs had been continuing since long and this was one of the most important reasons of poor agricultural production in the province. The Agriculture Department initiated several programmes in the past to improve this situation with special stress given on rice and jute crops in the begining. In 1920, several Government farms, each of about 20 to 25 acres in area, were established in some district head quaters, of which 11 farms comprising 275 acres in all are now lying in East Pakistan. Paddy seeds

grown in these farms as well as in the research stations, were distributed amongst the farmers and several procedures were adopted for this at different times. Some times improved seeds were sold to the farmers at usual market rates and some other times, farmers were supplied with seeds on loan, which were realised after harvest. Seeds were also distributed to the farmers in small packets free of cost. Besides, arrangements were also made to procure jute seeds from Bihar and distribute the same among the jute growers of Bengal. In fact, before Independence as much as 110 tons of jute seeds on average were annually imported from Bihar where seeds of superior quality were produced in the high land areas. The joint Steamer Company of Narayangonj used to procure the seeds from the selected groweres of Bihar and distribution of the seeds was made by the Agriculture Department. Government programme for production or procurement of better seeds of other crops was always inadequate.

Attempts were made several times to demonstrate in the Government farms and in the rural areas as to how to grow and use good seeds. But sufficient progress in respect of increassed production and use of good seeds could not be made due to inadequate effort and lack of scientific planning. As a matter fact, farmers using improved paddy seeds could not as yet comprise even 0.5%. Unfortunately neither any standard nor any regulation for seed has yet been made in the province. Besides, it has not also been possible to make suitable arrangements for field inspection, testing, cleaning and processing of seed in the rural areas. However, since Independence the matter has been improving. Several seed multiplication frams were first established in the year 1954 and there are at present 29 Government seed multiplication farms comprising about 8,000 acres of land in the province for production of seed and seedlings. These farms vary in size from 100 acres to 3,000 acres. Two farms, each of 50 acres in area have recently been established for production of planting materials of fruit crops. Besides, there are a few small size farms which are also utilised for production of seeds and suckers. Some seeds are also produced in the research farms such as Dacca farm, Habigong farm, Rahamat pur cocoanut farm etc. The Food and Agriculture Council of Pakistan has got a few farms for research work as well as for seed production. Pakistan Central Jute Committee have also a few farms under the organisation.

Table 59

Seeds produced in Govt farms

in mds

Crops	1955-56	1956-57	1957-58	1958-59	1959-60	1960-61	1961-62	1962-63
Aus	7650	10270	14520	19250	15900	25000	26000	19000
Aman	8210	15930	16600	19120	25230	26750	29000	31000
Boro	370	330	710	580	890	930	1000	1000
Jute	1150	920	1650	690	980	1730	2200	N.A.
S. Cane (Cuttings)	23950	24410	28570	N.A.	N.A.	33700	35900	N.A.
Mustard	930	370	1000	1050	N.A.	1270	880	N.A.
Gram	1860	1150	1080	1150	N.A.	N.A.	N.A.	N.A.
Wheat	280	640	600	2350	N.A.	1870	1510	N.A.
Maize	390	160	190	N.A.	N.A.	730	730	N.A.

The Government farms have produced 56,000 mds of paddy and 2200 mds of jute seeds, in addition to a small quantity of vegetables and other seeds in 1961-62(See table 59). But the quantity of Government grown seed is too small to meet the provincial requirement. These farms are at present producting less than 0.5% of paddy and 1.0% of jute seeds required in the province. Seeds of other crops produced in these farms are negligible. A huge area of land is required to produce seeds sufficient to meet the requirement of all farmers. It is estimated that about 51 lakh acres of land are required to produce seeds for the whole country and East Pakitan requires more thatn 20 lakh acres to meet its requirement of seed. This is, therefore, almost an impossible task on the part of the Government to set up sufficient number of farms for this purpose as this will involve huge expenditure on public sector and will cause great dislocation to persons

of this thickly populated province where sufficient culturable waste lands are not available in suitable blocks. In fact, like all developed countries where seed production is mostly the job of private organisations, attempts have recently been made here to broadbase the seed programme in cooperation with the farmers. So long breeder's seeds were multiplied in the few government farms and seeds thus produced (foundation seeds) were then directly distributed to the farmers without going through the stages of registration and certification. In 1958, foundation seeds were first supplied to about 2,000 selected farmers of the province for production of registered seed. In 1961, about 5,000 tons of paddy and about 2,000 tons of jute seeds were produced by the registered growers. This programme which is still in the begining, has some defects as it could not make sufficient provision for proper field inspection, testing and preservation, as required by the international seed regulations. However, seeds thus produced have been distributed by the registered growers amongst the interested farmers at usual market price and the growers have been given, in addition, a premium of Rs. 2 per manud as an incentive by the Govern ment. When the production of registered seed will attain real success, programme for producing certified seed will be taken up, without which distribution of good seeds amongst the farmers can not be effective. The Agriculture Department have, however, made a plan to increase area under farms for production of more foundation seeds. If it is intended to produce foundation seeds to the extent of only 20% of the total seed requirement of the province, then the Government seed farms shall have to be increased greatly to grow at least 75,000 tons of paddy, 85,000 tons of sugarcane, 9,000 tons of patoto, 1200 tons of jute and huge quantity of other seeds.

If a suitable programme for production of sufficient quantity of registered and certified seeds, is prepared and put into optation by the Government under proper technical supervision and in real co-operation with the farmers, a reasonable number of farmers will be able to use some kinds of good seeds in their fields in near future.

Tabel 60

Seeds of selected crops imported to East Pakistan.

in tons

Crops	1959-60	1960-61	1961-62
Potato	1460	3677	3364
Wheat	1655	1650	1630
Maize	441	437	—
Mustard	680	147	441
Cocoanuts	—	—	(2,50,000) (number)

But this programme will not succeed unless sufficient incentive is offered to the private seed growers in the begining. There are, however, some kinds of seeds which are not now produced sufficiently in the existing Government farms and most of these seeds (of which potato, maize, wheat, vegetables are important,) are procured from other countries and West Pakistan (see table60) A special project has recently been put into operation to grow here seeds of good quality potato which is gaining importance day by day. Efforts are going on to grow potato in summer in some areas of high elevation in the Chittagong Hill Tracts. When this will be possible on commercial scale, the prevailing acute problem of potato seeds preservation will be removed. For, this will make it possible to use the whole summer crop as seeds for planting in the following winter season.

Though seeds of wheat, maize etc may be grown here successfully under suitable programmes, production of some winter vegetable seeds may be difficult here mainly due to climatic peculiarities of the province. Until seeds of these crops can be grown here under special conditions, this will be required to be imported from other countries. Formerly ground nut seeds were purchased from India. But now it has been possible to grow groundnut here in summer for sowing in the next winter season. Production of seeds of winter vegetables is still a great problem here due

to climatic peculiarities. In fact, seeds of most of the English vegetables are imported every year. Attempt has been made to produce planting materials for cultivation of some spice crops such as cardamom black pepper, etc., which are now imported from other countries.

In the past sufficient importance was not given to the production of seeds, seedling, suckers and other planting materials of fruit crops. Much stress has of late been laid on these crops. Several fruit nurseries and orchards have been estabtished by the Government. A special programme has also been put into operation to push up production of seedling and sucjers of quick growing fruits such as banana, pineaplple, papaya etc. through the registered growers.

Storage and preservation of seed is still a great problem for the farmers. Individual farmers at present do not have proper storage facility. The seed containers used by them and the methods they adopt for storage of seed, are very unsatisfactory due to which their seeds deteriorate to a great extent. Seeds are generally kept in gola (small store room) made of bamboo or reed, which in most cases remain open. Seeds are also kept in earthen containers or are packed in rice straw or stored in many other ways. Proper arrangements for protection of the seeds against insects and diseases are hardly made. This results in detrioration of seed. Farmers are, therefore, compled to sow seeds at a rate higher than what is actually required. And this excess is estimated at 70% in paddy, 60% in wheat and other cereals, 80% in pulses, 80% in oil seeds and 60% in jute seeds. This means a huge wastage of national wealth every year. Seeds of cereals, pulses and oilseed crops thus wasted would alone amount to about 2,50,000 tons, .7,500 tons and 2,500 tons respectvely, which though now misused as seed, could be utilized as food. Seeds grown in the government farms are being distributed through Government seed stores which have been hired by Government in the year 1951 and earlier to meet emergent reguirement of seed distribution. These stores are now available in each thana of the Province. Though most of these stores do not have sufficient storage capacity nor do they provide ideal storage conditions, these have, no doubt, played important roles in distributing seeds amongst the farmers. However, Government have recently taken up construction of pucca stores for storage of seeds and other agriculture comodities. Construction of 4,000 Union stores with small capacity are in progress and about 2,000 stores have since been completed and the rest are under consturuction. In addition, constructions of 52 intermediary godowns with total storeage capacity of 70000 tons are in progress; 8 big godowns with total capacity of 16000 tons were constructed during 1960-61.

A few cold stores have been established in the province for preservation and storage of potato seeds and other agricultural products grown locally. It is expected that the number of cold stores will sufficiently increase in near future to meet the requirements of the farmer.

The Union stores will ultimately be managed by farmer's co-operatives and these may be utilized as seed banks where farmers may keep their seeds in sealed bags at the time of harvest and withdraw the same at the sowing time after paying a nomial cost in kind or cash for providing ideal storage facilities. The Agriculture Department have been trying through various programmes operated under Extension, Education and Research sections to produce and popularise use of better seeds. The real success, however, lies in getting the farmers educated in the production and useof imporved seeds.

Fertilizer Application

Use of fertilizers in East Pakistan is not new. East Pakistani farmers used cowdung, though in small scale, long before scientists could explain its beneficial effects. Cowdung was considered here for long as the only means of increasing the yeilds of their crops. Though cowdung is a very valuable manure, the yeilds of crops can not be increased very much by the use of cowdung alone. Firstly, because it is not a concentraced fertilizer,

a big bulk of which (nearly 6 to 8 tons per acre) is required to raise the fertility level only to a slight extent. Secondly, it does not have a satisfactory balance of plant nutrients. It has more of nitrogen than other nutrients. Thirdly, even though it is preferred, it is not available in sufficient quantity to spread on all agricultural land, and within foreseeable future there is little possibility of having increased production of cowdung in the province.[92] Hence, for sustained and productive agriculture East Pakistan had to resort to the use of chemical fertilizer along with cowdung and other indigenous fertilizing materials and in this direction work has already started.

