田植作業は機械化した方が有利になり、労賃の反応式は、R＝1150－110P となる。雇用労働の減少により、労賃変化に対する利益反応は減少する。

③ 労賃水準3.42～6.39LE／人･日（作付規模、水稲2フェダン、綿3フェダン、小麦5フェダン）

春作業労賃の上昇によって、機械化しても田植作業コストが上がり、水稲そのものが綿に対して不利となり、水稲面積が減る。

労賃反応は P＝1109－98P である。

④ 労賃水準6.39～6.75LE／人･日（作付規模、水稲2フェダン、綿3フェダン）

冬作小麦の作付は、春作業労賃の上昇によって不利となり廃止される。これは小麦作付による収益が収穫労賃の上昇によって無になってしまうからである。

労賃反応式 R＝534－8P

⑤ 労賃水準6.75～14.61LE／人･日（作付規模、水稲1.73フェダン、綿3.27フェダン）

春作業労賃の上昇は水稲の利益を一層押し下げ、綿に対する有利性を少なくする。そのため水稲作付面積が減少し、代って綿の面積が増える。

労賃反応式　R＝526.6－6.9P

⑥ 労賃水準14.61～25.71LE／人･日（作付規模、水稲1.38フェダン、綿3.62フェダン）

水稲の綿に対する有利性が一層減少し、作付面積は減る。

労賃反応式　R＝506.2－5.5P

⑦ 労賃水準25.71LE／人･日以上（作付規模、綿3.8フェダン）

労賃水準があり得ないが25.7LE以上になると水稲を作ること自体が損失となり、水稲は作付されない。換言すれば、春作業（田植）における水稲の労働評価は最大25.6LEであると言える。

以上のように、田植や小麦収穫における春作業労賃の変化は機械化の有利性を変えるだけでなく、関係する作物の有利性自体も変化させるのである。

現状の春作業労賃水準は2～3LEの範囲にあるから、それ程水稲にとって大きな影響を与えないが、4～5LEに上昇すれば水稲の機械化はその省力性をさらに高めるか、増収効果を付加しないと水稲作自体に不利に作用する恐れがある。

ちなみに、機械化によってフェダンあたり1.5トンの増収が見込める場合には付表　からかなりの労賃上昇に対して水稲機械化は安定する（理論的には48LEの労賃水準まで水稲作は有利となる）。

6－4　考　　察

エジプト国における米作機械化の可能性について以上の検討も含めて結論づけておこう。

まず、我国と比べてエジプト国における米作機械化が進められ易い幾つかの点を列挙しておく。

第1に、土地利用が米、綿、メイズを基幹とした3年輪作で地域計画的に行なわれ、その団地規模がおよそ50フェダン以上と大きいことである。我国の場合は水田の分散・錯圃性が機械化の大きな問題となっていたことに比べ機械化の有利な点となる。

第2に、個々の農家は零細であるが、協同組合を通じて機械化を普及していく体制が既に出来上がっている。機械の効率的利用やメインテナンス等の問題を考えても、今後この体制を軸に機械化を進めていく必要があろう。

第3に、エジプト国における家族労働力の機能が我国の場合と全く異なっている点があげられる。

同国の場合、家族労働力の大きさが直接経営規模を規定する要因とならず、小農においてすら主要な作業の多くを雇用労働に依存している。これはエジプト独自の宗教観や社会慣習から来る部分が多いが、米作機械化の効果が雇用労働の減少、労賃節約に直結し、農家自身によりわかりやすいものとなる。

第4に、これまでの稲作技術がどちらかと言えば多労的であり、技術的に粗放であったため、集約技術に裏打ちされた我国の機械化技術は単に省力性でなく、かなりの増収効果を現地に持たらす点である。経済分析でみたように増収効果は機械化の強い索引力となる。

第5に、エジプトにおける水利規制が機械化を促進する力になる。同国における農業用水は我国に比べて格段に重要で、水利が作付計画に強い影響を与えている。とりわけ、配水計画から所定期間内に作業を終了させねばならない事態が起った場合、機械化は従来の方法に比べてその威力を発揮するだろう。

以上のように、エジプトにおいて機械化の受容性は高いが、反面それを阻害する要因も見受けられる。

第1に、機械の利用・保修システムの問題が大きい。我国のようにスペアパーツの供給や即時的保修・点検の体制が充分に整っていないため、先に述べた機械化のメリットを充分に享受できない恐れがある。

第2に、エジプトの機械化は個別農家の内発的要請よりも、むしろ当面は政府ベースで進められていくものと思われるが、その場合の危険負担や財政的援助負担に耐えられるかどうかも重要である。

第3に、先にも述べたように米作機械化は増収量を伴なうことが肝要であるが、このための集約的栽培技術が同国にどの程度定着するかが問題となる。特に雑草・病虫害防除や施肥管理は増収の大きなポイントとなり、この面の政府機関による指導が今後重要となる。

付表1　フェダンあたり小麦純収益

1984

項目		ポンド	摘要
収入	穀実	160.0	10アルダブ／フェダン、価格：16ポンド／アルダブ
	麦わら	96.0	6ハンメル／フェダン、価格：16ポンド／ハンメル
	計	256.0	
支出	耕起	15.0	トラクタ作業委託による（3時間、5ポンド／時間）
	整地	8.0	同上　（2時間、4ポンド／時間）
	雑草防除	5.0	農薬代等
	施肥	19.2	肥料代
	播種	12.0	種子代
	脱穀	12.0	機機借料（3時間、4ポンド／時間）
	選別	8.0	
	灌漑	7.2	ポンプ借料（1ポンド／時間）
	雇用労賃	90.0	
	計	176.4	
純収入		79.6	

by Abdelgwad Elssaud Baly

付表2　ベルシーム生産費用

フェダンあたり　（1984）

項目	ポンド	摘要
播種	16.0	家族労力による。　種子代
灌漑	27.4	ポンプ借料
刈取・運搬	8.0	ラクダによる運搬。　刈取：家族労力
施肥	8.6	
雇用労賃	10.0	
合計	70.0	

by Abdelgwad Elssaud Baly
Ahmed Mohamed Ehtial

付表３　田植・収穫における雇用労働・費用

フェダンあたり　　１９８４

項目			日/フェダン	雇用人数	費用	摘要
田植	慣行	田植	1.0	14.0	32.5	
		1) 苗抜取	1.0	3.0	7.5	男子３人雇用　2.5ポンド/人
		2) 苗運搬		6.0	15.0	男子６人雇用　2.5ポンド/人
		3) 田植		5.0	10.0	少女５人雇用　2ポンド/人
	協同組合への作業委託		0.33	4.0	68.0	作業料金　40ポンド/フェダン 雇用労賃　7ポンド
収穫	慣行	収穫	5.0	24.0	72.0	
		1) 刈取	1.0	5.0	20.0	男子５人雇用　4ポンド/人
		2) 結束		4.0	8.0	女子４人雇用　2ポンド/人
		3) 収集・運搬	1.0	4.0	8.0	馬車つきロバによる男子２人 女子２人　2ポンド/人
		4) 脱穀準備	1.0	4.0	8.0	サッカと呼ばれる集積準備 男子４人　2ポンド/人
		5) 脱穀	1.0	1.0	16.0	トラクタによる脱穀４時間 4ポンド/時間
		6) 選別	1.0	3.0	6.0	３人　2ポンド/人
		7) 袋詰		3.0	6.0	女子３人　2ポンド/人
	コンバイン	収穫	2.0	10.0	93.0	
		1) コンバイン作業委託	1.0	1.0	50.0	作業料金　50ポンド/フェダン
		2) 収穫補助者労賃		2.0	6.0	男子２人　3ポンド/人
		3) 袋詰め替え		3.0	10.0	男子３人　3ポンド/人
		4) わら収集	1.0	3.0	9.0	男子３人　3ポンド/人
		5) わら運搬		1.0	18.0	ラクダによる

調査者：AHMED MOHAMED EHTIAL
ABDELGWAD ELSSAUD BALY

＊カリン、ドスーク地区の農家調査から算出

＊　その他費用

	慣行	機械化
1) 育苗	40.0ポンド	16.0ポンド
2) 耕起・整地	24.0	24.0
3) 施肥	25.0	25.0
4) 雑草防除	30.0	30.0
5) 灌漑	20.0	20.0
6) その他	10.0	10.0
	149.0	125.0

付表4　綿・小麦の収穫費用

項目		日/フェダン	雇用労働(人)	費用	摘要
綿	収集	3.0	65.0	130.0	(10月10日~10月30日) 2ポンド/人
	跡地整理	1.0	14.0	37.0	残幹抜取り 9人 3ポンド/人
					残幹収集・運搬5人 2ポンド/人
	計	4.0	79.0	167.0	
小麦	刈取	1.0	6.0	30.0	5ポンド/人
	収集		2.0	6.0	3ポンド/人
	運搬	1.0	1.0	15.0	ラクダによる
	脱穀	1.0	6.0	36.0	脱穀機利用4時間 4ポンド/時間
					雇用5人 3ポンド/人
	選別	1.0	1.0	10.0	
	袋詰		2.0	6.0	雇用2人 3ポンド/人
	計	4.0	18.0	103	

by Abdlgwad Elsaud Baly

*純収益		収量	価格(ポンド)	価格(ポンド)		総費用(ポンド)	純収入(ポンド)
綿		7カンタール	75	525		359	166
小麦	穀実	10アルダブ	16	160	256	1764	796
	わら	6ハンメル	16	96			

付表5　綿　費　用

費用項目	ポンド	摘要
耕起	200	トラクタ作業委託(協同組合)
整地	50	
灌漑用区画作り	60	
うねたて	120	4人雇用2ポンド/人 他に昼食代計4ポンド
播種	145	6人雇用2ポンド/人 種子代(クキラ×0.354ポンド)
灌漑	200	ポンプ借上料 1ポンド/時間
施肥	160	4人雇用(2ポンド/人) 肥料代8.5ポンド(250Kg)
虫害防除	180	一部政府補助あり
雑草防除	80	
中耕	720	3回実施 毎回6人雇用 4ポンド/人
摘取	1300	3回摘取
残幹処理	320	抜取り労力9人(3ポンド/人)、運搬5人雇用(2ポンド/人)
合計	3590	

ドスーク地区の農家事例より　　by Mr. Baly & Ahamed

付表6　米作機械化評価のための単体表

利益および費用							$\bar{4}0.0$			$\bar{2}.0$	115.0		$\bar{5}0.0$			$\bar{3}.0$	333.0	$\bar{1}49.0$	$\bar{1}25.0$	120.0
制約項目		値	単位	関係		春作業						秋作業						米その他費用		収量計
						田植		超過日数	合計日数	雇用人数	小麦収穫	米収穫		超過日数	合計日数	雇用人数	綿収穫			
						T	M					T	M					T	M	
					No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
作付面積	米	5.0	フェダン	≧	1	1.0	1.0													
	小麦	5.0	〃	≧	2						1.0									
	綿	5.0	〃	≧	3												1.0			
反作面積		5.0	〃	≧	4	1.0	1.0										1.0			
田植期間	適期間	10.0	日	≧	5	1.0	0.33	$\bar{1}.0$												
	不適期間	20.0	〃	≧	6			1.0												
	合計日数	0.0	〃	≧	7	1.0	0.33		$\bar{1}.0$											
春作業期間		30.0	〃	≧	8				1.0		4.0									
春作業雇用労力	バランス	0.0	人日	≧	9	14.0	4.0			$\bar{1}.0$	18.0									
	上限	300.0	〃	≧	10					1.0										
米収穫面積		0.0	フェダン	≧	11	1.0	1.0					$\bar{1}.0$	$\bar{1}.0$							
収穫期間	適期間	10.0	日	≧	12							5.0	2.0	$\bar{1}.0$						
	不適期間	20.0	〃	≧	13									1.0						
	合計日数	0.0	〃	≧	14							5.0	2.0		$\bar{1}.0$					
秋作業期間		30.0	〃	≧	15										1.0		3.0			
秋作業雇用労力	バランス	0.0	人日	≧	16							24.0	10.0			$\bar{1}.0$	79.0			
	上限	300.0	〃	≧	17											1.0				
その他米費用	慣行	0.0		≧	18	1.0												$\bar{1}.0$		
	機械化	0.0		≧	19		1.0												$\bar{1}.0$	
米収量		0.0		≧	20	$\bar{3}.0$	$\bar{4}.5$	0.5												1.0

付表7　労賃水準の変化と最適解（増収効果なし）

項目				機械化による収量 / 労賃範囲	フェダンあたり収量　3.0トン						
					未満 1.6ポンド	1.6 ～ 3.42	3.42 ～ 6.39	6.39 ～ 6.75	6.75 ～ 14.607	14.607 ～ 25.71	以上 25.71
面積	水稲			フェダン	5.0	5.0	2.0	2.0	1.73	1.38	—
	綿			〃	—	—	3.0	3.0	3.27	3.62	3.8
	小麦			〃	5.0	5.0	5.0	—	—	—	—
作業日数	春作業	田植	T	日	5.0	—	—	—	—	—	—
			M	〃	—	1.65	0.66	0.66	0.57	0.45	—
		小麦収穫		〃	2.0.0	2.0.0	2.0.0	—	—	—	—
		計		〃	2.5.0	2.1.65	2.0.66	0.66	0.57	0.45	—
	秋作業	米収穫	T	〃	—	—	1.0.0	1.0.0	8.64	—	—
			M	〃	1.0.0	1.0.0	—	—	—	2.75	—
		綿収穫		〃	—	—	9.0	9.0	9.81	1.0.86	1.1.4
		計		〃	1.0.0	1.0.0	1.9.0	1.9.0	1.8.45	1.3.61	1.1.4
雇用労力	春作業	田植	T	人	7.0.0	—	—	—	—	—	—
			M	〃	—	2.0.0	8.0	8.0	6.91	5.5	—
		小麦収穫		〃	9.0.0	9.0.0	9.0.0	—	—	—	—
		計		〃	1.6.0.0	1.1.0.0	9.8.0	8.0	6.91	5.5	—
	秋作業	米収穫	T	〃	—	—	4.8.0	4.8.0	4.2.0	—	—
			M	〃	5.0.0	5.0.0	—	—	—	1.3.8	—
		綿収穫		〃	—	—	2.3.7.0	2.3.7.0	2.5.8.0	2.8.6.2	3.0.0.0
		計		〃	5.0.0	5.0.0	2.8.5.0	2.8.5.0	3.0.0.0	3.0.0.0	3.0.0.0
純収入	水稲	粗収入		ポンド	1.8.0.0.0	1.8.0.0.0	7.2.0.0	7.2.0.0	6.2.2.8	4.9.5.7	—
		費用	田植	〃	7.0P	2.0.0 +2.0P	8.0+8P	8.0+8P	6.9.1 +6.9P	5.5.1 +5.5P	—
			収穫	〃	4.0.0.0	4.0.0.0	1.4.4.0	1.4.4.0	1.2.4.6	1.1.0.2	—
			その他	〃	7.4.5.0	6.2.5.0	2.5.0.0	2.5.0.0	2.1.6.3	1.7.2.1	—
			計	〃	1.1.4.5 +7.0P	1.2.2.5 +2.0P	4.7.4 +8P	4.7.4 +8P	4.1.0 +6.9P	3.3.7.4 +5.5P	—
		純収入		〃	6.5.5 −7.0P	5.7.5 −2.0P	2.4.6 −8P	2.4.6 −8P	2.1.2.8 −6.9P	1.5.8.3 +5.5P	—
	綿			〃	—	—	2.8.8.0	2.8.8.0	3.1.3.8	3.4.7.9	3.6.4.6
	小麦			〃	5.7.5 −9.0P	5.7.5 −2.0P	5.7.5 −9.0P	—	—	—	—
	計			〃	1.2.3.0 −1.6.0P	1.1.5.0 −1.1.0P	1.1.0.9 −9.8P	5.3.4 −8P	5.2.6.6 −6.9P	5.0.6.2 −5.5P	3.6.4.6

