

IV.2.4 Drainage from Hilly Land

The following are the flood management scheme of report for Flood Protection of Pat Feeder and Kirthar Canal recommended by National Engineering Services (Pakistan) LTD (NESPAK):

1. Recommended Flood Management Scheme

The plan proposed for the mitigation of flood losses to Pat Feeder and Kirthar Canal in Baluchistan primarily comprises construction of four cunettes raising and strengthening of right bank of Pat Feeder and Kirthar Canal, construction of flood regulating and dispersion structures on major hill torrents with high damage potential, improvement of training works of Lahri River at Lahri, and protection of Abadis around RD 547 of Pat Feeder. Reaches with inadequate bank sections of Pat Feeder and Kirthar Canals have been identified and recommended for raising and strengthening. Topographic survey along right bank of Pat Feeder indicated that movement of floodflows along Pat Feeder Canal to Qabula Nallah and ultimately to FP Bund is hampered by some natural ridges en-route. In order to facilitate the movement of floodflows, construction of cunettes across such ridges have been proposed. In case of major hill torrents, it was observed that management of floodflows when they reach right bank of Pat Feeder Canal would be relatively uneconomical. Field investigations and surveys were carried out in the catchment areas to identify sites where flood regulating and dispersion structures could be introduced. Detailed field surveys were carried out for the more promising sites and construction of flood regulating/dispersion structures have been proposed for three major hill torrents. Given below is the summary of proposed plan for flood protection of Pat Feeder and Kirthar Canal.

(1) Pat Feeder Canal

The major hill torrents affecting Pat Feeder Canal are Sori, Asreli, Hado, Mandoi, Jar, Uch, Landa Nadi, Chhatr and Lahri Rivers. Field investigations supplemented by hydrologic and hydraulic studies resulted

in the identification of problem area. Various alternatives for flood management were considered and evaluated for their economics. The recommended measures are as follows:

1.1 Major Raising and Strengthening of the right bank of Pat Feeder Canal in the reaches.

- i) RD 206 - 263
- ii) RD 267 - 278
- iii) RD 297 - 302
- iv) RD 341 - 343
- v) RD 368 - 372
- vi) RD 383 - 394
- vii) RD 400 - 413
- viii) RD 529 - 587

1.2 Minor Raising, Strengthening and Restoring* Existing right bank of Pat Feeder Canal to Design Section in the reaches.

- i) RD 305 - 337
- ii) RD 350 - 355
- iii) RD 413 - 510
- iv) RD 510 - 529

1.3 Construction of Cunettes along right bank of Pat Feeder in the reaches.

- i) RD 214 - 221
- ii) RD 397 - 404
- iii) RD 414 - 452
- iv) RD 549 - 575

1.4 Flood Regulating/Dispersion Structures.

- i) Flood Regulating/Dispersion Structure on Gandoi Nallah.
- ii) Dispersion Structure on Sori Nallah.

Note: * Generally this implies top width and side slopes.

- iii) Flood Regulating/Dispersion Structure on Landa Nadi.
 - iv) Three Flood Dispersion Structures on Chhatr River.
- 1.5
- i) Stone pitching of 450 feet length of silted berm in front of Gugi Bund.
 - ii) Construction of two water course crossing on Left Marginal Bund of Second Distribution System of Lahri River.
 - iii) Strengthening of Left Marginal Bund of Second Distribution System of Lahri River.
 - iv) Provision of a Dispersion Structure in escape channel (Mai wah) of Second Distribution System of Lahri River.
- 1.6 Construction of two Bridges at RD 418 and 440 Over Cunette against RD 414 to 452 of Pat Feeder.
- 1.7 Construction of One Village Road Bridge at RD 558 Over Cunette against RD 549 to 575 of Pat Feeder.
- 1.8 Construction of ten Water Course Crossing Over Cunette against RD 549 to 575 of Pat Feeder.

(2) Kirthar Canal and Dhori Distributary (FP Bund RD 10 to 170)

Minor Raising, Strengthening and Restoring Existing flood embankment to Design Section RD 10 to 170 of FP Bund. The floodflow through the Project area and Qabula River will lead to the right bank of Kirthar Canal and then to the FP Bund. Finally, the floodflow will discharge to Indus River at Sehwan.

2. Hydrologic Features of NESPAK's Report

According to the F/S NESPAK on Flood Protection of Pat Feeder and Kirthar Canal, flood flow coming from the hilly area will be stored at the depression area along the right bank of Pat Feeder as large as possible where the said area is mostly not developed area, and excessed

Table IV.2-23 Salient Hydrologic Features on Flood Control Plan

Reaches of Pat Feeder Canal	Name of Nallah	Catchment Area (sq. mile)	Time of Concentration (Hours)	Time to Peak (Hours)	Peak Flow for Design Storm (Cusec)	Total Volume of Flow (Acre-Feet)	Estimated Storage Ponds (Acre-Feet)
RD125 to RD205	Goh	34	2.93	2.26	7,214	3,547	
	Lundi	19	2.51	2.01	5,444	1,855	
RD205 to RD281	Asrelli	87	6.38	4.33	9,708	8,686	at El. 230 to 240ft
	Sori	200	7.93	5.26	18,408	20,924	23,370
RD295 to RD304	Hado	67	5.09	3.55	9,102	7,420	
RD368 to RD372	Uch	62	4.88	3.43	8,719	6,355	at El. 223 to 231ft
							7,739
RD400 to RD587	Landa	73	4	3	13,261	7,259	at El. 204 to 214ft
	Chhatr River	856	20	13	32,019	87,979	89,293
	Lahri River	1,494	22	14	51,982	155,321	at El. 204 to 215ft
							116,838

Note: Source: Planning and Design Report prepared by NESPAK in 1981.
Run-off and discharge were estimated based on a return period of 25 years.

flow will be gradually flowed towards the downstream reach of Pat Feeder Canal. Before the construction of Pat Feeder, the water of nallahs from the hilly area used to flow in natural channels towards left of Pat Feeder and whenever flows were in excess of depressional storages and other losses enroute, it used to ultimately discharge into the Indus River. In the design of Canal no provision was made for cross drainage and as a result, the natural waterways have been abandoned.

As shown in the table "Salient Hydrologic Features on Flood Control Plan", discharge of nallahs in the groups of 1,3 and 4 have no much drainage problem taking into consideration the total volume of flow and the capacity of the depression. However, the excessed flow from the depression in the groups of 2 and 5 will lead to Qabula River and will flow towards Kirthar Canal and then flood protection bund (F.P.Bund). Discharge of Qabula River at the crossing point of the Pat Feeder is estimated at 10,000 cusec considering the existing capacity of the said river.

3. Construction Cost of Drainage

Construction cost of drainage is not included into the financial cost, because the drainage work is considered as the second stage development programme. However, the said cost is estimated in the cost item of "On-farm Development & Drainage" as the economic value as shown in Tables VI.2-28 and VI.2-29 of Appendix. The breakdown of the said cost is seen in Table IV.2-24 provided based on the on-farm development plan discussed in the Report and the drainage development plan provided in the F/S NESPAK Report.

Table IV.2-24 Construction Cost of On-farm Development & Drainage

	<u>Case-3</u>	<u>Case-4 on Staged Development</u>
1. On-farm Development ^{1/}		
Water course & structures	122,400,000	122,400,000
Farm drain & structures	113,220,000	113,220,000
Miscellaneous works	47,124,000	11,781,000
<u>Total</u>	<u>Rs 282,744,000</u>	<u>Rs 247,401,000</u>
2. Drainage Development ^{2/}		
(1) Pat Feeder Canal		
Raising & strengthening of Right bank of canal	included into the cost of canal	included into the cost of canal
Construction of cunettes RD397 to 404, RD414 to 452 and RD549 to 575	27,977,000	27,977,000
(2) Kirthar Canal		
Raising & strengthening of right bunds of Kirthar Canal and Dhori Distributary (FP Bund RD10 to 170)	10,880,000	10,880,000
(3) Structures		
Three bridges over cunettes	910,000	910,000
Ten water courses crossing	970,000	970,000
Stone pitching, earthwork outlet and dispersion structure for Lahri River at Lahri	1,350,000	1,350,000
Construction of structures on major hill torrents (Sori Nallah, Landa Nadi and Chhatr River)	31,560,000	31,560,000
(4) Miscellaneous Works	13,770,000	6,880,000

(Cont'd)

	Case-3	Case-4 on Staged Development
(5) Land Acquisition for Cunettes	830,000	830,000
(6) Engineering and Administrative Charges	4,410,000	3,250,000
<u>Total</u>	<u>Rs 92,657,000</u>	<u>Rs 84,627,000</u>
3. Pump and Others ^{3/}		
Pumps	30,000,000	20,000,000
Others	20,000,000	10,000,000
Engineering and Administration Charges	7,142,000	6,652,000
<u>Total</u>	<u>Rs 57,142,000</u>	<u>Rs 36,652,000</u>
<u>Grand Total</u>	<u>Rs 432,543,000</u>	<u>Rs 368,680,000</u>

- Note : 1/ Construction Cost of On-farm Development is quoted from Table IV.2-25 of Appendix.
- 2/ Construction Cost of Drainage Development is quoted from F/S NESPAK's Report in 1981.
- 3/ Construction Cost for this item is estimated based on the past data on Kirthar Canal Drainage Project.

Table IV.2-25 Construction Cost of On-farm Facilities

1. Water Course and Structures

Main Water Course	Length	275,000 ft	
	Unit Cost	4,000	Rs/1,000 ft
	Construction Cost	Rs 1,100,000	
Internal Water Course	Length	431,500 ft	
	Unit Cost	2,000	Rs/1,000 ft
	Construction Cost	Rs 863,000	
Link Water Course	Length	467,000 ft	
	Unit Cost	2,000	Rs/1,000 ft
	Construction Cost	Rs 934,000	
Nakka & Diversion Box	Quantity	1,134 units	
	Unit Cost	200	Rs/unit
	Construction Cost	Rs 226,800	
Total (15,562 ac)		Rs 3,123,800	
Cost per ac		Rs 200.-	
Total Amount 612,000 ac x 200		Rs <u>122,400,000</u>	

2. Farm Drain and Structures

Farm Drain	Length	313,400 ft	
	Unit Cost	1,000	Rs/1,000 ft
	Construction Cost	Rs 313,400	
Branch Drain	Length	319,900 ft	
	Unit Cost	8,000	Rs/1,000 ft
	Construction Cost	Rs 2,559,200	
Total (15,562 ac)		Rs 2,872,600	
Cost per ac		Rs 185.-	
Total Amount 612,000 ac x 185		Rs <u>113,200,000</u>	

IV.3.1 Farmers' Intention Survey and Food Balance Projection

Table IV.3-1 Summary of Farmers' Intention Survey

Question 1/	Response 2/		Remarks	
	Nos.	%		
Q.1	(1)	14	100.0	
	(2)	0	0.0	
Q.2	(1)	14	100.0	
	(2)	0	0.0	
	(3)	0	0.0	
	(4)	0	0.0	
Q.3	(1)	* 1	7.1	* Specification of the non-farm income source : Rice mill management in Dera Murad Jamali
	(2)	13	92.9	
Q.4	(1)	* 4	28.6	* Specification of the land source : Surrounding lands
	(2)	10	71.4	
Q.5	(1)	0		
	(2)	0		
	(3)	11	78.6	
	(4)	3	21.4	
Q.6	(1)	*12	85.7	* Specification of reason : Un-leveled fields in some cases due to flood erosion & deposition / High elevation plots
	(2)	2	14.3	
Q.7	(1)	*11	78.6	* Specification of reason : Lack of bridges / roads and transporting facilities
	(2)	3	21.4	
Q.8	Kharif Cropping Intensity ----- 60 — 100 % ; 14 (100.0 %)			
	Rabi Cropping Intensity ----- 60 — 100 % ; 13 (92.9 %)			
	Kharif Priority Crops : See Table IV.3-2			
	Rabi Priority Crops : -do-			
Q.9	(1)	14	100.0	
	(2)	0	0.0	

Note: 1/ Refer to the questionnaire in Table IV.3-3

2/ Refer to the Table IV.3-4 to IV.3-17

Table IV.3-2 Crop Selection in the Farmers' Intention Survey

Crop	Priority			Total %
	1st Crop Nos.	2nd Crop Nos.	3rd Crop Nos.	
<u>Kharif Crop</u>				
(1) Rice	8	2	-	10
(2) Sorghum	6	3	-	9
(3) Sesamum	-	2	5	7
(4) Sugarcane	-	5	-	5
(5) Cotton	-	-	1	1
Total	14	12	6	32
	57.1	16.7	-	31.3
	42.9	25.0	-	28.1
	-	16.7	83.3	21.9
	-	41.6	-	15.6
	-	-	16.7	3.1
	100.0	100.0	100.0	100.0
<u>Rabi Crop</u>				
(1) Wheat	13	-	1	14
(2) Barley	-	4	-	4
(3) Mustard	1	2	3	6
(4) Pulses (Gram)	-	4	1	5
(5) Fodders (Lucern, Berseem)	-	1	2	3
(6) Fruits	-	-	1	1
(7) Vegetables	-	-	1	1
Total	14	11	9	34
	82.9	-	11.1	41.3
	-	36.4	-	11.8
	7.1	18.2	33.4	17.6
	-	36.3	11.1	14.7
	-	9.1	22.2	8.8
	-	-	11.1	2.9
	-	-	11.1	2.9
	100.0	100.0	100.0	100.0

Note: Refer to Table IV.3-4 to IV.3-17 for the number of response in this table.

Table IV.3-3 Questionary on Farmers' Intention Survey

Q. 1. Have you a plan to keep the farm management from now on in your village ?

Check	Answer / Discription
(1)	"Yes"
(2)	"No", If so, specify the reason:

Q. 2. What do you plan to choose as the major source of family income in future ?
(Choose one or two among the items below)

Check	Answer / Discription
(1)	Crop production (Specify major crops:)
(2)	Production of Livestock/flows (Specify the major animals:)
(3)	Hired for other farm management as farm laborer
(4)	Other source of income (Specify:)

Q. 3. Have you a plan to get the family income from any other sources than your farm management ?

Check	Answer / Discription
(1)	"Yes", If so, specify the reason:
(2)	"No"

(cont'd)

Q. 4. Have a plan to increase the acreage of your cultivating land ?

Check	Answer / Discription
	(1) "Yes", If so, specify the possible source of land:
	(2) "No"

Q. 5. Have you a sufficient supply of irrigation water at present ?

Check	Answer / Discription
	(1) Sufficient in the both seasons of Kharif and Rabi
	(2) In-sufficient only in Rabi Season
	(3) In-sufficient in both seasons of Kharif and Rabi
	(4) In-sufficient only in Kharif Season

Q. 6. Have you any difficulties of distributing irrigation water to each plot of your farm lands at present ?

Check	Answer / Discription
	(1) "Yes", If so, specify the reason:
	(2) "No"

(cont'd)

Q. 7. Have you any difficulties of transporting farm inputs and outputs to each plot ?

Check	Answer / Discription
(1)	"Yes", If so, specify the reason:
(2)	"No"

Q. 8. Do you crop more, if additional irrigation water is available in your cultivating lands ?

Season	Cropping Intensity (%)			Priority Crops		
	0 - 30	30 - 60	60 - 100	1st Crop	2nd Crop	3rd Crop
Kharrif						
Rabi						

Q. 9. Do you want to have allocation of additional irrigation water in your cultivating lands by the Pat Feeder Canal Widening Project ?

Check	Answer / Discription
(1)	"Yes"
(2)	"No" If so, specify the reason:

(cont'd)

Table IV.3-4 Response to Farmers' Intention Survey

No. of Sample 1		Tehsil	Tamboo				
		Village	Goth Mir Ghulam Haider				
Question	Item	Selection					
Q.1	(1)	✓					
	(2)		Reason:				
Q.2	(1)	✓	Spe.: N.A.				
	(2)						
	(3)						
	(4)		Spe.:				
Q.3	(1)		Spe.:				
	(2)	✓					
Q.4	(1)		Spe.:				
	(2)	✓					
Q.5	(1)						
	(2)						
	(3)	✓					
	(4)						
Q.6	(1)	✓	Reason: A number of fields are unlevelled due to flood				
	(2)		erosion and deposition.				
Q.7	(1)		Spec.:				
	(2)	✓					
Q.8	Season	Cropping Intensity (%)			Priority Crops		
		0-30	30-60	60-100	1st	2nd	3rd
	Khariif			✓	Sorghum	Sesamum	
	Rabi			✓	Wheat		
Q.9	(1)	✓					
	(2)		Spe.:				

Table IV.3-5 Response to Farmers' Intention Survey

No. of Sample 3		Tehsil	Chattar				
		Village	Goth Abdul Hameed Khoso				
Question	Item	Selection					
Q.1	(1)	✓					
	(2)		Reason:				
Q.2	(1)	✓	Spe.: N.A.				
	(2)						
	(3)						
	(4)		Spe.:				
Q.5	(1)		Spe.:				
	(2)	✓					
Q.4	(1)		Spe.:				
	(2)	✓					
Q.5	(1)						
	(2)						
	(3)	✓					
	(4)						
Q.6	(1)	✓	Reason: Unleveled fields				
	(2)						
Q.7	(1)	✓	Spe.: Not much transportation facilities.				
	(2)						
Q.8	Season	Cropping Intensity(%)			Priority Crops		
		0-30	30-60	60-100	1st	2nd	
	Kharif			✓	Paddy	Sugarcane	Cotton
	Rabi			✓	Wheat	Gram	Lemon, Mango Vegetables.
Q.9	(1)	✓					
	(2)		Spe.:				

Table IV.3-6 Response to Farmers' Intention Survey

No. of Sample 2		Tehsil	Chattar				
		Village	Goth Dolat Al:				
Question	Item	Selection					
Q.1	(1)	✓					
	(2)		Reason:				
Q.2	(1)	✓	Spe.: N.A.				
	(2)						
	(3)						
	(4)		Spe.:				
Q.3	(1)	✓	Spe.: To plan management of Rice Mill at Dera Murad Jamali.				
	(2)						
Q.4	(1)	✓	Spe.: No response				
	(2)						
Q.5	(1)						
	(2)						
	(3)	✓					
	(4)						
Q.6	(1)	✓	Reason: Some plots are at high elevation.				
	(2)						
Q.7	(1)	✓	Spe.: Lack of road.				
	(2)						
Q.8	Season	Cropping Intensity (%)			Priority Crops		
		0-30	30-60	60-100	1st	2nd	3rd
	Kharif			✓	Rice	Sugarcane	
Rabi			✓	Wheat	Gram	Berseem	
Q.9	(1)	✓					
	(2)		Spe.:				

