EGYPTIAN AGRICULTURAL MECHANIZATION PROJECT

Contract Number 263-0031-HHC-01

ACTIVITY REPORT NUMBER 8

1 January 1983-31 March 1983

Submitted by

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1.0 Executive Summary

The Extension and Training programs have continued to make substantial implementation progress. Field management structures have been further refined and strengthened through the development of comprehensive village activity workplans and the preparation of a detailed equipment locator, assignment and schedulling procedure. Thirty (3) training programs involving 293 participants were also completed together with a mass media efforts consisting of televised mechanization programs, 2 monthly agricultural magazines and preparation of 11 machinery bulletins.

The evaluation sub-unit should also be singled out for special recognition. During the reporting period, the field evaluation staff were recruited and trained and a number of significant activities were completed which have provided management with badly needed feedback concerning farmer's reactions to mechanized operations introduced under the Extension program and identifying cultural constraints requiring program fine tuning. Specifically, a complete evaluation of the water lifting credit program was prepared together with impact assessments of an Italian wheat harvester and farmers perceptions of change in soil and water conditions.

The Service Center/Village Workshop subproject continues to make progress. Six (6) service center and Four (4) village workshop applications have been completed and submitted to the banks for final approval. Of these, I service center and 4 village workshops are beginning construction and a total of £E 4.2 million has been obligated for projects. A major implementation problem continues to be the slowness through which completed loan applications move through the banks.

Other highlights of subproject activities are:

1. Planning and Evaluation: Publication of an agricultural mechanization cost model to generate financial and economic costs of mechanized operations introduced under Extension. Final drafting of Working Paper Number 6, describing and evaluating the socio-economic conditions in the Project villages. Preparation and design of a one-year long tractor cost survey. Development of a quantitative procedure for evaluating income effects of optimizing maize planting dates. Continuation of the statistical processing of farm management survey data.
2. Research and Development: Tillage experiments at West Nubaria and at Sakha and machinery tests of a corn sheller and potato digger.
3. Land Improvement: Startup of the demonstration landlevelling program in Minia Governorate.

Table 1.1 Service Center/Village Workshop loans in-process at Governate banks and at the Project level as of 31 March 1983 in LE.

Participant/Category	Loan Value	Expended	Balance	Loan Value
A. Bank Approved				
1. Service Centers				-
a.Mr Mashen Asony	250,000	55,000	195,000	
b.Mr.M.Gamal El-Din	95,000	-	95,000	-
2. Village Workshops				
5 loans	122,201	122,201	-	-
4 loans	113,859	-	113,859	
3. Subtotal	581,060	177,201	403,859	581,060
B. Loans in-process at Governate banks				
1. Service Centers				
a. Mamoudia Motors				190,000
b. Hammamy				185,000
c. Shiaty Co				250,000
d. Shoukry Engineering Co				250,000
e. Egyptian Tractor Co				250,000
f. Mr. Aly A.Mohamed				100,000
				1,225,000
2. Village Workshops				
a. Four loans				102,000
3. Subtotal				1,327,000
C. Loans in-process at Project level				
1. Service Centers				
a. Diabex				250,000
b. Mr.Magul				107,000
c. Mr. Zoomer				250,000
d. Mr. Assem				250,000
		Balance Forward		857,000

Table 1.1 Continued.

Participant/Category		Loan Value
Balance Forwarded		857,000
e. Mr. Mahgarzie		250,000
f. Mr. Korra		250,000
g. Mr. Sherif-Gabile		250,000
h. Mr. Ragaa		250,000
		1,857,000
2. Village Workshops		
a. 19 loans		509,500
3. Subtotal		2,366,500
D. Summary		
1. Bank approved loans		
a. Expended	177,201	
b. Remaining balance	403,859	581,060
2. Bank loans in-process		
a. Service Centers	1,225,000	
b. Village Workshop	102,000	1,327,000
3. Project loans in-process		
a. Service Centers	1,857,000	
b. Village Workshops	509,500	2,366,500
4. Grand Total (LE)		4,274,560
US Dollar Equivalent		5,139,731

2.0 PROJECT ACCOMPLISHMENTS

This section reviews the highlights of the Projects six programs: Planning and Evaluation, Extension/Training, Local Manufacturing, Research and Development, Service Center and Village Workshop development, and Land Improvement. The details of these activities can be reviewed in Annex A.

2.1 Overall Accomplishments

1. The Project is filling the financial pipeline, which increased from 36 percent to 43 percent.
2. Detailed reports prepared for the USAID evaluation team.
3. Procurement -- Soil test equipment shipped and land improvement IFB awarded.
4. Second tranch of the waterlifting fund in place.
5. Two TDY programs in place: Machinery Development Advisor and plant root evaluation.

2.2 Planning and Evaluation Subproject

2.2.1. Economic and financial subunit

1. Farm management study -- statistical processing started and completed for long-term berseem; a long-term berseem enterprise budget is in preparation.
2. Mechanization cost model -- the tractor cost model developed in Working Paper No.5 has been upgraded to include 21 implements used with the tractor: the model gives hourly tractor and implement costs, operational costs ranging from one to 20 feddans, and optimum land area unit costs.
3. Tractor Cost Survey -- this unit has initiated a year-long field study of tractor costs and the initial survey forms were pretested.
4. Two papers were prepared during this period and are submitted with this report:
   a. "Agricultural Mechanization Cost Model", see item two above.

b. Working Paper No.7: "Reducing Maize Losses through Optimizing Planting Dates: a Simulation Model and Economic Analysis". In a berseem-maize rotation this paper analyzed maize losses. Losses were minimized with a May 2 planting date but this requires foregoing a fifth berseem cutting; an economic analysis indicated that planting between June 1 and June 9 would maximize farm income while retaining the fifth cutting of berseem, given the existing price relationship.

2.2.2 Evaluation subunit

1. Conducted a field evaluation of the waterlift loan fund in three Project villages. Some highlights were:

   a. Smaller pumps, 5-6 hp., rather than the recommended 12 pumps prevailed. Farmer selection was dominated by cropping pattern, working farm size, and access to rentable land.

   b. Many of the interviewed farmers purchased pumps to avoid continued participation in the "sagia ring" because of dissatisfaction with the management of the sagia.

   c. Pump purchases have led to the rental of additonal ground either for the first time or as an expansion of rented land.

   d. Purchasers reported an increase in milk production by substituting the pumps for buffalo and/or cattle power.

   e. The Project needs to make a concerted effort to see that funds move to other areas when pump saturation occurs.

2. Prepared two case studies: (1) farmer reactions to an Italian wheat harvester, and (2) farmers perceptions of change in soil and water conditions (Annex B).

a. Over a four year period farmer interest in the harvester decreased because of losses.

b. Farmers did not associate landleveling, poor drainage, and alkalinity with salinity problems, which implies a need for an Extension effort.

3. In support of the land improvement activity, designed a survey in Minia focusing on: (1) how farmers identify field boundaries, the dangers of excess water, long or short irrigation furrows, and Project demonstation at Abyuha village.

4. The criteria for Project and control village selection prepared (Annex C).

5. Working Paper No.6 , "Project Village Profiles", revised draft in progress.

2.3 Machinery Management Extension/training Subproject

1. Completed the Annual Report-1982 for the Machines Management Extension and Training Subproject.

2. Completed the final draft of the 1983 Training Plan.

3. Finalized group 2 and 3 demonstrated/training equipment which was approved by project management but procurement was postponed due to delay in funds appropriations.

4. Collected and translated Villages Workplans for all five governorates.

5. Completed limited field demonstration/training sessions due to the absence of sufficient equipment and operating funds.

6. Employed Mr. Roger Engstrom, an agricultural extension specialist for a one year period to advise and support field extension activities.

2.3.1 Extension Subunit

1. Presented extension workplans for 1983/4 by the Mechanization extension specialists from Sharkia, Qualiubya and Minia Governorates.
2. Established a wall chart in the Cairo office for all demonstration/training equipment being placed in project villages areas.
3. Redefined the responsibilities of the field extension officers and received three new regional irrigation extension officers for the subproject.
4. Limited field demonstration/training sessions were held for backhoes, land scrapers and a lazer unit. These activities were stopped when funds were delayed from early March.
5. Several field trips were taken with the USAID evaluation team which spent two weeks evaluating project activities in February.
6. Attended the Cairo International fair in February where several agricultural mechanization exhibits were set up. Over 400 key farmers were transported to the fair with extension personnel's assistance.

2.3.2 Demonstration/Training Unit

1. Finalized and ordered a full set of demonstration/training equipment for a fully mechanized farming operation which will be demonstrated to farming and governmental personnel.
2. Prepared plans for demonstration farm including office and equipment support facilities.

2.3.3 Rural Agricultural Information Unit

1. Preparing bulletins on tractor maintenance and forms about soft loans from the project.
2. Preparing a television program on mechanization (32 minutes) to be aired once a week for 4 weeks.

3. Publishing 2 articles in 2 montly agricultural magazines and a newspaper article.

4. Participated in training project mechanization extension specialists on visual aids (cameras) at the Sidi Beshr training center in Alexandaria.

5. Participated in the Cairo International Fair during Feb/March. Reprinted 11 extension bulletins which were distributed during the fair.

6. Developed several documentary video tapes on wheat planting, backhoe operation, potatoe harvesting and land leveling by mechanical means.

2.3.4 Training Unit

1. Offered 30 programes on a monthly basis, which varied from daily sessions to three month courses.

2. Conducted 30 training programs involving 293 participants (table 2.1)

Program Location	Monthly Program	Participants
a) Training Center	20	175
b) Project University	5	41
c) American University	5	77

3. Screened 120 candidates from the MOA for English language testing the the participant training program.

4. Developed course materials for courses on visual aids for peanut farming and combine harvesting.

5. Continued to process 5 academic and 2 technical training programs with USAID/Cairo as additonal programs are developed by the project for processing.

Table 2.1 : TRAINING COURSES SCHEDULED FOR JANUARY - MARCH 1983 AS PER TRAINING PLAN AND RESCHEDULED COURSES

Course No.	Title	Jan	Feb	March	Participants/ Location
EXTENSION					
1. Scheduled:					
2EX78	Tractor operator	X			13-Nubaria T.C
2EX80f	Machinist	X			2-Nubaria T.C
2EX80m	Rice transplanting	X			14-Kollin
2EX80K,3EX80L	Mech.Ag.: Theory/Practice	X			62-Sidi Bèshr T.C
3EX43	Potatoe harvesting/planting	0			
3EX8.1- .5	Backhoe operation		X	X	50-Project villages
3EX9.1- .23 3EX33.1- .23	3EX35.1- .23 Plowing		0	0	
3EX12.1	Mechanic: Level 1a		X	X	12-Maamoura T.C
3EX13.1-.23 3EX36.1-.23	Discing			X	10-Project villages
3EX16.1-.23	Land leveling			X	5-Project villages
3EX17.1-.23	Bedding/ridging			0	
3EX18.1-.23	Planting(potatoes,peanuts)			0	
3EX19.1-.23 3EX39.1-.23	Irrigation			0	
3EX10.1-.3	Tractor operator instructor			0	
3EX21.1-.23	Tractor driver			0	
3EX29.1	Workshop: Mech.Extension		X		27-Sidi Bisher T.C
3EX45.1	Combine harvester:op./maint			X	24-Maamoura T.C
2. New/Rescheduled					
3EX44.1	Mechanization Short course: Visual aids use		X		(with 3EX29.1)
3EX44.2	Mech.Sic: lazer op/maint			X	12-Project Villages

Course No.	Title	Jan	Feb	March	Participants/ Location
B. PLANNING/EVALUATION					
1. Scheduled					
3PE3	Workshop:Tractor Economics			0	
2. New/Rescheduled			-NONE-		
C. RESEARCH AND DEVELOPMENT					
1. Scheduled			-NONE-		
2. New/Rescheduled			-NONE-		
D. LAND(Soil)IMPROVEMENT					
1. Scheduled					
2Si8	Mechanic: Level 2	X	X	X	8-Maamour T.C
3Li3.1	Lazer operation/maint.		X		5-G/A T.C
2. New/Rescheduled					
3Li3.3	Lazer op/maint.			X	5-G/A T.C
E. SERVICE CENTERS					
1. Scheduled					
3sc.1	Specialized Short Course			0	
2. New/Rescheduled			-NONE-		
F. TRAINING					
1. Scheduled					
2T11, 3T 2.1-.3		X	X		38-RUC
3T5.1-.3		X	X	X	3-Cairo office
2. New/Rescheduled			-NONE-		
G. LOCAL MANUFACTURING					
1. Scheduled					
3LM1.1	Grain thresher development	X	X	X	3-Behera T.C
3LM2.1	Mower development	X	X	X	(with 3LM1.1)
2. New/Rescheduled			-NONE-		

II. SUMMARY:	Monthly Programs	Total Participants
Training Centers	20	175
AUC/Cairo Office	5	41
Project Villages	5	77
Total:	30	293

2.4 Service Center/Village Workshop Subproject

1. Total loan activity exceeded the $ 5 million fund: This of course assumes that all projects will be successfully funded.
2. The banks approved loans totalling LE 581,060 which included two service centers and nine village workshops.
3. Loans totalling LE 1,327,000 are at the banks for processing which includes six service centers and four village workshops.
4. At the Project-level, loans totalling LE 2,366,500 are being prepared and negotiated; this includes eight sevice centers and 19 village workshop loans.
5. Overall total loan activity reached LE 4,274,560 ($ 5,139,731) which includes 16 service centers and 32 village workshops.

2.5 Research and Development Subproject

1. In-house tillage research
   a. Sandy soils -- tillage experiments at West Nubaria installed with peanuts as the cover crop
   b. Heavy clay soils -- tillage experiments at Sahka installed; cotton will be the cover crop .
2. Machinery tests
   a. Beit Hashita harvester was tested as a corn sheller: The machine has a good potential as a sheller with a capacity of 4,500 kg/h; the machine is simply constructed and could be locally manufactured.
   b. The Kuxman potato digger was tested and the report will be completed next quarter.
3. Applied Research Fund -- contracts not yet approved.
4. SAAP sprayer (Annex D) -- this small selfpropelled sprayer was redesigned and modified into a prototype model during Dr. Butler's one-month TDY. Areas redesigned and modified : filtration system, various nozzle tip sizes, distribution pattern, agitation system, steering system, and repositioning drive wheel.

5. Several other sprayers were also evaluated: Nir David, Rau-Sprimat, Baltan, and the Beheira trailed-sprayer.

2.6 Local Manufacturing Program

The emphasis on the development and manufacture of an all crop thresher continued in preparation for the wheat crop in May. The manufacture of four prototype machines was completed with improvements from the testing that was done last quarter.

2.7 Land Improvement Subproject

1. Received and assembled a landleveling demonstration unit.
2. Trained operators in laser-controlled landleveling at Gabal Asfar.
3. Started demonstration landleveling program in Minia Governate in cooperation with EWDP.
4. Completed tractor and equipment specifications for the balance of the land improvement program.
5. Evaluated tillage methods at the Seed Multiplication Farm (see report in Annex A).

3.0 Financial and Technical Level of Egypt

3.1 Financial Level of Effort

Table 3.1 summarizes the financial effort of the Project : 43 percent of the total Grant has moved into the expended/pipeline category while 15 percent of the funds have been physically expended. This compares to 36 percent and 13 percent in these same categories at the beginning of this reporting period. The categories are defined as follows:

1. Funds in-process -- funds requested and in-process at USAID or MOA, e.g., cash needs request and procurements in progress.
2. Funds available -- funds directly available to the Project in local currency bank accounts except in the case of technical assistance, which is available through a cash needs statement.
3. Funds committed -- available funds that have been committed but not expended, e.g., bank approval of service centers but where the monies have not yet been expended.
4. Funds expended -- funds physically expended.
5. Pipeline/expended funds -- the summation of items 3 through 6.

The increase in financial activity represents funds moving from the Project into the banks for the service center program and an increase in shelf item commodity procurement. However, as can be seen from column 5, the slow processing of service center applicants is still a major constraint to the physical expenditure of service center funds. Although the funds are not large, it is important to note that the machinery introduction fund has started to move. Again bank processing will a critical element in the success of this fund.

Also of financial significance was an amendment to the Grant Agreement that transferred $ 2 million from the uncommitted section of the credit funds to the local currency commodity line item. This reflects the increased activity of the demonstration program and especially the Gabal Asfar demonstration/training unit. It should also be noted that the value of the land improvement IFB has been reduced nearly $ 400.000 since several items were not bid and those that were bid were lower than anticipated.

3.2 Technical Level of Effort

The technical level of effort is summarized in table 3.2. The technical effort was 302 man-months as compared to an estimated 319.5 man-months. During this period the extension advisor's position was filled leaving only the machinery development advisor's position unfilled. As a temprory measure, a three month TDY in the machinery development slot started in mid-March.

Table 3.1 Financial Level of Effort: Foreign and Local Currencies From 15 September 1980 through 31 March 1983

Line Item	(1) Grant Agreement	(2) USAID Obligation	(3) Funds In-process (USAID,MOA)	(4) Funds Available Balance	(5) Committed Funds In-process (PBDAC)	(6) Funds Expended	(7) Pipeline Expended Fund 3+4+5+6
Foreign Currency(US $)							
1. Technical Assistance	6,424,000	5,955,618	–	3,502,252	–	2,453,366	5,955,618
2. Commodities	9,133,000	9,133,000	1,135,631 *	–	–	385,336	1,520,967
3. Training	2,023,000	2,023,000	225,350	–	–	8,410	233,760
4. Research Support	1,005,000	1,005,000	–	–	–	188,532	188,532
5. Special Studies&Evaluation	215,000	215,000	–	–	–	6,891	6,891
6. Subtotal	18,800,000	18,800,000	1,360,891	3,502,252	–	3,042,535	7,905,768
Local Currency (US $ equivalent)							
1. Technical Assistance	2,302,000	1,665,283	–	883,524	–	781,759 +	1,665,238
2. Commodities	2,000,000	4,000,000	422,690	–	–	1,322,563	1,745,235
3. Training	1,000,000	1,000,000	–	–	–	228,426	228,426
4. Vehicle Operating Expense	100,000	100,000	–	17,643	–	2,647 +	20,290
5. Facilities	70,000	70,000	–	–	–	–	–
6. Credit Funds							
a. Service Center	5,000,000	5,000,000	–	1,286,943	2,081,185	213,057	3,581,185
b. Waterlift	2,000,000	2,000,000	–	593,697	–	406,303	1,000,000
c. Machine Introduction	2,000,000	2,000,000	–	949,506	–	50,494	1,000,000
d. Uncommitted	4,000,000	2,000,000	–		–	–	
7. Research Support	2,000,000	2,000,000	–	271,872	–	–	271,872
8. Special Studies/Evaluation	728,000	728,000	–	18,751	–	–	18,751
9. Subtotal	21,200,000	20,563,283	422,690	4,021,936	2,081,185	3,005,255	9,531,060
Overall			1,783,671	7,524,188	2,081,185	6,047,784	17,436,828
						15%	43%

Land Improvement IFB bid value Through Jan 31,1983

Table 3.2: Level of Effort: Technical Staff, from Sept 15,1980 through March 31,1983, in man Months

Position	Starting Date Day/Mo/Yr	Actual Effort	Anticipated Effort (1)
1. Team Leader	4/10/80	29.9	30.0
2. Planning/Evaluation Advisor	15/9/80	30.5	30.5
3. Research Director	3/11/80	28.9	29.0
4. Evaluation Advisor	7/12/80	27.8	28.0
5. Extension Advisor		20.6	26.0
6. Farm Management Advisor	15/4/81	23.5	23.0
7. Service Center Director	9/4/81	23.7	23.0
8. Equipment Repair Advisor	3/6/81	22.8	23.0
9. Soil Improvement Director	13/7/81	20.6	21.0
10. Training Advisor	9/9/81	18.7	20.0
11. Machinery Development Advisor	5/1/82	11.8	15.0
12. Local Manufacturing Advisor	3/2/82	13.9	15.0
13. Soil Improvement Irrigation Eng	1/4/82	12.0	19.0
14. Senior Accounting Adviror	1/11/82	5.0	5.0
15. Short Term Technical Assistance		12.3	12.0
		302.0	319.5

NOTE:

(1) As reflected in the Inception Report, p.52

4.0 Implementation

Overall implementation is best summarized by the expenditure targets: the budget called for a 16 percent Project expenditure and 38 percent in the combined pipeline/expended category; the Project reached 15 percent and 43 percent in these two categories. This was mainly due to commodity shelf-item expenditures and funds in process at the PBDAC.

The extension program has fallen behind schedule due to the failure of the project to procure required demonstration/training equipment to implement planned activities. The funding for this equipment has been delayed due to administration and bureaucratic problems which has also caused the cancellation of most planned training activities for the spring quarter. The only equipment which has been procurred is combine harvesters and mower/binders for wheat harvesting in May which will have only a minimal effect on the overall success of the extension effort.

The participant training programs are coming back on schedule with the first two technical and five academic programs being approved by USAID/Cairo and forwarded to appropriate countries for final processing. Most of the remaining 17 technical and 17 academic programs planned for the project can be carried out or put into initial processing stages before the years end.

The Research and Development subproject is gaining ground with two sets of tillage experiments installed : one on heavy clay soils and the other on sandy soils. But the applied Research Fund is still inactive, although it appears that the contractual bottleneck has been broken.

Planning and Evaluation is moving forward but data collation is slow. It is anticipated that the arrival of the HP86 will alleviate this problem. Also, this unit has suffered for a lack of transportation vehicles of field activities.

Land improvement has started its field implementation program with a locally procured laser-controlled landleveling unit. The local manufacturing program has completed the manufacture of four prototype threshers and is on schedule so that field testing can proceed with the wheat crop .

There have been however several issues that are delaying full implementation as well as implementation in an orderly and planned manner:

1. Service Center/Village Workshop program: the slow bank processing makes it impossible to spend the available service center funds in an expeditious manner.

2. Vehicles : the Land Improvement program, the field extension effort, and planning and evaluation have suffered not from the lack of vehicles but from an inefficient allocation of existing vehicles.

3. Extension/training -- the delays in receiving quarterly cash needs funding is seriously affacting field implementation activities.

5.0 Major Objectives -- Next Quarter

5.1 Overall Objectives

1. Reach the 24 percent level for expended funds.
2. Preparation of IFB's totalling 1 million dollars.
3. Procurement of demonstration/training equipment.
4. Machine Introduction Fund in full year

5.2 Planning and Evaluation

1. Silage mower evaluation.
2. Partial economic analysis of wheat mechanization in Project village.
3. Completion of farm management statistics on long berseem and wheat data.
4. Working Paper No.6, "Project Village Profiles".
5. Working Paper No.7, "Reducing Maize Losses through Optimizing Planting date: a Simulation and Economic Analysis".

5.3 Extension/Training Subproject

1. Finalize and secure approvals for the 1983 training plan.
2. Finalize processing procedures for 8 academic and 10 technical (Observation/study tours) participant training programs for 84 candidates.
3. Complete a working paper No.8 entilled "Mechanization Extension in Eyptian Agriculture".
4. Revise Groups 2 and 3 demonstration/training equipment lists and finalize group 5.
5. Continue field day demonstrations with land leveling and peanut and cotton planting in April, mower/binder and combine harvesting of wheat in May and corn planting and cultivation in June.
6. Working Paper No.8, "Mechanization Extension in Egyptian Agriculture".

5.4 Research and Development

1. Plant rooting investigation in Egyptian soils.
2. Kusman potato digger report.
3. Tillage experiment report: West Nubaria and Shaka.
4. Activation of Applied Research Fund.

5.5 Local Manufacturing Program

1. Completion of experimental prototype threshers.
2. Testing of prototypes in the wheat crops at Sheik Ahmed.

5.6 Service Center/Village Workshop Subproject

1. Move an additional LE 600,000 into the banks.
2. Accelerate loan processing by the banks.

5.7 Land Improvement Subproject

1. Coordinated land improvement activities with EWUP.
2. Activity in Project demonstration basins.
3. Start training program for Project extension personnel.

ANNEX A

MONTHLY REPORTS

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A.1 PLANNING/EVALUATION SUBPROJECT

A.1.1 Planning and Financial Unit

Activity Report
January, 1983

Submitted by: Zaky Helmy
Steven Shepley
Mohammed Shoukry
Moustafa Abou-Ella

During the month, the subunit's activities were spent in the following areas. Extensive work was given to the development of a multi-item agricultural mechanization cost model. The unit provided computer assistance to the evaluation subunit in the statistical analysis of the village profile data. We also prepared a technical and economic evaluation of a French oilseed production proposal. Continuing effort was made to follow-up on the progress of the water lifting and service center credit funds. Finally, the subunit provided guidance and management assistance to the Ministry in the accounting and disbursement of AID-financed project local currency funds.

The Mechanization Cost Model

Using the computerized algorithm for tractor costing presented in Working Paper No. 5, the subunit staff developed a comprehensive mechanization cost model for all farming operations to be mechanized under the project. The tractor routine has been updated and improved with incorporated costing procedures obtained from the University of Minnesota's Department of Agricultural Economics. The model sub-routines for 24 implements have been incorporated. The model outputs hourly tractor and implement costs, costs of operation over a range from 1 to 20 feddans and the land area cost at computed optimum size. The model is now being calibrated for all of the equipment being procured for the Extension/Training Subproject and will be published in a paper shortly.

Statistical Processing for the Evaluation Subunit

Members of the subunit have joined the Evaluation steering committee and now are in the process of developing a questionnaire for the up-coming expanded tractor cost and operation survey.

A statistical analysis of village profile data was performed to test the hypothesis that village emigration is a function of:

- % of village population land holders
- man: land ratio
- equity
- % of small holders
- village accessibility
- % of landless laborers
- % of village land area affected by agrarian reform

- village tractor index
- village population

The hypothesis assumes that villagers migrate outside of their village areas when they perceive their land holdings to be inadequate when the village is isolated and with a low incidence of facilities and services, when they have no land at all and when their agricultural employment oppotrunities may have been preempted by increasing mechanization. A multiple regression analysis was performed to test the hypothesis, using a sample of 23 observations drawn from the Project's random villages. The basic run showed an R^2 value of 0.92 with an F-value of 25.69. The model was also run adding one variable at a time using a conditional cut off limit of F - 2.71 (at the = .05 level of significance for 9 degrees of freedom in the numerator and 13 DF in the denominator) to determine whether the variable enters the model. In this iterative procedure the variables which entered the model under this limit were:

- % of land holders
- man-land ratio
- equity
- village tractor incidence

The other variables were found to be insignificant. The R^2 value was found to be 0.90. The table below summarizes the results.

Table A.1

Analysis of Some Village Environmental Factors Affecting Emigration

Variable	Coefficient	F	t
- % of land holders	0.135	16.37*	7.74*
- Man: land ratio	19.409	20.15*	3.92*
- Equity	7.108	7.34*	1.67**
- Village tractor incidence	6.936	3.80*	-2.03*
- % of small holders	0.002	0.86	-0.05
- Accessability	- 1.344	0.44	-1.30
- % of landless labor	0.212	0.13	0.83
- % of agrarian reform land	0.037	0.31	-0.75
- Village population	0.000	0.32	0.57

* significant at 95%
** significant at 90%

From this analysis, we have identified two primary variables which influence emigration decisions - man to land balance and the incidence of tractors in the village. There are undoubtedly other variables unrelated to these two which also influence village emigration. There will be other economic as well as sociological factors influencing family decisions in this regard and we hope to identify a number of these from the Farm Management Survey and continuing village survey investigations.

Evaluation of French Oilseed Proposal

The subunit was tasked with the evaluation of an integrated oil seed production and marketing scheme prepared by ACTIM. The project

proposed an investment of $ 2,500,000 to set 1,000 feddan integrated farms engaged in oil seed, wheat and secondary crop production. The plan called for an integrated farming systems approach whereby oil seed would be marketed, the cake bi-products would be fed to the farm animals in addition to wheat production for human and animal rations with secondary crops grown to provide supplemental farm income.

Our evaluation focused on three major areas: (1) agronomic (2) economic and (3) irrigation. It was found that the proposal had some merit as a farming system but we questioned why the proposal did not include safflower as this oil seed has been found to yield higher production in soil and climatic conditions found in Egypt. For the economic evaluation, we found the supply and demand analysis to be adequate. We criticized the report's lack of treatment of the opportunity costs of changing the existing cropping pattern and farming practices. We also found fault with the report's failure to optimize the proposed cropping pattern. Finally, the economic analysis noted that the rate of price escalation used does not reflect actual inflation trends. The analysis of the proposed irrigation system revealed that this was the most unsatisfactory element of the proposal. No crop water requirements for the proposed irrigation system were provided. Little information concerning soils characteristics in the proposed cropping areas was furnished. The suitability of the recommended irrigation system could not be evaluated since no details of system design delivery rates or operating times were made available. As the proposed system, using a circular configuration would fail to reach 22% of the irrigated land area without assistance from a back-up system which was not included in the design, it would appear that the proposal is inadequate.

Recommendations provided were that the proposal should be redone to address the specific points made during the evaluation.

Financial Administration

The need for careful project account administration has never been greater. The USAID audit office made an initial contact for the beginning of its audit program. The subunit was asked to provide a record of all AID disbursements for the technical assistance contract together with all bank statements. We fully expect that there will be a complete audit soon. In preparation for this eventuality, considerable effort was made during the month to upgrade the accounting records in both Cairo and Alexandria to conform with the requirements of the simplified accounting system which was designed and initiated during the last reporting, the revised accounting system has been brought up-to-date in the arabic language for the Cairo records. No progress has been made in implementing the system in Alexandria pending Ministry review of all financial records documenting expenditures for the Research Support budget line item. During the month, a visit was made to the Alexandria staff to explain and provide guidance in the use of the streamlined system. One major problem facing us in our efforts to establish "audit-proof" files for all project accounts concerns the accounting system of the PBDAC.

The accounting system of the central PBDAC office has not been brought up-to-date for the project credit funds. Governorate bank records were inspected and found to meet all requirements. The system breaks down between that level and the central office. While records are flowing between the two levels, no one at the central office is consolidating these records and providing the monthly account activity reports which were specified in the credit fund letters of understanding. This problem has been flagged for the attention of management and to responsible officials of the bank. We are following-up but are not optimistic that there will be any quick resolution. The problem has already caused some implementation delays for the water lifting credit program in that USAID requires official certification of all disbursements from the central office prior to further funding disbursements. To date, our information from the governorate banks shows the following level of water lifting credit fund activity as of the end of December, 1982.

Water Lifting Credit Fund Activity

Governorate	Number of Loans	Amount Disbursed
Beheira	69	76,787.935
Gharbia	114	114,451.000
Sharkia	0	---
Qalubia	114	127,400.300
Minia	20	19,275.000
		337,914.235

of the LE 415,840 disbursed by USAID, 81% has already been allocated for approved loans. We fully expect that by the end of January or early February, all of this amount will have been disbursed by the governorate banks. Unless, the central office of the PBDAC is able to consolidate the accounting records in sufficient manner to satisfy AID, we could be faced with the uneviable situation of having no further disbursements at a time when the demand for funds is at its peak.

The Farm Management Survey

We have received all of the collated data for the winter cropping seasons. These data are distributed by farm code number and individual crop. At present we have over 300 variables for 210 farms ready for statistical processing. In our preliminary review of this material, it is apparent that we shall require full time participation of at least one of the farm management groups to explain a number of anomalies in the collation process while we are entering the data. This is needed to insure consistency in the interpretation process. At present, we estimate that some 600 man and computer hours are needed in the statistical analysis of the winter crop data prior to taking on the analysis of the summer crops. The partition of available time between the survey, the Gabel Asfar extension effort and other ad hoc assignments given to the farm management group may delay the required data processing.

A.1 PLANNING/EVALUATION SUBPROJECT

A.1.1 Planning and Financial Unit

Activity Report
February and March, 1983

Submitted by: Zaky Helmy
Mohammed Shoukry
Moustafa Abou-Ella
Steven Shepley

During the period, the subunit has become exceedingly preoccupied with processing of the Farm Management Survey. As time has permitted, we have also been able to prepare and publish a technical paper describing and testing an agricultural mechanization cost model and participate in the development of a tractor cost survey questionnaire. We have continued to provide management with administrative services related to project financial matters and accounts and follow-up of the project credit funds. The subunit also prepared two ad hoc studies requested by Project senior management.

Farm Management Survey

Collation of the survey data has been completed and the long arduous task of statistical processing has begun. Altogether, with the five farm size classifications and 49 crop data to process, there are 49,490 computer entries to be made. During the reporting period, the statistical processing of Long Berseem was completed in seven weeks. This included calculating the sample statistics for all variables, preparing bar graphs showing the crop labor distribution between family and hired labor for all operations and developing mechanization indices for various farm operations related to the Berseem crop. The statistical analyses have been processed on hard copy and stored on magnetic disc. For each crop, and enterprise budget showing all costs and returns will be prepared by farm size classification. The budgets shall show both cash and opportunity costs and returns for use in computer models to evaluate income effects of mechanized agriculture. The enterprise budgets for the Berseem crop are now under preparation. Taking approximately 7 weeks to process data for each crop, it is expected that the processing for the major crops (Berseen, wheat, vegetables, cotton, maize, short berseem and sorphum) can be completed by January, 1984, assuming the available staff time can be reserved exclusively for the Farm Management work.

The Mechanization Cost Model

Using the computerized algorithm for tractor costing presented in Working Paper No. 5, the subunit staff developed a comprehensive mechanization cost model for all farming operations to be mechanized under the project. The tractor routine has been up-graded and improved with incorporated costing procedures obtained from the University of Minnesota's Department of Agricultural Economics with sub-routines for 21 implements. The model outputs hourly tractor and implement costs, costs of operation over a range from 1 to 20

feddans and land area unit cost at computed optimum size. The paper describing the workings of the model is attached as an appendix. From the report, a table of mechanization costs is presented below.

Summary of Mechanization Costs by Operation

The detailed output of mechanization costs by cost component has been presented in Appendices 7 through 24 of the attached report. This section provides a summary listing of economic and financial costs of mechanization for each operation at the practical optimum plot treatment size.

Table A.2

Summary of Mechanization Costs at Optimum Plot Size for Mobile Farm Operations

Operation	Financial (LE/Fed) 1983	Optimum (Fed)	Economic (LE/Fed) 1983	Optimum (Fed)
Mouldboard Plowing	5.06	5	11.02	8
Disc Plowing	4.68	5	10.47	8
Chisel Plowing	3.60	5	9.21	7
Subsoiling	22.19	11	42.45	14
Disc Harrowing	4.50	6	8.09	8
Grain Drilling	3.54	6	6.06	8
Self-propelled Mowing/Binding	9.34	5	12.98	6
Self-propelled Combining	38.32	14	51.40	16
Land Smoothing	7.93	5	19.19	7
Silage Mowing	7.44	5	14.68	7
Mowing	5.20	5	10.36	7
Inter-Row Cultivating	5.68	6	11.47	8
Row Planting	3.30	6	5.42	8
Ridging	1.99	5	4.44	7
Manure Spreading	12.29	6	21.56	8
Chemical Fertilizing	1.49	5	2.88	7
Potato Planting	11.61	7	20.11	9
Bedding	4.70	7	7.57	9
PTO Mowing/Binding	15.22	7	25.87	8

For the two stationary operations included in the model, threshing and spraying, the following table provides a summary of hourly financial and economic costs:

Table A.2

Mechanization Costs for Stationary Farm Operations (LE 1983/hour)

Operation	Financial	Economic
Threshing	3.89	7.66
Spraying	5.11	9.49

Ad Hoc Assignments

At the request of management, the subunit prepared a draft of a paper for senior officials to present at a conference on agricultural production to be ehld at Manoufia University on May 1, 1983. The draft investigated the affects of maize yield as a function of planting dates in Lower Egypt. Yield-planting date data were fitted to a polynomial regression curve in the form:

$$y = a + bx \pm cx^2 \pm dx^3$$

where:

y = yield in ardab/feddan
x = date of planting

A frequency distribution of planting dates from the Farm Management Survey was converted into a cumulative frequency distribution for use in a simulation model where random planting dates were feed into the polynomial regression for 300 iterative loops to generate a frequency of predicted losses throughout the Farm Management Survey area. It was found that losses were substantial for planting dates after June 1st and that positive income effects could be obtained by encouraging farmers to plant their maize close to the optimum date. Data used for construction of the polynomial regression were obtained from a research publication entitled, "Differential Yield Response of Corn Varieties and Hybrids to Different Sowing Dates", Kamel and Mahmoud, Ain Shams University, Faculty of Agriculture, Research Bulletin No. 987, February, 1979.

The second ad hoc assignment concerned a request from management to evaluate Economic Working Paper No. 125 of the Agricultural Development Systems Project report on the summary and proceedings of the eighth ADS economics policy workshop. The findings of our evaluation appear in the following paragraphs.

The paper offers a well thought-out and comprehensive presentation of the economic factors and production constraints operating within the Egyptian livestock production sub-sector. The conclusions generally support the results of our independent investigations from the farm management and water lifting cost studies.

The only exception to this general conclusion concerns statements on page 11 under the sub-heading, "Impacts of Mechanization". Therein, it is stated that 80% of animal work is for transportation. It is also stated that there is no evidence that animal work used to operate sakia reduces milk production. We take exception to these conclusions based upon the results from our farm management and water lifting surveys.

The farm management survey shows that no lactating animal within the sampled farms are used for transportation as all transportation work is by donkey, not cattle or buffalo.

Secondly, we found that there are significant losses of milk production from lactating animals used in sakia duty. Our survey results quoted from Table 4 of Working Paper No. 2 entitled "Analysis of Comparative Water Lifting Costs in Lower Egypt", Haddad et al are summarized on the next page.

Table A-3

Comparative Milk Production Between Sakia Working and Non-Working Animals				
	Cattle		Buffalo	
	Winter	Summer	Winter	Summer
Milk yield (kgs/day) Non-Working Animals	4.78	3.26	6.84	5.02
Milk yield (kgs/day) Sakia Working Animals	4.00	2.43	5.78	4.05

Source: Egypt Agricultural Mechanization Project Water Lifting Cost Survey

From this investigation, there is a 16% loss in winter and a 25% loss in summer for working cattle. The buffalo losses between working and non-working animals is 15% and 19% for winter and summer respectively.

These findings are further supported by independent research carried out by Dr. Wayne Dyer of the University of California Project. Dr. Dyer calculated milk losses in monitary values for cattle and buffalo in winter and summer. We have also calculated the monitary value of these losses using the milk weight losses from Table 3, above and prevailing market prices of cattle and buffalo milk from the water lifting cost survey. These results are summarized in Table 4.

Table A-4

Comparison of Sakis Working Animal Milk Loss Opportunity Costs from the California and Mechanization Project Studies (Piasters/Hour)				
	Cattle		Buffalo	
	Winter	Summer	Winter	Summer
Dyer 1/	12.8	6.3	29.2	11.3
Mechanization Project 2/	15.8	7.1	26.7	11.6

Source: 1/ "The Opportunity Cost of Animal Labor in Egyptian Agriculture", Dyer, University of California, Agricultural Development Systems Project, Economics Working Paper No. 3, May, 1981.

2/ Egypt Agricultural Mechanization Project Water Lifting Cost Survey

From these analyses, we conclude that there is evidence of milk losses from using lactating animals for sakia irrigation. This conclusion also appears to be supported by comments from farmers

during Evaluation Unit Surveys in the 23 Project Villages where the general concensus of opinion provided to Dr. Peter Reiss is that milk losses from use of cattle and buffalo for sakia irrigation sometimes approaches 50% of total output weight.

Tractor Cost Survey Questionnaire

The subunit identified all of the economic and operational cost variables to be surveyed. A first draft of the questionnaire was pretested in Gharbia, Beheira, Qalubia, Sharkia and Minia during the month of February. The pretest was done by the Evaluation Subunit.

Following the pretest, a meeting was held of the Evaluation Subcommittee to review and discuss the suitability of the questionnaire format. Following this discussion, a final questionnaire was prepared for use in the principal survey. Issues were raised concerning the required sample size. It was necessary to select a sample size which would provide sufficient degrees of freedom within the physical constraints of only 9 enumerators and specified confidence interval half-widths and desired confidence level. The Subunit, using data from the pretest to obtain the sample variance prepared an analysis of the required sample size which appears in the next section.

Sample Size for Tractor Cost Survey

The following is an estimate of the required sample size based upon data gathered during the pretest. The pretest was conducted in two stages. The first, from which the fuel consumption data in liters/hour was taken, was conducted during December and February 1981-1982 in agricultural cooperatives in Beheira and Gharbia Governorates. The sample with 47 degrees of freedom included a representative sample of Eastern Bloc and locally assembled tractors within the 60-67 horsepower range. A summary of the sample description is presented on Page 2 of Working Paper No. 1, "Agricultural Cooperative Tractor Cost Survey in Beheira and Gharbia Governorates".

The second stage, from which other variables of the pretest were observed, was conducted during February of 1983 in Beheira, Gharbia and Minia Governorates. The sample consisted of 19 tractors surveyed by the Evaluation Subunit and encompassed a range of normally distributed Eastern Bloc and Western manufactured tractors within the survey area.

The variables enumerated are distributed in two categories: (1) economic and (2) operational. The economic variables include the fixed and variable costs of tractor operations related to fuel and lubricant consumption, maintenance and repair costs, purchase price, operating labor costs and miscellaneous charges. The operational variablesinclude equipment management practices such as road and field travel speeds, plot sizes, plot distances and annual operating hours. The sensitivity of tractor hourly and unit land area costs was investigated in Working Paper No. 5 and is summarized on Page 18.

Procedure

The required sample size for the next survey is a function of the pretest sample variance, the desired confidence level and the desired confidence interval half-width. The formula used for calculating the sample size is:

$$S = \frac{z^2 a^2}{H^2}$$

where: $z = z\ (1-a/2)$
a = the two tail areas of the normal distribution
a^2 = sample variance as proxy for the population variance
H = desired confidence interval half-width
S = required sample size for specified confidence interval and half-width

It was observed from the pre-test that sample variances of the economic variables are relatively low while for the operational variables, the variances are high. This is to be expected as tractors of the same manufacture and horsepower can usually be expected to consume fuel at closely equivalent rates under the same load conditions while equipment management practices will vary widely from user to user according to skill and local operating conditions.

Because of the large variances among some of the variables, samples sizes were calculated for two different confidence levels (95% and 90%) and half-widths ($\pm$ 15% and $\pm$ 20% on either side of x for the economic and operational variables respectively; and $\pm$ 20% for the economic and $\pm$ 25% for the operational variables). These selections are arbitrary but consistent with interval half-widths actually found in the Project Farm Management Survey for tractor operating costs. The results are summarized in Tables 5 and 6 below:

Table 5

Pre-Test Sample Statistics and Required Sample Size at the 95% Confidence Level							
Variable	$\bar{x}$	a	H_1^*	H_2^*	z (1-a/2)	S_1	S_2
Monthly Oil Consumption (kgs)	10.24	7.75	1.536	2.048	1.960	98	55
Monthly Grease Consumption (kgs)	1.10	.84	0.165	0.220		100	56
Distance @ Garage to 1st Plot (km)	3.30	4.10	0.660	0.825		148	95
Monthly Maint. Cost (LE)	6.21	2.90	0.932	1.242		37	21
Hourly Fuel Consumption (liters)	6.36	2.18	0.954	1.272		20	11
Road Travel @ Speed (km/hr)	8.99	10.48	1.798	2.248		131	83

* H_1 represents the half width for the economic variables which is ± 15% of $\bar{x}$ and H_2 is the half-width for the operational variables which is ± 20% of $\bar{x}$. Sample size magnitudes corresponding with H_1 and H_2 are at S_1 and S_2 respectively.

@ operational variables

Table 6

Pre-Test Sample Statistics and Required Sample Size at the 90% Confidence Level							
Variable	$\bar{x}$	a	H_1	H_2	Z (1-a/2)	S_1	S_2
Monthly Oil Consumption (kgs)	10.24	7.75	1.536	2.048	1.645	69	39
Monthly Grease Consumption (kgs)	1.10	0.84	0.165	0.220		70	39
Distance Garage to 1st Plot (km)	3.30	4.10	0.660	0.825		104	67
Monthly Maint. Cost (LE)	6.21	2.90	0.932	1.242		26	15
Hourly Fuel Consumption (liters)	6.36	2.18	0.954	1.272		14	8
Road Travel Speed (km/hr)	8.99	10.48	1.798	2.248		92	59

The guiding principal in sample size selection must be to sample on the basis of the highest confidence level with the narrowest confidence interval half-width. From Tables 5 and 6, this principal can be followed for fuel consumption and monthly maintenance but some compromises will have to be made for other variables, particularily for the operational variables to permit economies in sampling costs. It would appear from the statistics that the smallest permissable sample size sufficient to sample all of the data with an acceptable confidence level and confidence interval half-width is the size equivalent to the lowest permissable size for the variable with the highest variance. From the tables, this value is a sample size required for garage to 1st plot distance; namely 67 observations. In this selection is made, confidence levels and half-width magnitudes for the other variables will be well above the minimum requirement. Table 7, below shows the confidence levels and interval half-widths for each variable, if a sample size of 67 is selected.

Table 7

Confidence Levels and Confidence Interval Half-Widths Corresponding with a Sample Size of 67 Observations

Variable	Confidence Level (%)	Half-Width (+ from mean)
Fuel Consumption	99	14.5
Grease Consumption	95	18.5
Oil Consumption	95	18.0
Maintenance Cost	99	15.0
Garage to 1st Plot	90	25.0
Road Travel Speed	90	24.5

Fiscal Administration

Cash need statements for the Ministry requesting project funds from AID were prepared and finalized. Cash need statements and expenditure reports for the technical assistance contracts were also prepared. A cash need statement and expenditure report were prepared for the Water Lifting Credit Fund and a release of $ 500,000 was obtained and deposited. Continuous guidance and follow-up concerning accounting records for all project funds was provided. Amendment proposals for extension of the Farm Management and Training positions were prepared and reviewed with senior management. A comprehensive vehicle control and accountability system was developed and instituted as per instructions from senior management. Requests for letters of committment for soil improvement equipment were prepared in consultation with suppliers. Procedures of the Ministry procurement committee were audited and found satisfactory. Field trips were made to all of the participating governorate Agricultural Development Banks to audit credit fund accounting records, which were found to be in order. The Beheira bank accounting system was carefully examined and found suitable as a model for all banks. Efforts will be made to encourage the other banks to adopt this system.