T：慣行法、　P：1人1日あたり労賃、　M：機械化

付表8　労賃水準の変化と最適解（増収効果あり）

項目 ＼ 機械化による収穫 ＼ 労賃範囲					フェダンあたり収量　4.5トン					
					未満 6.39 ポンド	6.39 ～ 48.4	48.4 ～ 51.75	51.75 ～ 59.61	59.61 ～ 70.71	以上 70.71 ポンド
面積	水稲			フェダン	5.0	5.0	2.0	1.727	1.377	—
	綿			〃	—	—	3.0	3.273	3.623	3.8
	小麦			〃	5.0	—	—	—	—	—
作業日数	春作業	田植	T	日	—	—	—	—	—	—
			M	〃	1.65	1.65	0.66	0.57	0.45	—
		小麦収穫		〃	20.0	—	—	—	—	—
		計		〃	21.65	1.65	0.66	0.57	0.45	—
	秋作業	米収穫	T	〃	—	—	10.6	8.6	—	—
			M	〃	10.0	10.0	—	—	2.75	—
		綿収穫		〃	—	—	9.0	9.8	10.86	11.4
		計		〃	10.0	10.0	19.0	18.4	13.6	11.4
雇用労力	春作業	田植	T	人	—	—	—	—	—	—
			M	〃	20.0	20.0	8.0	6.9	5.5	—
		小麦収穫		〃	90.0	—	—	—	—	—
		計		〃	110.0	20.0	8.0	6.9	5.5	—
	秋作業	米収穫	T	〃	—	—	48.0	41.4	—	—
			M	〃	50.0	50.0	—	—	13.8	—
		綿収穫		〃	—	—	237.0	258.6	286.2	300.0
		計		〃	50.0	50.0	285.0	300.0	300.0	300.0
純収入	水稲	粗収入		ポンド	2700.0	2700.0	1080.0	932.6	743.5	—
		費用	田植	〃	200 +20P	200 +20P	80+8P	69 +6.9P	55.1 +5.5P	—
			収穫	〃	400.0	400.0	144.0	124.3	110.2	—
			その他	〃	625.0	625.0	250.0	215.8	172.1	—
		計		〃	1225 +20P	1225 +20P	474 +8P	409.1 +6.9P	337.4 +5.5P	—
		純収入		〃	1475 −20P	1475 −20P	606 −8P	523.5 −6.9P	406.1 −5.5P	—
	綿			〃	—	—	288.0	314.0	347.9	—
	小麦			〃	575 −90P	—	—	—	—	364.6
	計			〃	2050 −110P	1475 −20P	894 −8P	837.5 −6.9P	754.0 −5.5P	364.6

参　考　資　料　　モデルの枠組

1　変　　数

X_1 ：慣行法による田植面積

X_2 ：田植機による田植面積

X_3 ：好適田植期間を超過する日数

X_4 ：田植日数合計

X_5 ：春作業期総雇用人数

X_6 ：小麦収穫面積

X_7 ：慣行法による水稲収穫面積

X_8 ：コンバインによる水稲収穫面積

X_9 ：好適収穫期間を超過する日数

X_{10} ：水稲収穫総日数

X_{11} ：秋作業期総雇用人数

X_{12} ：綿収穫面積

X_{13} ：水稲その他費用（慣行）

X_{14} ：水稲その他費用（機械化）

X_{15} ：水稲総収量

2　制　約　式

1）作物栽培面積

水　　稲　　$5.0 \geq X_1 + X_2$

小　　麦　　$5.0 \geq X_6$

綿　　$5.0 \geq X_{12}$

夏作面積合計　　$5.0 \geq X_1 + X_2 + X_{12}$

2）田植日数

好適日数　　$100.0 \geq X_1 + 0.33 X_2 - X_3$

超過日数制限　　$20.0 \geq X_3$

田植日数合計　　$0.0 \geq X_1 + 0.33 X_2 - X_4$

春作業期間　　$300.0 \geq X_4 + 4 X_6$

3）春作業期雇用人数

雇用人数合計　　$0.0 \geq 14 X_1 + 4 X_2 - X_5 + 18 X_6$

雇用制限　　$3000.0 \geq X_5$

4）水稲収穫

収穫面積　　$0.0 \geq X_1 + X_2 - X_7 - X_8$

好適日数　　$100.0 \geq 5 X_7 + 2 X_8 - X_9$

超過日数制限　　$200.0 \geq X_9$

収穫日数合計　　$0.0 \geq 5X_7 + 2X_8 - X_{10}$

秋作業期間　　$300.0 \geq X_{10} + 3X_{12}$

5) 秋作業期雇用人数

雇用人数合計　　$0.0 \geq 24X_7 + 10X_8 - X_{11} + 79X_{12}$

雇用制限　　$3000.0 \geq X_{11}$

6) 水稲その他費用・収量

その他費用（慣行）　　$0.0 \geq X_1 - X_{13}$

その他費用（機械化）　　$0.0 \geq X_2 - X_{14}$

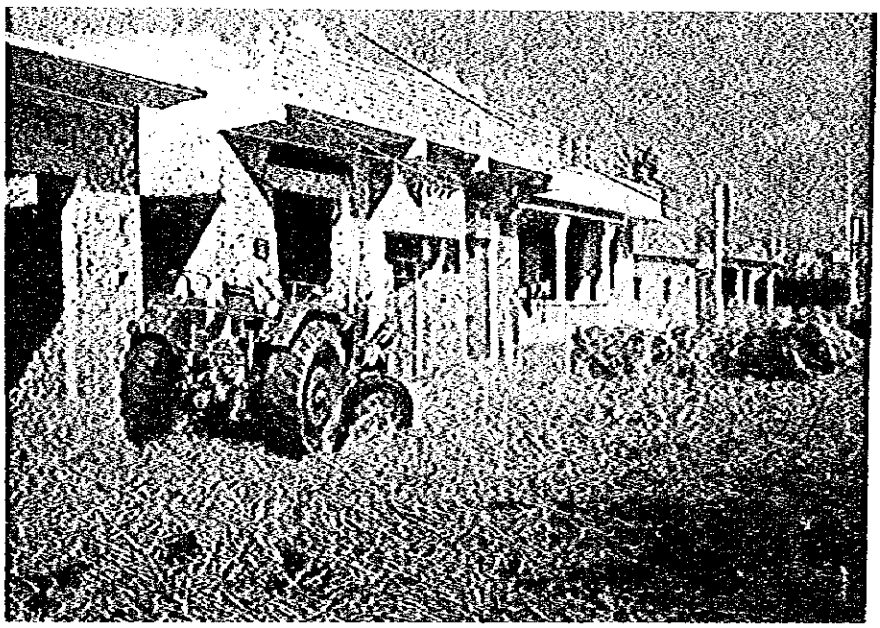
水稲収量合計　　$0.0 \geq -3X_1 - 4.5X_2 + X_{15}$

3 目的関数

$$R = -40X_2 - 2X_5 + 115X_6 - 50X_8 - 3X_{11} + 330X_{12} - 149X_{13} - 125X_{14} + 120X_{15}$$

費用は負、収益は正の値で示す。

従来の手による灌漑（サキア）に代ってポンプによる灌漑が急速に普及した



脱穀はトラクタ踏付によるものが主流

Table 1. Net Revenue of Wheat (/feddan)

1984

Item		L.E.	Notes
Revenue	grain	160.0	10 ardab/feddan, price: 16 LE/ardab
	straw	96.0	6 hemel/feddan, price: 16 LE/hemel
	total	256.0	
Expenditure	plowing	15.0	by rental tracter with operator (3 hours/ 5 LE/hour)
	leveling	8.0	the same as above (2 hours, 4 LE/hour)
	weed control	5.0	materials for herbicide, rent of spray
	fertilizing	19.2	materials
	sowing	12.0	
	threshing	12.0	by rental machine (3 hours, 4 LE/hours)
	winnowing	8.0	
	irrigation	7.2	by rental pump (1 LE/hour)
	labor cost	90.0	total employed labor costs
	total	176.4	
net revenue		79.6	

by Abdelgwad Elssaud Baly

Table 2. Cost of Berseem (/feddan)

1984

Item	L.E.	Notes
Sowing	16.0	by family labor, cost of seeds
Irrigation	27.4	by rental pump
Cutting & transport	8.0	by camel, cutting by family labor
Fertilizer	8.6	
Labor cost	10.0	total employed labor cost
total	70.0	

Table 3. Per hour cost of tracter

Fixed cost per year	Working hour per year	500	625	715	835	1,000	1,250
	Useful lit of machinery	10	8	7	6	5	4
	Depriclation	600	750	858	1,000	1,200	1,500
	Interest	330.0	337.5	342.6	350.0	360.0	375.0
	Construction cost	27	27	27	27	27	27
	Tax, etc.	0	0	0	0	0	0
	Total	957	1,114.5	1,229.6	1,377	1,589	1,902
Per hour cost	Fixed cost	1.92	1.79	1.72	1.65	1.59	1.53
	Variable cost: Repairing cost	0.84	0.84	0.84	0.84	0.84	0.84
	Variable cost: Fuel	0.15	0.15	0.15	0.15	0.15	0.15
	Variable cost: Oil, grease	0.05	0.05	0.05	0.05	0.05	0.05
	Personnel expenses	0.05	0.05	0.05	0.05	0.05	0.05
	Total	3.46	3.33	3.26	3.19	3.13	3.07

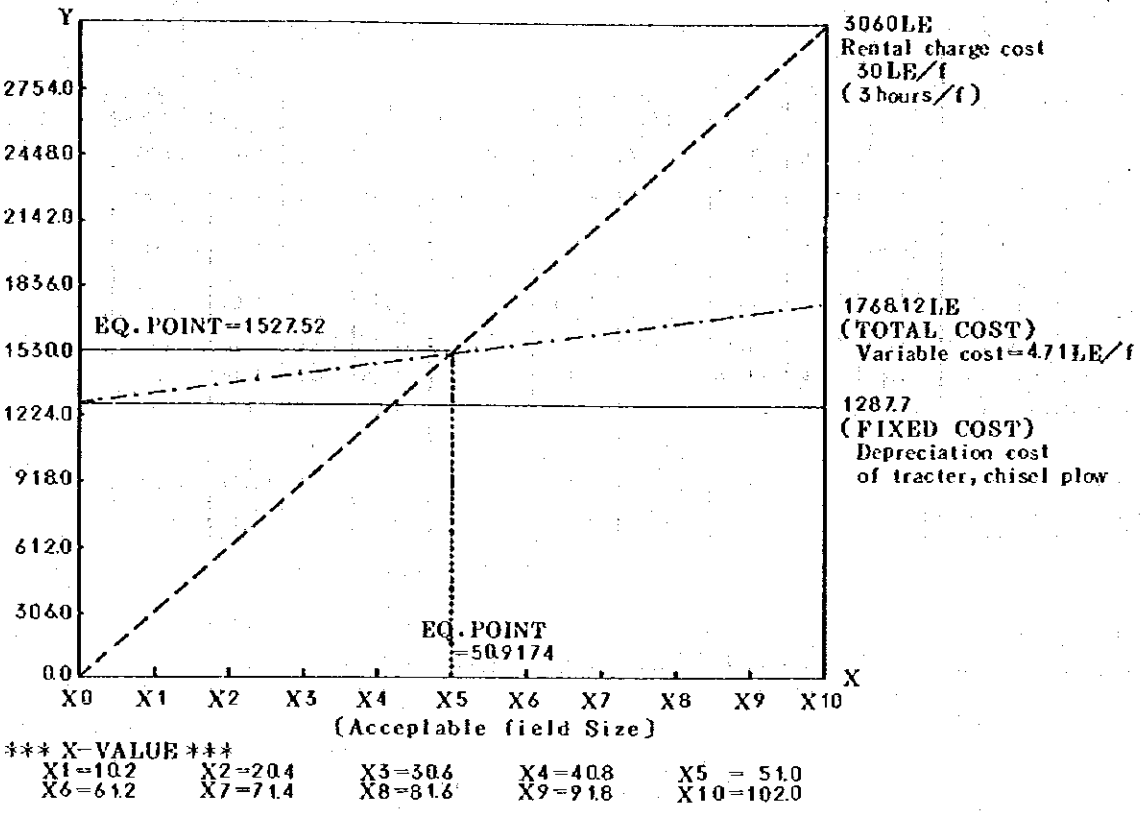
Name of tractor : ZEIOR , Model, TZ
Cost of machine : Le 6,000
Remaining cost : 0%

R.M.P. Kallin Center,
August, 1983

Table 4. Per hour cost of chisel plow

Fixed cost per year	Working hour per year	500	625	715	815	1,000	1,250
	Useful life of machine	10	8	7	6	5	4
	Depreciation	30	37.5	42.9	50.0	60.0	75.0
	Interest	16.5	17.0	17.2	17.5	18.0	19.0
	Construction cost	0	0	0	0	0	0
	Tax, etc.	0	0	0	0	0	0
	Total	46.5	54.5	60.1	67.5	78.0	94.0
Per hour cost	Fixed cost	0.093	0.088	0.085	0.081	0.078	0.076
	Variable cost: Repairing cost	0.020	0.020	0.020	0.020	0.020	0.020
	Variable cost: Fuel	0	0	0	0	0	0
	Variable cost: Oil, grease	0	0	0	0	0	0
	Personnel expenses	0	0	0	0	0	0
	Total	0.113	0.108	0.105	0.101	0.098	0.096

Graph 2 Break-even Point about Tracter (1)



*** X-VALUE ***

X1=10.2	X2=20.4	X3=30.6	X4=40.8	X5 = 51.0
X6=61.2	X7=71.4	X8=81.6	X9=91.8	X10=102.0

Graph 3 Break-even Point about Tracter (2)