Table IV.3-7 Response to Farmers' Intention Survey

No. of Sample 4		Tehsil	Chattar				
		Village	Goth Abdul Hameed				
Question	Item	Selection					
Q.1	(1)	✓					
	(2)		Reason:				
Q.2	(1)	✓	Spe.: N.A.				
	(2)						
	(3)						
	(4)		Spe.:				
Q.3	(1)		Spe.:				
	(2)	✓					
Q.4	(1)		Spe.:				
	(2)	✓					
Q.5	(1)						
	(2)						
	(3)	✓					
	(4)						
Q.6	(1)	✓	Reason: Unleveled land				
	(2)						
Q.7	(1)	✓	Spe.: Lack of proper infrastructure(roads).				
	(2)						
Q.8	Season	Cropping Intensity(%)			Priority Crops		
		0-30	30-60	60-100	1st	2nd	3rd
	Kharif			✓	Rice	Sugarcane	
	Rabi			✓	Wheat	Gram	Pulses (Mung Moti)
Q.9	(1)	✓					
	(2)		Spe.:				

Table IV.3-8 Response to Farmers' Intention Survey

No. of Sample 5		Tehsil	Jhatpat				
		Village	Drig-Deranomoli				
Question	Item	Selection					
Q.1	(1)	✓					
	(2)		Reason:				
Q.2	(1)	✓	Spe.: N.A.				
	(2)						
	(3)						
	(4)		Spe.:				
Q.5	(1)		Spe.:				
	(2)	✓					
Q.4	(1)		Spe.:				
	(2)	✓					
Q.5	(1)						
	(2)						
	(3)						
	(4)		Insufficient in Kharif only.				
Q.6	(1)	✓	Reason: Some fields are unlevel.				
	(2)						
Q.7	(1)	✓	Spe.: Inadequate transportation facilities.				
	(2)						
Q.8	Season	Cropping Intensity(%)			Priority Crops		
		0-30	30-60	60-100	1st	2nd	3rd
	Kharif			✓	Rice	Sorghum	
	Rabi		✓		Wheat	Barley	Peas (Vegetables)
Q.9	(1)	✓					
	(2)		Spe.:				

Table IV.3-9 Response to Farmers' Intention Survey

No. of Sample 6		Tehsil			Jhatpat		
		Village			Deranomoli		
Question	Item	Selection					
Q.1	(1)	✓					
	(2)		Reason:				
Q.2	(1)	✓	Spe.: N.A.				
	(2)						
	(3)						
	(4)		Spe.:				
Q.3	(1)		Spe.:				
	(2)	✓					
Q.4	(1)		Spe.:				
	(2)	✓					
Q.5	(1)						
	(2)						
	(3)						
	(4)		Insufficient in Kharif only.				
Q.6	(1)		Reason:				
	(2)	✓					
Q.7	(1)		Spe.:				
	(2)	✓					
Q.8	Season	Cropping Intensity (%)			Priority Crops		
		0-30	30-60	60-100	1st	2nd	3rd
	Khari f			✓	Sorghum	Sesamum	
	Rabi			✓	Wheat	Barley	Mustard
Q.9	(1)	✓					
	(2)		Spe.:				

Table IV.3-10 Response to Farmers' Intention Survey

No. of Sample 7		Tehsil		Jhatpat			
		Village		Rojhan			
Question	Item	Selection					
Q.1	(1)	✓					
	(2)		Reason:				
Q.2	(1)	✓	Spe.: N.A.				
	(2)						
	(3)						
	(4)		Spe.:				
Q.3	(1)		Spe.:				
	(2)	✓					
Q.4	(1)		Spe.:				
	(2)	✓					
Q.5	(1)		Insufficient in Kharif only.				
	(2)						
	(3)						
	(4)						
Q.6	(1)	✓	Reason: Unleveled land (some plots)				
	(2)						
Q.7	(1)	✓	Spe.: Lack of bridges and roads.				
	(2)						
Q.8	Season	Cropping Intensity (%)			Priority Crops		
		0-30	30-60	60-100	1st	2nd	3rd
	Kharif			✓	Sugarcane	Sorghum	Sesamum
	Rabi			✓	Wheat	Barley	Mustard
Q.9	(1)	✓					
	(2)		Spe.:				

Table IV.3-11 Response to Farmers' Intention Survey

No. of Sample 8		Tehsil	Dera Mustard Jamali				
		Village	Mangoli				
Question	Item	Selection					
Q.1	(1)	✓					
	(2)		Reason:				
Q.2	(1)	✓	Spe.: N.A.				
	(2)						
	(3)						
	(4)		Spe.:				
Q.3	(1)		Spe.:				
	(2)	✓					
Q.4	(1)		Spe.:				
	(2)	✓					
Q.5	(1)						
	(2)						
	(3)						
	(4)						
Q.6	(1)	✓	Reason: Unleveled land				
	(2)						
Q.7	(1)		Spe.:				
	(2)	✓					
Q.8	Season	Cropping Intensity(%)			Priority Crops		
		0-30	30-60	60-100	1st	2nd	3rd
	Kharif			✓	Sorghum		
	Rabi			✓	Wheat	Mustard	Lucern
Q.9	(1)	✓					
	(2)		Spe.:				

Table IV.3-12 Response to Farmers' Intention Survey

No. of Sample 9		Tehsil	Tamboo				
		Village	Dingery				
Question	Item	Selection					
Q.1	(1)	✓					
	(2)		Reason:				
Q.2	(1)	✓	Spe.: N.A.				
	(2)						
	(3)						
	(4)		Spe.:				
Q.3	(1)		Spe.:				
	(2)	✓					
Q.4	(1)		Spe.:				
	(2)	✓					
Q.5	(1)						
	(2)						
	(3)	✓					
	(4)						
Q.6	(1)	✓	Reason: Some fields are not level.				
	(2)						
Q.7	(1)	✓	Spe.: Lack of transportation and roads.				
	(2)						
Q.8	Season	Cropping Intensity(%)			Priority Crops		
		0-30	30-60	60-100	1st	2nd	3rd
	Kharif			✓	Rice	Sugarcane	Sesamum
	Rabi			✓	Wheat	Berseem	
Q.9	(1)	✓					
	(2)		Spe.:				

Table IV.3-13 Response to Farmers' Intention Survey

No. of Sample 10		Tehsil	Tamboo				
		Village	Dingery				
Question	Item	Selection					
Q.1	(1)	✓					
	(2)		Reason:				
Q.2	(1)	✓	Spe.: N.A.				
	(2)						
	(3)						
	(4)		Spe.:				
Q.3	(1)		Spe.:				
	(2)	✓					
Q.4	(1)		Spe.:				
	(2)	✓	not so rich to bear the expenses				
Q.5	(1)						
	(2)						
	(3)	✓					
	(4)						
Q.6	(1)	✓	Reason: Flood has rendered my field unlevelled.				
	(2)						
Q.7	(1)	✓	Spe.: No roads, no transportation available.				
	(2)						
Q.8	Season	Cropping Intensity (%)			Priority Crops		
		0-30	30-60	60-100	1st	2nd	3rd
	Khari f		✓		Sorghum	Rice	
Rabi		✓		Wheat	Mustard		
Q.9	(1)	✓					
	(2)		Spe.:				

Table IV.3-14 Response to Farmers' Intention Survey

No. of Sample 11		Tehsil	Tamboo				
		Village	Dingery				
Question	Item	Selection					
Q.1	(1)	✓					
	(2)		Reason:				
Q.2	(1)	✓	Spe.: N.A.				
	(2)						
	(3)						
	(4)		Spe.:				
Q.3	(1)		Spe.:				
	(2)	✓					
Q.4	(1)		Spe.:				
	(2)	✓					
Q.5	(1)						
	(2)						
	(3)	✓					
	(4)						
Q.6	(1)	✓	Reason: Land is not level.				
	(2)						
Q.7	(1)	✓	Spe.: No bridge and road to transport.				
	(2)						
Q.8	Season	Cropping Intensity (%)			Priority Crops		
		0-30	30-60	60-100	1st	2nd	3rd
	Khariif			✓	Sorghum	Rice	Sesamum
	Rabi			✓	Mustard	Pulses	Wheat
Q.9	(1)	✓					
	(2)		Spe.:				

Table IV.3-15 Response to Farmers' Intention Survey

No. of Sample 12		Tehsil	Usta Muhammad				
		Village	Biron				
Question	Item	Selection					
Q.1	(1)	✓					
	(2)		Reason:				
Q.2	(1)	✓	Spe.: N.A.				
	(2)						
	(3)						
	(4)		Spe.:				
Q.3	(1)		Spe.:				
	(2)	✓					
Q.4	(1)	✓	Spe.: Surrounding lands if irrigation water is available				
	(2)		there.				
Q.5	(1)						
	(2)						
	(3)	✓					
	(4)						
Q.6	(1)	✓	Reason: Fileds are not level.				
	(2)						
Q.7	(1)	✓	Spe.: Lack of roads of especially during flood				
	(2)		season, all roads and ways are blocked.				
Q.8	Season	Cropping Intensity(%)			Priority Crops		
		0-30	30-60	60-100	1st	2nd	3rd
	Khariif			✓	Rice	Sorghum	Sesamum
	Rabi			✓	Wheat	Barley	Mustard
Q.9	(1)	✓					
	(2)		Spe.:				

Table IV.3-16 Response to Farmers' Intention Survey

No. of Sample 13		Tehsil	Tamboo				
		Village	Mita Khan				
Question	Item	Selection					
Q.1	(1)	✓					
	(2)		Reason:				
Q.2	(1)	✓	Spe.: N.A.				
	(2)						
	(3)						
	(4)		Spe.:				
Q.3	(1)		Spe.:				
	(2)	✓					
Q.4	(1)	✓	Spe.:				
	(2)						
Q.5	(1)						
	(2)						
	(3)	✓					
	(4)						
Q.6	(1)		Reason:				
	(2)	✓					
Q.7	(1)	✓	Spe.: No tractor and transport root.				
	(2)						
Q.8	Season	Cropping Intensity (%)			Priority Crops		
		0-30	30-60	60-100	1st	2nd	3rd
	Kharif			✓	Rice		
	Rabi			✓	Wheat		
Q.9	(1)	✓					
	(2)		Spe.:				

Table IV.3-17 Response to Farmers' Intention Survey

No. of Sample 14		Tehsil	Tamboo				
		Village	Mita khan				
Question	Item	Selection					
Q.1	(1)	✓					
	(2)		Reason:				
Q.2	(1)	✓	Spe.: N.A.				
	(2)						
	(3)						
	(4)		Spe.:				
Q.3	(1)		Spe.:				
	(2)	✓					
Q.4	(1)	✓	Spe.:				
	(2)						
Q.5	(1)						
	(2)						
	(3)	✓					
	(4)						
Q.6	(1)	✓	Reason: Due to high cost of lifting water by pump.				
	(2)						
Q.7	(1)	✓					
	(2)						
Q.8	Season	Cropping Intensity(%)			Priority Crops		
		0-30	30-60	60-100	1st	2nd	3rd
	Kharif			✓	Rice	Sugarcane	
	Rabi			✓	Wheat		
Q.9	(1)	✓					
	(2)		Spe.:				

Food Balance Projection

Table IV.3-18 Calculation for Daily Calorie Intake of Pakistan

Age & Sex Group	Daily Calorie Intake by Group*1 (A) (cal)	Population Constitution by Group in Pakistan*2 (B) (%)	Weighted Average of Calorie Intake of Pakistan (A) x (B) (cal)
1. Infant Age (Both sex)			
◦ under 1	820	2.58	21
◦ 1 - 3	1,360	9.08	123
◦ 4 - 6	1,830	10.69	196
◦ 7 - 9	2,190	8.95	196
2. Puberty Age (Male)			
◦ 10 - 12	2,600	5.02	130
◦ 13 - 15	2,900	3.14	91
◦ 16 - 19	3,070	3.52	108
3. Puberty Age (Female)			
◦ 10 - 12	2,350	3.88	91
◦ 13 - 15	2,490	2.26	56
◦ 16 - 19	2,310	2.40	56
4. Adult Age (Male)			
◦ Middling worker	3,000	6.97	209
◦ Heavy worker	3,500	9.37	328
◦ Heaviest worker	4,000	9.37	375
5. Adult Age (Female)			
◦ Middling worker	2,200	4.48	99
◦ Heavy worker	2,600	6.03	157
◦ Heaviest worker	3,000	6.03	181
6. Pregnant women	2,550	2.58	66
7. Nursing women	2,750	3.65	100
Total	-	100.00 (rounded)	2,583 (rounded 2,600)

Source: *1 --- "Handbook on Human Nutritional Requirements, 1974" FAO Nutritional Studies No.28

*2 --- Based on "Population Census of Pakistan 1972, Population Census Organization, Statistics Division"

Table IV.3-19 Calculation for Per Capita Food Consumption
for the Year 2000

Commodity	Basic Data *1		Estimated Results (2000)			
	Calorie		Calorie	Calories	Grams	Kgs
	percent	per day	percent			
	1977	1982	/day	/day	/day	/year
1. Cereals	.64828	.64321	.62496	1,625	458.3	167.28
a. Wheat	.49243	.46198	.41999	1,092	308.6	112.64
b. Rice	.11001	.10972	.12954	337	95.5	34.86
c. Maize	.01353	.04313	.05847	152	42.0	15.33
d. Other Cereals	.03231	.02838	.01696	44	12.2	4.45
2. Pulses	.03492	.03519	.03616	94	26.6	9.71
a. Gram	.02619	.02422	.01713	45	12.2	4.45
b. Other Pulses	.00873	.01097	.01903	49	14.4	5.26
3. Fruit	.00770	.00769	.00765	20	90.9	33.18
4. Vegetable	.02138	.02286	.02819	73	128.1	46.76
5. Sugar	.13446	.12183	.07636	199	54.0	19.71
a. Refined	.04715	.04578	.04085	107	27.7	10.11
b. Raw Sugar	.08731	.07605	.03551	92	26.3	9.60
6. Oil Seeds (Groundnut)	.00068	.00109	.00257	6	1.0	0.37
7. Oil & Fats	.05850	.07000	.11140	290	32.1	11.72
8. Meat	.02510	.02725	.03499	91	43.8	15.99
a. Beef	.01389	.01265	.00816	21	8.8	3.21
b. Mutton	.01053	.01345	.02389	62	29.2	10.66
c. Poultry	.00068	.00115	.00294	8	5.4	1.97
9. Eggs	.00145	.00239	.00578	15	9.4	3.43
10. Milk	.06287	.06281	.06259	163	177.7	64.86
11. Fish	.00466	.00568	.00935	24	16.2	5.91
<u>Total</u>	<u>1.00000</u>	<u>1.00000</u>	<u>1.00000</u>	<u>2,600</u>	-	-

Source: *1 ... The Fifth Five Year Plan

Table IV.3-20 Estimation on the Minimum Food Demand in Pakistan for the Year 2000

(Unit: '000 tons)

Commodity	Per Capita *1 Consumption (kgs/year)	Net *2 Demand	Losses at *3 Market and Con- sumption Level	By-products *4	Total Demand
1. Cereals	167.28	24,089	2,676	7,405	34,170
a. Wheat	112.64	16,220	1,802	2,028	20,050
b. Rice	34.86	5,020	558	4,002	9,580
c. Maize	15.33	2,208	245	1,157	3,610
d. Other cereals	4.45	641	71	218	930
2. Pulses	9.71	1,398	155	427	1,980
3. Fruit	33.18	4,778	532	-	5,310
4. Vegetable	46.76	6,753	747	-	7,480
5. Sugar	19.71	2,858	316	176	3,330
6. Oil & Fats	12.31	1,773	197	-	1,970
7. Meat	15.84	2,281	259	-	2,540
a. Beef	3.21	462	48	-	510
b. Mutton	10.66	1,535	175	-	1,710
c. Poultry	1.97	284	36	-	320
9. Eggs	3.43	494	56	-	550
10. Milk	64.86	9,340	1,040	-	10,380
11. Fish	5.91	851	99	-	950

Note: *1 ... based on the human nutritional requirements by age (average 2,600 cal/day).
 *2 ... 2000's estimated population in Pakistan is 144 million.
 *3 ... each 5 percent losses at market and consumption level.
 *4 ... with reference to the Food Balance Sheet (1982 - 83) of the Fifth Five Year Plan.