A.1 PLANNING/EVALUATION SUBPROJECT

A.1.2 Evaluation Unit

Activity Report
January, February and March, 1983

Submitted by: Peter Reiss
Raafat Lutfi
Aiman El Tunsi

1. Evaluation of Water-Lift Loan Fund

In March, the Evaluation Advisor, with the assistance of village monitors from Konayiset, Damsheet and Qalib Abiar, Project villages in Gharbia Governorate, conducted an evaluation of the water-lift loan fund. Farmers who have purchased pumps through the fund and directors of the associated village banks were interviewed. A summary of the evaluation follows.

A. Loan Fund Operation

With the activation of the Loan Fund in early October, 1982, roughly 400,000 L.E., or one-quarter of the total endowment, was dispersed to pre-test and Project villages. The exact allocation was determined on the basis of certain village characteristics, including existing pump population, total cultivated area, and system of irrigation water use. Terms for the loans were mandated through the regional development banks to village banks, although the latter were given some latitude in determining the actual conditions for down payment and period of repayment. In the three villages selected for this report, each village bank chose different terms.

In all, 155,000 L.E. were distributed to the three villages under discussion. However, after six months of the fund's operation, slightly more than half of the money is still unspent. Furthermore, given the village conditions and terms of the loans, it appears unlikely than more of this money will be borrowed by villagers because of (a) saturation of the pump population making additional machines unnecessary or (b) undesirable loan terms which in their present form will not attract more borrowers. The greatest dissatisfaction with farmers has arisen over the period of repayment, which the Tanta regional bank has set from three to five years.

A plan for implementing the Loan Fund has called for the recruitment of a water-life extension specialist, the dispersal of information about the fund to villagers, and training for extension agents and purchasers in pump maintenance and repair. Thus far, the plan has not been carried out. As a result, the Project has effectively played no role in the Fund's operation. Farmers have not been informed about the Fund systematically; nor has assistance been provided concerning pump selection, maintenance, or repair. The recent recruitment of three water-lift specialists to the Extension Subproject may help to alter

the passive role the Project has played to date.

Since October, 1982, more than four hundred pumps have been purchased through the Loan Fund. Figures available for the first three months of the Fund's operation reveal a decided preference for small pumps. Of the 284 purchased between October and December, 76% have five to six horsepower. Yet this pattern of purchase runs counter to Project recommendations that water-lifting is most cost-effective using 12 hp. pumps operating areas of at least eleven, and preferably forty, feddans. Two working papers produced by the Project have called for the retention of the saqia command area, but with its irrigation conducted by the members of the "saqia ring" using a shared pump. In operation, however, individual farmers, rather than cooperating groups, have been the loan recipients. Nor has the saqia group remained as the basic organization; pump use has fractured the traditional saqia users' group. In fact, conflicts over access to the saqia among shareholders have driven many farmers to renting pumps, even before the Loan Fund's introduction.

B. Criteria for Pump Selection

Selection of a pump by Loan Fund participants was based on a number of factors: working farm size and access to rentable land, crops grown, water delivery and drainage systems, interest in undertaking custom work, experience with or knowledge of a particular pump, and recommendations and stock of the local pump distributor.

In terms of land, pump size selection was determined by the availability of excess land for rent, most usually put on the market by emigrants who were not able to conduct the agricultural work themselves. As a result, land has become concentrated in the hands of fewer people who have accordingly been able to increase their working farm size. In villages with few emigrants and little excess land, the terms of the renting arrangement between owner and user are seen to be counter to the interests of the latter, and consequently land rental is further discouraged.

While farmers in all three villages grow cotton, berseem, wheat, and maize, rice and vegetables and fruits are important cash crops in only some. Rice, described by farmers as one of the most water-demanding of all crops, is grown on large areas of two of the three villages. However, in one, large pumps were purchased, and in the other small. A deciding factor is the method of irrigation tied to this crop. In the former, rice is irrigated using water-lift methods, while in the latter only gravity-flow is used. In the third village, nearly half the total cultivated area is devoted to fruits and vegetables, which require water at less frequent intervals.

Many farmers purchased pumps to avoid continued participation in the "saqia ring". There is no intention to share the use of the pump with other saqia group members. Widespread dissatisfaction with the management of the saqia mitigates

against the appeal of electrifying it or the likelihood of encouraging groups of saqia users to purchase a pump cooperatively and share its running costs. According to farmers in one village, the installation of tile drainage has required them to lift more water also leading them to choose larger pumps.

Most of the purchasers interviewed have decided not to use their machines for custom work. Renting a machine requires having a household member who will be responsible for managing its operation. Since hired labor is expensive and would be needed otherwise, many pump owners have chosen to use the machines on their own land only.

Pumps were often selected on the basis of second-hand experience with particular models. A more important factor is the pump selection offered by the machinery distributor.

Distributors appear to sell pumps of only a few companies and the narrowness of their selection is reflected in the limited variety of pumps purchased by loan recipients. Purchasers were also restricted by the available stock, and, in some cases, were given pumps other than what they had requested.

C. Fund Impact on Purchasers

Although in operaton for only six months, purchasers have already begun to adapt their agricultural practices to their new acquisition. Changes have occurred in the amount of land rented, the crops grown, the system of livestock management, and in use of household labor.

As a result of having purchased a pump, many of the fund participants have decided either to rent land for the first time or increase the amount they ordinarily rent.

Every pump recipient has also spoken of his intention to increase the area of vegetable-growing on his land thereby increasing his income.

Purchasers have already noticed an increase in milk production by having taken their water buffaloes off the saqia. In what may be a widespread occurrence, one purchaser sold most of his animals and used the proceeds to purchase land to grow vegetables.

A number of purchasers intend to rent out their pumps for additional income. Such an activity requires a free member of the household to supervise the pump's use.

Acquisition of a pump has given the farmers a greater degree of control over their agricultural operations. In the past, many complained, they had been unable to gain access to their saqia or find an available pump to rent.

D. Recommendations

Based on the report, the following recommendations are made:

(1) A thorough examination of the distribution of funds ought to be made immediately. In two of the three villages, no requests have been made to the village banks for more than three months, and more than half the money remains unspent.

(2) A Project member from the Cairo office should be directed to make regular visits to the participating village banks to facilitate the movement of money to farmers.

(3) Unspent money ought to be (a) made available to villagers on different borrowing terms, (b) directed to Project villages where a demand continues, or (c) made available to farmers from neighboring villages which fall under the same village banks.

(4) A concerted effort ought to be made in the future to advertise the Fund to farmers since nearly all learned of it through personal contacts or from farmers who had already taken out loans.

(5) The Project's mechanization village extension experts should be directed to play a more active role in the operation of the Fund, particularly in the following areas: recruitment of Fund participants, providing suggestions about appropriate pumps to purchase, and giving advice about maintenance and repair.

(6) Assistance ought to be provided so that purchasers receive the pumps they request. Again, the village experts ought to play a role.

(7) The Project's call for the replacement of the saqia with pumps while retaining the same organization is unworkable and should be abandoned.

(8) As such, the Project might best put its efforts into reviewing the variety of low-horsepower pumps available for the purpose of recommending a preferred type or types. The recommendation ought to be based upon operating performance, availability of spare parts, and cost.

2. Tractor Costs and Time Use Survey

Using Working Paper No. 5 (A Methodology for Evaluating Economic and Financial Costs of Tractor Operations in the Arab Republic of Egypt) as the basis of a year-long study of tractor costs and time use, the Planning and Evaluation Committee designed survey forms. The survey is being conducted in the nine villages selected by the Evaluation Subunit for in-depth monitoring during the Project's life. The data collectors are the nine village monitors supervised by three employees of local sampling offices, who work as field managers in the Project's Village Studies Program. Dr. Bahgat Abdel Maksoud and Dr. Mahmoud Mesbah, team supervisors for Middle Egypt and the Delta, have responsibility for the data-collection process. The survey began with land preparation for cotton. A pretest was conducted during the end of February, following which the data were

reviewed, a sample was chosen, and adjustments were made in the methodology. During this period, members of the Evaluation Unit from Cairo visited the Delta team during one of its weekly meetings to discuss the problems with data-collection directly with the monitors. Monitors will now follow designated tractors for one complete year to catalogue. Aiman El Tunsi has been responsible for collating and coding the data from the nine villages.

3. Evaluation Case Studies

Two papers have been prepared for Project distribution. One, researched and written by Dr. Abdel Maksoud, investigates farmers' reactions to an Italian wheat harvester distributed by cooperatives in Minia and Assiout. He found that over a four year period between 1979 and 1982, there was a decreasing interest in and use of the machine, largely because of losses incurred.

A second paper, written by Dr. Bahgat Abdel Maksoud and Dr. Peter Reiss, concerns farmers' perceptions of changes in soil and water conditions in the five Project villages in Minia during the past decade. In terms of Project implementation, one interesting result was that although farmers say that their primary problem is salinity, they do not see its connection with land levels, poor drainage, or alkalinity. The Project, preferably in conjunction with the Agricultural Extension Service, ought to undertake an educational effort to apprise farmers of the extent of reparations required to improve soil and water conditions. The paper was first given at the First National Conference on the Problems of Land Degradation, Minia University and will be published in the Conference Proceedings. It has also been accepted for publication by the Agricultural Journal of Assiout University.

The two papers have been given to the Team Leader to decide how they might be best distributed to the Project: as part of the quarterly activity reports or as a working paper.

4. Basin Study in Minia

A planned study of demonstrations in three Project villages in Minia which have been selected for soil improvement activities has been postponed at the request of the Team Leader so that evaluations of the water-lift loan fund and machinery demonstrations given by the Training and Extension Component might be undertaken. However, during the period, meetings were held with Dr. Zakaria El Haddad and Dr. Abou Sabe and with Dr. Adel Orabi and Mr. Errol Coles concerning the need for the study. It was agreed at both meetings that the study should proceed. However, in consultation with the Team Leader, it was decided that the study would be redesigned. The last quarterly activity report includes a research design formulated by the Evaluation Unit and the Soil Improvement Component. Ostensible, it was to be a mini-Farm Management Survey. The delays make such a study difficult to complete at present. As such, the study will focus more specifically on four main points directly related to Project implementation.

(1) How do farmers identify the boundaries of their fields? If operations take place on a number of adjacent farms how

will farmers identify the boundaries of the original plots? (submitted by Jim McClung)

(2) To what extent do farmers see water as a potentially dangerous resource, one which might have deleterious effects on their production levels or soil conditions? (submitted by Jim McClung)

(3) Why do farmers prefer short furrows to lon ones? It is because they are easier to dig, take less time to irrigate, or are easier to manage in terms of water distribution? (submitted by Errol Coles).

(4) How did farmers from our soil improvement basins receive the Project demonstrations in Abyuha Village on 27 April? (submitted by Errol Coles).

The Evaluation Advisor intends to visit Minia in May to begin the work in association with Dr. Abdel Maksoud, Mahmoud Ridi (field manager) and the three village monitors working in El Atlat, Beni Abeid, and Birba El Kubra.

5. Meetings of the Planning and Evaluation Committee

At Dr. Zakaria El Haddad's behest, the Evaluation Advisory Committee has been enlarged to include members of the Planning Unit so that activities between the two units might be better coordinated. Meetings have been held roughly every two weeks with Drs. Nabil Habashi and Abdel Tawab El Yamani acting as Chairmen. The meetings during this period have largely focused on the tractor survey. Consideration of other activities (including a report on the labor situation, farmer adoption rates, and policy implications of the Project reports) has been postponed at Dr. Abdel Tawab's request.

6. Future Evaluations Requested

Dr. Gaiser has requested that the Evaluation Unit undertake evaluations of silage mower use for cutting cotton stalks, and seed drills used for planting wheat. An evaluation of the silage mowers will be conducted in May; the seed drill study will begin in June, following the wheat harvest. In addition, the Service Center Component has asked that the Evaluation Unit examine its loan fund. Such an evaluation has been anticipated and is included in the Unit's workplan.

7. Selection of Villages for Long-term Monitoring

A report discussing the criteria for the selection of nine of the Project villages for concentrated monitoring was approved by Dr. Zakaria El Haddad during this period and is included here for general consideration. Also included is the selection of five additional villages to serve as a control group.

8. Computer Purchase

The purchase of one mini-computer has been approved by Dr. Zakaria El Haddad during this period. The original budget for

Evaluation Studies, approved by Dr. El Sahrigi, called for the purchase of two small computers at an estimated cost of 1,000 L.E. each. HP-75 units were selected because they can interface with the office's HP-85s, thereby enabling us to create a dispersed information system. However, the present cost of one HP-75 unit with cassette interface reaches roughly 4,000 L.E. In any case, the computer would not be allowed outside Cairo for use by the evaluation teams in the governorates. Since the aim, which was the decentralization of data-coding and analysis activities and an expansion of training activities, cannot be met, it now seems advisable not to proceed with the purchase.

9. Computer Work on Labor Study

Raafat Lutfi has taken over the responsibility of coding the data collected in the Project villages by the monitors from return emigrants, landless laborers, and landholders. He has taught himself how to use VISICALC for the input of data. This information will be used for a working paper on the labor situation in the Project villages.

10. Computer Work on Village Profile Data

Nour El Din Nasr has written a program which allows him to use twenty-four observations and have them analyzed for mean, standard deviation, and correlations. The result will be incorporated into a redrafting of the village profile study.

11. Policy Implications of Project Reports

Dr. Abdel Tawab El Yamani has suggested that a series of brief papers be written concerning the policy implications of already distributed Project reports. He would like the first one to focus on the cost working papers produced by the Planning Unit.

12. Follow-up Activities

(1) Working paper on agricultural mechanization and labor in the Project villages.

(2) Preparation for evaluations on silage mowers and seed drills.

A.2 EXTENSION/TRAINING SUBPROJECT

Activity Report
January, 1983

Submitted by: Fred Schantz, Hussein Heiza, Dr. Mamdouh El Baz, Dr. El Ansary, Gordon Stringer, Ahmed El Beheri, Ibrahim El Ghatas, M. Abdel Aziz, Samir Showky, Fouad Metri

Summary

Major events of the month are summarized below. Detail reports of each subunit are found in A.2.1 through A.2.8. A.2.7 lists the expenditures for the subproject for the month.

Extension Activities

1. Most field operations were stopped during the month due to the winter season. Wheat plots planted in December with grain drills were examined to determine population density.

2. Limited backhoe demonstrations/training took place at the pretest village of Sheikh Ahmed and other selected sites. Four field days were held in Project villages for key farmers to orient them to the Project's activities.

3. Group 2 and 3 extension demonstration/training equipment were approved by Project management and the MOA commodities procurement committee. A total of 311 implements and machines are now being procured for placement in Project villages. An additional 50 units (Group A) are also being processed for placement at the Project's Demonstration/Training System Station.

4. Development of the village programs for Sharkia, Qalubia and Minia continued during the month and are to be presented to the Project on February 8.

5. A 173 page Annual Report 1982 was completed during the month and presented to Project management. Included were the five extension plans developed during the year as well as demonstration/training equipment papers and the 1980-82 Project Training Plan.

6. A demonstration/training equipment wall chart was placed on the inside door of the extension/training office during the month. Commodities and their locations are now being charted.

7. Peanut farming equipment specifications and the short term specialist began processing. Also a short term specialist for irrigation, especially drip, was put into process.

8. The short term equipment specialist, Mr. Mathew Peart, returned to Ohio on 21 January after successfully assisting the extension staff to service and repair the silage mowers, seed drills, land scrapers and ridgers now in Project Villages.

In-Country Training Activities

1. During the month 134 trainees attended 8 new and continuing courses/sessions for 589 students/days (trainee for 1 day) of training (Appendix A.2.7-2).

2. A rough draft of the 1983 Training Plan was developed but not completed dur to priorities given by project management to completing Group 4 demonstration/training equipment specifications, finalizing Group 2, 3 bid evaluations, completing the 1982 Annual Report and other duties. The plan draft should be complete by next month.

3. Several field trips were made by the training staff to project villages, including Minia, where numerous trainee candidates were selected and scheduled for upcoming training activities.

Participant Training Activities

1. Processing of 10 Observation/Study tours, 16 academic and 3 post doctoral programs continued. Numerous forms were prepared and sent to USAID for finalizing.

2. Several additional candidates were considered for project programs and were tested and/or placed in English Language training courses and/or begin processing procedures (see A.2.6).

During the Month

Field Extension activities were at a standstill during the month as cold weather set in and farming practices were completed in most areas for the season. Wheat population counts of mechanically planted wheat continued and were almost completed. A number of field days were held in various villages to discuss mechanized agriculture and various extension information publications continued to be processed.

Considerable effort was continued by the field staff to complete repairs and annual maintenance of the demonstration/training equipment used in the fall (silage mowers, grain drills, scrapers). Also two mounted disc harrows were delivered to the field (Beheira/Gharbia Governorates) where they will begin work in February/March, 1983.

Both Group 2 and 3 extension demonstration/training equipment recommendations were approved by Project management and the Project Procurement Committee during the month. Also Group A list for the demonstration/training system station was cleared for purchase and put into processing. All equipment on order should begin reaching Project Villages/areas within the next few months to be used for

extensive demonstrations as well as training activities for private and public populations. The development and approval process of the specifications required an intense effort by all concerned resulting in a quantity of appropriate farm machinery for use by the Project in Project areas.

Five field trips and eleven meetings attended during the month included:

1. A field trip/meeting was completed in Sharkia with the Project Mechanization Specialists. Discussed were the field activities, developing village programs for the governorate and relationship between the Project and the area's mechanization stations.

2. A trip to Alexandria was made to draft the local manufacturing training plan for 1983. It was completed with Mr. Berky, Dr. Kadim and Dr. Gaiser.

3. Numerous meetings were held during the month to discuss demonstration/training equipment specifications and to review the sum of 200 bids submitted to the Ali Kamel group for processing.

4. A meeting was held with Mr. Jeff Lee and Marvin Hurley to discuss participant training processing problems and procedures. Mr. Samir Shawky, the Project Participant Training Officer, emphasized the need for urgent processing of our Project's candidates which is now being carried out.

5. Two field trips were taken to inspect potatoe planters and diggers (Minofia) as well as peanut farming equipment (at South Tahrir Company).

6. A meeting was held in Cairo with the USAID Project Evaluation Team which will be evaluating Project activities over the next month. Discussed were the schedule of activities and visitation needs to field locations.

Major Problems

1. Problems similar to the last two months, primarily in Project villages where the absence of equipment support conditions which are critical to the success of maintaining Project demonstration/training equipment have not yet been improved.

2. The noise/personnel in the extension/training office has increased more than ever forcing the key staff to work in other offices when space is available. The extension/training advisor has secured a part-time office in Maadi where programs and plans are written.

Plans for Next Month

1. Continue planned extension and training coordination

activities with a focus on field operations/training for the backhoe as well as on the development of the 1983 Training Plan.

2. Orient the new Mechanization Extension Specialist, Mr. Roger Angstrom, who is dur to arrive in February. He will be advising extension personnel on village programs development as well as working with project extension demonstration/training equipment in the field.

3. Submit the fourth quarterly cash need statement for In-Country Training for February, March and April 1983.

4. Edit the translation of the Agricultural Mechanization Plan developed by Project Management.

5. Complete the draft of the 1983 Training Plan.

6. Develop a field training program for the land improvement subproject on tractor operation with lazer land leveling equipment.

7. Assist/accompany the USAID Project Evaluation Team to various field locations - project villages to evaluate the subproject's activities.

8. Reactivate the weekly planning meetings critical to a coordinated field operations effort. Also assign new extension officers to areas as needed.

A.2 EXTENSION/TRAINING SUBPROJECT

A.2.1 Rural Agricultural Information Unit

Activity Report
January, 1983

Submitted by: Dr. A. Mamduh El Baz

A. Summary

- 4 days in M. Sinai Governorate to attend a seminar about development of this community, and revising the needs from various agricultural machines.
- In Minofia to photograph potatoe cultivation.
- At the training center in Alexandria to lecture progressive farmers from project villages.
- Field day at Taliene village, Sharkia Governorate.
- Final reviewing of a specific bulletin about maintenance of tractors, and it is now under printing.
- Printing and distributing 16,000 bulletins and forms about soft loans offered by the Project.
- Following up the preparation of a bulletin about mechanical rice transplanting.
- Preparation and emission of one television rural program for 32 minutes about mechanization, and four times (once a week) in the broadcast.
- Publishing two articles in two monthly agricultural magazines (one in each), beside the third article in one newspaper.

B. Problems

As former month.

C. Plans for Next Month

- Delivering and distributing the bulletin of tractors' maintenance.
- Purchase order for Agricultural equipment needed for three other Governorates.
- Receiving, revision material and drawings of rice transplanting bulletin, and passing it for printing.

- Selecting and fitting the rest of village extension signs in its predetermined places.

- Collecting material about proper use of different agricultural machines.

A.2 EXTENSION/TRAINING SUBPROJECT

A.2.2 Farm Management Survey/Gebel Asfar Farms

Activity Report

Submitted by: Gordon B. Stringer

A. Summary

See Monthly Report

B. Problems

1. Finalization of the R.F.Q. No.'s 5-6-7 is still in the future. This delay will cause further problems of timing at the farm.

2. Equipment order delay with attached delay in arrival times is crowding us out of a full growing period for the summer corn crop. We may have to go to short season types if the seed is available and/or cut early with the resulting yield loss. We cannot allow the summer crop to back into the winter planting time.

C. Plans for Next Month

- To complete the farm survey transliteration
- To complete the "turn over" of the bicycles, scales and measuring wheels to "someone" ???
- Carry out the possible portions of the P.O.W for G.A.F.

A.2 EXTENSION/TRAINING SUBPROJECT

A.2.3 Beheira, Gharbia, Sharkia Governorates

Activity Report
January, 1983

Submitted by: Ahmed El Behery
Mohamaed Abd El Aziz

A. Summary

1. We has three trips to Sharkia Governorate with Mr. Schantz.
2. We travelled weekly with EMCIP staff to our extension villages to check wheat plots.
3. We accompanied Mr. Matthews to each village to adjust our silage mowers.
4. We carried out several field days at our extension villages at El Shik Ahmed with a key farmer.
5. We spent a week in Beheira Governorate with Dr. Hatem - mechanization coop visit.
6. We invited them to visit our pre-test village.
7. We moved two disc harrows from R&D, one to Arab Besint and the other one to Kuniset Damshet.
8. We spent three days in Minia Governorate as extension staff checking extension villages. At that time we choose the staff in each village that will help us.
9. We had a meeting at El Taliene village which was accompanied by a group from AID.

B. Problems

1. We are facing a shortage of transportation.
2. We need to provide the extension officer with papers and files.
3. A shortage of hand tools.

C. Plans for Next Month

1. Continue machinery inventory system.
2. Build a ramp as a sample at El Shaik Ahmed village
3. Build a shed to store our machinery.
4. Continue field day activities and night meetings.

5. Continue counting wheat population in each village.

6. Arrange a training course for back hoe operators in five governorates.

A.2 EXTENSION/TRAINING SUBPROJECT

A.2.4 Minia Area Extension Officer

Activity Report
January, 1983

Submitted by: Fouad Metri

A. Summary

- As a beginning of my work with the Extension Subproject I attended a meeting that was held at Sheik Ahmed on the 5th of January. This meeting concerned distribution of 25 water lifting pumps (5 H.P.), there were fruitful discussions with the farmers present as well as pictures that were taken with a video by Dr. El Abz's group.

- On January 18th a planter for potatoes, Model J3, was delivered from the workshop of the Ministry of Farm, Farahonia (Minofia Governorate).

- Being in charge of Minia Governorate, I visited Minia to meet the Extension Officers at all levels of government as well as district and villages, to look for the places to store the machines and to have the names of the storekeepers and the mechanics whom should be in charge of the machines. I advised them of our plans and also requested to have the names of the trainees for our training programs.

- Prepared plans to discuss with key farmers about the loans, machinery and workshops. Received the various kinds of forms for these loans and explained the procedure with the key farmers.

- Various kinds of posters were also distributed.

- On January 31st visited Sharkia Governorate with the AID's Evaluation Group, also a field day in Taliene village where some problems were discussed.

B. Problems

1. Car should be available to begin work.

2. Taking the orders of the available machines very soon.

3. Motor-cycles for each extension-officer as mode of transportation for work.

C. Plans for Next Month

Sending the machines to the chosen villages, beginning the work in these villages and following-up the work.

A.2 EXTENSION/TRAINING SUBPROJECT

A.2.5 In-Country Training Officer

Activity Report
January, 1983

Submitted by: Ibrahim Hassan El Ghattas

A. Summary

- Two courses were held for key farmers in Sidi Bishr, the first included 30 trainees, the second 32 trainees.
- Following-up courses held in Maamoura (Mechanic II), Nubaria (Machinists) and Beheira (Local Manufacturing).

Visits Paid to:

- South Tahrir to prepare for training courses.
- Minia Governorate to re-elect candidates for Mechanic I to be conducted in Maamoura.

Courses Terminated:

- Machinist ended on January 26th.
- Rice Transplantation ended on January 7th.

C. Plans for Next Month

- Hold Mechanic Level I course in Maamoura.
- Hold Tractor Operators course in Nubaria.
- Hold Visual Aids course for Extension Specialist in Sidi Bishr.
- Plan training needs of the Project's villages.

A.2 EXTENSION/TRAINING SUBPROJECT

A.2.6 Participant Training Officer

Activity Report
January, 1983

Submitted by: Samir Showky

A. Summary

Academic Training:

1. Five candidates already submitted the documents needed for processing.

2. New advertisement for more candidates was prepared and sent to the Agricultural Organization.

3. Twelve candidates are scheduled for TOEFEL, eight of them already attended the test, we have four results - two of them are over 500 in score.

4. Three candidates for post-doctoral degree are in language training.

Non-Academic Training:

1. Five letters for the Governorate with the proposed names for the observation tours.

2. One approval from Beheira Co. already came to the Project.

3. Twenty-eight candidates are scheduled for the Aligu screening test.

English Language Training:

Eighteen (18) students in courses in implementation.
Ten (10) students in courses that have now ended.
Eight (8) students in courses that have started.

B. Problems:

1. Training officer in each governorate and in all subprojects is needed to facilitate communications and processing the activities.

C. Plans for Next Month

- Processing the academic and non-academic groups.
- Arrange for more English screening tests.
- Arrange for English language training.

January, 1983 - Training Activities

DATE/TIME	LOCATION	COURSE NO.	COURSE TITLE	COMMENTS
MACHINERY MANAGEMENT EXTENSION				
Nov. 13 to Jan. 12	Nubaria Training Center	2EX 78	Tractor Operation	13 Trainees
Nov. 20 to Jan. 26	Nubaria Training Center	2EX 80F	Machinist	2 Trainees
Jan. 1 to Jan. 15	Sidi Bishr Training Center	2EX 80K	Mech. Ag: Theory and Practice	30 Trainees
Jan. 16 to Jan. 30	Sidi Bishr Training Center	2EX 80L	Mech. Ag: Theory and Practice	32 Trainees
Dec. 25 to Jan. 7	Kallin Research Station	2EX 80M	Rice Trans-planting	14 Students
LOCAL MANUFACTURING:				
Jan. to June	Beheira Training Center	3LM 1	Industrial Technology I	3 Students
SOIL IMPROVEMENT:				
Nov. 27 to Feb. 26	Maamoura Training Center	25 i8	Mechanic: Level II	8 Students
TRAINING:				
Jan.	AUC	2 T 11	English Language	26 Students

A.2 EXTENSION/TRAINING SUBPROJECT

A.2.7 Fiscal Report

Activity Report
January, 1983

Submitted by: Ahmed

The following is a summary of the fiscal report in local currency related to the referenced training subunit.

Line Item	Budget	Expenditure	Total To-Date
1. Instructors Fees:			
2. Equipment Rental:			666.00
3. Petroleum, oils, lubs:			
4. Training Aids/Equip.:			10,583.00
5. Machine Operators Fees:			
6. Room/Board:			3,200.00
7. Transportation:			427.00
8. Expendable Training Materials:			5,380.17
9. Incidental Living Expenses:			1,732.00
10. Training Center Fees:			1,968.96
11. Administrative Expenses:			4,038.40
TOTAL			27,995.53

Demo/Training Commodities: L.E. (See Attached)

1. 10 Combines (Dentz/Fahr)

2. Demo. System Equipment (1 Con)

GRICULTURAL MECHANIZATION PROJECT
A. I. D. Proj. NO. 263 - 0031
EGYPTIAN MOA/USAID
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General Society For Land Reform
P. O. B. 256 Dokki - Giza, ARE.
704660 - 704720
704364 - 707247

مشروع الميكنة الزراعية
وزارة الزراعة المصرية - وكالة التنمية الأمريكية
الدور الخامس - مبنى الجمعية العامة للاصلاح الزراعى
صندوق بريد ٢٥٦ - الدقى - جيزة ج م ع
٧٠٤٦٦٠ - ٧٠٤٧٢٠
٧٠٤٣٦٤ - ٧٠٧٢٤٧

DATE Feb. 6, 1983 التاريخ

SUBJECT الموضوع

REF. No. ATTACH مرفقات الرقم

TO: Mr. Fred Schantz, Training and Extention Coordinator

FROM: Matt Peart, Short Term Consultant

SUBJECT: A Summary of My Accomplishments, Concerns and Recommendations as a Result of My Short Term Consulting on A.I.D. Project No. 263-0031

During my short term consultancy (November 22, 1982 to January 20, 1983), I was asked to accomplish the following:

1. Follow-up and assist with the operation of the seed drills, silage mowers, and other field equipment.

2. Chart the location of and evaluate the field equipment condition and needs.

3. Identify needed support pertaining to tools, facilities, personnel, etc.

4. Provide weekly written activity reports including observations and recommendations.

Below I have identified my accomplishments, concerns, and recommendations. I feel that I accomplished what was expected of me and hope that you feel the same.

Accomplishments

1. Supervision of field operations for wheat planting.

   Seed bed preparation: The ground was typically chisel plowed twice, disced once, if a disc was available, and leveled. Phosphorus and potassium were hand broadcasted prior to planting.

   Planting: A Gallignani seeddrill was used to plant the wheat at a rate of 52 to 55 kilos per feddan.

Irrigation: Flood type irrigation was employed. It was critical that this was done slowly to prevent the seeds from washing out of the soil and that the ground was level to avoid standing water.

Population Counts: Population counts were completed roughly 3 weeks after planting and comparisons were made between the drilled and the hand broadcasted areas. The drilled areas were typically 1/3 denser. The procedure for conducting a population count was demonstrated to the village engineers.

Repair of Equipment: During and after planting the seed drills were repaired. Most repairs were done in the villages and involved straightening parts. A spare parts list was developed and spare parts were ordered.

2. Supervision of Cotton Stalk Mowing.

   The condition of the silage mowers and the fields being mowed were checked. It was found that the farmers insisted on adjusting the knives too close to the ground causing them to dull. The knives were sharpened. Workshops to teach the village farmers how to sharpen the knives were conducted. A spare parts list for the mowers was prepared and spare parts ordered.

3. Time was spent establishing good relations with the village leaders and engineers, key farmers, and governorate leaders. I feel that this effort is essential to the success of the project.

4. Parts catalogues for the silage mowers and grain drills were secured for the use of the village engineers. These were to be copied and distributed so that needed parts could be identified without having to see the piece of equipment.

5. Efforts were begun to alter existing equipment storage areas so that they were secure. The cooperative managers obtained and presented bids for the construction of gates for the existing storage areas. They were to be approved by the office before construction began.

6. Field days were conducted in all the governorates to teach key farmers about the benefits of mechanization. I attended as many of these as I could and gave assistance whenever possible.

7. The location of field equipment was charted, as can be seen in the attachment to this report. But, due to the wide use and mobility of the equipment the list may be obsolete.

8. Lists of tools that were needed by the village engineers and the regional extention specialists were prepared and these tools were ordered.

9. Assistance was provided to the Data Collection Team, in the pick-up of the bicycles that had been used by the enumerators.

10. By describing the operation and identifying the parts of the laser plane equipment I was able to expedite its clearance through customs.

11. Weekly reports of the past week's activities and the plans for the next were prepared.

Concerns:

1. Some fields were not adequately leveled presenting problems in using flood irrigation.

2. Farmers often irrigated too quickly causing seeds to float to the surface.

3. Insufficient equipment, such as disc harrows, cultivators, and fertilizer spreaders resulted in the improper preparation of the seed bed.

4. Lack of tractors with dual external hydraulics limits the use of implements requiring external cylinders, such as scrapers.

5. Tractor drivers did not like to use the row markers, resulting in a large number of skips and overlaps in the field.

6. The engineers need more practical experience in the use and repair of equipment. For example, the engineers had difficulty setting the markers on the grain drills, resulting in improper spacing of the rows.

7. The silage mowers' knives are being damaged by the farmers running them too close to the ground.

8. Parts catalogues were not copied for distribution to the village engineers.

9. Equipment was excessively damaged in transport.

10. In the villages there is no one person accountable for the equipment and there is no area where it can be secured.

11. There are insufficient tools for the village engineers and the regional extention specialists.

12. The extension specialist in the governorate of Oualibya lacks field experience.

13. Recent personnel problems in the governorate of Sharkia has limited the success of the program in this area.

Recommendations:

1. Work to insure that the village engineers stress the criticalness of leveling the fields, irrigating slowly and using the row markers when planting and keeping the silage mower knives sharpened.

2. Obtain the following needed equipment:
Disc harrows, fertilizer spreaders, cultivators and small ditchers for irrigation ditches. These items are in addition to the equipment that has already been ordered.

3. Find out if external hydraulics are available for the Zetor tractors. If so, obtain conversion kits.

4. Provide the village engineers with more technical training.

5. Get the parts catalogues copied and distributed to the village.

6. To lessen damage to equipment in transport either build loading ramps at each village or equip the tractors with 3-point hitch booms.

7. Assign the responsibility of the equipment to one person in each village and continue with plans to construct a secure area for equipment storage.

8. Make sure that the tools that were ordered get to the extention specialists and to the village engineers.

9. With time the extension specialist in Oualibya will gain the field experience he needs.

10. Because of recent changes in personnel in Sharkia, the success of the program should improve.

LOCATION OF EQUIPMENT

Governorate	Village	Equipment
Behera	Shiek Ahmed	David Brown Tractor Silage Mower Scraper Disc Ridger Cultivator Seed Drill Back Hoe Chisel Plow
	Ezab Besentali	Seed Drill Silage Mower Ridger Scraper
	El Gorn	Seed Drill Silage Mower
Gardya	Kafr Dima	Silage Mower Seed Drill
	Kafr Damshit	Seed Drill Scraper Silage Mower Ridger
Sharkia	Sardeen	Seed Drill Scraper Silage Mower Back Hoe
	Shoduk	Seed Drill Ridger Silage Mower Scraper
	Tiline	Seed Drill
Qualibya	Deltan	Seed Drill
	Shamut	Seed Drill Silage Mowers Scraper Ridger

A.2 EXTENSION/TRAINING SUBPROJECT

Activity Report
February, 1983

Submitted by: Fred Schantz, Roger Engstrom, Gordon Stringer, Maher Iskander, Dr. Mamdouh El Baz, Ibrahim El Gatas, Samir Showky, Hussein Heiza, Salah Bakar, Ahmed El Beheri, M. Abdel Aziz Soiden, Moh. Yasser Afifi, Mostafa Moh. Moustafa, Essam El Din Wasef

Summary

Major events of the month are summarized below. Detailed reports of each unit are found in A.2.1 through A.2.8. A.2.7 lists the expenditures for the subproject for the month.

Extension Activities:

1. Weekly meetings were reactivated during the month for 0930 Sundays. All personnel are now required by project management to attend these planning meetings and complete weekly plan forms. This was done to help coordinate all project activities. During the first meeting it was announced that Mr. Soiden would replace Dr. Ansary as Area Extension Officer for the Sharkia/Qualibya area, also it was made clear that Ahmed El Beheri is in charge of all field extension activities and Dr. Mamdouh is in charge of all extension information activities. Mr. Roger Engstrom was introduced as the new Machinery Extension Advisor and three area Irrigation Engineers were assigned to the project including Mohamed Yasser Mohamed Adly Afifi, Mostafa Mohmoud Moustafa, and Essam El-Din Aly Wasef, as well as Mr. Hassan as the new Minia area Extension Officer.

2. Limited field demonstration/training sessions (4 total: are in Beheira, Gharbia, Sharkia, Qalubiya) continue on one agricultural backhoe.

3. Limited field demonstrations also continued on the land scrapers (also four sessions in four governorates).

4. Mr. Roger Engstrom, the new Machinery Extension Advisor, arrived on February 5th. Most of the month was used for initial adjustment and orientation. A.2.8 details his activities.

5. Several field visits were taken with the USAID evaluation team who analyzed and evaluated the extension activities.

6. Extension materials and filming continued to be developed and many were prepared for the International Fair due to

begin in Cairo in March.

7. Village programs for Sharkia, Qalubiya and Minia were presented to the project staff at the Alexandria Sidi Bishr training center on February 8th. This completes all 23 village programs for 1982-1983 for project villages. They are now being translated into English and should be bound for distribution by May, 1983.

8. Group 2 and 3 extension demonstration/training equipment procurement was delayed during the month due to administrative and bureaucratic problems.

In-Country Training Activities:

1. During the month 114 trainees attended six new and continuing courses/sessions for 1,974 student/days (trainee for one day) for training (see A.2.6).

2. A final draft of the 1983 Training Plan was completed during the month and presented to project management for approval on February 28th.

3. The fourth quarterly cash need statement was completed and submitted to the financial unit.

4. Developed sources for visual aids training and began developing courses for pean farming in South Tahrir, peanut mechanization at Kaha and combine harvester operation and maintenance at the Maamoura Farm Machinery Training Center.

Participant Training Activities:

1. Continued processing of observation/study tours and academic programs. Of the sixteen academic and ten tours put into process, one observation/study tour and one academic program have been accepted by the USAID - Cairo training office and are being passed onto the Washington D.C. office for final processing. The other program/tours will continue in process until the detailed requirements are met.

2. Ninety more candidates for participant training have been placed in the screening process which should provide the Project with sufficient candidates for its academic programs.

During the Month:

Implementation of the field extension activities was severely limited during the month dur to the slow processing of the extension/demonstration equipment order of Group 2 and 3. The agricultural backhoes which are badly needed in all areas were delayed due to the absence of available funds and the extremely complex system used to evaluate, select, approve, renegotiate, finance and deliver the equipment. Also equipment needed for land levelling, bedding and

and other operations are being delaved and probably will be used on a small scale only this spring season. Most of these operations will be delayed until the spring of 1984 if the equipment is not procured by next month.

Equipment which is in the final stages of procurement includes the mechanization system demonstration/training equipment for the project's training station in Qualibya as well as 11 combine harvesters primarily for wheat and rice harvesting. The focus will be on these units until the other extension equipment is procured and placed in project village. The training unit intensified its efforts during the month in anticipation of increased training needs for the spring period. A number of new courses were formulated including peanut farming at South Tahrir Company, combine harvester operation and maintenance at Maamoura Training Center and numerous field sessions for the incoming demonstration/training equipment for project villages. Much of this effort which has been generated with the help of the extension specialists in the 23 villages has been temporarily delayed pending receipt of equipment spaced out and requested in December, 1982..

Four field trips and twelve meetings were attending during the month including:

1. Two trips were taken (to shieh Ahmed/Ezab Besentwai and Gereclease/Maamoura Training Centers) with the USAID evaluation team to examine implementation activities.

2. Several meetings/discussions were held with the procurement staff concerning processing of extension demonstration/training equipment.

3. A field trip/meeting was taken/held at Alexandria with all extension field staff where the Sharkia/Qaliubya/Minia village programs were presented.

4. Meetings were held with World Bank staff and Agricultural Development staff concerning project equipment/activities. They were interested in supplementing the project's activities and beginning activities in areas similar to those established.

5. Several meetings were held with the ICON dealers in order to secure the 4 unit planters already procurred. Ongoing discussion continues about who is responsible for field delivery of the planters which have remained for several weeks at the ICON office.

MAJOR PROBLEMS:

1. Same as last month (January, 1983).

2. Most field extension activities proceeded slower than planned due to delays in extension demonstration/training equipment procurement.

PLANS FOR NEXT MONTH:

1. Continue extension/training activities as planned.

2. Procure final approval and distribute the 1983 Training Plan.

3. Procure 15 mower/grinders and 4 planters for field distribution.

4. Begin combine harvester training at the Maamoura Training Center as well as other planned courses in the field.

5. Attend the International Fair in Cairo with selected key farmers from project villages.

A.2 EXTENSION/TRAINING SUBPROJECT

A.2.1 Rural Agricultural Information Unit

Activity Report
February, 1983

Submitted by: Dr. A. Mamdouh El-Baz

A. Summary:

- For five days with mechanization extension specialists to train them about proper use of A.V. aids available now, to discuss village extension programs for next summer season.
- Four four days in Kena to investigate the probability of meachinizing banana areas to increase its production.
- Round-trip to Kafr-El-Shiekh with national television to prepare rural program relating to the contest.
- Received and started distributing 50,000 copies of a specific bulletin about maintaining tractors.
- Preparing to participate in Cairo International Fair to be held next month.

B. Problems:

- Same as last month (January, 1983).

C. Plans for Next Month:

- Following up on a specific bulletin about mechanized rice transplanting.
- Involved in Cairo International Fair.

A.2 EXTENSION/TRAINING SUBPROJECT

A.2.3 Beheira, Gharbia, Sharkia Governorates

Activity Report
February, 1983

Submitted by: Ahmed El Beheri

A. Summary:

1. I accompanied AID Group to our extension villages in Beheira Governorate to see our activities during the wheat planting.

2. We had several meetings with different groups of farmers from Beheira districts at El-Shakh Ahmed Village.

3. We attended a meeting with the extension staff at Sidi Bishr Training Center and we had a discussion according to their plans.

4. We had a meeting at Waked Village in Beheira area to encourage them to build mechanization coops, at that meeting we present the project facilities for that kind of coop.

5. We had 4 trips to Sharkia and Qalubiya to check the wheat planting.

6. We had 3 trips to Gharbia and Beheira.

7. We started backhoe training courses on February 21st in Shorking for one week, the second week on February 26th we started another course in Qabubiya, and we have planned for three other courses for Gharbia and Beheira as well as Minia.

8. We accompanied Mr. Roger Engstrom to Sakha farm to check harvest combine.

9. We have been in a mechanization workshop at Cairo University arranged by the California project.

10. We accompanied a group from World Bank to view our extension activities in Beheira and Gharbia Governorates.

11. I had two trips to the mechanization farm looking for post hole diggers for demonstrations on our extension village.

12. We named the storekeepers in each village.

13. We registered the machines which belong to the Project in each village and the storekeepers signed for them.

14. We start building a pump as a model in El Shakh Ahmed village for loading and unloading machines.

B. Problems:

1. There is no extension officer in Minia Governorate.

2. There is no machine in our villages in Minia and we haven't effective program in that area.

3. The extension agent in each village needs transportation.

C. Plans:

1. Arrange a meeting with the farmers in extension village.

2. Following extension plots in each village during seedbed preparation.

3. Continue backhoe training course in the spots.

4. Continue land levelling course in each village during summer seedbed preparation.

5. Selecting cotton plot in each village, 50 feddan in each one, with extension agent.

A.2 EXTENSION/TRAINING SUBPROJECT

A.2.5 In-Country Training Officer

Activity Report
February, 1983

Submitted by: Ibrahim El Gatas
Hussein Heiza

A. Summary: Training programs started during the month:

- Mechanic Level I at Maamoura on February 4th for 12 trainees (extension subproject).
- Land levelling using lesser units, hydraulic systems at Gabal El Asfar on February 12th for 5 trainees (soil improvement subproject).
- Backhoe operation and maintenance. Five courses are held under this program: one in each governorate. 50 trainees are planned to be trained (extension subproject).
- Using audio and visual aids at Sidi Bisher for 27 trainees on February 4th.

B. Courses in Progress:

- Mechanic II at Maamoura for 8 trainees

C. Visits paid during the month:

- Maamoura training center.
- Sidi Bisher training center
- Nubaria training center
- South Tahrir agricultural-camp.

D. Preparation for the several courses:

- Tractor operators at Nubaria.
- Peanut mechanization at South Tahrir.
- Vegetable mechanization at Kaka.
- Combine operating and maintaining at Maamoura.

A.2 EXTENSION/TRAINING SUBPROJECT

A.2.6 Participant Training Officer

Activity Report
February, 1983

Submitted by: Samir Shawky

A. Summary:

1. Academic Training:

   - Seven candidates are ready for processing by USAID T.O.
   - Three of them have totals over 500.
   - New advertisement is distributed and 250 candidates applied for the fellowships.
   - 130 candidates are scheduled for the screening test
   - 40 of them attended the test - the remaining people will be tested during March.

2. Non-academic Training:

   - Group of three participants from soil improvement subproject are in processing by USAID training officer.
   - Other 3 groups are in processing for the same trip.
   - All other groups (10) about 100 candidates are in processing application farms are distributed among all candidates in all Governorates.

3. English Training

   - 12 participants in english courses.