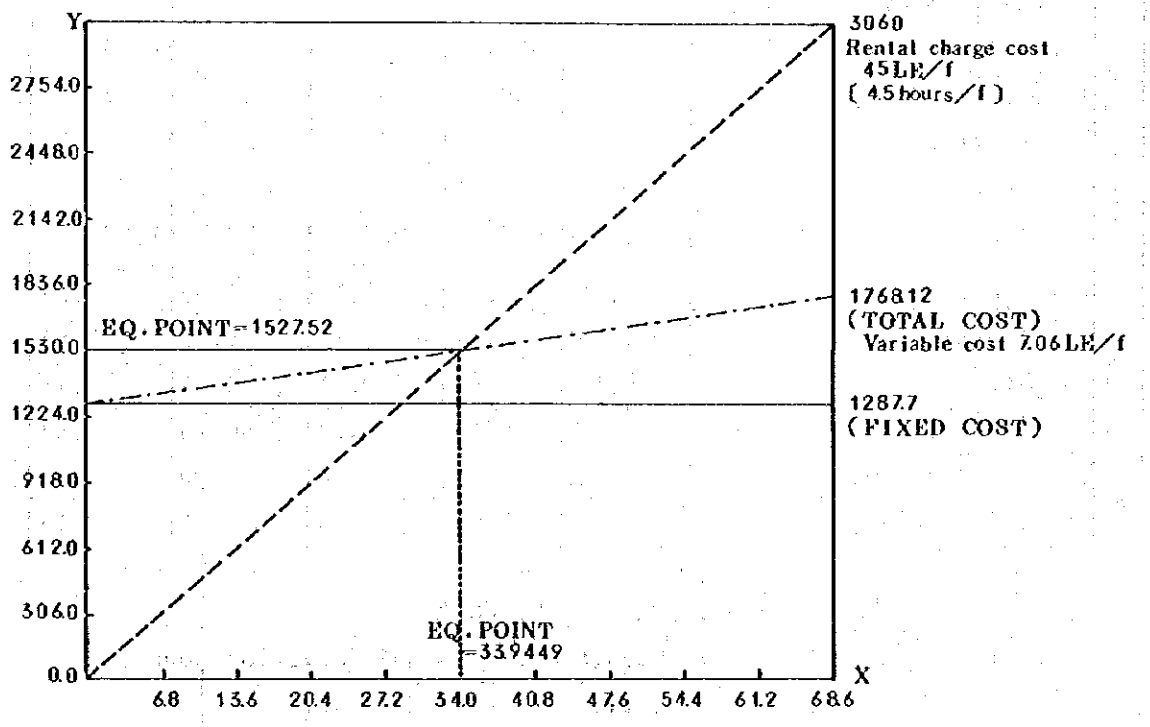


Table 5. Nursery & Transplanting Cost

per feddan 1984

Cost Items	By hand						By machine					
	LE	%	detail				LE	%	detail			
			wage	machine	animal	material			wage	machine	animal	material
Nursery cost	40.12	48.2	8.8	7.09	3.24	20.99	15.44	24.2	8.16	0.99	-	6.29
1) Preparation of nursery bed	17.82	21.4	4.94	2.79	1.99	8.1	7.14	11.2	4.76	0.99	-	1.39
2) Spaking & sowing of seeds	14.49	17.4	1.6	-	-	12.89	6.39	10.0	1.46	-	-	4.90
3) Taking care of nursery	7.81	9.4	2.26	4.3	1.25	-	1.94	3.0	1.94	-	-	-
Transplanting cost	37.68	45.3	36.78	-	0.9	-	47.18	74.1	3.18	44.0	-	-
1) Transparing nursery	14.08	16.9	13.18	-	0.9	-	6.18	9.7	3.18	3.0	-	-
2) Transplanting	23.6	28.4	23.6	-	-	-	41.0	64.4	-	41.0	-	-
Other cost	5.47	6.5	-	-	-	5.47	1.06	1.7	-	-	-	1.06
Total cost	83.27	100.0	45.58	7.01	4.14	26.46	63.68	100.0	11.34	44.99	-	7.35
Percentage of each cost	100.0	-	54.7	8.5	5.0	31.8	100.0	-	17.8	70.7	-	11.5

By Abdelgwad Elssaud Baly

1) Machine cost is almost rental charge.
2) Figure is average of actual data from some district, Kallin, Disuk, etc.

Table 6. Per hour cost of Rice Transplanter

Fixed cost per year	Working hour per year		120	150	200	240	300
	Useful life of machinery		10	8	6	5	4
	Depreciation		444	555	740	888	1,109
	Interest		244	250	259	266	278
	Construction cost		34	34	34	34	34
	Tax, etc.		0	0	0	0	0
	Total		722	837	1,033	1,188	1,421
Per our cost	Fixed cost		6.02	5.60	5.17	4.95	4.74
	Variable cost	Repairing cost	1.87	1.87	1.87	1.87	1.87
		Fuel	0.41	0.41	0.41	0.41	0.41
		Oil, grease	0.13	0.13	0.13	0.13	0.13
	Personnel expenses		1.00	1.00	1.00	1.00	1.00
	Total (Egyptian pound)		7.63	9.01	8.58	8.36	8.15

Name of rice transplanter: Yanmar, YP-6000
Cost of machinery : US$5,408.9 = £4,436 (Egyptian pount)
(C.I.F. Port sayds Egypt)

R.M.P. Kallin Center, August 1983

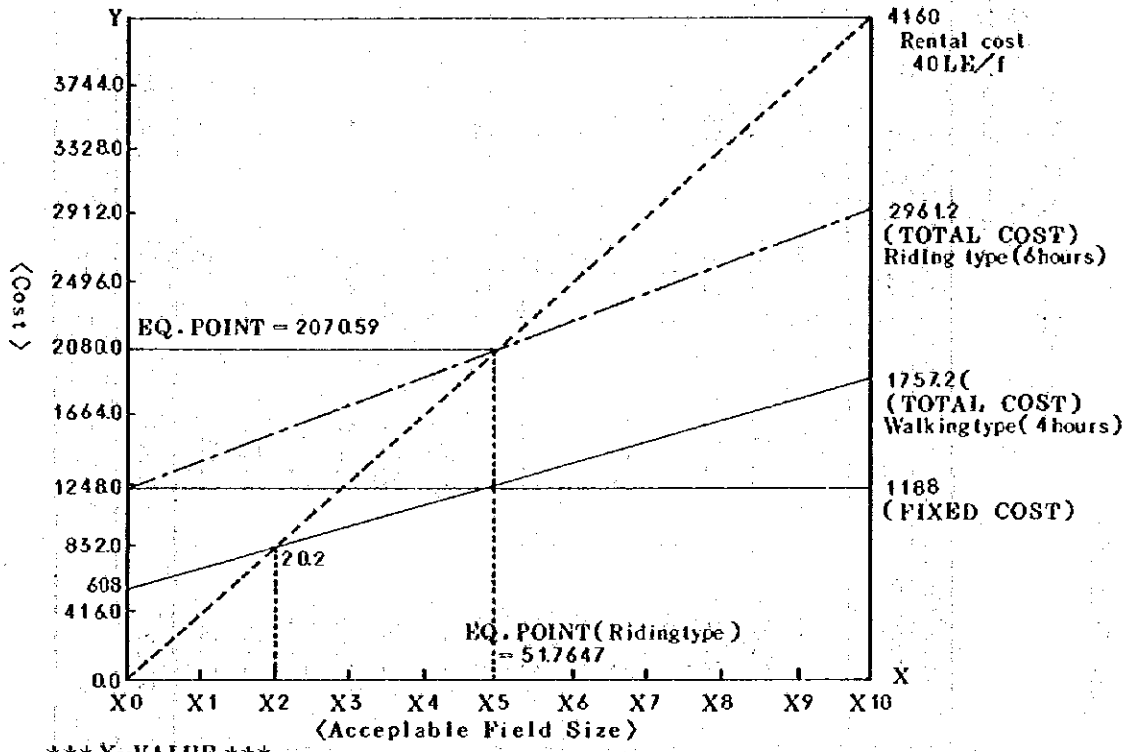
Table 7. Actual working capacity of rice transplantater

Ship ratio 20%, Speed 30.5/20m

July 1983. Kafr El Sheik
Nour El Din Saleh.
Essem Mohamed Gazy

Name of coop	Area Fedan.	Duration of transplanting	Nos. of machine	Actual working capacity of rice transplanter				
				per day	per machine per day	Per finger	Per hour	Efficiance of machine %
1. Zidane	60	28	1	2.14	2.14	0.356	0.268	26.4
2. El zai	120	56	2	2.14	1.07	0.178	0.134	13.2
3. Ibshen	107	25	2	4.28	2.14	0.356	0.268	26.4
4. Bil shasha	90	39	2	2.31	1.16	0.192	0.145	14.3
5. Sandirah	150	40	3	3.75	1.25	0.208	0.156	15.4
6. El hamura	70	39	2	1.79	0.90	0.149	0.113	11.1
7. Mohaletkhasah	125	43	3	2.31	0.97	0.161	0.121	11.9
8. El morabin	57	35	1	1.63	1.63	0.271	0.204	20.1
9. Ariamun	133	26	3	5.12	1.71	0.284	0.214	21.1
10. Mohalet Diay	85	21	2	4.05	2.03	0.337	0.254	25.1
11. Demenka	48	20	1	2.40	2.40	0.400	0.300	29.6
12. Shabas No.2	58	26	2	2.23	1.12	0.185	0.140	13.8
13. Gamaila	157	27	3	5.81	1.94	0.322	0.243	23.9
14. Sidi Ghazy	42	28	1	1.50	1.50	0.250	0.188	18.5
Total	1302	453	28	42.06	21.96	3.649	2.745	270.80
Average	93	32.36	2	3.04	1.56	0.260	0.200	19.34

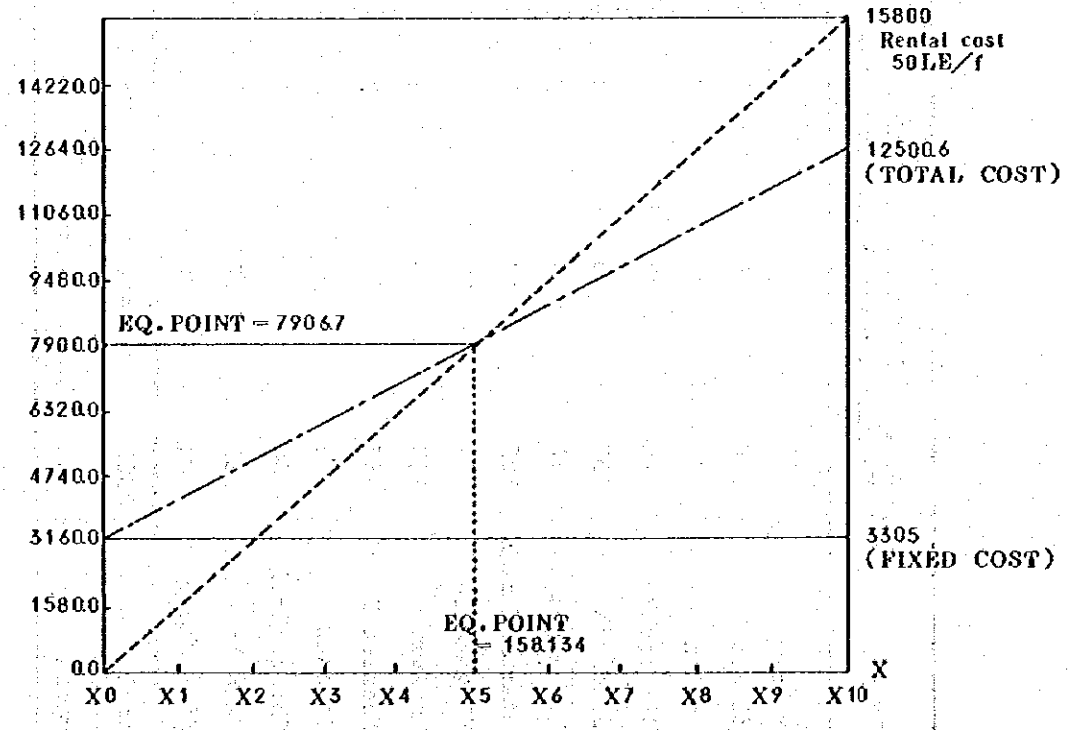
Graph 4 Break-even Point about Transplater



X-VALUE

X1=10.4	X2=20.8	X3=31.2	X4=41.6	X5 = 52.0
X6=62.4	X7=72.8	X8=83.2	X9=93.6	X10=104.0

Graph 5 Break-even Point about Combine



X-VALUE

X1= 31.6	X2= 63.2	X3= 94.8	X4=126.4	X5 =158.0
X6=189.6	X7=221.2	X8=252.8	X9=284.4	X10=316.0

Table 8. Harvesting cost by hand

1983

District	Farmer's No.	Reaping	Binding	Collecting & Piling	Transporting	Arrangement for threshing	Threshing	Separating straw	Winnowing	Packing	Collecting straw	Total cost
Kallin	1	22.5	9.0	9.0	12.0	5.0	6.0	30.0	14.0	8.0	12.0	127.5
	2	17.5	7.0	10.0	15.0	4.0	8.0	12.0	10.0	6.0	6.0	95.5
	3	20.0	4.0	8.0	20.0	8.0	6.0	12.0	12.0	6.0	8.0	104.0
	4	25.0			25.0	5.0	6.0	9.0	9.0	6.0	8.0	93.0
	5	48.0	12.0	12.0	18.0	6.0		20.0		12.0	12.0	140.0
	6	30.0		10.0	15.0	5.0	8.0	20.0	10.0	10.0	8.0	116.0
	7	30.0		10.0	15.0	5.0	8.0	20.0	10.0	10.0	8.0	116.0
Kafr el Shelk	1	20.0	6.0	6.0	18.0	6.0		20.0		6.0	8.0	90.0
	2	25.0	9.0	6.0	15.0	5.0	7.5	7.5	6.0	5.0	5.0	90.0
	3	25.0	5.0	6.0	9.0	5.0	5.0	9.0	4.0	5.0	6.0	79.0
	4	25.0	12.0	8.0	18.0	35.0						95.0
	5	25.0	6.0	6.0	22.0	10.0	10.0	-	10.0	10.0	4.0	103.0
	6	25.0	6.0	6.0	22.0	6.0		10.0	10.0	5.0	10.0	100.0
	7	12.0	4.5	6.0	20.0	6.0	8.0	12.0	10.0	6.0	8.0	92.0
	8	24.0	6.0	6.0	20.0	6.0		14.0	12.0	5.0	8.0	101.0
Fuwa	1	20.0	6.0	16.0	20.0	5.0	6.0	12.0	10.0	6.0	6.0	107.0
	2	24.0	4.6	4.0	18.0	4.0	9.0	16.0	10.0	4.0	10.0	103.5
	3	21.3	8.0	5.0	16.0	6.0	12.0	13.3	16.0	6.0	13.3	119.9
	4	30.0	8.0	17.4	20.0	4.0	13.45	10.0	17.14	3.0	10.0	132.99
	5	27.0	6.0	6.0	21.0	6.0	9.0	14.0	16.0	8.0	8.0	121.0
	6	24.0	10.0	16.0	25.2	16.0	5.0	12.0	14.7	3.0	6.0	137.9
	7	21.0	6.0	9.0	15.0	25.0	9.0	7.5		6.0	8.0	102.5

Average cost per feddan is 107.86 LE.

by Abdelgmad Elssaud Baly

Table 9. Per hour cost of combine

Fixed cost per year	Working hour per year	200	250	280	334	400	500
	Useful life of machinery	10	8	7	6	5	4
	Depriciation	2090	2613	2986	3484	4180	5225
	Interest	1150	1176	1195	1219	1254	1307
	Construction cost	65	65	65	65	65	65
	Tax, etc.	0	0	0	0	0	0
	Total	3305	3854	4246	4768	5499	6597
Per hour cost	Fixed cost	16.53	15.42	15.17	14.28	13.75	13.20
	Variable cost: Repairing cost	5.23	5.23	5.23	5.23	5.23	5.23
	Variable cost: Fuel	0.18	0.18	0.18	0.18	0.18	0.18
	Variable cost: Oil, grease	0.06	0.06	0.06	0.06	0.06	0.06
	Personnel expenses	1.00	1.00	1.00	1.00	1.00	1.00
	Total	23.00	21.89	21.64	20.75	20.22	19.67

Name of machine: COMBINE, Yanmar, Model (TC-3500)
Cost of machine: LE 20,900 (C.I.F.)