Table IV.3-21 Land Utilization and Cropped Area in Pakistan

(Unit: Million hectares)

Area	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80
1. Geographical Area	79.61	79.61	79.61	79.61	79.61	79.61	79.61	79.61
2. Forest Area	2.81	2.85	2.80	2.84	2.86	2.89	2.84	2.84
3. Not Available for Cultivation	20.73	20.53	20.32	20.63	21.47	20.92	20.99	21.02
4. Culturable Waste	11.09	11.15	11.25	10.62	10.88	11.05	11.02	11.93
5. Cultivated Area	19.12	19.38	19.55	19.83	19.76	20.10	20.11	20.30
a. Current fallow	5.05	4.19	4.78	4.77	4.69	4.88	4.78	4.82
b. Area cropped	14.07	15.19	14.77	15.06	15.07	15.22	15.33	15.48
b-1. Area cropped more than once	2.86	3.09	2.60	2.96	3.14	3.27	3.83	3.32
b-2. Total cropped area	16.93	18.28	17.37	18.02	18.21	18.49	19.16	18.80
(1) Food grains *1	9.37	9.78	9.21	9.73	10.03	10.24	10.67	10.79
(2) Cash crops *2	2.59	2.54	2.76	2.60	2.70	2.72	2.69	2.85
(3) Pulses *3	1.46	1.63	1.38	1.48	1.54	1.55	1.68	1.55
(4) Oil seeds *4	0.61	0.63	0.53	0.56	0.62	0.53	0.58	0.53
(5) Vegetables *5	0.17	0.18	0.19	0.18	0.16	0.18	0.20	0.21
(6) Condiments *6	0.04	0.04	0.04	0.06	0.06	0.06	0.08	0.09
(7) Fruits	0.23	0.22	0.24	0.24	0.25	0.27	0.27	0.29
(8) Others	2.47	3.25	3.03	3.18	2.84	2.95	2.99	2.49

Source: Agricultural Statistics of Pakistan, 1980
Ministry of Food, Agriculture and Cooperative

Note: *1 ... Wheat, Rice, Jowar, Mize, Bajra and Barley
*2 ... Sugarcane, Cotton, Tobacco and Jute
*3 ... Gram, Mung, Masoor, Mash, Mattar, Other Kharif and Rabi Pulses
*4 ... Rape and Mustard, Sesamum, Groundnut, Linseed, Caster seed and Other Oil Seed
*5 ... Including Onion and Potato
*6 ... Chillies, Garlic, Corrainder, Turmeric, Ginger and Other

Table IV.3-22 Agricultural Production in Pakistan

(Unit: '000 tons)

Commodities	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80	1980-81
1. Cereals	11,193	11,720	11,403	12,831	13,341	12,861	14,720	15,541	No data
a. Wheat	7,442	7,629	7,674	8,691	9,144	8,367	9,950	10,805	"
b. Paddy	2,330	2,455	2,314	2,618	2,737	2,950	3,272	3,216	"
c. Maize	706	767	747	803	764	821	799	875	"
d. Others	715	869	668	719	696	723	699	645	"
2. Pulses	750	836	715	783	843	812	736	511	"
a. Gram	553	610	550	601	649	614	538	313	"
b. Others	197	226	165	182	194	198	198	198	"
3. Fruit	1,803	1,926	2,060	2,112	2,142	2,090	2,203	2,381	"
4. Vegetable* ¹	2,089	2,193	2,293	2,168	1,975	2,079	2,369	2,412	"
5. Sugarcane	19,948	23,911	21,242	25,547	29,523	30,077	27,326	27,498	"
6. Edible Oil Seeds	792	488	472	403	355	454	370	537	"
a. Rapeseed & Mustard	287	292	248	267	296	236	248	247	"
b. Groundnut	44	54	57	62	64	72	46	50	"
c. Sesamum	10	12	8	11	12	13	19	19	"
d. Cotton Seed	449	421	406	329	278	368	303	466	"
e. Others	2	1	1	1	1	1	2	2	"
7. Meat	591	618	644	675	709	742	782	823	869
a. Beef	349	354	357	362	366	370	375	379	384
a-1. Cattle	181	182	182	183	184	184	189	185	186
a-2. Buffaloes	168	172	175	179	182	186	190	194	198
b. Mutton	226	245	265	288	314	339	368	399	433
b-1. Sheep	98	106	114	124	136	146	158	171	185
b-2. Goats	128	139	151	164	178	193	210	228	248
c. Poultry	16	19	22	25	29	33	39	45	52
8. Eggs	30	38	42	54	63	73	85	98	114
9. Milk	7,899	8,044	8,193	8,348	8,509	8,670	8,841	9,014	9,195
a. Cow	2,143	2,150	2,156	2,163	2,170	2,176	2,183	2,189	2,196
b. Buffaloes	5,506	5,623	5,743	5,866	5,992	6,119	6,250	6,383	6,519
c. Sheep	22	23	25	27	30	31	34	36	39
d. Goats	228	248	269	292	317	344	374	406	441
10. Fish	No data	214	169	174	211	268	293	300	279

Source: Agricultural Statistics of Pakistan, 1980
Ministry of Food, Agriculture and Cooperatives

Note: *1.... Including Onion and Potato

Table IV.3-23 Agricultural Production in Baluchistan

(Unit: '000 tons)

Commodities	1972-73	1973-74	1974-75	1075-76	1076-77	1077-78	1978-79	1979-80	1980-81
1. Cereals	165.9	267.3	212.8	221.8	207.2	272.6	312.1	366.9	No data
a. Wheat	68.6	111.2	131.1	137.8	146.0	161.4	208.8	231.1	"
b. Paddy	40.9	33.4	35.5	39.6	28.0	38.9	61.2	93.6	"
c. Maize	1.8	2.7	2.0	1.9	2.8	2.5	2.7	2.6	"
d. Others	54.6	120.0	44.2	42.5	30.4	69.8	39.4	39.6	"
2. Pulses	4.8	4.8	2.6	3.0	2.8	3.7	3.8	2.8	"
a. Gram	2.1	2.1	1.0	0.9	0.0	0.8	0.8	0.8	"
b. Others	2.7	2.7	1.6	2.1	2.8	2.9	3.0	2.1	"
3. Fruit	141.2	224.5	218.9	227.1	235.2	248.8	255.9	265.7	"
4. Vegetable* ¹	93.4	98.5	100.1	98.9	171.1	131.0	135.2	174.0	"
5. Sugarcane	1.5	0.8	1.6	2.1	2.3	1.7	1.7	2.8	"
6. Edible Oil Seeds	8.5	10.3	9.4	5.1	15.7	9.8	19.9	15.7	"
a. Rapeseed & Mustard	6.8	6.7	7.0	3.4	11.4	6.6	12.2	9.3	"
b. Groundnut	-	-	-	-	-	-	-	-	"
c. Sesamum	1.7	3.5	2.3	1.6	4.2	3.1	7.6	6.4	"
d. Cotton Seed	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	"
e. Others	-	-	-	-	-	-	-	-	"
7. Meat	67.1	72.2	77.3	83.3	90.4	97.0	104.6	112.8	121.9
a. Beef	8.8	8.9	8.9	8.9	9.0	9.1	9.1	9.1	9.2
a-1. Cattle	8.3	8.4	8.4	8.4	8.5	8.5	8.5	8.5	8.6
a-2. Buffaloes	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6
b. Mutton	57.3	62.1	67.1	72.9	79.6	85.9	93.1	101.0	109.5
b-1. Sheep	29.1	31.5	33.9	36.8	40.4	43.4	46.9	50.8	54.9
b-2. Goats	28.2	30.6	33.2	36.1	39.2	42.5	46.2	50.2	54.6
c. Poultry	1.0	1.2	1.3	1.5	1.8	2.0	2.4	2.7	3.2
8. Eggs	1.8	2.3	2.6	3.3	3.9	4.5	5.2	6.0	6.9
9. Milk	104.4	105.4	106.5	107.8	109.4	110.3	111.9	113.0	114.7
a. Cow	81.4	81.7	81.9	82.2	82.5	82.7	83.0	83.2	83.5
b. Buffaloes	16.5	16.9	17.2	17.6	18.0	18.4	18.8	19.1	19.6
c. Sheep	6.5	6.8	7.4	8.0	8.9	9.2	10.1	10.7	11.6
d. Goats	50.2	54.6	59.2	64.2	69.7	75.7	82.3	89.3	97.0
10. Fish	No data	37.7	39.8	41.1	49.3	68.8	68.3	62.4	57.7

Source: Agricultural Statistics of Pakistan, 1980
Ministry of Food, Agriculture and Cooperatives

Note: *¹ ... Including Onion and Potato

Table IV.3-24 Estimation of the Food Balance in Pakistan

(Unit: '000 tons)

Commodity	Demand in Future (2000) (A)	Supply & Balance at Present		Supply & Balance in Future (2000)	
		Domestic *1 Production (B)	Balance (B) - (A)	Domestic *2 Production (C)	Balance (C) - (A)
1. Cereals	34,170	14,370	-19,800	26,560	-7,610
a. Wheat	20,050	9,710	-10,340	18,640	-1,410
b. Rice	9,580	3,140	-6,440	6,350	-3,250
c. Maize	3,610	830	-2,780	1,170	-2,440
d. Other Cereals	930	690	-240	420	-510
2. Pulses	1,980	690	-1,290	550	-1,430
3. Fruit	5,310	2,230	-3,080	3,370	-1,940
4. Vegetable	7,480	2,290	-5,190	2,300	-5,180
5. Sugar	3,330	2,850	-500	5,490	+2,160
6. Edible Oil	1,970	150	-1,820	110	-1,860
7. Meat	2,540	830	-1,710	1,500	-1,040
a. Beef	510	380	-130	470	-40
b. Mutton	1,710	400	-1,310	910	-800
c. Poultry	320	50	-270	120	-200
8. Eggs	550	100	-450	300	-250
9. Milk	10,380	9,020	-1,360	12,340	+1,960
10. Fish	950	290	-660	680	-270

Note: *1 ... recently 3 years average.
*2 ... figures are based on the trend for the last 8 years.

Table IV.3-25 Estimation of the Food Balance in Baluchistan

(Unit: '000 tons)

Commodity	Demand in *1	Supply & Balance at Present		Supply & Balance in Future(2000)	
	Future (2000) (A)	Provincial *1 Production (B)	Balance (B) - (A)	Provincial *2 Production (C)	Balance (C) - (A)
1. Cereals	1,755	297	-1,458	777	-978
a. Wheat	1,030	200	-830	589	-441
b. Rice	492	65	-427	154	-338
c. Maize	186	3	-183	5	-181
d. Other Cereals	47	29	-18	29	-18
2. Pulses	102	6	-96	0	-102
3. Fruit	273	257	-16	503	+230
4. Vegetable	384	48	-336	391	+7
5. Sugar	145	0	-145	1	-144
6. Edible Oil	101	18	-83	18	-83
7. Meat	130	114	-16	241	+111
a. Beef	26	9	-17	10	-16
b. Mutton	88	102	+14	224	+136
c. Poultry	16	3	-13	7	-9
8. Eggs	28	6	-22	18	-10
9. Milk	533	1,285	-752	138	-395
10. Fish	49	63	-14	152	+103

Note: *1 ... 2000's estimated population in Baluchistan is 7.4 million.
 *2 ... recently 3 years average.
 *3 ... figures are based on the trend for the last 8 years.

IV.3.2 Proposed Cropping Patterns

Four cropping plans have been formulated in consideration of four irrigation water quantities to be allocated to the Project as follows;

<u>Case</u>	<u>Availability of Irrigation Water</u>
Case 1	8,200 cusec throughout the year
Case 2	6,700 cusec throughout the year
Case 3	8,200 cusec(Karif) + Dependable flow(Rabi)
Case 4	6,700 cusec(Karif) + Dependable flow(Rabi)

In determining the proposed cropping pattern, a cropping plan was formulated for Case 3, and the plan was modified for the other cases by applying the irrigation water quantities as conversion factors. The cropping plan for Case 3 consists of Cropping Types of A, B and C which correspond to the three profile-salinity classes respectively, as shown below;

<u>Cropping Type</u>	<u>Profile Salinity Class (1.8 m of Soil Depth)</u>
A	Non-saline and non-sodic throughout the profile
B	Slightly saline (4 to 8 mmho/cm)
C	Saline (8 to 15 mmho/cm)

Out of these cropping types, rice is scheduled to be grown in both Cropping Types B and C areas. Areas of which soils are more saline than 15 mmho/cm will be planted to no crops. It is expected that salt substance will be leached by irrigation water during rice cultivation, and that irrigation water will prevent salt from coming up to top soils from subsoils. In Cropping Types B and C, 25 percent and 60 percent of the command areas will be cultivated with rice, respectively. In Cropping Type B rice will be grown once a four-year period whereas in Cropping Type C 60% of the comand area will be planted with rice every year.

The cropping calendar and crop rotation plan are illustrated in Figure IV.3-1 and IV.3-2.

Table IV.3-26 Cropping Types by Profile Salinity Class (Case-3)
(Unit : %, ac)

Cropping Type Soil Salinity Class Command Area	A	B	C	Overall
	Non-saline (Non-sodic) Ia	(Slightly) Saline Ib, IIa, IIb, IIc, IIIa, IIIb	(Saline) IIIc, IVa, IVb	
Crop	214,200 (35.0%)	336,600 (55.0%)	61,200 (10.0%)	612,000 (100.0%)
<u>Kharif</u>				
1. Sorghum	(3.0) 18,400	(6.0) 36,700	(-) -	(9.0) 55,100
2. Rice	(-) -	(14.0) 85,700	(6.0) 36,700	(20.0) 122,400
3. Oilseeds ^{1/}	(9.0) 55,000	(5.0) 30,600	(-) -	(14.0) 85,600
4. Pulses ^{2/}	(4.0) 24,500	(8.0) 49,000	(-) -	(12.0) 73,500
5. Sugarcane, Misc. ^{3/}	(5.0) 30,600	(-) -	(-) -	(5.0) 30,600
Sub-total	(21.0) 128,500	(33.0) 202,000	(6.0) 36,700	(60.0) 367,200
<u>Rabi</u>				
1. Wheat	(14.0) 85,700	(20.0) 122,400	(-) -	(34.0) 208,100
2. Oilseeds ^{4/}	(2.0) 12,200	(11.0) 67,400	(-) -	(13.0) 79,600
3. Pulses ^{5/}	(3.0) 18,400	(-) -	(5.0) 30,600	(8.0) 49,000
4. Fodders, Misc. ^{6/}	(2.0) 12,200	(2.0) 12,200	(1.0) 6,100	(5.0) 30,600
Sub-total	(21.0) 128,500	(33.0) 202,000	(6.0) 36,700	(60.0) 367,200
<u>Total</u>	(42.0) 257,000	(66.0) 404,000	(12.0) 73,400	(120.0) 734,400

- Note : 1/ Represented by sunflower.
2/ Soybean (2/3) and others (mungbean, mash, etc., 1/3)
3/ Including fruits and vegetables.
4/ Represented by rapeseed and mustard.
5/ Represented by gram.
6/ Represented by berseem

Table IV.3-27 Crop Salt Tolerance Levels for Different Crops

(Unit : mmho/cm)

Crop	Yield Potential								Max. ECe
	100%		90%		75%		50%		
	ECe	ECw	ECe	ECw	ECe	ECw	ECe	ECw	
<u>Kharif</u>									
1. Sorghum	4.0	2.7	5.1	3.4	7.2	4.8	11.0	7.2	18.0
2. Maize	1.7	1.1	2.5	1.7	3.8	2.5	5.9	3.9	10.0
3. Rice	3.0	2.0	3.8	2.6	5.1	3.4	7.2	4.8	12.0
4. Mungbean	1.0	0.7	1.5	1.0	2.3	1.5	3.6	2.4	7.0
5. Soybean	5.0	3.3	5.5	3.7	6.2	4.2	7.5	5.0	10.0
6. Sunflower	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	6.0	3.3	7.0
7. Sesamum	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
8. Groundnut	3.2	2.1	3.5	2.4	4.1	2.7	4.9	3.3	7.0
9. Sugercane	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	**8.0	N.A.	N.A.
10. Cotton	7.7	5.1	9.6	6.4	13.0	8.4	17.0	12.0	27.0
11. Vegetables (Watermelon)	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	*4.0	N.A.	N.A.
<u>Rabi</u>									
1. Wheat	6.0	4.0	7.4	4.9	9.5	6.4	13.0	8.7	20.0
2. Barley (Hay)	6.0	4.0	7.4	4.9	9.5	6.3	13.0	8.7	20.0
3. Rapes & Mustard	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	*12.0	N.A.	N.A.
4. Safflower	5.3	3.5	6.2	4.1	7.6	5.0	9.9	6.6	15.0
5. Gram	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	**4.0	N.A.	N.A.
6. Berseem	1.5	1.0	3.2	2.1	5.9	3.9	10.3	6.8	19.0
7. Vegetables (Onion)	1.2	0.8	1.8	1.2	2.8	1.8	4.3	2.9	8.0
<u>Fruit</u>									
1. Citrus (Lemon)	1.7	1.1	2.3	1.6	3.3	2.2	4.8	3.2	8.0
2. Mango	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
3. Guava	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

Note : Ece = Electrical conductivity of the soil saturation extract for a given crop appropriate to the tolerable degree of yield reduction

ECw = Electrical conductivity of the irrigation water

Max.ECe = Maximum tolerable electrical conductivity of the soil saturation extract for a given crop

Source : FAO, Crop Water Requirements, P.78

* USDA, Saline and Alkali Soils

** Land Reclamation Int. Land and Water Management in West Pakistan

Table IV.3-28 Proposed Cropping Plan

(unit : ac)

Crops	Case 1		Case 2		Case 3		Case 4	
	Intensity	Area	Intensity	Area	Intensity	Area	Intensity	Area
1. Kharif								
a. Sorghum	(9.0)	55,100	(7.0)	42,800	(9.0)	55,100	(7.0)	42,800
b. Rice	(20.0)	122,400	(17.0)	104,100	(20.0)	122,400	(17.0)	104,100
c. Oilseeds	(14.0)	85,700	(12.0)	73,400	(14.0)	85,700	(12.0)	73,400
d. Pulses	(12.0)	73,400	(10.0)	61,200	(12.0)	73,400	(10.0)	61,200
e. Sugarcane	(5.0)	30,600	(4.0)	24,500	(5.0)	30,600	(4.0)	24,500
Sub-total	(60.0)	367,200	(50.0)	306,000	(60.0)	367,200	(50.0)	306,000
2. Rabi								
a. Wheat	(54.0)	330,500	(45.0)	275,400	(34.0)	208,100	(34.0)	208,100
b. Oilseeds	(20.0)	122,400	(17.0)	104,100	(13.0)	79,600	(13.0)	79,600
c. Pulses	(13.0)	79,600	(11.0)	67,300	(8.0)	48,900	(8.0)	48,900
d. Fodders, Misc.	(8.0)	48,900	(7.0)	42,800	(5.0)	30,600	(5.0)	30,600
Sub-total	(95.0)	581,400	(80.0)	489,600	(60.0)	367,200	(60.0)	367,200
Total	(155.0)	948,600	(130.0)	795,600	(120.0)	734,400	(110.0)	673,260

Note: Proposed cultivation area = 612,000 acres (100%)

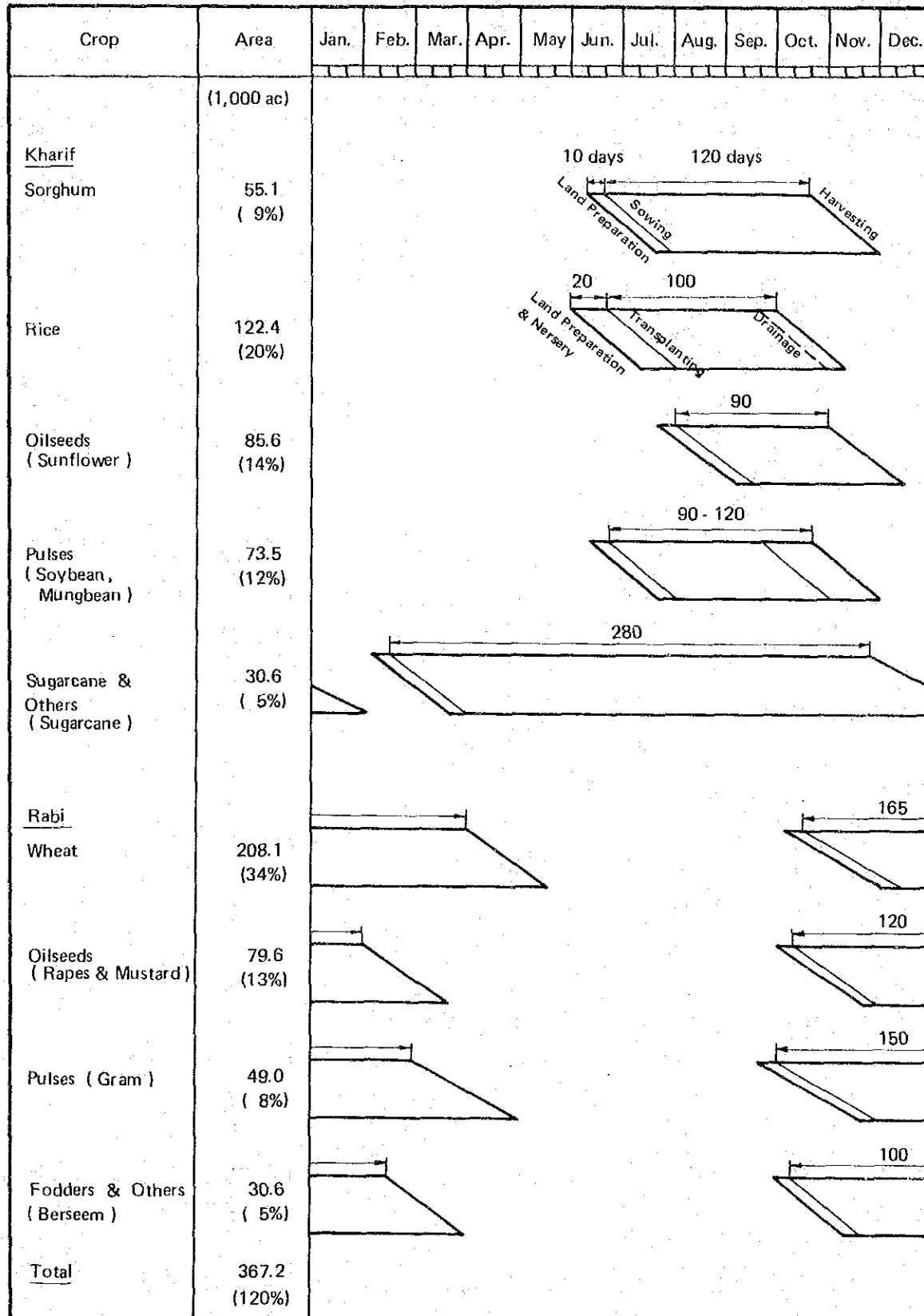
In Type A, wide selection of crops is possible due to few limitations. In Type B rice will be grown in 25 percent of the command area every year so that soils in the entire command area is leached by irrigation water within a four-year period. After rice cultivation, upland crops will be grown in the subsequent three years. The ordinary cropping of upland crops specially of high water efficient crops could be introduced after the cultivation of rice. In Type C, rice is grown every year in 60 percent of the command area. After harvesting rice, pulses and fodder crops could be raised.