February, 19[illegible] - Training Schedule

DATE/TIME	LOCATION	COURSE NO.	COURSE TITLE	COMMENTS
MACHINERY MANAGEMENT EXTENSION UNIT				
Feb. 4 - Mar. 3	Maamoura Training Center	3EX 12.1	Mechanic: Level I	12 Trainees
Feb. 12 - Mar. 26	Project Villages	3EX 8.1-5	Agriculture Backhoe Operation	50 Trainees
Feb. 5 - Feb. 8	Sidi Bishr Training Center	3EX 44.1	Visual Aids Use (Camera)	27 Trainees
TRAINING UNIT				
Feb. 1 - Feb. 28	AUC	3T 2.1	English Language	12 Students
SOIL IMPROVEMENT				
Nov. 27 - Mar. 24	Maamoura Training Center	2si 8	Mechanic: Level II	8 Trainees
Feb. 12 - Feb. 28	Gabel Asphar Farm	3Li 3.1	Lazer Operation/ Maintenance	5 Trainees

A.2 EXTENSION/TRAINING SUBPROJECT

A.2.7 Fiscal Report

Activity Report
February, 1983

Submitted by: Ahmed

The following is a summary of the fiscal report in local currency related to the referenced training subunit.

Line Item	Budget 100%	Expenditure 74%	Total To-Date + 26%
1. Instructors Fees:	2,000.000		2,000.000
2. Equipment Rental:	2,000.000	2,612.000	- 612.000
3. Petroleum, Oils, Lubs:	1,000.000		1,000.000
4. Training Aids/ Equipment:	2,000.000	13,969.250	- 11,969.250
5. Machine Operators Fees:	500.000	12.000	488.000
6. Room/Board:	5,000.000	608.000	4,392.000
7. Transportation:	2,000.000	1,230.750	769.250
8. Expendable Training Materials:	3,000.000	1,212.550	1,787.450
9. Incidental Living Expenses:	4,000.000		4,000.000
10. Training Center Fees:	5,000.000	76.800	4,923.200
11. Administrative Expenses:	2,000.000	1,295.000	705.000
TOTAL	28,500.000	21,016.350	7,483.650

	Budget	Expenditure	Balance
Commodities		26,240.000	(2) Sava-24 (10) YP 400 (L.D. Co.)
February, 1983		264,631.012	E.G.C.T. Co.
	330,000.000	290,871.012	39,128.988

A.2 EXTENSION/TRAINING SUBPROJECT

A.2.8 Machinery Management Extension Advisor

Activity Report
February, 1983

Submitted by: Roger Engstrom

A. Summary:

1. Settling in progress.

2. Office Orientation.

3. Supplies Location.

4. Visit potatoe research - conflicting reasons for not using potatoe diggers. Second visit did get new machine into field, and video recording of same. Tractor needs more weighy inform of water in tires to make it operate properly, plow must be set below potatoes to prevent cutting. Tractor must be driven at slowest speed and P.T.O. speed keep at about 350 RPM to allow excessive amount of soil to be allowed to drop out through rattles instead of being thrown out behind the machine and mixed with harvested potatoes. Operator must practice driving on land without potatoes, then get on a row and keep the machine centered on row of hay outlines to prevent driving on harvested potatoes and still be efficient in the case of time and fuel.

   Cyprus machine - I did not get to use it although I came to the field. I noted some modifications and suggested two more. First to add fingers (rods about five larger - spaced 1½" apart by welding to crossrod at output of first rattle - second drill four holes in side of machine to allow rod to be passed crossways about 6" or 8" above rattle. This will allow potatoes to pass but not large clods of soil which will tumble until broken smaller. When the rod is not needed it can be removed easily.

   The Engineer driving themachine damaged potatoes by driving over harvested potatoes rather than driving with the wheels in the place where the potatoes had been removed in the previous pass. I will not allow incorrect methods to be passed on. There is a tremendous difference between experimentation (which is necessary to observe various results as well as practice once results are satisfactory), and teaching because in teaching the person learning can learn "wrong" methods as well as "correct" methods but also very important is to teach correct methods first so that the learner can appreciate a good result. Many many times the learner will not give a "second chance" if he sees an "incorrect" reason. His mind is made up that it is "wrong" or that the

teacher is incompetent. I attended a meeting at research center to see Brazilian planter, it seems a good tool-bar type for crops other than peanuts, saw some of the equipment available here. Visited a couple of dealers, also Tanta motors. Did not find Vicon dealer yet. Looked at Freeman Bailer, J.D.

B. Problems:

1. Time to settle into house.

2. Moving to settle into house.

3. Last house.

C. Plans for next month:

1. Keep looking for house.

2. Get familiar with machinery.

3. Attend farmer meetings/demonstrations

4. Visit more areas of Egypt

5. Get machinery where it is needed

6. Try to solve any problems with the machi demonstrate the machinery.

A.2 EXTENSION/TRAINING SUBPROJECT

Activity Report
March, 1983

Submitted by: Fred Schantz, Roger Engstrom, Gordon Stringer, Maher Iskander, Dr. Mamdouh El Baz, Youseef Abdel Mawgood, Ibrahim El Gatas, Samir Shawky, Hussein Heiza, Salah Bakar, Salah Ismail, Ahmed El Beheri, M. Abdel Aziz Soiden, Mostafa Moh. Moustafa, Essam El Din Wasef

Summary

Major events of the month are summarized below. Detailed reports of each unit are found in A.2.1 through A.2.8. A.2.7 lists the expenditures for the month.

Extension Activities:

1. All field extension activities were stopped or cancelled during most of the month due to the absence of funds, field equipment, and sufficient fuel necessary to carry out planned activities. This was due to administrative and bureaucratic difficulties which hopefully will be resolved soon.

2. Most of the 15 mower/binders, 4 seed planters and one laser unit were distributhd to the project villages during the month in preparation for wheat harvesting and corn planting in April-June. A.2.4 describes the distribution of this equipment.

3. The International Fair held in Cairo during the month attracted several hundred project village farmers as well as most of the project staff. Several lines of equipment were on display including some developed and demonstrated in the field by the project.

4. A concentrated effort was given by the mechanization extension specialists during the month to advising project village farmers on water pump sets and machinery introduction funds availability as well as the advantage of using long furrow irrigation and land levelling practices.

In-Country Training Activities:

1. During the month 131 trainees attended 9 new and continuing courses/sessions for 1,731 student/days (trainee for 1 day) of training (A.2.5).

2. All training activities stopped during the month due to the absence of funds and fuel limitations required to

carry out planned activities.

3. The 1983 Training Plan was partially revised during the month and returned to project management for final approval. Copies were also sent to USAID for review and comment.

4. A major training course was begun at the Maamoura Training Center on March 20th for combine harvester operations, mechanics and engineers. Following this formal/practical training and the arrival of 11 Dentz/Fahr 980 combines in April, these trainees will participate in the assembly and field demonstration/training of this equipment in project villages.

Participant Training Activities

1. Participant training candidates continued processing during the month with 5 candidates reaching the final USAID/Cairo processing stage for academic programs out of 120 attending initial English testing/screening.

2. Two non-academic (technical) training programs reached final USAID/Cairo processing while eight others remained in initial processing stages.

3. The volume of participant training candidates has become large enough for two full-time participant training officers to screen and collect initial information required by the USAID/Cairo training office.

During the Month:

A major setback accured in the activities of the extension and training subproject during the month due to the delay of funds for the February/March/April, 1983 quarterly cash need request and the newly enforced regulation of 200 liters of fuel per vehicle per month. Courses stopped or postponed included peanut farming at South Tahrir Company, tractor operation at Nubaria Station, scraper (land levelling) operation and maintenance in most project areas including the soil improvement's training areas, and backhoe operation and maintenance in selected villages. Several project mechanization extension specialists and training personnel were put in an extremely embarassing position when they had to cancel field training activities and training center courses in progress or in final negotiation stages. This combined with fuel limitations of 200 liters per month which is less than half of what is normally required for planned activities, has resulted in a severe blow to the success of implementing the extension and training plans for 1983. Unless the funds are made available soon and the fuel allowance increased for the field needs, the spring, summer and perhaps fall farming seasons will passwithout a noticeable impact on project villages from project staff. More importantly the loss of confidence by both farmers and the subproject's staff in the implementation backup of the project has resulted in a definite negative effect on project implementation. This came at an unfortunate time when the spring rowcrop operations are at their peak resulting in

the loss of this valuable demonstration/training period until next year.

Five field trips and ten meetings were attended during the month including:

1. Two field trips were taken and several meetings were held with the local manufacturing subproject staff concerning their training plan for 1983. The program was revised and finalized during the month.

2. Several meetings were held with project management concerning the 1983 Training Plan which was revised during the month.

3. Normal weekly planning and evaluation meetings were held with the extension and the training staff during the month.

4. The International Fair was visited and its displays discussed.

5. Several meetings were held with the Dentz/combine harvester's representative in Cairo - and Alexandria - to discuss/examine the incoming combines and necessary arrangements required.

6. Two meetings were held with project management concerning the development of project training strategy and a subsequent report was completed.

Major Problems:

1. Same as January, 1983.

2. The lack of available funds, fuel limitation and demonstration/training equipment has resulted in a loss of most of the spring farming season operations.

3. The absence of available vehicles for 2 of the 3 project areas for extension/training activities continues to severely limit project implementation activities.

Plans for Next Month:

1. Continue extension/training activities as possible with funds and fuel limitations.

2. Secure final approval of the 1983 Training Plan.

3. Procure and service 11 Dentz/Fahr 980 combines at Shiek Ahmed and deliver to selected project villages.

4. Write a paper on mechanization extension covering project philosophy and develop an implementation model.

5. Participate in the first project cotton and peanut planting field trials in extension areas.

A.2 EXTENSION/TRAINING SUBPROJECT

A.2.1 Rural Agricultural Information Unit

Activity Report
March, 1983

Submitted by: Dr. A. Mamdouh El Baz

A. Summary:

- Before February came to an end, and until the end of March, I was highly engaged in preparing the display of Agricultural Mechanization Projects in the Cairo International Fair. We occupied 290 square meters, representing 22.3%, out of the total area devoted to the Ministry of Agriculture as a whole. We reprinted eleven extension specific bulletins, in sufficient numbers to be distributed during the Fair.

- About 400 progressive Farmer Farm mechanization extension villages paid visits to our display along the week devoted for the public.

- Received some audio visual aids for central extension unit.

B. Problems:

- Collecting material to be displayed. From here and there is very tedious and time-comsuming process. A storage place is again and again badly needed.

C. Plans for Next Month:

- Office work to compensate my absence in the Fair.

- Preparing a pocket calender for Ramadan (Moslem fasting month) including some relevant advice.

- Collecting bids about changing the drawing of extension signs.

- Distributing 45,000 copies from a printed extension bulletin about maintenance of tractors.

A.2 EXTENSION/TRAINING SUBPROJECT

A.2.1-1 Information Unit - Video Operator

Activity Report
March, 1983

Submitted by: Yussuf Abdel-Naiem
Abdel-Mawgood

A. Summary:

Made documentary video shots of the following activities:

1. Wheat planted by machines compared with manually planted in different areas and different ages.
2. Training farmers on backhoe operations in Sharkia and Qalualia Governorates.
3. Potatoes harvesting by potatoe digger in Farhonia, Menufia Governorate (World Bank Project).
4. Land-levelling of Gabel Asfar Farm land by lazer equipment.

Prepared all procedures needed for the seminar held on March 27th, about "Harvesting Technology Appropriately for the Small Farmer" (Small Scale Project).

B. Problems:

1. Lack of a stand-by battery and spot light lamps.

C. Plans for Next Month:

Making D.V.S. of the following activities:

1. Tractor maintenance.
2. Harvester combine.
3. Planting cotton by machines.
4. Laser system working in Beheira.
5. The activities of the Small Scale Project in different Governorates.

A.2 EXTENSION/TRAINING SUBPROJECT

A.2.2 Farm Management Group

Activity Report
March, 1983

Submitted by: Gordon B. Stringer

A. Summary:

- Preparing the data for computer entry.
- Preparing the office at Gebel Asfar.

B. Problems:

- None at present.

C. Plans for Next Month:

- Move office to Gebel Asfar
- Receive some of the shop equipment
- Start to prepare the shop for operations.

A.2 EXTENSION/TRAINING SUBPROJECT

A.2.3 Beheira, Gharbia, Sharkia Governorates

Activity Report
March, 1983

Submitted by: Ahmed Beheri

A. Summary:

1. We attended a farmer meeting at El-Gosak village, Belpas District and El Shamout village, Benha District.

2. We held a digger demonstration at Kafer Deima Kafr El Zaaist District for potatoe digger.

3. Visits to Faculty of Agriculture at Mostohur, check the leveller.

4. We held several meetings in Sharkia Governorate for mechanization.

5. We held several meetings in Minia Governorate to build a mechanization coop.

6. We had a visit to Nile Valley project in Minia.

7. We sent our backhoe operator to Sharkia Governorate to demonstrate different kinds of backhoe.

8. We held a meeting with the leader of central coop in Gharbia, helping them to build agriculture mechanization coops.

9. We had a field day at El Shaik Ahmed with the leader of Gharbia coop on the 16th of March.

10. We have had several contacts with ICON commenting about planter delivery.

11. We had a trip to the World Bank pilot farm at Monufia.

12. We accompanied Dr. Hassan Fouad on a trip to El Shaik Ahmed village to see our activity over there.

13. We had several meetings with a committee concerning peanuts. The committee agreed to choose several plots not less than 15 feddans to demonstrate the complete set of peanuts during this season from seedbed till harvesting.

14. We held a workshop at the Faculty of Agriculture in Giza about harvesting.

15. We planned to plant 28 feddans of cotton in Dakalia as a demonstration area.

16. We accompanied our farmers to the Cairo International Fair during their visits.

17. We set up an inventory system with Mr. Heshmat Farah.

18. We have a plan to move a rear mounted binder from Tanta to our villages.

19. We carried out five backhoe training courses at our villages.

20. We carried out two training courses for land levelling.

21. We supervised the foundation of the implements shed.

22. We have a construction materials license to build the ramp.

23. We held a weekly meeting with the extension officer and the expatriate every Sunday.

24. We held several meetings with Dr. Hatem and Mr. Abd El Moula in Beheira Governorate on mechanization coop.

B. Problems:

1. We have a shortage of money to carry out extension program.

2. There are no implements to carry out the summer plan at extension villages.

3. The limitation amount of fuel, with 200 liters to cover our trips is not enough to supervise the five governorates.

C. Plans for Next Month:

1. Continue levelling training courses in extension governorates.

2. Mower binder delivery to extension villages.

3. Select eight maize soybeen areas.

4. Planting 28 feddans with cotton in Dakahlia, by different kinds of planters, different methods of primary and secondary tillage.

5. We are going to participate in peanut planting in Sharkia according to peanut committee.

6. Draw the outline of extension program for the next six months.

7. Cotton cultivation by tractor.

STOREKEEPERS

Governorate	District or Village	Name of Storekeeper
Sharkia	Telien	Mustafa Said Hashem
	Saadien	Abdel-Hameed Fuad Ismaiel
	Gosak	Yaser Abdel Aziz Mohamed
Beheira	Dept. of Ag.	Abdel Salam Mahmoud Bais
Gharbia	Dept. of Ag. Tanta	Ibrahim Mohamed Tella
Qalubia	Hissa	Ahmed Hasan Ahmed
	Beltan	Abdel Moniem Abdel Aziz Megawry
	Hosafa	Abdel Rahman Morsi Saad
	Magol	(No One)
	Shamout	Ibrahim El Hady
Minia	Korbas	Abdel Moiz Mohamed Aly
	Matai	Yunan Grgawy Tawdros

A.2 EXTENSION/TRAINING SUBPROJECT

A.2.3-1 Beheira/Gharbia Assistant Extension Officer

Activity Report
March, 1983

Submitted by: Mohamed Abdel Aziz

A. Summary:

We plowed up the land in preparation for cotton at Gharbia and BEheira try to coerce the farmers into using long farrow irrigation system. Five backhoe training courses at Sharkia, Qalubia, Gharbia, two at Beheira and one land levelling course at El Sheik Ahmed and four days visiting Cairo International Fair.

B. Problems:

1. Fuel limitation, we have to cut back on four activities to fit with the fuel allowances.

2. We miss the summer crops because no machines arrived.

3. We stopped two courses because there were no funds.

C. Plans for Next Month:

1. We start lazer training course at Gharbia and Beheira.

2. Go on with out activities.

A.2 EXTENSION/TRAINING SUBPROJECT

A.2.3-2 Sharkia, Qalubia Governorate Extension Officer

Activity Report
March, 1983

Submitted by: Abd El Hamied Mohamoud Soidan

A. Summary:

1. Extension meeting at V.El Gosek - Sharkia March 1st.
2. Extension meeting at V.El Shamoot - Qalubia March 3rd.
3. Collecting the agricultural machinery funds from Sharkia, Qalubia for studying.
4. Machines transportation from Dearb Negem to the other extension villages.
5. Training course for backhoe at Sharkia and Qalubia.
6. Training course for land levelling at Sharia, Qalubia.
7. Visit, trip for the farmers from the extension villages to Cairo International Fair.
8. Follow up for summer plan to make land levelling for 50 feddans in every village.

B. Problems:

1. We have no car.
2. Hydraulic piston for land scraper at El Shamoot - no good
3. The ridgers not hard enough.
4. No money for operation.

C. Plans for Next Month:

1. Field days to show Siphon irrigation system.
2. Follow up for summer plans of cotton.
3. Land preparation and planting for 200 feddans of peanuts at Sharkia. Broad bean harvesting.

A.2 EXTENSION/TRAINING SUBPROJECT

A.2.4 Minia Extension Officer

Activity Report
March, 1983

Submitted by: Hassan

A. Summary:

1. Starting work and know with group of workers there bring meeting in Minia Agricultural Government going to Naway village to regard some machines in another project there.

2. Making a weekly meeting in the agricultural district to know problems. Make collecting groups of area in order to extension about cultivate cotton by planter.

3. Making a visit for farmers and a group of project to visit Cairo International Fair.

4. Bring farmers to training on combine circle and digger circle.

B. Problems:

1. There are no machines to cultivate cotton.

2. The quantity of money in bak to give loans to pumps is nearly finished in some villages.

3. There are no machines in order to enter the soybean cultivation season when we consider that the season of cotton finishs without extension.

C. Plans for Next Month:

1. Making extension group area to cultivate soybean.

2. Making visits to the field of wheat which we want to harvest it with the mower binder and collect problems against the mower and give solutions in order to make system.

3. Make extension program about the mower before harvesting season.

Mower/Binder Distribution

No	Area / Coordinator	Village / Specialist		Storekeeper	Delivery Time
1					
2		Shiek Ahmed	A.Beheri		16 Mar 83
3		Ezab Besewni	Moh.Sobeh		
4	Behera/A.Abdel Aziz	El Gorn	Helmy Moh.		
5		Dessoures	Moursy Has		
6		sh.El Hessa	Ah.Balal		17-31
7	Garbya/M.Abdel Aziz	Ken.Damshit	Sami Moh. Ali		Mar 83
8		K.El Nagar	Abdel Zaher		
9		Kafr Dima	Helmy Abo Zeid		
10	Sharkia/Soidan	El Teline	Moust.Saied		
11		El Gosk	Ibr.Matkees		17-31
		El Saadyine	Taha Aly Yores		Mar 83
12					
13	Quolibia/Soidan	Magol	Abd Lateif		
		Beltan	Moh.Marzouk		
14					
15	Minia / Hassan	El Atlat	Goloe A.Elwa		14 Mar 83
		Beni Ibeid	Osman Mok.		

Notes: 1. The area coordinators will pick up the units for his area at tanta motors and travel with the truck to his areas. The project Inventory office will also be present to properly record receiving the equipment.

2. The area coordinators will sign responsibility for the equipment and place them under the supervisior of the project village mechanization extension officer and storekeeper.

I D 71 Planter Distribution

1. Behera	Shiek Ahmed	31 March
2. Garbya	Kafr Dima	" "
3. Sharkia/Qalibya	Soodine	" "
4. Minia	Bini Abeit	" "

S P Lazer Distribution

1. Behera	Shiek Ahmed	19 March

A.2 EXTENSION/TRAINING SUBPROJECT

A.2.5 In-Country Training Officer

Activity Report
March, 1983

Submitted by: Ibrahim Hassan El Gattas

A. Summary:

DATE/TIME	LOCATION	COURSE NO.	COURSE TITLE	COMMENTS
MACHINERY MANAGEMENT EXTENSION UNIT				
Feb. 4 - Mar. 31	Maamoura	3EX 12.1	Mechanic: Level I	12 Trainees
Mar. 20 - Mar. 30	Maamoura	3EX 45.1	Combine Operation & Maintenance	24 Trainees
Feb. 21 - Mar. 10	Locally in Government	3EX 8.1-5	Backhoe Operation	50 Trainees
Mar. 20 - Mar. 24	Shekh Ahmed	3EX 16.1	Hydraulic Scrapers Operation	5 Trainees
Mar. 19 - Mar. 31	Shekh Ahmed		Lazer Operation/Maintenance	12 Trainees
LOCAL MANUFACTURING				
March	Beheira	3LM 1.3	Industrial Technology	3 Trainees
SOIL IMPROVEMENT				
Feb. 12 - Mar. 3	Gabal El Asfer	3Si 3.1	Specialized Training in Lazer based Levelling	5 Trainees
Nov. 27 - Mar. 24	Maamoura	2SI 8	Mechanic: Level II	8 Trainees
TRAINING UNIT				
March	AUC	3T 22	English Language	12 Students
March	Cairo Office	3T 5.3	Computer Operation	1 Student

B. Problems:

1. The delay of the funds assigned for training farms major setback for the activity.

2. Transporation is another delay since the instructions have limited fuel consumption.

C. Plans for Next Month:

1. Next month training activity depends upon flowing USAID fund.

A.2 EXTENSION/TRAINING SUBPROJECT

A.2.6 Participant Training Officer

Activity Report
March, 1983

Submitted by: Samir Shawky

A. Summary:
Academic Training

- Out of the 7 candidates admitted to USAID Training Officer 5 are in processing as follows:

  1. Zaki Helmy Zaki Wissa - MSc Computer Science
  2. Sohair Mohamas Abdel Rahman- MSc Rural Sociology
  3. Nader Fawzy Lelaika - MSc Agri. Engineering
  4. Adel Mahmoud El Gohary - PhD Post Harvest
  5. Atef Abdel Razik Salama - MSc Agri. Economics

  All candidates applied for the fellowships and are scheduled for the screening test (May 23,24)

  120 of them attended the test.

Non-Academic Training

- In addition to the first soil improvement group (3 candidates) other groups of 2 are in processing as follows:

  First Group:
  1. Dr. Adel Orabi
  2. Dr. Amin Mashali
  3. Dr. Saad El Sherif

  Second Group:
  1. Dr. Ahmad El Arabi
  2. Eng. Hassan El Banna

  Other non-academic groups are still in the stage of collecting forms from the different subprojects and the governorates.

- 12 participants in English courses.

- 14 participants are registered for English courses.

B. Problems:

1. Training officers in the governorates are needed to follow up the training activities and to assist in preparing and collecting different forms and documents needed for participant training.

2. Assistance for the participant training is needed as the P.T. activities increase.

C. Plans for Next Month:

- Collecting the remaining forms for the non-academic group and put them in processing as soon as possible.

- Language training for the new candidates for the academic fellowships.

- Processing the ready candidates for the academic training.

A.2 EXTENSION/TRAINING SUBPROJECT

A.2.7 Fiscal Report

Activity Report
February, 1983

Submitted by: Ahmed

The following is a summary of the fiscal report in local currency related to the referenced training subunit.

Line Item	Estimated Monthly Budget	Expenditure	Total Balance To-Date
1. Instructors Fees:	3,000.000	55.600	2,944.400
2. Equipment Rental:	3,000.000	320.000	2,680.000
3. Petroleum, Oils, Lubs:	1,000.000		1,000.000
4. Training Aids/ Equipment:	3,000.000		3,000.000
5. Machine Operators Fees:	500.000		500.000
6. Room/Board:	5,000.000	1,838.000	3,162.000
7. Transportation:	2,000.000	(312.500)	2,312.500
8. Expendable Training Materials:	3,000,000	160.270	2,839.730
9. Incidental Living Expenses:	4,000.000	2,643.000	1,357.000
10. Training Center Fees:	5,000.000	1,157.700	3,842.300
11. Administrative Expenses:	2,000.000		2,000.000
TOTAL		5,862,070	

	Total Budget	Expenditure	Total Balance
Commodities:			
(1) Catter Bar	330,000.000	1,500.000	328,500.000

A.2 EXTENSION/TRAINING SUBPROJECT

A.2.8 Machinery Management Extension Advisor

Activity Report
March, 1983

Submitted by: Roger Engstrom

A. Summary:

1. Visited potatoe research station.
2. Attended meetings of mechanization at Minia.
3. Visited Malawi to see tillage machines, very good results in virgin sugar fields.
4. Researched addresses of manufactures at Embassies in Cairo, found more local dealers, suppliers.
5. Saw machine to dig potatoes, it has other potentials.
6. Attended cotton planting demonstration with two machines - not effectively adjusted. Backhoe, levelling, cold breaker, harrows, plows, etc.
7. Attended Cairo International Fair with selected farmers.
8. Attended mechanization seminar at AUC.
9. Attended peanut committee meeting.
10. Preliminary visit to cotton demonstration.
11. Air Freight, Housing, Drivers Licenses.

B. Problems:

1. Fuel limitations (not known at beginning of month).
2. Time (much time taken for non-productive work - Housing, Air Freight, Registrations, etc.)
3. No progress on getting John Deere planters to sites.

C. Plans for Next Month:

- Cotton planting/demonstrations - land level, fertilize seed, planters and equipment, i-rigation.
- Peanut preliminary - local machinery needed.
- levelling, backhoe follow-up

- More effective use of limited fuel.
- Maize preparation.
- Wheat harvest preparation (attend CSA orientation).

A.3 SERVICE CENTER/VILLAGE WORKSHOP

A.3.1 Service Center Unit

Activity Report
January, 1983

Submitted by: Graham G. Sparrow

At the beginning of this month Hammamy's application was approved by Dr. Sahrigi and presented to the bank. Unfortunately, it was in English only as my counterparts spent very little time working with me due to the amount of work he had to do for project management. However, this situation has been rectified, I now have a trainee counterpart.

Since our transfer from Alexandria to Cairo, which is now three months, it has been a difficult period. Firstly, it has taken two and a half months to acquire office furniture and of the five new people assigned to the project only one is an engineer the others are either agrominists or horticulturists. This has retarded our operations through the lack of knowledge and experience. However, the new team is working well, but it will be sometime before we will be effective as we were before the move.

It would appear to me that the objective now is to process and erect as many service centers as possible in the least amount of time but it must be recognized that erecting a building and installing tools and machinery is only halfway to developing a successful business.

When an application is received in the office one of the younger members is sent out to interview the applicant. In my opinion, these young people do not have enough experience to access the criteria the applicant should have. Nevertheless they commit us to appointments without any reference to ourselves as to our ability to keep the appointment. This situation will work against us instead of for us. We also discovered that as a subproject we aren't informed of any new clients until this meeting is arranged. This does make planning difficult.

We were informed unofficially that Azmy's bid and evaluation had been approved in a letter to the Bank in Minia before the evaluation had been completed. We also learned in the samy way that the bank had released half of the amount required for the Minia service center. On reflections, it appears that the cart is put before the horse in some cases.

The practice has developed whereby the client should attend any meetings in our office and that it is not necessary for us to visit their officies. We have found from past experience that many of the appointments are not kept, so this is why we adopted the practice of visiting them. And this has been very successful in the past, as the client knows you are arriving and is there to discuss the various items. This approach does avoid many no show situations.

We met Mr. Bebars of Arab Technical Development Company who is the importer of IH agricultural machinery and discussed some of the finer points of the terms and conditions for the service center loan fund. He told us that he is talking with five of their dealers, who have shown great interest in the project. We discussed an idea of the type of building and left a set of building plans with him. As soon as he has met these dealers and gotten their final reaction, he will contact us and introduce them.

We have gone as far as we can at the present time with Diabex's application, as they have met with Morad and some changes were made. So it isn't clear now as to what exactly they want with regards to the design and costing figures they left for us.

On Tuesday, January 11th, met with Mr. Fathmg El Mowgauzy in Mansoura, his request is for a service center in Bilcas. This client would do well with a service center, as our field trip report indicates.

Wednesday, January 18th, we visited Mr. Ragaa Fathah Rehiem of Beni Suef. This gentleman we have visited twice before but neither time made contact with him. Briefly, he already operates a small dealership, but is planning to expand his operations. Again, this is an ideal client for a service center.

Shoukry Company came to the office where we went through the draft projection of the service center in Nasrah village. After one or two modifications, it should be ready for approval. At the same time we were informed by them that we were to meet them on Monday, January 31st, in Sherbein, as they are going to develop another service center there.

We have had two meetings cancelled with Mr. Korra, who is planning an agricultural service center and a gas station at Km 76 from Alexandria on the desert road. This is on a grand scale and in my opinion too large an agricultural project to start with. We will not, of course, become involved with the filling station side.

A.3 SERVICE CENTER/VILLAGE WORKSHOP

A.3.1 Service Center Unit

Activity Report
February, 1983

Submitted by: Graham G. Sparrow

We received five new applications for service centers this month, although one of these turned out to be a small workshop application which was past onto Bob Snyder. Of the small workshop section, we also had a number of meetings with new and old clients during the month and visited a number of site locations to determine their suitability. Among these meetings, we did have four clients who failed to keep their appointments with us in our office. This does affect our planning, as they then arrive at a later date when we are involved with other clients.

1. Mr. Sherif Gabily is a new client who is already involved in the agricultural machinery business, and we have made two visits to Fayoum. The first was to review his present operations and activities, the second visit was to view land he had purchased and to give our opinion. Also to suggest a possible layout of the center itself on this site. We had earlier in the month discussed with him the terms and conditions of the loan fund and the objectives of our project.

2. Mr. Azmy visited us to discuss and look through our catalogs of machines and tools that would be suitable for his center. He has asked us to visit his site on his return from abroad to see what development has taken place. Also he informed us that he would be having a foundation stone laying ceremoney, which we would be invited to.

3. Mr. Mowghazy of Bilcass discussed the design of the service center and submitted a plan for us to review. After much discussion he suggested that, in light of what had been said, he would prefer to redesign the layout of the service center and resubmit it to us.

4. Abdou Khir Alla of Mahmodia Motors came to the office to see if the project through the M.O.A. would write, a letter supporting his application for planning approval. He is still awaiting the title to the piece of land he is purchasing to be transferred before it can be registered in his name. This registration is a lengthy, process that has to be completed before the Banks will action any loan. (Many people own land but it is not always registered in their name, but in the family name, which is not acceptable to the Banks).

5. We met Mr. Mourad Fahmy, from Metobeis and during our meeting it became apparent that a service center was

larger than he was prepared to take on. He in fact was thinking more on the line of a small workshop. At this point we invited Mr. Bob Snyder of the small workshop section to take over.

6. Two meetings were held with Saad Aguizy to finalize his proposal in Qalub. This will now allow us to complete our investigation and to submit his application for approval early next month.

7. Mr. Zoomer came to our office with his application for a service center in Imbaba-Giza. After talking about the objectives of the project and the terms and conditions of the loan fund, we agreed to visit his location and the possible design layout of the center. He is going to furnish us with more information, so that we may assess the whole project.

8. Mr. Adel Assam from Badrashin in Giza also presented an application, after discussions we visited him to look at two sites that he had. We recommended one location and discussed the possible design layout in relation to the site itself. He will submit to us further information for us to assess his proposal.

9. Mr. Mahgub from Beyala in Kafr El Shiek governorate has requested a loan to develop a small service center on the outskirts of the town. The site is in a good location with all service facilities available. We have also talked of the possible design of the center in relation to the site which in this case runs back from the main road at an angle of about 45^{o}, he will submit further information regarding his plans.

A.3 SERVICE CENTER/VILLAGE WORKSHOP

A.3.1 Service Center Unit

Activity Report
March, 1983

Submitted by: Graham G. Sparrow

At the beginning of the month Mr. Azmy came to the office to select various types of machines from our catalogs. We also made a list of hand tools and special tools he would require. He informed us that the steel had arrived on site and that the framework was being constructed. Since then, we have heard that the foundations are completed and the steel framework will be erected next month (April).

After one or two modifications, Saad Aquizy's application was completed and approved by Dr. Sahrigi. This is the only service center application to be presented to the bank this month.

Due to some external pressure, Diabex requested to relocate his service center. But after very long and in-depth discussions he agreed to leave everything as it was originally. Thus this delayed the finalization of this application, but it should be completed next month and sent to the bank then.

We had two meetings with Mr. Zoomer from Embaba. First we visited the proposed location, which is good, and discussed the type of arrangement (layout) that the center should take. We talked about the design of the building that will incorporate an existing building. This will house the showroom, spare parts department and administration offices. He will submit more details, which will be discussed before any final decision is made.

Mr. Ragaa Reheim of Beni Suef has changed his mind and has decided to develop an area next to his existing showroom rather than to develop a completely new center. This has, of course, retarded this particular project, but nevertheless his revised idea is sound, although not on such a large scale.

We have had three meetings with Eng. Assem from Badrashin-Giza. After viewing a site that he proposed to develop, which would have been ideal for a service center, he discovered that the frontage cannot be used due to future road development, the small drainage ditch on one side must have a right-of-way of 25m. The amount of land available for a service center was then too small. However, we did later in the month view two other parcels of land. While both were ideal, there would be some legal problems. He then showed us another area, which was ideal, and he is going to buy some land there.

Two meetings were held with Mr. Mahgub of Biala, Kafr El Shiekh this month and the draft proposal has been agreed for a small service center. So this one should be finalized and approved next month.

The partnership of Mr. Sherif and Gabile from Fayoum has been dissolved, but we have received a new application from Mr. Sherif and Mr. Mahmoud Masoud. It is our opinion that after visiting Mr. Gabile that he will not pursue his application any further, in which case we will take up the new one from Mr. Sherif and Masoud.

We also visited Desouk (Mr. Abd El Karder) to view his business operation. Basically, it is an engine overhaul setup, although he does sell a few tractors and spare parts. He also has a license for repair workshop but does not operate one at the present time. While Desouk probably has more repair workshops than any other town or city in Egypt, we feel that with the limited amount of funds available we should invest it in other areas. We will, however, keep his application on file.

We had a long and detailed meeting with Mr. Korra. His original plan was really on a grand scale and in our opinion too large. However, agreement was reached in which a scaled down version would be submitted to us for review.

Mr. Hammamy came to the office informing us that he has to get permission from the following ministries before the Bank will approve his loan: Ministry of Health, Ministry of Transport, Ministry of Irrigation and the Ministry of New Building Authority. It would appear that all service centers may encounter the same procedure because most will be located outside the city or town limits.

While we are aware of the problems with the various Banks, this does not account for all the slowness at which the applications are being processed. Other areas are purchasing land and meeting the legal requirements this demands, but mainly the problem is registration of ownership, which is beyond the Banks or our control.

On reviewing the present status of the credit fund at the end of March, 1983, we found that all the money has been tentatively committed, although not yet spent.

Requested for Service Centers (March)	3,232,000 L.E.
Requested for Small Workshops	1,042,000 L.E.
	4,274,560

This represents 14 service centers and 34 small workshops, the question is now, do we stop soliciting new clients as we must assume that all applications approved will be fulfilled or is more money going to be made available for the credit fund.

A.3 SERVICE CENTER/VILLAGE WORKSHOP

A.3.2 Village Workshop Unit

Activity Report
January, 1983

Submitted by: Robert Snyder
Mousa Shafik

General

Most of our work this month was centered around Qalubia, Sharkia, Minia and Beheira. We have noticed that since the Bank officers have been offered an incentive payment for processing loans, there has been a noticeable increase in activity. The Bank officer in Benha is especially active and has brought us four prospective clients to date. With the exception of Sharkia Bank, all seem willing to cooperate. The amendments to the letter of understanding have also helped us considerably.

Loan Activity

On January 19th we finalized our first loan. The client was Ibrahim Ateya of Delingat, Beheira Governorate and the loan amount was approximately L.E. 14,000. The machinery has been delivered and the supplier has received payment. Other loan activity includes nine clients in the various governorates for a total of approximately L.E. 344,000. These files have been delivered to the Banks. Two have Bank approval and are shopping for tools and equipment.

Cooperative in Sharkia

On January 9th we had a meeting with the Coop group in Zagazig. They have decided to develop the shop facility at Kiniyat as a small workshop. If all goes well they will then consider establishing other shops in the Sharkia area. We have prepared a suggested list of equipment and tools, a staffing pattern and performance standards for the shop. It now needs to be translated and presented to the group. The last word on the project was that they would complete the concrete floors, electricity, plumbing and drainage and prepare themselves for the next phase, which would be to recruit help and purchase the aforementioned machinery and tools. We expect the tools and machinery will cost approximately L.E. 50,000.

A.3 SERVICE CENTER/VILLAGE WORKSHOP

A.3.2 Village Workshop Unit

Activity Report
February, 1983

Submitted by: Robert Snyder

General

I started the month off badly by having surgery on February 2nd. Although I did not loose much time from work, my travel was curtailed considerably. My counterpart (Eng. Moussa Shafik) left on February 6th for six weeks training in the United States. Considering weather conditions there at the time of Moussa's arrival, I expect he'll be happy to return to Egypt.

Coop Workshop/Kiniyat, Sharkia

On February 8th, R. Snyder and Eng. Mohamed Wagih Abou Zeed and members of the Sharkia Coop staff attended a meeting in the office of Dr. Salah Abd El Maksoud at his University in Zagazig.

At this time we provided them with some technical documents which will hopefully help the Coop group to open their first workshop in the not too distant future. The document that we provided included the following:

a. List of machinery and tools
b. Shop performance standards
c. Staffing pattern
d. Shop floor plans for machinery, air system, water system, lighting, work areas, offices, etc.

After the meeting we visited the shop site. As mentioned in previous reports the shop structure is not ideal for a workshop. We were encouraged, however, to find that they had completed the drainage system, had placed concrete in the parts room floors and had nearly completed the electrical system. They promised that the balance of the concrete floors would be completed in February. At this point they will need funds to hire workers and purchase and install machinery. We have not broached the subject of funding as we were told several months ago that this would be handled by Dr. Sahrigi's office. Considering the problems we have been having with the PBDAC in Sharkia I'll be surprised if this element goes smoothly.

Personnel

We're certainly not hurting for help. In December we were given three young Agricultural Engineers. We have been utilizing them by sending them out to survey shops (make the initial contacts), doing some of our paperwork and filing, help some of our clients find machinery and to deliver documents to various banks and/or clients. If these engineers are going to stay with us, I would

recommend they have some hands-on-training in machine shops, welding shops and mechanical shops. This could no doubt be done in some of the government workshops around Cairo. In February we received two more men. I'm not quite sure how they are to be utilized, but it will no doubt get sorted out in the near future.

Visits to Workshops and Loan Activity

During the month there were 33 shop surveys made:

a.	Kafr El Sheik	20
b.	Beni Suef	5
c.	Assiut	7
d.	Beheira	1

Of these, we made follow-up visits to all of those in Beheira, Beni Suef and Assiut.

As a result of the follow-up visits we have received loan applications from:

a.	Assiut	4
b.	Beni Suef	3
c.	Beheira	1

Letters have been written to the Executive Committee requesting approval for these applicants. We have scheduled follow-up visits to Kafr El Sheik for March 1st and 2nd.

The Executive Committee has approved and we have sent files to the banks for approval on four previous clients:

a.	Qalubia	2
b.	Gharbia	1
c.	Sharkia	1

Our client, Mr. Shalaby, from Beheira has received at least some, if not all, of his machinery this month. The Beheira Bank has been very cooperative.

Training

We seem to have an on-going problem here. The training section has gone to considerable trouble and expense to put clients, workers into training class, only to have many of them not show when the class begins. On follow-up we have heard such excuses as:

a. It interfered with his school.
b. This is our busy season.
c. He was sick, etc., etc.

We don't know the answer to this one yet, but I would suspect that class scheduling should not coincide with the planting and harvesting seasons might help.

Special Problems

Yes we have a few, and all are not new to us. Just for reminders:

a. We need at least twice the office space that we now have, service center and small shop groups should not be in the same room.
b. As we acquire more personnel, naturally we need more furniture.
c. We should consider whether or not to properly repair or replace our copy machine. We're having an unreasonable amount of breakdown with the current unit.
d. The PBDAC in Sharkia has no budget from their hard-line position as relates to our project. This will very soon effect our Coop-project at Kiniyat.

A.3 SERVICE CENTER/VILLAGE WORKSHOP

A.3.2 Village Workshop Unit

Activity Report
March, 1983

Submitted by: Robert Snyder

General

Eng. Moussa was in the USA most of the month on a Procurement Training Program with the USAID group.

The question has been raised again as to how much we should become involved in governorates other than the five originally proposed in the Project Paper. If we are forced to abandon those we have already begun doing business with that are not in those five governorates, it will considerably reduce our L.E. volume of business.

The end result will be that we will have expended an enormous amount of time and effort for nothing.

Although it appears on paper that all of our funds are committed, we feel that a large amount of these projects, for one reason or another could fall apart. Considering this and the fact that such a small amount of our funds have actually been disbursed, we feel that we should continue as before until such time as we have a more realistic view of the financial situation.

There have been some rather steep price increases in locally produced machinery.

Visits/Field Trips

Eng. Wagih Abou Zeid and R. Snyder attended two meetings with the Sharkia Coop group and Dr. Salah Maksoud to advance development of the Coop workshop at Kiniyat village in Sharkia. We expect to deliver their request for a loan (L.E. 50,000) to the Bank within two weeks.

Other workshop visits were as follows:

Beheira:

Damanhour	2
Kafr El Dawar	2
Delingat	2
Messin	1
Zawiet Gazal	1

Qalubia

Benha	3
Meshtohour	2
Sandanhour	1

Sharkia

Zagazig (PBDAC-Coop)	2
Kiniyat	1
Equa	1

Gharbia

Tanta	3
Zifta	2

Kafr El Shiekh (not in the original government)

Kafr El Shiekh City	3
Sidi Selem	3
El Hamoul	3
Desouk	5
Rhiad	1
Bela	

Fayoum (not in the five original governorates)

Fayoum City	2
Sanarus	1

Loan Activity

A. Funds expenditures for March were as follows:

No. 1:	Mohamed Kohla, Delingat, March 10	L.E.	10,000
No. 2:	Hassan Shalaby, Zawiet Gazal March 15	L.E.	12,000
No. 3:	Mahmoud Mahalawy, Benha March 31	L.E.	44,000
No. 4:	Morsy Bagoury, Benha March 31	L.E.	37,950
Total Expenditures (March, 1983)		L.E.	130,950
Previous Expenditures			27,637
Grand Total as of March 31, 1983		L.E.	131,587

B. Status of New Loans

		Clients	Approx. Loan Amount
a)	Have Bank approval - No funds disbursed to-date	5	L.E. 225,000
b)	Delivered to Banks - but have not yet been approved	4	L.E. 85,000
c)	Ready for delivery - to the Bank (need translation and signature)	14	L.E. 300,000

Problems

Translations

Some of our work is being delayed due to the lack of translation services. Eng. Morad had made this service available for several weeks, but it seems to have fallen apart lately.

Office Space and Office Furniture

Just another reminder that neither is adequate. This makes working conditions in the office deplorable at best.

Office Supplies:

We either have a very poor system or lack a system for procurement of office supplies. If the man hours wasted, waiting for copy machine paper, etc., were added up I am sure it would be considerable.

PBDAC

As of March 31st the PBDAC and our Project had not been coordinated to function together properly.

A.4 RESEARCH AND DEVELOPMENT SUBPROJECT

Activity Report
January, 1983

Submitted by: Carl A. Reaves
Samir Younis

Progress

Devoted a large part of the month toward helping Jack Butler (T.D.V.) get things together and accomplishing modifications on the small self-propelled S.A.A.P. field sprayer. Jack wrote a detailed report on changes made and also other things that need to be done. He also wrote discussions on all of the sprayers on hand at the Tractor Testing Station and the Beheira Co. Sprayer that covered quality of accessories, needed changes, etc. Jack's report is rather complete and copies have been sent to Cairo so no further comments will be made with respect to it in this report. Shop personnel were not present the second day before Jack left, so a few small jobs did not get completed and he did not have an opportunity to operate the machine. He did discuss these unfinished items with me and we will complete them plus calibrate and evaluate the system during February.

Due to higher priority items, work on the spinning disk cotton stalk cutter did not progress. Attended three Executive Committee Meetings. Wrote a request for a three months T.D.Y. for Dr. Goss of California to come to Egypt and work on harvesting equipment. The 60 hp Ford Tractor was delivered by Ragab Co. so I checked it for meeting specifications. Eight variations in specs. were listed and I gave the list to Mr. Naggar. Wrote a summary of R&D activities since November, 1980 for the A.I.D. Project Evaluation Team.

Started writing a detailed report of preliminary tests on the Beit Hashitta grain thresher. Tried from the first of January to locate some potatoes to test the Kuxman root crop digger. Wagdy's team made several trips to Faronia, but due to weather conditions and other factors they were not able to dig any potatoes. The digger was left in Faronia for several weeks for another group to use. Hence, we missed this potatoe harvesting season. Hopefully the digger can be tested in some other root crop such as onions, carrots, or beets.

Made three trips to W. Nubaria to visit the Beheira Co. Reclamation area. An area of land under one of the pivot irrigation systems was selected to conduct some mechanization tests. A proposal was written and it was accepted by the Beheira Co. for the R&D group to perform or supervise all operations from soil tillage through harvest for one crop season. It was agreed that Beheira would supply seed, fertilizer, spray material, water, and two tractors with drivers to prepare the soil and plant the crop. The R&D would supply equipment to be tested and personnel to establish tests plus make decisions on all operations to be performed. Detailed test plans were written and discussed with engineers at the

Tractor Testing Station. General agreement was made but final decisions on crop to be planted, number of tools to be tested, number of replications, etc., were not determined. These decisions will be made and tests will be initiated during the first week of February.