R.M.P. Kalline Center
August. 1983

Table 10. Harvesting cost of cotton & wheat

Item		days/fed.	employ labors	cost	Notes
Cotton	Gathering	3.0	65.0	130.0	(10/Oct. - 30/Oct.) 2 LE/labor
	Cleanland	1.0	14.0	37.0	Pulling out cotton stems: 9 Labors 3 LE Collect and transport 5 Labors 2 LE
	Total	4.0	79.0	167.0	
Wheat	Reaping	1.0	6.0	30.0	5 LE/labor
	Gathering		2.0	5.0	3 LE/labor
	Transporting	1.0	1.0	15.0	by camel
	Threshing	1.0	6.0	36.0	4 hours tracter threshing machine, 4 LE/labor 5 Labors 4 LE/labor
	Winnowing	1.0	1.0	10.0	by rental machine with operater
	Packing		2.0	6.0	2 labors, 3 LE/labor
	Total	4.0	18.0	103	

by Abdlgwad Elsaud Baly

* Net revenue

	Yield	Price	Amount	Total cost	Net Revenue
Cotton	7 kantol	75 LE	525 LE	259 LE	166 LE
Wheat grain	10 ardab	16 LE	160 LE	176.4 LE	79.6 LE
traw	6 hemol	16 LE	96 LE	256 LE	

Table 11. Employed Labors & Cost of Rice

per feddan 1984

		Items	days /fed.	Employ labors	cost	Notes
Transplanting	by hand	Transplanting	1.0	14.0	32.5	
		1) Pulling out nursery	1.0	3.0	7.5	3 men employed 2.5 LE/man
		2) Transporting to paddy field		6.0	15.0	6 men employed 2.5 LE/man
		3) Transplanting		5.0	10.0	5 labors employed 2.0 LE/girl
	Commit to the cooperative		0.33	4.0	68.0	• Rent transplanter with operater • Labor cost 7 LE • Rental charge 40 LE/feddan
Harvesting	by hand	Harvesting	5.0	24.0	72.0	
		1) Reaping	1.0	5.0	20.0	5 men employed 4.0 LE/man
		2) Binding		4.0	8.0	4 women employed 2.0 LE/woman
		3) Gathering transport	1.0	4.0	8.0	by donkey with cart. 2 men, 2 women, 2.0 LE/person
		4) Preparing of threshing	1.0	4.0	8.0	named Sakka 4 men, 2.0 LE/man
		5) Threshing	1.0	1.0	16.0	4 hours, 4 LE/hour by tracter
		6) Winnowing	1.0	3.0	6.0	3 labors 2.0 LE/labor
		7) Packing		3.0	6.0	3 women 2.0 LE/labor
	by combine	Harvesting	2.0	10.0	93.0	estimate per feddan
		1) rental combine	1.0	1.0	50.0	Rental charge with operater 50 LE/feddan
		2) assistant with combine		2.0	6.0	2 men, 3 LE/man
		3) Change packing		3.0	10.0	3 men, 3 LE/man
		4) Collecting straw	1.0	3.0	9.0	3 men, 3 LE/man
		5) Transport straw to house		1.0	18.0	by camel

investigater: AHMED HOLLANED EHTIAL
ABDELGWAD ELSSAUD BALY

* Some examples of farmers in Kallin & Disuk

* Other cost of rice (/F)

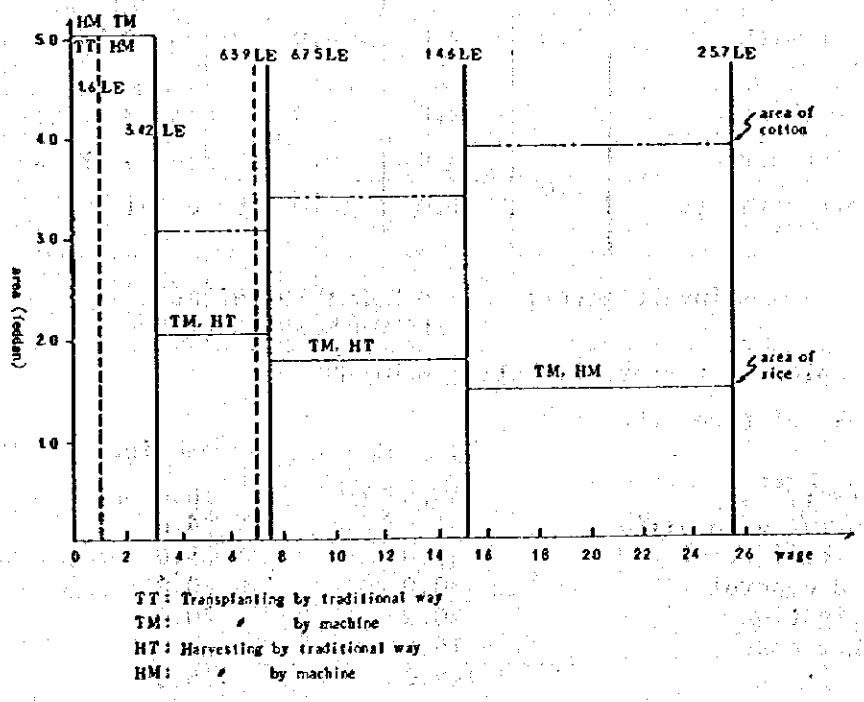
	by hand	by machine
1) Nursery	40.0 LE	16.0 LE
2) Plowing & levelling	24.0	24.0
3) Fertilizer	25.0	25.0
4) Weed control	30.0	30.0
5) Irrigation	20.0	20.0
6) Other cost	10.0	10.0
	149.0	125.0

Table 12. Cost of Cotton

Cost item	LE	Notes
Plowing	20.0	by rental tracter with operater
Levelling	5.0	the same as above
Making plot	6.0	the same as above
Making ridge	12.0	4 Labors employed, wage 2 LE/labor cost of lunch 4 LE
Sowing	14.5	6 labors, 2 LE/labor, cost of seed (7 killa x 0.354 LE)
Irrigation	20.0	by rental pump, 1 LE/hour
Fertilizer	16.5	employ, 4 labors (2 LE) fertilizer cost 8.5 LE (250 kg)
Insect control	18.0	by government subsidy
Weed control	8.0	
Intercultivation	72.0	3 times, 6 labors/time, 4 LE/labor
Gathering	130.0	
Pulling & transporting stick	37.0	Pulling labor, 9 men x 3 LE transporting labor 2LE/5 men
Total cost	359.0	

The case of farmer in Disuk by Mr. Baly & Anamed

Graph 7 Change of rice area with each wage



TT: Transplanting by traditional way
TM: " by machine
HT: Harvesting by traditional way
HM: " by machine

Table 13. Simplex table

Selection Weight (Profit or cost)					- 40				- 2	115.0		- 50.0			- 3.0	333.0	- 1119.4	- 125.0	120.0
Constraint items		Value	Unit	Relation	Trans-plant T	Trans-plant M	Over days	Total days	Employ labor	Harvest of wheat	Harvest of rice T	Harvest of rice M	Over days	Total days	Employ labor	Harvest of cotton	Other rice cost T	Other rice cost M	Total
				No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Area of crops	Rice	5.0	feddan		1	1.0	1.0												
	wheat	5.0	"		2					1.0									
	cotton	5.0	"		3											1.0			
Summer land		5.0	"		4	1.0	1.0									1.0			
Transplanting days	favorite	10.0	days		5	1.0	0.33	1.0											
	not favorite	20.0	"		6			1.0											
	sumit days	0.0	"		7	1.0	0.33		1.0										
Available days in spring		30.0	"		8				1.0		4.0								
Employ labor in spring	Balance	0.0	man-days		9	14.0	4.0			1.0	18.0								
	limmit	300.0	"		10					1.0									
Harvest area at rice		0.0	feddan		11	1.0	1.0					1.0	1.0							
Harvesting days	favorite	10.0	days		12							5.0	2.0	1.0						
	not favorite	20.0	"		13									1.0						
	Sumit days	0.0	"		14							5.0	2.0		1.0					
Available days in autumn		30.0	"		15										1.0		3.0			
Employ labor in autumn	balance	0.0	may days		16							24.0	10.0			1.0	79.0			
	limmit	300.0	"		17											1.0		1.0		
Other rice cost	traditional	0.0			18	1.0												1.0		
	Mechanized	0.0			19		1.0												1.0	
Yield rice		0.0			20	3.0	4.5	0.5												1.0

Table 14. Rental charge parmetric solution

Items \ Calculation type					Transplanter				Combine			
					T: 3.0 ton M: 4.5 ton		T: 3.0 ton M: 3.0 ton		T: 3.0 ton M: 4.5 ton		T: 3.0 ton M: 4.5 ton	
					Less than 224LE	more than 224LE	Less than 44LE	More than 44LE	Less than 161.4LE	More than 161.4LE	Less than 53.4LE	More than 53.4LE
Area	Rice			Fed.	5.0	5.0	5.0	5.0	5.0	2.0	5.0	2.0
	Cotton			"	-	-	-	-	-	-	-	-
	Wheat			"	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Working days	Spring	Transplant of rice	T	days	-	5.0	-	5.0	-	-	-	
			M	"	1.65	-	1.65	-	1.65	0.66	1.65	0.66
		Harvest of wheat		"	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
		Total		"	21.65	25.0	21.65	25.0	21.65	20.66	21.65	20.66
	Autumn	Harvest of rice	T	"	-	-	-	-	-	10.0	-	10.0
			M	"	10.0	10.0	10.0	10.0	10.0	4.2	10.0	-
		Harvest of cotton		"	-	-	-	-	-	9.0	-	9.0
		Total		"	10.0	10.0	10.0	10.0	10.0	19.0	10.0	19.0
Employed labors	Spring	Transplant of rice	T	man	-	70.0	-	70.0	-	-	-	-
			M	"	20.0	-	20.0	-	20.0	8.0	20.0	8.0
		Harvest of wheat		"	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0
		Total		"	110.0	160.0	110.0	160.0	110.0	98.0	110.0	98.0
	Autumn	Harvest of rice	T	"	-	-	-	-	-	48.0	-	48.0
			M	"	50.0	50.0	50.0	50.0	50.0	-	50.0	-
		Harvest of cotton		"	-	-	-	-	-	237.0	-	237.0
		Total		"	50.0	50.0	50.0	50.0	50.0	285.0	50.0	285.0
Net revenue	Rice	Gross revenue		LE	2700.0	1800.0	1800.0	1800.0	2700.0	1080.0	1800.0	720.0
		Cost	Transplant	"	40+5P	140.0	40+5P	140.0	240.0	56.0	240.0	96.0
			Harvest	"	400.0	400.0	400.0	400.0	150+5P	144+2P	150+5P	144+2P
			Others	"	625.0	745.0	625.0	745.0	625.0	250.0	625.0	250.0
			Total	"	1065+5P	1285.0	1065+5P	1285.0	1015+5P	490+2P	1015+5P	490+2P
		Net revenue		"	1635-5P	515.0	735-5P	515.0	1685-5P	590-2P	785-5P	230-2P
	Cotton			"	-	-	-	-	-	288.0	-	288.0
	Wheat			"	395.0	395.0	395.0	395.0	395.0	395.0	395.0	395.0
	Total			"	2030-5P	910.0	1130-5P	910.0	2080-5P	1273-2P	1180-5P	913-2P

1) T: Traditional Type
M: Mechanized type

2) by parametric programming method (Program name: Para-c)

Table 15. Change of wage in spring

Items \ Yield by machine / Stage of wage					Yield of Rice 3.0 ton						
					Less than 1.6LE	1.6∿3.42	3.42∿6.39	6.39∿6.75	6.75∿14.607	14.607∿25.71	More than 25.71
Area	Rice			Fed.	5.0	5.0	2.0	2.0	1.73	1.38	-
	Cotton			"	-	-	3.0	3.0	3.27	3.62	3.8
	Wheat			"	5.0	5.0	5.0	-	-	-	-
Working days	Spring	Transplant of rice	T	days	5.0	-	-	-	-	-	-
			M	"	-	1.65	0.66	0.66	0.57	0.45	-
		Harvest of wheat		"	20.0	20.0	20.0	-	-	-	-
		Total		"	25.0	21.65	20.66	0.66	0.57	0.45	-
	Autumn	Harvest of rice	T	"	-	-	10.0	10.0	8.64	-	-
			M	"	10.0	10.0	-	-	-	2.75	-
		Harvest of cotton		"	-	-	9.0	9.0	9.81	10.86	11.4
		Total		"	10.0	10.0	19.0	19.0	18.45	13.61	11.4
Employed labors	Spring	Transplant of rice	T	man	70.0	-	-	-	-	-	-
			M	"	-	20.0	8.0	8.0	6.91	5.5	-
		Harvest of wheat		"	90.0	90.0	90.0	-	-	-	-
		Total		"	160.0	110.0	98.0	8.0	6.91	5.5	-
	Autumn	Harvest of rice	T	"	-	-	48.0	48.0	42.0	-	-
			M	"	50.0	50.0	-	-	-	13.8	-
		Harvest of cotton		"	-	-	237.0	237.0	258.0	286.2	300.0
		Total		"	50.0	50.0	285.0	285.0	300.0	300.0	300.0
Net revenue	Rice	Gross revenue		LE	1800.0	1800.0	720.0	720.0	622.8	495.7	-
		Cost	Transplant	"	70P	200+20P	80+8P	80+8P	69.1+6.9P	55.1+5.5P	-
			Harvest	"	400.0	400.0	144.0	144.0	124.6	110.2	-
			Others	"	745.0	625.0	250.0	250.0	216.3	172.1	-
			Total	"	1145+70P	1225+20P	474+8P	474+8P	410+6.9P	332.4+5.5P	-
		Net revenue		"	655-70P	575-20P	246-8P	246-8P	212.8-6.9P	658.3-5.5P	-
	Cotton			"	-	-	288.0	288.0	313.8	347.9	364.6
	Wheat			"	575-90P	575-90P	575-90P	-	-	-	-
	Total			"	1230-160P	1150-110P	1109-78P	534-8P	526.6-6.9P	506.2-5.5P	364.6

T: Traditional operation

M: Mechanized operation

P: wage price

Table 16. Change of wage in spring

Items \ Yield by machine / Stage of wage					Yield of rice 4.5 ton					
					Less than 6.39LE	6.39∿48.4	48.4∿51.75	51.75∿59.61	59.61∿70.71	More than 70.71LE
Area	Rice			Fed	5.0	5.0	2.0	1.727	1.377	-
	Cotton			"	-	-	3.0	3.273	3.623	3.8
	Wheat			"	5.0	-	-	-	-	-
Working days	Spring	Transplant of rice	T	days	-	-	-	-	-	-
			M	"	1.65	1.65	0.66	0.57	0.45	-
		Harvest of wheat		"	20.0	-	-	-	-	-
		Total		"	21.65	1.65	0.66	0.57	0.45	-
	Autumn	Harvest of rice	T	"	-	-	10.0	8.6	-	-
			M	"	10.0	10.0	-	-	2.75	-
		harvest of cotton		"	-	-	9.0	9.8	10.86	11.4
		Total		"	10.0	10.0	19.0	18.4	13.6	11.4
Employed labors	Spring	Transplant of rice	T	man	-	-	-	-	-	-
			M	"	20.0	20.0	8.0	6.9	5.5	-
		Harvest of wheat		"	90.0	-	-	-	-	-
		Total		"	110.0	20.0	8.0	6.9	5.5	-
	Autumn	Harvest of rice	T	"	-	-	48.0	41.4	-	-
			M	"	50.0	50.0	-	-	13.8	-
		Harvest of cotton		"	-	-	237.0	258.6	286.2	300.0
		Total		"	50.0	50.0	285.0	300.0	300.0	300.0
Net revenue	Rice	Gross revenue		LE	2700.0	2700.0	1080.0	932.6	743.5	-
		Cost	Transplant	"	200+20P	200+20P	80+8P	69+6.9P	55.1+5.5P	-
			Harvest	"	400.0	400.0	144.0	124.3	110.2	-
			Others	"	625.0	625.0	250.0	215.8	172.1	-
			Total	"	1225+20P	1225+20P	474+8P	409.1+6.9P	337.4+5.5P	-
		Net revenue		"	1475-20P	1475-20P	606-8P	523.5-6.9P	406.1-5.5P	-
	Cotton			"	-	-	288.0	314.0	347.9	-
	Wheat			"	575-90P	-	-	-	-	364.6
	Total			"	2050-110P	1475-20P	894-8P	837.5-6.9P	754.0-5.5P	364.6