(*i*) **Researches**

A considerable amount of research work has been done since the establishment of the agricultural laboratories, to find out fertilizer requirement of different crops and soils and to ascertain suitable methods of application of fertilizers. On the basis of these researches, appropriate requirements of fertilizers for different crops along with the methods of their applications were recommanded to the farmers. But the recommandations were mostly tentative as more extensive experiments could not be conducted to bring the recommandations to a detailed accuracy with respect to different soil tracts, seasons, stages of plant growth etc. Systematic survey of East Pakistan's soils could help, to a great extent, this reseracrh programme on fertilizers and manures. But the soil survey project which was started in 1940 could not be yet completed as the project faced a big setback due to Partition. The soil survey project has till now covered only about 14000 sq. miles spread over the districts of Dacca, Mymensingh, Comilla, Noakhali and Rangpur. Chemical analysis of a good number of soil samples taken from various parts of the province and manurial trials on various crops conducted in the Government farms in different zones, were so long the basis for fertilizer recommandation. But the Rapid Soil Fertility Survey Project which was started only in 1957 did remarkable work in this respect. Under this project, more than 7000 manurial experiments on different crops were conducted all over the province in farmers' fields and this has given rise to revised fertilizer recommandations for different zones. Fertilizer recommandations so far made have shown promising results. On the basis of latest recommandations (see table 63) it has been found that yeild of paddy can be increased to more than 60% (see table 61). In many cases the incease due to fertilizer application was from 100 to 200 percent over control. Yeild of other crops has shown increase from 50% of jute to about 200% of sugarcane and vegetables. Increase in yeilds of potato, wheat, maize, quick growing fruits, tea etc. has been also very high. Keeping in mind "the probable dosage cultivators will use," it is assumed "that each ton of fertilizer will produce 3 additional tons of rice, 4 additional tons of jute, 35 additional tons of vegetables and 70 additional tons of sugarcane" by 1970 due to development activiteis during third plan period.

Table 61

Increased yeild of rice by fertilizer treatments[93].

Crops	No. of field experiments conducted upto 1960	average yeilds in mds. per acre due to the following teratments.					
		Contol	40 lbs N (nitrogen)	40 lds P (phospho-rus)	40 lbs K (potash)	40 lbs NP	40 lbs NPK
Aus	1297	15.40	21.14	19.49	19.68	25.32	29.59
Aman	1489	17.46	24.45	22.47	22.07	27.58	31.16
Boro	303	18.96	27.63	25.41	24.26	28.47	30.65

(*ii*) **Fertilizer Requirement**

Though East Pakistan's crops unlike the Japanese varieties, do not have great capacity for fertilizer consumption, total requirement of fertilizers as per latest recommandations is not small. In proportion to its total area, East Pakistan has a vast cropped area and a large number of crops are grown here which

require fertilizers. Some of these crops are grown in lowlying areas where soil is fertile and is replenished every year by fresh deposits of silt carried by flood water. Therefore, fertilizer was not recommanded earlier for some of these crops. But some recent experiments have, however, revealed that natural fertility is not sufficient to meet the requirement of low land rice crops which are taller than any other rice groups and have a comparatively longer life. These crops have been found to respond satisfactorily to fertilizer application. However, in general, crops grown in the province require all the three major plant food nutrients viz: nitrogen, phosphorus and potassium. But in some areas, application of potassic or phosphatic or both of these fertilizers, is not now considered essential and in some tracts, requirement of nitrogenous fertilizers is realatively low (see Nutrient Status of East Pakistan soils). Inspite of all these considerations, East Pakistan requires 21,57,280 tons of nitrogenous fertilizers in terms of ammonium sulphate, 19,29,270 tons of phosphatic fertilizers in terms of bone meal and 4,48,320 tons of potassic fertilizers in terms of muriate of potash (see table 62)

Table 62

Fertilizer requirement of East Pakistan.

Crops	Total acreage[94] (inlakh acres)	Fertilizers required in term of (in tons)		
		Ammonium sulphate (for nitrogen)	Bonemeal (for phosphorus)	Muriate of potash (for potash)
Aus	58.38	3,98,040	3,98,040	88,460
Aman	134.85	12,26,250	12,26,250	2,04400
Boro	7.92	72,000	72,000	.....
Jute	14.66	1,00,000	.....	66,700
Sugar cane	2.59	70,640	29,440	7,070
Wheat	1.14	7,780	7,780	.....
Maize	0.07	950	950	380
Tobacco	1.10	15,000	...	3,500
Tea	0.76	10,370	...	...
Fruits[95]	4.20	38,200	38,200	9,560
Potato	0.84	9,550	9,550	3,820
Vegetables	5.22	94,910	29,660	11,860
Oil seeds[96]	7.49	30,640	22,980	21,450
Spices	3.05	20,800	17,340	13,870
Pulses[97]	8.34	.....	23,700	.....
Others[98]	.....	62,150	53,380	17,250
Total	.....	21,57,280	19,29,270	4,48,320
Equivalent value in term of of nitrogen, phosphorus & potash respectively.		4,31,460 (N)	3,85,860(P)	2,69,000(K)

But the provincial requirement of fertilizers in terms of actual plant food nutrients is 4,31,460 tons of nitrogen, 3,85,860 tons of phosphorus and 2,69,000 tons of potash. In other words, an acre of cropped land here requires on average 36.3 lbs. of nitrogen, 32.5 lbs of phosphorus and 22.6 lbs of potash whereas the requirement for each acre of the cultivated land comes to 43.8 lbs of nitrogen, 39.2 lbs of phosphorus and 27.3 lbs of potash. This requirement will increase further with the increase of cropping intensity.

Table 63

Per acre requirement of fertilizers for important crops.

crops.	Nitrogen in term of ammonium sulphate (in lbs)	Phosphorus in term of bonemeal (in lbs)	Potassium in term of muriate of potash. (in lbs)
Aus rice	150	150	100 (for Barind, Teesta and Madhupur Tracts)
Aman rice	200	200	100 (for Teesta, Barind and Madhupur tracts)

Baro rice	200	200	—
Jute	150	—	100
Sugarcane	600	250	120 (for Teesta, Barind and Madhupur tracts)
Wheat	150	150	60 (for Teesta, Barind and Madhupur tracts)
Tobacco	300	—	70
Tea	300	—	—
Potato	250	250	100
Vegetables	400	150	50
Fruits	200	200	100 (for Teesta, Barind and Madhupur tracts)
Maize	300	00	120
Cotton	150	75	—

(*iii*) Consumption of Fertilizer

East Pakistani farmers have not as yet been accustomed to the use of fertilizer in large scale. Sufficient quantity of fertilizer was not also available in the Province in the past. Fertilizer so long used by them was mostly of indigenous types. But the province had a poor production of indigenous fertilizing materials in the form of cow dung, oil cakes, bonemeal, fishmal and kitchen ash (see table 64). Though total production of raw cowdung in the province is about 48 million tons, not more than 25% of it is available for use as fertilizers, the rest quantity being misused or left unpreserved. The Agriculture Department have been trying

Table 64

Indigenous fertilizers available in East Pakistan

Unit in tons

Fertilizing materials	Quantity available for use as fertilizers	Equivalent value in term of Ammonium sulphate	Bonemeal	Muriate of potash
Cowdung[99]	1,20,00,000	3,00,000	...	...
Oil cakes[100] (mustard, rape linseed, cotton etc)	73,000	18,250		
Fishmeal	375	150	...	...
Bonemeal	3700	...	3700	
Kitchen ash[101]	31,800	...	...	3180
Total[102]		336,650	3,700	3,180
Equivalent value in term of nitrogen, phosphorus and potash.		63,680(N)	740(P)	1,900(K)

to educate the farmers in respect of proper preservation and utilization of cowdung. Attempts have also been made by the Department to popularise preparation and use of village and town composts amongst the agriculturists. If, as a result of this drive, cowdung can be preserved and utilized in near future to the extent of 50%, then 12 million tons more of cowdung, that is, three lakh tons more of fertilizer in term of ammonium sulphate can be made available in the province. Similarly, it is possible to obtain 13 million tons of compost, that is, 3.25 lakh tons moret of fertilizer in term of ammonium sulphate if two heaps of compost each of one ton, are prepared by each rural family, and this is not a difficult job in a province like this where natural vegetation is plentiful and its growth is quick. This will not only increase soil

fertility but also keep the villages and towns clean. But unfortunately it will probably take long time to acheive significant results. At present wood ash is the main source of potash supplied to the lands. Amongst the agricultural population, East Pakistan has about 70 lakh kitchens which produce ash out of burnt wood, stick or straw as a byproduct. But all of the ash is not preserved and utilized properly and as a result, not more than 10 lbs of ash from each kitchen can be expected for use as fertilizer. Water-hyacinth which is a serious floating weed in rice and jute fields in the low-lying areas, contains a good percentage of potash. But its use as fertilizer in the form of compost, though advocated by the Agriculture Department, involves considerable expenditure for its collection, transport and compostmaking in large scale and so gives rise to practical difficulties. For an application of 40 lbs of potash per acre, about 8 lakh lbs of water hyacinth are required and so water-hyacinth can not do much to meet potash requrement of the province. At the instance of Lord Carmichael, the then Governor of Bengal, two plants were established in 1915 for extraction of potash (Kcl) from water hyacinth on commercial scale. But this was found costly and hence could not last long. However, as the province must get rid of this menacing weed, it is no doubt better to destroy this weed by way of compost-making to get the additional benefit.