Major Activities for February:

Install tillage tests in W. Nubaria and get ready to plant the crop, plan and install similar tillage tests on clay soil in Sakha to plant cotton, complete, evaluate, and calibrate the S.A.A.P. self-propelled field sprayer.

A.4 RESEARCH AND DEVELOPMENT SUBPROJECT

Activity Report
February, 1983

Submitted by: Carl A. Reaves
Samir Younis

Progress:

Completed several small unfinished items on the S.A.A.P. field sprayer, wrote a detailed calibration procedure, and got Eng. Ahmed Ali Ibrahim to conduct the first phase of calibrations. At this time I was informed that Dr. Ali Youssry Korayem is responsible for testing and evaluating the S.A.A.P. sprayer. With our limited experience it has been determined that stability and maneuverability are acceptable, even with the rear wheels at a minimum spacing. The liquid pressure system, pump and controls, is good and provides adequate flow for spraying and agitation of spray chemicals. Within the normal range of spraying pressures it is capable of maintaining pressure fluctuations within acceptable limits. Preliminary tests showed that discharge from each of the 12 nozzles was well within the acceptable limit of plus or minus 5% variation from the average of the 12 nozzles. The only alteration that has to be made is to provide more leg space between the liquid tank and the operator's seat.

Completed the report of preliminary tests with maize on the Beit Hashitta thresher and submitted it to the Cairo office. Spent one day with the USAID Evaluation Team. Participated in three R&D Executive Committee Meetings. We finalized two projects, one on solar drying equipment and one on determining the minimum amount of soil manipulation required to produce a crop. The third meeting was devoted to reviewing the status of all projects that have been submitted to date. Gave the bill of material for a 3-point hitch dynamometer adapter to the machine shop on February 17th and requested that one adapter be fabricated.

Tests were conducted on the Kuxman potatoe digger in West Nubaria on private farm. Measurements were obtained for four different forward speeds of operation, three different depths of operation, and three replications of each test on one potatoe variety. A preliminary examination of data indicated that a depth of 15 cm. was good so a fourth replication was obtained for this condition. The soil was very sandy and moist enough that digging conditions were excellent and from observations the digger performed very good. Soil measurements included penetration resistance and moisture content. Operating variables measured were forward spped and wheel slip. Data are being summarized for a technical report.

The mechanization tests for peanuts in W. Nubaria were continued. Installation of the tillage tests was completed, most of the data was summarized, and the report is 85% complete. Data for profile measurements are still being summarized. Some seed peanuts were purchased to calibrate the pneumatic planter. A germination

test was made on a subsample of the peanuts. Beheira Co. was given a list of seed, seed treatment material, and fertilizer requirements that should be available for a planting date of March 15th.

Went to the Sakha Ezperiment Station and located some land for mechanization tests with cotton. Arrangements were made to move equipment from W. Nubaria to Sakha and initiate test about the second week in March and to plant cotton near the end of March. R&D will be responsible for all operations from land preparation to harvest. On the return trip from Sakha visited the Japanese Rice Research Project and looked the mechanization equipment over.

Major Activities for March:

Complete reports for the W. Nubaria tillage tests and potatoe digging. Plant peanuts in W. Nubaria, install tillage tests in Sakha and perhaps plant cotton before the end of the month. Initiate plans for mechanization tests in a intermediate soil, probably around Ganaclis. Trouse will begin his one month T.D.Y. on plant root evaluations with Dr. Araby.

Report: PROPOSED MECHANIZATION TESTS IN SAKHA
February 27, 1983

Eng. Naggar and I visited Eng. Abou El Saoud on Wednesday, February 23rd at his office in Sakha to discuss the possibility of conducting some mechanization studies with cotton. Our proposed tillage operations are very similar to the ones we installed on sandy soil in W. Nubaria. In general, Eng. Souad agreed to cooperate with this proposal and he obtained permission from his superior in the Sakha office. The next step is to get approval from the Cairo office and Mr. Naggar has gone to Cairo today for this purpose. Also while in Cairo, Mr. Naggar has agreed to make hotel arrangements in Sakha for our personnel during the ten days or two weeks required to install the tillage test and to rent two 150 hp Fiat tractors for the Soil Amelioration Group in Kafr El Sheikh.

Eng. Souad agreed to make available approximately 30 feddans for our equipment. R&D will be responsible to install the primary tillage tests according to our specifications. The area is not large enough to evaluate all of the secondary tillage equipment, but preliminary trials will be conducted to gain knowledge on the type of soil manipulation required to prepare a seedbed. Details of planting, cultivating, spraying, etc., still have to be coordinated with Eng. Souad. It is hoped that R&D equipment and personnel can be used for all operations to produce the cotton crop.

The R&D proposal is as follows:

1. Location - on the Sakha Experiment Station. (Karada)
2. Area - on Eng. Abou El Souad's farm.
3. Crop to be grown - cotton on alternate 40 and 80 cm. row spacing.
4. Equipment, materials, and labor to be furnished by R&D:
   (a) All required personnel except for irrigation, required hand weeding if any, and for picking cotton.

(b) All required machinery except tractors for cultivating and spraying.

5. Equipment, materials, and labor to be furnished by the Experiment Station.
   (a) Seed, chemical fertilizer, spray material and water.
   (b) Tractors and drivers for cultivating, spraying, and possibly applying fertilizer after planting.
   (c) People to pick the cotton.
6. Four different types of primary tillage equipment will be tested (moldboard plow, disk plow, chisel plow, and the justice chisel-sweeps).
7. Required secondary equipment to develop an adequate seedbed will be selected and these operations will be uniform over the entire test area.

EXPERIMENTAL DESIGN

1. Primary treatments - 4 tillage implements.
2. Secondary treatments - 3 depths of operations.
3. Three replications will be made of each test.

Hence there will be 4 x 3 x 3 = 36 test plots. A split block design will be used and each block will consist of one replication. Location of tests within a block will be randomly selected. Each test plot will be 10 meters wide and approximately 140 meters long. This will leave adequate area for adjusting implement orientation and depth of operation.

Soil measurement will consist of bulk density, moisture content, resistance to penetration with a drop type cone penetrometer, profiles of the surface before tillage plus after tillage, and a profile at the depth of tillage by removing disturbed soil.

Operation variables to be measured consist of draft, forward speed, and slip. All of the implements are mounted by a 3-point hitch and we do not have an appropriate dynamometer, hence we will use a drawbar dynamometer between two tractors. Due to the inconvenience and time involved forces will not be measured during plot tillage and the area at the edges and end of rows will be used for this.

SCHEDULE OF EVENTS

Feb. 23 - Visit Sakha with Eng. Naggar to make a general cooperative agreement end to select an area for tests.

Feb. 27 - Eng. Naggar travels to Cairo to obtain final agreement on tests plus land area for test, to make arrangement for hotel requirements, and to get final approval for renting two 150 hp Fiat tractors from the Soil Amelioration Group in Kafr El Sheikh.

Feb. 28 - Dr. Samir Younis will make arrangements with Beheira Co. to move equipment from Alexandria and W. Nubaria to Sakha on March 2nd or 3rd.

Mar. 2 -
Mar. 3 - Engineers from the Tractors Testing Station will go to Sakha to layout test plots, take moisture and bulk density soil samples, and soil resistance to penetration readings. It will be necessary for them to obtain the use of a machine to unload the test equipment from the Beheira truck.

Mar. 5 - Personnel will move to Sakha and install the primary tillage tests. Assuming that the hydraulics and hitches of the rented tractors are compatible with our implements tests can possibly be completed in one week.

Mar. 5 - Secondary tillage will be performed as soon as the tilled soil dries to the appropriate moisture content.

Mar. 15 -
Mar. 20 - Starter fertilizer will be applied as the cotton is planted.

A.4 RESEARCH AND DEVELOPMENT SUBPROJECT

Activity Report
March, 1983

Submitted by: Carl A. Reaves
Samir M. Younis

Progress:

Completed the rough draft for W. Nubaria tillage tests, except for discussion of the profile data which was not completely summarized. The W. Nubaria potatoe digging report was started and approximately 50% completed. Minor alterations were made on the S.A.A.P. sprayer and one set of nozzles was calibrated. Spent considerable time on revising Dr. Araby's report on the effect of subsoiling clay soils. Discussed with Dr. Araby the final tests on compaction under tractor tires in the Damanhour area.

The pneumatic planter was adjusted for 80 cm. rows, calibrated for peanuts, and used to plant peanuts on the W. Nubaria tillage test plots. It performed quite satisfactorily in this sandy soil and there were no material failures. Said peanuts were treated with Akadine and Vitavaks and it appears that germination will be good if irrigation is adequate.

Participated in four Executive Committee Meetings. Made two trips to Sakha to make arrangements for the tillage tests with cotton. It took more than one week to receive one of two tractors that were rented from the Soil Improvement Project; the second tractor arrived after the tillage treatments were almost complete. Started taking soil samples and measuring penetration resistances on March 23rd and started installing tillage tests on the 26th. Soil moisture content was higher than desirable, but we could not wait any longer because of the recommended planting dates for cotton. There were areas of poor drainage in the field which made it difficult to install the tests but they were completed almost according to plans. Due to high moisture content the soil failed in large lumps which required more draft, secondary tillage, and levelling than normal. Since only one tractor was available during installment of the tillage treatments, draft measurements had to be made in soil adjacent to the test plots.

Trouse arrived in Egypt and started the investigation of plant root environment with Dr. Araby.

Major Activities for April:

Complete secondary tillage, levelling, and planting the cotton plots in Sakha. Keep close watch on weeding, spraying, irrigation, and cultivation of the peanuts in W. Nubaria. Start plans for installing tillage tests in the Ganaclis area, hopefully on an intermediate clay soil. Complete writing reports for the peanut project and the potatoe digging project.

A.5 LAND IMPROVEMENT SUBPROJECT

Activity Report
January, February, March, 1983

Submitted by: Erroll D. Coles

Summary of Activities

Gabal Asfar Training Activities

The main achievements of this period was the procurement of the four tractors and three scrapers (plus laser control equipment) and the start of the initial training of operators at Gabal Asfar at the beginning of January. The fitting of the laser equipment was carried out by the technicians of the Egyptian Electronic and Computer Co. Their technicians assisted with the training of the operators and the counterparts. The drawbar tongues on the Beheira 3 meter scrapers had to be modified to correct the verticality of the laser receiver mounting platforms. The subproject counterparts commenced the topographic survey of two large fields in Gabal Asfar using the grid techniques and the laser actuated automatic leveling rods. Some 50 feddans was surveyed. The earthworks were calculated on the project Hewlett Packard 85 computer, using a program compiled by Mr. James McClung.

Abuha (EWUP) Leveling Activity

The Training Unit moved to Abuha, the Egyptian Water Use and Management Project, project area in El Minia Governorate, in mid-March the tractors and scrapers were transported by low-loaders to Minia. Although the tractors arrived safely, the scrapers were damaged in offloading, neither a crane or ramp was available for this purpose. Land leveling commenced satisfactorily up to the end of April. The subproject is grateful for the assistance of the EWUP personnel at Abuha and Dr. Erwin Nielson.

Tractor Specifications

The specifications for next tractor and implement procurement was completed in January, that is for the remaining grant funds allocated to the subproject. These specifications were drawn up with the specific object of limiting the number of makes that may eventually be supplied. The proliferation of makes will only complicate the spare parts inventory and maintenance operations.

USAID Evaluation Team

The USAID evaluation team discussed the progress of the subproject and visited Gabal Asfar, Beni Suef and Fayoum. They appeared to be dissatisfied with the progress of the implementation of the land improvement activities.

Topographic Survey of Demonstration Basins, Minia

The three basins selected for leveling in Minia where surveyed in early January, totalling some 200 feddans. The earthworks were computed, using the HP 85 computer. The rehabilitation planning was completed by Eng. Ahmad El Fayoumi. The whole plan was presented to the farmers in the respective basins by the two persons responsible for extension in the field, Eng's Ahmad El Fayoumi and Hassan El Banna, using slides and flip sheets. The response from the farmers has been very good.

Infrastructural Support and Equipment

A careful review of the subproject situation indicates that the planned field program could not be implemented without considerable infrastructural support and the procurement of personnel, transport, service trucks and maintenance equipment. About 80 or 90 persons will have to be recruited and trained for the operation of the 40 tractors that will be delivered in the near future. Furthermore, an effective management component will have to be created and trained before the arrival of this equipment. The details of the additional equipment, specifications and costs are being drawn up and submitted shortly.

Management Training Course

The Central Authority for Management Training drew up a comprehensive management training program for the subproject personnel and other project personnel, for the April or May period, however, this has been put forward to the autumn.

Research Activities

Field research areas in Minia, Beni Suef and Fayoum were reviewed by Dr. Ahmad El Araby. A short report was drawn up indicating the observations required for gathering data on salinity changes, groundwater fluctuations and analytical procedures for determining the effect on crop yields.

State Seed Multiplications Farm

The state seed multiplication farm in Sakha was visited by Dr. A. El Araby and E.D. Coles and a short report prepared advising a complete reassessment of the tillage methods used, equipment inventory and investigation of the drainage system.

Future Activities

Minia; Land Leveling Activities

The land leveling in Abuha will continue up until the crops, mainly wheat and beans, have been harvested in the demonstration basins, this should be between April 30 and mid-May. Field work will continue until funds run out.

Extension Activities

It is becoming more apparent as leveling proceeds in Abuha basins that clearly defined follow-up will be needed to provide the farmers with proper advice on long furrow irrigation and land preparation following the leveling of the land. This applied to subsequent cropping seasons too. To achieve this kind of follow-up a comprehensive training program in this subject will have to be given to the extension personnel responsible at the farmer level. However, orientation training sessions should be given to other persons concerned with extension. The present status of the Land Improvement Training manual, resulting from work done by Eng's A. El Fayoumi and H. El Banna, during 1982, is the basic material in the form of lectures has been obtained from various sources but it has to be sorted out and edited to suit specific conditions for extension training, visual aid material will have to be prepared (slides, flip sheets and O/H project foils etc.), then translated into Arabic. This work is in progress and the aim is to have the greater part available for presentation in July, ready for the extension training course in Sakha. However, discussion with the Extension and Training Subprojects should take place to finalize their requirements.

Training Activities

The recruitment of operators, mechanics and supervisor from the Minia area has been completed but training of these proceed until funding is available. Further personnel will be recruited from Beni Suef and Fayoum.

Procurement of Additional Equipment

In order to implement the proposed land improvement program personnel transport, service transport and maintenance equipment will be required to operate the tractors and implements in the field. It is perfectly clear that this operation cannot proceed with the present complement of two vehicles, as provided for with dollar funding in the Project Paper. Besides, the two vehicles used now are unsuitable for the transport of fuel and service materials. Furthermore, routine maintenance and servicing of the 40 tractors will require procurement of fuel and lubricants, greasing and oiling equipment, small tools and welding equipment. Besides, some kind of secure storage will be needed. At present there is no provision for these requirements.

This situation is being studied and detailed assessment will be submitted.

Transport

Transport remains the single most problem area of the subproject. One vehicle is permanately located in Minia. Another vehicle is allocated to the Team Leader and is not available to any other member of the subproject and a third vehicle has broken down and is unlikely to be satisfactorily repaired for a long while.

This situation is inhibiting the implementation of subproject activities particularly the progress of topographic surveys in other basins required for levelling in the coming autumn and the assessment of conditions in Beni Suef and Fayoum. Furthermore, the situation has arisen where the Land Improvement Advisor, who is without transport, is not able to fulfill the field supervisory activities.

Outstanding Equipment Requirements

Repeated requests over more than six months for a suitable chisel plough used on a 45 kw tractor and a two-wheeled 1500 lt. fuel bowser has failed to procure these two items. The lack of these two items does make the field work more costly.

A Short Report, On a Visit To:

State Seed Multiplication Farms at Sakha and Mahalit Moosa, Kafr El Sheikh Governorate

General Authority for Agricultural Productions

Dr. Ahmed El Araby
Mr. E. D. Coles

Land Improvement Subproject
Egyptian Agricultural Mechanization Project

Multiplication

Locality:

Two farm visited, one of 5000 feddans at Sakha, and the other of 6000 feddans at Mehalet Moosa, all in the governorate of Kafr El Sheikh.

Farming System:

These farms are used for propagating seed for distribution to farms throughout Egypt.

A three year crop rotation is followed, 30 percent of the area is planted to rice, to cotton and the remaining 60 percent to flax, beans, maize, wheat and barley.

It appears that cotton follows rice after berseem in the same fields and this order does not apply to other crops.

Drainage System:

A tile drainage system had been installed 3 or 4 years ago and the pipes are concrete 1 to 1½ m. long and 0.2 m. in diameter, have been laid butt to butt without any envelope material. The trenches were excavated by machine and the pipes laid by hand. The depth is 1.25 m. at the head and 1.50 m. at the collector junction. The spacing is 40 m. and the field laterals are 100 m. to 120 m. long. The collectors then flow into the open main drains.

Irrigation System:

The surface irrigation is used on both farms and basin system is used for applying water.

Farming Operations:

The tillage of the rice fields prior to planting cotton in March consists of ploughing with a mouldboard plough to facilitate drying out of the soils followed by discing.

Chisel ploughing followed by discing seems to be the customary practice for all other crops.

Although the mouldboard ploughing is claimed to have been an effective method of drying the soils when open drains are used, since the tiles drains were installed the soils have remained wet up until late February. Drying-out is slowed up by late rains in February.

In order to facilitate drying-out the ploughed soils are being "flattened" by means of drag scrapers and chisel ploughs but with little success. This operation appears to be a costly procedure.

The mouldboard ploughs are in poor state of repair, with broken mouldboards, broken shears and coulters. Furthermore, the three

furrow ploughs are incorrectly set so that the rear outer furrow is set too deep and front furrow too shallow resulting in uneven cuts. Obviously, the plough has been set for "speedy" work resulting in poor ploughing which will not provide effective drying-out of the soil.

Excessive tire wear was observed which is indicative of high speed operation too. The method of ploughing the fields could be improved too, running back and forth throwing the furrow slice in opposite directions creates at an uneven land surface. A reversible plough would alleviate this problem or changing in ploughing technique.

Assessment of Problem Areas:

There appears to be four main problem areas.

a. A drainage related problem; that includes the slow drying out of the soil, development of alkalinity and the possible modificaton of the clay fraction following rice cultivation.

b. Drainage problems include, spacing that may be too wide, blocking of pipes with clay or sediment of some kind and inability to clear field laterals of sediment.

c. Cultural practices including, present tillage methods or ploughing that are too shallow, using the incorrect kind of equipment and wrong method of setting implements, wrong tilling techniques and rotational factors concerned with cotton following rice.

d. Operational training including, tractor operator training, management training, at various levels to include personnel familiarization with new methods and equipment.

These factors outline the most pressing problems observed during a brief visit to the farms. Further investigations will be required to ascertain the exact nature of the problems, some short term recommendations will be presented but most problems will require some long-term investigations.

The Drainage Related Problems:

Saturated Rice Paddy Soils

Prevailing climatic conditions may preclude rapid drying out of the soils of the rice paddies. The formation of a "puddled" layer and the possible modification of the clay fraction after a long period of anaerobic submergance may inhibit the drainage of the soils.

The formation of a puddled layer can be observed in the field by examining the soil profiles and by comparing the nature of the clay fractions "normal" and rice paddy soils by means of X-ray specraphic analysis. Though it would be more important to try out alternative methods of tilling these soils to facilitate drying, some basic information regarding the behavior of the soils, special-

ly of the clay fraction, would be helpful in understanding future ameliorative practices.

The climatic conditions during this period must be taken into consideration too. Besides the rainfull that occurs between November and February or even later into March, this is also a period of low evaporative rates and low temperatures. Consequently, moisture losses from the soil surface would be very slow. It appears that the downward movement of water (gravitational low) measured in terms of the hydraulic conductivity, is very low while the flow in the capillary and vapour range may be greater. Hence, disturbing the soil surface would inhibit the free flow of moisture across the soil/atmosphere interface. The use of a mouldboard plough or even a chisel plough would aggrevate the dryout process in this case but the use of a deep tillage tool going down to 0.90 m. or more may be suitable, particularly if it "lifts" the soil over a wide area. Such soil disturbance would penetrate below the "puddle" layer and exposing a large surface area to the drying-out process.

Improvement of the Soil Systems

Two possible methods may be of practical use to excellerate the drying out of the soil.

a. Deep tillage; using a new type of implement a Peja sub-soiler. This implement penetrates to 0.90 m. and the road foot-pieces lifts the soil up to 0.5 m. on either side of the "cut". The implement would break up any "puddle" layer as well as "opening" up the soil for better aeriation.

   The use of this implement in the field will be combined with the measurement of drain efficiency to determine its effect on drainage.

b. Mole drains drawn with a proper mole-plough, drawn at right angles to the existing tile drains could achieve the dual purpose of rapidly draining the soils after the rice is harvested.

   However, this method should be tested before extensive installation of any additional drains whethers, open or closed - is considered.

   Furthermore, a careful study of the costs should be considered as well.

The Salinity and Alkalinity Problems:

It appears that both salinity and alkalinity is progressing steadily on these farms but the extent of this development is not known. However, the extent of the areas can only be obtained by carrying out a soil survey and taking samples or by using an inexpensive infra-red colour photography technique.

Infra-red colour photography offers an inexpensive method of monitoring saline/alkaline areas. The equipment needed is an ordinary 35 mm camera, preferably with automatic apature control. The film used is Kodak Ektachrome infrared colour which may be diffi-

cult to obtain locally. Special developing process is needed though the processing simply provides the chemicals are available. The film has to be stored in a refrigerator. Simple Wratten filters are required too. The photography can be taken from a light airplane or helicopter. The cost of which is reasonably inexpensive.

The technique of using this type of film is quite simple. Once the area has been "flown", the film developed and mounted in slide holders, the image is projected into a map of the field and the colour gradients marked onto the map, these deviant coloured areas are then investigated in the field. The deviant colours indicate salinity/alkalinity or wet areas with high watertable conditions. The colour ranges depend on the kind of filters used.

This technique has been used before with great success in areas planted to various crops, it is inexpensive compared to the usual soil survey and sample procedure and takes very much less time.

Various materials and chemicals can be used for ameliorating the soil affected but the kind and quantity will depend on the analysis of the soil taken from the affected areas.

Drainage Problems:

From the information gathered it appears that the drainage system is not functioning efficiently, however, the degree of efficiency, or effectiveness, has to be measured before giving specific recommendations to change the system.

Before constructing additional drains some field investigations should be carried out. A very superficial field examination indicated that the drain spacing may be too far apart for the kind of soils occurring in this area, however, this view has to be substantiated by more detail field investigation.

1. The examination of a number of soil profiles in the fields planted to rice and in other fields planted to other crops, for comparison.
2. Taking of soil samples from fields before rice is grown and after the rice is harvested. These clay fraction of these samples should be analyzed to determine the kind and proportion of each clay mineral using x-ray spectography. The samples can be analyzed for the usual chemical constituents and the soil reaction.
3. In the same selected fields a series of test wells should be located to measure the water table level changes following the harvesting of rice. The measuring frequency can be decided after observing the magnitude of the change in water levels in the wells. These data will give some idea of the efficiency of the drains. Piesometers may be used to measure the watertable configuration between the field drains.

4. The drain out-falls from the collectors, into which the field drains flow, will be measured to ascertain the drain flow regime, some attempt will be taken to measure irrigation water application too.

A simple groundwater fluctuation simulation model can be constructed from these data. This model will give some idea whether additional drains at the interspace will be required or whether some other less costly improvements can be recommended.

In addition to this, data will be collected before and after deep tilling the fields, to indicate the improvements that this activity may provide.

Cultural Practices:

Tillage Practices

From the cursory examination of the tillage practices being used during the course of the visit, neither the implements, methods or techniques are suitable to the soil or the soil conditions.

The one-way mouldboard ploughs, even if correctly set and adjusted, would not provide adequate drying out of the wet, heavy clays. They would also tend to form a "plough sole" under these conditions. If, for preference, a mouldboard plough has to be used, a reversible threefurrow mouldboard should be used. However, a reversible disc plough could deal with the rice trash and turn the soil satisfactorily, besides it is less likely to form plough sole.

Other types of implements will be tried out to determine their suitability for tilling these soils, notably a heavy-duty chisel plough and a disc harrow specifically designed for plowing heavy wet soils.

Cropping Practices

The crop rotations followed are those usually used elsewhere in that locality but the management of such rotations seems very rigid in following them. If difficulty is experienced in tilling those fields previously planted to rice, being to wet, then a change should have been made to other fields that may not have been too wet. So flexibility is required in making decisions of this kind, after all it is only a simple change of fields and this would not affect subsequent field rotations.

Improvement of Mechanization

An inventory of existing equipment on the farms should be compiled and the requirements for a comprehensive mechanization program should be drawn up to deal with the extensive cropping program.

An E.E.C. team hour submitted a report for the mechanization of the farms. A copy of the equipment schedule is attached.

Such a mechanization program would also include the costs of purchasing the equipment, maintenance equipment, materials and facilities and operating procedures.

Training Program

There would be little point in preparing an elaborate mechanization program, improving drainage and implementing these without a comprehensive training program in various fields of activity, notably:

a. Tractor operator training.

b. Maintenance and repair management training

c. Mechanization management training

d. Field and estate management training.

The creation of such programs would follow after careful study of the condition and the person involved.

Item No.	Specification of Equipment	No need	No. present	Condition	to complete	Unit Price LE X 1000
1	Bulldozer with C. frame and angling blade, power shift, 6 cyl water cooled diesel engine (120-130 Hp.)	2	2	50%	2	90
2	Crawler tractors for agricultural application with 3-point lift, and front counterbalancing weights manual shift, 8 speed, 6 cyl diesel engine, water cooled (120-130 Hp)	10	x	0%	10	70
3	Wheel tractors, 4-wheel drive, only equal sized front and rear tires, 3-point lift cat. II 2-dual remote cylinder control R.O.P. canopy with sunroof, 6 cylinder diesel engine (130-140 Hp.)	28	15	25%	25	35
4	Wheeltractors, 2-wheel drive, short turning front axle, 3-point lift cat. II, 2-dual remote cylinder controls, R.O.P. canopy with sunroof, 4 cylinder diesel engine (70-80 Hp.)	10	10	25%	5	16
5	Wheel tractors 4-wheel drive 3-point lift cat. II, 2-dual remote cylinder control. R.O.P. canopy with sunroof, 3 or 4 cylinder diesel engine (55-65 Hp.)	4	0	--	4	16
6	Wheel tractors, high-crop, 3 or 4 wheels, 2 wheel drive, 2-dual remote cylinder controls, R.O.P. canopy and sunroof, 4 cylinder diesel engine (70-80 Hp.)	6	6	0%	6	20
7	Toolbars, heavy duty for crawler tractors, with 3-subsoiler shanks for 80 cm. penetration and 9 chisel shanks	2	x	0%	2	10
8	5-bottom mouldboard plows 37 to 42 cm. per bottom, heavy-clay mouldboards Dutch type, max. depth 27 cm., sharetip coulters, 3-point attachment for use behind crawler tractor	10	0	--	10	4,6
9	3-bottommouldboard plow 37 to 42 cm. per bottom, heavy-clay mouldboards Dutch type, max. depth 27 cm. sharetip coulters, 3-point attachment for use behind 75 hp. wheel-tractor	2	6	10%	2	3,1

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Item No.	Specification of Equipment	No need	No. present	Condition	to complete	Unit Price LE X 1000
10	Chisel plow, 4 m. width, 16 shanks preferably heavy duty vibrating for max. 30 cm. penetration, Scandinavian type open frame with 3 crossbars.	8	6 (3 cm.)	10%	8	4
11	Chisel plow, 2,25 m. width, 9 shanks preferably heavy duty vibrating for max. 30 cm. penetration Scandinavian type open frame with 3 crossbars.	2	6	35%	0	0
12	Disc harrow 4 m. width, tandem type, 2 wheels and hydraulic lift cylinder, 36 discs, 55 cm. front notches, rear plain, pull type for use behind 135 Hp wheel tractors.	6	0	--	6	5
13	Disc harrow, 3-point cat. II mounted tandem type, adjustable gangs 24 discs, 45 cm., working width 225 cm. front gangs notched rear gangs plain	2	2	50%	1	2
14	Land leveler, pull type width 4,2 m. length 9 m. with shiveling tail and rear axle, with vibrating breaker tines behind leveling blade, rubber tired, hydraulically activated.	6	0	--	6	10
15	Ditcher, plow type on wheeled undercarriage, may be pull type or 3-point mounted, to be used behind 125 to 135 hp tractors	4	2	50%	3	4
16	Rotary ditcher, max. depth 75 cm. P.T.O. drive 1000 rpm, with shearbolt protection, 3-point mounted, category II	2	1	70%	1	5
17	Sprayers, 3-point mounted cat. II 600 L tank, 10 m. wide boom piston type pump, 25 bar 100 L/min. Pendular boom mounting and hydraulic height regulation extra: special 10 m. boom for cotton with vertical hanging spraypipes for underleaf spraying	6	4	20%	6	4
18	Fertilizer broadcasters, 800 L hopper, pendulum or centrifugal system, 3-point cat. II mounted	6	0	--	6	1

Item No.	Specification of Equipment	No need	No. present	Condition	to complete	Unit Price LE X 1000
19	Combine harvesters, 4,5 m. cutting table for rice, wheat and soybeans, with pick-up reel, 5 straw walkers. Additional:	8	7	10%	8	50
	- dual rubber tired sheels (set of 2)	4	0		4	2
	- half-trac, interchangeable by wheels (set)	4	0		4	8
	- rice concave and drums	8	8	50%	4	3
20	High density roundbaler	4	0	--	4	10
	Low density balers	0	0		0	0
21	Mower-binder, self-propelled 1,5 m. cutterbar, 15 hp diesel engine, rear steering wheel(s) and seat or walk behind. To be adapted for long beans (removable binder)	6	0	--	6	5
22	Corn pickers 2 row, pull type	4	0	--	4	12,5
23	Rotary slashers, dual rotary knives and fixed counterknives, working width approx. 2 m., 2 rear caster wheels 3-point cat. II mounted P.T.O. with shear bottom protection	8	3	0	6	3,5
24	Manure trailer-spreader 3 tons, 4 wheels, two by two mounted on walking beams P.T.O. drive 540 rpm	6	0	--	6	5
25	Canal/ditch cleaner with tractor mounted side-boom	4	6	50%	1	11
	- 1,5 m. mud bucket		0			
	- 2 m mowing bucket		0			
26	Hydraulic excavator with 8 m. boom, tracklaying type 2 m. wide ditch/canal cleaning bucket and 1 m. wide digging bucket	2	3	50%	1	60
27	Cable excavator with 10 m. boom, on tracks, 1,5 m^3 bucket	2	1	poor	1	60
28	5 tons trailers, pivot steer 4 wheels, detachable sides (7 m^3)	24	6	ok	18	3

A-105

Item No.	Specification of Equipment	No need	No. present	Condition	to complete	Unit Price LE X 1000
29	High pressure P.T.O. driven cleaning pump, to be mounted in 3-point cat. II lift with 15 m. hose and gun pressure 40-50 bar.	6	0	--	6	1,5
30	Mobile irrigation pumps, 20 hp diesel engine, 25 cm. suction hose 6 m. length outlet hose 10 m., to be mounted on 2 wheel rubber tired undercarriage, to be transported behind 4 x 4 pick-up commercial car or tractor fuel tank for 30 hours fail safe protection automatic oil level adjustment pump.	17	17	50%	9	7,8
31	10 Ton truk chassis, long wheelbase for 6 m. platform diesel engine (LE 5000 for home-made platform)	6	(8 ton) 4	3/ok 3/50%	4	25
32	Low bed trailers, to be towed behind 8 ton truck and wheeltractor, pivot steer capacity 15 tons	2	0	--	2	12,5
3	Trucks 3 ton, 4 x 4 wheel drive, diesel engine 2000 L diesel fuel tank with pump hose and pistol for tractor filling - oil delivery system with reels and hoses - grease equipment with reels and hoses	2	0	--	2	25

A-106

ANNEX B

CASE STUDIES

1. ITALIAN WHEAT HARVESTER IN MINIA GOVERNORATE.

2. FARMER'S PERCEPTIONS OF SOIL AND WATER CONDITIONS IN MINIA GOVERNORATE.

THE REACTIONS OF FARMERS IN MIDDLE EGYPT TO A SMALL ITALIAN WHEAT HARVESTER

Dr. Bahgat Abdel Maksoud

ABSTRACT

In 1979, a small Italian wheat harvester was introduced to farmers in the two Middle Egypt governorates of Minia and Assiout. This paper will examine the success of the harvester among the farmers who used it. In all, thirty farmers were interviewed. The results of this study show that the machine has not been accepted by the users. Farmers found that the losses resulting from the machine's use exceeded the savings in time, effort, and costs. The machine was not compatible with the present methods of cultivation or with the typically small holdings.

" ملخـــــــــــــص "

- أدخلت حصادة قمح أيطاليه فى سنة ١٩٧٩
- أستخدمت بواسطة المزارعين فى محافظتين من محافظات مصر الوسطى وهما المنيـــا وأسيـــــــوط .
- وقد هدفت هذه الدراسة الى أختبار مدى نجاح أستخدام هذه الحصادات وذلك مـــن خلال المقابلة التى أجريت مع الثلاثون مزارعا مستخدمى هذه الحصـــــادات .
- وقد أظهرت نتائج هذه المقابلة أن هذه الآلة لم تحظى بالقبول من مستخدميهـــا حيث وجد المزارعون أن كمية الفاقد الناتج عن أستخدام هذه الآله أكبر من معدل توفيرها للوقت والجهد والتكلفـــــــه .
- لقد أتضح أن الآلة غير متلائمه مع الوسائل الحالية المستخدمة فى الزراعـــــة المصرية وأنماطـ الحيازات الصغيرة السائدة فيهـــــــا .

INTRODUCTION AND OBJECTIVES

In 1979, a small Italian wheat harvester was introduced to farmers in some areas of the country. Among these were nine districts in Minia Governorate and Assiout District in Assiout Governorate. The harvester was purchased by agricultural cooperatives and introduced as a way of dealing with the labor shortage and the high wages charged by agricultural workers, particularly at the time of harvesting wheat. At the time of purchase, it was believed that the machine would be especially beneficial to farmers since it requires three hours to harvest a feddan of wheat at an average cost of ten pounds, half the cost of human labor.

This study will examine the following points in order to determine the success or failure of the machine:

(1) the perceived benefits to farmers

(2) the perceived handicaps

(3) the continuity and discontinuity of use.

METHODOLOGY

This study is based on data collected from the records of agricultural cooperatives in ten districts in Minia and Assiout Governorates. It also presents the results of an empirical inquiry conducted in Matai and Abu Qurqas Districts in Minia and Assiout District in Assiout. In all, twenty-five farmers in Minia and five in Assiout were interviewed. The interviews in Minia were conducted

by monitors in the Village Studies Program of the Agricultural Mechanization Project. The five farmers in Assiout Governorate were interviewed by the author.

RESULTS

Over the past four years, seventy farmers have used the harvester on 371 feddans in the two governorates. The use of the machine is given in Table 1. These data indicate a general falling off in use during the period between 1979 and 1982. Furthermore, most of the farmers used the machine only once. The harvester was tried also as a cotton plan cutter, a weed cutter, and a bean plant cutter.

In order to understand more fully the reactions of the farmers themselves, thirty were interviewed. Their personal attributes are given in Table 2. As a group, the farmers are likely better educated than the general farming population. None is illiterate. Six hold university degrees, thirteen have secondary school diplomas, and an additional seven completed preparatory school. When compared, for example, with the 1000 farmers interviewed for the Project's mechanization survey, they are far better educated. In that survey, two-thirds of the farmers interviewed could not read or write (Hopkins, Mehanna, and Abdel Maksoud 1982). Since the thirty farmers interviewed for this study are far better educated one might expect them to be better critics and be more willing to use and accept agricultural innovations.

Another factor which distinguishes these thirty farmers

Table 1 NUMBER OF FARMERS USING THE WHEAT HARVESTER AND THE AREA WORKED IN MINIA AND ASSIOUT GOVERNORATES BETWEEN 1979 AND 1982

Gov.	District	Year								Total	
		1979		1980		1981		1982			
		Number	Area	Number	Area	Number	Area	Number	Area	Number	Area
Minia	El Edwa	3	29.6			5	28.5			8	58.1
	Maghagha					2	14.5			2	14.5
	Beni Mazar			5	59.5	3	10.7	3	19.5	11	59.5
	Matai			5	28.8	2	36.3	1	1.5	8	66.6
	Samalout	2	7.0			n.a.	25.0			6**	32.0
	Minia					1	5.5			1	5.5
	Abu Qurqas	2 demonstration				13	28.0	4	17.0	18*	45.0
	Mallawi									1**	5.0
	Deir Mawas									9**	46.9
Assiout	Assiout	7	38.0							7	38.0
Total		14	74.6	10	88.3	26	148.5			71	371.1

*One farmer used the machine twice
**Estimated figures
n.a.=not available

Table 2 PERSONAL ATTRIBUTES OF FARMERS SAMPLED

Attributes		Number	Percent
Total sample size		30	100
Age:	less than 30 years	2	7
	30 -	6	20
	40 -	11	37
	50 years or more	11	37
Education:	read and write	4	13
	preparatory school	7	23
	secondary school	13	43
	university degree	6	20
Marital status:	single	6	20
		24	80
Family size:	fewer than 5 members	8	27
	5 - 8	11	37
	9 or more members	11	37
Farm size:	fewer than 5 feddans	1	3
	5 -	7	23
	10 -	6	20
	20 or more feddans	16	53

from the general population is their farm size. They have relatively large holdings. The average area cultivated by the farmers is 25 feddans, vastly greater than the country's in which eighty percent of the farmers work less than three feddans. In the three districts alone, the average holding is 1.6 feddans. Again, one expects large holders to be more in need of machinery and likely more willing to accept newly introduced models.

The farmers interviewed usually harvest wheat with hired labor. Their reasons for using the machine initially were the unavailability and high wages of agricultural workers. Ninety-three percent cited these as reasons. Sixty percent mentioned the speed of the machine. Other reasons and more general information about the use of the machine are to be found in Table 3.

According to farmers, the cost of using the machine varied from 6 to 15 L.E. per feddan, although 73% said it was 10 L.E. The number of hours needed to harvest one feddan of wheat was said to range from two to three and a half, although 80% said it was between two and a half and three.

Great losses in grains and straw was the cited as the most important disadvantage by users. Every farmer interviewed said that the use of the machine increased losses. Seventy-three percent of the farmers interviewed said that the losses in grains and straw caused by the machine exceeded the savings in time, effort, and costs. That the machine requires a flat land surface to work well was also cited as a disadvantage of the harvester. Others include the generally small farm size of the Egyptian

Table 3 SUMMARY OF THE RESULTS OF HARVESTER USE

Item	Number	Percent
Total sample size	30	100
Usual wheat harvesting method:		
wheat harvesting machine		
hired labor only	30	100
family labor only		
hired and family labor		
Year harvester first used:		
1979	5	17
1980	7	23
1981	14	47
1982	4	13
Reasons for first using harvester:		
lack of hired labor and high wages demanded	28	93
saving time	18	60
saving money	7	23
large area grown	3	10
to try it	1	3
Number of times the machine was used:		
only once	29	97
twice	1	3
Reasons for not continuing to use it:		
great losses in production	20	67
lack of expertise in use	9	30
not appropriate for wheat varieties grown	1	3

Table 3 (continued)

Item	Number	Percent
Advantages of harvester:		
saves time and effort	25	83
allows for better turn-around time	22	73
saves money	23	77
saves labor	2	7
Disadvantages of using harvester:		
leaves some straw in ground	30	100
leaves some wheat when turning	16	53
not appropriate (land level)	19	63
inconsistent with small areas	9	30
no technical expertise	2	7
frequent breakdowns	1	3
inappropriate for wheat varieties grown	1	3
Cost of using machine:		
6 - 8 L.E.	2	7
10 L.E.	22	73
11 - 15 L.E.	6	20
Number of hours needed to harvest one feddan:		
2 hours	1	3
2½ - 3 hours	24	80
3 hours	5	17
Balance between losses in grain a straw and savings in time, effort, and money:		
losses in production greater	22	73
losses equal to savings	8	27

Table 3 (continued)

Item	Number	Percent
Those who think that the use of the harvester:		
saves time and effort	28	93
saves money	24	80
increases production	4	13
improves quality of production	0	
increases losses	30	100

farmers, the lack of technical expertise in operating and maintaining the harvestor, and the difficulty using it with the varieties of wheat grown in Egypt.

CONCLUSIONS

The falling off in the number of farmers who used the wheat harvester during the period between 1979 and 1982 suggests a disenchantment with the machine. All but one of the farmers interviewed used the machine only once. Admittedly, they are not typical of the Egyptian farmer. They are better educated and have large holdings. However, for these reasons, one might have expected them to be more inclined to accept the machine.

Farmers chose initially to use the machine for the following reasons: lack of agricultural workers, the high wages they charge, the time, effort, and cost that can be saved, and the large areas of land covered with wheat that demand immediate attention. Still, farmers chose not to continue its use because they felt that the losses in grain and straw that they suffered were not offset by the savings in time or costs, that the present system of cultivation was not attuned to the machine's operation, and that holdings were usually too small to make the machine worthwhile.

REFERENCE

Hopkins, N. S., S. Mehanna, and B. M. Abdel Maksoud 1982 The State of Agricultural Mechanization in Egypt. Results of a Survey:1982. Agricultural Mechanization Project. Ministry of Agriculture and U.S.A.I.D. Cairo.

FARMERS' PERCEPTIONS OF CHANGING AGRICULTURAL CONDITIONS AND THE ROLE OF EXTENSION IN MINIA GOVERNORATE*

Dr. Bahgat M. Abdel Maksoud
Dr. Peter Reiss

*This paper was presented at the First National Conference on Soil Degradation in Egypt, Minia University, 5 February 1982.

ABSTRACT

Soil and water conditions in Egypt changed dramatically with the operation of the Aswan High Dam in the late 1960s. However, there is a continuing debate over the improvement or deterioration of these conditions during the ensuing years. The debate has largely focused on studies made by technical experts using a variety of scientific methods, but the attitudes of the affected farmers must also be included. Agricultural practices reflect their perceptions of a stable or a fluid environment. This paper investigates how farmers perceive changes in soil and water conditions during the past decade. It is based on survey research conducted in five villages in Minia Governorate. In all, three hundred farmers were interviewed. Of particular interest are the changes observed by farmers, how they were identified, and the strategies used to compensate for them. The paper continues with a discussion of the role and the effectiveness of the Agricultural Extension Service during the post-High Dam period and considers alternative ways of dealing with the present situation.

أدراك الزراع للتغيرات فى ظروف الزراعة وضرورة الأرشاد الزراعى فى محافظة المنيا

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" ملخص البحث "

لقد تغييرت ظروف التربه والمياه فى مصر تغيرا كبيرا بعد أتمام السد العالى فى أواخر السبعينات . ومع ذلك فان الجدل يستمر حول تحسن أو تدهور هذه الظروف خلال السنوات القادمة . ويقوم هذا الجدل على دراسات أجراها خبراء الأراضى والمياه متبعين فى ذلك طرقا علميه مختلفة . لكن أتجاهات الزراع المتأثرين يجب أيضا أن تؤخذ فى الأعتبار . ولاشك أن الخبرات الزراعية يتبعونها تعكس أدراكهم لمدى ثبات أو تغير تلك الأحوال .

وتهدف هذه الدراسة الى التعرف على كيفية أدراك الزراع للتغيرات فى ظروف التربة والمياه خلال العشر سنوات الماضيه . وتتضمن نتائج دراسة أستفصائيه تم أجراؤها على عينه من الزراع بلغ حجمها ٣٠٠ مزارعا فى خمسة قرى بمحافظة المنيا ولقد ركزت الدراسة على التغييرات التى أدراكها الزراع ، وكيفيه تعرفهم عليها أو تحديدهم لها والأجراءات المتبعه لمواجهتها .

وتناقش الدراسة دور وفعاليه الأرشاد الزراعى خلال السنوات الماضيه لمواجهة مثل تلك التغييرات . وتتضمن بعض المقترحات والتوصيات لتحسين الوضع الراهن .

INTRODUCTION

Various research investigations have been carried out by soil scientists on changes in soil and water conditions in Egypt since the construction of the Aswan High Dam (cf. El Gharably et al. 1977a, 1977b; El Gibaly 1977; El Gibali 1977a, 1977b; Fathi and Soliman 1977). It appears from these investigations that the construction of the High Dam played a major role in the shift from basin to perrenial irrigation in the Nile Valley. However, this new system of irrigation was not accompanied by the introduction of an effective drainage system. As a result, the groundwater level rose causing salts to appear on the surface of the cultivated land. A concentration of salt in the irrigation water has also increased since the construction of the High Dam (El Gibaly el al. 1977). This has added still more salt to the soil. Furthermore, the termination of the flood has made the soil less fertile and has had serious implications for landlevelling requirements.

Considering the seriousness of the situation, it is surprising that little effort has been made by social scientists to study the attitudes of the affected farmers. Since an individual's response to a situation is, in large part, determined by his perception of it (Abdel Maksoud 1974:2, Rogers and Burdge 1972:61), it is important to know whether farmers perceive any changes in soil and water conditions and their reactions to them. An understanding of farmers' perceptions has definite policy implications, since the problems will not be

resolved unless farmers and government decision-makers work cooperatively. Here the role of agricultural extension becomes crucial since it is an implementation arm of government policies.