Table 17. Change of harvesting labor wage

Items \ Yield of rice / Stage of wage					4.5 ton			3.0 ton			
					Less than 0.63LE	0.63 31.7	more than 31.7	Less than 2.655LE	2.655 2.928	2.928 13.7	More than 13.7LE
Area	Rice			Fed.	2.0	5.0	-	1.73	2.0	5.0	-
	Cotton			"	3.0	-	-	3.27	3.0	-	-
	Wheat			"	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Working days	Spring	Transplant of rice	T	days	-	-	-	-	-	-	-
			M	"	0.66	1.65	-	0.57	0.66	1.65	-
		Harvest of wheat		"	20.0	20.0	20.0	20.0	20.0	20.0	20.0
		Total		"	20.66	21.65	20.0	20.57	20.66	21.65	20.0
	Autumn	Harvest of rice	T	"	10.0	-	-	8.64	10.0	-	-
			M	"	-	10.0	-	-	-	10.0	-
		Harvest of cotton		"	9.0	-	-	9.82	9.0	-	-
		Total		"	19.0	10.0	-	18.46	19.0	10.0	-
Employed labors	Spring	Transplant of rice	T	Man	-	-	-	-	-	-	-
			M	"	8.0	20.0	-	6.91	8.0	20.0	-
		Harvest of wheat		"	90.0	90.0	90.0	90.0	90.0	90.0	90.0
		Total		"	98.0	110.0	90.0	96.91	98.0	110.0	90.0
	Autumn	Harvest of rice	T	"	48.0	-	-	41.4	48.0	-	-
			M	"	-	50.0	-	-	-	50.0	-
		Harvest of cotton		"	237.0	-	-	258.6	237.0	-	-
		Total		"	285.0	50.0	-	300.0	285.0	50.0	-
Net revenue	Rice	Gross revenue		LE	1080.0	2700.0	-	621.7	720.0	1800.0	-
		Cost	Transplant	"	96.0	240.0	-	82.9	96.0	240.0	-
			Harvest	"	48P	250+50P	-	41.4P	48P	250+50P	-
			Others	"	250.0	625.0	-	215.9	250.0	625.0	-
			Total	"	346+48P	1115+50P	-	298.8 +41.4P	346.0 +48P	1115 +50P	-
		Net revenue		"	734-48P	1585-50P	-	322.9- 41.4P	374.0 -48P	685 -50P	-
	Cotton			"	999.0 -237P	-	-	1089.9 -258.6P	999.0 -237P	-	-
	Wheat			"	395.0	395.0	395.0	395.0	395.0	395.0	395.0
	Total			"	2128.0 -285P	1980.0 -50P	395.0	1087.8 -300P	1768.0 -285P	1080 -50P	395.0

Per hour cost of Rice Transplanter

Name of rice transplanter: Yanmar YT-4000

Cost of machinery : US$2,766.13 = LE2,269

Fixed cost per year	Working hour per year	120	150	200	240	300
	Useful life of machinery achinery	10	8	6	5	4
	Depriciation	227	284	379	454	568
	Interest	125	128	132	137	146
	Construction cost	17	17	17	17	17
	Tax, etc.	0	0	0	0	0
	Total	369	429	528	608	731
Per hour cost	Fixed cost	3.075	2.86	2.64	2.533	2.436
	Variable cost: Repairing cost	0.96	0.96	0.96	0.96	0.96
	Variable cost: Fuel	0.19	0.19	0.19	0.19	0.19
	Variable cost: Oil, grease	0.06	0.06	0.06	0.06	0.06
	Personnel expenses	1.00	1.00	1.00	1.00	1.00
	Total	5.29	5.07	4.85	4.74	4.64

R.M.P. Kallin Center

August, 1983

APPENDIX

Linear programming is for determining the optimum set of variables & values under under some constraint conditions.

EXSAMPLE PROBLEM / the maxmization of net revenue in the following problems

1) Conditions
   a) available field 10 (unit = 10a)
   b) available labor 100 (unit + man-day)

2) Production
   a) Some crop (net revenue = 200$)
   b) live stock (net revenue =250$)

3) Necessary resources for production (per unit)
   a) field (10a) : crop = 1 live stock = 2
   b) labor (man-day): crop = 20 live stock = 10

* Algebraic expression of this problems

1) Valuables
   a) X1 = the area of planting crop
   b) X2 = the number of keeping live stock

2) Objective function (the sum of net revenue)
   R = 200*X1 + 250*X2 (maximization of R-value)

3) Constraint expression
   a) field constraint : 10 >= X1 + 2*X2
   b) labour constraint : 100>= 20*X1 + 10*X2
   c) each valuables are non-negative: X1.X2>= 0

* Matrix expression of this problem (called Simplex Table)

Items	Level	X1	X2	
field	10.0	1.0	2.0	X1 : crop
labour	100.0	20.0	10.0	X2 : live stock
R - C	0.0	200.0	-250.0	

Manual for Caluculation

1) Setting program disk & data disk on disk unit

Profram Disk put into drive 1

Data disk put into drive 2

2) Switch on each machine as following order

printer → display → disk unit → main computer

3) The following message appears on the screen

Disk version (Feb. 4. 1982)

How many files (0-15)

4) Push on the key (return-key) and then the next message appears

NEC N-88 BASIC Version 1.0

Copyright (C) 1981 by Microsoft

45601 Bytes free

OK

5) Input the following message by pushing key (in the case of not initialized)

run plan and R key push on --- R key is return key

6) Menu of Caluculation appears on the screen

*** Please select one in the following job **

** REMARKS (Selection Number)

* ONLY FILING OF ORIGINAL DATA ..... (SELECT No.1)

* ONLY PRINTING OF ALREADY FILED DATA ..... (SELECT No.2)

* ORDINALY LINEAR PROGRAMMING ..... (SELECT No.3)

* GOAL PROGRAMMING ..... (SELECT No.4)

* PARAMETRIC PROGRAMMING ..... (SELECT No.5)

* MIXED INTEGER (0-1) PROGRAMMING ..... (SELECT No.6)

7) Data input as the following message

WHAT IS THE SELECTION NUMBER ? 3 R

TITLE OF JOB ? EXAMPLE PROBLEM R

```
OK ?  R
SCALE OF MATRIX (ROW & COLUMN) ?   2.2   R
OK ?  R
TYPE OF CONSTRAINTS (EQAL(1 or o) & LARGER (1 or 0) ?  0.0   R
OK ?   R
USE OF ALREADY FILED DATA (YES=1 OR NO=0) ?  0    R
DATA OF TECHNICAL COEFFICIENT (end of data = 0.0.0)
  ROW & COLUMN & VALUE ?  1.1.1   R
  ROW & COLUMN & VALUE ?  2.1.20   R
ROW & COLUMN & VALUE ? 0.0.0   R
OK ?
DATA OF CONSTRAINT FACTOR (end of data = 0.0)
  ROW NO. & VALUE ?   1.10  R
  ROW NO. & VALUE ?   2.100   R
  ROW NO. & VALUE ?   0.0   R
OK ?   R
DATA OF PROFIT OR COST FACTOR (end of data = 0.0)
  COLUMN NO. & VALUE ?  1.200   R
  COLUMN NO. & VALUE ?  2.250   R
  COLUMN NO. & VALUE ?  0.0   R
OK ?    R
*** PRINT STYLE OF BIGINNING DATA TABLE & FINAL SOLUTION TABLE ?***
SHORT PRINT OF BOTH BIGINNING & FINAL TAB. .... id=1 & jd = 1
SHORT PRINT OF ONLY FINAL TAB ..............  id=1 & jd = 0
PRINT STYLE (id.jd)?  0.0   R
STORAGE OF THIS DATA (YES=1 or NO=0) ?  1   R
NAME OF NEW DATA FILE?  d-2   R
```

8) OUTPUT

```
***EXAMPLE ..... SCALE OF MATRIX = 2    2
***JOB TYPE .... ORDINARY LINEAR PROGRAMMING
***ORIGINAL SIMPLEX TABLEAU ***
```

Basic	Value	1	2
1001	10.000	1.000	2.000
1002	100.000	20.000	10.000
2001	0.000	-200.000	-250.000

```
1001:  Field
1002:  Labour
2001:  R-C
   1:  Crop
   2:  Live stock
```

*** OPTIMUM SOLUTION ***

BASIC	VALUE	1002	1001
2	3.333	-0.033	0.007
1	3.333	0.067	-0.333
2001	1500.000	5.000	100.000

9) Appraisal of the results

a) Optimum production

Crop area = 33a : Number of live stock = 3.3

b) Received net revenue ..... 1500.0$

c) The revenue of each resourse raising

Y1 = Agricultural land
Y2 = Usage of labour
R = The sum of revenue
R = 100*Y1 + 5*Y2 (land revenue = 1000$
Labour revenue = 500$)
Y1 = 10.0
Y2 = 100.0

d) The merginal productivity of each resource

Land = 100$ per 10a
Labour = 5$ per man-day

e) The revenue of each product

R = 3.333*X1 + 3.333*X2 (Crop = 666.7$
Live stock = 833.3$)

f) The merginal revenue of each product

Crop = 33.3$ per 10a Crop
Live stock = 33.3$ per head

10) Final message

JOB CONTINUE (YES=1, NO=0)? 0 R

REMARKS

1) under-line is input-data
2) R is key
3) OK?

Input data is right key
Input data is mistake key

THE 3RD MONTHLY SEMINAR

THE ECONOMIC ADVANTAGE OF RICE MECHANIZATION IN SMALL & MIDDLE SIZE FARMERS

SETSUYA HARADA, ABDELGAWAD ELSSAUD BALY, AHMED MOHAMED ETHTIAL
(Temporary Economic Research in R.M.P.)

TIME: 12:00 - 15:00 DATE: 2nd December PLACE: Auditorium at R.M.C.

RICE MECHANIZATION CENTER (R.M.C.), RICE MECHANIZATION PROJECT (R.M.P.)
AGRICULTURE MECHANIZATION RESEARCH INSTITUTE
MEET EL DYBA, KAFR EL SHEIKH, A.R. EGYPT

* Economic Advantage of Rice Mechanization in Small and Middle Size Farmer *

This report is drawn up by help of many staffs in R.M.P. We thank Dr. SAHARIGI, Dr. ZAKARIYA, Mr. SAMIL, Dr. TANAKA for giving the great support to us. And we can have good chance of investigation by help of Mr. OSAMA, Mr. DOMA, Mr. FITTOH and other Egyptian staffs. Also, Japanese experts help us sincerely about our task. We appreciate also sincerely Japanese experts, Mr. SUGAWARA, Mr. NARUSE and Mr. KIMURA, Mr. NANBA.

1. The objects of this report.

There are three important viewpoints at least to make clear the ability of rice mechanization in this country.

1) What is economic advantages of rice mechanization?
2) What's technical problem to spread mechanized farming?
3) What's does government practice to spread the rice mechanization?

In this report I will put stress on the economical points as the followings.

1) To make clear the economical advantage of each mechanized operation against each traditional operation.
2) To calculate the total economic advantages of mechanized farming in farm management.

2. Economical Advantage in each mechanized operation.

1) Plowing & levelling

Recently many farmers use tracter for plowing & levelling instead of animal. But we should make sure which is more economical for small farmers to use tracter or animal?

(1) Cost of animal keeping

The buffalo is used to plow & make levelling in traditional operating. The cost of plowing & levelling by buffalo is almost as same as the cost of keeping buffalo, and is nearly fixed cost. Cost of keeping buffalo is estimated the followings.

a) Winter feed (berseem) ..... 105.6 LE
necessary area of Berseem / Buffalo .. 18 kerrat
production cost of Berseem(/fed.) .... 70 LE
opportunity cost of berseem field (fed.) .. 70.8 LE
opportunity cost = net income of wheat
detail data of berseem & wheat : table No. 1-2

b) Summer feed (6 month: June-November)..... 123 LE
Straw: 4kg/day buffalo, price of straw: 0.132 LE/kg
Dry food: 100 kg/month buffalo,
Price: 0.0466 LE/kg

c) Labor cost ..... 300 LE
a man can keep 3 buffalo wage: 75 LE/month man

d) depreciation cost (house & buffalo) ..... 186.7 LE
house (rental charge = 10 LE/month) 120 LE
buffalo ..... 66.7 LE
(useful life = 6 years, price+ 1200 LE)
(remaining price = 800 LE)

The total cost of above case takes 715.3 LE/buffalo.
But buffalo produces some milk & calf for meat. We can estimate these income as follows.

a) milk ..... 420 LE/year
5 kg/day, milking period: 7 months,
price: 0.4 LE/kg

b) net income of 2 month age buffalo ..... 200 LE
Buffalo can produce one baby per year

Total income is 620 LE per year. In this case net cost is 101.9 LE.

(2) Plowing & levelling cost by tracter
If the farmer has tracter, he must pay the cost as shown table No.3. For example, if the useful life of tracter is 7 years, fixed cost is 1227.6 LE/year and variable one is 1.54 LE/hour. And total cost per hour is 3.26 LE. As the actual time to plow one feddan may be 2.0 hours, machinary cost takes 6-7 LE/fed.

(3) Which is more economical by buffalo or by tracter?

Judging only by above data, buffalo is more economical especially as if we calculate depreciation cost of buffalo.

But actually many small farmers practice plowing and levelling by tracter. Why?

I think one of the most important reason is to loose more profitable chance by using animal instead of machine.

Some times we call 'opportunity cost' such as the following cost:

*Opportunity cost of animal using

a) labor cost: It needs many hours to plow & make level, estimately 10 hours/feddan by animal. There are about 6 or 7 hours loss against by tracter. And it's operation need 2 men at the same time. Therefore opportunity labor cost is estimated by 10-12 LE/fed. (average wage = 3 LE/man.day)

b) yield loss: As animal operation takes long times to finish one job process, sometimes farmers can't practice the job within favorate working period. This is the one of cause to decrease the crop yield.

c) healthy loss: The hard labor under burning sun causes to injure the health of human and animal some damage of animal take much cost by decrease of milk and early death.

But it is not so good for small farmers to own a tracter, because of too much wasteful of tracter utilities. Next, we consider the acceptable farm size to have tracter by oneself.

(4) The economical farm size to own a tracter.

Now, rental charge of tracter for plowing & levelling is 10 LE/hour. According to table (No.3, 4) fixed cost & variable one of tracter & chisel are the followings.

* fixed cost (/year): tracter+1227.6 LE (7 years),
chisel = 60.1 LE (7 years)

* variable cost (/hour): tracter = 1.55 LE,
chisel = 0.02 LE

Under this condition, we can get the following break-even graph (No. 2). As graph shown, the economical point by owned is large size of farm. If plowing & levelling time per feddan is 3 hours, economical farm size to own a tracter is about 50.9 feddan. If 4-5 hours including transfer time of tracter, economical size is about 34.0 feddan (Graph 3).

Whenever it's true or not, I think sure that it isn't economical for a small farmer to have a tracter by himself. But if the farmer can lend another farmers as pump machine, economical size may be smaller.

2) Nursery & Transplanting

Nursery & transplanting operation are one of the most important working process in rice cropping. Because that operations are not only more hard but also more affective to yield of rice.

(1) The advantage of mechanized operation.

Usually farmers make nursery bed on a part of berseem field at the day within the first half days of May.

The bed is necessary about 2 kerrat area to get young plants for a feddan. The traditional way is more expensive by the following reasons.

a) Traditional way takes long times for seedling and many seeds in spite of lower yield than mechanized way as followings.

	traditional	mechanized
Amount of seeds (/F)	60 - 80 kg	20 kg
Period of nursery	40 - 45 days	15 - 20 days
No. of plants (/hill)	30 - 40 stems	3 - 5 stems
No. of hills (/m)	16.08 hills	22.08 hills
No. of stems (/m) *	404.3 stems	84.4 stems
No. of stems (/m) **	529.4 stems	523.3 stems
Yields (ton/fed.)	3.0 t	4.5 t

* at the time of transplanting

** at the time of harvesting

This data is from Agronomy Division in R.M.C.

b) Traditional way takes more expensive cost than mechanized way. Let's see table (No. 5). Traditional way takes cost about 40 LE for nursery and 38 LE for transplanting per feddan. The difference of total cost between two ways is 20 LE. And main reason of high cost is the amount of labor & material cost.

c) Another actual advantages of mechanized operation. There are another important advantages in actual mechanized farming.