Production of other indigenous fertilizers such as oil cakes (mustard, rape, seasum, groundnut, linseed, cocoanut, cotton etc), bone meal, and fish-meal is also meagre. Oil cake which is the most important of this group of fertlizers is also used as a cattle feed in the province. Average annual production of oil cake is about 1,46,000 tons of which not more than 50% may be available for use as fertilizers. As a matter of fact, available stock of all indigenous fertilizers is very small in proportion to total fertilizer requirement of the province. Use of chemical fertilizers is still poorer in the province. Introduction of chemical ferilizers in a country is associated with scientific and technological development of that country. East Pakistan has just made a modest start in this respect and hence use of chemical fertilizer has also made only a modest start. Until 1961, there was no factory for chemical fertilizer in the province and so, all chemical fertilizers were so long imorted from foreign countries and West Pakistan. Of these fertilizers, ammonium sulphate, urea,

Table 65

Use of chemical fertilizers in East Pakistan

unit in tons

Year	Nitrogen (N_2)	Phosphorus (P_2O_5)	Potash (K_2O)
1951-52	540	...	...
1952-53	644	...	...
1953-54	1270	78	...
1954-55	1818	86	...
1955-56	336	...	...
1956-57	5058	...	...
1957-58	5560	351	...
1958-59	6900	220	...
1959-60	11685	925	...
1960-61	19150	3507	600
1961-62	19260	3250	680
1962-63	22980	1400	900

superphosphate and muriate of potash are important. Though these fertilizers were introduced in the province in the recent past use of these fertilizers has now gained considerable popularity. In comparison to 1951-52, provincial consumption of chemical fertilizers has increased by about 25 times in 1960-61. This rate of increase in consumption of fertilizers is large in view of the fact that world consumption of fertilizers has only doubled during the last decade, that is, it increased from 13.7 million tons in 1950 to

27.7 million tons in 1960. But in the begining of the last decade, use of chemical fertilizers was only started in the provincee and consumption was very small (only 2700 tons of gross fertilizers), Use of chemical fertilizers varies from place to place. This has got direct relation with topography of land, cropping pattern and agricultural extension work. However, use of chemical fertilizers is bigger in the districts of Dacca, Bogra, Chittagong, Mymensingh, Rangpur, and Rajshahi than in other districts.

Application of fertilizers per unit area of land is, however, still very poor in the province. If it is presumed that East Pakistani farmars use 25% of total cowdung, 50% of total oil cakes and 100% of other indigenons manures available in the province, in addition to the imported materials, it will be revealed that the average input of fertilizers per acre of cultivated land is only 8.41 lbs of nitrogen, 0.43 lbs of phosphorus and 0.20 lbs of potash. This is agsinst 97.92 lbs of nitrogen, 56.56 lbs of phosphorus and 66.98 lbs of potash utilised in Japan (see table 67). Consumption of fertilizers is very small in proportion to the requirement. The province has so far consumed only 19.18% of nitrogenous, 1.09% of phosphatic and 0.97% of potassic fertilizers required for different crops. (see table 66).

Table 66

Per acre requirement and consumption of fertilizers in East Pakistan

unit in lbs.

	Requirement[103]	Consumption[104]			Consumptionin as p. c. of requirement
		indigenous fertilizers	chemical fertilizers	Total	
Nitrogen (N_2)	43.83	6.47	1.94	8.41	19.18%
phosphorus (P_2O_5)	39.20	0.07	0.36	0.43	1.09%
Potash (K_2O)	20.50	0.15	0.05	0.20	0.97%

If only ' chemical fertilizers are considered, the corresponding figures of consumption will be 1.94Lb of nitrogen and 0.36Lb of phosphorus, the figure for potash being negligible (0.05Lb) Pakistan Census of Agriculture 1960 reveals that 27.4 lakh farms. that is, 45% of all farms used some kind of manure during the census year and the area manured was 43.3 lakh acres which was 23 percent of the total sown area. The proportion of farms reporting use of manures to the total farms was the highest in the medium size farms and lowest in the small size farms. The proportion was as low as 26 percent in farms under half an acre in size. But the area as percentage of the net sown area was highest in the small size farms and gradually declined with the increase in size of farms, which will be evident from the following particulars furnished by the census :

	Farms reporting manure as p.c. of all farms	Area manured as p. c. of net sown area
Small	39	28
Medium	50	23
Large	50	19

Though 45% of all farmers used any type of manure, only 4 percent of the farmers used some kind of chemical fertilizers. However, in proportion to the number of farms using manures, the quantity of manure used by them is very small. And the situation is worse in respect of phosphatic and potassic fertilizers use of which is now almost negligible (see table 66.)

A fertilizer factory has been established at Fenchugonj in Sylhet in 1961 for production of urea fertilizer out of natural gas. The factory started its production in early 1961 and has an annual capacity of 1.17 lakh tons of urea equivalent to 2.5 lakh tons of ammonium sulhate. Researches reveal that in East Pakistan soils, urea which contains as much as 46% nitrogen is as good as ammonium sulphate and in some cases, better than ammonium sulphate. It is expected that production from this factory shall

be able to meet East Pakistan's requirement of nitrogenous fertilizer to a great exetent. Until factories for manufacture of phosphatic and potassic fertilizers, for which unfortunately there are now little raw materials in the province, are established, these fertilizers will be required to be imported from other countries for supply of balanced plant nutrients to the soils. A factory for production of phosphatic fertilizers is however going to be established in Chittagong in the near future.

So far availability of chemical fertilizers in the province is concernd, the situation has been improving. Formerly there were big problems for proper storage and distribution of fertilizers., In the begining of the use of chemical fertilizers in the province, sale and distribution were conducted by some private commercial organisations of which the Imperial Chemicall ndustries (LTD) was prominent. These organisations had a good number of agents located in the prominent markets. However, the procedure was not allowed to continue for long. In consideration of the poor economic status of the farmers and with a view to increasing use of fertilizers on scientific lines, Govt., took over distribation of fertilizers in 1951 and from that year on, Govt. have been importing chemical fertilizers and distributing the same amongst the farmers mostly at subsidised price, the subsidy varying from 20% to 70% of the actual cost.

Fertilizers are distributed mainly from the Govt. agricultural stores known as Thana Agricultural Stores, under the supervision of the Thana Agricultural Officers and other Extension workers. There are more than 400 Thana agricultural stores in the province, but most of these stores are not suitable for proper storage and distribution of fertilizers. These are small private houses rented by Govt. However, 50 of the Thana Agricultural Stores, each of 150 to 200 tons capacity, have been constructed by Govt., which provide better storage facilities. A development scheme has recently been taken up by Govt. to establish one agricultural store of about 45 tons capacity in each Union. Of these stores, more

Table 67

Per acre consumption of fertilizer in different countries [105]

unit in lbs.

Country	Nitrogen	Phosphorus	Potash
Netherlands	156.30	94.70	141.35
Japan	97.92	56.56	66.98
United Kingdom	37.20	49.27	39.09
South Korea	17.80	7.56	2.06
United States	10.70	10.45	9.36
Spain	7.16	12.41	3.55
East Pakistan	8.41	0.43	0.20

than 2,000 have already been constructed. These stores will be ultimately utilised by the Union co-operative societies for storage and distribution of agricultural commodities including fertilizers. In order to remove the storage problem of fertilizers, Govt. have recently constructed 8 godowns, each of 2000 tons capacity and intend further to construct 52 godowns, each of 1000 to 2000 tons capacity during the second plan period (1960-61 to 1964-65.)

Distribution of fertilizers in the province by Govt. involves a huge affair and its success depends on two imporlant factors viz: (a) availability of fertilizers in the villages, preferably in all rural markets, at the minimum cost and with the least formalities and (b) systematic Extension work with emphasis on fertilizer demonstration. These activities are diverse in nature and cannot be properly performed by the same person or organisation. Govt. realised this fact and, as a result, the Agriculture Development Corporation was created in 1961 as an autonomous organisation. This organisation has been now entrusted with the task of fertilizer distribution along with other functions.

Agricultural Implements And Mechanisation

(i) Implements

Agricultural operations adopted by the East Pakistani farmers, are yet very unsatisfactory. Though agriculture is the oldest and biggest profession of the people here, little modern technique has been added to what the farmers were doing in the past. Their lands are not cultivated properly. The ploughs they use are light and do not have proper arrangement for turning down the soil or exposing the soil underneath to the sun. Animals which are the only source of traction power for farming are very poor. And as aresult, lands are hardly ploughed beyond a depth of three inches which is insufficient for maintaining soil fertility and proper root development of most of the crops grown in the province. Due attention is not also given to proper spacing, depth of sowing etc. and these operations are not easy in absence of suitable implements. Interculture operations such as weeding, mulching etc. are difficult and so are done only in the fields of a few crops like jute, patato, winter vegetables, Aus rice etc. which get a little more care than others. But these operations are also done very inadequately. A limitted number of crops of which winter vegetables, patoto and boro paddy are important, receive irrigation facilities. While irrigation received by these crops is far below the optimum requirement, other crops are to depend entirely on the mercy of nature for soil moisture and so face drought very off and on. Extent of adoption of plant protection measures by the farmers, is also very small in proportion to the total requirement. All these drawbacks are due to many traditional reasons of which lack of suitable equipments is very important. Farmers here use a few kinds of simple implements. A short describption of the agricultural implements commonly used by the farmers is given below :

(*a*) **Plough (langal)**—It consists of a wooden body bent in the middle at an angle of about 130° between the share and the handle. A small and narrow piece of iron is fitted with the lower end which looks like a tongue. A small handle is attached at the upper end and the wooden drawbar passes through the body just above the bend at an agngle of about 40° with the handle. The yoke may be wooden or bamboo-made. On average a plough will weigh about 10 pounds or less. Some regional differences are, however, noticed in its construction and weight.

(*b*) **Ladder (Mai)**:—This generally consists of two parallel pieces of bamboo, having several cross-bars. It is used for levelling of ploughed lands, breaking the clods and compacting the soil. But it is so light that a man can easily carry a plough and a ladder on his shoulder.

(*c*) **Bida or rake (Anchra)**:—This consists of a thick wooden barfitted with several wooden or iron tines on one side. This implement is used for mulching and thinning of crops.

All these implements are drawn by work animals.

(*d*) **Lift irrigation equipments** :—For lift irrigation, 'done' and 'swing baskets' are used. 'Done' which looks like a small boat of narrow width, is generally made of wood and is costlier than swing basket which is made of bamboo and is very handy. These are utilized only for lifting surface water.

Amongst other equipments and accessories used by the farmers, mention may be made of several kinds of (i) spades (used dfor opening of land and intercultural operations in small area), (*ii*) sickles (used for harvesting of crops,) (iii) khurpi or nirani (used for weeding and mulching), (iv) kula (used for winnowing) and (v) buckets (used for carrying water for small size kitchen garden).