OBJECTIVES

The aim of this study is to examine farmers' perceptions of soil and water conditions and the role of the Agricultural Extension Service in Minia Governorate. As such, the following points will receive particular attention:

(1) the changes and problems in soil and water conditions during the past decade as perceived by farmers and the relative importance of each;

(2) how farmers have tried to meet these changes or resolve these problems;

(3) government attempts to assist farmers with these changes and farmers' determination of their successfulness;

(4) the role of the extension service in meeting these problems and its degree of success according to farmers;

(5) suggestions for an improvement in the extension services given the results of this study.

METHODOLOGY

An empirical inquiry was carried out in five villages in Minia Governorate using a sample of 300 farmers. These five villages are the Minia implementation sites of the

Agricultural Mechanization Project. Two are in Matai District: El Atlat and Seila El Gharbia; three are in Abu Qurqas District: Beni Musa, Beni Abeid, and El Birba El Kubra. Sixty farmers were randomly selected in each village on the basis of landholding size.

A questionnaire was designed to be collected by five monitors working in the Village Studies Program of the Agricultural Mechanization Project during December 1981 and January 1982. Data-collection was conducted in two stages. The first focused on soil and water conditions, changes occurring during the past decade, and adaptations made by farmers. It also examined the role of the Agricultural Extension Service according to farmers. On the basis of these results, further information was gathered about how farmers rated their problems in soil and water. This information was collected using interviews.

A chi-square statistic was employed to examine the relationship between the personal characteristics of farmers and how they identified soil and water conditions. Analysis of variance was applied in order to rank order problems cited by farmers according to their importance. The results of these tabulations are presented and discussed in the following section.

RESULTS

Farmers were classified according to their age, literacy, years of schooling, family size, and landholding.

These classifications may be found in Table 1.

The majority of sample members (92%) thought that their soil at the present time is worse than it was ten years ago. The most frequently cited reasons are the following: increased soil salinity, loss of silt following the termination of the floods, lack of an effective drainage system, inefficient crop rotation and land use sytems, shortage in fertilizer, difficulty with weeds, rising water table, and unlevelled fields.

Most farmers in the sample (87%) also indicated that the irrigation water has gone under alteration during the past decade. However, the reasons cited are much more diffuse: end of flood, shortage of irrigation water, and the mixture of irrigation water with drainage water. All three are directly or indirectly related to the construction of the High Dam.

Problems in soil and water were mentioned as the following: high salinity of the soil, low fertility, increasing encroachment of weeds, shortage in water increasing difficulties in irrigation, level of the land, high alkalinity, and inefficient drainage facilities. The associated data are provided in Table 2. Some differences were found to exist between farmers in Matai and in Abu Qurqas Districts. Those in the former complained most about problems with irrigation, while farmers in Abu Quarqas mentioned soil problems more frequently.

A chi-square test was made in order to determine if there is an association between the personal characteristics of the farmers interviewed and the problems with soil and

Table 1 THE DISTRIBUTION OF SAMPLE MEMBERS ACCORDING TO AGE, LITERACY, EDUCATION, FAMILY SIZE, AND LANDHOLDING

Characteristics		Number	%
Total sample size		300	100
Age:	less than 30 years	19	6
	30 -	52	17
	40 -	111	37
	50 -	63	21
	60 year or more	55	18
Literacy:	illiterate	156	52
	write name only	51	17
	read and write	93	31
Education:	none	186	62
	1 - 3 years	15	5
	4 - 6 years	67	22
	7 - 9 years	12	4
	10 years or more	20	7
Family size:	1 - 5 members	135	45
	6 - 9 members	133	44
	10 members or more	32	11
Landholding	less than one feddan	144	48
	1 -	79	26
	2 -	39	13
	3 -	22	7
	5 -	11	4
	10 feddans or more	5	2

Table 2 SOIL AND WATER PROBLEMS AS PERCEIVED BY FARMS IN FIVE MINIA VILLAGES

Problems	Matai District		Abu Qurqas District			Total	
	El Atlat	Seila El Gharbia	Beni Musa	Beni Abeid	El Birba El Kubra	Number	%
Total sample size	60	60	60	60	60	300	100
High salinity	43	28	60	60	60	251	84
Low fertility	11	46	56	48	59	220	73
Weeds encroachment	10	1	48	49	48	156	52
Difficulty in irrigation	41	31	25	16	23	136	45
Land levels	2	12	39	1	56	110	37
Groundwater level	2	11	10	31	34	88	29
High alkalinity	2	10	21	10	22	65	22
Poor drainage system	0	15	15	20	10	60	20

water problems they identified. The personal attribute which scored most strongly was family size, although there seems little reason why this ought to be the case. One might have expected age and education to have been more important since they indicate greater experience and perhaps an ability to understand the conditions more clearly. The results to be found in Table 3 suggest that a knowledge of agricultural conditions is informally learned. They further indicate that, with the exception of difficulties in irrigation, large landholders do not single out problems in agriculture any more than small holders do. Such problems, then, may affect all farmers equally.

Even though such problems were identified by all sorts of farmers, they were perceived to be of varying importance by them. A ranking of the problems was undertaken to determine the priority they ought to be given. The results are found in Table 4.

High soil salinity ranks as the most serious of the problems faced by farmers, with 196 of the 300 farmers sampled citing it. What is perhaps most interesting is that certain other conditions which we would ordinarily associate with salinity are not perceived as being of equal or near importance. For example, land levels, poor drainage and groundwater level are not identified as being of crucial importance. Therefore, farmers may not see such conditions as being part of a single complex which must be treated at the same time. While 196 cite salinity, only five mention poor drainage. That farmers may see these as unrelated problems will certainly have implications for Project landlevelling activities. As

Table 3 A SUMMARY OF THE RESULTS OF A CHI-SQUARE TEST ON CHARACTERISTICS OF SAMPLE MEMBERS ASSOCIATED WITH THEIR PERCEPTIONS OF SOIL AND WATER CONDITIONS

Problems	Characteristics				
	Age	Education	Literacy	Family Size	Farm Size
High salinity	.70	.01	.20	.80	.02
Low fertility	.10	.10	.001	.10	.05
Weeds	.30	.01	.10	.05	.05
Irrigation	.01	.80	.50	.30	.99
Land levels	.001	.01	.50	.80	.30
Groundwater	.20	.01	.01	.50	.10
Alkalinity	.30	.01	.20	.98	.01
Bad drainage	.30	.05	.02	.10	.10

Table 4 SOIL AND WATER CONDITIONS RANKED IN IMPORTANCE BY FARMERS

Problems	Most important					Least important		
	1	2	3	4	5	6	7	8
High salinity	196	53	16	15	10	8	2	0
Low fertility	13	70	68	81	40	15	8	5
Weeds encroachment	10	76	41	38	81	29	20	5
Difficulty in irrigation	63	32	50	37	38	55	21	4
Land levels	1	8	16	50	16	40	46	123
Groundwater level	11	13	30	17	17	62	73	72
High alkalinity	0	15	22	17	44	61	69	72
Poor drainage system	5	33	57	45	55	30	56	19

such, a concerted land improvement extension and educational effort will be required.

The analysis of variance was applied to the kinds of soil and water problems cited by farmers. Table 5 indicates that there is a significant degree of variation within and between soil and water problems.

Clearly, the problems mentioned by farmers have decreased the productivity of agricultural lands. Eighty-eight percent of the farmers interviewed said that production was lower even though they were using greater amounts of fertilizer. More specifically, they believe that their yields are markedly lower in a range of important crops: cocton, wheat, and maize. Table 6 indicates the degree of the perceived changes.

Despite the problems, farmers have not made changes in their cropping patterns or in their methods of cultivation to a signifcant degree. Only a few of the farmers have substituted new crops during the past decade: soy beans, vegetables, and sesame. In no case was more than a third of the farmers involved. However, it is likely that the apparent conservatism of the farmers originates more in the frequently restrictive policies of the government which has imposed a largely inflexible rotation system upon them. Nor has the welfare approach of the government, which provides them with agricultural inputs at well below world market prices, encouraged them to seek ways to improve the situation themselves.

An active agricultural extension service, which educates farmers in the causes and possible solutions to their problems, would assist them greatly. Although they seem

Table 5 THE DEGREE OF VARIATION WITHIN AND BETWEEN SOIL AND WATER PROBLEMS

Source	D.F.	SS	MS	F	Level of Significance
Between	7	5365.18	766.45	255.48	.01
Among	2392	7172.54	3.00		
Total		12537.72			

Table 6 CHANGES IN PRODUCTIVITY AND YIELDS AS PERCEIVED BY FARMERS

Changes			Number	Percent
Total sample size			300	100
Productivity of land:		higher	32	11
		same	5	2
		lower	263	87
Productivity of crops:				
	Cotton:	higher	28	9
		lower	268	90
		undecided/unknown	4	1
	Wheat:	higher	121	40
		lower	171	57
		undecided/unknown	8	3
	Maizw:	higher	46	15
		lower	249	83
		undecided/unknown	6	2

able to identify a given soil or water problem at a later stage of destruction, it would be useful to train them in early detection. When asked to offer solutions for their problems, the farmers frequently did not show an indication of a real understanding. Thus, when asked for what they would to solve salinity problems, nearly all called for the use of gypsum. However, the need for gypsum must be determined by soil analyses which also reveal the amount to be applied.

To date, the Extension Service has offered little assistance. Ninety-nine percent of the farmers sampled said that they had never been visited or advised by an extension agent. Eighty-four percent said that they had never received information from any government service as is indicated in Table 7. The Extension Service must take on the responsibility of educating farmers in the identification of problems and the providing of advice concerning what steps could most effectively be taken to rectify them.

CONCLUSIONS AND RECOMMENDATIONS

Farmers interviewed have identified a number of soil and water problems which have worsened considerably during the past decade in Minia Governorate. A ranking of these problems indicates that farmers do not see these problems as being parts of a complex system which must be dealt with as a totality. While they cite salinity as the most serious of their problems, they fail to see a connection

Table 7 NUMBER AND PROPORTION OF FARMERS OBTAINING INFORMATION FROM GOVERNMENT SOURCES

Source	Number	Percent
Total Sample Size	300	100
Extension worker	14	5
Agricultural officer	5	2
Radio	7	2
Television	9	3
Agricultural extension magazine	6	2
Newspapers	3	1
Extension meetings	4	1
Never received information	252	84

with land levels, poor drainage, or alkalinity, to mention only a few of the problems they cited. The Project, preferably in conjunction with the Agricultural Extension Service ought to undertake an educational effort to apprise farmers in implementation locations of the extent of reparations required to improve soil and water conditions. From farmer responses, it is apparent that the Service has not assisted them adequately in the past.

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ANNEX C

SELECTION OF PROJECT AND CONTROL VILLAGES FOR INTENSIVE MONITORING AND EVALUATION ACTIVITIES

بسم الله الرحمن الرحيم

-1/82-

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صندوق بريد ٢٥٦ - الدقى - جيزة ج م ع
٧٠٤٦٦٠ - ٧٠٤٧٢٠
٧٠٤٣٦٤ - ٧٠٧٢٤٧

DATE ..... التاريخ

SUBJECT ..... الموضوع

REF. No. ..... ATTACH ..... مرفقات ..... الرقم

To: Dr. David Gaiser, Project Technical Director
Dr. Zakaria El Haddad, Project Coordinator

From: Dr. Peter Reiss, Evaluation Advisor
Dr. Abdel Tawab El Yamani, Chairman of Evaluation Committee

Date: 9 January 1983

Re: Selection of Project and Control Villages for Intensive Monitoring and Evaluation Activities

Introduction

During the first stage of the Village Studies Program, data concerning the current state of agricultural mechanization and related factors were collected in the twenty-three Project villages. The information gathered will serve as a baseline for the assessment of project impact during the period of implementation. One working paper based on these data has been written and is being circulated in draft form at the present; others are anticipated in the near future.

The Evaluation Workplan sets forth a second stage of the Village Studies Program in which its size is restricted to a small number of villages to be intensively monitored. According to the Workplan, nine Project villages will be continuously monitored during the rest of the life of the Project.

This memorandum discusses the method used for selecting these nine villages. It also deals with the selection of control villages which will be regularly monitored as a way of determining the influence of exogenous factors on the expansion of agricultural mechanization.

Criteria for Project Village Selection

Working Paper No. 6 provides a profile of the twenty-three villages based on landholding and cropping patterns, labor dimensions, access to services, and machinery levels and services. Using information presented in that report, nine of the villages were selected.

Criteria for village-selection were the following:

1. present level of mechanization
2. cropping pattern
3. labor availability
4. access to machinery and other services
5. presence and extent of Agrarian Reform land
6. specialized subproject activities

Since the existing machinery in the rural areas tends to be very restricted in its nature, the level of mechanization was determined on the basis of tractor and pump populations.

The cropping pattern was an important factor used because a particular effort was made to include villages which cultivated significant levels of rice and had large areas devoted to fruits and vegetables. Cotton, wheat, and bersim were found throughout the Project areas.

Labor availability referred to relative proportions of emigrants and landless laborers in the village populations. It is believed that in those villages where emigration is high and landless laborers are few, a labor shortage will be most acutely felt and the demand for mechanization will be greatest. Furthermore, remittances from emigration may be invested to stimulate the expansion of mechanization. Villages were chosen which as a group give us a range of these traits.

Accessibility to services is likely to play a role in the ability of machine owners to get their equipment serviced and in the ability of farmers to use machines at optimal times. Villages were assessed in the working paper on the basis of distance from the district center, the distance to the nearest paved road, and the presence or absence of a weekly market. Furthermore, the existence of a workshop for traditional tools or modern machinery was included as a crucial feature.

The presence of Agrarian Reform land, particularly at high levels, was a criterion in village selection because their cooperatives are independent institutions which must be made a part of Project planning and involvement.

The final point, specialized subproject activities, referred especially to the work of the Soil Improvement Component which is mandated to work only in Middle Egypt. As such, villages in Minia Governorate were chosen in order to monitor the work of that subproject.

Governorate weights

Of the nine villages chosen, two are in Beheira, two in Gharbia, one in Qalubia, one in Sharqia, and three in Minia. The greater number in Minia relfects the concentration of soil improvement activitities there and a desire to be able to provide information about a climatically and historically different area to the Project.

The Project villages selected are the following:

Beheira	Desounes
	Disia
Gharbia	Kanisa Damsheet
	Qaliub Abiar
Qalubia	Beltan
Sharqia	El Sadiine
Minia	El Atlat
	Beni Abeid
	Birba El Kubra

As a totality, these nine villages cover the range of variation in all twenty-three Project sites. The attached table demonstrates the variation, and it may be compared with the tables in Working Paper No. 6.

To state it plainly, the interest here is not in choosing a sample which statistically represents the full number of Project villages. Rather, our objective is to select nine villages, the combined features of which include the characteristics of all. Practically, we want to monitor the impact of our activities on rural life, and with the fullest possible range of these features we are likely to be the most successful.

Finally, the activities of the Evaluation Unit will not be restricted to these nine villages. As conditions and circumstances require, we shall also periodically be working in many of the other fourteen villages. In addition, a number of control villages have been selected.

The Need for Control Villages

Control villages have been selected as a way of measuring or assessing the extent to which changes in mechanization patterns at the village level have resulted from Project activities or from other factors. Certainly, we can expect that the latter will also play a significant role in determining the expansion of agricultural mechanization in Egypt. Government policies regarding availability of credit, machinery distribution, agricultural inputs, etc. are outside the control of the Project. By periodically monitoring developments in mechanization in the control villages we ought to gain added insight about the effectiveness of our own work.

Control Village Selection

The Evaluation Unit has already selected a number of villages in the Project districts for control purposes. In the area-wide survey, seven of the ten villages were not Project sites. Since we therefore have a body of

VILLAGES TO BE MONITORED IN THE VILLAGES STUDIES PROGRAM

Gov.	Village	Pop.	Feddans/ Tractor	No. of Pumps	% Land Fruits	% Land Veget.	Emigr./ Pop.	Landless/ Pop
Project Villages								
Beheira	Desounes	5317	166	12	12	8	8	3
	Disia	2959	92	50	0	1	6	8
Gharbia	Kanisa Damsheet	4936	48	36	5	1	11	1
	Qaliub Abiar	5832	141	30	30	14	3	2
Qalubia	Belten	7930	72	6	23	7	2	1
Sharqia	El Sadiine	6075	132	14	2	8	2	3
Minia	El Atlat	2854	101	10	8	0	6	3
	Beni Abeid	11585	132	37	4	4	7	3
	Birba El Kubra	4917	114	40	3	0	3	1
Control Villages								
Beheira	El Garadat	6500	167	4	low	moderate	low	-
Gharbia	Kutamat El Ghaba	15000	34	15	high	high	low	-
Qalubia	Mansuret Namul	2250	143	12	high	high	low	-
Minia	Manshat Lutfalla	2750	228	0	moderate	low	high	-
	Zawayet Hatim	3500	179	12	low	low	high	-

VILLAGES TO BE MONITORED IN THE VILLAGES STUDIES PROGRAM

Gov.	Village	Access to Services	% Land in Rice	No. of Workshops	% Agrarian Reform Land	Specialized Subproject Activities
Project Villages						
Beheira	Desounes	+ 2	28	1	21	
	Disia	0	49	0	29	
Gharbia	Kanisa Damsheet	- 7	42	0	0	
	Qaliub Abiar	- 9	2	2	23	
Qalubia	Belten	- 6	0	0	0	
Sharqia	El Sadiine	- 8	0	2	5	
Minia	El Atlat	-10	0	0	3	Landlevelling
	Beni Abeid	- 5	0	1	25	Landlevelling
	Birba El Kubra	-25	0	0	0	Landlevelling
Control Villages						
Beheira	El Garadat	- 4	high	0	7	
Gharbia	Kutamat El Ghaba	-10	moderate	0	1	
Qalubia	Mansuret Namul	-14	low	1	6	
Minia	Manshat Lutfalla	- 5	0	0	100	
	Zawayet Hatim	-31	0	0	15	

data at our disposal about these villages, it is most efficient to select from these seven. Of the seven, the five following have been chosen:

Beheira	El Garadat
Gharbia	Kutamet El Ghaba
Qalubia	Mansuret Namul
Minia	Manshet Lutfalla Zawayet Hatim

Unlike the Project villages where monitors will be placed, forays will be made into these five control villages on a regular basis and when particular needs arise. While the very basis of their being control villages is the absence of Project involvement, it is to be hoped that at some future point in time, the Project make some mechanization contribution in return for the assistance of the villagers.

The preceeding table also includes corresponding information (where available) on these control villages.

Program Implementation

Monitors are expected to begin their work in mid-month. While the first assignments are concerned with the tractor costs and time-use study and a review of irrigation organization in three Minia basins, some initial work will be done in the five control villages. We shall want to gather some information resembling that collected in the first stage of the Village Studies Program, although it will be a much lesss intensive effort. Following this, visits are expected to take place every two to three months.

ANNEX D

REPORT ON SELF-PROPELLED S.A.A.P. FIELD SPRAYER

REPORT ON SELF-PROPELLED S.A.A.P. FIELD SPRAYER AND OTHER SPRAYERS

January 27, 1983

I. Introduction:

In accordance with instructions a majority of effort was towards the revamping of the S.A.A.P. sprayer located at the Tractor Testing Station, Ministry of Agriculture. As time permitted, the other spray units located there were examined for adequacy and possible improvements. The boom type, trailed sprayer constructed at the Beheira Co. also was evaluated.

This report therefore will include a section on the S.A.A.P. sprayer followed by sections on the other sprayers and final section of other suggestions, recommendations, etc.

II. The S.A.A.P. Sprayer:

A. Introduction:

This unit was originally designed to be pulled and supported by two men. The 5 HP Honda G200 engine was used only to power the sprayer pump. It was designed to spray row crops in 55 to 75 cm. rows using a 4.8 meter boom. A redesign had used some of excess power from the Honda engine (see Appendix A) to drive a single wheel. A seat for the operator, single pivot steering, brakes, etc., had been added (1)*.

The sprayer was examined and its intended use discussed with Dr. Zakaria, Dr. Reaves, Eng. Naggar, Dr. Korayem, Dr. Younis and others. The unit was then modified in the shop of the Tractor Testing Station using parts brought from the U.S.A. but also using many parts that were fabricated in the shop or purchased locally.

B. Modifications:

The modifications made and some of the reasons for making them are discussed in the following paragraphs.

1. The sprayer needed better filtration of the liquid flow prior to the pump to protect it from wear and after the pump to protect the nozzles. Also it is desirable to use low application rates if still effective to allow spraying more feddans per tankful thus increasing field capacity. When the plants are small, rates as low as 50 liters per feddan are reasonable but this results in the use of nozzles with outputs as low as 0.3-0.4 liters per minute which are easily clogged. Therefore, nozzle strainers are desirable. In addition nozzle check valves

* Footnote: see list of references appended.

should be used to prevent nozzle drip and emptying of the boom when the sprayer is shut-off during turning and transporting.

To provide for better filtration the following changes were made:

(a) A removable basket strainer with approximately 1 mm openings was built and fitted in the tank fillter opening. This will help assure that the liquids added to the tank are free of debris and any wettable powders are well mixed.

(b) A Spraying System 124-A-3/4 Al aluminium line strainer fitted with a 50 mesh removable filter was placed in the suction line ahead of the pump. Other filter sizes can also be used in the strainer such as 80 mesh for protecting the small nozzles.

(c) Combination strainers and check valves (Spraying Systems 4193-A-SS stainless steel) with 5 p.s.i. opening pressure and 80 mesh screens were installed in each nozzle body.

2. In order to spray at rates from 50 ro 400 liters per feddan with a relatively fixed travel speed (4 kilometers/hr.) and a fixed nozzle spacing (40 cm), various nozzle tin sizes must be used. Also it is desirable to be able to use various combinations of cone nozzles for spraying different types and sizes of crops with insecticides and fungicides while flat fan and flooding nozzle tips are useful for spraying herbicides. Spraying Systems Co. nozzle bodies are interchangeable with Delavan Corporation nozzle bodies. Both companies make a full range of nozzle tip sizes and types that fit this standard nozzle body (2,3). Nozzle tips from one or the other of these companies are available in most countries that can be used for almost any spraying job. To obtain additional flexibility we replaced the nozzle bodies on the sprayer boom with nozzle bodies made in the shop to the Spraying Systems and Delavan nozzle body dimensions but with metric threads to fit the boom. For examples of types and sizes of nozzle tips available see Appendix B.

3. The original nozzle tips on the sprayer were quite variable in orifice size and flow rate. To obtain a more uniform distribution pattern across the boom and give better break up of the spray at lower pressures Spraying Systems TX-18 nozzle tips were installed in the new nozzle bodies. The TX-18 nozzle tips permit spraying 200 liters/feddan at 4 kilometers/hr. with the 40 cm. nozzle spacing and provide good break-up into many drops for adequate coverage.

4. Many fungicide and insectide formulations as purchased are either wettable powders or liquid flowables. The liquid flowables are actually finely ground particles in a formulation that keeps the particles more or less permanently suspended. Once the formulations are diluted with liquid in the spray tank they are susceptible to settling out if spraying is halted for any length of time. Then it may be difficult to get them remixed well enough to provide a uniform spray concentration over time. It is therefore desirable to have a good means of agitating the spray mixture in the tank.

   The piston pump on the unit didn't have adequate flow to supply the boom plus adequate hydraulic agitation. Also the high pressures available from it weren't needed and, if used, required considerable power. Therefore, the piston pump was replaced by a Hypro roller pump, Model 6500, providing about 38 liters/minute at 640 RPM and 50 p.s.i. (see Appendix C). This capacity provides flow for the boom and agitation line plus 30% reserve for loss of capacity due to wear.

   The roller type pump provides a uniform output without pulsations so the pressure dampener used with the piston pump was removed. The pump itself was hung on the end of the first countershaft as it is designed to operate with such mounting.

5. At the low pressures to be used for spraying, the pressure guage dial needs to be well subdivided so the pressure can be accurately read and set. Therefore the 0-30 kg/cm^2 guage was replaced with a 0-5 kg/cm^2 one with 0.1 kg/cm^2 subdivided.

6. The power train of the sprayer is such that the spray pump runs at all times that the engine runs. Since spray pumps should never be run dry it is imperative that the spray tank always have liquid in it before the engine is started so the pump can prime immediately.

   The suction line on the sprayer was installed in the top of the tank and could not empty the last 10% of the tank liquid. This setup also causes the pump to be slower to prime. To make all the tank capacity available for spraying so pesticide isn't wasted and to make sure that the pump primed quickly, the suction line was changed to draw the liquid from the bottom of the tank and shut-off valve provided in case a line ruptures.

   The former suction line was replaced with a new agitation line with a Spraying System Jet Agitator 6290-1 fastened at the bottom and placed so the agitation flow sweeps the bottom of the tank. One jet

orifice was drilled to 2.5 mm. diameter to double the total agitator flow rate and to provide most of the flow along the long dimension of the tank bottom for better mixing.

7. The existing steering system on the sprayer was single pivot steering which can be quite tiring on the operator when ground conditions vary, row spacing varies, etc.

   A steering system using double pivoting axles with a tie rod interconnection was installed to give the operator more precise steering control with less fatigue.

   With the narrowest wheel spacing and the wheels steering straight ahead, the tie rod arms were each angled inward 14°. This results in the inner wheel having a shorter radius than the outer wheel regardless of the turning direction and makes turning easier.

8. When a single drive wheel is used turning is easier and performance under soft field conditions is better if the drive wheel is in front, instead of behind the steering wheels. Therefore the direction of machine travel was reversed by turning the engine 180° so the drive pulley rotating direction was reversed. This also necessitated turning the operator seat around which puts the operator in position to see the boom at all times. Therefore less spraying should be done while the nozzles are clogged or while patterns are poor because the operator will quickly notice the problem.

   If a particularly dangerous pesticide is being used and the wind and field conditions cause more of the spray to envelop the operator, the boom can be mounted on the back of the sprayer if necessary.

III. <u>The Nir David Sprayer</u>

A. This three point hitch mounted sprayer is manufactured by NIR David Metal Works, Israel. It has a 320 liter stainless steel tank with well-constructed stainless steel basket strainer and large well-sealed tank opening. The pump is a 50 liter/minutes, Italian-made diaphragm pump capable of high pressures so a double regulator system for both low and high pressure control is provided.

   This particular sprayer does not have a pendulum suspension system with pulley-operated boom height control but one is available as an option (See Appendix D). Such mounting is very useful when spraying land that is rough or has varying slopes.

The 10 meter 20 nozzle boom with 50 cm. nozzle spacing is well constructed but the 15 mm. inside diameter plastic pine and 9.5 mm inside diameter feeder hoses are quite small if one sprays at high speed and high application rates. The outside sections are fed at one end and have eight hollow cone nozzles producing 1.1 liters/min. at 2.8 kg/cm^2 (40 p.s.i.). At 8 km/hr, the sprayer as equipped would apply 69 liters/feddan at 2.8 kg/cm^2 pressure. To apply a higher rate such as 200 liters/feddan at the same speed would require nozzle flow rates of 3.2 liters/minute. This would require the pressure on the D4-25 nozzles to be increased to 23.5 kg/cm^2 (334 p.s.i.) or larger nozzles would have to be used to keep the pressure low. At these higher nozzle flow rates, the pressure drop from the first nozzle to the eighth nozzle on the outer sections would be enough to cause a lighter application on the outer edge of the swath. Therefore the sprayer should be modified with larger hoses and pipes if high volume spraying is planned.

Such high volume spraying would also take all the pump flow for the boom leaving none for agitation unless slower travel speeds were used to lower nozzle flow requirements. It is recommended that the sprayer be used to apply 150 liters/feddan or less, preferably 100 liters/feddan or less.

B. Some actual or possible discrepancies observed in this sprayer are as follows:

1. The aforementioned small diameter hoses and booms.

2. The pressure gauge on the low pressure regulating system has a smallest division of 0.5 bar on one scale and 10 p.s.i. on the other. Smallest divisions of 0.2 bars and 2.5 p.s.i. would be much better for calibration.

3. The line strainer is too coarse being 20 mesh (400 openings/in^2) when it should be 50 mesh (2500 openings/in^2) to protect the nozzles and nozzle strainers from clogging. Nozzle strainers are 50 mesh but contain no check valves to prevent dripping.

4. The plastic tube sight gauge on the outside of the tank should have a small cut-off valve at the bottom inlet to permit shut-off it the tube ruptures when the tank is full of pesticide mixture.

5. The winged set screws used to adjust and hold the boom height will not hold the height in rough ground unless the steel uprights have shallow holes drilled for setting the screws into. Three cm. spacings are suggested.

6. The 1/2 PVC plastic pipe used in the tank for the bypass and agitator lines may be affected by some pesticide mixtures.

IV. The RAU - Sprimat Sprayer

A. This RAU Spritze Model 14S47 Sprayer also is a three point hitch mounted unit and is manufactured by RAU Gmbh, Weilheim, W. Germany. It has a 425 liter plastic tank (polyethylene) with light weight basket strainer of 16-18 mesh. The pump is apparently German-made and is a disphragm pump producing approximately 70 liters/min. at low pressures and 540 RPM. Agitation is by means of the bypass line to a tube with holes spaced in it along the bottom of the tank. The pressure, guage, on-off valves, and pressure regulator are all incorporated into one control unit and body. The 7 meter boom has 14 Spraying Systems 11006 flat fan nozzles on 50 cm. spacing. The boom height is adjustable in 8.5 cm. increments.

B. Some discrepancies noted with this sprayer are as follows:

1. The line filter has one outlet broken off so it cannot be used in the suction line as intended (or anywhere else).

2. The tank outlet mounting had to be rotated 90° clockwise to use the hose from it to the pump.

3. The pressure guage mounting in the control manifold has cracked open making the entire control unusable.

4. Clearance between the pump and the bottom of the sprayer support is too small so that placing the sprayer on the ground if there are any obstructions can damage the pump or fittings. Skids need to be fitted under the sprayer to increase the clearance.

5. The nozzles have individual combination strainers and check valves to protect the orifices and prevent dripping but the screens are 20 mesh which is too large to avoid some plugging of orifices. They should be replaced with 50 mesh screens.

6. The handle on the control unit that controls the on-off valves to the agitation and boom lines is broken off and needs replaced.

7. A separate line should be installed for agitation so the agitator can be at the same pressure as the boom. Much mixing energy is lost when the flow must go through the pressure regulator.

8. The pressure guage has a p.s.i. scale that should be subdivided more for more accurate reading and calibration. A new more subdivided guage should be installed.

V. The Balton Precision Sprayer

A. This unit is mounted on a four row tool bar with adjustable row spacing. It is from Beth Hashitta of Israel but appears to have been designed and manufactured by Balton of Amsterdam, The Netherlands. The sprayer is designed for directed herbicide spraying of row crops using a single flat fan nozzle on each side of the crop row. It is equipped with Spraying Systems 8003 flat fan nozzles. The pump is a seven roller pump from General Hydraulics of the USA. Pump capacity and pressure should be adequate. The unit seems well-made in general.

B. Some discrepancies noted are as follows:

1. The line strainer has a 20 mesh screen. It should have a 40 to 50 mesh screen to protect the roller pump and the nozzles.

2. The nozzles have no strainers or check valves. The company literature shows 50 mesh nozzle strainers but no check valves. The 50 mesh strainers would be fine.

3. The pressure guage has 10 p.s.i. divisions while 2 p.s.i. divisions would be much better.

4. The agitation pipe is on the end of the bypass line from the pressure regulator. The 400 liter tank would need 20-25 liters/minute flow out the agitator lines at spraying pressure for good agitation. When the bypass line is used for agitation much of the hydraulic energy is lost going through the pressure relief valve and little energy is left for agitation. It is much better to use a separate line from the output of the pump and size the holes in the agitator so the pump can provide adequate flow and pressure for both the boom and the agitator. In other words, the agitator holes must not be too large for a given pump capacity or adequate pressure cannot be provided for the boom and agitator.

VI. The Beheira Trailed Sprayer

A. This unit has a 635 liter tank and approximately 14.5 meter swath width. It is designed to be towed by a small 12 hp tractor which also has a belt-driven Delavan roller pump mounted upon it. The boom has a truss design for strength and plastic pipe is clamped to it which carries the spray liquid and has the nozzles spaced along it. Nozzle spacing is fixed but could be changed fairly easily by replacing the plastic pipe and drilling holes at a new spacing for the nozzle clamps.

B. Mr. Habib Diab describes rather completely and well the sprayer design, construction and testing in his master's thesis in Agricultural Engineering, University of

Alexandria, December, 1981. His boom design is an excellent one and the boom is certainly sturdy. However, the following modifications are suggested:

1. The plastic hose connecting the boom suctions is crimped too tightly at each hinged joint when the boom is folded. Elbows could be added at the boom end on each side of the hinge and a loop of hose used.

2. Each side of the boom can be shut off using cut-off valves mounted behind the tank. This is adequate when wanting to spray full width or with one side only. However, one may frequently wish to use a portion of one or both sides. Therefore a cut-off valve should also be installed at each hinge joint to give choices of spraying with the six nozzles on the center section spraying 3.66 meters, with the center and first section on each side spraying 8.54 meters, with all the sections on both sides spraying 14.64 meters, with one half the center section plus one section on one side spraying 6.10 meters, with half the center section plus two sections on one side spraying 7.32 meters, with all the center section plus two sections on one side spraying 10.65 meters, and with all the center section plus one section on one side plus two sections on the other side spraying 11.59 meters. This gives a tremendous number of choices to fit the spray width to the field width and to the unsprayed width remaining.

3. The plastic pipe seems to warp under field conditions due to temperature extremes. To hold it and the nozzles in better alignment, the plastic pipe should be clamped to the boom trusses at one side of each nozzle connection.

4. When one is not using the outer section on one or both sides to spray, the section can be folded, which is fine, but the means of securing that section after folding needs to be improved. The same situation occurs when both sections are folded on one or both sides.

5. Due to the wide boom and the narrow wheel tread, the boom height at the ends will vary greatly on uneven ground. When this happens the uniformity of distribution across the boom will be very poor. For those pesticides requiring a very uniform distribution, such as some herbicides, this may be a problem. If so there are two choices. One choice is to use fewer sections of the boom. The other choice is to use a pendulum mounting such as shown in Appendix D. (This is an option available on the Nir David M-30 sprayer for example).

C. The main agitation of the pesticide mixture in the tank is by means of a mechanical agitator which is driven from one of the wheels. This means that good agitation is only available when the sprayer is moving. Yet agitation is also needed during the mixing and filling of the tank with pesticide and diluent and during any delays in spraying for unplugging nozzles, breakdown, etc.

When the boom is shutoff or when the spray applications are made at 50 to 100 liters per feddan instead of 200 liters/feddan (which can be done effectively with many pesticides) considerable pump flow would be available for agitation. Therefore a steel pipe with 22 holes of 1.4 mm diameter drilled in it on 4 cm spacings should be placed in the tank parallel to the mechanical agitator but 4 cm. from the side and 4 cm. from the bottom. The holes should point towards the center and parallel to the tank bottom. The pipe could be placed through a hole in one end of the tank then welded in place (See schematic diagram of hydraulic system in Appendix E).

The mechanical agitator design uses a No. 80 (1 inch pitch) chain drive from the ground wheel and shafts with bevel gears to give an additional speed increase of 2:1. The agitator shaft is mounted parallel to the direction of travel at 15 cm above the tank bottom and has only two paddles upon it.

By using No. 60 chain, the sprocket on the drive wheel can have 40 teeth and the agitator shaft can be mounted across the tank perpendicular to the direction of travel with a 13 tooth sprocket driven directly from the wheel. At 4 km/hr ground speed the drive wheel sprocket would turn 37 RPM and the agitator would turn 114 RPM. Such a chain design can be used for up to two horsepower load.

Using the same 29.2 cm. diameter paddles but with 10 cm. paddle width and using 4 paddles instead of 2 in order to eliminate dead spots in the tank the minimum peripheral paddle speed was calculated as (5):

$$Sm = 5.39 \frac{A^{.422}}{R^{.531}} F_e^{.293} \quad (1.22) \text{ where}$$

Sm = Minimum paddle speed, m/min.

A = 500 mm, the depth of liquid above shaft, mm

R = .44, the total combined paddle width divided by tank width

F_e = 0.5, a factor indicating difficulty of agitation for an emulsion.

then

$$Sm = \frac{5.39\ (500)^{.422}\ (0.5)^{.293}\ (1.22)}{(.441)^{.531}}$$

and Sm = 114 m/min

While the calculated peripheral paddle speed is:

$$Sm \text{ (actual)} = 114 \text{ RPM} \times \pi \times \frac{29.2}{100} = 104.6 \text{ meters/min.}$$

so agitation should be adequate when the additional agitation given by the hydraulic agitator pipe and bypass flow is included.

The power requirement of the mechanical agitator can be calculated using the following equation (5):

$$Sp = 3.26 \times 10^{-11} \; R^{.582} \; Sm^{3.41} \; L$$

where:

Sp = power input to the shaft, kilowatts

Sm = Actual RPM of shaft

L = 90 cm tank width as before

R = .441 as before

then:

$$Sp = 3.26 \times 10^{-11} \; (.441)^{.582} (104.6)^{3.41} 950 = 0.1542 \text{ KW}$$

which is a much lower power requirement due to the much lower peripheral speed of the paddles. Note that cutting the paddle speed in half cuts the power needed by over 90% or to one-tenth as much.

D. The line to the agitator pipe should have a gate valve so the agitator flow can be restructed or closed when the boom is turned on for spraying. This will assure that all the pump flow can be made available to the boom if needed. Yet the agitator can be turned on and the pump run to agitate when the sprayer is stationary. A three way valve can also be used at the junction of the line to the boom and the line to the agitator. This would permit having the boom on and the agitator off, the agitator on and the boom off, or both the boom and agitator on (See the schematic diagram in Appendix E).

E. The return line from the bypass type pressure regulator ends at the top of the tank. It should be extended to near the tank bottom. This will give some additional agitation and also will put fewer air bubbles in the liquid and help reduce foaming in the tank which can be a problem with some formulations.

F. Although the pump mounting on the locally manufactured tractor was not observed, the plumbing diagram on Pg. 80 and the text on Pg. 78 of Diab's thesis indicates two intake lines and two output lines being used at the pump. This is not necessary. The two inlet and two outlet ports on the pump are provided for convenience in plumbing the system. One should choose either the side or end ports as needed.

The suction line to the pump should usually come directly from the bottom center of the tank but it is drawn upward and then out the side of the tank near the top on this sprayer. Since the belt driven pump is about the same height as the suction pipe outlet on the side of the tank there seems no advantage in changing the pipe now. If the pump is changed to a P.T.O. mounting then the pump would prime quicker if the suction line came from the bottom of the tank. Also the tank would empty more completely.

G. The present sprayer has no basket strainer in the filler opening. A heavy duty one with 20 mesh screen or equivalent should be installed.

H. The delavan Rain Drop nozzles on the sprayer are excellent for some herbicides and insecticides where coarse drops can be used. For some contact herbicides and most insecticides and fungicides a finer spray is needed. The nozzle bodies on the sprayer have standard caps that will take Delavan or Spraying Systems nozzle tips of various types. However, the plastic boom pipes should be rotated to give proper direction to the spray. (The Raindrop nozzles eject the spray at 90° to the inlet). In fact the Raindrop patterns would be more uniform if the nozzles were tilted back 30° to 45°.

Nozzle strainers of 50 mesh and with 5 p.s.i. check valves should be used to avoid nozzle clogging and dripping after shutoff.

VII. Other Discussion:

In the previous parts of this report certain aspects of spraying systems have been emphasized. In this section some of these aspects will be discussed in more detail.

A. Cleanliness and Filtering

First one should start with a completely clean sprayer. If it is a new sprayer or an old one just coming out of storage, the boom caps and nozzle caps should be removed and the sprayer filled with clean water which is then pumped out the boom. All suction strainers, line strainers and nozzle strainers should be checked of debris if needed. Nozzle tips should also be checked and cleaned if necessary. When the sprayer is clean and ready for filling only very clean water should be used.

Filtering should be progressive and start when the tank is filled. All tanks should have large filler openings which permit the tank to be cleaned if necessary and the openings should contain a basket strainer of 20 or 30 mesh. Then the spray pump, unless it is of the centrifugal type, should be protected by a large suction line strainer of 40 or 50 mesh. If small nozzle tips are being used for low volume spraying then an output line

strainer with 80 mesh screen should be used to assure that little foreign material collects on the nozzle strainers which should be 100 mesh. This avoids frequent plugging of the nozzle strainers. If nozzles larger than the Spraying Systems 8002 size (0.2 gallons/minute at 40 p.s.i.) are used for medium to high volume spraying then the output line strainer can be eliminated and 50 mesh strainers used in the nozzles.

B. Agitation

Good agitation should always be provided. It should be available to help with mixing the pesticide and water while the tank is being filled, during spraying, and during any delays while there is still pesticide mixture in the tank. This can be provided either mechanically with paddles or propellers or hydraulically by using a sprayer pump large enough to provide flow to the boom and to the agitator plus some reserve. A good rule is to have agitator flow equal to at least 5% of tank capacity. For example a 500 liter tank would need 25 liters/minute agitator flow. Also the agitators must be properly placed so the flow sweeps the tank bottom. The pressure available to the agitator should be that available to the boom so that maximum energy is provided (See Appendix E). However, there should be a gate valve installed on the agitator line to permit decreasing flow if foaming occurs in tank. This is more likely to occur with some pesticides that with others and also when the tank is almost empty.

C. Boom and Nozzles

The boom should be easily adjusted as to height and not subject to much bouncing or swinging. It should be capable of swinging back, however, with no permanent damage when an obstruction is encountered. The boom pipes or lines and all fittings must be large enough to limit pressure drops to less than 5% from the first nozzle on any section to the last section and pressure at all nozzles should vary no more than 5%.

Standard nozzle bodies with standard caps made to the dimensions used by Delavan and Spraying Systems should be used so all the nozzle types and tip sizes can be used for various spraying jobs. Also standard nozzle strainers and check valves can be used.

Before any spraying operation the correct nozzle type and size should be selected for the pesticide to be used and crop being sprayed. Tip size and nozzle pressure can be selected tentatively based on the planned travel speed, application rate and nozzle spacing but must always be checked under field conditions. If application rate during field calibration is not correct then slight adjustments in travel speed or nozzle pressure should be made until

the rate is correct. At this time, one should also check flow from all nozzles to see that it is uniform within ± 5% and replace those nozzles that are too high or low in flow.

The boom height should be adjusted to give the correct pattern overlap for the crop being sprayed and type of nozzle used. Flat fan nozzle tips should be high enough above the canopy to have 50% overlap between individual nozzle patterns. The nozzle manufacturers recommend 30 to 50% overlap but tests have shown 50% overlap gives a more uniform pattern. Also the height for 50% overlap allows more variation to boom height to occur with less change in uniformity of pattern. Fifty percent overlap is when half the individual nozzle pattern is overlapped by individual patterns from the nozzles on each side so that one half the nozzle spacing is sprayed by two nozzles and one-half (directly under the nozzle) gets sprayed only by that nozzle. (See Appendix E for nozzle types and patterns and examples of 50% and 100% overlap).

For hollow cone nozzles and flooding flat fan nozzles boom height should be adjusted to give a pattern that produces 110-115% overlap at the top of the canopy. If one uses the hollow cone core and disc type nozzles one has wide selection of low rate and spray angle to do almost any spraying of fungicides and insecticides. Appendix G shows the choices available. For examples one can choose a D3 disc and No. 46 core producing a 20° spray angle and 0.32 g.p.m. at 40 p.s.i. if a narrow angle is needed or choose a D4 disc and No. 25 core producing a 76° angle and 0.32 g.p.m. at 50 p.s.i. if a wide angle is needed.

VIII. Additional Changes and Work Needed on S.A.A.P. Sprayer

A. Due to the shop being closed on the next to last day of the one month assignment, time did not permit completing all the changes that were needed. Also some items that were needed were not found locally.

B. Some of the further items or modifications needed are as follows:

1. The frame which holds the boom at the front of the sprayer needs to be duplicated on the back of the sprayer so the boom can be used there if desired.

2. The V-belt clutch for the ground wheel drive needs to be replaced with an overcentering clutch either on the belt or on the countershaft.

3. The drain plug on the bottom of the tank needs to be replaced with a 3/4 inch nipple, 3/4 inch quarter turn valve and 10 meters of 3/4 inch hose with a 20 mesh suction strainer on the end for use in filling the tank. An alternative would be the use of a

siphon valve and proper valving on the output side of the pump.

4. Hose that would be durable and withstand up to 100 p.s.i. pressure was unavailable in the 0.5 inch inner diameter needed so 0.375 inch I.D. hose was used. It should be replaced with the 0.5 inch I.D. size of suitable strength.

5. The left steering axle has much more play between it and the pipe used for a hub than does the righ steering axle. This is the case because the design called for the use of nominal 2 inch diameter standard Schedule 80 pipe which has an outer diameter of 2.375 inches and an inner diamter of 1.939 inches for the hub and nominal 1.75 inch diameter Schedule 80 pipe which has an outer diameter of 1.9 inches for the axle. Enough Schedule 80 pipe for 2 inch nominal diameter was found for the right hub but Schedule 40 pipe had to be used for the left hub resulting in a loose fit.

   Either the present left hub should be shimmed to eliminate the play or Schedule 80 pipe should be found and used to replace it.

   The axles themselves are also lighter than the design called for so they had to be strengthened by welding one light weight 30 mm x 30 mm x 3 mm angle on the front of each axle.

6. The Honda engine needs the following:

   (a) An approved replacement spark plug rather than the substitute used.

   (b) A new starter rope as supplied by Honda.

   (c) A new pawl spring for the starter winding mechanism. The substitute made in the shop doesn't allow centrifugal action to release the pawl from dragging. It is suggested the entire starter mechanism be taken to the Honda dealer at the Alexandria market.