The first one is that some farmers depend nursery & transplanting on cooperative branch. If the farmer commits the work both nursery and transplanting to cooperative association, he pays only 40 LE/feddan. If part of commition, for example only transplanting, the cost of commition is cheaper (24 LE/transplant). This charge is more economical than the cost of self practice.

The second one of commition to the cooperative decrease opportunity cost of self operation.

* By the commition, the farmers can avoid loss of the proceeding crop yield, for instance the last harvesting of berseem. The opportunity cost of the last yield of berseem estimates about 3 LE/kerrat. Because farmer can sell the last berseem to the keeper of cattle by 3 LE/kerrat.

* The farmer can save his family labors and get some wages by engaging another job.

(2) How many size is economical when farmer owns transplanter?

According to data from R.M.C. the cost of transplanter (Yanmar, YP-6000) the fixed cost per year is 722 LE - 1421 LE, and variable cost per hour is 3.41 LE (see the table No. 6).

Actual working capacity of transplanter is investigated in detail by Mechanization Division in R.M.C. (table No. 7).

Actual working time is rather bigger than performance test in R.M.C. That is, actual time attains 5 hours/fed. against test time 2.2 hours. At any rate, by this fact variable cost per feddan takes about 17.05 LE.

If a rental charge of transplanter is 40 LE, and other opportunity cost is ignored, the economical size is as the following (graph No. 4).

In case of 5 useful time, the economical size is more than 52 feddan. If farming size is less than 52 feddan, it is economical for farmers to choice the rental form.

3) Harvesting

(1) harvesting cost by hand

Many farmers practice harvesting work by hand as the following example.

a) Reaping practice by employed man labor, usually 5 or 6 persons. And at the same time, binding and collecting by employed 5 or 6 women.

b) Transporting rice to the place where thresh rice by donkey or camel.

c) Arrangement rice for threshing named Sakka by employed labors, 2 or 3 persons.

d) Threshing by tracter running on rice.
This work takes time 2-3 hours and cost may be 8 LE per feddan.

e) Separating straw by employed labor, may be 3-4 persons.
This cost takes 6-8 LE/feddan.

f) Packing by employed 4-5 women.
The farmer pays not only by cash but also by products. And it costs about 10 LE. In this case, total harvesting cost takes about 90 LE.

But harvesting cost is sometimes different by the conditions of farmers. And then, we show the average harvesting cost as the following table (No. 8). This table shows harvesting cost of 22 farmers in Disuk, Kallin, Kafr el Sheik. The range of cost is wide from 79 to 140 LE. And it's average is 107.9 LE. And

contents of cost is almost labor cost.

(2) Harvesting cost by combine

Almost farmers don't use combine except large farmers. But if combine is used, it's cost may be cheaper as the followings.

According to the report of R.M.P. Kallin Center (Table No. 9), harvesting cost per hour takes account to 19.67-23.0 LE. In this case, cost per feddan may be almost 88-103 LE (4.5 hours/fed.). Though this data is exact in practice of R.M.P., it's difficult to own combine for almost farmers because of high price. Therefore it is natural for many farmers to rent the machine with cooperative operater.

Next we estimate actual harvesting cost in case of renting combine.

a) Rental charge of combine is 50 LE actually.

b) Labor cost with combine is 8 LE (2 men* 4 LE)

c) Transport baggages (30 - 40 baggages/feddan) takes about 10 LE.

d) Collecting straw takes cost by 9 LE (3 men* 3 LE).

e) Transport straw takes 18 LE (by camel).

Total cost is 95 LE in this case. But if the farmer will use straws for sale or feeding to cattle, he can decrease the cost at least 18 LE, by cutting collect & transport cost.

(3) Which is more economical for the farmer, by rental or by owned?

Now we try to analysis the advantage of rental machine. According to table (No. 9), we determine the fixed cost & variable cost.

fixed cost of owned machine ..... 3305 LE (200 hours/year)
variable cost per feddan ..... 29.1 LE (4.5 hours)
rental charge per feddan ..... 50.0 LE

When calculating of break point for rental & owned, we get the following graph (No. 5). Break-even point is 158.1 feddan. It is cheaper cost to choose rental combine within 158 feddan.

But the owner of combine may decrease the break-even area to lend his machine to others. Because he can reduce fixed cost by lending it.

3. Some Study for Effect of Rice Mechanization

Most farmers usually have two most busy seasons in a year, in spring & autumn. In spring, especially the latter of May & June, farmers have hard works of transplanting rice nursery & harvesting wheat.

In autumn, especially the middle of October & November, he must harvest rice and cotton at almost same time.

Though rice mechanization is very useful to easy these hard works, but the economical effect of mechanization is rather different by farmer's conditions.

Linear programming method is also useful to know the effectiveness under some different conditions. (See appendix, if you know the outline of L.P.)

And so I try to study the effect of rice mechanization under some primitive linear programming model.

(1) The outline of L.P. model

The model farmer has 5 feddans crop fields. And under the conditions, shown as table No. 10-12, he practices farming.

I am afraid that we can't get reliable answers. Because these data are not so concreate. But I am glad if I can inform how to aproach this problem.

a) Variables

X_1 : transplanting area by traditional method
X_2 : transplanting area by transplanter
X_3 : over days than favarate transplanting period
X_4 : total days to transplant nursery of rice
X_5 : total labors employed in spring
X_6 : the area of harvesting wheat
X_7 : the area of harvesting rice by traditional method
X_8 : the area of harvesting rice by machine
X_9 : over days than favarate harvesting period of rice
X_{10}: total days of harvesting rice.
X_{11}: total labors employed in autumn
X_{12}: the area of harvesting cotton
X_{13}: other rice cost except of transplant & harvest cost by traditional

X_{14}: other rice cost except of transplant & harvest cost by machine

X_{15}: total yield of rice

b) Constraint equations

(1) Each crop area

rice	$5.0 >= X_1 + X_2$	(1)
wheat	$5.0 >= X_6$	(2)
cotton	$5.0 >= X_{12}$	(3)
total summer land	$5.0 >= X_1 + X_2 + X_{12}$	(4)

(2) The days for transplanting

favarate days	$10.0 >= X_1 + 0.33* X_2 - X_3$	(5)
over days limit	$20.0 >= X_3$	(6)
total transplant days	$0.0 >= X_1 + 0.33* X_2 - X_4$	(7)
available days in spring ...	$30.0 >= X_4 + 4* X_6$	(8)

(3) Employed labors in spring

Total employed labors	$0.0 >= 14*X_1 + 4*X_2 - X_5 + 18*X_6$	(9)
employed labors limit	$300.0 >= X_5$	(10)

(4) Harvesting of rice

harvesting area	$0.0 >= X_1 + X_2 - X_7 - X_8$	(11)
favarate days	$10.0 >= 5*X_7 + 2*X_8 - X_9$	(12)
over days limit	$20.0 >= X_9$	(13)
total harvest days	$0.0 >= 5*X_7 + 2*X_8 - X_{10}$	(14)
available days in autumn ...	$30.0 >= X_{10} + 3*X_{12}$	(15)

(5) Employed labors in autumn

total employed labors	$0.0 >= 24*X_7 + 10*X_8 - X_{10} +79*X_{12}$	(16)
employed labor limit	$300.0 >= X_{10}$	(17)

(6) Other cost & yield of rice

other cost by traditional .... $0.0 >= X_1 - X_{13}$ (18)

other cost by machine ..... $0.0 >= X_2 - X_{14}$ (19)

yield of rice ..... $0.0 >= -3*X_1 - 4.5*X_2 + X_{15}$ (20)

c) Cost & net revenue of some variables & objective function

X_1 : only labor cost

X_2 : labor cost + rental charge of transplanter (40 LE/f)

X_5 : average wage in spring (2 LE/labor)

X_6 : net revenue + harvest labor cost of wheat (detail table No.10)

X_8 : rental charge of combine with operater (50 LE/f)

X_{11}: average wage in autumn (3 LE/labor)

X_{12}: net revenue + harvest labor cost of cotton (detail table No.10)

X_{13}: other rice cost (traditional) 149.0 LE/feddan

X_{14}: other rice cost (mechanized) 125.0 LE/feddan

X_{15}: average price of rice 120 LE/ton

* objective function

$$R = -40*X_2 - 2*X_5 + 115*X_6 - 50*X_8 - 3*X_{11} + 330*X_{12} - 149*X_{13} - 125*X_{14} + 120*X_{15}$$

Our object is to find the conbination of variables to maximize this R-value. We can make simplex table as table No. 13, and calculate the following problems.

(2) Some solutions by linear programming calculation

A. The effect of rental charge changing to optimum solution

Rental charge of machine depends on many conditions, but especially the effect of saving time & increasing yield by machine are important. And also wage of labor & price of rice may be important economically. So, we try to study how much charge is economical on rice mechanization.

At first, we can get the optimum solution from simplex table (No. 13). The model farmer makes choice only rice in summer crop, and mechanized operation both transplant & harvest of rice. (detail

table No. 14)

Why does the model get the above solution?

Cost items	Traditional	Mechanized
* transplant cost	28 LE	48 LE
* harvest cost	72 LE	80 LE
* other cost	149 LE	125 LE
Total cost	249 LE	253 LE
* gross revenue	360 LE	540 LE
* net revenue	111 LE	287 LE

Mechanized model have advantage against traditional one. Because mechanized model takes much yield (4.5 ton) & more profitable revenue. On the other hand cotton profit is only 166 LE. Cotton is less profit than mechanized rice cropping. (See table No. 10)

Next we consider how much retal charge of transplanter have the advantage against a traditional operating.

This problem is solved by parametric linear programming as table No. 14. Until rental charge of transplanter attains 224 LE/fed., mechanized one has dvantage. It is very surprized conclusion.

Is it true? I try to make clear what's mean of this conclusion. See the next table.

Difference of profit between Traditional & Mechanized

Items	Traditional	Mechanized	Advantage (machine)
Gross revenue	360 LE (3*120)	540 LE (4.5*120)	180 LE
transplant cost	28 LE (14*2)	48 LE (40+4*2)	-20 LE
other cost	149 LE	125 LE	24 LE
difference	.....	.....	184 LE

As mechanized transplant has the advantage 184 LE/feddan, rental charge can increase until 224 LE (40 LE + 184 LE) by the effect of high yield. So, if there is no effect of increasing yield with transplanter, how to change the optimum solution? The solution is shown on table No, 14. Machinery transplanting has the economical advantage only less than 44 LE. You can understand how big effect of increasing yield by transplanter. At same time, when there

is the effect of yield increasing, total income is shown the followings.

R = 2030.0 - 5.0*P (R=total net revenue, P=rental charge of machine)

By this formula, you may understand that 1 LE higher charge reduce income by 5 LE. So we can call this coefficient (5 LE), the elasticity of rental charge to income, and it is important for us to know the elasticity to judge the ability of rice mechanization.

Next, we try to study the same thing about combine. (See table No. 14) If there is the effect of yield increasing, Mechanized harvesting is profitable until 161.4 LE charge price. And if no effect, profitable retal charge go down to 53.4 LE.

Another important information we can get, if rental charge is rising up, rice area reduce and cotton area increase instead of rice. That is, cotton is good rival to use summer land. But high charge of combine makes weak rice profitability against cotton.

B. The influence of wage

The wage level of employed labors is also important to judge the advantage of rice mechanization. Because, recently, agricultural worker flow out to non-agricultural job market. Therefore, farmers take much effort to employ labors, and must pay much money to employ labors.

So, in spring, if wage is rising higher, how change the advantage of mechanized transplanting takes?

We can get the solution by using parametric programming as the follow table No. 15 (this solution is under condition of same yield 3 tons). From the solution, we can get some important informations.

a) If there is no effect of increasing yield, traditional transplanting is more profitable than mechanized one until 1.6 LE wage. But the farmer have serious influence with rising wage, because the elasticity of wage to total income is very high, about 160 LE.

b) Over than 1.6 LE wage, mechanized transplanting takes advantage against traditional one. And summer crop is only rice.

c) Over than 3.42 LE to 6.39 LE wage, summer crop devide two crops. Rice is 2 feddan & cotton is 3 feddan. This conbination bring more profitable income to 5 feddan farmers.

d) Wage more than 6.39 LE to 6.75 LE, wheat raising is not profitable. Because employed labor cost exceed the profit of wheat. The wage level of 3.42 LE is very important for wheat raising.

e) When wage is rising over 6.75 LE, the area of rice is reducing gradually, and cotton area is increasing instead of rice. And to avoid the hard work in autumn, mechanized harvesting become profitable again for enlarging cotton area.

We must pay careful attentions to the difference of mechanized meanings between two wage stages less than 3.42 wage and more than 14.6 wage.

At less than 3.42 wage, the mechanized harvesting contributes to rice cropping only, but at more than 14.6 wage, mechanization is useful to enlarge cotton area, and to get more money from cotton.

f) At last, when the wage exceeds 25.71 LE, it is no sense to raise rice. In other words, the value of transplanting labor in spring is 25.71 LE at maximum level.

Next, if it can increase the yield of rice by mechanized transplanting, how influence does the change of wage gives to rice mechanization?

Speaking shortly, mechanization takes more advantages than the former solution, at expensive wage cost. (See the table No. 16)

Especially, the following informations are important.

a) At any rate wage, mechanized transplanting is more profitable than traditional one, because of increasing yield income.

b) At 6.39 LE wage, wheat disappears by the reason of high labor cost

c) Rice raising has labor value of 70.7 LE conclusionally.

You can understand that rice mechanization with increasing yield takes much advantages.

Above all, we can have the following conclusion through parametric analysis. Under conditions, in particular, short of labor, and rising of wage, the mechanization of transplanting may take advantage, and higher yield through mechanized operation enlarge this advantage further.

Next, we consider about change of harvesting labor wage. By using same method, we can get the solution shown as table No. 17. Under condition of 3 ton yield, the table shows very interesting results.

a) As wage is rising up, rice cropping is taking a advantage against cotton. It seems some strange, but it has rational reason as the follow. In cheaper wage, traditional harvesting of rice is more profitable than mechanized one. But traditional harvesting needs many labors.

   Generally speaking, the laborious crop takes more benefits by decreasing wage of labor.

   In this case, cotton is such crop, and traditional harvesting of rice is more benefitable than mechanized one.