It is unfortunate that all farmers do not own even these simple implements and accessories required for farm operation. 34% of the farmers do not have any plough which is the most important

implement here. The percentage of farmers having no irrigation appliances and rakes will be higher. It may be of interest to know that the hilly area where 'dao' (a kind of heavy and broad knife) is the only equipment used by the farmers for crop production. In these areas where agriculture is almost in the primitive stage, the tribal people grow crops on the hill sides by the means of what is known as Jhoom cultivation (a kind of shifting cultivation) The Jhum farming clearly indicates that in this modern age, very primitive method of cultivation is yet prevaling in this province. The tribal farmers (Jhumias) grow crops on temporary farms (Jhums) which vary from one to two acres in size. For preparation of a Jhum, the jungle and scrub on the hill slope is burnt once in winter and again in spring. The soil is then stirred with a heavy knife (Dao) and the Jhum is ready for sowing. Mixed sowing is the rule in the Jhums. The seeds of Aus paddy, Till, maize, cotton and vegetables are mixed at home and hand-fulls are sown in small pits dug out by the knife in the begining of the monsoon. The proportion of different seeds is as follows: paddy about 75%, cotton and Till about 20% and other crops 5%. Each Jhum is cultivated once or twice and is then left and and an adjoining piece is similarly burnt and cultivated. The first crop that is harvested is maize in June-July, second, paddy in August-September, third, Till in September-October and fourth is cotton. Vegetables are harvested over a long period. The yeilds of crops are very poor and are as follows : rice 7 to 10 mds, maize 4 to 5 mds, Till 3 to 4 mds, and cotton 2 to 3 mds. kapas per acre.

After harvest of the crops the Jhoom farmers leave the hills for new ones and will not returen uhtil generally 3 years are gone. As a matter of fact, East Pakistan is one of the most backward areas in the world in respect of use of improved and modern implements.

Govrnment have, however, been endeavouring to improve the situation. Much agronomical researches have been conducted and some useful results have also been obtained particularly in respect of land preparation, spacing and interculture operations.

Seeds and seedlings sown or planted in lines have been found to give higher yeild than those sown broadcast when other basic requirements are satisfied. Planting of sugarcane in trench system has been found superior to other systems. Similarly suitable methods have also been evolved for several other crops. Most of these operations require better implements for best results. The reaserch division of the Agricultural Engineering has been conducting reaserch work to find out suitable implements for various farm operation. As a result of the researches some important implements have been evolved. A brief description of these implements is given below :

(*a*) **Ploughs :**

(*i*) Kishan Plough——It is a light mould-board plough suitable for the conditions of East Pakistan. Its bottom is made of iron and its drawbar and handle are made of wood. The centre of resistance, the hitch point and yoke point are in one line so that minimum draft is required for pulling. Its shares are easily replaceable. Its operation is also simple. The height of the drawbar is matched with the height of the animals by means of the two wedges provided with the drawbar. The depth of ploughing is varied by attaching different notches of the drawbar to the yoke. Kishan plough weighs about 26 pounds and can cover about O.45 acres per day of 8 hours.

(ii) Bengal Standard Plough——This is a mould board plough. This plough is heavier than kishan plough and can be worked by using good type of bullocks.

(b) **Seed treater :**

(i) Drum type seed treater——It is a drum mounted on a suitable frame and operated by the hand. The diameter of the drum varies from $1\frac{1}{2}$ ft. to 2 ft. The chemical and the seeds are fed through one of the two openings of the drum. The drum is then rotated by hand slowly for about 15 minutes after which the treated seed is taken out through another opening. Per hour capacity of this treater is 2 mds.

(ii) Gravity seed treating machine——This machine is simple, inexpensive and at the same time its capacity is also high. It does not require any external source of power to operate it. This machine resembles an almirah inside which there is a number of sloping boards, The kinetic energy of falling mass of the seeds through the adjustable throat of the seed hopper is utilised to drive the component of the machine. The chemical from the container is metered by means of an auger passing through perforated pipe. The seed to be treated is poured in the hopper by busket. The chemical container is to be filled with dry chemicals. It is also neccessary to fill up auger pipe with the chemical by operating the auger manually. The throat of the seed hopper should be fully opened by hand. The chemically treated seeds comeing out through the opening of the machine at the lower end should be collected in bags. The casing of the auger pipe should by manually adjusted to have the requisite quantity of the chemical as indicated in the semi circular dial. This machine can treat 30 mds of seed per hour.

(c) Seed drill

(i) Paddy seed drill——For sowing of paddy seeds in line, this simple drill has been designed. It is entirely made of bamboo. No iron material is required for making this simple seed drill which can easily be made by the cultivators themselves. The seed drill works as an attachment to the bullock-drawn ploughs. The seed drill is mechanically operated. It consists of a bamboo funnel, a wooden metering roller, two wooden ground drive wheels and a bamboo frame. The seed drill is to be attached to the plough. The paddy seed is poured in the bamboo funnel and as the animals move forward the seeds are deposited in the soil. The Deshi plough opens the furrow, the seeds are then deposited and the earthing up device covers the seeds. The marker marks the line on the ground. The seed drill follows the lines marked on the ground in subsequent operations. It is desirable to get the first line marked on the ground by means of ropes, sticks etc. Its capacity is about 0.66 acres per day of 8 hours.

(ii) Jute seed drill——It consists of a hopper in which there is a metering roller. The drive of the metering roller is taken from the front wheel through a system of linkage. The furrow opener opens the furrow in which the seed is deposited. The earthing up and compacting are done by two seperate devices attached to the frame. The implement is made of iron. For operation, the hopper is partially filled up with seeds in the field. The first line is required to be aligned on the ground by means of rope and sticks. The seed drill is pushed forward along the line by hands. The seed drill then follows the second line which is marked on the ground by the marker at the time of planting the first line. The procedure is followed for subsequent lines. Its per day capacity is 0.66 acres.

(d) Implements for weeding and interculture operations

(i) Rice weeder—Weeding of rice by hand under wet conditions involves drudgery of the cultivators. In order to have efficient weeding of the rice field and also to minimise the drudgery, rice weeder has been evolved. It consists of two iron drums having flat but curved spikes. The two drums and the float are mounted on an iron frame fitted with wodden handles which are braced at three points for rigidity. For operation, the implement should be pushed ahead in the rice field with jerks by hands. There is provision for adjustment of the float and the drums in order to meet the varying field conditions. The height of the handle can also be adjusted. Its capacity is about 0.3 acre per day of 8 hours.

(ii) Hand hoe——Crops like jute, cabbage, cawliflower, chillies etc., when grown in lines can have the interculture operations easily done by hand hoe. It consists of three iron tines placed about 4 inches apart and fitted to an iron frame. The implement is provided with wodden handles and an iron wheel. The implement is pushed ahead by hands in between the lines of the crops. It requires to be pushed with jerks. The implement

uproots the weeds and breaks the crust. Its capacity is about 0.4 acre per day of 8 hours.

(iii) Bida or rake——Interculture of broadcast paddy by means of Nirani etc. is labourious and time consuming. This bida or bullock-drawn rake does the job of weeding, thinning and breaking of the crust quite satisfactorily in paddy fields. This is an improvement over the bida used by the farmers. It consists of several tines fitted to a wooden bar which is provided with a beam. The tines can be made of bamboo or mild steel. The tines are usually placed at $3\frac{1}{2}$ inches apart and the width of the implement is about 5 ft. The implement is hitched to a pair of bullocks which draws the rake. The animals draw the implement through broadcast paddy field and thereby weeding, thinning and breaking of the crust are done. Its capacity is about 1.5 acres per day.

(e) **Irrigation appliances**

(i) Iron 'done'——Use of 'done' is almost extensive in the province. But farmers generally use wooden dones which are heavy and do not last long. The iron done is made of iron sheet about 15 ft. long, 11 inches wide at one end and 12 inches wide in the middle. The other end of the done is a point. Its average height is about $7\frac{1}{2}$ inches. This is provided with a number of reinforcing rods. This is durable, light and can be carried and and worked by one man. For operation, it is fitted by the side of the surface water by means of posts, rope and counter weights. The operator pulls the rope down and then steps in the 'done' which acts against the counter weights. The 'done' is released when filled up with water and the discharge takes place due to the counter-weight. Its discharge capacity is 5,000 gallons per hour for a lift varying from $2\frac{1}{2}$ft. to 4ft..

(ii) Propeller pump——This is a low-lift high capacity pump. It can handle dirty water and does not require priming as the impeller works in the water. It consists of a pipe about 12ft. long through which passes a shaft. The shaft is supported on plain bearings and it is concentric with pipe. The lower end of the shaft is provided with a propeller which raises the water through the pipe. At the lower end of the pipe there is a bell-shaped suction bowl with a strainer and the top end of the pipe is shaped like a 90° bend. The pump can be fixed either vertically upright or at different angles depending on the nature of the bank of the surface water. The pump can be operated either directly placing a motor on it or by belt pully from the sides. The propeller should always be under water as long as the pump works. Its discharge capacity is 84,000 gallons per hour under a static head of $11\frac{1}{2}$ft. with $8\frac{1}{2}$ inches pipe.

The engineering division of the Agriculture Research Institute has also brought about some improvement over Persian wheel and chain pump.

(f) **Thresher and Winnower**

(i) Pedal thresher——Threshing of paddy by human foot, beating with sticks, etc., is tedious and time-consuming. Threshing of paddy by treading with bullocks has also various disadvantages. Threshing by the pedal thresher is an efficient and improved method which has various advantages over the primitive ones. It is a small and simple machine having a drum fitted with a large number of metalic staples. The drum is operated by foot through a system of levers and gears. Little effort is required to operate the drum which is mounted on antifrication bearings. The drum is rotated in such a manner that the threshed grains are thrown outward. The straw left in the hands of the operator after threshing are collected in one place. Per hour capacity of this thresher is 2 mds. of paddy.