   (d) A throttle control linkage that can be set at any selected speed for calibration and operation of the sprayer.

7. A warning statement or decal should be placed prominently on the engine. It should emphasize that the tank must contain water and the gate valve under the tank be open before the engine is started. This is to avoid running the pump with no waterin it as the rollers will wear rapidly under dry conditions.

8. A repair kit consisting of new seals and rollers should be purchased for the Hypro Model 6500 pump used.

9. The pump repair kit, an extra pressure guage and the extra nozzle tips and combination nozzle strainers and check valves along with a tool kit should be assembled into a kit and kept with the sprayer. Such a kit will avoid delays in the field.

10. Two pressure guages are used on the sprayer, one at the pressure regulator and one at the boom control valves. They should read very close to the same pressure with the one at the pressure regulator reading slightly less. If the readings start to vary widely one needs replacing and the sprayer calibration should be checked. Nozzle selection and sprayer calibration are discussed in some detail in the University of Illinois Agricultural Extension Circular 1192 by L.E. Bode and B.J. Butler.

11. The brake pads on the wheels were not properly secured from turning on the sprayer so straps were formulated and welded to the vertical axles. However, time did not permit the installation of the control cables. These need to be installed so the operator can apply one or both with either his left foot or his right hand preferably with his right hand.

REFERENCES

1. FINAL REPORT. Development of the S.A.A.P. Field Sprayer (Conversion of The Sprayer to A Self-Propelled Unit).

2. Spraying Systems Co., Spray Manual Catalog 37.

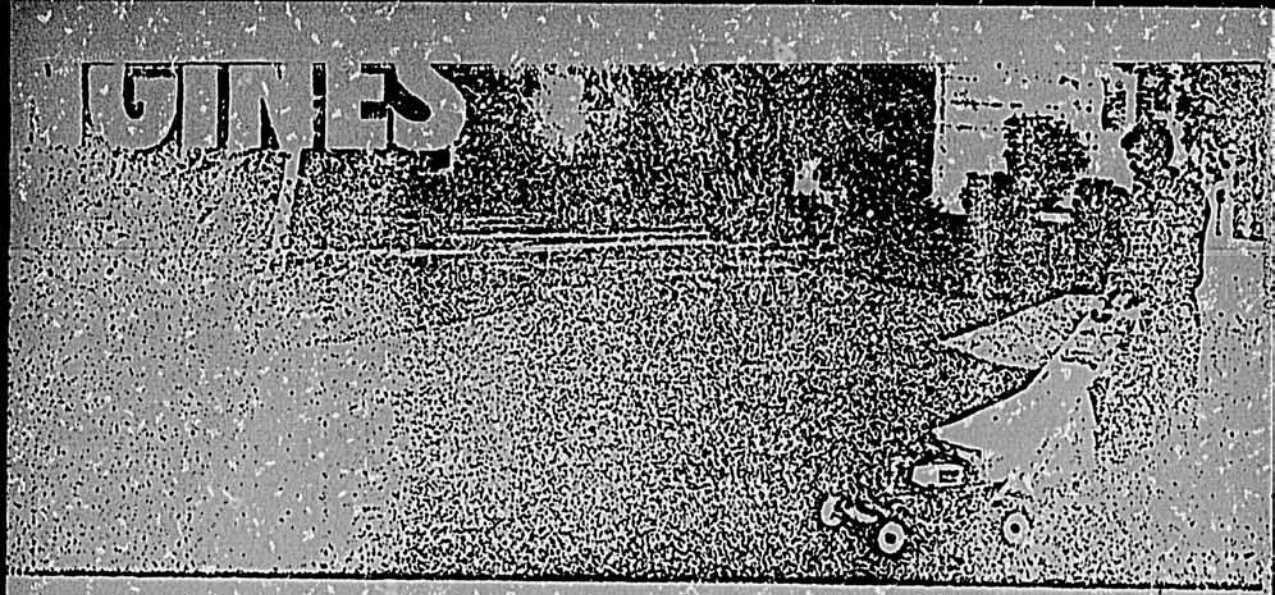
3. Delavan Corporation Color Brate Catalog No. 16097.

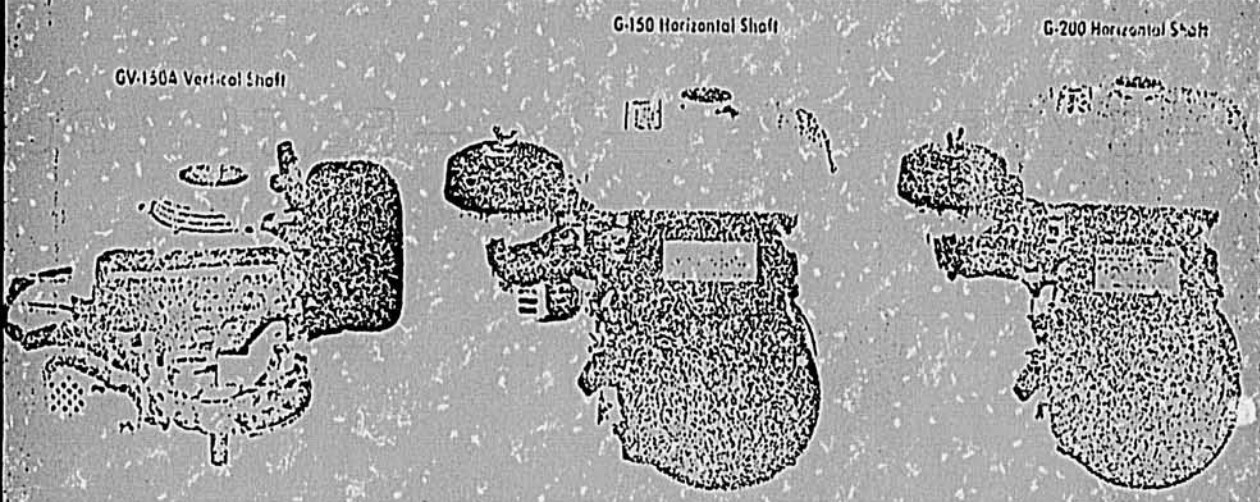
4. Equipment and Calibration: Low-Pressure Sprayers. Circular 1192, College of Agriculture, University of Illinois, Urbana, Illinois 1981.

5. Bainer, R., Kepner, R.A. and Barger, L.E. Principles of Farm Machinery, John Wiley & Sons, Inc., New York, 1979.

APPENDIX A

SPECIFICATION FOR G-200 ENGINE





Also available. Hard working Honda engines in 6.8- and 8.0-hp models.

SPECIFICATIONS

Engine	GV-150A	G-150 (Q TYPE)	G-200 (Q TYPE)
	Single-cylinder, side-valve, four-stroke, forced air-cooled	Single-cylinder, side-valve, four-stroke, forced air-cooled	Single-cylinder, side-valve, four-stroke, forced air-cooled
Displacement	8.8 cu. in. (144cc)	8.8 cu. in. (144cc)	12.0 cu. in. (197cc)
Bore x stroke	2.5 X 1.8 in.	2.5 X 1.8 in.	2.6 X 2.2 in.
Compression	6.3:1	6.5:1	6.5:1
Max. horsepower	3.5 hp/3600 rpm	3.5 hp/3600 rpm	5.0 hp/3600 rpm
Max. torque	5.1 ft.-lb./2500 rpm	5.2 ft.-lb./3000 rpm	7.7 ft.-lb./2500 rpm
Ignition system	Flywheel magneto	Flywheel magneto	Flywheel magneto
Ignition timing	20° B.T.D.C. (fixed)	20° B.T.D.C. (fixed)	20° B.T.D.C. (fixed)
Starting system	Recoil starter	Recoil starter	Recoil starter
Air cleaner	Semi-dry	Oil bath	Oil bath
Fuel tank capacity	0.53 gal.	0.66 gal.	0.92 gal.
Dry weight	28.7 lbs.	29.8 lbs.	33.1 lbs.
Shaft diameter	5/8 in.	3/4 in.	3/4 in.
Shaft length	3 3/32 in. (A1 model) 2 1/16 in. (A2 model)	2 1/16 in.	2 1/16 in.

APPENDIX B

EXAMPLE OF TYPES AND SIZES OF NOZZLES AVAILABLE FROM DELAVAN CORPORATION AND SPRAYING SYSTEM COMPANY

NOZZLE INTERCHANGE

FLAT SPRAY NOZZLE TIPS

73	
Delavan	Spraying Systems
LF .77-73	730077
LF 1.16-73	730116
LF 1.54-73	730154
LF 2.31-73	730231
LF 3.08-73	730308
LF 3.85-73	730385
LF 4.62-73	730462
LF 6.16-73	730616
LF 7.70-73	730770
LF 9.24-73	730924
LF 15.5-73	None

65	
Delavan	Spraying Systems
LF 67-65	650067
LF 1-65	6501
LF 1.5-65	65015
LF 2-65	6502
LF 3-65	6503
LF 4-65	6504
LF 5-65	None
LF 6-65	6506
LF 8-65	6508
LF 10-65	6510
LF 15-65	6515
LF 20-65	6520
LF 25-65	None
LF 30-65	6530
LF 40-65	6540

80		80 - 90
Delavan	Spraying Systems	Delavan Raindrop* Drift-Control Tips
LF .67-80	800067	None
LF 1-80	8001	None
LF 1.5-80	80015	None
LF 2-80	8002	RD1
LF 3-80	8003	RD2
LF 4-80	8004	RD4
LF 5-80	8005	None
LF 6-80	8006	RD5
LF 8-80	8008	RD7
LF 10-80	8010	RD8
LF 15-80	8015	RD10
LF 20-80	8020	None
LF 25-80	None	None
LF 30-80	8030	None
LF 40-80	8040	None

EVEN SPRAY TIPS 80°

Delavan	Spraying Systems
LE 1-80	8001E
LE 1.5-80	80015E
LE 2-80	8002E
LE 3-80	8003E
LE 4-80	8004E
LE 5-80	8005E
LE 6-80	8006E
LE 8-80	8008E
LE 10-80	8010E
LE 15-80	8015E

RAINDROP® TIP AND NOZZLES

Delavan RD (80 - 90)	Delavan RA (120 - 140)
RD 1	RA 2
RD 2	None
RD 3	None
RD 4	RA 4
RD 5	RA 5
RD 6	None
RD 7	RA 8
RD 8	RA 10
RD 9	None
RD 10	RA 15

CONE SPRAY NOZZLE TIPS

(Low capacity, fine atomization)

Brass		Stainless Steel	
Delavan	Spraying Systems*	Delavan*	Spraying Systems*
HB 1	TX 1	HC 1	TX-SS 1
HB 1.25	TX 1.25	HC 1.25	TX-SS 1.25
HB 1.5	TX 1.5	HC 1.5	TX-SS 1.5
HB 2.0	TX 2	HC 2.0	TX-SS 2
HB 2.5	TX 2.5	HC 2.5	TX-SS 2.5
HB 3	TX 3	HC 3	TX-SS 3
HB 4	TX 4	HC 4	TX-SS 4
HB 5	TX 5	HC 5	TX-SS 5
HB 6	TX 6	HC 6	TX-SS 6
HB 8	TX 8	HC 8	TX-SS 8
HB 10	TX 10	HC 10	TX-SS 10
HB 12	TX 12	HC 12	TX-SS 12
HB 14	TX 14	HC 14	TX-SS 14
HB 18	TX 18	HC 18	TX-SS 18
HB 22	TX 22	HC 22	TX-SS 22
HB 26	TX 26	HC 26	TX-SS 26

*Brass with S.S. metering parts.

TWIN ORIFICE TIPS - 150°

Delavan	Spraying Systems
2LF 1.5	15001
2LF 2	15002
2LF 3	15003
2LF 4	15004
2LF 5	None
2LF 6	15006
2LF 8	15008
2LF 9	15009

OFF-CENTER

Delavan	Spraying Systems
LX 2	OC-02
LX 3	OC-03
LX 4	OC-04
LX 6	OC-06
LX 8	OC-08
LX 12	OC-12
LX 16	OC-16

DISC-CORE NOZZLE TIPS

(High capacity, coarse atomization)

	40° 110°	
Delavan DC Disc-Core Nozzle	Delavan RD Raindrop Nozzle	Spraying Systems
DC 2-13	—	D 2-13
DC 2-23	—	D 2-23
DC 3-23	—	D 3-23
DC 2-25	—	D 2-25
DC 3-25	—	D 3-25
DC 3-45	—	D 3-45
DC 4-25	RD 2	D 4-25
DC 5-25	RD 3	—
DC 5-45	RD 4	D 5-45
DC 7-25	—	D 7-25
DC 6-45	RD 5	D 6-45
DC 7-45	RD 6	D 7-45
DC 5-46	—	—
DC 8-45	RD 7	—
DC 12-25	—	D 12-25
DC 14-25	—	—
DC 6-46	RD 8	—
DC 12-45	RD 9	—
DC 7-56	RD 10	D 7-56
DC 8-46	—	—
DC 8-56	—	D 8-56
DC 10-46	—	—

CONE SPRAY NOZZLES (120° - 140°)

(Right angle, high capacity, coarse atomization)

120		120 - 140
Delavan	Spraying Systems	Delavan RA Raindrop* Drift-Control Nozzle
WRW 2	1 W	RA 2
WRW 4	2 W	RA 4
WRW 5	None	RA 5
WRW 6	3 W	RA 6
WRW 8	None	RA 8
WRW 10	5 W	RA 10
WRW 15	8 W	RA 15
WRW 20	10 W	RA 20

NOTE: Some nozzles may not interchange exactly. However, normal manufacturing tolerances are such that in most cases flow rates are practically identical.

NOZZLE INTERCHANGE (continued)

FLOODING NOZZLES AND TIPS

Flooding Tips		Flooding Nozzles		Delavan Raindrop® Drift-Control Nozzles
Delavan	Spraying Systems	Delavan	Spraying Systems	
D 5	None	F 5 (1/8")	None	None
D .75	TK .75	F 75 (1/8")	K .75 (1/8")	None
D 1	TK 1	F 1 (1/8")	K 1 (1/8")	RA 2 (1/4")
D 1.5	TK 1.5	F 1.5 (1/8")	K 1.5 (1/8")	None
D 2	TK 2	F 2 (1/8")	K 2 (1/8")	RA 4 (1/4")
D 2.5	TK 2.5	F 2.5 (1/8")	K 2.5 (1/8")	RA 5 (1/4")
D 2.5	TK 2.5	F 2.5 (1/4")	None	RA 5 (1/4")
D 3	TK 3	F 3 (1/8")	K 3 (1/8")	RA 6 (1/4")
D 3	TK 3	F 3 (1/4")	None	RA 6 (1/4")
D 4	TK 4	F 4 (1/8")	K 4 (1/8")	RA 8 (1/4")
D 4	TK 4	F 4 (1/4")	None	RA 8 (1/4")
D 5	TK 5	F 5 (1/8")	K 5 (1/8")	RA 10 (1/4")
D 5	TK 5	F 5 (1/4")	None	RA 10 (1/4")
D 7.5	TK 7.5	F 7.5 (1/8")	K 7.5 (1/8")	RA 15 (1/4")
D 7.5	TK 7.5	F 7.5 (1/4")	None	RA 15 (1/4")
D 7.5	TK 7.5	None	None	RA 15 (3/4")
D 10	TK 10	F 10 (1/8")	K 10 (1/8")	RA 20 (3/4")
D 10	TK 10	F 10 (1/4")	None	RA 20 (3/4")
None	None	F 12 (1/8", 1/4")	None	RA 25 (3/4")
D 15	TK 15	F 15 (1/8")	K 15 (1/8")	RA 30 (3/4")
D 15	TK 15	F 15 (1/4")	None	RA 30 (3/4")
D 18	None	F 18 (1/8", 1/4")	None	RA 35 (3/4")
D 20	TK 20	F 20 (1/8")	K 20 (1/8")	RA 40 (3/4")
D 20	TK 20	F 20 (1/4")	None	RA 40 (3/4")
None	None	None	None	RA 45 (3/4")
D 25	None	F 25 (1/4, 3/8")	None	RA 50 (3/4")
None	None	None	None	RA 55 (3/4")
D 30	TK 30	F 30 (1/4")	None	RA 60 (3/4")
D 30	TK 30	F 30 (3/8")	K 30 (3/8")	RA 60 (3/4")
None	None	None	None	RA 65 (3/4")
None	None	F 35 (3/8", 1/2")	K 35 (3/8")	RA 70 (3/4")
None	None	None	None	RA 75 (3/4")
None	None	F 40 (3/8")	K 40 (3/8")	RA 80 (3/4")
None	None	F 40 (1/2")	None	RA 80 (3/4")
None	None	None	None	RA 85 (3/4")
None	None	F 45 (3/8", 1/2")	K 45 (3/8")	RA 90 (3/4")
None	None	None	None	RA 95 (3/4")
None	None	F 50 (1/2")	K 50 (1/2")	RA 100 (3/4")
None	None	F 50 (3/4")	None	RA 100 (3/4")
None	None	None	None	RA 110 (3/4")
None	None	F 60 (1/2")	K 60 (1/2")	RA 120 (3/4")
None	None	F 60 (3/4")	None	RA 120 (3/4")
None	None	None	None	RA 130 (3/4")
None	None	F 70 (1/2", 3/4")	K 70 (1/2")	RA 140 (3/4")
None	None	None	None	RA 150 (3/4")
None	None	F 80 (1/2",)	K 80 (1/2")	RA 160 (3/4")
None	None	F 80 (3/4")	None	RA 160 (3/4")
None	None	None	None	RA 170 (3/4")
None	None	F 90 (3/4")	K 90 (3/4")	RA 180 (3/4")
None	None	None	None	RA 190 (3/4")
None	None	F 100 (3/4")	K 100 (3/4")	RA 200 (3/4")
None	None	F 100 (3/4")	None	None
None	None	None	K 110 (3/4")	RA 220 (3/4")
None	None	F 120 (3/4")	K 120 (3/4")	RA 240 (3/4")
None	None	None	None	RA 250 (3/4")
None	None	None	None	RA 280 (3/4")
None	None	None	None	RA 300 (3/4")
None	None	None	K 150 (3/4")	None
None	None	None	None	None
None	None	None	K 210 (3/4")	None

NOTE: [illegible] must be used at pressures greater than 20[illegible] 30 for specific calibration information.

REPAIR PARTS INTERCHANGE

SPRAY GUN REPAIR PARTS

(Refer to page 72)

Flat Spray Nozzles (0°, 25°, 40°, 65°)	
Delavan (nozzles sold singly)	Teel (4 nozzles included in each package)
WFF 4.5	1P845
WFF 5.5	1P846
WFF 8.5	1P847
WFF 10.0	1P848

TURBINE PUMPS

(Refer to pages 78-79)

Description	Delavan	Ace
1000 RPM TURBINE	26556-4	PTOC1000

CENTRIFUGAL PUMPS

(Refer to pages 80-81)

Description	Delavan	Hypro	Ace
4 GPM, Hydraulic Driven Centrifugal	34945-1	HM2	FMC204
10 GPM, Hydraulic Driven Centrifugal	35566-1	HM 1	FMC210

ROLLER PUMPS

(Refer to pages 82-84)

Description	Delavan	Teel	Hypro
6 Roller Back-Port with cast iron body	66-3110	1P734	6500
7-Roller Side-Port with cast iron body	77-3110	1P735A	1700C
7-Roller Side-Port with Ni-Resist Body	77-4110	1P736	1700N
7-Roller Side-Port, 1000 RPM, with cast iron body	77-3110HS	—	7560C
7-Roller Side-Port, 1000 RPM, with Ni-Resist body	77-4110HS	—	7560N

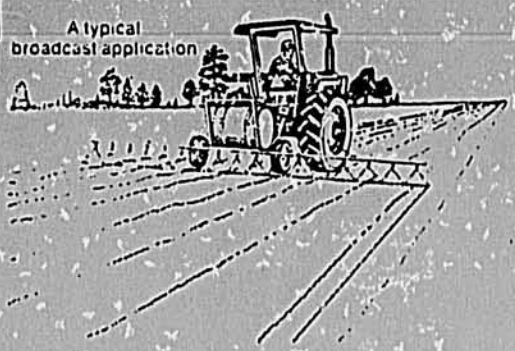
ROLLER PUMP REPAIR KITS

(Refer to page 83)

No. of Rollers	Delavan	Teel
6	25227	1P743
7	25228	1P744

LF NOZZLE TIPS: Flat Spray for broadcast spraying

nozzles and nozzle accessories



A typical broadcast application

Bulk P/N 31119 —

Nylon sizes LF-1 through LF-20 65°, 73°, 80° only

Brass or stainless steel in all tip sizes.

This tip is used when applying chemicals with broadcast sprayers, planter or cultivator attachments.

SPRAY CHARACTERISTICS – Delivers a fan-shaped spray pattern, finely tapered at each end. Tapered ends permit overlapping of spray patterns to assure uniform coverage.

FEATURES – Recessed orifice minimizes chances for damage. Wrench flats provide for easy pattern alignment.

MATERIALS – All sizes available in brass or stainless steel . . . also Nylon in sizes LF-1 through LF-20. LF-15 through LF-20 (80° only) available in color-coded, color-brated, totally molded Nylon. (See pages C1 through C8 — center 8 pages of catalog.)

SPRAY ANGLES — 65°, 73°, 80°, 100°, 100° — Brass & S.S
65°, 73°, 80° — Nylon
80° — Color-coded, totally molded Nylon

MAX. RECOMMENDED PRESSURE –
Brass: 500 psig (3500 kPa)
Nylon: 100 psig (700 kPa)
Stainless: 500 psig (3500 kPa)

MAX. RECOMMENDED TEMPERATURE –
120°F (50°C)

Shaded area represents sizes available in color-coded, color-brated totally molded Nylon in 80° only. (See pages C1 through C8 — center 8 pages of catalog.)

Based on Water

Nozzle Tip No	Standard Rating @ 30 PSIG and 4 MPH	Pressure (PSIG)	Capacity 1 Nozzle (GPM)	20" Spacing Gallons Per Acre (GPA) 3 MPH	4 MPH	5 MPH	7.5 MPH	10 MPH
LF-.67 65° & 80° (100 mesh)	4.3 GPA		.050	4.7	3.5	2.8	1.9	1.4
			.065	5.2	3.9	3.1	2.1	1.6
			.080	5.8	4.3	3.4	2.3	1.7
			.087	6.6	5.0	4.0	2.6	2.0
			.095	7.4	5.5	4.4	3.0	2.2
			.107	8.1	6.1	4.9	3.2	2.4
LF-1 • 65°, 80°, 100° (100 mesh)	6.4 GPA		.080	7.1	5.3	4.3	2.8	2.2
			.095	8.5	6.4	5.1	3.4	2.6
			.107	9.6	7.2	5.7	3.8	2.9
			.120	10.8	8.1	6.5	4.3	3.2
			.135	12.2	9.1	7.3	4.9	3.7
LF-1.5 • 65°, 80°, 100° (100 mesh) Brown	9.7 GPA		.120	10.8	8.1	6.5	4.3	3.2
			.135	12.2	9.2	7.3	4.9	3.6
			.150	13.6	10.2	8.1	5.4	4.0
			.165	14.9	11.1	8.9	6.0	4.5
			.180	16.2	12.1	9.7	6.5	4.8
			.195	17.5	13.1	10.5	7.0	5.2
LF-2 • 65°, 80°, 100° (50 mesh) Lime	12.9 GPA		.150	13.6	10.2	8.1	5.4	4.0
			.165	14.9	11.2	8.9	6.0	4.5
			.180	16.2	12.1	9.7	6.5	4.8
			.195	17.5	13.1	10.5	7.0	5.2
			.210	18.9	14.2	11.3	7.6	5.6
LF-3 • 65°, 80°, 110° (50 mesh) Orange	19 GPA		.195	17.5	13.1	10.5	7.0	5.2
			.210	18.9	14.2	11.3	7.6	5.6
			.225	20.3	15.2	12.2	8.1	6.0
			.240	21.6	16.2	13.0	8.6	6.4
			.255	23.0	17.2	13.8	9.2	6.8
			.270	24.3	18.2	14.6	9.7	7.2

• Nylon available in 65° & 80° only

Nozzle Tip No	Standard Rating @ 30 PSIG and 4 MPH	Pressure (PSIG)	Capacity 1 Nozzle (GPM)	20" Spacing Gallons Per Acre (GPA) 3 MPH	4 MPH	5 MPH	7.5 MPH	10 MPH
LF-4 • 65°, 80°, 110° (50 mesh) Yellow	26 GPA	20	28	28	21	16.8	11.2	8.4
		25	32	31	24	18.7	12.5	9.4
		30	35	34	26	21	13.7	10.3
		40	40	40	30	24	15.8	11.9
		50	45	44	33	27	17.7	13.3
		60	49	49	36	29	19.4	14.6
LF-5 • 65°, 80°, 110° (50 mesh) Dk. Blue	32 GPA	20	35	35	26	21	14.0	10.5
		25	40	39	29	23	15.7	11.7
		30	43	43	32	25	17.2	12.9
		40	50	49	37	30	19.8	14.9
		50	56	55	42	33	22	16.6
		60	61	61	45	36	24	18.2
LF-6 • 65°, 80°, 110° (50 mesh) Dk. Green	39 GPA	20	42	42	31	25	16.9	12.6
		25	47	47	35	28	18.7	14.1
		30	52	52	39	31	21	15.5
		40	60	59	45	36	24	17.8
		50	67	66	50	40	27	20
		60	73	73	55	44	29	22
LF-8 • 65°, 80°, 110° (50 mesh) Red	52 GPA	20	56	56	42	34	22	17.0
		25	63	63	47	37	25	19
		30	69	69	52	41	27	21
		40	80	79	59	48	32	24
		50	89	89	66	53	35	27
		60	98	97	73	58	39	29
LF-10 • 65°, 80° Tan	64 GPA	20	70	70	53	42	28	21
		25	78	78	59	47	31	24
		30	86	86	64	51	34	26
		40	100	99	74	59	40	30
		50	111	111	83	66	44	33
		60	122	121	91	73	49	36
LF-15 • 65° & 80° LL Blue	97 GPA	20	111	105	79	63	42	32
		25	124	117	88	71	47	35
		30	136	129	97	77	52	39
		40	157	148	111	89	59	45
		50	175	165	124	100	67	50
		60	192	181	136	109	73	55
LF20 • 65° & 80° LL Green	128 GPA	20	148	140	105	84	56	42
		25	166	156	117	94	63	47
		30	182	171	128	103	69	51
		40	210	198	149	119	79	59
		50	235	221	166	132	88	66
		60	257	242	182	146	97	73

D NOZZLE TIPS AND F NOZZLES: Flooding Spray for broadcast spraying

nozzles and nozzle accessories

These nozzles are used for broadcast applications.

SPRAY CHARACTERISTICS — Both types deliver a flat spray pattern with a wide spray angle. Varying chemical coverage can be obtained by mounting nozzles in different positions.

FEATURES — The D nozzle tip has screwdriver slot on all sizes. Large orifices reduce plugging. F nozzle is used mainly as boom nozzle for broadcast spraying.

MATERIALS — The D tip and F nozzle are available in brass and stainless steel in all sizes and in Nylon in some sizes. The D tip is available in color-coded, color-brated Nylon in sizes D2 through D10. (See pages C1 through C8 — center 8 pages of catalog.)

Additional corrosion resistance may be gained by using Nylon materials in some cases. Erosion resistance of stainless steel may be superior to Nylon when using abrasive fluids.

SPRAY ANGLES — Varies from 100°-145° depending on pressure and material. (For the spray angle of a specific nozzle, contact factory.)

MAX. RECOMMENDED PRESSURE-
Brass: 500 psig (3500 kPa)
Stainless: 500 psig (3500 kPa)
Nylon: 100 psig (700 kPa)
MAX. RECOMMENDED TEMPERATURE
120°F (50°C)

D FLOODING TIPS

Brass
S S
#29530-

Nylon
#29530-

F FLOODING NOZZLE with threaded inlet

Brass
S S
#29300-

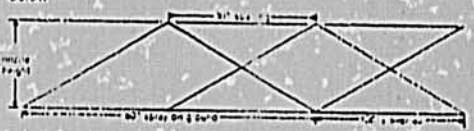
Nylon
#36160-
#36161-
#36162-

F FLOODING NOZZLE with quick coupler inlet to fit ½" & ¾" couplers

S.S.
#38392

Nylon
#36967-
#36707-
#36708-

Flooding nozzles are usually mounted on a boom in one of these two positions. Spray patterns should be overlapped to assure adequate coverage regardless of fluctuations in boom height as the sprayer travels over uneven ground. For example of recommended overlap, see below



BULK PART NUMBERS

PART NO.	NOZZLE TYPE & SIZE	MATERIAL
29530-	D5 - D30 Nozzle Tip	Brass, Nylon* & Stainless Steel
29300-	F5 - F210 [illegible] NPTM	Stainless Steel
36160-	F20 - F60 [illegible] NPTM	Nylon
36161-	F90 - F120 [illegible] NPTM	Nylon
36162-	F150 - F210 [illegible] NPTM	Nylon
38392	F20 - F210 Quick Coupler Inlet	Stainless Steel*
36967-	F20 - F60 [illegible] Quick Coupler Inlet	Nylon
36707-	F90 - F120 [illegible] Quick Coupler Inlet	Nylon
36708-	F150 - F210 [illegible] Quick Coupler Inlet	Nylon

* selected sizes, see chart

6 PER PACK DELAPAK CARDS FOR TYPE-D

NOZZLE TIP NUMBER	DELAPAK NUMBER (6 per pack)		
	BRASS	NYLON	STAINLESS STEEL
D-.75	73-690	—	73-697
D-1	73-684	—	73-685
D-1.5	73-686	—	73-687
D-2	73-688	73-932	73-689
D-2.5	73-690	73-53	73-691
D-3	73-692	73-57	73-693
D-4	73-710	73-935	73-711
D-5	73-694	73-61	73-695
D-6	73-696	73-937	73-697
D-7.5	73-698	73-64	73-699
D-10	73-700	73-68	73-701
D-15	—	73-69	73-703
D-20	—	73-73	73-707
D-30	—	—	73-709

D & F CAPACITIES (continued on page 42)

Shaded area shows sizes available in color-coded, color-brated totally molded nylon. (See page C1 through C8 — center 8 pages of catalog.)

Code: BR-brass; SS-stainless steel; NY-Nylon; QC-quick coupler inlet

NOZZLE NUMBER		PRESSURE (PSIG)	CAPACITY 1 NOZZLE (GPM)	GALLONS PER ACRE — BASED ON WATER											
				40" SPACING					60" SPACING						
D TIP	F NOZZLE			4 MPH	5 MPH	6 MPH	10 MPH	15 MPH	4 MPH	5 MPH	6 MPH	10 MPH	15 MPH	18 MPH
D.75	F.75	10	.075	2.8	2.2	1.9	1.1	.74	1.9	1.5	1.2	.74	.50	.41
BR		20	.11	3.9	2.2	2.6	1.6	1.1	2.6	2.2	1.8	1.1	.70	.56
SS	1/8" - SS	30	.13	4.8	3.9	3.2	1.9	1.3	3.2	2.6	2.1	1.3	.86	.71
		40	.15	5.6	4.5	3.7	2.2	1.5	3.8	3.0	2.5	1.5	.93	.82
D1	F1	10	.10	3.7	3.0	2.5	1.5	.99	2.4	2.0	1.6	1.0	.66	.56
BR		20	.14	5.3	4.2	3.5	2.1	1.4	3.6	2.8	2.3	1.4	.93	.78
SS	1/8" - SS	30	.17	6.4	5.1	4.3	2.6	1.7	4.2	3.4	2.9	1.7	1.1	.95
		40	.20	7.4	5.9	5.0	3.0	2.0	5.0	4.0	3.3	2.0	1.3	1.1
D1.5	F1.5	10	.15	5.6	4.5	3.7	2.2	1.5	3.8	3.0	2.5	1.5	.93	.82
BR		20	.21	7.9	6.3	5.3	3.2	2.1	5.2	4.2	3.5	2.2	1.4	1.2
SS	1/8" - SS	30	.25	9.6	7.7	6.4	3.9	2.6	6.4	5.2	4.3	2.6	1.7	1.4
		40	.30	11.1	8.9	7.4	4.5	3.0	7.4	6.0	5.0	3.0	2.0	1.6
D2	F2	10	.20	7.4	5.9	5.0	3.0	2.0	5.0	4.0	3.3	2.0	1.3	1.1
BR		20	.28	10.5	8.4	7.0	4.2	2.8	7.0	5.6	4.7	2.8	1.9	1.6
SS	1/8" - SS	30	.35	12.9	10.3	8.6	5.1	3.4	8.6	6.8	5.7	3.4	2.3	1.9
NY-Yellow		40	.40	14.8	11.9	9.9	5.9	4.0	9.8	8.0	6.6	4.0	2.6	2.2
D2.5	F2.5	10	.25	9.3	7.4	6.2	3.7	2.5	6.2	5.0	4.1	2.4	1.7	1.4
BR		20	.35	13.1	10.5	8.8	5.3	3.5	8.8	7.0	5.8	3.6	2.3	1.9
SS	1/8" - SS	30	.43	16.1	12.9	10.7	6.4	4.3	10.8	8.6	7.1	4.2	2.9	2.4
NY-Dk. Blue		40	.50	18.6	14.8	12.4	7.4	5.0	12.4	10.0	8.2	5.0	3.3	2.8
D3	F3	10	.30	11.1	8.9	7.4	4.5	3.0	7.4	6.0	5.0	3.0	2.0	1.6
BR		20	.42	15.5	12.6	10.5	6.3	4.2	10.6	8.4	7.0	4.2	2.8	2.3
SS	1/8" - SS	30	.52	19.3	15.4	12.9	7.7	5.1	12.8	10.2	8.6	5.2	3.4	2.9
NY-Dk. Green		40	.60	22	17.8	14.8	8.9	5.9	14.8	11.8	9.9	6.0	4.0	3.3
D4	F4	10	.40	14.8	11.9	9.9	5.9	4.0	9.8	8.0	6.6	4.0	2.6	2.2
BR		20	.57	21	16.8	14.0	8.4	5.6	14.0	11.2	9.3	5.6	3.7	3.1
SS	1/8" - SS	30	.69	26	20	17.1	10.3	6.9	17.2	13.8	11.4	6.8	4.6	3.9
NY-Red		40	.80	30	24	19.9	11.9	7.9	19.8	15.8	13.2	8.0	5.3	4.4
D5	F5	10	.50	18.6	14.9	12.4	7.4	5.0	12.4	10.0	8.2	5.0	3.3	2.8
BR		20	.71	26	21	17.5	10.5	7.0	17.6	14.0	11.7	7.0	4.7	3.9
SS	1/8" - SS	30	.87	32	26	21	12.9	8.6	21	17.2	14.3	8.6	5.7	4.8
NY-Tan		40	1.0	37	30	25	14.9	9.9	25	19.8	16.5	10.0	6.6	5.5
D6		10	.60	22	17.8	14.8	8.9	5.9	14.8	11.8	9.9	6.0	4.0	3.3
BR		20	.85	33	25	21.0	12.6	8.4	21	16.8	14.0	8.4	5.5	4.7
SS		30	1.0	39	31	26	15.4	10.3	26	21	17.1	10.2	6.9	5.7
NY-Purple		40	1.2	45	36	30	17.8	11.9	30	24	19.8	11.8	7.9	6.6
D7.5	F7.5	10	.75	28	22	18.6	11.1	7.4	18.6	14.8	12.4	7.4	5.0	4.1
BR		20	1.1	39	32	26	15.8	10.5	26	21	17.5	10.8	7.0	5.8
SS	1/8" - SS	30	1.3	48	38	32	19.3	12.9	32	26	21	12.8	8.6	7.1
NY-LL Blue		40	1.5	56	45	37	23	14.8	37	30	25	14.9	9.9	8.2
D10	F10	10	1.0	37	30	25	14.9	9.9	24.8	19.8	16.5	10.0	6.6	5.5
BR		20	1.4	53	42	35	21	14.0	35	28	23	14.0	9.3	7.8
SS	1/8" - SS	30	1.7	64	51	43	26	17.1	42	34	29	17.2	11.4	9.5
NY-LL Green		40	2.0	74	59	50	30	19.8	50	40	33	19.8	13.2	11.0
D15	F15	10	1.5	56	45	37	23	14.8	37	30	25	14.8	9.9	8.2
BR		20	2.1	79	63	53	32	21	52	42	35	21	14.0	11.7
SS	1/8" - SS	30	2.6	96	77	64	39	26	64	52	43	26	17.1	14.3
NY		40	3.0	111	89	74	45	30	74	60	50	30	19.8	16.5
D20	F20	10	2.0	74	59	50	30	19.8	50	40	33	19.8	13.2	11.0
BR	1/8" - SS	20	2.8	105	84	70	42	28	70	56	47	28	18.7	15.6
SS	1/2" - NY	30	3.5	128	103	86	51	34	86	68	57	34	23	19.1
NY	QC - NY, SS	40	4.0	148	119	99	59	40	98	80	66	40	26	22
D25	F25	10	2.5	93	74	62	37	25	62	50	41	25	16.5	13.8
BR		20	3.5	131	105	88	53	35	88	70	58	35	23	19.4
SS	3/8" - SS	30	4.3	161	129	107	64	43	108	86	71	42	29	24
		40	5.0	186	149	124	74	50	124	100	82	50	33	28
D30	F30	10	3.0	111	89	74	45	30	74	60	50	30	19.8	16.5
BR	3/8" - SS	20	4.2	156	126	105	63	42	106	84	70	42	28	23
SS	1/2" - NY	30	5.2	193	154	129	77	51	128	102	86	52	34	29
	QC - NY, SS	40	6.0	223	178	148	89	59	148	118	99	60	40	33

D & F CAPACITIES (continued from page 41)

Code: BR - brass; SS - stainless steel; NY - nylon; QC - quick coupler inlet

NOZZLE NUMBER	PRESSURE (PSIG)	CAPACITY 1-NOZZLE (GPM)	GALLONS PER ACRE — BASED ON WATER															
			40" SPACING					60" SPACING					120" SPACING*					
			4 MPH	5 MPH	6 MPH	10 MPH	15 MPH	4 MPH	5 MPH	6 MPH	10 MPH	15 MPH	18 MPH	4 MPH	5 MPH	6 MPH	10 MPH	15 MPH	18 MPH
F 35	10	3.5	130	104	87	52	35	86	70	58	35	23	19.2	43	35	29	17.3	11.6	9.6
3/8" - SS	20	4.9	184	147	123	74	49	122	78	82	50	33	27	61	49	41	25	16.3	13.6
1/2" - NY	30	6.1	225	180	150	90	60	150	120	100	60	40	33	75	60	50	30	20	16.7
QC - NY	40	7.0	260	208	173	104	69	174	138	116	70	46	38	87	69	58	35	23	19.2
F 40	10	4.0	148	119	99	59	40	100	80	66	40	26	22	50	40	33	19.8	13.2	11.0
3/8" - SS	20	5.7	210	168	140	84	56	140	112	93	56	37	31	70	56	47	28	18.7	15.6
1/2" - NY	30	6.9	257	206	171	102	69	172	138	114	68	46	38	86	69	57	34	23	19.1
QC - NY, SS	40	8.0	297	238	198	119	79	198	158	132	80	53	44	99	79	66	40	26	22
F 45	10	4.5	167	134	111	67	45	112	90	74	44	30	25	56	45	37	22	14.8	12.4
3/8" - SS	20	6.4	236	189	158	95	63	158	126	105	64	42	35	79	63	53	32	21	17.5
1/2" - NY	30	7.8	289	231	193	116	77	192	154	129	78	51	43	96	77	64	39	26	21.4
QC - NY	40	9.0	334	267	223	134	89	222	178	148	90	59	50	111	89	74	45	30	25
F 50	10	5.0	186	149	124	74	50	124	100	82	50	33	28	62	50	41	25	16.5	13.8
1/2" - SS	20	7.1	263	210	175	105	70	176	140	117	70	47	39	88	70	58	35	23	19.4
1/2" - NY	30	8.7	322	257	214	129	86	214	172	143	86	57	48	107	86	71	43	29	24
QC - NY, SS	40	10.0	371	297	248	149	99	248	198	165	100	66	55	124	99	82	50	33	28
F 60	10	6.0	223	178	148	89	59	148	119	99	60	40	33	74	59	50	30	19.8	16.5
1/2" - SS	20	8.5	315	252	210	126	84	210	168	140	84	56	47	105	84	70	42	28	23
1/2" - NY	30	10.4	386	309	257	154	103	258	206	171	102	69	57	129	103	86	51	34	29
QC - NY, SS	40	12.0	445	356	297	178	119	296	238	198	118	79	66	148	119	99	59	40	33
F 70	10	7.0	260	208	173	104	69	174	138	116	70	46	38	87	69	58	35	23	19.2
1/2" - SS	20	9.9	368	294	245	147	98	246	196	163	98	65	54	123	98	82	49	33	27
1/2" - NY	30	12.1	450	360	300	180	120	300	240	200	120	80	67	150	120	100	60	40	33
QC - NY	40	14.0	520	416	346	208	139	346	278	231	138	92	77	173	139	116	69	46	38
F 80	10	8.0	297	238	198	119	79	198	158	132	80	53	44	99	79	66	40	26	22
1/2" - SS	20	11.3	420	336	280	168	112	280	224	187	112	75	62	140	112	93	56	37	31
1/2" - NY	30	13.9	514	412	343	206	137	342	274	229	138	91	76	171	137	114	69	46	38
QC - NY, SS	40	16.0	594	475	396	238	158	396	316	264	158	106	88	198	158	132	79	53	44
F 90	10	9.0	334	267	223	134	89	222	178	148	90	59	50	111	89	74	45	30	25
3/4" - SS, NY	20	12.7	473	378	315	189	126	316	252	210	126	84	70	158	126	105	63	42	35
QC - NY	30	15.6	579	463	386	231	154	386	314	257	154	103	86	193	154	129	77	51	43
	40	18.0	668	535	446	267	178	446	356	297	178	118	99	223	178	148	89	59	50
F 100	10	10.0	371	297	248	149	99	248	198	165	100	66	55	124	99	82	50	33	28
3/4" - SS, NY	20	14.1	525	420	350	210	140	350	280	233	140	93	78	175	140	117	70	47	39
QC - NY, SS	30	17.3	643	514	429	257	171	428	342	286	172	114	95	214	171	143	86	57	48
	40	20.0	743	594	495	297	198	496	396	330	198	132	110	248	198	165	99	66	55
F 108	10	10.8	401	321	267	160	107	268	214	178	106	71	59	134	107	89	53	36	30
3/4" - SS, NY	20	15.3	567	454	378	227	151	378	302	252	152	101	84	189	151	126	76	50	42
QC - NY	30	18.7	694	556	463	278	185	462	370	309	186	123	103	231	185	154	93	62	51
	40	21.6	802	642	535	321	214	534	428	356	214	143	119	267	214	178	107	71	59
F 120	10	12.0	446	356	297	178	119	296	238	198	118	79	66	149	119	99	59	40	33
3/4" - SS, NY	20	17.0	630	504	420	252	168	420	336	280	168	112	93	210	168	140	84	56	47
QC - NY, SS	30	20.8	772	617	514	309	206	514	412	343	206	137	114	257	206	171	103	69	57
	40	24.0	891	713	594	356	238	594	476	396	238	158	132	297	238	198	119	79	66
F 150	10	15.0	557	446	371	223	149	372	298	248	148	99	82	186	149	124	74	50	41
3/4" - SS, NY	20	21.2	788	630	525	315	210	526	420	350	210	140	117	263	210	175	105	70	58
QC - NY, SS	30	26.0	965	772	643	386	257	642	514	429	258	171	143	321	257	214	129	86	71
	40	30.0	1114	891	742	446	297	742	594	495	296	198	165	371	297	248	149	99	82
F 180	10	18.0	668	535	446	267	178	446	356	297	178	119	99	223	178	148	89	59	50
3/4" - SS, NY	20	25.5	945	756	630	378	252	630	504	420	252	168	140	315	252	210	126	84	70
QC - NY, SS	30	31.2	1157	926	772	463	309	772	618	514	308	206	171	386	309	257	154	103	86
	40	36.0	1337	1069	891	535	356	892	712	594	356	238	198	446	356	297	178	119	99
F 200	10	20.0	743	594	495	297	198	496	396	330	198	132	110	248	198	165	99	66	55
3/4" - SS, NY	20	28.3	1050	840	700	420	280	700	560	467	280	187	156	350	280	233	140	93	78
QC - NY	30	34.6	1286	1029	857	514	343	858	686	572	342	229	191	429	343	286	171	114	95
	40	40.0	1485	1188	990	594	396	998	792	660	396	264	220	499	396	330	198	132	110
F 210	1	21.0	780	624	520	312	208	520	416	346	208	139	116	260	208	173	104	69	58
3/4" - SS, NY	[illegible]	29.7	1103	882	735	441	294	736	588	490	294	196	163	368	294	245	147	98	82
QC - NY, SS	[illegible]	36.4	1350	1080	900	540	360	900	720	600	360	240	200	450	360	300	180	120	100
	[illegible]	42.0	1559	1247	1039	624	416	1040	832	693	416	277	231	520	416	346	208	139	116

[illegible] conversion factors to [illegible]

*At 120° spacing, viscosity or specific gravity of the material may seriously affect coverage.

WHEN ORDERING Nylon F Flooding Nozzles, please order in multiples of 12 only.