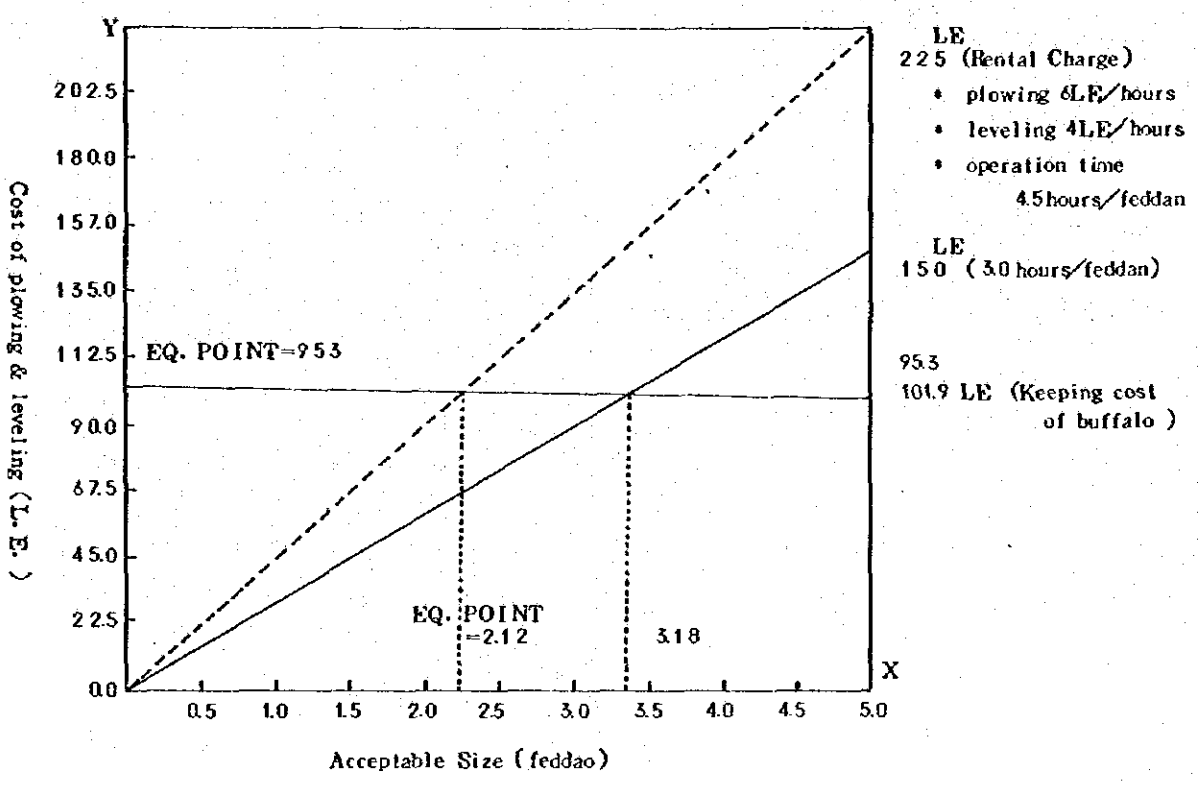
b) Gradually wage rising up, such advantage is disappeared. And at 2.93 LE wage, mechanized harvesting become benefitable. At same time, cotton become unprofitable.

c) At last, when wage attains 13.7 LE, rice harvesting has disadvantage to pay much money to workers exceeding income.

   In other words, the value of harvesting labor can not overcome 13.7 LE.

Next, we try to calculate another case under 4.5 ton yield. As shown table No. , the influence of wage changing is more sensitive, and the value of harvesting labor rise up until 31.7 LE.

Graph 1 Acceplable Size of buffalo



Ⅶ　付　属　資　料

1　サテライトフィルドに関する埃側からの要請書

2　合同委員会議事録

3　本調査団のブリーフリポート

1. サテライト協力に関する　側からの要請書

Translation

Ministry of Foreign Affairs
Department of Cultural Relations,
Asian Section

Ref. No.: 321+2/165
Dated: 8/1/1984

NOTE VERBALE

The Ministry of Foreign Affairs of the Arab Republic of Egypt presents its compliments to the Embassy of Japan in Cairo and, has the honour to enclose herewith the proposals of the Egyptian Ministry of Agriculture concerning the establishment of some extension centers in Kafr El Sheikh Governorate in order to achieve the goals of the Rice Mechanization Project in Kafr El Sheikh which has been extended as a grant by the Japanese Government.

The Ministry would like to be informed about the opinion in the regard.

The Ministry of Foreign Affairs avails itself of this opportunity to renew to the esteemed Embassy the assurances of its highest consideration.

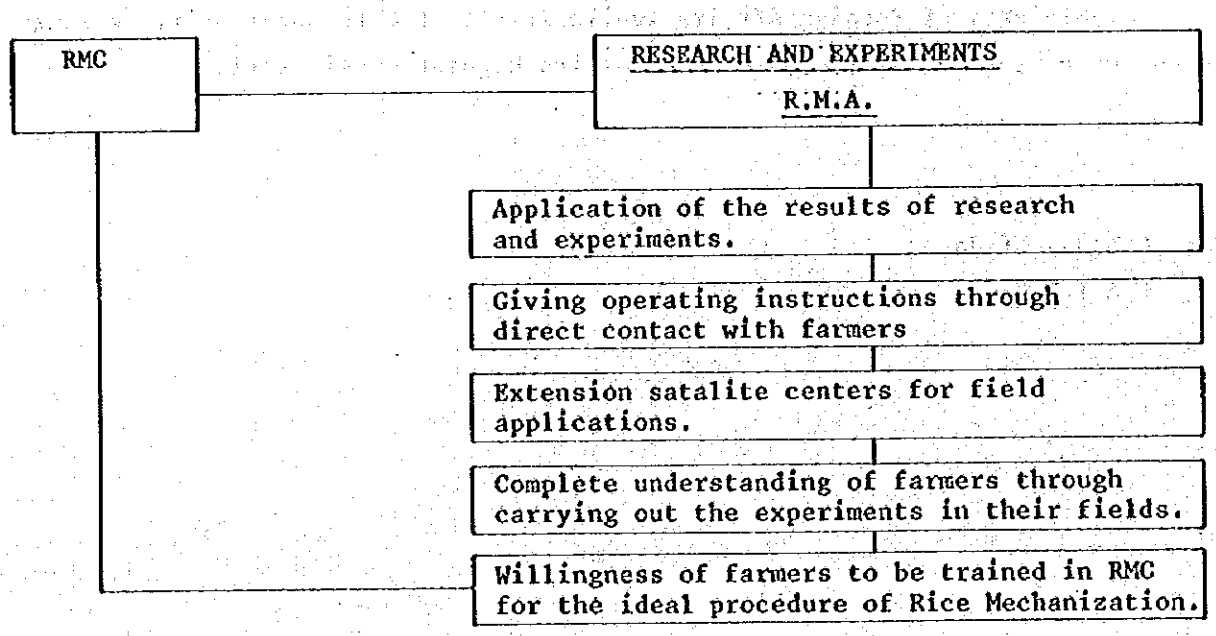
To: Embassy of Japan
C A I R O

PROPOSALS
FOR THE ESTABLISHMENT OF EXTENSION CENTERS
UNDER THE ACTIVITIES OF RICE MECH. PROJECT
IN KAFR. EL. SHEIKH GOVERNORATE
WHICH WAS DONATED FROM THE JAPANESE GOVERNORATE

Concerning the discussions that took place between the Japanese evaluation team (JICA) and the M.O.A. representatives during the period from 24/9/1983 to 2/10/1983 concerning activity evaluation of R.M.P. during the last two seasons 82/83 and 83/84, the following recommendations are to be considered:

1. The RMP has completely achieved the required goal in the field of experiments related to the Rice nursery preparation, soil preparation, mechanical transplanting, field fertilizing application and weed control experiments training etc. The Egyptian Authorities appreciate so much this fine work which was done to achieve the project goals by RMP in Egypt according to the R/D signed between the two governments.

2. To be able to achieve all the project goals, it was clear to both Japanese and Egyptian sides and through extensive studies that the activity of the project must include a number of extension centers to act as a link between the various project components and the establishment of Meet El Diba Rice Mechanization Center,



3. Due to what was previously noted, the ministry of Agriculture of Egypt has presented the following suggestions to establish about 25 satelite extension fields, 100 Fed. each, throughout Kafr El Sheikh governorate.

FIRST: Commitment of the Japanese Government:

- Financing the necessary equipment lines for these fields from nursery preparation to harvesting.
- Providing technical supervision over the operation of these fields.

SECOND: Commitment of the Egyptian Governments.

- Providing the necessary fields.
- Covering the operating costs regarding fuel, oil, grease and necessary agricultural materials.
- Routine maintenance costs for these equipment.
- Incentives an salaries to Egyptians supervising these fields.
- Training costs.

We hope that these proposals will be considered with adequate care from the proper authority of the Japanese Government.

2. 合同委員会議事録

MINUTES OF THE FOURTH JOINT COMMITTEE MEETING

The fourth Joint Committee Meeting was held on Agusut 27, 1984 in Dr. Aly El Hossary's Office, Undersecretary for Agricultural Engineering Affairs. The meeting was presided by Dr. Ahmad El Sahrigi, Project Director.

Committee Members attending were:

Egyptian side

- Dr. Ahmad El Sahrigi Chairman
- Dr. Zakaria El Haddad
- Eng. Osama Kamel
- Dr. Ballal

Japanese Side

JICA Office Cairo

- Dr. T. Tanaka
- Mr. S. Sugawara
- Mr. T. Namba
- Mr. Y. Kimura
- Mr. T. Naruse

Mr. J. Koizumi

Technical Guidance Team

- Mr. T. Tauchi
- Mr. Uemura
- Mr. K. Ahizawa
- Mr. K. Miura

Observers: Dr. A. El Hossary, MOA - Mr. Yasumura (Embassy of Japan)

Dr. Aly El Hossary, Undersecretary for Agricultural Engineering Affairs opened the meeting by an introductory speech, he said;

Gentlemen, we open the Fourth Committee Meeting under the chairmanship of Dr. El Sahrigi and both parties will discuss in detail and openly the progress and achievements of the Rice Mechanization Project from the Administrative and Technical view points.

Dr. Ahmad El Sahrigi then added that the Egyptian Government extends its appreciation for the Japanese Technical Guidance Team led by Mr. T. Tauchi for their cooperation and assistance to the Egyptian Staff.

As we are aware, the Rice Mechanization Project started on a small farm level three years ago, and gradually it developed and expanded to a large scale activity as part of achieving food security objectives in Egypt.

The Kallin Experimental Station where RMP had been initially started began the foundation activity leading to the development of the Rice Mechanization Center which the Japanese Government granted to the Government of Egypt at Meet El Dyba.

We would like also to extend our gratitude for the efforts exerted by Dr. T. Tomita at the early or preliminary stages of the RMP. Dr. Tomita conveyed regularly to the Japanese Government, difficulties and constraints he confronted in order to facilitate RMP activities. Dr. Tanaka who is now in charge instead of Dr. Tomita is carrying out efficient and successfully the implementation of the RMP activities.

His Excellency, Dr. Youssef Wally, Minister of State for Agriculture and Food Security is very much appreciative and encourages the Japanese assistance and cooperation leading towards the unanimous goal of maximizing food production. In addition, The Minister has issued a Ministerial decree to allocate the Rice Mechanization Center as one of the main sectors of the Agricultural Mechanization Research Institute. It is greatly expected that food production will increase through the efforts of all parties concerned.

Again thank you very much.

The following are the Committee resolutions.

1. High level training courses will be carried out in addition to basic courses.

2. Dr. Ballal will take the responsibility of Agronomy and Breeding as far as rice is concerned.

3. Joint Technical Committee will be held before the rice season in order to integrate all matters regarding rice production in Egypt.

4. A monthly technical meeting was recommended.

5. A request for increasing Egyptian counterparts was submitted.

6. The Minister of Agriculture has requested the RMC to extend its technicalities all over rice production area.

7. 70 officials of the National Rice Institute will be trained at RMC to integrate our activities as far as rice is concerned.

8. It is also recommended that train should start immediately at RMC after proving the effectiveness of Japanese Technology.

9. The following 4 steps were also recommended to carry out the project.
   a) Basic trials
   b) Verifications
   c) Demonstration
   d) Implementation in the Farmer's fields.

10. New variety "Reiho" has already expanded since Dr. Toriyama introduced it to Egypt 10 years ago.

11. Economical studies were strongly requested to along in parallel lines with machine performance testing.

12. Machinery and Mechanization Department was requested to varify each machine and its utilization.

13. The Establishment of a Satelite Field has been negotiated several times between Japanese side and Egyptian side but not settled yet.

A.F. El Sahrigi

Dr.Ahmad F.El Sahrigi
Project Director

Takayuki Tanaka

Dr.Takayuki Tanaka
Team Leader

THE PROGRESS IN THE IMPLEMENTATION OF THE RICE MECHANIZATION PILOT PROJECT

I. Verifying experiment on mechanized rice farming

1. Analysis of soil and irrigation water

As a result of soil survey in the experimental field at Meet El Dyba, two types of soil are classified as follows:

(a) Alkaline soil (PH is over 8.5, EC and Cl^- concentration are low respectively) Soil texture is totally heavy clay in top soils. Below 20cm, few mm width of core in grayish white colour was observed which seemed to center around ferreous carbonate and many cores were confirmed to be distributed below 20 to 35cm and 70cm respectively. Some cores lay which seemed to be soild carbonic lime. Ferreous carbonate causes poor drainage, strong reduction and the disadvantageous vegetation to the rice plants.

The desirable countermeasure to such conditions is to apply plaster in order to replace the exchangeable sodium by calsium, at the same time, it will replace carbonate soda by sulfate soda. After this countermeasure has been completed, it is necessary to provide a drainage system.

(b) Saline soil (PH) is below 8.5, EC and Cl^- concentration are high respectively)

A considerable amount sodium chloride is accumulated in the soils. There is only chloride oxcide in the few cm of surface stratum and it is confirmed that about 20cm depth of horizon where the roots reached was gray horizon, and there was ferric mottles. It was also confirmed that soil texture is heavy clay at the surface stratum, 20cm depth is silty clay and flows out water in the 90cm depth of soils.

Countermeasure to cope with such conditions is to wash away the soil with irrigation water. For that purpose, it is necessary to bury the underdrains in the 60cm depth of soils, in addition, bury the mole drains in the 30cm depth of soils cross with the underdrains.

(c) Irrigation water

It seems that the PH, EC and Cl^- concentration of irrigation water was comparatively favorable. But, it is necessary to examine the fluctuations of PH, EC and Cl^- concentration annually.

2. Land preparation by small tractor. 24 Hp and 30 Hp.

Rotary plowing by a small tractor was extremely efficient because of its multifunction such as soil cracking, smashing, weeding, etc. Both tractors of 24Hp and 30Hp required 2 to 4 hours per feddan for plowing work. It was one time plowing. The plowing by rotary plow required that moisture of field condition could be higher than 20% to make high rate of work. On the other hand, the chisel plow had wider adaptabilities even though less content of moisture in the soil but in case that the tractor Ph required gradually big Hp accoriding to getting hard of the soil.

The puddling work should be improved as follows; in case of insufficiently irrigated field, cagewhells attached to tractors lift up much clay soil and make some deep condition. Therefore, this condition affects transplanting work. The best way to keep around 15 to 20 cm in depth puddling. In order to avoid to deep puddling that puddling work should be done immediately after enough irrigated.

It is required that the puddling work must be prevented for puddling work by tractors.

3. Transplanting work by walking-type and riding type transplanter

Both transplanters of 4 row walking type and 6 row riding type were functioned well for transplanting work, but in case of deep puddling condition of fields, the rate of work was decreased. The operation of walking type of transplanter had a tendency that operator extremely tired due to deep puddled and sticky condition.

As for riding transplanter, there are two types of transplanting machines at Kallin Station. One is front-mounted type and the other is rear-mounted.

(a) Front-mounted type: according to the performance test done in Kallin, 2.5 hours per feddan was required by 6 row. Soil was lifted up by wheel, and caused some damage to those planted seedlings under the stickly field condition.

(b) Rear-mounted type: planting device is as same that of front-mounted type. This type performed transplanting work with less damage that front-mounted type.

The field of mechanized transplanting is required to keep enough irrigation water till the date of transplanting to avoid sticky soil. There are 2 types of pushing rod in Kallin Station. According to performance test could be described as follows:

(a) cam type : this type of pushing rod had a tendency to occure high rate of missing hills due to sticky soil of seedling mat. Especially picked up seedling by finger from seedling mat couldn't release from pushing rod.

(b) spring type: according to test this kind of pushing rod could plant good enough condition.