The selection of crops to each salinity class is based on the salinity tolerance levels of the selected crops as shown in Table IV.3-27.

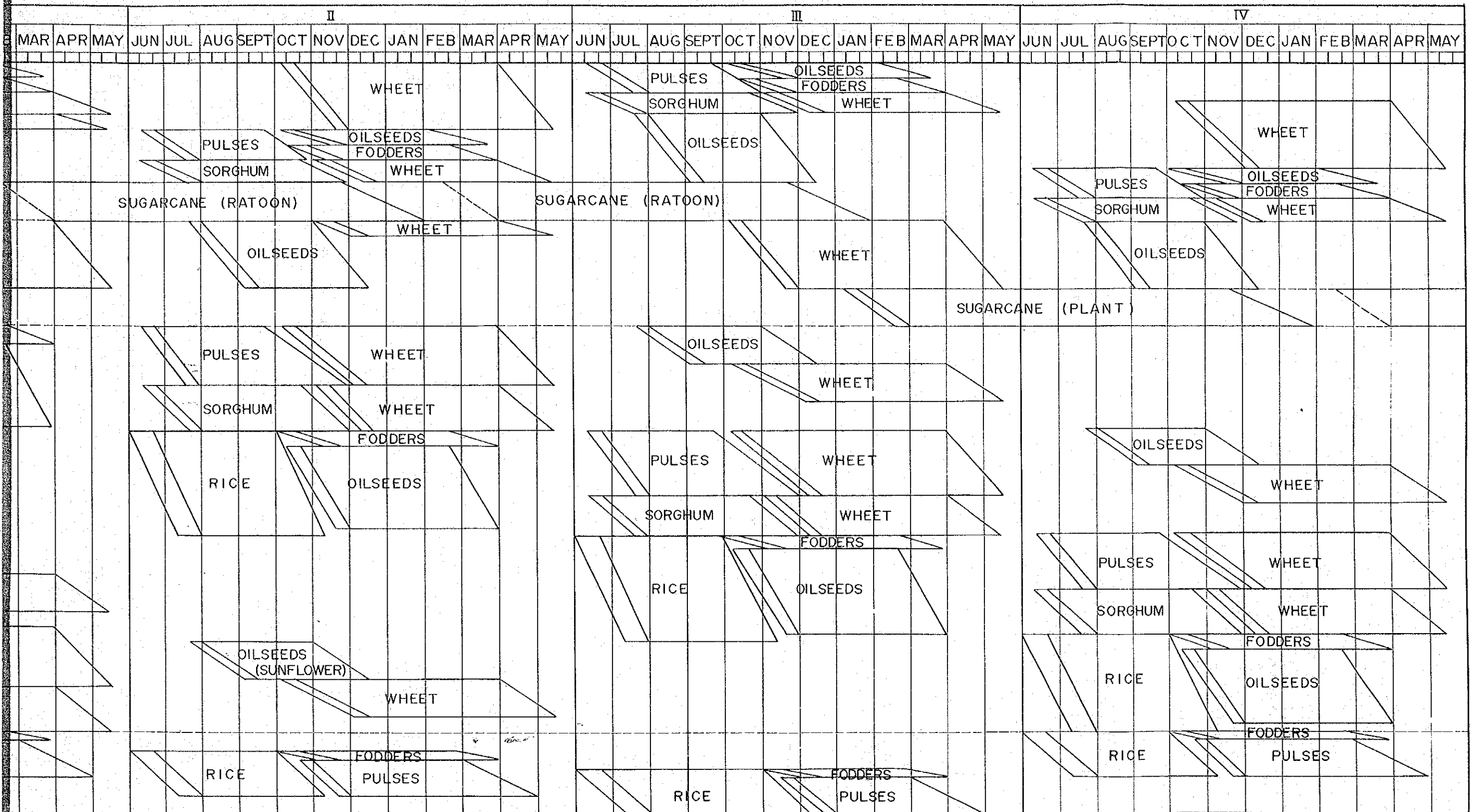
As for the proposed cropping plans for Cases 1, 2 and 4, the cropping plan for Case 3 was modified as mentioned above. (see Table IV.3-27). Therefore, the proportion of cropping areas by crops in both summer and winter is the same in these four cropping plans.

In order to control the salinization of soils, the importance of adequate drainage systems and proper water management specially in on-farm level should be emphasized from the view point of cropping plans.

Fig. IV.3 - 1 Proposed Cropping Calendar (Case - 3)



Crop Rotation Plan (Case 3)



IV.3.3 Target Yield of Selected Crops with the Project

1. Experimental Yield

The experimental yields of each selected crops when a varying quantity of fertilizers is applied are shown in Table IV.3-29, IV.3-30. The figures in Table IV.3-30 were used to obtain the quadratic equations of regression between the crop yield in ton per hectare (y) and the nitrogen quantity applied to the crop in kilogram per hectare (x). Table IV.3-31 shows the equation by the selected crops.

2. Crop Yield with the Optimum Application of Nitrogen

A yield of wheat with the optimum application of Nitrogen is computed as follows;

The quadratic equation base on experimental yields;

$$Y = 1.655 + 0.02431x - 0.00006x^2$$

$$\text{Opt. nitrogen (kg/ha)} = \frac{0.02431 \times py - Pn}{2(0.00006 \times Py)} = 181 \doteq 180 \text{ (kg)}$$

Where $P_y = \text{Rs. } 2,523$ (economic price of wheat per ton)

$R_n = \text{Rs. } 6.60$ (economic price of nitrogen per kg)

Yield at 180 kg of the nitrogen application $\doteq 4.1$ ton

The wheat yield of 4.1 tons per acre is considered as the economic potential yield of wheat in experimental level. The economic potential yield of each selected crop was computed by the same method as applied in the computation of the yield of wheat, and shown in Table IV.3-31.

3. Target Yield of Selected Crops in the Project Area

The potential yield of each selected crop at farmers' level is estimated at 85 percent of the economic potential yield of the crop in experimental level.

The target yield of the crop in each land class from the first to third is estimated by the application of discount factor to the potential yield at farmers' level, 95 percent for the first class

farm lands, 85 percent for the second class and 75 percent for the third class.

Finally, the target yield of each selected crop in the Project Area was computed as the weighted averages of yields of each crop by land classes as shown in Table IV.3-32.

Table IV.3-29 Experimental Yields of Selected Major Crops

Crops	Varieties	Experimental Yield (tons/ha)	Fertilizer Dosage			Remarks
			N (kgs/ha)	P ₂ O ₅ (kgs/ha)	K ₂ O (kgs/ha)	
1. Sorghum	D.G. Pearl	G. 1.0 - 1.4 F. 36.7 + α	34 - 67	0 - 34	0 - 34	Fodder Research Station (Sargoda, 1971/72 - 1975/76)/ Maize & Millets Research Int.)
2. Rice	IRRI - 6	2.6 - 6.1	112 - 168	101 - 112	0 - 202	Soil Fertility Survey and Soil Testing Int. (SFSSSTI, Lahore), 1971/72 - 1972/73.
*3. Sunflower	HO - 1, Armavirets, Peredovic, etc.	1.1 - 2.1	112	56	0	Tandojam Agriculture Research Int. 1977, Autumn.
4. Soybean	Lee, Wayne, Merit & Ford	1.1 - 1.8	N.A.	N.A.	N.A.	Oil Seeds Research Int. (Faisalbad, 1971/72 - 1974/75)
5. Sugarcane	Approved varieties	71.7 - 95.0	168 - 224	0 - 112	0 - 112	SFSSSTI, 1974/75.
6. Wheat	Comprised varieties (Semi-dwarf, Dwarf)	2.9 - 4.7	84 - 196	67 - 134	0 - 67	SFSSSTI, 1971/72 - 1975/76.
7. Gram	Local	1.3 - 2.0	0 - 34	45 - 90	-	SFSSSTI, 1971/72 - 1975/76.
8. Mustard	Poorbi raya	1.2 - 2.0	90 - 179	0 - 90	0 - 45	SFSSSTI, 1971/72 - 1975/76.
9. Berseem	Local	70.0 - 98.7	34	56 - 168	0 - 112	SFSSSTI, 1971/72 - 1975/76.

Source : (1) Punjab Agriculture Research Institute, Faisalbad, 5-YEAR RESEARCH FINDINGS (1971 - 76)
(2) *Annual Report for 1979 - 80, PARC

Note : G = Grain, F = Fodder

Table IV.3-31 Estimation on Target Yield by Land Class, with Project, in Future

Crop	Equation for Experimental Yield (Y:ton/ha,N:kg/ha,P:kg/ha)	Potential Yield		1st Class		2nd Class		3rd Class	
		Experiment (ton/ha)	Project Area (ton/ha)	Rate (%)	Yield (ton/ha)	Rate (%)	Yield (ton/ha)	Rate (%)	Yield (ton/ha)
1. Sorghum	$Y = 0.700 + 0.02950N - 0.00026N^2$	1.5 (N=50)	1.3	95	1.2	85	1.1	75	1.0
2. Rice	$Y = 2.880 + 0.03714N - 0.00013N^2$	5.5 (N=130)	4.7	95	4.4	85	4.0	75	3.5
3. Sunflower	$Y = 0.600 + 0.00873N$	1.6 (N=110)	1.4	95	1.3	85	1.2	75	1.1
4. Soybean	$Y = 1.010 + 0.01493P - 0.00007P^2$	1.8 (P=90)	1.5	95	1.4	85	1.3	75	1.1
5. Sugarcane	$Y = 43.000 + 0.39241N - 0.00083N^2$	88.8 (N=210)	75.5	95	71.7	85	64.2	75	56.6
6. Wheat	$Y = 1.655 + 0.02431N - 0.00006N^2$	4.1 (N=180)	3.5	95	3.3	85	3.0	75	2.6
7. Gram	$Y = 0.900 + 0.02111P - 0.00012P^2$	1.8 (P=70)	1.5	95	1.4	85	1.3	75	1.1
8. Mustard	$Y = 0.600 + 0.01519N - 0.00006N^2$	1.5 (N=100)	1.3	95	1.2	85	1.1	75	1.0
9. Berseem	$Y = 47.100 + 0.52559P - 0.00199P^2$	81.5 (P=100)	69.3	95	65.8	85	58.9	75	52.0

Table IV.3-32 Target Yield per Hectare (Weighted Average by Land Class)

Crop	Cropping Type A		Cropping Type B		Cropping Type C		Overall	
	A (ha)	Y (ton/ha)	A (ha)	Y (ton/ha)	A (ha)	Y (ton/ha)	A (ha)	Y (ton/ha)
1. Kharif								
a. Sorghum	7,400	1.2	14,800	1.1	-	-	22,200	1.1
b. Rice	-	-	34,700	4.0	138,800	14,900	49,600	3.9
c. Oilseeds (Sunflower)	22,300	1.3	12,400	1.2	14,880	-	34,700	1.3
d. Pulses (Soybean)	9,900	1.4	13,860	1.3	25,740	-	29,700	1.3
e. Others (Sugarcane)	12,400	71.7	889,080	-	-	-	12,400	71.7
Sub-total	52,000		81,700		14,900		148,600	
2. Rabi								
a. Wheat	34,700	3.3	114,510	3.0	148,500	-	84,200	3.1
b. Oilseeds (Rapes & Mustard)	4,900	1.4	6,860	1.3	35,490	-	32,200	1.3
c. Pulses(Gram)	7,400	1.2	8,880	-	-	12,400	19,800	1.1
d. Others	5,000	65.8	329,000	58.9	288,610	2,500	12,400	60.1
Sub-total	52,000		81,700		14,900		148,600	
Total	104,000		163,400		29,800		297,200	

Note: (1) A = Cropping Area, Y = Yield, P = Production.
(2) Yield by land class are studied in Table

IV.3.4 Farm Mechanization Plan and Demand-Supply Balance of Farm Labour

1. Mechanization Area

Taking into consideration the expected on-farm conditions and other farm management conditions in the Project area, the proposed farm mechanization is limited to the minimum level. The farm operation systems of the proposed mechanization are shown in Table IV.3-33, where only such specified operations as land preparation, threshing and spraying are planned to be mechanized with the area coverage of 70 percent of the total cropping area of the respective crops. The remaining of the 30 percent of the total cropping area of the respective crops is covered by the area of the manual and animal power systems without mechanization.

In the proposed farm operation systems, the mechanization of land preparation does not mean full mechanization. Namely, the combination use of tractors and draft animals will be applied as shown as follows;

2. Selection of Farm Machineries

2.1. Tractors and Attachments

50 to 60 HP class four-wheel tractors are selected for the mechanization of land preparation works. The deep plowing will be required to improve soil fertility and also to leach the salts downward. Furthermore, the efficient land preparation is indispensable to solve the labor shortage during the overlapping period of the harvest of Kharif crops and land preparation for Rabi crops. But mechanization throughout Pakistan is at its infant stage and machinery cost is generally not so cheap to compare with the cost of animal-drafting operations under the conditions that most of tractors and their attachment are imported. Then, the combination use of tractors and draft animals is planned for the land preparation works to minimize the number of tractors to be introduced in the Project Area. Followings shows the assumed procedure of land preparation and equipments to be used.

Table IV.3-33 Proposed Farm Operation Systems with Mechanization
(Area Coverage = 70 percent)

Operation	Sorghum	Rice	Oilseeds (Kharif)	Pulses (Kharif)	Others (Kharif)	Wheat	Oilseeds (Rabi)	Pulses (Rabi)	Fodders (Rabi)
1. Plowing	T + P	T + P	T + P	T + P	T + P	T + P	T + P	T + P	T + P
2. Breaking	T + H	T + H	T + H	T + H	T + H	T + H	T + H	T + H	T + H
3. 2nd Plowing	A + P	A + P	A + P	A + P	A + P	A + P	A + P	A + P	A + P
4. Planking/Level- ing	A + Pl	A + Pu	A + Pl	A + Pl	A + Pl	A + Pl	A + Pl	A + Pl	A + Pl
5. Furrow Making	A + P	-	A + P	A + P	A + P	-	M	M	M
6. Sowing/Planting	M	M	M	M	M	Drill	M	M	M
7. Spraying	P.S.	P.S.	P.S.	P.S.	P.S.	P.S.	P.S.	P.S.	P.S.
8. Intercultivation	A + C	R.W.	A + C	A + C	A + C	A + C	A + C	A + C	A + C
9. Reaping/Plucking	M	M	M	M	M	M	M	M	M
10. Threshing	M	Th	M	Th	-	Th	A	Th	-
11. Transportation	A + Ca	A + Ca	A + Ca	A + Ca	A + Ca	A + Ca	A + Ca	A + Ca	A + Ca

Note: (1) T; Tractor, A; Animal, M; Manual, P; Plow, H; Harrow, Pl; Planker, Pu; Puddler,
P.S.; Powered Sprayer, R.W.; Rotary Weeder, C; Cultivator, Ca; Cart.

<u>Operation</u>	<u>Implement</u>	<u>Efficiency (hr/ac)</u>
a) Plowing (one passing)	Tractor + Plow (16' x 3)	2.55
b) Soil breaking (cross-wise) ^{1/}	Tractor + Disc harrow (24' x 8 x 2)	0.97x2=1.94
c) 2nd plowing by animal ^{2/}	Draft animal + Plow	12.0
d) Planking	Draft animal + Planker	4.0
<u>Total</u>		<u>20.49</u>

Note : ^{1/} In case of heavy soil texture, rotary harrow and rotavator will be required to use.

^{2/} If soil breaking will be done by rotavator, harrowing by draft animal will be enough for this operation.

2.2. Power Threshers

The power threshers have not been introduced in the Project Area, but, in order to reduce the peak demand of farm labor in October and November when harvesting of Kharif crops and land preparation works for Rabi crops overlap each other, the power threshers are planned to be introduced into 70 percent of wheat cropping area. The IRRI type threshers which have been developed recently could be introduced, having the operation capacity of one ton of paddy or wheat grain per hour. This thresher may be used for threshing works of Kharif and Rabi pulses with the area coverage of 70 percent.

2.3 Power Sprayers

The controlled areas of insects will be increased very much after completion of the Project and more timely control will be required. In this connection, the introduction of power sprayers are planned to cover at least 70 percent of the Project Area.