(ii) Combined pedal thresher and winnower——Threshing and winnowing of paddy are done in two seperate operations by two different machines. By this machine the operations can by done seperately by the same machine. It has got two main parts: (a) threshing part and (b) winnowing part. The machine consists of a revolving drum which is worked by foot pedal. The drum is

made of wooden bars on which 'V' pegs are fixed. The drum is sheilded by iron hood to protect grains from being scattered and helps in collecting them in one selected place. There is a sloping screen in the winnowing box which remove the chaffs and straw. For operation, paddy bundles are held loosely over the revolving drum when metal pegs remove the grain by combing action from the straw. When the threshing job is finished the winnowing attachment is connected with the machine. It can now be used for winnowing by driving the drum in opposite direction and covering the machine so that the blast of wind produced by fans is controlled and worked for winnowing. The threshed paddy is poured in the hopper which has opening to allow grains to fall intermittently while the blast of air removes the lighter praticles. All grains are collected in lower part of box. Threshing capacity is 3 mds of paddy and winnowing capacity is 20 mds. per hour.

(iii) Hand operated winnower——Winnowing of threshed paddy is done in the villages by means of the primitive shovel shaped equipment called 'Kula' in Bengali. The working with 'Kula' is dartly dependent on breeze. Winnowing by this method is a very slow process. The operation of winnowing can speedily be done by means of this equipment. It has the appearance of an wooden box in which there is an wooden fan and a few seives. The wooden fan operated by hand produces the draft of wind required for the blowing of lighter particles from the threshed paddy. The sieves help the seperation of broken straw, lighter particles etc. from the grain. For operation, the threshed grains are placed on the hopper and the fan is operated by the hand. The threshed grains are allowed to fall through the adjustable throat of the hopper in such a manner that the draft of wind generated by the fan blows away the lighter particles from the grains. There is provision inside the machine for varying the intensity of the draft of wind so that requisite cleaning of grain can be acheived. The quantity of seed falling through the throat is varied by means of a lever arrangement. Its capacity is 15 mds. per hour.

(g) **Cane crusher**

(i) Only a small portion of the total sugrarcanes produced in the province is crushed in sugar mills and the major portion crushed by the indiganous crushers. This is an important equipment of the cane growers. Cane crusher consists of three cast iron rollers mounted mostly on wooden frame. There is a tray made of iron sheet at the base of rollers. The tray collects the juice squized out of the cane by the rollers. The percentage of extraction of juice is much higher (around 50 p.c.) with iron rollers than that with wooden rollers. For operation, the crusher is to be properly fixed in the ground. The machine is driven by a pair of bullocks with an wooden beam passing through the head stock of the crushers. One man feeds the machine with canes and another man drives the animals. The crushing pressure is adjusted by means of the adjusting bolts. Its capacity is 2 mds. per hour.

These equipments have been designed with due consideration given to local soil, climate etc. and have been found to increase, to a considerable extent, the efficiency of farmers and productivity of land. The Agriculture Department have been trying since its inception to popularise use of better implements amongst the farmers. But hardly any success could as yet be acheived mostly owing to poor quality of work animals and low financial power of the farmers. The Pakistan Agricutture Inquiry Committee observed in 1952 that, "As far as we could find out no large scale improved indigenous implements have been introduced in East Pakistan and much remains to be done there". The situation has not yet improved. During 1960-62, only 12,503 rice weeders, 443 pedal threshers and 4,673 seed drills were manufactured in the province. This indicates that use of these implements by the farmers is yet negligible. But improved implements are indispensible for increased agricultural production and so the age old and out-dated implements require to be replaced by the improved ones. There are lots of difficulties in the way; but in consideration of various socio-economic and technical aspects of the problem, it seems that agricultural improvement in this

province lies in careful mechanisation suitable for the province, as advocated by many authorities and specialists.

Table 68

Production of Improved Implements

Name of Implements	1960—61	1961—62
Weeders	6503	6000
Seed drills	2173	2500
Paddle thresher	213	230

(ii) Mechanisation

Introduction of power driven machines in East Pakistan agriculture is quite new and yet negligible. In 1951 there were only about 100 tractors in the province. There are at present about 200 tractors owned by the Government and there are, in addition, a few tractors owned by the private organisations. The United Kingdom with much smaller cultivated area (which is about 14 million acres excluding area under grass) had 4 lakhs of tractors in 1951. In 1958, the U.S.A. farmers used 4.7 million tractors. While in U.S.A., almost all operations required in the rice fields are done mechanically, East Pakistani rice farmers use harldy any machines in the rice fielids. Use of machines in the paddy fields of Japan which possesses small holdings, is not very extensive, but all operations required there between pro-harvest and pre-seeding are done mechanically. But here all operations such as sowing, transplanting, weeding and harvesting are done by manual labour; and men and animals work togather for preparation of land and for threshing of harvested crops. However, the province has recently made a humble venture for introduction of machinary in agriculture. There are, of course, a number of factors which militateagainst introduction of full-scale or extensive mechanisation in East Pakistan agriculture as is found in the western countries of the world. The most important of these factors are (i) fragmented holdings, (ii) large rural population without immediate prospect of their diversion to industrial or other fruitful non-agricultural persuits, (iii) poor rural economy, (iv) lack of technical know-how and (v) bad communication system.

Cultivable holdings here are as small as 3.1 acres in size on average and each acre of this consists of several plots scattered in different places. The use of heavy machinery for ordinary agricultural purposes has therefore some practical difficulties under these conditions, and the progarmme of mechanisation with heavy implements requires to be viewed and framed with caution. Though general mechanisation on large scale is still a controversial matter, there are certain fields where introduction of machinery not only shows considerable promise and potentialities but also constitutes one of the most important steps for the overall development of agriculture and stepping up food production. Cultivation by tractors including power tillers and irrigation by power pumps are two such fields which may open up fresh possibilities in East Pakistan agriculture. In fact, mechanisation of agriculture has made a humble start here only in these two fields.

(a) Tractor cultivation :

Tractors are now mainly utilised here for reclamation of waste lands. During a survey conducted in 1945, about 2.5 million acres of cultivable waste lands scattered all over the province were found uncultivated and, therefore, unproductive for various reasons. Due to heavy pressure of population and food shortage, a considerable portion of these waste lands particularly small blocks have been brought under cultivation by ordinary means available with the farmers. But it is estimated that there are still about 1.9 million acres of cultivable lands lying waste including those in haors, beels etc. Area of these waste lands varies from district to district. While there is little

scope to bring more new lands under cultivation in the districts of Comilla and Noakhali, there are some areas lying waste in the districts of Chittagong Hill tracts, Chittagong, Sylhet, Dinajpur, Rangpur, kusthia; Faridpur and Jessore (See table 51)

Table 69

Use of tractors for reclamation of waste lands

Year	No. of tractors used	Area reclaimed in acres
1950—51	...	...
1951—62	18	1,920
1952—53	30	2,700
1953—54	35	2,990
1954—55	25	1,950
1955—56	25	1,600
1956—57	30	3,000
1957—58	32	3,200
1958—59	55	5,700
1959—60	66	7,330
1960—61	93	11,060
1961—62	125	8,100
1962—63	156	20,630

Most of these areas are high lands and can be reclaimed by tractors. The ordinary cultivator with his traditional methods and limitted resources is unable to bring these lands under cultivation. The Agriculture Department, therefore, prepared a a programme and accordingly supplied some tractors on hire system to the farmers owning waste lands for reclamation. As a result, considerable areas have been reclaimed in different places mainly in the districts of Sylhet, Chittagong, Dinajpur, Rajshahi and Mymensingh (See table 69)

Beside the essential use of tractors for reclamation of waste lands, normal cultivation may also be done by tractors specially in some areas of high and medium lands through suitable rural organisation. Some tractors are being very successfully utilised for this type of cultivation. But scope of the Government owned tractors which are comparatively big in size, is limitted for extensive use in the ordinary lands of the farmers. "These tractors included six makes and nine sizes ranging from about thirty to fifty horsepower. About one-fifth were crawler type, and the the balance were conventional four wheel, pneumatic tyred, farm or industrial types. Some were gasoline powered, but most had disel engines. All were equipped with disc harrows or disc or mouldboard ploughs. A few of the crawler tractors had hydraulically operated bulldozer blades." Although the province does not have sufficient areas suitable for large size tractors, there is great possibility of extensive use of small size tractors or tillers in this part of the country.

Many attempts were made by the Agriculture Department through exhibition, demonstration, group discussion etc., to popularise use of improved implements amongst the farmers. But as improved implements involve better animals, this progamme could not as yet succeed. Use of improved plughs is considered as one of the essential steps for increased production, but necessary animal power is not available from most of the local bullocks to pull this plough. Cattle of the province are ill-managed and very poor in health. The standard of animal nutrition in this province is one of the lowest in the world and about 15 years back, a bullock was estimated to be equivalent to 0.4 B.H.P. Compared, however, to tractor power one pair was considered to be equivalent to three I.H.P. (indicated horse power). But cattle condition has greatly deteriorated since then due to decrease of area under fodder crops. As mentioned elsewhere on one acre of fodder crop depend as many as 241 livestock units and this is against 6 units as recrommanded by the livestock experts. It

may be mentioned here that in the old Punjab area, a pair of bullocks "will consume 2 acres of fodder per annum and most of the wheat bunsa, gram busa and missa busa". However, it is estimated that on the basis of 150 percent cropping intensity, present livestock of the province will require about 4.5 million acres under fodder and 3.8 million acres under pulse crops to have adequate feed only in respect of these two items. It is impossible under the present circumstances to allot livestock these areas which are more than one-third of the total cultivated area of the province. It may be noted that low grade pulses such as mash-kalai and khesari which were formerly used as cattle feed, to a large extent, are now mainly being used as human food. Oil-cakes which are valuable concentrated feed, are also applied in the fields to increase soil fertility and thus to step up food production. Each acre of cultivated land now supports 2.6 human beings and 1 livestock unit. All thse indicate a severe competition between men and aminals for food from the same lands. As a result, bullock population is deteriorating here and will deteriorate at a faster rate on the smaller farms which can hardly maintain work animals. Mr. A. Z. Khan in his publication, "Introduction of Tractors in a Subsistance Farm Economy" observes, "If the law of inheritance is allowed to remain in effect, average farm size would be even further reduced. It is a logical deduction that the work cattle will also gradually be reduced to the minimum or ultimately even disappear." His observation was based on some surveys conducted in the Comilla district under the Pakistan Academy for Rural Development.