There are 2 or 3 kinds of planting fingers such as straight round shank type, L-shank type and LL-shank type (A company name MB type, B company name King finger type).

The soil for seedling mat is contented much clay soil in this area, therefore, the pushing rod and planting finger are required to have system which can be released or pick up the seedling by force. It is consider that the spring type of pushing rod and LL-shank type of planting finger are adaptable for this area.

4. Machinery for harvest

The machines used for harvesting rice are classified as follows:

(a) Binder is an implement made for efficient reaping and binding of rice plants, had binding operation can be mechanically done by this implement.

This binder was designed for harvest of short-stem variety. According to harvesting test done with GIZA-172, long-stem variety around 120 cm, the suitability of binder was very low due to the complete lodging of this variety. On the contrary, great success was obtained in short-stem variety.

(b) THRESHER (head feeding manual type)

The threshing machine with mobil crawler is movable to any spot of field. The threshing machine consists of thresher, sieving, cleaning and conveyer. The diameter and width of threshing drum are 420 x 520 mm respectivelly, and rotation of drum is 480 R.P.M. The thresher obtained some popularity among the farmers at Kallin because of it's easy operation.

This thresher was well fitted for threshing of Giza-172, average unmaturity of processed straw was 30 kg/minutes, and working capacity was 3.5 hours per feddan.

(c) COMBINE (auto threshing type)

The two types of combine were issued for harvesting at R.M.P. Kallin station, one was 3-row and the other was 5-row type. The most remarkable characteristics of these types were as follows:

The reaped crops are conveyed to the threshing section and only the panicles pass through to be threshed in paralled with the threshing shaft.

The travel section was equipped with a full crawler to minimize the sinking of the combine body into soft paddy field. Reaping speeds was 0.12 to 1.0 (wheat) per second. As the harvesting performance, the damage ratio was very low and less than 1% in all cases. If the feeding depth of panicle into the threshing chamber is too shallow, grain remain on the straw. On the other hand, it is too deep, threshing power is wasted and large amounts of chaff may be born in the chamber. Accordingly the capacity of grain threshing might be decreased. Therefore, feeding depth of panicle into the chamber should be kept at the proper length according to the ear length according to the ear length of harvested variety.

There are various kinds of mechanisms for automatic feeding depth control, and it is called sencer. A sencer mechanism is set in front of the threshing chamber, and the sencer will judge mechanically the position of feeding depth to set the suitable length of crop.

The staff of A.M.Division well understood the above systems and has operated well. According to, that result of test, the harvesting condition was good enough for Reiho, 3.12 hour per feddan, Giza-172,

4.7 hours per feddan and wheat Giza-144, 1.6 hours per feddan. But it is required that Giza-172 should be harvested before lodging to make more high working ratio. The sensor of combine could not adjusted Giza-172 due to long stem. Therefore, harvesting for Giza-172 variety by this type of combine, control unit of feeding position should be adjusted by manual.

5. Modification

Transplanter: The soil in Kallin area is generally heavy clay. The both walking and riding type transplanters are originally designed for volcanic ash soil in Japan.

Therefore, those planting fingers did not work well in the heavy clay soil. Whenever the sticky soil stuck to those push rods, the release of seedlings from push rod was malfunctioned. Therefore, some modifications were tried to solve this problems. About combine generally the straw of Giza-172 is too long, at least 120 cm whereas most of Japanese rice varieties are less than 90 cm in length.

Therefore, when the threshed straws were dumpted from the vonbine, they dropped over the unharvested rows of rice plants. This caused some disturbances in the work of mechanical harvest. Modification was given so that the threshed straws could drop in the proper place behind the combine. The zinc plate was fixed at the straw out-let to guide the drop of the straws 30 cm apart from unharvested row.

6. Nursery

Various preparatory works to establish nursing technology for mechanical transplanting such as soil selection, PH adjustment of soil, study of soil characteristics, preliminary test of nursing and so on were carried out in 1982 and 1983.

7. Varietal cultivation test

(a) Among the various cultivation tests, Akihikari (Japanese early variety) brought the highest paddy yield of 12.03 tons per ha. (5.05 tons/feddan) under the condition of the high planting density (30cm x 12.5 cm, 26.6 hills per m^2). Then Nipponbare (Japanese medium variety) recorded the second high yield of 11.76 tons per ha (4.94 tons/feddan). Reiho (Japanese late variety) and Giza-172 yielded 11.28 tons and 11.25 tons

per ha repectively.

(b) The total growth duration from seeding to seed of Akihikari was 120 days, whereas those of Giza-172 and Reiho were around 150 days. Moreover, the former's yield was higher than those of the latter two varieties with long growth duration. Therefore, some high yield varieties with short growth duration seem to be more efficient than long growth duration varieties from the view point of rice farming, i.e. efficient land utilization, less amount of irrigation water, eary crop rotation and higher profit.

(c) The panical number type varieties such as Akihikari and Nipponbare which grow many tillers (shoots) with reasonably sized panicles, were recommended to be transplanted under the condition of standard density (20 to 24 hills/m^2). On the other hand, the panicle weight type varieties such as Giza-172 and Reiho, which grow less number of tillers but bear long panicles, can be transplanted more densely than the other type.

8. Method of transplanting

In comparison with the convertional transplanting method of Egyptian farmer, the advantages of mechanical transplanting method are to use the young and vital seedlings instead of over-grown and exhausted seedlings, and also to be transplanted shallowly with constant number of seedlings per hill (3 to 5 seedlings) together with attached soil to the roots which causes earlier recovery after transplanting. These advantages cause the vigorous tillering effect, and finally lead to high yield.

9. Necessity of three fertilizer elements

According to results from trial of three fertilizer elements, balanced fertilizer of N, P, and K applied plot obtained maximum grain yield of 11.30 ton per ha. in Giza-172 and 11.46 ton in Nipponbare.

For this reason, balanced fertilizer application will be required to obtaining higher grain yield, and quantity of each different fertilizer were shown below;

(kg/ha. by elements)

Field condition	N	P_2O_5	K_2O
Rich soil	60 - 80	50	20
Normal soil	80 - 120	60	30
Poor soil	120 - 150	80	50

10. Nitrogen quantity and application method for different field condition

According to results, both of Nipponbare and Giza-172 obtained maximum yield at 150 kg of nitrogen level.

The Giza-172 obtained 11.82 ton per ha. at 150 kg Nitrogen, and Nipponbare also 11.98 ton. But, this quantity of nitrogen is too high level for farmer's field, and recommendable quantity shown below.

And, nitrogen fertilizer application method also very important to obtaining maximum yield with mechanical transplanting. According to results of different nitrogen fertilizer application method trial, 50% of total nitrogen for basal, 25% at 7 to 10 days after transplanting and remaining 25% at 7 to 10 days before the Panicle initiation stage for panicle number type varieties and just before the Reduction Division Stage for panicle weight type varieties. Optimum nitrogen quantity and application method as shown below;

(kg per ha. by element)

Preceding crop	N	P_2O_5	K_2O
Wheat	120 - 130	60 - 80	30 - 40
Flax	130 - 150	"	"
Fallow land	120 - 130	"	"
Vegetable	80 - 120	40 - 60	"
Clover	100 - 120	60 - 80	"

With nitrogen quantity, application method of nitrogen fertilizer also extremely important to obtaining optimum growth and high grain yield, and application method and its time were mentioned as follow:

a. Basal doses will be applied at just before the plowing, and mix well with all layer of soil. And, specially anmonum sulfate will be suitable for basal dose of nitrogen, and all quantity of P_2O_5 and K_2O should be applied as basal.

b. 1st top-dressing should be appoied 7 to 10 days after transplanting by urea.

c. 2nd top-dressing is so call "fertilizer for panicle", but application time will be difference against panicle number type and panicle weight type i.e. 7 to 10 days before panicle initiation stage for panicle number type such as Akihikari, Nipponbare and Reiho, and at just before the reduction division stage for panicle weight type such as Giza-172.

Nitrogen top-dressing at 7 to 10 days before the panicle initiation stage can be promoted to increasing the spikelet number for panicle number type varieties.

But, if nitrogen fertilizer applied to the panicle weight type at same time as above panicle number type, grain yield will be decreased by heavy lodging.

So, in case of panicle weight type, 2nd top-dressing should be applied at just before the reduction division stage to avoid the lodging damage.

d. 3rd top-dressing can be used when rice plant leaves changed to yellowish at heading stage or its field was less than 85% of ripening ratio every year.

Application time of fertilizer and its quantity were shown below;

Preceeding crop	Different application time and its quantity					
	Basal			1st TD	2nd TD	3rd TD
	N	P	K	N	N	N
Wheat	60-65	60-80	30-40	30-32	20-30	10-15
Flax	65-75	60-80	30-40	32-38	20-30	10-15
Fallow land	60-65	60-80	30-40	30-32	20-30	10-15
Vegetable	40-60	30-40	20-30	20-30	20-30	10-15
Crover	50-60	60-80	30-40	25-35	20-30	10-15

Note: Above quantity about kg per ha. by elements.

11. Seedling number per hill and planting density

The trial of Seedling number per hill and Planting Density has been carried out and obtained following results i.e. i) Optimum seedling number per hill were 4 to 6 numbers per hill ii) and planting density will be related with cultivation time and nitrogen application quantity. Early transplanting should be kept 30 cm x 16 cm or 30 cm x 14, and late transplanting field should be kept dense condition such as 30 cm x 12 cm.

Planting density and seedling number per hill shown in below:

The planting density and seedling number per hill have been relation with cultivation season and nitrogen fertilizer quantity. Through obtained data in the 1983, optimum planting density per unit area and seedling number per hill on different rice cultivation time as shown below;

Reiho variety

	PLANTING DENSITY		
Transplanting time	30 cm x 12 cm	30 cm x 14 cm	30 cm x 16 cm
1st May-15 May	3 - 5	3 - 5	3 - 5
15 May-30 May	3 - 5	4 - 6	4 - 6
1st June-30June	4 - 6	4 - 6	6 - 8
After 1st July	6 - 8	———	———

Note: Number of seedling per hill can be adjusted by machine.

Giza-172

	PLANTING DENSITY		
	30 cm X 12 cm	30 cm x 14 cm	30 cm x 16 cm
1st May - 15 May	3 - 5	3 - 5	3 - 5
15 May - 30 May	3 - 5	4 - 6	6 - 8
1st June - 30 June	4 - 6	6 - 8	———
After 1st July	6 - 8	———	———

12. Optimum rice cultivation time

During the rice cultivation season in the 1983, date of seeding on 1st May and transplanted 23rd May has obtained maximum grain yield, and second highest was 15th May seeding, and 7th June transplanted plot. And, if made a line of 8 ton per ha, optimum seeding date were from 20th April to 20th May and transplanting during 15th May to 15th June.

13. Weed control

a) Paddy weeds of R.M.C. are identified and the main weeds were as follows, Echinochloa crus-galli, E.colonum, Cyperus difformis, C.rotundus, Ammannia spp., Panicum repens, Cynodon ductylon, Paspalum paspaloides, Scirpus spp., Eclipta alba.

b) On mechanized transplanting culture, in the case that irrigation water is sufficient and Cyperus rotundus is not so much, one application is suitable (for example, pyrazolate butachlor granule, CNP butachlor granule, etc.). In the case that irrigation water is not sufficient or Cyperus rotundus imerges so much, systematic treatments combined with early stage treatment (benchioncarb granule liquid, CNP granule, etc.) and middle or late stage treatment (bentazon granule liwuid etc.) is suitable.

On wet direct seeding culture, systematic treatment combined with pyrazorate treatment directly after seeding and middle or late treatment will be suitable, On dry direct seeding culture, systematic treatment combined with pre-emergence treatment and post emergence treatment will be suitable.

14. Method of transplanting

In comparison with the conventional transplanting method of Egyptian farmer, the advantages of mechanical transplanting method are to use the young and vital seedling instead of over-grown and exhausted seedlings, and also to be transplanted shallowly with constant number of seedlings per hill (3 to 5 seedlings) together with attached soil to the roots which causes earlier recovery after transplanting. These advantages cause the vigorous tillering effect, and finally lead to high yield.

II. Economic study on mechanized rice farming

(a) Expenses of mechanized transplanting and thoseof conventional transplanting per feddan were calculated and made a report on the basis of collected data by the Training Division. It shows that mechanized transplanting is 11 LE (13%) cheaper in cost than conventional transplanting.

(b) The cost was devided into nursery and transplanting, cost of nursery is 4.85 LE (13%) higher for the mechanized transplanting and the cost of transplanting, 15.85 LE (35%) cheaper for the mechanized transplanting.

(c) Study on harvesting compare combine with conventional method is being conducted in the experimental field at Meet El Dyba.

III. Establishment of mechanized rice farming system

The Project started with the first experiment on the 11 feddan experiment field at Kallin, a large amount of basic data has been collected from the field since April 1982. According to the collected data, the Project has made the comparison between Egyptian traditional method and Japanese mechanized method. But it is too early to refer the merits and demerits of both methods. Such Evaluation should be made after the operation of the experimental fields at Meet El Dyba.

IV. Advice and guidance on training for the operation and maintenance of agricultural machinery (including raising seedling)

The training work was conducted at project center by R.M.P. staff. The mechanical and agronomy staff of Kafr El Sheik governorate were trained around 400 persons till Febraly 1984. The curriculum of training was consists of raising seedling, rice transplanter operation and it's maintainance, planning and etc. Among 400 trainees, 177 trainces were retrained to improve technical settlement who are incharged of mechanized rice transplanting at KF. Further planning for training will be included the subjects of weed control, fertilizer application, harvesting machinery and etc.

V. Advice and guidance for the demonstration activities of mechanized rice farming

Demonstration of mechanized rice transplanting 1983, 1984 in Kafr El Sheikh Governorate has been carried out by the effective advices and guidances of personnels who had been trained at RMP.

VI. Grant aid

Construction of the Rice Mechanization Centre at Meet El Dyba was started in January 1983, and completed March 1984. The total cost of one billion four hundred million yen was paid by the Japanese Government.

VII. Model infrastructure

The improvement of experimental field at Kallin and experimental field at Meet El Dyba was made with the total cost of sixty million yen which was paid by the Japanese Government.

VIII. Expert

Six (6) long-term experts and eight (8) short-term experts were dispatched in accordance with the Record of Discussions.

IX. Supply of equipment and machinery

Total amount of grant aid for equipment and machinery was one hundred sixty five (165) million yen as of fiscal year 1983.

3. 本調査団のブリーフリポート

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Brief Report of the Japanese Technical Guidance Team on the Rice Mechanization Pilot Project

The Japanese Technical Guidance Team (hereinafter referred to as "the Team") organized by the Japan International Cooperation Agency, and headed by Mr. Takashi TAUCHI visited the Arab Republic of Egypt from August 18th to August 30th for the purpose of a general review and technical guidance on the technical cooperation program concerning the Rice Mechanization Pilot Project (hereinafter referred to as "the Project").

The Team understands that the Project located both in Kallin and Meet El Dyba are very valuable for the rice mechanization and useful for the activities of experiment on mechanized rice farming in Egypt.

The Team, after its visit to the related fields and interviews with the Japanese experts and Egyptian counterparts, recommends the followings to the Egyptian authorities concerned so that this mutual cooperation will lead to more successful stage.

1. It is necessary for the Egyptian side to make a prompt and great improvement on sufficient irrigation water to be supplied to the Meet El Dyba Experiment Field.

2. Land improvement is in great need because a high Cl^- concentration has been found in the Meet El Dyba Experiment Field.

The Team would like to express its heartfelt gratitude to all those who are concerned for the most cordial cooperation and hospitality extended to the

Team during its stay in Egypt.

Cairo, August 27, 1984

Takashi TAUCHI

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JICA