Table IV.3-34 Estimated Farm Operation Capacity

(Unit : day/ac)

Operation	Machinery/Implement	(1) Width (m)	(2) Op. Speed (km/hr)	(3) Theoretic Op. Capacity (ha/hr)	(4) Effici- ency in Field (%)	(5)= (3)x(4) Op. Capacity in Field (ha/hr)	(6) Op. Effici- ency out of Field (%)	(7)= (5)x(6) Actual Capacity (ha/hr)	(8)= 1.0÷(7) Op. Hours per ha (hr/ha)	(9) Op. Hours per ha (hr/ha)	(10)= (8)x(9) Op. Hours per Day (hr/day)	(11) Op. Hours per Day (hr/day)	(12)= (10)÷(11) Days per Acre (day/ac)
1. 1st Plowing (Bullock)	One pair of bullock with plow	0.2	2.5	0.050	75	0.037	70	0.025	40.0	1	40.0	8.0	2.0
2. 2nd Plowing (Bullock)	- do -	0.2	3.0	0.060	80	0.048	70	0.033	30.3	1	30.3	8.0	1.5
3. Planking (Bullock)	One pair of bullock with planer	0.8	2.5	0.200	80	0.160	70	0.112	8.9	1	8.9	8.0	0.5
4. Puddling/Leveling (Bullock)	One pair of bullock with puddler	0.8	2.5	0.200	80	0.160	70	0.112	8.9	1	8.9	8.0	0.5
5. Threshing (Bullock)													
6. 1st Plowing (Tractor)	Plow (16" x 3)	1.0	2.5	0.250	80	0.200	80	0.160	6.3	1	6.3	8.0	0.3
7. Breaking (Tractor)	Disc Plow (24" x 8 x 2)	2.3	5.5	1.265	80	0.1012	80	0.810	1.2	2	2.4	8.0	0.1
8. Spraying (Sprayer)	Portable sprayer	6.0	2.7	1.620	38	0.616	80	0.493	2.0	1	2.0	8.0	0.1
9. Reaping (Reaper)	Powered reaper (2 tows)	0.4	2.2	0.088	75	0.066	75	0.050	20.0	1	20.0	8.0	1.0
10. Threshing (Thresher)	Powered thresher	—	—	1.0ton/hr	80	0.8ton/hr	80	0.6ton/hr	—	—	—	—	1.6ton÷0.6ton x6hr = 0.5
11. Threshing (Bullock)	—	—	—	—	—	—	—	0.55ton/day/pair	—	—	—	—	1.6ton÷0.55ton x3.0

0.2ton/head-day

3. Required Numbers of Farm Machinery

The working capacity and efficiency of the respective farm machines to be introduced are estimated and shown in Table IV.3.34, in referring to the efficiency data available in case of paddy cultivation in Japan and other Southeast Asian countries.

The total number of farm machines required is determined as follows;

Required Units of Farm Machinery

<u>Machinery</u>	<u>Crop</u>	(1) <u>Area Coverage</u> (ac)	(2) <u>Workable Days</u> (day)	(3) <u>Capacity^{1/}</u> (ac/day)	(4)=	(5)=
					(2)x(3) <u>Operation Area</u> per Unit (ac)	(1)÷(4) <u>Required Unit</u>
a) Tractor	Rabi Crops	257,040 ^{3/}	60	2.5 ^{2/}	150	1,714
b) Powered Thresher	Rice, Pulses (Kharif & Rabi)	85,700 ^{4/}	50	2.0	100	857
c) Powered Sprayer	Rabi Crops	257,040 ^{3/}	6	10.0	60	4,284

- Note :
- 1/ Based on the capacity in Table IV.3-34
 - 2/ One passing of plow + two passing of disc harrow
 - 3/ 612,000 ac x 0.60 x 0.7
 - 4/ 612,000 ac x 0.34 x 0.7

4. Ownership of Farm Machinery and Operation Costs

It is expected that the required farm machinery will be introduced by cooperatives and also by individual farmers. The cooperative machinery will be rent at the fixed charge and farmers will operate machinery by themselves or the contract-base tractor services with the rented machinery will be rendered to farmers with fixed rate of charge.

The economic costs of the selected machinery on the basis of the above contract-base services are estimated as shown in Table IV.3-35.

Table IV.3-35 Estimation on Machinery Cost

1. Annual Working Hours of Machinery per Unit

Item	Mechanized Area (x 1,000 ac)			Tractor		Powered Thresher	Powered Sprayer
	Plow	Disc Harrow	Total	Disc Harrow	Total		
(1) Required number of units in the project	1,714	1,714	1,714			85.7	4,284
(2) Total Acre-turn							
i) Sorghum	38.6	77.2	115.8				38.6
ii) Rice	85.7	171.4	257.1			85.7	85.7
iii) Oilseeds (K)	60.0	120.0	180.0				60.0
iv) Pulses (K)	51.4	102.8	154.2			51.4	51.4
v) Others (K)	21.4	42.8	64.2				21.4
vi) Wheat	145.7	291.4	437.1			145.7	145.7
vii) Oilseed (R)	55.7	111.4	167.1				55.7
viii) Pulses (R)	34.3	68.6	102.9			34.3	34.3
ix) Fodders (R)	21.4	42.8	64.2				21.4
Total	<u>514.2</u>	<u>1,028.4</u>	<u>1,542.6</u>			<u>317.1</u>	<u>514.2</u>
(3) Ave. Acre-turn per Unit [(2)+(1)]	300	600	900			370	120
(4) Working Hours per Acre-turn	2.55	0.97	-			2.67	0.81
(5) Annual Working Hours per Unit [(3)x(4)]	<u>765</u>	<u>582</u>	<u>765+582=1,347</u>			<u>988</u>	<u>97</u>

2 Fixed Cost per Working Hour

Machinery	Unit Price (Rs.)	Durable Year (year)	Fixed Cost per Unit			Annual Working Hours per Unit (hr)	Cost per Hour (Rs./hr)
			Depreciation (Rs.)	Repair ^{1/} (Rs.)	Others ^{3/} (Rs.)		
(1) Tractor							
- Tractor (50-60HP class)	95,230	8	10,713 (7%)	6,666	952	18,331	13.61
- Plow (16" x 3)	4,000	5	720 (4%)	160.	40	920	1.20
- Disc harrow (24" x 8 x 2)	7,400	5	1,332 (4%)	296	74	1,702	2.92
(2) Power thresher (7-8PS, Throw-in Type)	25,000	8	2,813 (3%)	750	281	3,844	3.89
(3) Power sprayer (30L/min, 2.4PS)	9,000	5	1,620 (4%)	360	90	2,070	7.11

Note: 1/ Unit price $\times 0.9 \div$ durable year (source of price : AMD)

2/ Unit price \times the percents in parenthesis

3/ Unit price $\times 0.01$

3 Variable Cost per Acre-turn

Operation	Machinery	Fuel Consumption			Unit Price (Rs./ℓ)	Fuel Cost (Rs./ac)	Fuel Cost Inclusive of Oil (Rs./ac)
		Op. Hours (hr)	Fuel Con- sumption Rate (ℓ/hr)	Amount (ℓ)			
(1) Plowing	Tractor+ Mould Plow	2.55	D 5.5	23.97	4.27	102.35	133.06
(2) Soil Breaking (Cross-wise)	Tractor+Harrow	0.97	D 4.5	4.3	4.27	18.36	23.87
(3) Threshing	Power Thresher	2/ 3/ 2.67 1.34	D 2.0	2/ 3/ 5.34 2.68	4.27	2/ 3/ 22.80 11.44	2/ 3/ 29.64 14.89
(4) Sprayer	Power Sprayer	0.81	D 1.0	0.8	4.27	3.42	4.10

Note: 1/ Fuel cost × 1.3

2/ Cost for paddy

3/ Cost for pulses

4 Machinery Cost by Operation

Operation	Machinery	Op. Hours per Acre-turn (hr/ac)	Per Hours (Rs./hr)	Fixed Cost ^{3/} Acre-turn (Rs./ac)	(1)	(2)	(3)=(1)+(2)	(4) ^{4/}	(5)=(3)+(4)	Total Cost
					(Rs./ac)	Variable Cost (Rs./ac)	Machinery Cost (Rs./ac)	Operator Cost (Rs./ac)		
(1) Plowing	Tractor+ Disc Plow	2.55	(T) 13.61	34.71						
			(P) 1.20	3.06						
			(Total)	37.77	133.06	170.83	11.17	182.00 ^{1/}		
(2) Soil Breaking	Tractor+ Disc Harrow	0.97	(T) 13.61	13.20						
			(D.H) 2.92	2.83						
			(Total)	16.03	23.87	39.90	4.24	44.14 ^{1/}		
(3) Threshing	Power Thresher	5/ 2.67	5/ 3.89	5/ 10.39	5/ 29.64	5/ 40.03			5/ 40.03 ^{2/}	
		6/ 1.34	6/ 5.21	6/ 14.89	6/ 20.10	6/ 20.10			6/ 20.10 ^{2/}	
			7.11	5.76 ^{2/}	4.10	9.86			9.86 ^{2/}	
(4) Spraying	Power Sptayer	0.81								

Note: 1/ Operation charge in the contracted base

2/ Rental fee 3/ (T): Tractor, (P): Plow, (D.H): Disc Harrow

4/ Calculated as ope hours per acre-turn × Rs.35/8 hours (day)

5/ Cost for paddy

6/ Cost for Pulser

Table IV.3-37 Requirement of Farm Labour and Animal Power
(with Mechanization)

Item	(unit: day/ac)												Total
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	
A. Labor													
1. Sorghum						3.3	9.1	4.4	0.7	3.1	5.8	4.0	30.4
2. Rice						6.5	16.4	3.4	1.9	6.5	1.2	0.9	36.8
3. Oilseeds (Kharif)							1.1	10.5	6.2	2.8	5.7	8.1	34.4
4. Pulses (Kharif)						3.2	7.2	4.9	4.7	5.1	1.9	2.9	29.9
5. Others (Kharif)	14.8	3.0	9.4	2.6	3.0	3.3	1.6	1.4	1.4	1.0	5.9	14.7	62.1
6. Wheat	0.7	1.4	1.6	5.2	2.8					1.6	2.9	2.1	18.3
7. Oilseeds (Rabi)	2.3	8.0	5.8							3.9	6.1	3.3	29.4
8. Pulses (Rabi)	0.2	0.2	4.5	4.8	0.2					3.0	5.8	2.7	21.4
9. Fodders	5.0	5.0	5.0							5.1	5.3	5.0	30.4
B. Animal													
1. Sorghum						1.4	3.4	1.2		0.4	1.0	0.6	7.5
2. Rice						1.3	3.3	0.2	0.2	1.1	0.4		6.5
3. Oilseeds (Kharif)							0.4	2.7	1.8	0.6	1.4	1.1	8.0
4. Pulses (Kharif)							2.4	1.2	0.9	0.4	0.4	0.5	7.0
5. Others (Kharif)	3.1	0.7	2.8	0.5	0.5	0.6	0.1			0.9	1.3	3.9	13.5
6. Wheat										0.9	1.5	1.1	5.5
7. Oilseeds (Rabi)	0.4	2.1	1.5							1.5	1.9	0.6	8.0
8. Pulses (Rabi)										1.6	1.9		5.0
9. Fodders	0.7	0.7	0.7							2.6	2.1	0.7	7.5

Table IV.3-38 Labour Requirement, Sorghum

Operation	W/O Project, Present		W/Project, Future		W/Project, Future		(Unit: day/ac)	
	Man-day	Animal-day	Man-day	Animal-day	Man-day	Animal-day	Man-day	Machinery
1. Seed-bedding								
a. Land Preparation/Sowing	-	-	-	-	-	-	-	-
b. Care of Seedings	-	-	-	-	-	-	-	-
Sub-total	-	-	-	-	-	-	-	-
2. Land Preparation								
a. Cleaning/Bund Mending			1.5		1.5			
b. Plowing	(1x)2.0	2.0	(1x)2.0	2.0	(1x)0.3			0.3
c. Breaking/Harrowing	(1x)1.5	1.5	(1x)1.5	1.5	(2x)0.1			0.1
d. Final Harrowing/Leveling	(3x)1.5	1.5	(3x)1.5	1.5	2.0			
Sub-total	7.5	6.0	7.5	6.0	3.9			0.4
3. Planting								
a. Pulling/Deliver of Seedlings	0.5	0.5	0.5	0.5	0.5			
b. Furrowing/Planting/Thinning	2.0	1.0	3.5	1.0	3.5			
Sub-total	2.5	1.5	4.0	1.5	4.0			
4. Fertilizing								
a. Basal Fertilizers	1.0	0.5	1.0	0.5	1.0			
b. Top-dressing	-	-	-	-	-			
Sub-total	1.0	0.5	1.0	0.5	1.0			
5. Pest Control								
a. Cultivation/Weeding	-	-	(2x)1.0	0.5	1.0			
b. Irrigation/Drainage	-	-	(2x)4.5	1.5	(3x)4.5			0.2
c. Harvesting	(4x)2.0	-	(4x)2.0	-	2.0			
Sub-total								
6. Reaping/Plucking/Bundling	4.0	-	5.0	-	5.0			
7. Hauling/Piling	2.0	1.5	2.5	1.5	2.5			
8. Threshing/Winnowing	3.0	-	3.5	-	3.5			
Sub-total	9.0	1.5	11.0	1.5	11.0			
9. Post Harvesting								
a. Drying	-	-	-	-	-			
b. Sacking/Piling/Delivery	1.5	0.5	1.5	0.5	1.5			
Sub-total	1.5	0.5	1.5	0.5	1.5			
10. Total	23.5	10.0	32.5	11.5	28.9			0.6

Table IV.3-39 Labour Requirement, Rice

Operation	W/O Project, Present		W/Project, Future		W/Project, Future		(Unit: day/ac)	
	Man-day	Animal-day	Man-day	Animal-day	Man-day	Animal-day	Man-day	Machinery
1. Seed-bedding								
a. Land Preparation/Sowing	1.0	1.0	1.0	1.0	1.0	1.0	1.0	-
b. Care of Seedings	0.5	-	0.5	-	0.5	-	0.5	-
Sub-total	<u>1.5</u>	<u>1.0</u>	<u>1.5</u>	<u>1.0</u>	<u>1.5</u>	<u>1.0</u>	<u>1.5</u>	<u>1.0</u>
2. Land Preparation								
a. Cleaning/Bund Mending	1.5	-	1.5	-	1.5	-	1.5	-
b. Plowing	(1x)2.0	2.0	(1x)2.0	2.0	(1x)0.3	-	(1x)0.3	0.3
c. Breaking/Harrowing	(2x)3.0	3.0	(2x)3.0	3.0	(2x)0.1	-	(2x)0.1	0.1
d. Final Harrowing/Leveling	(2x)1.0	1.0	(2x)1.0	1.0	3.0	-	3.0	-
Sub-total	<u>7.5</u>	<u>6.0</u>	<u>7.5</u>	<u>6.0</u>	<u>4.9</u>	<u>3.0</u>	<u>3.0</u>	<u>0.4</u>
3. Planting								
a. Pulling/Deliver of Seedlings	2.5	0.5	3.0	0.5	3.0	0.5	3.0	-
b. Furrowing/Planting/Thinning	6.0	-	8.0	-	8.0	-	8.0	-
Sub-total	<u>8.5</u>	<u>0.5</u>	<u>11.0</u>	<u>0.5</u>	<u>11.0</u>	<u>0.5</u>	<u>0.5</u>	<u>-</u>
4. Fertilizing								
a. Basal Fertilizers	0.5	0.5	0.5	0.5	0.5	0.5	0.5	-
b. Top-dressing	0.5	-	0.5	-	0.5	-	0.5	-
Sub-total	<u>1.0</u>	<u>0.5</u>	<u>1.0</u>	<u>0.5</u>	<u>1.0</u>	<u>0.5</u>	<u>0.5</u>	<u>-</u>
5. Pest Control	1.0	-	(3x)1.5	-	(3x)1.5	-	(3x)1.5	0.3
6. Cultivation/Weeding	1.0	-	3.0	-	3.0	-	3.0	-
7. Irrigation/Drainage	7.0	-	(14x)7.0	-	(14x)7.0	-	(14x)7.0	-
8. Harvesting								
a. Reaping/Plucking/Bundling	6.0	-	6.0	-	6.0	-	6.0	-
b. Hauling/Piling	1.0	1.0	1.5	1.0	1.5	1.0	1.5	1.0
c. Threshing/Winnowing	4.5	2.5	5.0	3.0	2.0	-	2.0	0.5
Sub-total	<u>11.5</u>	<u>3.5</u>	<u>12.5</u>	<u>4.0</u>	<u>9.5</u>	<u>1.0</u>	<u>9.5</u>	<u>0.5</u>
9. Post Harvesting								
a. Drying	-	-	-	-	-	-	-	-
b. Sacking/Piling/Delivery	1.5	0.5	1.5	0.5	1.5	0.5	1.5	0.5
Sub-total	<u>1.5</u>	<u>0.5</u>	<u>1.5</u>	<u>0.5</u>	<u>1.5</u>	<u>0.5</u>	<u>1.5</u>	<u>0.5</u>
10. Total	<u>40.5</u>	<u>12.0</u>	<u>46.5</u>	<u>12.5</u>	<u>40.8</u>	<u>6.5</u>	<u>40.8</u>	<u>1.2</u>

Table IV.3-40 Labour Requirement, Kharif Oilseeds(Sunflower)

Operation	W/O Project, Present		W/Project, Future		W/Project, Future		(Unit: day/ac)
	Man-day	Animal-day	Man-day	Animal-day	Man-day	Animal-day	
1. Seed-bedding	-	-	-	-	-	-	-
a. Land Preparation/Sowing	-	-	-	-	-	-	-
b. Care of Seedings	-	-	-	-	-	-	-
Sub-total	-	-	-	-	-	-	-
2. Land Preparation	1.5	-	1.5	-	-	-	-
a. Cleaning/Bund Mending	(1x)2.0	-	(1x)0.3	-	-	-	0.3
b. Plowing	(2x)3.0	-	(2x)0.1	-	-	-	0.1
c. Breaking/Harrowing	(2x)1.0	-	2.0	-	2.0	-	-
d. Final Harrowing/Leveling	7.5	6.0	3.9	2.0	2.0	-	0.4
Sub-total	-	-	-	-	-	-	-
3. Planting	-	-	-	-	-	-	-
a. Pulling/Deliver of Seedlings	7.5	1.0	7.5	1.0	1.0	-	-
b. Furrowing/Planting/Thinning	7.5	1.0	7.5	1.0	1.0	-	-
Sub-total	-	-	-	-	-	-	-
4. Fertilizing	0.5	0.5	0.5	0.5	0.5	-	-
a. Basal Fertilizers	0.5	-	0.5	-	-	-	-
b. Top-dressing	1.0	0.5	1.0	0.5	0.5	-	-
Sub-total	(2x)1.0	-	(2x)1.0	-	-	-	-
5. Pest Control	4.0	2.0	4.0	2.0	2.0	-	0.3
6. Cultivation/Weeding	(8x)4.0	-	(8x)4.0	-	-	-	-
7. Irrigation/Drainage	-	-	-	-	-	-	-
8. Harvesting	5.0	-	5.0	-	-	-	-
a. Reaping/Plucking/Bundling	1.5	1.0	1.5	1.0	1.0	-	-
b. Hauling/Piling	5.0	-	5.0	-	-	-	-
c. Threshing/Winnowing	11.5	1.0	11.5	1.0	1.0	-	-
Sub-total	-	-	-	-	-	-	-
9. Post Harvesting	1.5	0.5	1.5	0.5	0.5	-	-
a. Drying	1.5	0.5	1.5	0.5	0.5	-	-
b. Sacking/Piling/Delivery	38.0	11.0	34.4	7.0	7.0	-	0.7
Sub-total	-	-	-	-	-	-	-
10. Total	-	-	-	-	-	-	-