The Pakistan Census of Agriculture 1960 reveals that 90% of the farms under 0.5 acre in size and 72% of the farms of 0.5 acre to 1.0 acre in size do not have any work animals. Of the total farms, 35% do not have any work animals. The Census also reveals that 28.27 lakhs of cows are being utilised by the farmers as work animals. It, however, indicates some increase in number of bullocks over the corresponding figure of the livestock Census of 1945. But during this period human population has greatly increased, and grazing lands and area under fodder crops have greatly decreased as a result of which there has been qualitative deterioration of the bullocks and no addition of wealth in terms of power. In fact, increase in number of animals in the province indicates deterioration of their quality and loss of traction power. It is a paradox that the present livestock population, though considered to be larger than what the province can support, can hardly manage the farm lands satisfactorily. Many a traditional defect in farming may be traced to poor quality of work animals. Some of the serious defects are as follows :

(*a*) Lands do not get sufficient number of ploughings, ladderings and other operations required for normal production of crops.

(*b*) The few operations a crop receives here, are very poor in quality. Ploughing is very shallow, laddering is inadequate and other operations are unsatisfactory in quality.

(*c*) Most of the farm operations are not done in time. Due to poor productivity per animal, the existing work animals are not sufficient to manage the cultivated land in the proper season and, so very long periods are required to complete even the basic operations. Land prepration and other important operations are related with rainfall and favourable weather conditions. As these conditions do not continue for long, heavy work requires to be done in the farm within a short period. But lack of suitable animal power makes it difficult to do the work in time in all farms. In fact, a good percentage of farms are operated out of season.

All these defects have far-reaching and undesirable effects on crop production. The problem may be solved, to a considerable extent, by improving the quality of the work animals. But this will require a long period and a complex programme. Besides, with the rise of human population, management and feeding of cattle will always be a problem. But the province shall have to be self-sufficient in food within the shortest possible time. This is possible only when work animals are gradually withdrawn from farms and replaced by power tillers. This will improve efficiency of farming, increase crop production and enable a

group of rural people to raise better cattle for increased production of milk and beef.

As mentioned above, use of heavy tractors has got many limitations due to lack of finance, farmers' organisations and technical known-how. But most of these difficulties including unemployment problem which may be created by introduction of heavy tractors, will be reduced to considerable extent if small size tractors or tillers are utilised as is found in Japan. Tractor cultivation in Japan which has small holdings and grows rice as the main crop, is recent. From only 78 power cultivators used in 1931 in Japan, the figure has increased to 82,280 in 1955 and this has not upset the rural population to an unmanagable extent. This has been possible only due to the introduction of small size tillers which are mostly within the range of 2 to 6 H.P. and due to partial mechanisation.

Complete farm mechanisation may displace here '2 out of every 3 labourers.' It is therefore true that "mechanisation while it is bound to come, outhght to be cautiously and gradually introduced so as not to alter the rural condition too rapidly."[107] The situation, therefore, necessiates adoption of partial mechanisation for the important farm operations such as land preparation, irrigation, plant porotection, thershing etc. For, any improvement made in respect of the important farm operations, will bring about great rise in agricultural production and only small size power equipments can serve this purpose and suit the farmers' economy, and rural organisation and communication. The engines utilised for tilling may also be utilised for pumping, spraying, threshing, husking, boat transport etc., with suitable attachments. A unit of such equipments may be utilised by a big farmer or by the farmers living in a rural home('Bari') or by a suitable group of farmers. Introduction of these machines may also help in removing some other difficulties, thereby stepping up agricultural production. With the gradual development of industries in the province, dearth of agricultural labour is being felt. In fact, the landless agricultural labourers and share-croppers who were hard workers and were so long doing the farm operations even under very odd situations, are now decreasing in number day by day in the rural areas, and as a result, a new group of labourers, who are just above the preceding group in socio-economic status but are less hard-working, are coming out to do these operations. Introduction of these machines will increase their efficiency. Besides, this will increase dignity of labour which is now miserably wanting and will encourage the socalled 'bhadra' (gentlemen) farmers to operate their farms personally. While 10% of the population of U.S. A. produce about 120% of the national requirement of food and farm products, 88% of the people of East Pakistan (including landless agricultural workers) now barely produce 56% of their food requirement. This means that per capita production of the farmers here is extremely poor. Hence, in order to increase agricultural production, farmers here must spend more productive energy in the farms and realise much more H.P. out of each farm worker. The extent to which efficiency of farm and farm worker has been improved and agricultural production has been increased, may be guessed from table 70 and 71 which relate to U.S. A. Mechanisation of farm in the western pattern is not possible here. But in order to increase efficiency of farming, raise dignity of agricultural labour and step up agricultural production, the province must at least adopt partial mechanisation.

The Pakistan Agricultural Inquiry Committee (1951-52) have shown that per acre cost of cultivation is less by tractor than by bullocks even on the assumption that a pair of bullocks can manage 12.5 acres of land. But in this province, a pair of work animals can manage only 3 to 4 acres of land and so there is no doubt that cultivation by power tiller will be cheaper than bullock operation. This has been established by many an agricultural specialist after detailed study of comparative costs. If some good models of power tillers and other equipments suitable for the province are evolved and manufactured in the country or initially imported from other countries and distributed amongst the farmers on a suitable system, a revolutionary change in agriculture is expected to dawn in.

Table 70

Estimated power available in USA farms

Availability of H.P.	1850	1910	1950
1. Per farm	4.3	4.4	55.0
2. Per farm worker	1.3	2.3	27.5
3. From animals on farms	64,94,000	2,11,31,000	80,00,000
4. From tractors of farms	...	5,00,000	6,80,00,000

Table 71

Man-hours required to produce a bushel of wheat in U.S.A.

	1800	1880	1920	1950
Man-hours	3.7	1.5	0.87	0.31

(*b*) Power pump irrigation

Average annual rainfall in the province is as high as 81.75 inches. But this is not evenly distributed throughout the year. In the winter (during the months from Nov. to March) only 4.36 inches of rainfall is noticed on average. This is why in the province large areas of cultivable land remain fallow during the winter season for want of sufficient moisture. While 80% of the total cropped area is put under cutivation in the rainy season (kharif), only 18% of it is cultivated in the winter (rabi). This difference of cropped areas in two seasons is largely due to the difference of soil moisture. Irrigation can, therefore, bring extensive areas under winter crops. Besides, it can also help increase acreage under kharif crops. Important crops like jute, broadcast Aman and Aus are sown in the begining of summar monsoon which is very uncertain. As a result, these crops very often give poor yeilds due to lack of moisture at the time of sowing or due to delayed sowing. It is not uncommon that these crops need resowing due to poor germination in absence of sufficient moisture after first sowing. Sometimes preparation of seed bed for transplanted Aman paddy is also hampered due to lack of timely rainfall. Delayed sowing of these important crops has also adverse effects on the crops to be followed in rotation which in many cases can not at all be grown for loss of the proper sowing time. If irrigation facilities are made available in the begining of monsoon, two important crops (Aus or jute and transplanted Aman) can be easily grown in all medium and high lands in the kharif season alone. And so production of 3 crops in a year is not a difficult job. In some experimental farms, it has been possible to grow successfully with irrigation 3 crops in suitable rotations, some of which are as follows :

(*a*) Aus or jute-transplanted Aman-pulse
(*b*) Aus or jute-transplanted Aman-groundnut
(*c*) Aus -transplanted Aman-soyabean
(*d*) Aus-green manure-wheat or potato

At present, generally minor crops are grown in the winter. But with the availability of irrigation water, many of these crops can be replaced by crops of more economic importance. In fact, irrigation can tremendously increase cropping intensity and change cropping pattern for higher and economic production. The few crops which now receive some irrigation, are grown in small patches of land where an easily accesible source of surface water is available. But these crops also do not get sufficient water as required for normal production. In many cases, irrigation is done only to avoid total failure of the crops. Experiments have revealed that yeilds of winter crops now grown without irrigation can be even doubled if these are properly irrigated.

Water requirement of different crops under East Pakistan condition have not yet been finally ascertained. But irrigation requirements of some crops have, however been tentatively

worked out, on the basis of some experiments and observations. Irrigation requirements of some of the crops are as follows:

	Required no. of irrigation		Required no. of irrigation
Wheat	4	Tobacco	2
Maize	5	Potato	3
Sugar cane	3	Winter vegetables	3
Boro paddy	8	Mustard	2
Aus (early)	2-3	B.Aman (early)	2

From the above particulars it will appear that irrigation requirement of the province is really big. This requirement can not be at all met by the existing indigenous waterlifting appliances of the province viz: bucket, bamboo-made swing basket, wooden 'done' etc. Although it is comparatively easy to prepare these equipments under rural condition, they do not have adequate discharge capacity. These appliances are now-a-days neither economical nor suitable for large scale irrigation. However in 1959-60, 23.24 lakh acres, that is, 7% of the total cultivated area was irrigated mostiy by these indigenous methods. This area is very small in proportion to the total cultivated area of the province which has excellent soil, climate and plenty of surface water. If the surface water available in the province is utilised, most of the cultivated area particularly in the southern regions can be irrigated. In order to intensify cultivation in the province, Government have, therefore, been tryingto provide more irrigation facilities to the farmers. There was no flow irrigation by canal system in the province in the past. As this system of irrigation involves huge capital investment and a long period to acheive success, importance was initially given to low cost lift irrigation. The Agriculture Department manufactured a good member of better quality iron 'dones' and distributed the same amongst the farmers. In addition to this, new types of water lifting equipments were also introduced in the province. In pre-Independence days, 500 persian wheels were procured for distrition amongst the winter crop growers. Attempts were also made to introduce Egyptian screws. But none of these equipments could gain popularity in the province mainly due to the fact that lifting of water in these new methods is costly and time consuming. Besides, these equipments cannot be locally prepared.