DELAVAN

Color-Brate

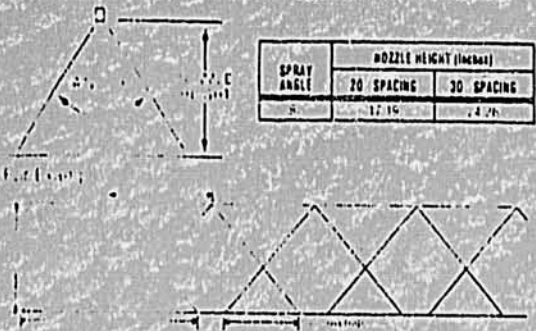
LF Flat Fan Spray Tips

The most commonly used type of broadcast spray tip. It produces a fan shaped spray pattern, finely tapered at each end [illegible] permit overlapping of spray patterns to assure uniform coverage.

FEATURES

- Color-coding system makes it easy to match nozzle flow rates (gpm) for easy calibration.
- Superior molding process of Zytel® Nylon insures high quality nozzle tips — no machining necessary. (See page C7)
- Recessed orifice minimizes chances for damage.
- Wrench flats provide for easy pattern alignment.
- Color-Brate™ color coded LF tips are available in 80° spray angle only in Zytel® Nylon. (See #1609F Delavan Agspray Products Catalog for other tip sizes and spray angles available.)

APPROXIMATE NOZZLE HEIGHT in Inches



SPRAY ANGLE	NOZZLE HEIGHT (inches)	
	20 SPACING	30 SPACING
80°	17-19	24-28

Capacities

MAX. RECOMMENDED PRESSURE: Nylon: 100 psig (700 kPa)

MAX. RECOMMENDED TEMPERATURE: 120°F (50°C)

Nozzle Tip No. Color Code	Pressure (PSIG)	Capacity 1 Nozzle (GPM)	20" Spacing Gallons Per Acre (GPA) Based on Water				
			3 MPH	4 MPH	5 MPH	7.5 MPH	10 MPH
LF-1 (50 mesh)	20	.42	42	31	25	16.9	12.6
	25	.47	47	35	28	18.7	14.1
	30	.52	52	39	31	21	15.5
	40	.60	59	45	36	24	17.8
	50	.67	66	50	40	27	20
	60	.73	73	55	44	29	22
LF-2 80° (50 mesh)	20	.56	56	42	34	22	17.0
	25	.63	63	47	37	25	19
	30	.69	69	52	41	27	21
	40	.80	79	59	46	32	24
	50	.89	89	66	53	35	27
	60	.98	97	73	58	39	29
LF-3 80°	20	.70	70	53	42	28	21
	25	.78	78	59	47	31	24
	30	.86	86	64	51	34	25
	40	1.0	99	74	59	40	30
	50	1.1	111	83	66	44	33
	60	1.2	121	91	73	49	36
LF-4 80° (50 mesh)	20	1.1	106	79	63	42	32
	25	1.2	117	88	71	47	35
	30	1.3	129	97	77	52	39
	40	1.5	148	111	89	59	44
	50	1.7	165	124	100	67	50
	60	1.8	181	136	109	73	55
LF-5 80° (50 mesh)	20	1.4	140	105	84	56	42
	25	1.6	156	117	94	63	47
	30	1.7	171	128	103	69	51
	40	2.0	198	149	119	79	59
	50	2.2	221	166	132	88	66
	60	2.5	242	182	146	97	73

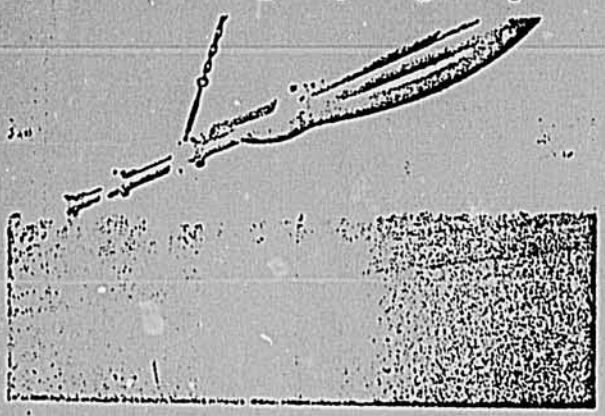
Nozzle Tip No. Color Code	Pressure (PSIG)	Capacity 1 Nozzle (GPM)	20" Spacing Gallons Per Acre (GPA) Based on Water				
			3 MPH	4 MPH	5 MPH	7.5 MPH	10 MPH
LF-10 80°	20	.70	70	53	42	28	21
	25	.78	78	59	47	31	24
	30	.86	86	64	51	34	25
	40	1.0	99	74	59	40	30
	50	1.1	111	83	66	44	33
	60	1.2	121	91	73	49	36
LF-15 80°	20	1.1	106	79	63	42	32
	25	1.2	117	88	71	47	35
	30	1.3	129	97	77	52	39
	40	1.5	148	111	89	59	44
	50	1.7	165	124	100	67	50
	60	1.8	181	136	109	73	55
LF-20 80°	20	1.4	140	105	84	56	42
	25	1.6	156	117	94	63	47
	30	1.7	171	128	103	69	51
	40	2.0	198	149	119	79	59
	50	2.2	221	166	132	88	66
	60	2.5	242	182	146	97	73

DELAVAN

Color-Brate

D

Flooding Spray Tips



This is a wide-angle, broadcast flat spray tip. 100% overlap of spray pattern is recommended to assure adequate coverage. (See diagram.)

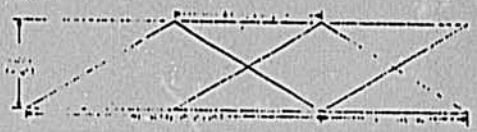
FEATURES:

- Color-coding makes it easy to match nozzle flow rates (gpm) for easy calibration.
- Superior molding process of Zytel® Nylon insures high quality nozzle tips — no machining necessary. (See page C7.)
- Large orifice reduces plugging.
- Screwdriver slot provides for easy pattern alignment.
- Color-Brate™ color-coded D tips are available in Zytel® Nylon only.

(See #1609F Delavan Agspray Products Catalog for other tip sizes available.)

Recommended Nozzle Positioning and Overlap

Flooding nozzles are usually mounted on a boom in one of these positions. Spray patterns should be overlapped to assure adequate coverage regardless of fluctuations in boom height as the spray rig travels over uneven ground. For example of recommended overlap see below.



Capacities

NOZZLE NUMBER / Color Code	PRESSURE (PSIG)	CAPACITY 1-NOZZLE (GPM)	GALLONS PER ACRE — BASED ON WATER											
			40" SPACING					60" SPACING						
			4 MPH	5 MPH	6 MPH	10 MPH	15 MPH	4 MPH	5 MPH	6 MPH	10 MPH	15 MPH	18 MPH
D2	40	.20	74	59	50	30	20	50	40	33	20	13	11
	60	.26	105	84	70	42	28	70	56	47	28	19	16
	80	.30	129	103	86	51	34	86	68	57	34	23	19
	100	.40	148	119	99	59	40	98	80	66	40	26	22
	20	.15	83	74	62	37	25	62	50	41	24	17	14
	30	.20	111	105	88	53	35	88	70	58	36	23	19
	40	.23	131	120	107	64	43	108	86	71	42	29	24
	60	.28	166	148	124	74	50	124	100	82	50	33	28
	20	.17	111	89	74	45	30	74	60	50	30	20	16
	40	.24	165	126	105	63	42	106	84	70	42	28	23
	60	.30	193	154	129	77	51	128	102	86	52	34	29
	80	.35	222	178	148	89	59	148	118	99	60	40	33
	40	.28	148	118	99	59	40	98	80	66	40	26	22
	60	.34	211	168	140	84	56	140	112	93	56	37	31
	80	.40	259	207	172	103	69	172	138	114	68	46	38
	100	.45	324	259	216	129	86	198	156	132	80	53	44
D5	20	.30	185	148	124	74	50	124	100	82	50	33	28
	30	.37	231	185	154	93	62	176	140	117	70	47	39
	40	.43	268	214	179	107	72	21	172	143	86	57	48
	60	.50	312	250	208	125	83	25	198	165	100	66	55
	20	.23	143	114	95	57	38	148	118	99	60	40	33
	30	.28	175	140	116	70	47	21	168	140	84	56	47
	40	.33	205	164	137	82	55	26	21	171	102	69	57
	60	.40	248	198	165	99	66	30	24	198	118	79	66
D7.5	20	.34	211	169	141	85	56	169	135	113	68	45	38
	30	.42	261	209	174	104	70	30	24	201	120	80	67
	40	.48	298	238	198	119	79	34	27	228	137	91	76
	60	.58	360	288	240	144	96	41	33	276	166	110	92
D10	20	.45	279	223	186	112	74	223	178	149	89	59	50
	30	.55	342	273	228	137	91	44	35	263	158	105	88
	40	.64	397	318	265	159	106	51	41	306	183	122	102
	60	.78	484	387	323	194	129	62	50	372	223	149	124

MAX. RECOMMENDED PRESSURE:
Nylon: 100 psig (700 kPa)

MAX. RECOMMENDED TEMPERATURE:
120°F (50°C)

DC NOZZLE TIPS (Disc-Core): Hollow Cone Spray for chemical application

nozzles and nozzle accessories

This tip is used when applying chemicals, especially in directed spray applications. Also used in mist blowers for their fine atomization at higher pressures. When disc is used alone, it will provide a straight stream spray for recirculating sprayers and aerial applications.

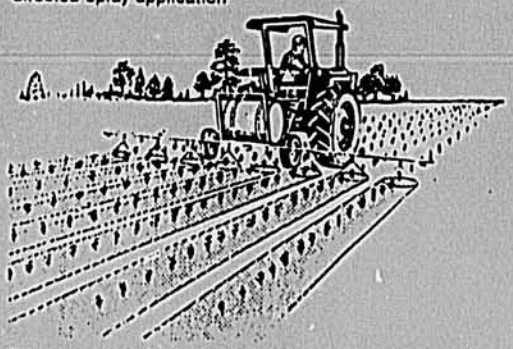
SPRAY CHARACTERISTICS — Delivers a hollow cone spray pattern with relatively large droplets at lower pressures. As pressure increases, atomization becomes much finer. The disc alone will provide a straight stream spray.

FEATURES — Disc and core are compatible with other make hollow cone components as well as all Delavan components.

MATERIALS — The core is Nylon. The disc is hardened stainless steel or stainless steel.

SPRAY ANGLES — Vary from 40°-110° depending on disc-core combination.

A typical directed spray application



For aerial applications of Disc/Core nozzle tips, also refer to page 34.

For Delapak Numbers for the Nylafil Slotted Strainer see page 21.

STRAINER RECOMMENDATIONS — A Nylafil (glass-filled Nylon) slotted strainer is suggested for use with DC tips.
Use #19410-1 for capacities to .09 GPM @ 40 PSIG
Use #19410-2 from .10 to .50 GPM @ 40 PSIG
Use #19410-3 from .51 GPM and higher @ 40 PSIG

MAX. RECOMMENDED PRESSURE-
500 psig (3500 kPa)
MAX. RECOMMENDED TEMPERATURE
120°F (50°C)

DELAPAK CARDS FOR DISCS & CORES

STAINLESS STEEL DISCS	
#34553 Disc No.	Delapak No. 12 per pack
# 4	73-220
# 5	73-222
# 6	73-254
# 7	73-260
# 8	73-293
#10	73-297
#12	73-323
#14	73-326

NYLON CORES	
#18664 Core No.	Delapak No. 12 per pack
#13	73-983
#23	73-984
#25	73-985
#45	73-986
#46	73-987
#56	73-988

DISC
SS-#34553
HSS-#12283

CORE
(Nylon)
#18664

CAPACITIES FOR DISC ORIFICE ONLY — Straight Stream Spray for recirculating sprayers and aerial applications

BASED ON WATER

Disc Number	Equiv. Orifice Dia.	Press. (PSIG)	Cap. (GPM)
		10	11
		15	14
		20	16
		25	18
		30	20
		40	23
		50	26
4	.41		
		10	15
		15	18
		20	21
		25	23
		30	25
		40	29
		50	32
5	.47		
		10	20
		15	24
		20	28
		25	31
		30	34
		40	39
		50	44
6	.54		
		10	26
		15	32
		20	37
		25	41
		30	45
		40	52
		50	58
7	.109		
		10	74
		15	91
		20	105
		25	117
		30	128
		40	148
		50	165
		10	11
		15	14
		20	16
		25	18
		30	20
		40	23
		50	26
	125		
		10	16
		15	20
		20	23
		25	26
		30	28
		40	32
		50	36
10	.156		

Disc Number	Equiv. Orifice Dia.	Press. (PSIG)	Cap. (GPM)
		10	26
		15	32
		20	37
		25	41
		30	45
		40	52
		50	58
12	.188		
		10	37
		15	45
		20	52
		25	58
		30	64
		40	74
		50	82
14	.213		
		10	51
		15	62
		20	72
		25	80
		30	88
		40	102
		50	114
	250		

See page 13 for conversion factors for other row spacing.

See page 34 for calibration gpa for aerial application.

DC (DISC/CORE) CAPACITIES

Based on Water

Disc & Core Number	PSIG	Cap. (GPM)	Spray Angle	ONE NOZZLE PER 30° ROW 3 MPH	4 MPH	5 MPH	TWO NOZZLES PER 30° ROW 3 MPH	4 MPH	5 MPH	THREE NOZZLES PER 30° ROW 3 MPH	4 MPH	5 MPH	ONE NOZZLE PER 40° ROW 3 MPH	4 MPH	5 MPH	TWO NOZZLES PER 40° ROW 3 MPH	4 MPH	5 MPH	THREE NOZZLES PER 40° ROW 3 MPH	4 MPH	5 MPH
DC 2-13			70°																		
DC 2-23			65°																		
DC 3-23			70°																		
DC 2-25			50°																		
DC 3-25			65°																		
DC 3-45			60°																		
DC 4-25			75°																		
DC 5-25			80°																		
DC 5-45			75°																		
DC 7-25			70°																		
DC 6-45																					

See page [illegible] for tips for aerial application.

*Fully [illegible] pattern may not result with all nozzles when operated at 20 psig or lower.

(Continued from page 52)

BASED ON WATER

Disc & Core Number	PSIG	Cap (GPM)	Spray Angle	ONE NOZZLE PER 30° ROW 3 MPH	4 MPH	5 MPH	TWO NOZZLES PER 30° ROW 3 MPH	4 MPH	5 MPH	THREE NOZZLES PER 30° ROW 3 MPH	4 MPH	5 MPH	ONE NOZZLE PER 40° ROW 3 MPH	4 MPH	5 MPH	TWO NOZZLES PER 40° ROW 3 MPH	4 MPH	5 MPH	THREE NOZZLES PER 40° ROW 3 MPH	4 MPH	5 MPH
	20	46		32	24	19.0	63	48	38	95	71	57	24	17.8	14.3	48	36	29	71	53	43
	30	66		45	34	27	90	67	54	135	101	81	34	25	20	67	50	40	101	76	61
	40	84		55	42	33	111	83	67	166	125	100	42	31	25	83	62	50	125	94	75
DC 7-45	50	97	85°	64	48	38	128	96	77	192	144	115	48	36	29	96	72	58	144	108	86
	60	111		73	55	44	147	110	88	220	165	132	55	41	33	110	82	66	165	124	99
	80	135		89	67	53	178	134	107	267	200	160	67	50	40	134	100	80	200	150	120
	100	174		115	86	69	230	172	138	345	258	207	86	65	52	172	130	103	258	194	155
	120	225		148	111	89	297	223	178	445	335	267	111	84	67	223	167	134	335	251	200
	20	54		36	27	21	71	53	43	107	80	64	27	20	16.0	53	40	32	80	60	48
	30	77		51	38	30	102	76	61	152	114	91	38	29	23	76	57	46	114	86	69
	40	94		62	46	37	124	93	74	186	140	112	46	35	28	93	70	56	140	105	84
DC 5-46	50	110	40°	73	54	44	145	109	87	218	163	131	54	41	33	109	82	65	163	123	98
	60	125		82	62	50	165	124	99	248	186	148	62	46	37	124	93	74	186	139	111
	80	150		99	74	59	198	148	119	297	223	178	74	56	45	148	111	89	223	167	134
	100	193		127	96	76	255	191	153	382	287	229	96	72	57	191	143	115	287	215	172
	120	247		163	122	98	326	245	196	489	367	293	122	92	73	245	183	147	367	275	220
	20	59		39	29	23	78	58	47	117	88	70	29	22	17.5	58	44	35	88	66	53
	30	84		55	42	33	111	83	67	166	125	100	42	31	25	83	62	50	125	94	75
	40	104		69	51	41	137	103	82	206	154	124	51	39	31	103	77	62	154	116	93
DC 8-45	50	121	90°	80	60	48	160	120	96	240	180	144	60	45	36	120	90	78	180	135	108
	60	135		89	67	53	178	134	107	267	200	160	67	50	40	134	100	80	200	150	120
	80	168		111	83	67	222	166	133	333	249	200	83	62	50	166	125	100	249	187	150
	100	217		143	107	86	286	215	172	430	322	258	107	81	64	215	161	129	322	242	193
	120	278		183	138	110	367	275	220	550	413	330	138	103	83	275	208	165	413	310	248
	20	61		40	30	24	81	60	48	121	91	72	30	23	18.1	60	45	36	91	68	54
	30	93		61	46	37	123	92	74	184	138	110	46	35	28	92	69	55	138	104	83
	40	115		76	57	46	152	114	91	228	171	137	57	43	34	114	85	68	171	128	102
DC 12-25	50	132	110°	87	65	52	174	131	104	261	196	157	65	49	39	131	98	78	196	147	118
	60	147		97	73	58	194	145	116	291	218	175	73	55	44	145	109	87	218	164	131
	80	181		119	90	72	239	179	143	358	269	215	90	67	54	179	134	108	269	202	161
	100	234		154	116	93	309	232	185	463	347	278	116	87	69	232	174	139	347	261	208
	120	295		195	146	117	389	292	234	584	438	350	146	110	88	292	219	175	438	329	263
	20	72		48	36	29	95	71	57	143	107	86	36	27	21	71	53	43	107	80	64
	30	103		68	51	41	136	102	82	204	153	122	51	38	31	102	76	61	153	115	92
	40	126		83	62	50	166	125	100	249	187	150	62	47	37	125	94	75	187	140	112
DC 14-25	50	147	110°	97	73	58	194	145	116	291	218	175	73	55	44	145	109	87	218	164	131
	60	165		109	82	65	218	163	131	327	245	196	82	61	49	163	123	98	245	184	147
	80	202		133	100	80	266	200	160	400	300	240	100	75	60	200	150	120	300	225	180
	100	261		172	129	103	345	258	207	516	388	310	129	97	78	258	194	155	388	291	233
	120	331		218	164	131	437	328	262	655	492	393	164	123	98	328	246	197	492	369	295
	20	78		51	39	31	103	77	62	154	116	93	39	29	23	77	58	46	116	87	69
	30	110		73	54	44	145	109	87	218	163	131	54	41	33	109	82	65	163	123	98
	40	135		89	67	53	178	134	107	267	200	160	67	50	40	134	100	80	200	150	120
DC 6-46	50	156	50°	104	78	63	209	156	125	313	235	188	78	59	47	156	117	94	235	176	141
	60	173		114	86	69	228	171	137	342	257	206	86	64	51	171	128	103	257	193	154
	80	216		143	107	86	285	214	171	428	321	257	107	80	64	214	160	128	321	241	192
	100	279		184	138	110	368	276	221	552	414	331	138	104	83	276	207	166	414	311	249
	120	352		232	174	139	465	348	279	697	523	418	174	131	105	348	261	209	523	392	314
	20	95		63	47	38	125	94	75	188	141	113	47	35	28	94	71	56	141	106	85
	30	136		90	67	54	180	135	108	269	202	162	67	51	40	135	101	81	202	151	121
	40	168		111	83	67	222	166	133	333	249	200	83	62	50	166	125	100	249	187	150
DC 12-45	50	195	100°	129	97	77	257	193	154	386	290	232	97	72	58	193	145	116	290	217	174
	60	220		145	109	87	290	218	174	436	327	261	109	82	65	218	163	131	327	245	196
	80	269		178	133	107	355	266	213	533	399	320	133	100	80	266	200	160	399	300	240
	100	347		229	172	137	458	344	275	687	515	412	172	129	103	344	258	206	515	386	309
	120	440		290	218	174	581	436	348	871	653	523	218	163	131	436	327	261	653	490	392
	20	107		71	53	42	141	106	85	212	159	127	53	40	32	106	79	64	159	119	95
	30	152		100	75	60	201	150	120	301	226	181	75	56	45	150	113	90	226	169	135
	40	186		123	92	74	246	184	147	368	276	221	92	69	55	184	138	110	276	207	166
DC 7-56	50	215	50°	142	106	85	284	213	170	426	319	255	106	80	64	213	160	128	319	239	192
	60	240		158	119	95	317	238	190	475	356	285	119	89	71	238	178	143	356	267	214
	80	294		194	146	116	388	291	233	582	437	349	146	109	87	291	218	175	437	327	262
	100	380		251	188	150	502	376	301	752	564	451	188	141	113	376	282	226	564	423	339
	120	481		317	238	190	635	476	381	952	714	571	238	179	143	476	357	286	714	536	429
	20	133		86	64	51	172	129	103	257	193	154	64	48	39	129	97	77	193	145	116
	30	184		121	91	73	243	182	146	364	273	219	91	68	55	182	137	109	273	205	164
	40	225		148	111	89	297	223	178	445	335	267	111	84	67	223	167	134	335	251	200
DC 8-46	50	262	60°	173	130	104	346	259	208	519	389	311	130	97	78	259	195	156	389	292	233
	60	293		193	145	116	387	290	232	580	435	348	145	109	87	290	218	174	435	326	261
	80	360		236	178	143	475	356	285	713	535	428	178	134	107	356	267	214	535	401	321
	100	464		306	230	184	612	459	367	919	689	551	230	172	138	459	345	276	689	517	413
	120	568		388	291	233	776	582	466	1164	873	699	291	218	175	582	437	349	873	655	524
	20	136		90	67	54	180	135	108	269	202	162	67	50	40	135	101	81	202	151	121
	30	193		127	96	176	255	191	153	382	287	229	96	72	57	191	143	115	287	215	172
	40	238		156	117	93	312	234	187	467	350	280	117	88	70	234	175	140	350	263	210
DC 6-56	50	273	60°	180	135	108	360	270	216	541	405	324	135	101	81	270	203	162	405	304	243
	60	305		201	151	121	403	302	242	604	453	362	151	113	91	302	226	181	453	340	272
	80	373		246	185	148	492	369	295	739	554	443	185	138	111	369	277	222	554	415	332
	100	482		318	239	191	636	477	382	954	716	573	239	179	143	477	358	286	716	537	429
	120	590		403	302	242	805	604	483	1208	906	725	302	226	181	604	453	362	906	679	544
	20	175		116	87	69	231	173	139	346	260	208	87	65	52	173	130	104	260	195	156
	30	248		164	123	98	327	246	196	491	368	295	123	92	74	246	184	147	368	278	221
	40	302		201	151	121	403	302	242	604	453	362	151	113	91	302	226	181	453	340	272
DC 10-46	50	349	60°	233	175	140	466	349	280	699	524	419	175	131	105	349	262	210	524	393	315
	60	391		261	196	157	523	392	314	784	588	470	196	147	118	392	294	235	588	441	353
	80	462		319	239	191	638	478	383	956	717	574	239	179	143	478	358	287	717	538	430
	100	596		411	308	246	821	616	493	1232	924	739	308	231	185	616	462	369	924	693	554
	120	729		503	377	302	1006	754	603	1509	1131	905	377	283	226	754	565	452	1131	848	679
	20	216		143	107	86	286	215	172	429	322	258	107	80	64	215	161	129	322	242	193
	30	306		202	152	121	405	304	243	608	456	365	152	114	91	304	228	182	456	342	274
	40	374		247	185	148	494	370	296	741	556	445	185	139	111	370	278	222	556	417	333
DC 10-56	50	432	60°	285	214	171	571	428	342	856	642	513	214	160	128	428	321	257	642	481	385
	60	484		320	240	192	640	480	384	960	720	576	240	180	144	480	360	288	720	540	432
	80	572		378	283	227	755	567	453	1133	850	680	283	212	170	567	425	340	850	638	510
	100	738		487	365	292	974	730	584	1460	1095	876	365	274	219	730	547	438	1095	821	657
	120	902		595	446	357	1191	893	714	1786	1339	1071	446	335	268	893	670	536	1339	1004	804

*Fully developed cone pattern may not result with all nozzles when operated at 20 psig or lower.

TeeJet® NOZZLE ASSEMBLIES with INTERCHANGEABLE PARTS

for spraying herbicides, insecticides, fertilizers and other chemicals

Type 1/4T with 1/4" NPT FEMALE pipe connection

Type 1/4TT with 1/4" NPT MALE pipe connection

Weight brass and stainless steel 2½ ounces
aluminum 1 ounce
nylon ¾ ounce

Tips 1/2 GS also supplied with ⅛" ¼" and ⅜" NPT pipe connections . . . see page 27.

TeeJet Spray Nozzles with interchangeable Flat Spray Tips assure uniform ground coverage by means of multiple nozzle boom spraying. Each tip produces a tapered edge spray pattern for uniform coverage where patterns overlap. Each tip is also designed for uniform distribution and for accuracy in flow rate and spray pattern as specified. Spray tips and internal strainers may be changed simply by removing caps . . . without removing nozzle bodies from boom.

TeeJet® FLAT SPRAY TIP TAPERED EDGE PATTERN

TeeJet nozzles with tapered edge spray patterns assure overall uniform coverage by the boom . . . with no excess spray in the overlap zones. Spray Tips should be rotated approximately 12° to 15° so that patterns are slightly offset as shown.

TeeJet® FLAT SPRAY TIP DESIGN

All TeeJet Spray Tips are interchangeable so that capacity, spray angle and type of spray may be changed without removing nozzle bodies from the spray boom. Design features of TeeJet Flat Spray Tips include:

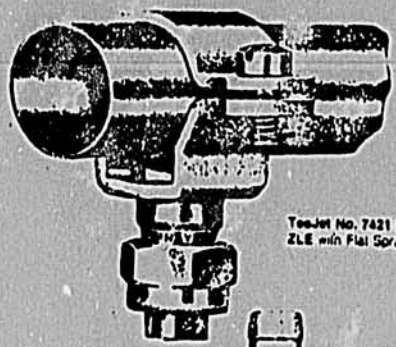
- Parallel flats as a guide for easy alignment of patterns.
- Recessed orifice to protect from accidental damage.
- Air flow channels on either side of the orifice prevent distortion and turbulence of spray pattern edges.

TeeJet® SPRAY NOZZLE ASSEMBLIES

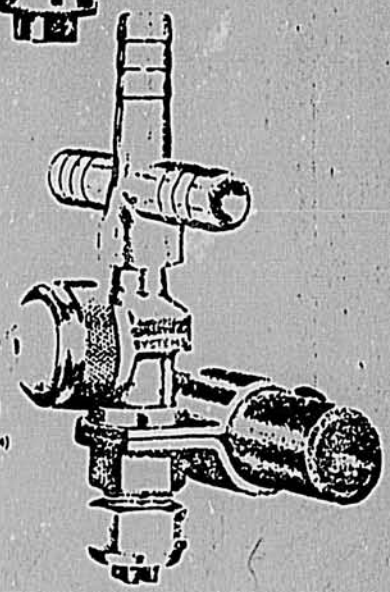
Type 1/4T and 1/4TT TeeJet Spray Nozzles are usually four part assemblies . . . except in larger capacities where a strainer is not needed. Other TeeJet Nozzle bodies are shown at right and also on page 4. See table below for choice of materials.

PARTS	CHOICE OF MATERIALS	
Type T / Type TT	Brass	Aluminum
	Nylon	Aluminum-Electrolimed
	Steel	Stainless Steel
Strainer	Brass	Stainless Steel
	Aluminum	Polypropylene
Flat Spray Tip	Brass	Stainless Steel
	Aluminum	Hardened Stainless Steel
	Steel	
Cap	Brass	Aluminum
	Nylon	Aluminum-Electrolimed
	Steel	Stainless Steel

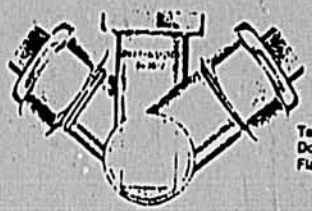
TYPICAL TeeJet® BODY ASSEMBLIES



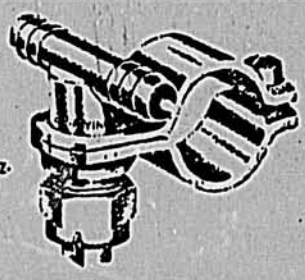
TeeJet No. 7421 SPLIT-EYELET NOZZLE with Flat Spray Tip (see page 29)



TeeJet No. 13430-3 Nylon TRIPLE HOSE SHANK DIAPHRAGM NOZZLE with Flat Spray Tip (see page 44)



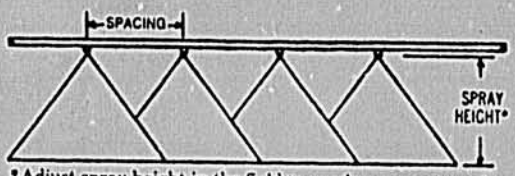
TeeJet No. 8600-2 Nylon Double Swivel Nozzle with Flat Spray Tip (see page 28)



TeeJet Type 112 VARI-SPACING NOZZLE with Flat Spray Tip (see page 31)

For details on nozzle parts . . . see page 27

TeeJet SPRAY NOZZLES WITH FLAT SPRAY TIPS 65° AND 80° SERIES



HOW TO ORDER: For complete TeeJet Nozzle, specify Nozzle Body, Tip No., Material. Example: 6506 Brass. (For body options see pages 4 and 27). To order Spray Tip only, specify Tip No., Material. Example: 6501 Brass

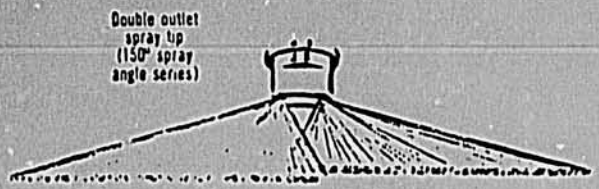
*Adjust spray height in the field to overlap approximately 30% of each edge of pattern. See page 6 for suggested spray heights.

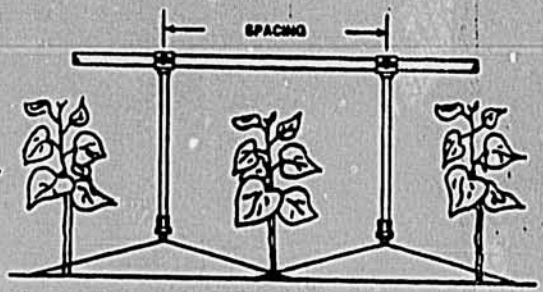
TIP NO. (Stainless Screen Size) 65° Series	TIP NO. (Stainless Screen Size) 80° Series	Liquid Pressure in PSI	Capacity 1 Nozzle in GPM	GALLONS PER ACRE—20" SPACING 4 MPH	5 MPH	6 MPH	7 MPH	8 MPH	10 MPH	12 MPH	14 MPH	16 MPH	GALLONS PER ACRE—30" SPACING 4 MPH	5 MPH	6 MPH	7 MPH	8 MPH	10 MPH	12 MPH	14 MPH	16 MPH
650067	800067	20	.05	3.5	2.8	2.4	2.0	1.8	1.4	1.2	1.0	—	2.4	1.9	1.6	1.3	1.2	—	—	—	—
		25	.055	3.9	3.2	2.6	2.3	2.0	1.6	1.3	1.1	—	2.6	2.1	1.8	1.5	1.3	1.1	—	—	—
•4.3 GPA	•4.3 GPA	30	.06	• 4.3	3.5	2.9	2.5	2.2	1.7	1.4	1.2	1.1	2.9	2.3	1.9	1.6	1.4	1.2	—	—	—
(100 Mesh)	(100 Mesh)	40	.067	5.0	4.0	3.3	2.8	2.5	2.0	1.7	1.4	1.2	3.3	2.7	2.2	1.9	1.7	1.3	1.1	—	—
		50	.07	5.6	4.5	3.7	3.2	2.8	2.2	1.9	1.6	1.4	3.7	3.0	2.5	2.1	1.9	1.5	1.2	1.1	—
		60	.08	6.1	4.9	4.1	3.5	3.1	2.4	2.0	1.7	1.5	4.1	3.3	2.7	2.3	2.0	1.6	1.4	1.2	1.0
6501	8001	20	.07	5.3	4.2	3.5	3.0	2.6	2.1	1.8	1.5	1.3	3.5	2.8	2.3	2.0	1.8	1.4	1.2	1.0	—
		25	.08	5.9	4.7	3.9	3.4	2.9	2.4	2.0	1.7	1.5	3.9	3.1	2.6	2.2	2.0	1.6	1.3	1.1	—
•6.4 GPA	•6.4 GPA	30	.09	• 6.4	5.1	4.3	3.7	3.2	2.6	2.1	1.8	1.6	4.3	3.4	2.9	2.5	2.1	1.7	1.4	1.2	1.1
(100 Mesh)	(100 Mesh)	40	.10	7.4	5.9	5.0	4.2	3.7	3.0	2.5	2.1	1.9	5.0	4.0	3.3	2.8	2.5	2.0	1.7	1.4	1.2
		50	.11	8.3	6.6	5.5	4.7	4.2	3.3	2.8	2.4	2.1	5.5	4.4	3.7	3.2	2.8	2.2	1.8	1.6	1.4
		60	.12	9.1	7.3	6.1	5.2	4.6	3.6	3.0	2.6	2.3	6.1	4.9	4.0	3.5	3.0	2.4	2.0	1.7	1.5
		20	.11	7.9	6.3	5.3	4.5	3.9	3.2	2.6	2.3	2.0	5.3	4.2	3.5	3.0	2.6	2.1	1.8	1.5	1.3
65015	80015	25	.12	8.8	7.0	5.9	5.0	4.4	3.5	2.9	2.5	2.2	5.9	4.7	3.9	3.4	2.9	2.4	2.0	1.7	1.5
		30	.13	• 9.7	7.7	6.4	5.5	4.8	3.9	3.2	2.8	2.4	6.4	5.1	4.3	3.7	3.2	2.6	2.1	1.8	1.6
•9.7 GPA	•9.7 GPA	40	.15	11.1	8.9	7.4	6.4	5.6	4.5	3.7	3.2	2.8	7.4	5.9	5.0	4.2	3.7	3.0	2.5	2.1	1.9
(100 Mesh)	(100 Mesh)	50	.17	12.5	10.0	8.3	7.1	6.2	5.0	4.2	3.6	3.1	8.3	6.6	5.5	4.7	4.2	3.3	2.8	2.4	2.1
		60	.18	13.6	10.9	9.1	7.8	6.8	5.5	4.6	3.9	3.4	9.1	7.3	6.1	5.2	4.6	3.6	3.0	2.6	2.3
		20	.14	10.5	8.4	7.0	6.0	5.3	4.2	3.5	3.0	2.6	7.0	5.6	4.7	4.0	3.5	2.8	2.3	2.0	1.8
6502	8002	25	.16	11.7	9.4	7.8	6.7	5.9	4.7	3.9	3.4	2.9	7.8	6.3	5.2	4.5	3.9	3.1	2.6	2.2	2.0
		30	.17	•12.9	10.3	8.6	7.4	6.4	5.1	4.3	3.7	3.2	8.6	6.9	5.7	4.9	4.3	3.4	2.9	2.5	2.1
•12.9 GPA	•12.9 GPA	40	.20	14.9	11.9	9.9	8.5	7.4	5.9	5.0	4.2	3.7	9.9	7.9	6.6	5.7	5.0	4.0	3.3	2.8	2.5
(50 Mesh)	(50 Mesh)	50	.23	16.6	13.3	11.1	9.5	8.3	6.6	5.5	4.7	4.2	11.1	8.9	7.4	6.3	5.5	4.4	3.7	3.2	2.8
		60	.25	18.2	14.6	12.1	10.4	9.1	7.3	6.1	5.2	4.6	12.1	9.7	8.1	6.9	6.1	4.9	4.0	3.5	3.0
		20	.21	15.8	12.6	10.5	9.0	7.9	6.3	5.3	4.5	3.9	10.5	8.4	7.0	6.0	5.3	4.2	3.5	3.0	2.6
6503	8003	25	.24	17.6	14.1	11.7	10.1	8.8	7.0	5.9	5.0	4.4	11.7	9.4	7.8	6.7	5.9	4.7	3.9	3.4	2.9
		30	.26	•19	15.4	12.9	11.0	9.7	7.7	6.4	5.5	4.8	12.9	10.3	8.6	7.4	6.4	5.1	4.3	3.7	3.2
•19 GPA	•19 GPA	40	.30	22	17.8	14.9	12.7	11.1	8.9	7.4	6.4	5.6	14.9	11.9	9.9	8.5	7.4	5.9	5.0	4.2	3.7
(50 Mesh)	(50 Mesh)	50	.34	25	19.9	16.6	14.2	12.5	10.0	8.3	7.1	6.2	16.6	13.3	11.1	9.5	8.3	6.6	5.5	4.7	4.2
		60	.37	27	22	18.2	15.6	13.6	10.9	9.1	7.8	6.8	18.2	14.6	12.1	10.4	9.1	7.3	6.1	5.2	4.6
		20	.28	21	16.8	14.0	12.0	10.5	8.4	7.0	6.0	5.3	14.0	11.2	9.3	8.0	7.0	5.6	4.7	4.0	3.5
6 04	8004	25	.32	23	18.8	15.7	13.4	11.7	9.4	7.8	6.7	5.9	15.7	12.5	10.4	8.9	7.8	6.3	5.2	4.5	3.9
• PA	•26 GPA	30	.35	•26	21	17.2	14.7	12.9	10.3	8.6	7.4	6.4	17.2	13.7	11.4	9.8	8.6	6.9	5.7	4.9	4.3
(50 Mesh)	(50 Mesh)	40	.40	30	24	19.8	17.0	14.9	11.9	9.9	8.5	7.4	19.8	15.8	13.2	11.3	9.9	7.9	6.6	5.7	5.0
		50	.45	33	27	22	19.0	16.6	13.3	11.1	9.5	8.3	22	17.7	14.8	12.7	11.1	8.9	7.4	6.3	5.5
		60	.49	36	29	24	21	18.2	14.6	12.1	10.4	9.1	24	19.4	16.2	13.9	12.1	9.7	8.1	6.9	6.1
		20	.35	26	21	17.5	15.0	13.1	10.5	8.8	7.5	6.6	17.5	14.0	11.7	10.0	8.8	7.0	5.8	5.0	4.4
6505	8005	25	.40	29	23	19.6	16.8	14.7	11.7	9.8	8.4	7.3	19.6	15.7	13.0	11.2	9.8	7.8	6.5	5.6	4.9
		30	.43	•32	26	21	18.4	16.1	12.9	10.7	9.2	8.0	21	17.2	14.3	12.3	10.7	8.6	7.1	6.1	5.4
•32 GPA	•32 GPA	40	.50	37	30	25	21	18.6	14.9	12.4	10.6	9.3	25	19.8	16.5	14.1	12.4	9.9	8.3	7.1	6.2
(50 Mesh)	(50 Mesh)	50	.56	42	33	28	24	21	16.6	13.8	11.9	10.4	28	22	18.5	15.8	13.8	11.1	9.2	7.9	6.9
		60	.61	45	36	30	26	23	18.2	15.2	13.0	11.4	30	24	20	17.3	15.2	12.1	10.1	8.7	7.6
		20	.42	32	25	21	18.0	15.8	12.6	10.5	9.0	7.9	21	16.8	14.0	12.0	10.5	8.4	7.0	6.0	5.3
6506	8006	25	.47	35	28	23	20	17.6	14.1	11.7	10.1	8.8	23	18.8	15.7	13.4	11.7	9.4	7.8	6.7	5.9
		30	.52	•39	31	26	22	19.3	15.4	12.9	11.0	9.7	26	21	17.2	14.7	12.9	10.3	8.6	7.4	6.4
•39 GPA	•39 GPA	40	.60	45	36	30	25	22	17.8	14.9	12.7	11.1	30	24	19.8	17.0	14.9	11.9	9.9	8.5	7.4
(50 Mesh)	(50 Mesh)	50	.67	50	40	33	28	25	19.9	16.6	14.2	12.5	33	27	22	19.0	16.6	13.3	11.1	9.5	8.3
		60	.74	55	44	36	31	27	22	18.2	15.6	13.6	36	29	24	21	18.2	14.6	12.1	10.4	9.1
		20	.57	42	34	28	24	21	16.8	14.0	12.0	10.5	28	22	18.7	16.0	14.0	11.2	9.3	8.0	7.0
6508	8008	25	.63	47	38	31	27	23	18.8	15.7	13.4	11.7	31	25	21	17.9	15.7	12.5	10.4	8.9	7.8
		30	.69	•52	41	34	29	26	21	17.2	14.7	12.9	34	27	23	19.6	17.2	13.7	11.4	9.8	8.6
•52 GPA	•52 GPA	40	.80	59	48	40	34	30	24	19.8	17.0	14.9	40	32	26	23	19.8	15.8	13.2	11.3	9.9
(50 Mesh)	(50 Mesh)	50	.89	66	53	44	38	33	27	22	19.0	16.6	44	35	30	25	22	17.7	14.5	12.7	11.1
		60	.98	73	58	49	42	36	29	24	21	18.2	49	39	32	28	24	19.4	16.2	13.9	12.1
		20	.71	53	42	35	30	26	21	17.5	15.0	13.1	35	28	23	20	17.5	14.0	11.7	10.0	8.8
6510	8010	25	.79	59	47	39	34	29	23	19.6	16.8	14.7	39	31	26	22	19.6	15.7	13.0	11.2	9.8
		30	.87	•64	51	43	37	32	26	21	18.4	16.1	43	34	29	25	21	17.2	14.3	12.3	10.7
•64 GPA	•64 GPA	40	1.00	74	59	50	42	37	30	25	21	18.6	50	40	33	28	25	19.8	16.5	14.1	12.4
(No Strainer)	(No Strainer)	50	1.12	83	66	55	47	42	33	28	24	21	55	44	37	32	28	22	18.5	15.8	13.8
		60	1.23	91	73	61	52	45	36	30	26	23	61	49	40	35	30	24	20	17.3	15.2
		20	1.06	79	63	53	45	39	32	26	23	20	53	42	35	30	26	21	17.5	15.0	13.1
6515	8015	25	1.19	88	70	59	50	44	35	29	25	22	59	47	39	34	29	23	19.6	16.8	14.7
		30	1.30	•97	77	64	55	48	39	32	28	24	64	51	43	37	32	26	21	18.4	16.1
•97 GPA	•97 GPA	40	1.50	111	89	74	64	56	45	37	32	28	74	59	50	42	37	30	25	21	18.6
(No Strainer)	(No Strainer)	50	1.68	125	100	83	71	62	50	42	36	31	83	66	55	47	42	33	28	24	21
		60	1.84	136	109	91	78	68	55	46	39	34	91	73	61	52	45	36	30	26	23
		20	1.41	105	84	70	60	53	42	35	30	26	70	56	47	40	35	28	23	20	17.5
6520	8020	25	1.58	117	94	78	67	59	47	39	34	29	78	63	52	45	39	31	26	22	19.6
		30	1.73	•128	103	86	73	64	51	43	37	32	86	69	57	49	43	34	29	25	21
•128 GPA	•128 GPA	40	2.00	149	119	99	85	74	59	50	42	37	99	79	66	57	50	40	33	28	25
(No Strainer)	(No Strainer)	50	2.23	166	133	111	95	83	66	55	47	42	111	89	74	63	55	44	37	32	28
		60	2.45	182	146	121	104	91	73	61	52	46	121	97	81	69	61	49	40	35	30

•Indicates standard nozzle. Gallons Per Acre coverage at 30 p.s.i., 4 MPH tractor speed and 20" nozzle spacing . . . based on spraying WATER. For other nozzle spacings and liquids with densities or weights per gallon different from water . . . see page 5 for Conversion Factors to apply to data in these tables to determine actual Gallons Per Acre coverage.
NOTE: Other sprays [illegible] are also available including 95° and 110° Flat Spray Tips. Write for Data Sheet 2851.

TeeJet SPRAY NOZZLES WITH DOUBLE OUTLET FLAT SPRAY TIPS 150° SERIES

for spraying herbicides, insecticides, fertilizers and other chemicals



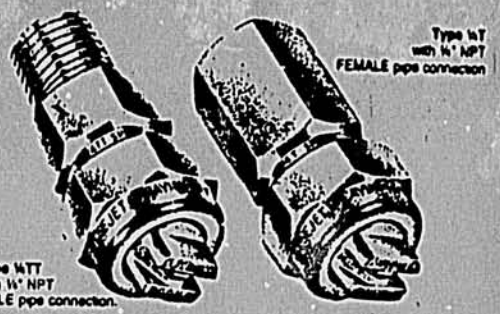


HOW TO ORDER: For complete TeeJet Nozzle, specify Nozzle Body, Tip No., Material. Example: ¾T15001 Brass. (For body options see pages 4 and 27).
To order Spray Tip only, specify Tip No., Material. Example, 15001 Brass.