Table IV.3-42 Labour Requirement, Sugarcane (Plant) and Others

Operation	W/O Project, Present		W/Project, Future		W/Project, Future		(Unit: day/ac)
	Man-day	Animal-day	Man-day	Animal-day	Man-day	Animal-day	
1. Seed-bedding	-	-	-	-	-	-	-
a. Land Preparation/Sowing	-	-	-	-	-	-	-
b. Care of Seedings	-	-	-	-	-	-	-
Sub-total	-	-	-	-	-	-	-
2. Land Preparation	1.5	-	1.5	-	1.5	-	-
a. Cleaning/Bund Mending	(1x)2.0	2.0	(1x)2.0	2.0	(1x)0.3	-	0.3
b. Plowing	(2x)3.0	3.0	(2x)3.0	3.0	(2x)0.1	-	0.1
c. Breaking/Harrowing	(2x)1.0	1.0	(2x)1.0	1.0	(2x)1.0	1.0	-
d. Final Harrowing/Leveling	7.5	6.0	7.5	6.0	2.9	1.0	0.4
Sub-total	18.0	18.0	18.0	18.0	18.0	3.0	-
3. Planting	2.0	1.0	2.0	1.0	2.0	1.0	-
a. Pulling/Deliver of Seedlings	16.0	2.0	16.0	2.0	16.0	2.0	-
b. Furrowing/Planting/Thinning	18.0	3.0	18.0	3.0	18.0	3.0	-
Sub-total	36.0	6.0	36.0	6.0	36.0	6.0	-
4. Fertilizing	1.0	1.0	6.0	2.5	6.0	2.5	-
a. Basal Fertilizers	0.5	0.5	0.5	0.5	0.5	0.5	-
b. Top-dressing	1.5	1.5	6.5	3.0	6.5	3.0	-
Sub-total	2.5	3.0	13.0	6.0	13.0	6.0	0.3
5. Pest Control	1.0	-	(3x)2.0	-	(3x)2.0	-	-
6. Cultivation/Weeding	6.0	2.0	6.0	2.0	6.0	2.0	-
7. Irrigation/Drainage	10.0	-	10.0	-	10.0	-	-
8. Harvesting	20.0	15.0	25.0	-	25.0	-	-
a. Reaping/Plucking/Bundling	2.0	2.0	4.0	4.0	4.0	4.0	-
b. Hauling/Piling	-	-	-	-	-	-	-
c. Threshing/Wimowing	22.0	17.0	29.0	4.0	29.0	4.0	-
Sub-total	22.0	17.0	29.0	4.0	29.0	4.0	-
9. Post Harvesting	-	-	-	-	-	-	-
a. Drying	10.0	8.0	10.0	5.0	10.0	5.0	-
b. Sacking/Piling/Delivery	10.0	8.0	10.0	5.0	10.0	5.0	-
Sub-total	20.0	16.0	20.0	10.0	20.0	10.0	-
10. Total	76.0	57.5	89.0	23.0	84.4	18.0	0.7

Table IV.3-43 Labour Requirement, Sugarcane (Ratoon) and Others

Operation	W/O Project, Present		W/Project, Future		W/Project, Future		(Unit: day/ac)	
	Man-day	Animal-day	Man-day	Animal-day	Man-day	Animal-day	Man-day	Machinery
1. Seed-bedding	-	-	-	-	-	-	-	-
a. Land Preparation/Sowing	-	-	-	-	-	-	-	-
b. Care of Seedings	-	-	-	-	-	-	-	-
Sub-total	-	-	-	-	-	-	-	-
2. Land Preparation	-	-	-	-	-	-	-	-
a. Cleaning/Bund Mending	-	-	-	-	-	-	-	-
b. Plowing	(1x)5.0	2.0	(1x)5.0	5.0	(1x)0.3	-	-	0.3
c. Breaking/Harrowing	-	-	-	-	-	-	-	-
d. Final Harrowing/Leveling	-	-	-	-	-	-	-	-
Sub-total	5.0	2.0	5.0	5.0	0.3	-	-	0.3
3. Planting	-	-	-	-	-	-	-	-
a. Pulling/Deliver of Seedlings	-	-	-	-	-	-	-	-
b. Furrowing/Planting/Thinning	-	-	-	-	-	-	-	-
Sub-total	-	-	-	-	-	-	-	-
4. Fertilizing	-	-	-	-	-	-	-	-
a. Basal Fertilizers	1.0	1.0	1.0	1.0	1.0	1.0	1.0	-
b. Top-dressing	0.5	-	0.5	0.5	0.5	0.5	0.5	-
Sub-total	1.5	1.0	1.5	1.5	1.5	1.5	1.5	-
5. Pest Control	-	-	(3x)2.0	-	(3x)2.0	-	-	0.2
6. Cultivation/Weeding	6.0	-	6.0	2.0	6.0	2.0	2.0	0.3
7. Irrigation/Drainage	9.0	-	(18x)9.0	-	(18x)9.0	-	-	-
8. Harvesting	-	-	-	-	-	-	-	-
a. Reaping/Plucking/Bundling	15.0	-	20.0	-	20.0	-	-	-
b. Hauling/Piling	2.0	2.0	4.0	4.0	4.0	4.0	4.0	-
c. Threshing/Winnowing	-	-	-	-	-	-	-	-
Sub-total	17.0	2.0	24.0	4.0	24.0	4.0	4.0	-
9. Post Harvesting	-	-	-	-	-	-	-	-
a. Drying	-	-	-	-	-	-	-	-
b. Sacking/Piling/Delivery	8.0	4.0	8.0	4.0	8.0	4.0	4.0	-
Sub-total	8.0	4.0	8.0	4.0	8.0	4.0	4.0	-
10. Total	46.5	9.0	55.5	16.5	50.8	11.5	11.5	0.8

Table IV.3-44 Labour Requirement, Wheat

Operation	W/O Project, Present		W/Project, Future		W/Project, Future		(Unit: day/ac)	
	Man-day	Animal-day	Man-day	Animal-day	Man-day	Animal-day	Man-day	Machinery
1. Seed-bedding	-	-	-	-	-	-	-	-
a. Land Preparation/Sowing	-	-	-	-	-	-	-	-
b. Care of Seedings	-	-	-	-	-	-	-	-
Sub-total	-	-	-	-	-	-	-	-
2. Land Preparation	1.5	1.5	1.5	1.5	1.5	1.5	1.5	0.3
a. Cleaning/Bund Mending	(1x)2.0	2.0	(1x)2.0	2.0	(1x)0.3	0.3	(1x)0.3	0.1
b. Plowing	(3x)4.5	4.5	(3x)4.5	4.5	(2x)0.1	0.1	(2x)0.1	-
c. Breaking/Harrowing	(2x)1.0	1.0	(2x)1.0	1.0	2.0	2.0	2.0	-
d. Final Harrowing/Leveling	9.0	7.5	9.0	7.5	3.9	2.0	2.0	0.4
Sub-total	9.0	7.5	9.0	7.5	3.9	2.0	2.0	0.4
3. Planting	0.5	0.5	0.5	0.5	0.5	0.5	0.5	-
a. Pulling/Deliver of Seedlings	0.5	0.5	0.5	0.5	0.5	0.5	0.5	-
b. Furrowing/Planting/Thinning	2.0	1.0	2.0	1.0	2.0	1.0	2.0	-
Sub-total	2.5	1.5	2.5	1.5	2.5	1.5	2.5	-
4. Fertilizing	1.0	0.5	1.0	0.5	1.0	0.5	1.0	-
a. Basal Fertilizers	1.0	0.5	1.0	0.5	1.0	0.5	1.0	-
b. Top-dressing	-	-	0.5	-	0.5	-	0.5	-
Sub-total	1.0	0.5	1.5	0.5	1.5	0.5	1.5	-
5. Pest Control	-	-	1.0	-	1.0	-	1.0	-
6. Cultivation/Weeding	-	-	-	-	-	-	-	-
7. Irrigation/Drainage	-	-	-	-	-	-	-	-
8. Harvesting	(6x)3.0	-	(7x)4.0	-	(7x)4.0	-	(7x)4.0	-
a. Reaping/Plucking/Bundling	4.0	-	5.0	-	5.0	-	5.0	-
b. Hauling/Piling	1.5	1.0	1.5	1.0	1.5	1.0	1.0	-
c. Threshing/Winnowing	3.0	1.5	4.0	3.0	2.0	1.0	2.0	0.5
Sub-total	8.5	2.5	10.5	4.0	8.5	1.0	8.5	0.5
9. Post Harvesting	-	-	-	-	-	-	-	-
a. Drying	-	-	-	-	-	-	-	-
b. Sacking/Piling/Delivery	1.5	0.5	1.5	0.5	1.5	0.5	1.5	-
Sub-total	1.5	0.5	1.5	0.5	1.5	0.5	1.5	-
10. Total	25.5	12.5	30.0	14.0	22.9	5.5	22.9	0.9

Table IV.3-45 Labour Requirement, Rabi Oilseeds (Mustard)

Operation	W/O Project, Present		W/Project, Future		W/Project, Future, W/Machinery		(Unit: day/ac)
	Man-day	Animal-day	Man-day	Animal-day	Man-day	Animal-day	
1. Seed-bedding	-	-	-	-	-	-	-
a. Land Preparation/Sowing	-	-	-	-	-	-	-
b. Care of Seedings	-	-	-	-	-	-	-
Sub-total	-	-	-	-	-	-	-
2. Land Preparation	1.5	-	1.5	-	1.5	-	-
a. Cleaning/Bund Mending	(1x)2.0	2.0	(1x)2.0	2.0	(1x)0.3	-	0.3
b. Plowing	(2x)3.0	3.0	(2x)3.0	3.0	(2x)0.1	-	0.1
c. Breaking/Harrowing	(2x)1.0	1.0	(2x)1.0	1.0	2.0	-	-
d. Final Harrowing/Leveling	7.5	6.0	7.5	6.0	3.9	2.0	0.4
Sub-total	12.0	12.0	12.0	12.0	7.7	2.0	0.4
3. Planting	-	-	-	-	-	-	-
a. Pulling/Deliver of Seedlings	1.5	0.5	1.5	0.5	1.5	0.5	-
b. Furrowing/Planting/Thinning	1.5	0.5	1.5	0.5	1.5	0.5	-
Sub-total	3.0	1.0	3.0	1.0	3.0	1.0	-
4. Fertilizing	1.0	0.5	1.0	0.5	1.0	0.5	-
a. Basal Fertilizers	-	-	0.5	-	0.5	-	-
b. Top-dressing	1.0	0.5	1.5	0.5	1.5	0.5	-
Sub-total	1.0	0.5	1.5	0.5	1.5	0.5	-
5. Pest Control	-	-	(2x)1.0	-	(2x)1.0	-	0.2
6. Cultivation/Weeding	-	-	5.0	2.0	5.0	2.0	-
7. Irrigation/Drainage	3.0	-	4.0	-	4.0	-	-
8. Harvesting	3.0	-	5.0	-	5.0	-	-
a. Reaping/Plucking/Bundling	1.5	0.5	1.5	0.5	1.5	0.5	-
b. Hauling/Piling	4.0	2.0	4.5	2.0	4.5	2.0	-
c. Threshing/Winnowing	8.5	2.5	11.0	2.5	11.0	2.5	-
Sub-total	15.5	5.0	21.0	5.0	21.0	5.0	-
9. Post Harvesting	-	-	-	-	-	-	-
a. Drying	1.5	0.5	1.5	0.5	1.5	0.5	-
b. Sacking/Piling/Delivery	1.5	0.5	1.5	0.5	1.5	0.5	-
Sub-total	3.0	1.0	3.0	1.0	3.0	1.0	-
10. Total	33.0	10.0	33.0	12.0	29.4	8.0	0.6

Table IV.3-46 Labour Requirement, Rabi Pulses (Gram)

Operation	W/O Project, Present		W/Project, Future		W/Project, Future, W/Machinery		(Unit: day/ac)
	Man-day	Animal-day	Man-day	Animal-day	Man-day	Animal-day	
1. Seed-bedding	-	-	-	-	-	-	-
a. Land Preparation/Sowing	-	-	-	-	-	-	-
b. Care of Seedings	-	-	-	-	-	-	-
Sub-total	-	-	-	-	-	-	-
2. Land Preparation	1.5	-	1.5	-	1.5	-	-
a. Cleaning/Bund Mending	(1x)2.0	2.0	(1x)2.0	-	(1x)0.3	-	0.3
b. Plowing	(2x)3.0	3.0	(2x)3.0	-	(2x)0.1	-	0.1
c. Breaking/Harrowing	1.0	1.0	1.0	-	2.0	-	-
d. Final Harrowing/Leveling	7.5	6.0	7.5	-	3.9	-	0.4
Sub-total	12.0	12.0	12.0	-	7.7	-	0.7
3. Planting	-	-	-	-	-	-	-
a. Pulling/Deliver of Seedlings	2.0	1.0	2.0	-	2.0	-	-
b. Furrowing/Planting/Thinning	2.0	1.0	2.0	-	2.0	-	-
Sub-total	4.0	2.0	4.0	-	4.0	-	-
4. Fertilizing	1.0	0.5	1.0	-	1.0	-	-
a. Basal Fertilizers	-	-	-	-	-	-	-
b. Top-dressing	1.0	0.5	1.0	-	1.0	-	-
Sub-total	1.0	0.5	1.0	-	1.0	-	-
5. Pest Control	-	-	-	-	-	-	-
6. Cultivation/Weeding	-	-	-	-	-	-	-
7. Irrigation/Drainage	1.0	-	1.0	-	1.0	-	-
8. Harvesting	3.0	-	4.0	-	4.0	-	-
a. Reaping/Plucking/Bundling	1.5	0.5	2.0	-	2.0	-	-
b. Hauling/Piling	3.5	2.0	5.0	-	2.0	-	0.5
c. Threshing/Winnowing	8.0	2.5	11.0	-	8.0	-	0.5
Sub-total	13.0	5.0	17.0	-	14.0	-	1.0
9. Post Harvesting	-	-	-	-	-	-	-
a. Drying	1.5	0.5	1.5	-	1.5	-	-
b. Sacking/Piling/Delivery	1.5	0.5	1.5	-	1.5	-	-
Sub-total	3.0	1.0	3.0	-	3.0	-	-
10. Total	21.0	10.5	28.0	-	21.4	-	0.9

Table IV.3-47 Labour Requirement, Fodders (Berseem) and Others

Operation	W/O Project, Present		W/Project, Future		W/Project, Future		(Unit: day/ac)
	Man-day	Animal-day	Man-day	Animal-day	Man-day	Animal-day	
1. Seed-bedding	-	-	-	-	-	-	-
a. Land Preparation/Sowing	-	-	-	-	-	-	-
b. Care of Seedings	-	-	-	-	-	-	-
Sub-total	-	-	-	-	-	-	-
2. Land Preparation	1.5	-	1.5	-	1.5	-	-
a. Cleaning/Bund Mending	(1x)2.0	2.0	(1x)2.0	2.0	(1x)0.3	-	0.3
b. Plowing	(1x)1.5	1.5	(1x)1.5	1.5	(2x)0.1	-	0.1
c. Breaking/Harrowing	(2x)1.0	1.0	(2x)1.0	1.0	2.0	2.0	-
d. Final Harrowing/Leveling	6.0	4.5	6.0	4.5	3.9	2.0	0.4
Sub-total	11.0	9.0	11.0	9.0	7.9	4.0	0.4
3. Planting	-	-	-	-	-	-	-
a. Pulling/Deliver of Seedlings	2.0	1.0	2.0	1.0	2.0	1.0	-
b. Furrowing/Planting/Thinning	2.0	1.0	2.0	1.0	2.0	1.0	-
Sub-total	4.0	2.0	4.0	2.0	4.0	2.0	-
4. Fertilizing	1.0	0.5	1.0	0.5	1.0	0.5	-
a. Basal Fertilizers	-	-	0.5	-	0.5	-	-
b. Top-dressing	1.0	0.5	1.5	0.5	1.5	0.5	-
Sub-total	1.0	0.5	1.5	0.5	1.5	0.5	-
5. Pest Control	-	-	-	-	-	-	-
6. Cultivation/Weeding	-	-	-	-	-	-	-
7. Irrigation/Drainage	(14x)7.0	-	(17x)9.0	-	9.0	-	-
8. Harvesting	8.0	-	10.0	-	10.0	-	-
a. Reaping/Plucking/Bundling	3.0	3.0	5.0	4.0	5.0	4.0	-
b. Hauling/Piling	-	-	-	-	-	-	-
c. Threshing/Winnowing	11.0	3.0	15.0	4.0	15.0	4.0	-
Sub-total	11.0	3.0	15.0	4.0	15.0	4.0	-
9. Post Harvesting	-	-	-	-	-	-	-
a. Drying	-	-	-	-	-	-	-
b. Sacking/Piling/Delivery	-	-	-	-	-	-	-
Sub-total	-	-	-	-	-	-	-
10. Total	27.0	9.0	33.5	10.0	31.4	7.5	0.4

Table IV.3-48 Labour Requirement per 1000 Acres of Command Area.