Introduction of power pump in the province is recent. But this is now considered as one of the quickest and surest ways of increasing agricultral productivity significantly. Power pumps have particularly been found beneficial for boro paddy cultivation. Aus paddy is grown during the period having 20 to 30 inches rainfall while transplanted Aman enjoys as much as 40 to 60 inches rainfall. Hence these crops normally may not require any irrigation. But Boro paddy which is grown during the months from Novermber to March, gets less than 5 inches rainfall on average, though it requires 20 to 30 inches water for its production. Hence Boro paddy has been particularly benefitted by power pump which has higher discharge capacity than other indigenous appliances. It is estimated that o.2 million acres of waste lands are concentrated in the haors of Mymensingh, Sylhet and Comilla districts, which could be profitably utilised for growing a bumper boro paddy if irrigation water could be made available during winter. Similar types of land are also available in the 'chalan beel' area of Pabna-Rajshahi districts and other parts of the province. The province has in all about 0.4 million acres of cultivable waste lands under the catagory of 'haors'. beels', 'jeels' etc., which are suitable for boro paddy cultivation. It is with this object of bringing more lands under boro paddy cultivation that Agriculture Department immediately after Independence started a small scheme of power pump irrigation which, however, was localised mainly in the district of Sylhet. In the subsequent years, the scheme was extended to other parts of the haors but it did not actually make any

significant impact on the existing situation. In the year 1956-57, another attempt was made to utilise more pumps in the wastes of the 'hors'. As a result of this drive to popularise power pumps among the cultivators and considerable organisational work among them, it was possible to put into operation 136 pumping sets of different sizes which irrigaed an area of about 10,000 acres. Successful working of the power pumps in 1956-57 and effective demonstration of their utility evolved a great response from the cultivators. In fact, owing to this new development, the price of land in the haors went up several times and absentee land owners who gave up their lands in the haors as permanent waste lands rushed back to establish their ownership and take advantage of this new venture[109]. However, the power pump scheme was further improved in 1957--58 when 600 sets were utilised. These power pumps operated in lands where nothing would have ordinarily grown without them and if any crop was grown it was a gamble with nature. But even under the worse drought condition that was experienced in that winter, the pump-fed areas yeilded a bumper crop to the tune of 20 thousand tons. This was a significant acheivement because of the fact that it has enabled the farmers to stand on a firm footing. Another new development that has taken place in this field is the utilization of a number of heavy pumping sets of about 50 H.P. Several steel pontoons were constructed and these pumps were mounted on these pontoons for irrigation from rivers and other big sources of sufrace water. Each pontoon was able to irrigate an area of about 400 acres. As a result of this experiment, a new phase of pontoon irrigation with heavier pumps particularly in the riverine districts is expected to be opened up.

Use of power pumps has been increasing rapidly. From a humble begining of 40 pumps that the Agriculture Department had immediately after Independence, it has now 2024 pumping sets (see table 72). These pumps are of about

Table 72

Use of power pumps in East Pakistan for irrigation

Year	No. of pumps used	Area irrigated in acres
1951—52	50	1920
1952—53	30	1900
1953—54	40	720
1954—55	38	1900
1955—56	40	2,660
1956—57	135	10,000
1957—58	514	29,000
1958—59	848	32,800
1959—60	1150	47,370
1960—61	1367	62,140
1961—62	1555	73,925
1962—63	2024	1,33,045

fifteen makes ranging from one to five cusec capacity. They are all centrifugal types, designed to operate at a total head of forty-five feet or less. Most of the pumps are powered by diesel engines. The Department has a programme to increase number of the pumping sets to 7040 in the year 19646-65. Though at present power pumps are utilised mostly for Boro paddy cultivation, these may also very successfully be utilised in areas other than 'haors' and 'beels' for large scale production of vegetables, potato, wheat, pulses, oilseed crops etc., as well as for early or timely sowing of jute, Aus, broadcast Aman, sugarcane etc. Power pumps may enable the farmers to grow two or more crops in the same fields and this indictes a bright future for the East Pakistan farmers. Bigger pumps have high capacity for water discharge and hence are more economical than the smaller ones. But use of heavy pumps for irrigating crops other than Boro, in the ordinary cultivated areas of the plain, may involve many difficulties. The existing pumps which are comparatively heavy,

and range from about 5 to 55 H.P., are not suitable for these crops. Pumps for these areas which unlike haor areas, do not have uniform cropping pattern and so at present have poor common interest among the farmers for formation of successful co-operative organisation, must be smaller in size so as to suit the rural economy, organisation, transport facilities, size of holding, etc.

The province has about 4500 miles long rivers and khals which are navigable in the rainy season. These rivers and khals are mostly perennial and suitable for lift irrigation. Assuming however, that 15% of this length will not be suitable for lift irrigation in the winter due to bad type of silting and salinity, the remaining portion of the rivers and khals may be utilised to irrigate annually more than 11 lakh acres of land if 5 small size power pumps, each having a capacity to cover only about 30 acres in a season, are accomodated on each bank of the water course within the distance of a mile. Besides, the sweet water impoundments (ponds, dighis etc.) of the province, which amount to 1,89,000 acres in area may be utilised to irrigate more than 4 lakh acres without adversely affecting pisiculture. Thus more than 1.5 million acres may easily be put under irrigated crops in the rabi season. However, the area under irrigated crops will increase further if small canals and khals are slightly improved and utilised for lift irrigation and if pontoon irrigation is taken up in suitable areas. But, probably more than 25% of the total cultivated area cannot be irrigated by low-lift power pumps without bringing about any major change in the existing agricultural pattern and social outlook.

A survey of surface water sources for lowlift irrigation prepared by EPWAPDA indicats that "4.5 million acres of land lie within one mile of available surface water", which can be irrigated easily. Of course, about half of this area (probably 2.5 million acres) is already under rabi crops some of which will also respond significantly to irrigation. There are several specialists who are very much optimistic regarding the potentiality of power pump irrigation and some of them think that "if the lift irrigation is managed on attractive workable co-operative ventures, at least 15 million acres out of the total 20 million acres can be put under additional crop[10]".

Centrifugal pumps are suitable mostly for riverine areas where perennial surface water is available and water-lift is not very excessive. In the areas where there is not much surface water for irrigation purpose, underground water shall have to be tapped not only for bringing the culturable waste lands under cultivation but also to save the major crops from disaster of drought and to convert single cropped areas into doubled cropped ones. It is possible to increase the productive capacity of these lands many times by setting up a proper system of tube-well irrigation. In order to explore possibilities in this direction and to assess the economics of such irrigation methods, a scheme for sinking 50 large diameter power tube-wells in the Dinajpur district, was under taken as a pilot project. The project was found useful and so 320 of such tube-wells have so far been installed in that district. The project indicates that it will be possible to take up a comprehensive programme of tube-well irrigation covering a large part of the northern districts of the province.

Of all irrigation systems introduced in the province in the recent past, power pump irrigation has gained much popularity. But this system has got some important limitations specilly in respect of carrying water to a distant place. Power pumps have so far covered only about 10% of the total irrigated area and less than 1% of the total cultivated area.

At present 93% of the total cultivated area of the province do not have any irrigation facilities. So, in order to cover the larger part of the province, introduction of flow irrigation and and power tube-well irrigaions are essential. The East Pakistan Water and Power Development Authority have, however, already taken up two projects viz: Ganges-Kobadak project and Teesta Embankment project for partial flow irrigation. The Ganges-Kobadak project aims at utilising sweet water of the Ganges and

Kobadak for irrigaion of 3.5 lakh acres of land in the districts of Jessore and Khulna. Water supplied by this project will also help in washing away salt from the lower part of Khulna district where salinity gives rise to a serious problem. The Tessta project aims at irrigating 18.50 lakh acres in the districts of Bogra, Rangpur and Dinajpur. A good number of similar other projects have also been taken up by the East Pakistan WAPDA and are awaiting final execution. The province needs more of such projects for maximum utilization of agricultural lands.

Use of water lifting equipments and other machineries which are increasing gradually in the province, has given rise to some new problems. There is no manufacturing industry here for power driven agricultural machines including power sprayers. All such machines now used in the province are imported from other countries. Power pumps are procured mostly from a manufacturing firm in West Pakistan, while other equipments are imported mostly from Western countries. But the province should have sufficient industries scattered in different parts of the province for manufacturing agricultural machineries to meet the growing local demand. This will also help in absorbing surplus agricultural labour.

Agricultural machines now used in the province are mostly owned by the Government. Of course, there are a few big growers of sugarcane and tea, who are using some machines for commercial production. The Government owned tractors and pumps are hired out to the interested farmers mainly on seasonal basis and only a few power equipments are used in Governmnet farms. Running of these machines in large numbers on Government account in widly acattered areas most of which are difficultly accessible, is not an easy task as it involves training of a large number of operators and mechanics, speedy movement of equipment, oil, fuel etc, under difficult conditions, spot-serviceing and repairs, supervision and inspection of workers at sites, measurement of work done and collection of hireing charges and above all organisation of thousands of small holders into co-operative societies. The work involved in the existing procedure is heavy and difficult for the Government. So this procedure cannot be allowed to continue for long. The work should ultimately be taken up by the farmers or private organisations. This will be easy if small size equipments are distributed amongst the farmers on some systems suitable for the economy and organisations of the farmers.

An agricultural machinery workshop has been established in Dacca in the year 1958 for major repair works of tractors, pumps etc. It has also arrangement to train up qualified technicians for operation and maintenence of agricultural machinery. The province will, however, need dozens of such workshops when the extent of mechanisation will increase.

Plant Protection

There is a good number of factors which adversely affect agricultural production of the province and one of these important factors is the attack of insect pests and prevalence of diseases. Although no assessment of damage caused by insects and diseases has been made here on proper survey and experiment, it will be probably in the neighbourhood of 20% (that is, 15% in the field and 5% in the stores). Some plant protection specialists, however, think that the percentage of damage will be higher. The following statement of a German professor, Dr. Kurt Hansen supports this view :

"In some parts of the world especially in the developing countries, insect pests and plant diseases of all kinds often still destroy more than 50% of crops. Even in the Federal Republic of Germany yearly crop damage caused by pests average as much as 15 to 20%. Expressed in terms of money this represents a loss of about 750 million dollars. Crop losses inflicted all over the world by insect pests alone are estimated at almost 22500 million dollars yearly".