Crop	Area (ac)	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Total
A W/O Mechanization														
1 Sorgham	27						126.9	288.9	94.5	18.9	83.7	156.6	108.0	877.5
2 Rice	60						426.0	1,110.0	204.0	114.0	708.0	156.0	72.0	2,790.0
3 Oilseeds(K)	42						75.6	533.4	289.8	117.6	348.6	231.0		1,596.0
4 Pulses	36						165.6	338.4	176.4	172.8	208.8	111.6	122.4	1,296.0
5 Others	15	222.0	73.5	181.5	39.0	45.0	49.5	24.0	21.0	21.0	15.0	88.5	220.5	1,000.5
6 Wheat	102	71.4	142.8	163.2	867.0	459.0					346.8	601.8	408.0	3,060.0
7 Oilseeds(R)	39	89.7	312.0	226.2							222.3	308.1	128.7	1,287.0
8 Pulses(R)	24	4.8	4.8	132.0	139.2	4.8					124.8	196.8	64.8	672.0
9 Fodders(R)	15	75.0	75.0	75.0							91.5	88.5	75.0	480.0
Sub-total	360	462.9	608.1	777.9	1,045.2	508.8	768.0	1,836.9	1,029.3	616.5	1,918.5	2,056.5	1,430.4	13,059.0
B W/Mechanization														
1 Sorghum	63						207.9	535.5	220.5	44.1	195.3	365.4	252.0	1,820.7
2 Rice	140						910.0	2,310.0	476.0	266.0	1,330.0	238.0	196.0	5,726.0
3 Oilseeds(K)	98						107.8	1,029.0	607.6	274.4	558.6	793.8		3,571.2
4 Pulses	84						268.8	604.8	411.6	394.8	428.4	159.6	243.6	2,511.6
5 Others	35	518.0	105.0	329.0	91.0	105.0	115.5	56.0	49.0	49.0	35.0	206.5	514.5	2,173.5
6 Wheat	238	166.6	333.2	380.8	1,713.6	904.4					499.8	856.8	595.0	5,450.2
7 Oilseeds(R)	91	209.3	728.0	527.8							354.9	555.1	300.3	2,675.4
8 Pulses(R)	56	11.2	11.2	252.0	268.8	11.2					168.0	324.8	151.2	1,198.4
9 Fodders(R)	35	175.0	175.0	175.0							196.0	203.0	175.0	1,099.0
Sub-total	840	1,080.1	1,352.4	1,664.6	2,073.4	1,020.6	1,502.2	3,614.1	2,816.1	1,361.5	3,481.8	3,467.8	3,221.4	26,026.0
Total	1,200	1,543.0	1,960.5	2,442.5	3,118.6	1,529.4	2,270.2	5,451.0	3,215.4	1,978.0	5,500.3	5,524.3	4,651.8	39,085.0

Table IV.3-49 Draft Animal Requirement per 1000 Acres of Command Area.

Crop	Area (ac)	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Total
A W/O Mechanization														
1 Sorghum	27						86.4	145.8	24.3		10.8	27.0	16.2	310.5
2 Rice	60						120.0	336.0	12.0	12.0	198.0	54.0	18.0	750.0
3 Oilseeds(K)	42							50.4	214.2	109.2	25.2	33.6	29.4	462.0
4 Pulses(K)	36						100.8	172.8	43.2	32.4	14.4	14.4	18.0	396.0
5 Others(K)	15	46.5	42.0	87.0	7.5	7.5	9.0	1.5				19.5	58.5	279.0
6 Wheat	102		10.2	20.4	316.2	163.2				244.8		387.6	285.6	1,428.0
7 Oilseeds(R)	39	15.6	81.9	58.5						136.5		152.1	23.4	468.0
8 Pulses(R)	24			52.8	52.8	2.4				86.4		93.6		288.0
9 Fodders(R)	15	10.5	10.5	10.5						61.5		46.5	10.5	150.0
Sub-total	360	72.6	144.6	229.2	376.5	173.1	316.2	706.5	293.7	153.6	777.6	828.3	459.6	4,315.5
B W/Mechanization														
1 Sorghum	63						88.2	201.6	56.7		25.2	63.0	37.8	472.5
2 Rice	140						182.0	462.0	28.0	28.0	154.0	56.0		910.0
3 Oilseeds(K)	98							39.2	264.6	176.4	58.8	78.4	68.6	686.0
4 Pulses(K)	84						100.8	201.6	100.8	75.6	33.6	33.6	42.0	588.0
5 Others(K)	35	108.5	24.5	98.0	17.5	17.5	21.0	3.5				45.5	136.5	472.5
6 Wheat	238		23.8	47.6	261.8	142.8				214.2		357.0	261.8	1,309.0
7 Oilseeds(R)	91	36.4	191.1	136.5						136.5		172.9	54.6	728.0
8 Pulses(R)	56			39.2	5.6					89.6		106.4		280.0
9 Fodders(R)	35	24.5	24.5	24.5						91.0		73.5	24.5	262.5
Sub-total	840	169.4	263.9	345.8	318.5	165.9	392.0	907.9	450.1	280.0	802.9	986.3	625.8	5,708.5
Total	1,200	242.0	408.5	575.0	695.0	339.0	708.2	1,614.4	743.8	433.6	1,580.5	1,814.6	1,085.4	10,240.0

Table IV.3-50 Farm Labour Balance, with Project

Case	Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
1	Requirement ('000 man-days)	1,006	1,812	2,177	2,997	1,450	1,363	3,301	1,987	1,199	3,739	3,839	3,323
	Supply (min.*) Balance(%)	31.1	56.2	67.5	92.9	44.3	42.3	102.3	61.6	37.2	115.9	119.0	103.0
	Supply(Max.*) Balance(%)	24.9	44.8	53.8	74.1	35.3	33.7	81.6	49.1	29.6	92.4	94.9	82.1
2	Requirement ('000 man-days)	1,022	1,534	1,831	2,500	1,189	1,136	2,758	1,669	1,012	3,156	3,407	2,780
	Supply (min.*) Balance(%)	31.7	47.6	56.8	77.5	36.9	35.2	85.5	51.7	31.4	97.8	105.6	86.2
	Supply (Max.*) Balance(%)	25.3	37.9	45.3	61.8	29.4	28.1	68.2	41.3	25.0	78.0	84.2	68.7
3	Requirement ('000 man-days)	944	1,201	1,494	1,911	934	1,363	3,301	1,987	1,199	3,130	3,118	2,726
	Supply (Min.*) Balance(%)	29.3	37.2	46.3	59.2	29.0	42.3	102.3	61.6	37.2	97.0	96.7	84.5
	Supply (Max.*) Balance(%)	23.3	29.7	36.9	47.2	23.1	33.7	81.6	49.1	29.6	77.4	77.1	67.4

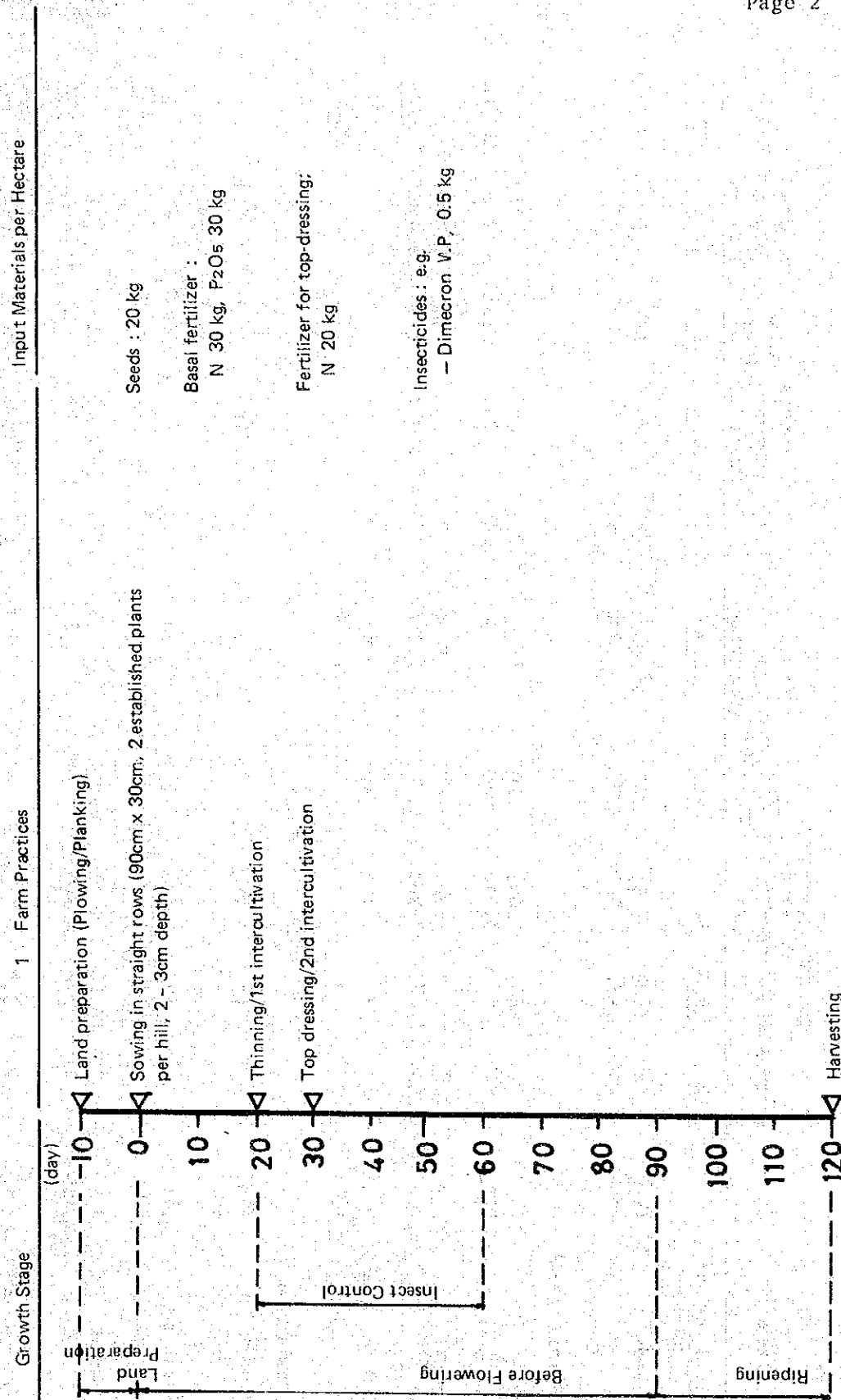
Note: *... The number of minimum and maximum farm labour supply are 3.23 and 4.05 million man-days per month, respectively.

Table IV.3-51 Requirement of Input Materials in the Project Area

Item	Unit	Sorghum	Rice	Oilseeds (Sunflower)	Pulses (Soybean)	Sugarcane & Others (Sugarcane)	Wheat	Oilseeds (Rapes & Mustard)	Pulses (Gram)	Fodders & Others (Berseem)	Total
Area (1,000ha)		22.3	49.5	34.7	29.7	12.4	84.2	32.2	19.8	12.4	297.2
1. Seeds	(kg) ton	(20) 446	(40) 1,980	(15) 521	(80) 2,376	(5,000) 62,000	(85) 7,157	(6) 193	(35) 693	(50) 620	
2. Fertilizers											
- N	(kg) ton	(50) 1,115	(100) 4,950	(100) 3,470	(20) 594	(170) 2,108	(120) 10,104	(60) 1,932	(30) 594	(20) 248	25,115
-P ₂ O ₅	(kg) ton	(30) 669	(60) 2,970	(60) 2,082	(60) 1,782	(100) 1,240	(90) 7,578	(60) 1,932	(60) 1,188	(120) 1,488	20,929
-K ₂ O	(kg) ton	(-) -	(-) -	(-) -	(40) 1,188	(100) 1,240	(-) -	(30) 966	(-) -	(-) -	3,394
3. Pesticides											
-Powder,WS	(kg) ton	(-) -	(-) -	(-) -	(-) -	(-) -	(-) -	(-) -	(-) -	(-) -	
-Granular	(kg) ton	(-) -	(-) -	(-) -	(-) -	(30.0) 372	(0.1) 8	(-) -	(4.0) 79	(-) -	459
-Liquid	(ℓ) 1,000ℓ	(0.5) 11	(3.6) 178	(3.0) 104	(2.0) 59	(3.0) 37	(-) -	(2.0) 64	(-) -	(-) -	453
4. Herbicides	(ℓ) 1,000ℓ	(-) -	(2.0) 99	(-) -	(-) -	(-) -	(-) -	(-) -	(-) -	(-) -	99

Note: The figures in the parenthesis shows the amount per hectare

Table IV.3-52 Farm Practices and Input Materials, Sorghum, with Project, in Future



Note : (1) Soil requirement : Deep Sandy Loam to Clay Loam, Well drained;

(2) Fertilizer requirement; 50 - 30 - 0 (kg/ha)

Table IV.3-53 Farm Practices and Input Materials, Rice, with Project, in Future

Growth Stage	Farm Practices	Inputs per Hectare
Nursery & Land Pre-paration	Start of land preparation (Plowing / Planking / Puddling) Sowing in the wet seedbed	Seeds: 40 kg Insecticides for seedbeds: e.g. Azodrin 20.2% EC, 0.12l Fertilizer for seedbeds: — N 14 kg, P2O5 14 kg, K2O 14 kg
Vegetative Growth	Transplanting in Strait row (20 cm x 20 cm, 3 seedlings per hill at the depth of 2 - 3 cm)	Basal fertilizer: — N 50 kg, P2O5 50 kg
Reproductive Growth	Start of weeding (by rotary & hand) First top-dressing Second top-dressing	Insecticides for seedlings treatment e.g. Fradan 2F Flowable 0.75l Herbicides: Hednal 40% EC 2.0l Insecticides: e.g. — Hopcin 50% EC, 1.25l (2x) — Hytox 50% WP, 1.5 kg (1x) Fertilizer for top-dressing: — First, N 25 kg — Second, N 25 kg
	Drainage	
	Harvesting	

Note: (1) Soil requirement: Loam - Clay Loam
(2) Fertilizer requirement: 100 - 60 - 0 (kg/ha)

Table IV.3 – 54 Farm Practices and Input Materials, Sunflower, with Project, in Future

Growth Stage	Farm Practices	Input Materials per Hectare
Land Preparation	Land preparation. (Plowing Harrowing/Planking)	
Vegetative Growth	Sowing in straight rows (hill seeding, 60cm x 30cm one plant per hill after thinning)	Seeds; 15 kg
Vegetative Growth	Thinning/1st intercultivation/Start of weeding	Basal fertilizer; N, 50 kg, P ₂ O ₅ 60 kg
Flower Initiation	2nd Intercultivation/Top-dressing	Fertilizer for top-dressing; N, 50 kg
Flower Initiation	Insect Control	Insecticides: e.g. - Diazinon 40% EC, 2.0ℓ (2x) - Malathion 50% EC, 1.0ℓ (1x)
Ripening	Harvesting	

Note : (1) Soil requirement: Sandy Loam – Clay Loam

(2) Fertilizer requirement : 100 – 60 – 0 (kg/ha)

Table IV.3 - 55 Farm Practices and Input Materials, Soybean, with Project, in Future

Growth Stage	Farm Practices	Inputs per Hectare
Land Preparation	Land preparation (Plowing/Harrowing/Leveling/Furrowing)	
Land	Sowing in straight rows (65cm x 2.5cm, in the depth of 3 - 4 cm)	Seeds; 80 kg
Before flowering	1st Intercultivation	Insecticides for seed treatment: e.g. ECP Powder, 1.8 kg
	2nd Intercultivation	Fertilizers: N 20 kg, P ₂ O ₅ 60 kg, K ₂ O 40 kg Compost: 20 - 25 ton
After flowering	3rd Intercultivation/Hand-weeding	Insecticides: e.g. Malathion 50% EC, 2.0ℓ
	Insect Control (1 - 2x)	
	Harvesting	

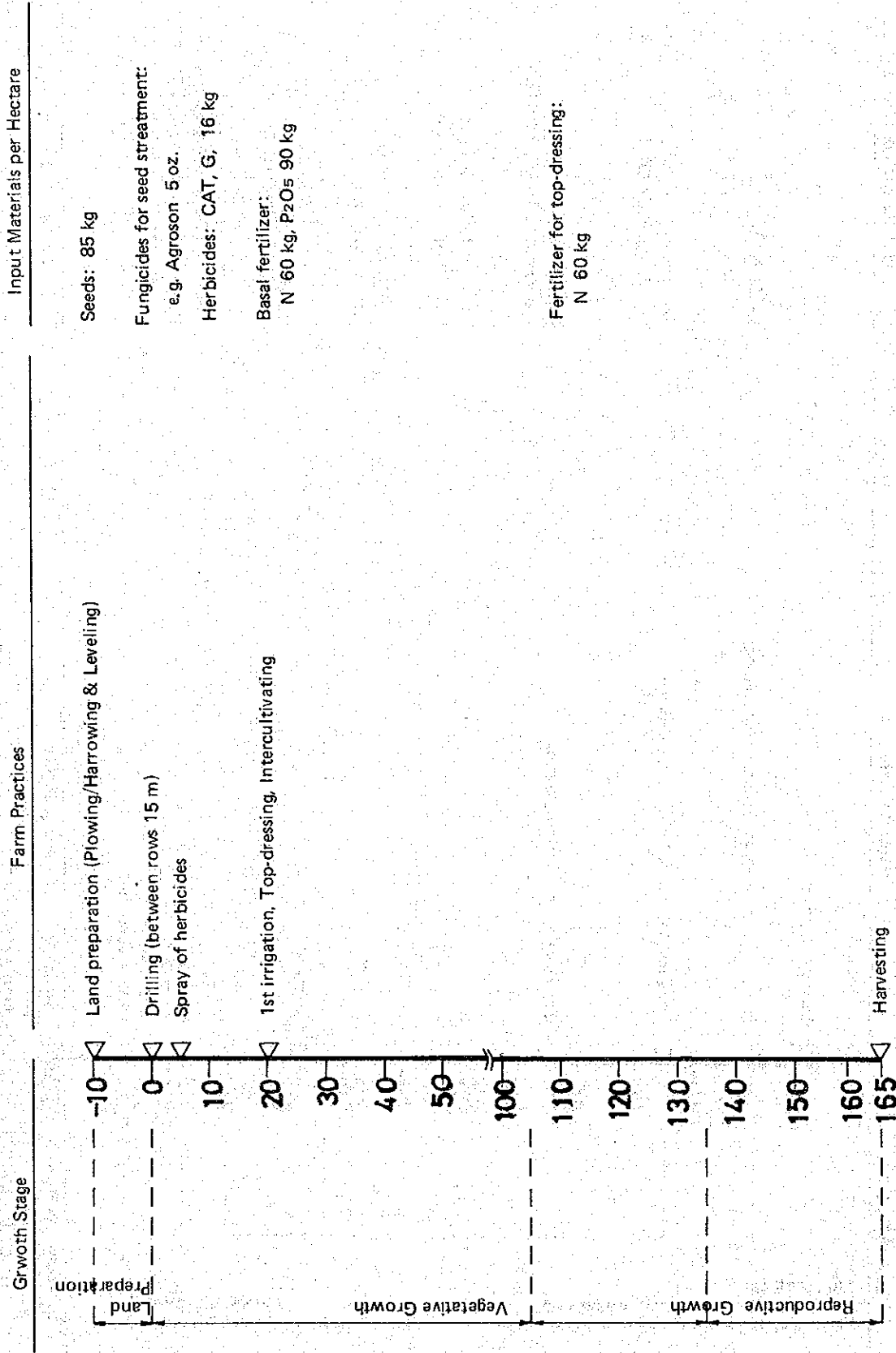
Note: (1) Soil requirement: Loam - Silty Clay Loam with high content of organic matter
(2) Fertilizer requirement: 20 - 60 - 40 (kg/ha)

Table IV.3 – 56 Farm Practice and Input Materials of Sugarcane, w/Project, in Future

Growth Stage		Farm Practices	Farm Input per Hectare
(month) -1 0 1 2 3 4 5 6 7 8 9 10 11 12	Land Preparation	Land preparation (Plowing/Harrowing/Furrowing)	Seeds: 5.0 ton F.Y.M: 60 ton
	Planting	Planting (120cm x 30cm, in furrow with 3 - lyed stick canes, 6 - 8 month-aged of new plant cane)	Fungicides for seed treatment; e.g. formative 1% Basal fertilizers; N 120 kg, P ₂ O ₅ 100 kg, K ₂ O 100 kg
	Sprouting	Complementary planting/1st Irrigation/Harrowing	
	Tillering (productive tillers)	Top-dressing, Interculturing & Earthing up	Fertilizer for top-dressing, N 50 kg
	Tillering (productive tillers)		Insecticides: e.g. - Dimecron 50% E.C. 3.0 l (2x) - Furadan 3G 3%, 30 kg (1x)
	Growth of Productive Tillers		
	Harvesting	Start of Harvesting	

Note: (1) Soil requirement: Silt Loam, Silty Clay Loam, Fine Sandy Loam, High content of organic matter, well drained, low water table, deep soil depth
(2) Fertilizer requirement: 170 - 100 - 100 (kg/ha)

Table IV.3 - 57 Farm Practices and Farm Inputs, Wheat, with Project, in Figure



Note: (1) Soil requirement: Loam to Clay Loam, Well drained
(2) Fertilizer requirement: 120 - 90 - 0 (kg/ha)

Table IV.3 - 58 Farm Practices and Farm Input Materials, Mustard, with Project, in Future

Growth Stage	Farm Practices	Input Materials per Hectare
Land Preparation	Land preparation	
Before Flowering	Sowing (interrow space, 30 cm, stripe seeding)	Seeds: 6 kg
	Thinning, 1st Intercultivation & Weeding	Fertilizers: N, 30 kg, P ₂ O ₅ 60kg
	Top-dressing, 2nd Intercultivation	Insecticides: e.g Malathion 50% EC, 2.0 l (2x)
After Flowering	Harvesting	Fertilizer for top-dressing: N, 30 kg

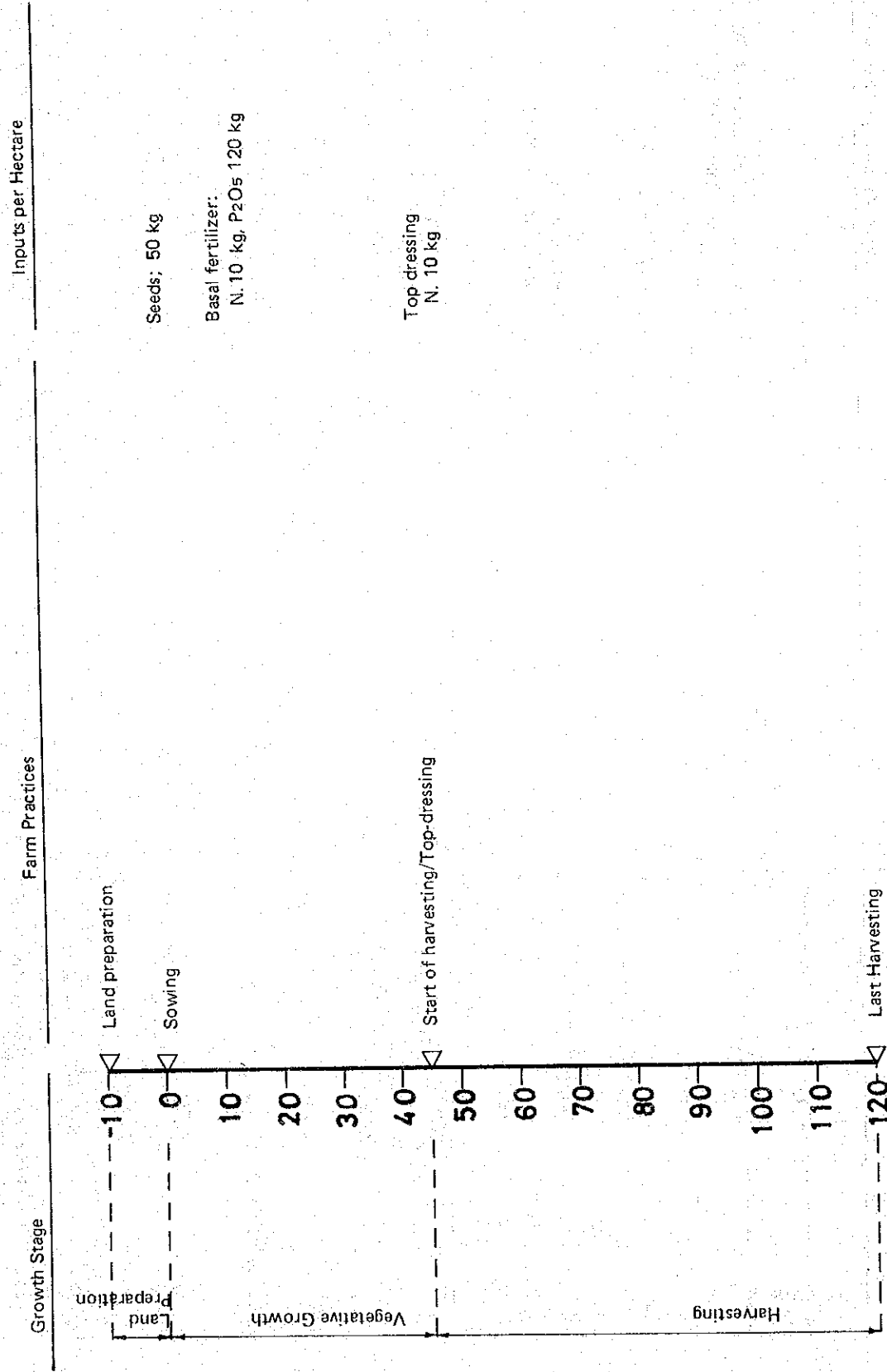
Note: (1) Soil requirement: Medium textured soils
(2) Fertilizer requirement: 60 - 60 - 30

Table IV.3 - 59 Farm Practices and Input Materials, Gram, with Project, in Future

Growth Stage	Farm Practices	Input Materials per Hectare
Land Preparation	Land preparation	
	Sowing	Seeds: 35 kg (row planting), 70 kg (broadcasting) 70 kg (broadcasting)
Vegetative	Weeding	Fertilizer: N 30 kg, P ₂ O ₅ 60 kg
		Insecticides: e.g. Sevin 85 W.P., 45 kg (2x)
Flowering		
Ripening		
	Harvesting	

Note: (1) Soil requirement: Loam to Clay Loam
(2) Fertilizer requirement: 30 - 60 - 0 (kg/ha)

Table IV.3-60 Farm Practices and Input Materials, Berseem, with Project, in Future



Note: (1) Soil requirement: Loam to Clay Loam
(2) Fertilizer requirement: 20-120-0

IV.3.6 Livestock Farming Plan

1. Introduction

The widening of Pat feeder canal and the related improvement of irrigation facilities will bring about the effective production of fodder crops throughout the year. Taking into account an increased production of fodder crops in the Project, a livestock farming plan has been formulated aiming at the following;

- (i) To produce meat and milk to meet the forecast demand of them in the entire Project Area as of the year 2000 with some 25 percent surplus for local markets in the surrounding areas
- (ii) To secure two head of bullock and one head of ass for each farm household. The assumed ratio of draft cattle and draft buffaloes is four to one.
- (iii) To determine the head of cattle and buffaloes in order to make possible the reproduction of the required draft animals in the Project Area. The production of meat and milk was estimated from the head so determined. The deficit in meat and milk production of cattle and buffaloes to the forecast demands would be covered by the production of sheep, goats and poultry birds.
- (iv) Feed would be self-made in the Project Area. By-products of crops and wild grasses will be used for livestock farming as much as possible.
- (v) The per capita and total demands of meat and milk are estimated as follows;

Item	Annual Consumption per Capita ^{1/}	Population			Total Demand
		Project Area	Outside ^{2/}	Total	
Meat	16 kg	420,000	105,000	525,000	8,400tons
Milk	64	420,000	105,000	525,000	33,600

Note: ^{1/} Forecast demand in the year 2000

^{2/} 25 percent of the forecast demand in the entire Project Area

2. Livestock Rearing Plan

(1) Cattle and Buffaloes

The required head of draft cattle and draft buffaloes as well as the head of cattle and buffaloes to be reared for the reproduction of draft cattle and buffaloes are calculated below. The meat and milk production resulting from the cattle and buffaloes rearing was also estimated below.

(i) Required head of draft cattle and buffaloes

Each farm household would rear two head of bullock for draft use. The workable years of the draft animal are assumed to be six years from three years old to eight years old.

Bullock (Cattle): 64,000 head

$38,000 \text{ farm households} \times 2 \text{ head} \times 0.8 \div 0.95^{*/}$

Bullock (Buffaloes): 16,000 head

$38,000 \text{ farm households} \times 2 \text{ head} \times 0.2 \div 0.95^{*/}$

Note: */ five percent of mortality

(ii) Required head of cows

The required head of cows for the reproduction of bullocks are computed as follows;

° Durable years, female: 5 years from 3 to 7 years old

° Annual birth rate, female: 70%

° Breeding cows, cattle: $30,500 \text{ head} (64,000 \text{ head} /$
 $6 \text{ years}) \div 0.5 \text{ (sex ratio)}$
 $\div 0.70 \text{ (annual birth rate)}$

° Breeding cows, buffaloes: $7,600 \text{ head} (16,000 \text{ head} /$
 $6 \text{ years} \div 0.70 \div 0.5)$

(iii) Total head of cattle and buffaloes

From the above-mentioned number of bullocks and matured

female cattle and buffaloes, the composition of all-aged cattle and buffaloes to be reared are assumed as follows;

<u>Composition of Rearing Cattle and Buffaloes</u>		
<u>Stage</u>	<u>Cattle</u>	<u>Buffaloes</u>
1. Bullock (3 - 8 years old)	64,000	16,000
2. Breeding cow (3 - 7 years old)	30,500	7,600
3. Calf (0 - 7 years old)		
Male	32,000	8,000
Female	32,000	8,000
Sub-total	<u>64,000</u>	<u>16,000</u>
4. Fattening female (3 years old) ^{1/}	4,500	1,100

Note: ^{1/} After selecting the necessary number of female calves for heifers the residue could be fattened for one year.

(iv) Meat and Milk Production in Rearing Cattle and Buffaloes

The meat and milk production resulting from cattle and buffaloes rearing and the share of the production out of the target production are estimated as follows;

Meat and Milk Production of Cattle and Buffaloes

<u>Item</u>	<u>Heads for Production</u> (head/year)	<u>Production per Head</u> (kg/head)	<u>Dressing Percentage</u> (%)	<u>Production</u> (ton)
1. Meat				
(1) Fatted female				
- Cattle	4,200	400	60	1,008
(2) Bullock after use				
- Cattle	8,700	600	60	3,132
- Buffalo	2,100	600	60	756
Sub-total	<u>10,800</u>			<u>3,888</u>
(3) Breeding Cow after use				
- Cattle	5,795	400	60	1,391
- Buffalo	1,400	400	60	336
Sub-total	<u>7,195</u>			<u>1,727</u>
Total				<u>6,623</u>
2. Milk				
- Cattle	21,300	1,000		21,300
- Buffalo	5,300	1,000		5,300
Total				<u>26,600</u>

Share of Cattle and Buffaloes Project Meat and Milk in
Forecast Demand

Share of Cattle and Buffalo Production Meat and Milk

Item	Forecast Demand (Net Amount) (ton)	Forecast Demand (Gross Amount) (ton)	Production (Cattle & Buffaloes) (ton)	Deficit <u>3/</u> (ton)
Meat	8,400	<u>1/</u> 9,333	6,623	2,710
Milk	33,600	<u>2/</u> 37,333	26,600	10,733

Note: 1/ 8,400 ÷ 0.90
2/ 33,600 ÷ 0.90
3/ Forecast gross demand amount minus the produc-
tion amount of cattle and buffaloes

(2) Asses

The required head of asses for draft use was calculated on the assumption that each farm household would rear one ass. The workable years, annual birth rate and mortality employed for cattle and buffaloes are applied to the above calculation. The head of asses required for draft use and total head of asses to be reared are as follows.

Required number of ass for draft use: (3 - 8 years old)	38,000 head
Number of Rearing ass (all age)	
- Three to eight years, Male:	19,000 head
- Three to eight years, Female:	19,000 head
- Zero to three years, Male:	14,250 head
- Zero to three years, Female:	14,250 head
Total	<u>66,500 head</u>

(3) Sheep, Goats and Chicken

The required numbers of sheep, goats and chicken are calculated on the assumption that a difference between the target total production and the production amount of cattle and buffaloes will be covered

Table IV.3-61 Flock Size and Composition of Sheep

Item	No. of beginning births	No. of Change in stage (+)	No. of sales	No. of Change in deaths stage (-)	No. of end	Monthly Fluctuations												Average				
						Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.					
Ewes	8	-	2	-	1	8	8	8	8	10	10	10	10	10	10	10	10	8	8	8	9.2	
Yearlings for replacement	2	-	2	-	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2.0
Lambs for replacement	2	2	-	-	2	2	2	2	2	-	2	2	2	2	2	2	2	2	2	2	2	1.8
Lambs for fattening and sale	-	8	-	-	1	-	-	-	-	-	8	8	8	8	8	7	7	-	-	-	-	5.8
Total	12	10	-	-	2	12	12	12	12	12	22	22	22	22	22	21	21	12	12	12	12	16.8

Feed Requirements in One Flock Size

Item	Live weight (gr)	Digestible Crude Protein (D.C.P.) per day head (gr)	Annual (kg)	Total Digestible Nutrient (T.D.N.)													
				Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Annual	
(1) Ewes upkeep	40	45	107.5	504	121	121	-	-	151	151	151	151	151	121	121	121	1,309
Suckling period	40	81	48.5	1,008	-	-	-	302	-	-	-	-	-	-	-	-	604
Pregnancy	40	66	19.9	756	-	-	227	-	-	-	-	-	-	-	-	-	227
(2) Yearlings for replacement	32	52	37.4	594	36	36	36	36	36	36	36	36	36	36	36	36	452
(3) Lambs for replacement	32	61	40.2	504	30	30	30	30	30	30	30	30	30	30	30	30	330
(4) Lambs for fattening and sale	32	58	79.5	468	-	-	-	112	112	112	112	98	98	-	-	-	644
Total			333.0		187	187	187	263	480	480	329	329	315	315	187	187	3,446

3. Feed Requirement and Demand and Supply Balance

(1) Feed Requirement

Based on the above livestock rearing plan, the total requirement of TDN and DCP is estimated in Table IV.3-62. About 438,100 tons of TDN and 49,000 tons of DCP will be required in the Project Area.

(2) Demand and Supply Balance

The estimated production of TDN and DCP based on the propose cropping plan (Case 3) is about 447,200 tons and 44,000 tons, respectively as shown in Table IV.3-63. Therefore, the estimated production would meet the feed requirement in the TDN base, and a slight deficit is found in the DCP.

Table IV.3-62 Total Requirement of TDN and DCP

Kind	Nos. of Rearing Livestock	Live Weight (kg)	TDN		DCP	
			Per head (kg/year)	Total (ton)	Per head (kg/year)	Total (ton)
1. Cattle						
- Bullock (3 ~ 8 years)	64,000	500	1,642	105,088	245	14,016
- Breeding cow (3 ~ 7 years)	30,500	400	1,460	44,530	161	4,911
- Calf (0 ~ 2 years)	64,000	300	1,569	100,416	137	8,768
- Fattening female (3 years)	4,500	400	1,716	7,722	161	725
Sub-total	<u>163,000</u>			<u>257,756</u>		<u>28,420</u>
2. Buffaloes						
- Bullock (3 ~ 8 years)	16,000	500	1,642	26,272	219	3,504
- Breeding cow (3 ~ 7 years)	7,600	400	1,606	12,206	168	1,277
- Calf (0 ~ 2 years)	16,000	300	1,569	25,104	137	2,192
Sub-total	<u>39,600</u>			<u>62,472</u>		<u>6,920</u>
3. Ass						
- Male & Female (3 ~ 8 years)	38,000	120	817	31,046	89	3,382
- -do- (0 ~ 3 years)	28,500	70	584	16,644	80	2,280
Sub-total	<u>66,500</u>			<u>47,690</u>		<u>5,662</u>
4. Sheep	11,762 flocks	-	3,446/flock	40,531	333/flock	3,917
5. Goat	5,746 flocks	-	3,446/flock	19,801	333/flock	1,913
6. Chicken	452,000	-	22	9,944	5	2,260
Total				<u>438,194</u>		<u>49,092</u>

Table IV.3-63 Feed Production in the Project Area

Crop	Area (ha)	Yield (dry weight, ton)	Production (ton)	TDN		DCP	
				Content (%)	Amount (ton)	Content (%)	Amount (ton)
1. Sorghum, Grain	22,200	1.1	24,420	78.4	19,145	7.4	1,807
Straw	22,200	6.6	146,520	52.6	77,070	4.6	6,740
2. Rice, Straw/Stubble	49,600	3.9	193,440	37.8	73,120	1.1	2,128
Bran	49,600	0.42	11,904	82.1	9,773	10.8	1,286
3. Oilseeds (Kharif) Oil cake	34,700	0.7	24,290	61.2	14,865	30.8	7,481
4. Pulses (Kharif) Straw	29,700	0.7	20,790	48.0	9,979	7.4	1,538
5. Sugarcane, Top	12,400	5.0	62,000	47.6	25,512	3.6	2,232
Molasses	12,400	2.4	29,760	51.2	15,237	3.9	1,160
6. Wheat, Straw/stubble	79,800	3.1	247,380	35.9	88,809	0.3	742
7. Barley, Grain	4,200	2.5	10,500	73.2	7,686	8.0	840
Straw/stubble	4,200	3.1	13,020	39.4	5,130	0.7	91
8. Oilseeds (Rabi); Oilcake	32,200	0.7	22,540	61.2	13,794	30.8	6,942
9. Pulses (Rabi), Straw	19,800	0.7	13,860	48.0	6,653	7.4	1,026
10. Fodders (Berseem)	12,400	10.2	126,480	48.0	60,710	7.4	9,359
11. Natural Grazing	100,000	0.6	60,000	32.9	19,740	1.1	660
Total					<u>447,223</u>		<u>44,032</u>