In this province loss to economic crops alone amounts to about 1600 million reupees, due to attack of insect pests and diseases. In some years, infestation causes greater havocs to the agriculturists. The earcutting catterpillar of rice and stem borer of sugarcane may damage these crops to the extent of about 75%. Loss caused to rice and potato by ufra disease and late blight disease respectively may exeeed 80%. There is a good number of minor diseases and insect pests which, under favourable years may be cause of heavy damages. The leaf spot disease of rice which is generally a minor disease, appeared in epidemic form in 1943 and lowered rice yeild to such a deplorable extent that this was considered to be one of the reasons of the great famine of 1943. Loss due to infestation is, therefore, tremendous. This is mainly because average farmer hardly adopts any effective methods for protection of their crops against pests and diseases. Even in the recent past, there was a strong taboo amongst the farmer against use of pesticides in their fields.

Adoption of plant protection measures in the province in scientific lines is quite new and still at the initial stage. Before Independence, little attention was given to this aspect of agriculture, but after Independenc, Government started giving importance to it with a view to stepping up food production. Since then the plant protection programmes of the province were gradually expanded and these programmes have been strengthened both for research and extension.

The present activities of the agricultural research unit for plant protection may be grouped into 3 broad programmes viz: (a) survey of insects pests and diseases, (b) their biological study and (c) control measures.

The survey so far conducted has revealed 266 insect pests of which 127 are major and more than 130 crop diseases of which about 20 are major (see table 73). During this survey, a good number of insects which are quite new in the field of Entomology, have also been recorded. However, there is still a long way to go for completion of the survey. As biological study of pests and diseases is a lengthly process, only some of the major pests and diseases could be studied so far in details. Much emphasis has, however, been laid on the experiments for control measures and as a result, some valuable findings have been made in this respect. In the begining recommandations were made to the farmers for adoption of preventive measures and for use of indigenous pesticides. But with the invention of better pesticides in the developed countries which were made available here by means of import, use of these pesticides gradually increased in the province. These materials which were more effective than the indigenous ones, created some confidence amongst the farmers and so they could realise the utiluty of plant protection measures. But the number of farmers using pesticides properly and regularly is still very small. This is mainly because the farmers can hardly afford to buy pesticides and equipments for use in their fields and moreover, they do not possess necessary technical knowledge in this respect. Almost all pesticides and equipments now in use in the province are manufactured in other countries and are costly. However, in order to check great wastage of agricultural products due to infestation and to popularise adoption of plant protection measures amongst the farmers, Government at the initial stage meet most of the expenditure for plant protection extension work as well as for supply of services and materials required for this. The plant protection unit of the Agriculture Department, which works in close cooperation with the Agricultural Extension Organisation, has got now nearly two thousand workers and a good number of equipments. But this is still too small to serve the total cropped area of the province. During the period between 1959-60 and 1961-62, the area under different crops treated annually by this organisation was only 0.02% of the total cropped area. But this is, no doubt, a good success for an organisation which was started only in 1956.

In addition to the equipments used for ground operations, there are in the province four small size aeroplanes fitted with

pesticide tanks. The province does not have sufficient landing grounds in the rural areas and so these can not be used very effectively and extensively. However, instpte of this difficulty aerial opertions have been of great use.

Infestation in the province is common and it may appear in any season of the year. The plant protection unit in the begining concentrated its activities mainly on control measures against large scale infestation. But the organisation is now also taking preventive action against possible appearance of pests and diseases. It is expanding its seed treatment programmes. To preserve and treat all seeds in scientific methods is a giganitc task for the plant protection organisation. The programmes for preservation of seeds are, therefore, now mainly confined to the major crops including patato. But these are still in the begining and their successful implementation depends on the extent of education the farmers will receive on plant protection mesures and availability of cheapest kinds of equipments and pesticides. It is impossible for the Government to take up full responsibility for protection of field crops, agricultural produces and seeds belonging to as many as 6.2. million farmers, each owning only 3.1 acres of cultivated land which is greatly fragmented and scattered in different places. The existing plant protection organisation for obvious reasons can cover only a small portion of the total cropped area (see table 74). Government are, however, expanding the organisation and are going to utilise better equipments for spraying and dusting. As sudden out-break of pests or diseases may cause great damage to standing crops, the organisation needs modern equipments like power dusters and sprayers etc. for quick and efficient operations. The present situation demands at least one power sprayer and one power duster for each village. Attempts should be made to manufacture in the province cheapest and effective plant protection equipments so that average farmers can use them. It is also necessary to exploit national resources for production of suitable pesticides.

Table 73

Major and minor insect pests and diseases of some crops of East Pakistan.

Crops	Insect pests		Diseases	
	Major	Minor	Major	Minor
Rice	14	8	3	5
Jute	7	6	2	8
Sugarcane	7	4	1	7
Wheat	0	2	1	4
Maize	0	3	0	4
Potato	3	9	1	6
Tobacco	3	5	3	2
Mustard	2	2	0	3
Seasamum	2	2	0	3
Castor	1	1	0	2
Mango	7	17	0	3
Litchi	3	4	0	2
Banana	2	2	1	5
Pineapple	1	1	0	2
Cocoanut	1	1	0	3
Citrus	4	5	1	3
Guava	1	2	0	2
Jack fruit	1	1	0	2
Brinjal	6	8	0	3
Other vegetables	15	11	3	27
Tea	2	1	1	6
Betel vine	0	2	2	2
Chilli	1	3	1	3
Sweet potato	0	2	0	4
Grains & other stored products	10	16	N.A.	N.A.

Table 74

Plant protection work in East Pakistan

Type of work	Unit	1958—59	1959—60	1960—61	1961-62	1962-63
1. Treatment of field crops:						
(a) by ground operation	acres	3,39,230	2,36,850	5,83,230	9,17,270	21,15,000
(b) by aerial operation	acres	27,230	73,050	1,49,150	1,69,900	
2. Treatment of fruit trees	number	2,61,550	5,53,600	6,48,520	31,17,900	N.A.
3. Rodent control	No. of holes	1,29,900	37,100	2,14,370	9,40,760	N.A.
4. Seed treatment	maunds	7,000	1,26,160	1,61,240	2,53,160	5,59,000
5. Weed control	acres	1,330	490	8,000	2,550	5,200

NOTES AND REFERENCES

[72]The Population Census of Pakistan 1961 reveals that total area of East Pakistan is 352.81 lakh acres.

[73]Source — Directorate of Agriculture, Government of East Pakistan.

[74]This area also includes small forests under farm holdings which amounted to 5.1 lakh acres in 1960.

[75]Source — Pakistan Census of Agriculture, 1965.

[76]Source — Directorate of Agriculture, Government of East Pakistan.

[77]Kharif crops are grown in the spring or the summer season and harvested in late summer or in early winter. Important Kharif crops are jute, sugarcane, Aus etc.

[78]Rabi crops are sown in the winter and harvested in the spring or early summer. Important rabi crops are wheat, mustard, boro rice, onion, English vegetables etc.

[79]Source — Pakistan Census of Agriculture 1960. Some crops like betel nuts etc. which are not fruit crops have been included here.

[80]Source — Pakistan Census of Agriculture 1960.

[81]Agriculture Production Level in East Pakistan, Department of Agriculture, East Pakistan.

[82]Source — Pakistan Census of Agriculture, 1960.

[83]The Census figure for fruits includes betel-nuts and some other crops which are not fruits. Some differences will be noticed in the estimates of acreage under different crops as arrived at by the Department of Agriculture (East Pakistan) and the Pakistan Census of Agriculture (1960). This is mainly due to the difference of calender year and fiscal year and lack of common difination of some crops and items of work.

[84]According to the Agriculture Department, the total cropped area was 274.29 lake acres in 1960—61.

[85]Sources — Pakistan Census of Agriculture, 1960.

[86]Source — Ministry of Food and Agriculture, Government of Pakistan.

[87]Forest area does not include small forests under farm holdings.

[88]Source—Ministry of Food and Agricaulture, Govt. Pakistan.

[89]Dr. Mohammad Shahidullah — 'Rug Chikitsaya lata-gulma' (Herbs in curing ailments)

[90]S. Z. Hasain—The Wild Plant Wealth of Pakistan and its Value in Plant Breeding (Pakistan Agriculture, 1950)

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[92]Dr. M. A. Islam—Fertilizer Use in East Pakistan, 1961

[93]Agricultural Research Acheivements in East Pakistan 1961, Directorate of Agriculture, Government of East Pakistan.

[94]Acreage has been based on average for 6 years ending 1960.

[95]Fruit crops include cocoanut. All fruit crops require nitrogen and phosphorus and 50% require potash in addition.

[96]90% of the area under oilseed crops (specially rape and mustard) require fertilizers.

[97]50% of all pulse crops (particularly mung, lentil, gram pea & rahar) respond to fertilizers specially phosphatic fertilizer.

[98]Area under other crops is about 4% of the total cropped area and so fertilizer requirement for these crops has been estimated at about 4% of the total requirement.

[99]About 25% of total production of cowdung is available for use as manure.

[100]Not more than 50% of the total production of oilcakes is now available for use in the fields; this is because cakes are used as cattle feed and also exported to some extent.

[101]Kitchen ash is not at all properly preserved by the farmers and so only 10 Lbs of ash per kitchen (agricultural families have about 70 lakh Kitchens) have been estimated to be available for application in the lands.

[102]Only the main plant nutrients available in the fertilizing materials have been considered.

[103]Total requirement of fertilizers has been based on total cropped area of the province, for which 6 years average for the years ending 1960—61, has been taken into consideration. To find out per acre requirement, total requirement has been devided by the total cultivated area (average for 6 years ending 1960—61)

[104]To find out per acre consumption, total consumption of fertilizers during the year 1960—61, has been devided by the total cultivated area in that year. If the quantity of fertilizers used by the tea estates which consume about 16% of the total chemical nitrogenous fertilizers, is excluded, extent of use of chemical fertilizers in the ordinary cultivated lands will be less.

[105]Most of the fertilizers used by different countries (except East Pakistan,) are chemical products, whereas the proportion of chemical fertilizers used in East Pakistan is very small, which will be evident from table 66

[106]Directorate of Agriculture, Information Regarding Improved Agricultural Machines and Implements specially suitable for East Pakistan.

[107]Report of the Pakistan Agricultural Inquiry Committee, 1951-52.

[108]Source— Pakistan Census of Agriculture 1960

[109]Dr. M. O. Ghani M.Sc. P. Hd., Inaugural spech at the opening ceremony of the Dacca agricultual machinery workshop.

[110]Dr. A. Rahim Chowdhry—New Horizons in the Agricultural Production Potential of Pakistan, 1962.