TIP NO. (Strainer Screen Size)	Liquid Pressure in PSI	Capacity of Nozzle in GPM	GALLONS PER ACRE—30" SPACING									GALLONS PER ACRE—40" SPACING								
			4 MPH	5 MPH	6 MPH	7 MPH	8 MPH	10 MPH	12 MPH	14 MPH	16 MPH	4 MPH	5 MPH	6 MPH	7 MPH	8 MPH	10 MPH	12 MPH	14 MPH	16 MPH
15001 (200 Mesh)	20	07	35	28	23	20	18	14	12	10	—	26	21	18	15	13	11	—	—	—
	25	08	39	31	26	22	20	16	13	11	—	29	24	20	17	15	12	—	—	—
	30	09	43	34	29	25	21	17	14	12	11	32	26	21	18	16	13	11	—	—
	40	10	50	40	33	28	25	20	17	14	12	37	30	25	21	19	15	12	11	—
	50	11	55	44	37	32	28	22	18	16	14	42	33	28	24	21	17	14	12	10
	60	12	61	49	40	35	30	24	20	17	15	46	36	30	26	23	18	15	13	11
150015 (100 Mesh)	20	11	53	42	35	30	26	21	18	15	13	39	32	26	23	20	16	13	11	—
	25	12	59	47	39	34	29	24	20	17	15	44	35	29	25	22	18	15	13	11
	30	13	64	51	43	37	32	26	21	18	16	48	39	32	28	24	19	16	14	12
	40	15	74	59	50	42	37	30	25	21	19	56	45	37	32	28	22	19	16	14
	50	17	83	66	55	47	42	33	28	24	21	62	50	42	36	31	25	21	18	16
	60	18	91	73	61	52	46	36	30	26	23	68	55	46	39	34	27	23	20	17
15002 (100 Mesh)	20	14	70	56	47	40	35	28	23	20	18	53	42	35	30	26	21	18	15	13
	25	16	78	63	52	45	39	31	26	22	20	59	47	39	34	29	24	20	17	15
	30	17	86	69	57	49	43	34	29	25	21	64	51	43	37	32	26	22	19	16
	40	20	99	79	66	57	50	40	33	28	25	74	59	50	42	37	30	25	21	19
	50	22	111	89	74	63	55	44	37	32	28	83	66	55	47	42	33	28	24	21
	60	25	121	97	81	69	61	49	40	35	30	91	73	61	52	46	36	30	26	23
15003 (100 Mesh)	20	21	105	84	70	60	53	42	35	30	26	79	63	53	45	39	32	26	23	20
	25	24	117	94	78	67	59	47	39	34	29	88	70	59	50	44	35	29	25	22
	30	26	128	103	86	74	64	51	43	37	32	97	77	64	55	48	39	32	28	24
	40	30	148	119	99	85	74	59	50	42	37	111	89	74	64	56	45	37	32	28
	50	34	166	133	111	95	83	66	55	47	42	125	100	83	71	62	50	42	36	31
	60	37	182	146	121	104	91	73	61	52	46	136	109	91	78	68	55	46	39	34
15004 (50 Mesh)	20	28	140	112	93	80	70	56	47	40	35	105	84	70	60	53	42	35	30	26
	25	31	157	125	104	89	78	63	52	45	39	117	94	78	67	59	47	39	34	29
	30	34	172	137	114	98	86	69	57	49	43	129	103	86	74	64	51	43	37	32
	40	40	198	158	132	113	99	79	66	57	50	149	119	99	85	74	59	50	42	37
	50	45	222	177	148	127	111	89	74	63	55	166	133	111	95	83	66	55	47	42
	60	49	243	194	162	139	121	97	81	69	61	182	146	121	104	91	73	61	52	46
15005 (50 Mesh)	20	35	175	140	117	100	88	70	58	50	44	131	105	88	75	66	53	44	38	33
	25	39	196	157	130	112	98	78	65	56	49	147	117	98	84	73	59	49	42	37
	30	43	214	171	143	123	107	86	71	61	54	161	129	107	92	80	64	54	46	40
	40	50	248	198	165	141	124	99	83	71	62	186	149	124	106	93	74	62	53	46
	50	56	277	222	185	158	138	111	92	79	69	207	166	138	119	104	83	69	59	52
	60	61	304	243	203	173	152	121	101	87	76	228	182	152	130	114	91	76	65	57
15006 (50 Mesh)	20	42	210	168	140	120	105	84	70	60	53	158	126	105	90	79	63	53	45	39
	25	47	235	188	157	134	117	94	78	67	59	176	141	117	101	88	70	59	50	44
	30	52	258	206	172	147	129	103	86	74	64	193	154	129	111	97	77	64	55	48
	40	60	297	238	198	170	149	119	99	85	74	223	178	149	128	111	89	74	64	56
	50	67	333	266	222	190	166	133	111	95	83	249	199	166	143	125	100	83	71	62
	60	73	365	292	243	208	182	146	121	104	91	273	219	182	156	137	109	91	78	68
15008 (50 Mesh)	20	56	280	224	187	160	140	112	93	80	70	210	168	140	120	105	84	70	60	53
	25	63	314	251	209	179	157	125	105	90	79	236	188	157	135	118	94	79	67	59
	30	69	345	276	230	197	173	138	115	99	86	258	207	173	148	129	104	86	74	65
	40	80	398	318	265	227	199	159	133	114	99	299	239	199	171	149	119	99	85	75
	50	89	445	356	297	255	223	178	148	127	111	334	267	223	191	167	134	111	95	84
	60	98	488	390	325	279	244	195	163	139	122	366	293	244	209	183	146	122	104	91
15009 (50 Mesh)	20	70	350	280	233	200	175	140	117	100	88	263	210	175	150	131	105	88	75	66
	25	78	392	314	261	224	196	157	131	112	98	294	235	196	168	147	118	98	84	74
	30	86	430	344	287	246	215	172	143	123	108	323	258	215	184	161	129	108	92	81
	40	99	496	397	331	284	248	198	165	142	124	372	298	248	213	186	149	124	106	93
	50	111	555	444	370	317	277	222	185	158	139	416	333	277	238	208	166	139	119	104
	60	121	608	487	405	348	304	243	203	174	152	456	365	304	261	228	182	152	130	114

LP TeeJet® SPRAY NOZZLES WITH FLAT SPRAY TIPS

for spraying herbicides and other AG chemicals



Patent No. 3,858,812

CHOICE OF MATERIALS

The LP TeeJet Spray Tip is available in Brass or Stainless Steel materials. See pages 8 and 27 for description of nozzle parts and materials. TeeJet nozzles with LP TeeJet Spray Tips are normally supplied in all Brass with Stainless Steel Screen or all Stainless Steel.

All LP TeeJet Spray Tips are interchangeable, so that capacity and spray angle may be changed without removing nozzle bodies from the spray boom.*

The LP TeeJet Spray Tips are designed specifically to operate as low as 10 p.s.i., providing the same spray performance, spray angle, flow rate and liquid distribution at 15 psi., as the standard TeeJet Tips at 40 psi. Lower operating pressures and larger orifices increase wear life of Tips. This helps to diminish clogging problems and provides larger spray particles than those from the standard Tips. Patented orifice inlet design provides good tapered edge liquid distribution at lower pressures.

ACCESSORIES

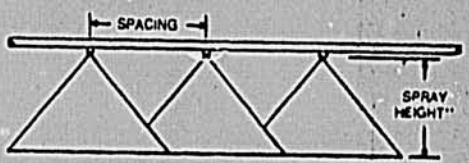
No. 5815 – 50 Low Pressure Relief Valve (see page 35)

No. 5460 – 50 Diaphragm Low Pressure Relief Valve (see page 34)

For more information, write for Data Sheet # 14447.

HOW TO ORDER: For complete Nozzle, specify Nozzle Body, Tip No, Material. Example: ¼TT 8001LP Stainless Steel. (For body options see pages 4 and 27).

To order Spray Tip only, specify Spray Tip No., Material. Example: 8001LP Stainless Steel.



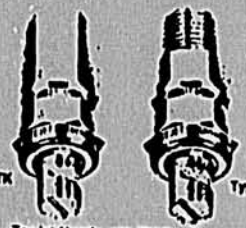
**Adjust spray height in the field to overlap approximately 30% of each edge of pattern. See page 6 for suggested spray heights.

TIP NO. (Strainer Screen Size)	Liquid Pressure in PSI	Capacity 1 Nozzle in GPM	GALLONS PER ACRE—20" SPACING									GALLONS PER ACRE—30" SPACING							
			4 MPH	5 MPH	6 MPH	7 MPH	8 MPH	10 MPH	12 MPH	14 MPH	16 MPH	4 MPH	5 MPH	6 MPH	7 MPH	8 MPH	10 MPH	12 MPH	14 MPH	16 MPH
8001 LP (100 Mesh)	15	10	7.4	5.9	5.0	4.2	3.7	3.0	2.5	2.1	1.9	5.0	4.0	3.3	2.8	2.5	2.0	1.7	1.4	1.2
	20	12	8.6	6.9	5.7	4.9	4.3	3.4	2.9	2.5	2.1	5.7	4.6	3.8	3.3	2.9	2.3	1.9	1.6	1.4
	30	14	10.5	8.4	7.0	6.0	5.3	4.2	3.5	3.0	2.6	7.0	5.6	4.7	4.0	3.5	2.8	2.3	2.0	1.8
	40	16	12.1	9.7	8.1	6.9	6.1	4.8	4.0	3.5	3.0	8.1	6.5	5.4	4.6	4.0	3.2	2.7	2.3	2.0
80015 LP (50 Mesh)	15	15	11.1	8.9	7.4	6.4	5.6	4.5	3.7	3.2	2.8	7.4	5.9	5.0	4.2	3.7	3.0	2.5	2.1	1.9
	20	17	12.9	10.3	8.6	7.4	6.4	5.1	4.3	3.7	3.2	8.6	6.9	5.7	4.9	4.3	3.4	2.9	2.5	2.1
	30	21	15.8	12.6	10.5	9.0	7.9	6.3	5.3	4.5	3.9	10.5	8.4	7.0	6.0	5.3	4.2	3.5	3.0	2.6
	40	24	18.1	14.5	12.1	10.4	9.1	7.2	6.0	5.2	4.5	12.1	9.7	8.1	6.9	6.0	4.8	4.0	3.5	3.0
8002 LP (50 Mesh)	15	23	14.9	11.9	9.9	8.5	7.4	5.9	5.0	4.2	3.7	9.9	7.9	6.6	5.7	5.0	4.0	3.3	2.8	2.5
	20	23	17.2	13.7	11.4	9.6	8.6	6.9	5.7	4.9	4.3	11.4	9.2	7.6	6.5	5.7	4.6	3.8	3.3	2.9
	30	28	21	16.8	14.0	12.0	10.5	8.4	7.0	6.0	5.3	14.0	11.2	9.3	8.0	7.0	5.6	4.7	4.0	3.5
	40	33	24	19.4	16.1	13.8	12.1	9.7	8.1	6.9	6.1	16.1	12.9	10.8	9.2	8.1	6.5	5.4	4.6	4.0
8003 LP (50 Mesh)	15	34	22	17.8	14.9	12.7	11.1	8.9	7.4	6.4	5.6	14.9	11.9	9.9	8.5	7.4	5.9	5.0	4.2	3.7
	20	39	26	21	17.2	14.7	12.9	10.3	8.6	7.4	6.4	17.2	13.7	11.4	9.8	8.6	6.9	5.7	4.9	4.3
	30	43	32	25	21	18	15.8	12.6	10.5	9.0	7.9	21	16.8	14.0	12.0	10.5	8.4	7.0	6.0	5.3
	40	50	36	29	24	21	18.2	14.5	12.1	10.4	9.1	24	19.4	16.1	13.8	12.1	9.7	8.1	6.9	6.1
8004 LP (50 Mesh)	15	45	30	24	19.8	17.0	14.9	11.9	9.9	8.5	7.4	19.8	15.8	13.2	11.3	9.9	7.9	6.6	5.7	5.0
	20	49	34	27	23	19.6	17.2	13.7	11.4	9.8	8.6	23	18.3	15.2	13.1	11.4	9.2	7.6	6.5	5.7
	30	60	42	34	28	24	21	16.8	14.0	12.0	10.5	28	22	18.7	16.0	14.0	11.2	9.3	8.0	7.0
	40	69	48	38	32	28	24	19.4	16.2	13.9	12.1	32	26	22	18.5	16.2	12.9	10.8	9.2	8.1
8005 LP (50 Mesh)	15	57	38	30	25	21	18.6	14.9	12.4	10.6	9.3	25	19.8	16.5	14.1	12.4	9.9	8.3	7.1	6.2
	20	66	44	34	29	25	21	17.2	14.3	12.3	10.7	29	23	19.1	16.3	14.3	11.4	9.5	8.2	7.1
	30	81	54	43	35	30	26	21	17.5	15.0	13.1	35	28	23	20	17.5	14.0	11.7	10.0	8.8
	40	93	62	49	40	35	30	24	20	17.3	15.1	40	32	27	23	20	16.2	13.5	11.5	10.1
8006 LP (No Strainer)	15	68	45	36	30	25	22	17.8	14.9	12.7	11.1	30	24	19.8	17.0	14.9	11.9	9.9	8.5	7.4
	20	78	52	41	34	29	26	21	17.2	14.7	12.9	34	27	23	19.6	17.2	13.7	11.4	9.8	8.6
	30	96	64	50	42	36	32	25	21	18.0	15.8	42	34	28	24	21	16.8	14.0	12.0	10.5
	40	110	73	58	46	42	36	29	24	21	18.2	48	39	32	28	24	19.4	16.2	13.8	12.1
8008 LP (No Strainer)	15	90	60	48	40	34	30	24	19.8	17.0	14.9	40	32	26	23	19.8	15.8	13.2	11.3	9.9
	20	104	69	55	46	40	34	27	23	19.6	17.2	46	37	30	26	23	18.3	15.2	13.1	11.4
	30	127	85	68	56	48	42	34	28	24	21	56	45	37	32	28	22	18.7	16.0	14.0
	40	147	98	78	65	55	48	39	32	28	24	65	52	43	37	32	26	22	18.5	16.2
8010 LP (No Strainer)	15	113	75	60	50	42	37	30	25	21	18.6	50	40	33	28	25	19.8	16.5	14.1	12.4
	20	131	87	69	57	49	43	34	29	25	21	57	46	38	33	29	23	19.1	16.3	14.3
	30	160	107	84	70	60	53	42	35	30	26	70	56	47	40	35	28	23	20	17.5
	40	185	123	97	81	69	61	48	40	35	30	81	65	54	46	40	32	27	23	20

*Also available in 11[illegible] series. Write for Data Sheet 17083.

FloodJet WIDE ANGLE FLAT SPRAY TIPS AND NOZZLES

for fertilizers and other chemicals



TeeJet Nozzle with TK FloodJet Tip (¼" thru ½" N.P.T.)


FloodJet Nozzle (½" thru 1" N.P.T.

HOW TO ORDER: For complete TeeJet Nozzle with TK Tip, specify Pipe Size, Body Type, Tip No., Material.
Example: ¼ TK-SS2 Stainless Steel.

To order Tip only, specify Tip No., Material
Example: TK-SS2 Stainless Steel.

To order FloodJet Nozzle specify Nozzle No., Material.
Example: ¼ K-SS2 Stainless Steel.


TK FloodJet Tip

The FloodJet Tips and Nozzles produce a very wide deflector type flat spray pattern. Round orifice minimizes clogging.

FloodJet Tips and FloodJet Nozzles are also used for incorporating herbicides in soil while field discing . . . see page 26 and write for Data Sheet 12348.

TYPE		Liquid Pressure in PSI	Capacity in GPM	GALLONS PER ACRE—40" SPACING								GALLONS PER ACRE—60" SPACING							
FloodJet TIP NO.	FloodJet NOZZLE NO			4 MPH	5 MPH	6 MPH	8 MPH	10 MPH	12 MPH	14 MPH	16 MPH	20 MPH	4 MPH	5 MPH	6 MPH	8 MPH	10 MPH	12 MPH	14 MPH	16 MPH	20 MPH
TK-SS.50 (100 Mesh)	¼K-SS.50	10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		20	.07	2.6	2.1	1.8	1.3	1.1	.88	.76	.66	.53	1.8	1.4	1.2	.88	.70	.58	.50	.44	.35
		30	.08	3.2	2.6	2.1	1.6	1.3	1.1	.92	.80	.64	2.1	1.7	1.4	1.1	.86	.71	.61	.54	.43
		40	.10	3.7	3.0	2.5	1.9	1.5	1.2	1.1	.93	.74	2.5	2.0	1.7	1.2	1.0	.82	.71	.62	.49
TK-SS.75 (100 Mesh)	¼K-SS.75	10	.075	2.8	2.2	1.9	1.4	1.1	.93	.80	.70	.56	1.9	1.5	1.2	.93	.74	.62	.53	.46	.37
		20	.11	3.9	3.2	2.6	2.0	1.6	1.3	1.1	.98	.79	2.6	2.1	1.8	1.3	1.1	.88	.75	.66	.53
		30	.13	4.8	3.9	3.2	2.4	1.9	1.6	1.4	1.2	.96	3.2	2.6	2.1	1.6	1.3	1.1	.92	.80	.64
		40	.15	5.6	4.5	3.7	2.8	2.2	1.9	1.6	1.4	1.1	3.7	3.0	2.5	1.9	1.5	1.2	1.1	.93	.74
TK-SS1 (100 Mesh)	¼K-SS1	10	.10	3.7	3.0	2.5	1.9	1.5	1.2	1.1	.93	.74	2.5	2.0	1.7	1.2	1.0	.82	.71	.62	.49
		20	.14	5.3	4.2	3.5	2.6	2.1	1.8	1.5	1.3	1.1	3.5	2.8	2.3	1.8	1.4	1.2	1.0	.88	.70
		30	.17	6.4	5.1	4.3	3.2	2.6	2.1	1.8	1.6	1.3	4.3	3.4	2.9	2.1	1.7	1.4	1.2	1.1	.86
		40	.20	7.4	5.9	5.0	3.7	3.0	2.5	2.1	1.9	1.5	5.0	4.0	3.3	2.5	2.0	1.7	1.4	1.2	1.0
TK-SS1.5 (50 Mesh)	¼K-SS1.5	10	.15	5.6	4.5	3.7	2.8	2.2	1.9	1.6	1.4	1.1	3.7	3.0	2.5	1.9	1.5	1.2	1.1	.93	.74
		20	.21	7.9	6.3	5.3	3.9	3.2	2.6	2.3	2.0	1.6	5.3	4.2	3.5	2.6	2.1	1.8	1.6	1.3	1.1
		30	.26	9.7	7.7	6.4	4.8	3.9	3.2	2.8	2.4	1.9	6.4	5.1	4.3	3.2	2.6	2.1	1.8	1.6	1.3
		40	.30	11.1	8.9	7.4	5.6	4.5	3.7	3.2	2.8	2.2	7.4	5.9	5.0	3.7	3.0	2.5	2.1	1.8	1.6
TK-SS2 (50 Mesh)	½K-SS2	10	.20	7.4	5.9	5.0	3.7	3.0	2.5	2.1	1.9	1.5	5.0	4.0	3.3	2.5	2.0	1.7	1.4	1.2	1.0
		20	.28	10.5	8.4	7.0	5.3	4.2	3.5	3.0	2.6	2.1	7.0	5.6	4.7	3.5	2.8	2.3	2.0	1.8	1.4
		30	.35	12.9	10.3	8.6	6.4	5.1	4.3	3.7	3.2	2.6	8.6	6.9	5.7	4.3	3.4	2.9	2.5	2.1	1.7
		40	.40	14.9	11.9	9.9	7.4	5.9	5.0	4.2	3.7	3.0	9.9	7.9	6.6	5.0	4.0	3.3	2.8	2.5	2.0
TK-SS2.5 (50 Mesh)	½K-SS2.5	10	.25	9.3	7.4	6.2	4.6	3.7	3.1	2.7	2.3	1.9	6.2	5.0	4.1	3.1	2.5	2.1	1.8	1.6	1.2
		20	.35	13.1	10.5	8.8	6.6	5.3	4.4	3.8	3.3	2.6	8.8	7.0	5.8	4.4	3.5	2.9	2.5	2.2	1.8
		30	.43	16.1	12.9	10.7	8.0	6.4	5.4	4.6	4.0	3.2	10.7	8.6	7.1	5.4	4.3	3.6	3.1	2.7	2.1
		40	.50	18.6	14.9	12.4	9.3	7.4	6.2	5.3	4.6	3.7	12.4	9.9	8.3	6.2	5.0	4.1	3.5	3.1	2.5
TK-SS3 (50 Mesh)	¼K-SS3	10	.30	11.1	8.9	7.4	5.6	4.5	3.7	3.2	2.8	2.2	7.4	6.0	5.0	3.7	3.0	2.5	2.1	1.9	1.5
		20	.42	15.8	12.6	10.5	7.9	6.3	5.3	4.5	3.9	3.2	10.5	8.4	7.0	5.3	4.2	3.5	3.0	2.6	2.1
		30	.52	19.3	15.4	12.9	9.7	7.7	6.4	5.5	4.8	3.9	12.9	10.3	8.6	6.4	5.1	4.3	3.7	3.2	2.6
		40	.60	22	17.8	14.9	11.1	8.9	7.4	6.4	5.6	4.5	14.9	11.9	9.9	7.4	5.9	5.0	4.2	3.7	3.0
TK-SS4	¼K-SS4	10	.40	14.9	11.9	9.9	7.4	5.9	5.0	4.2	3.7	3.0	9.9	7.9	6.6	5.0	4.0	3.3	2.8	2.5	2.0
		20	.57	21	16.8	14.0	10.5	8.4	7.0	6.0	5.3	4.2	14.0	11.2	9.3	7.0	5.6	4.7	4.0	3.5	2.8
		30	.69	26	21	17.2	12.9	10.3	8.6	7.4	6.4	5.1	17.2	13.7	11.4	8.6	6.9	5.7	4.9	4.3	3.4
		40	.80	30	24	19.6	14.9	11.9	9.9	8.5	7.4	5.9	19.8	15.8	13.2	9.9	7.9	6.6	5.7	5.0	4.0
TK-SS5	½K-SS5	10	.50	18.6	14.9	12.4	9.3	7.4	6.2	5.3	4.6	3.7	12.4	9.9	9.3	6.2	5.0	4.1	3.5	3.1	2.5
		20	.71	26	21	17.6	13.1	10.5	8.8	7.6	6.6	5.3	17.5	14.0	11.7	8.8	7.0	5.8	5.0	4.4	3.5
		30	.87	32	26	21	16.1	12.9	10.7	9.2	8.0	6.4	21	17.2	14.3	10.7	8.6	7.1	6.1	5.4	4.3
		40	1.0	37	30	25	18.6	14.9	12.4	10.6	9.3	7.4	25	19.8	16.5	12.4	9.9	8.3	7.1	6.2	5.0
TK-SS7.5	¼K-SS7.5	10	.75	28	22	18.6	13.9	11.1	9.3	8.0	7.0	5.6	18.6	14.9	12.4	9.3	7.4	6.2	5.3	4.6	3.7
		20	1.1	39	32	26	19.7	15.8	13.1	11.3	9.8	7.9	26	21	17.5	13.1	10.5	8.8	7.5	6.6	5.3
		30	1.3	48	39	32	24	19.3	16.1	13.8	12.1	9.7	32	26	21	16.1	12.9	10.7	9.2	8.0	6.4
		40	1.5	56	45	37	28	22	18.6	15.9	13.9	11.1	37	30	25	18.6	14.9	12.4	10.6	9.3	7.4
TK-SS10	¼K-SS10	10	1.0	37	30	25	18.6	14.9	12.4	10.6	9.3	7.4	25	19.8	16.5	12.4	9.9	8.3	7.1	6.2	5.0
		20	1.4	53	42	35	26	21	17.5	15.0	13.1	10.5	35	28	23	17.5	14.0	11.7	10.0	8.8	7.0
		30	1.7	64	51	43	32	26	21	18.4	16.1	12.9	43	34	29	21	17.2	14.3	12.3	10.7	8.6
		40	2.0	74	59	50	37	30	25	21	18.6	14.9	50	40	33	25	19.8	16.5	14.1	12.4	9.9
	¼K-SS12	10	1.5	56	45	38	28	22	18.9	16.9	14.9	11.9	37	30	25	18.9	14.9	12.6	10.8	9.4	7.5
		20	2.1	79	63	53	39	31	26	23	20	15.8	53	42	35	26	21	17.8	15.0	13.1	10.5
		30	2.6	96	77	64	48	38	32	28	24	19.2	64	51	43	32	25	21	18.0	15.8	12.6
		40	3.0	111	89	74	56	45	37	32	28	22	74	59	50	37	30	25	21	18.6	14.9
TK-SS15	¼K-SS15	10	1.5	56	45	37	28	22	18.6	15.9	13.9	11.1	37	30	25	18.6	14.9	12.4	10.6	9.3	7.4
		20	2.1	79	63	53	39	32	26	23	19.7	15.8	53	42	35	26	21	17.5	15.0	13.1	10.5
		30	2.6	96	77	64	48	39	32	28	24	19.3	64	51	43	32	26	21	18.4	16.1	12.9
		40	3.0	111	89	74	56	45	37	32	28	22	74	59	50	37	30	25	21	18.6	14.9
	¼K-SS18	10	1.8	67	53	45	33	27	22	19.1	16.7	13.4	45	36	30	22	17.8	14.9	12.7	11.1	8.9
		20	2.5	95	76	63	47	38	32	27	24	18.9	63	50	42	32	25	21	18.0	15.8	12.6
		30	3.1	116	93	77	58	46	39	33	29	23	77	62	51	39	31	26	22	19.3	15.4
		40	3.6	134	107	89	67	53	45	38	33	27	89	71	59	45	36	30	25	22	17.8
TK-SS20	¼K-SS20	10	2.0	74	59	50	37	30	25	21	18.6	14.9	50	40	33	25	19.8	16.5	14.1	12.4	9.9
		20	2.8	105	84	70	53	42	35	30	26	21	70	56	47	35	28	23	20	17.5	14.0
		30	3.4	129	103	86	64	51	43	37	32	26	86	69	57	43	34	29	25	21	17.2
		40	4.0	149	119	99	74	59	50	42	37	30	99	79	66	50	40	33	28	25	19.8
	¼K-SS22	10	2.2	82	66	54	41	33	27	23	20	16.3	54	44	36	27	22	18.2	15.6	13.6	10.9
		20	3.1	116	92	77	58	46	39	33	29	23	77	62	51	39	31	26	22	19.3	15.4
		30	3.8	142	113	94	71	57	47	40	35	28	94	75	63	47	38	31	27	24	18.9
		40	4.4	163	131	109	82	65	54	47	41	33	109	87	73	54	44	36	31	27	22
	¼K-SS24	10	2.4	89	71	59	45	36	30	25	22	17.8	59	48	40	30	24	19.8	17.0	14.9	11.9
		20	3.4	126	101	84	63	50	42	36	32	25	84	67	56	42	34	28	24	21	16.8
		30	4.2	154	123	103	77	62	51	44	39	31	103	82	69	51	41	34	29	26	21
		40	4.8	178	143	119	89	71	59	51	45	36	119	95	79	59	48	40	34	30	24

NOTE: Tip and Nozzle numbers shown in table indicate Stainless Steel construction. Also available in Brass.

TeeJet SPRAY NOZZLES with HOLLOW CONE ConeJet SPRAY TIPS

for row crop spraying of insecticides, fungicides, defoliants and foliar fertilizers

TeeJet Spray Nozzles with interchangeable ConeJet Tips provide a finely atomized hollow cone spray . . . for overall coverage of plant leaf surfaces. Other than the spray tips, nozzle construction is the same as described on page 8. Nozzles with ConeJet Tips are designed to give coverage from above and from below the surfaces of plant leaves. Usually this requires the use of drop pipes, with nozzles attached to Swivel Connectors, see page 28. TeeJet Swivel Nozzles may also be used, as shown at right. For easy connection of drop pipes to boom, see page 29 for Split-Eyelet Connectors.

Write for Data Sheet 5200-Y and 6970 for capacity data on 65° Type TY ConeJet Tips.

For complete listing of TX ConeJet Tip sizes, write for Data Sheet 5200-X.

INTERCHANGEABLE SPRAY TIPS

Nozzle bodies are of brass and stainless steel.

Type TX (80° at 100 psi) and Type TY (65° at 100 psi) ConeJet Tips

ConeJet

Type TLX (80° at 100 psi) and Type TLY (65° at 100 psi) ConeJet Tips with attached strainer.

Type ¼ TT with ¼" NPT MALE pipe connection

Typical nozzle for drop pipe mounting. Type 5000-¼T TeeJet Single Swivel Nozzle with ConeJet Tip. See page 28

HOW TO ORDER: For complete Nozzle, specify Nozzle Body, ConeJet Tip No., Material. Example: 6TTX1 Brass.
(For body options see pages 4 and 27).
To order Tip only, specify ConeJet Tip No., Material.
Example: TX1 Brass

ONE NOZZLE PER 30" SPACING

ConeJet TIP NO.	Liquid Press. in psi	(1 Hor.) Cap. in GPM	Gallons Per Acre 3 MPH	4 MPH	5 MPH
TX1 •1.1 GPA (100 Mesh)	40	1.1	11	.83	.66
	60	1.3	13	.98	.78
	75	1.4	14	•1.1	.85
	90	1.5	15	1.2	.92
	120	1.6	17	1.3	1.0
TX2 •2.2 GPA (100 Mesh)	40	2.0	22	1.7	1.3
	60	2.4	26	2.0	1.6
	75	2.6	29	•2.2	1.7
	90	2.8	31	2.3	1.9
	120	3.2	36	2.7	2.1
TX3 •3.3 GPA (100 Mesh)	40	3.0	33	2.5	2.0
	60	3.6	39	3.0	2.4
	75	4.0	43	•3.3	2.6
	90	4.2	47	3.5	2.8
	120	4.8	54	4.0	3.2
TX4 •4.4 GPA (50 Mesh)	40	4.0	44	3.3	2.6
	60	4.8	53	4.0	3.2
	75	5.3	59	•4.4	3.5
	90	5.8	64	4.8	3.8
	120	6.6	73	5.4	4.4
TX6 •6.6 GPA (50 Mesh)	40	6.0	66	5.0	4.0
	60	7.2	79	6.0	4.8
	75	8.0	88	•6.6	5.3
	90	8.7	96	7.2	5.7
	120	9.9	109	8.2	6.5
TX8 •8.9 GPA (50 Mesh)	40	8.0	88	6.6	5.3
	60	9.7	107	8.0	6.4
	75	10.8	119	•8.9	7.1
	90	11.8	130	9.7	7.8
	120	13.5	149	11.2	8.9
TX10 •11.1 GPA (50 Mesh)	40	10.0	110	8.3	6.6
	60	12.1	133	10.0	8.0
	75	13.5	149	•11.1	8.9
	90	14.7	162	12.2	9.7
	120	16.8	186	13.9	11.2
TX12 •13.4 GPA (50 Mesh)	40	12.0	132	9.9	7.9
	60	14.7	162	12.0	9.6
	75	16.4	181	•13.4	10.7
	90	17.9	198	14.6	11.7
	120	20.7	228	16.7	13.4
TX18 •20 GPA (50 Mesh)	40	18.0	198	14.9	11.9
	60	22.0	242	18.0	14.5
	75	24.5	270	•20	16.2
	90	26.9	296	22	17.6
	120	31.0	341	25	20
TX26 •29 GPA (50 Mesh)	40	26.0	286	21.5	17.2
	60	31.8	350	26	21
	75	35.5	391	•29	23
	90	38.9	428	32	26
	120	44.8	493	37	30

TWO NOZZLES PER 30" SPACING

ConeJet TIP NO.	Liquid Press. in psi	(2 Nor.) Cap. in GPM	Gallons Per Acre 3 MPH	4 MPH	5 MPH
TX1 •2.1 GPA (100 Mesh)	40	2.0	2.2	1.7	1.3
	60	2.4	2.6	2.0	1.6
	75	2.6	2.9	•2.1	1.7
	90	2.8	3.1	2.3	1.8
	120	3.2	3.5	2.6	2.1
TX2 •4.3 GPA (100 Mesh)	40	4.0	4.4	3.3	2.6
	60	4.9	5.2	3.9	3.1
	75	5.3	5.8	•4.3	3.5
	90	5.7	6.3	4.7	3.8
	120	6.5	7.1	5.3	4.3
TX3 •6.5 GPA (100 Mesh)	40	6.0	6.6	5.0	4.0
	60	7.2	7.9	5.9	4.7
	75	7.9	8.7	•6.5	5.2
	90	8.5	9.4	7.0	5.6
	120	9.7	10.7	8.0	6.4
TX4 •8.8 GPA (50 Mesh)	40	8.0	8.8	6.6	5.3
	60	9.6	10.6	7.9	6.4
	75	10.7	11.7	•8.8	7.0
	90	11.6	12.7	9.6	7.6
	120	13.2	14.5	10.9	8.7
TX6 •13.2 GPA (50 Mesh)	40	12.0	13.2	9.9	7.9
	60	14.4	15.9	11.9	9.5
	75	16.0	17.6	•13.2	10.5
	90	17.4	19.1	14.3	11.5
	120	19.8	22	16.3	13.1
TX8 •17.8 GPA (50 Mesh)	40	16.0	17.6	13.2	10.6
	60	19.4	21	16.0	12.8
	75	21.6	24	•17.8	14.3
	90	23.6	26	19.4	15.5
	120	27.0	30	22	17.8
TX10 •22 GPA (50 Mesh)	40	20.0	22	16.6	13.2
	60	24.3	27	20	16.0
	75	27.0	30	•22	17.8
	90	29.5	32	24	19.4
	120	33.8	37	28	22
TX12 •27 GPA (50 Mesh)	40	24.0	26	19.8	15.8
	60	29.1	32	24	19.2
	75	32.4	36	•27	21
	90	35.4	39	29	23
	120	40.6	45	33	27
TX18 •41 GPA (50 Mesh)	40	36.0	40	30	24
	60	44.0	48	36	29
	75	49.2	54	•41	32
	90	53.8	59	44	36
	120	62.1	68	51	41
TX26 •59 GPA (50 Mesh)	40	52.0	57	43	34
	60	63.6	70	52	42
	75	71.0	78	•59	47
	90	77.7	86	64	51
	120	89.7	99	74	59

THREE NOZZLES PER 30" SPACING

ConeJet TIP NO.	Liquid Press. in psi	(3 Nor.) Cap. in GPM	Gallons Per Acre 3 MPH	4 MPH	5 MPH
TX1 •3.2 GPA (100 Mesh)	40	3.0	3.3	2.5	2.0
	60	3.5	3.9	2.9	2.3
	75	3.9	4.3	•3.2	2.6
	90	4.2	4.6	3.5	2.8
	120	4.7	5.2	3.9	3.1
TX2 •6.5 GPA (100 Mesh)	40	6.0	6.6	5.0	4.0
	60	7.2	7.9	5.9	4.7
	75	7.9	8.7	•6.5	5.2
	90	8.5	9.4	7.0	5.6
	120	9.7	10.7	8.0	6.4
TX3 •9.8 GPA (100 Mesh)	40	9.0	9.9	7.4	5.9
	60	10.7	11.8	8.9	7.1
	75	11.8	13.0	•9.8	7.8
	90	12.8	14.1	10.6	8.5
	120	14.5	16.0	12.0	9.6
TX4 •13.2 GPA (50 Mesh)	40	12.0	13.2	9.9	7.9
	60	14.4	15.9	11.9	9.5
	75	16.0	17.6	•13.2	10.5
	90	17.4	19.1	14.3	11.5
	120	19.8	22	16.3	13.1
TX6 •19.8 GPA (50 Mesh)	40	18.0	19.8	14.9	11.9
	60	21.7	24	17.9	14.3
	75	24.0	26	•19.8	15.8
	90	26.1	29	21	17.2
	120	29.7	33	25	19.6
TX8 •27 GPA (50 Mesh)	40	24.0	26	19.8	15.8
	60	29.1	32	24	19.2
	75	32.4	36	•27	21
	90	35.3	39	29	23
	120	40.6	45	33	27
TX10 •33 GPA (50 Mesh)	40	30.0	33	25	19.8
	60	36.4	40	30	24
	75	40.5	45	•33	27
	90	44.2	49	36	29
	120	50.7	56	42	33
TX12 •40 GPA (50 Mesh)	40	36.0	40	30	24
	60	43.7	48	36	29
	75	48.6	53	•40	32
	90	53.0	58	44	35
	120	60.8	67	50	40
TX18 •61 GPA (50 Mesh)	40	54.0	59	45	36
	60	66.0	73	54	44
	75	73.7	81	•61	49
	90	80.7	89	67	53
	120	93.1	102	77	61
TX26 •88 GPA (50 Mesh)	40	78.0	86	64	51
	60	95.4	105	79	63
	75	107	117	•88	70
	90	117	128	96	77
	120	134	148	111	89

TeeJet SPRAY NOZZLES with DISC-CORE TYPE CONE SPRAY TIPS

for row crop spraying

HOLLOW CONE SPRAY PATTERN

Materials: Choice of brass, stainless steel and aluminum.

Weights: brass and stainless steel . . . 2-½ ounces
aluminum . . . 1 ounce

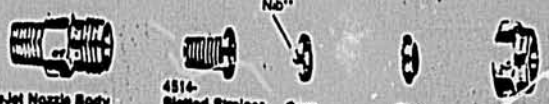
For spraying insecticides at higher pressures and flow rates. Especially suitable for wettable powders and other erosive chemicals. Larger capacity nozzles are also used in AIR BLAST sprayers. Supplied with choice of brass, aluminum or nylon slotted strainers . . . see page 27. Disc and cores may be used with all types of TeeJet Nozzle body assemblies as listed on page 4. CONE SPRAY PATTERN . . . Spray is uniformly distributed in a cone pattern with good atomization. Choice of Disc and Core combinations provides complete range of capacities.

HOW TO ORDER: For complete Nozzle, specify Nozzle Body, Disc and Core No., Material. Example: ¼T-D2-13 Brass. (For body options see pages 4 and 27).

To order Orifice Disc only, specify Disc No., Material. Example: D2 Hardened Stainless Steel.

To order Core only, specify Core No., Material. Example: No. 13 Brass.

FIVE PART NOZZLE



Combination TeeJet Disc and Core No. (Slotted Strainer No.)	Liquid Pressure in PSI	Capacity in GPM per Nozzle	GALLONS PER ACRE*—30" ROW SPACING — ONE NOZZLE PER ROW 3 MPH	4 MPH	5 MPH	TWO NOZZLES PER ROW 3 MPH	4 MPH	5 MPH	THREE NOZZLES PER ROW 3 MPH	4 MPH	5 MPH	GALLONS PER ACRE*—40" ROW SPACING — ONE NOZZLE PER ROW 3 MPH	4 MPH	5 MPH	TWO NOZZLES PER ROW 3 MPH	4 MPH	5 MPH	THREE NOZZLES PER ROW 3 MPH	4 MPH	5 MPH
D2-13 (4514-20)	40	.10	5.3	4.0	3.2	10.5	7.9	6.3	15.8	11.9	9.5	4.0	3.0	2.4	7.9	5.9	4.7	11.8	8.8	7.1
	60	.10	6.6	4.9	4.0	13.2	9.9	7.9	19.8	14.8	11.9	4.9	3.7	3.0	9.9	7.4	5.9	14.8	11.1	8.9
	80	.11	7.3	5.4	4.4	14.5	10.9	8.7	22	16.3	13.1	5.4	4.1	3.3	10.9	8.2	6.6	16.3	12.3	9.8
	100	.12	7.9	5.9	4.8	15.8	11.9	9.5	24	17.8	14.2	5.9	4.5	3.6	11.8	8.8	7.1	17.8	13.4	10.7
	150	.14	9.2	6.9	5.5	18.5	13.9	11.1	28	21	16.6	6.9	5.2	4.2	13.8	10.4	8.3	21	15.6	12.5
	250	.17	11.2	8.4	6.7	22	16.8	13.5	34	25	20	8.4	6.3	5.0	16.7	12.5	10.0	25	18.9	15.1
	400	.21	13.9	10.4	8.3	28	21	16.6	42	31	25	10.4	7.8	6.2	21	15.6	12.5	31	23	18.7
D2-23 (4514-20)	40	.10	6.6	4.9	4.0	13.2	9.9	7.9	19.8	14.8	11.9	4.9	3.7	3.0	9.9	7.4	5.9	14.9	11.1	8.9
	60	.13	8.6	6.4	5.2	17.2	12.9	10.3	26	19.3	15.5	6.2	4.6	3.7	12.4	9.3	7.4	18.5	13.9	11.1
	80	.14	9.2	6.9	5.5	18.5	13.9	11.1	28	21	16.6	6.9	5.2	4.2	13.9	10.4	8.3	21	15.6	12.5
	100	.16	10.6	7.9	6.3	21	15.8	12.7	32	24	19	7.7	5.8	4.6	15.4	11.6	9.2	23	17.3	13.8
	150	.19	12.5	9.4	7.5	23	18.8	15.0	38	28	23	9.2	6.9	5.5	18.3	13.7	11.0	27	21	16.5
	250	.23	15.2	11.4	9.1	30	23	18.2	46	34	27	11.3	8.4	6.8	23	16.9	13.5	34	25	20
	400	.28	18.5	13.9	11.1	37	28	22	55	42	33	13.9	10.4	8.3	28	21	16.7	42	31	25
D3-23 (4514-20)	40	.12	7.9	5.9	4.8	15.8	11.9	9.5	24	17.8	14.2	5.8	4.4	3.5	11.7	8.8	7.0	17.5	13.1	10.5
	60	.14	9.2	6.9	5.5	18.5	13.9	11.1	28	21	16.6	6.9	5.2	4.2	13.9	10.4	8.3	21	15.6	12.5
	80	.16	10.6	7.9	6.3	21	15.8	12.7	32	24	19	7.9	5.9	4.8	15.8	11.9	9.5	24	17.8	14.4
	100	.18	11.9	8.9	7.1	24	17.8	14.2	36	27	21	8.7	6.5	5.2	17.4	13.1	10.5	26	19.5	15.6
	150	.21	14.0	10.4	8.3	28	21	16.6	42	31	25	10.3	7.8	6.2	21	15.5	12.4	31	23	18.6
	250	.27	17.2	12.9	10.3	34	26	21	52	39	31	12.8	9.6	7.7	26	19.2	15.4	38	29	23
	400	.32	21	15.8	12.7	42	32	25	63	48	38	15.8	12.8	9.5	32	24	19.0	47	35	28
D2-25 (4514-20)	40	.13	10.6	7.9	6.3	21	15.8	12.7	32	24	19	8.0	6.0	4.8	15.9	11.9	9.6	24	17.9	14.3
	60	.17	12.5	9.4	7.5	25	18.8	15.0	38	28	23	9.6	7.2	5.8	19.2	14.4	11.5	29	22	17.3
	80	.20	14.6	10.9	8.7	29	22	17.4	44	33	26	10.9	8.2	6.6	22	16.4	13.2	33	25	19.7
	100	.22	16.5	12.4	9.9	33	25	19.8	50	37	30	12.1	9.1	7.3	24	18.1	14.5	36	27	22
	150	.27	20.1	15.1	12.1	38	29	23	57	43	34	14.5	10.9	8.7	29	22	17.5	44	33	26
	250	.35	26.1	19.6	15.7	49	37	29	73	55	44	18.3	13.7	11.0	37	28	22	55	42	33
	400	.46	34.3	25.7	20.6	64	49	38	96	72	58	23	17.1	13.7	46	35	28	68	51	41
D3-25 (4514-32)	40	.17	12.5	9.4	7.5	25	18.8	15.0	38	28	23	9.4	7.0	5.6	18.7	14.0	11.2	28	21	16.8
	60	.21	15.4	11.5	9.1	30	23	18.2	46	34	27	11.3	8.6	6.8	23	17.0	13.5	34	26	20
	80	.24	17.6	13.2	10.3	34	26	21	52	39	31	12.9	9.7	7.7	26	19.4	15.5	39	29	23
	100	.27	19.8	14.8	11.5	38	29	23	57	43	34	14.4	10.8	8.7	29	22	17.3	43	33	26
	150	.33	24.3	18.2	14.2	46	35	28	69	52	42	17.3	13.0	10.4	35	26	21	52	39	31
	250	.43	31.5	23.6	18.4	59	44	35	87	65	52	22	16.5	13.1	44	33	26	66	49	40
	400	.55	40.4	30.3	23.6	76	57	45	114	85	68	27	20	16.3	54	41	33	82	61	49
D3-45 (4514-32)	40	.25	18.4	13.8	11.0	37	28	22	55	42	33	11.4	8.6	6.9	23	17.1	13.7	34	26	21
	60	.30	22.1	16.6	13.2	44	33	26	65	49	39	13.9	10.4	8.4	28	21	16.7	42	32	25
	80	.35	25.7	19.3	15.4	51	38	30	76	57	45	16.2	12.2	9.7	32	24	19.4	49	36	29
	100	.39	28.7	21.5	17.2	57	43	34	86	64	51	18.0	13.5	10.8	36	27	22	54	41	33
	150	.48	35.2	26.4	21.1	70	53	42	105	79	63	22	16.3	13.0	43	33	26	65	49	39
	250	.63	46.3	34.7	27.8	92	69	55	139	104	83	28	21	16.7	56	42	33	84	63	50
	400	.80	58.8	44.1	35.3	118	88	71	176	132	106	35	26	21	70	53	42	105	79	63
D4-25 (4514-32)	40	.33	24.3	18.2	14.6	49	36	29	73	55	44	14.2	10.6	8.6	28	21	17	43	32	26
	60	.40	29.4	22.1	17.6	59	44	35	88	66	53	17.3	13.0	10.4	35	27	21	52	39	31
	80	.46	33.8	25.3	20.3	68	51	40	101	76	60	19.8	14.9	11.9	40	30	24	60	45	36
	100	.52	38.2	28.7	22.9	76	57	45	115	86	69	22	16.5	13.2	44	33	26	66	50	40
	150	.64	47.0	35.2	28.2	94	71	56	141	106	85	27	20	16.0	53	40	32	80	60	48
	250	.84	61.8	46.3	37.1	123	92	74	185	139	111	34	25	20	68	51	41	101	76	61
	400	1.06	78.0	58.5	46.8	156	117	94	234	176	141	43	32	26	85	64	51	128	96	77

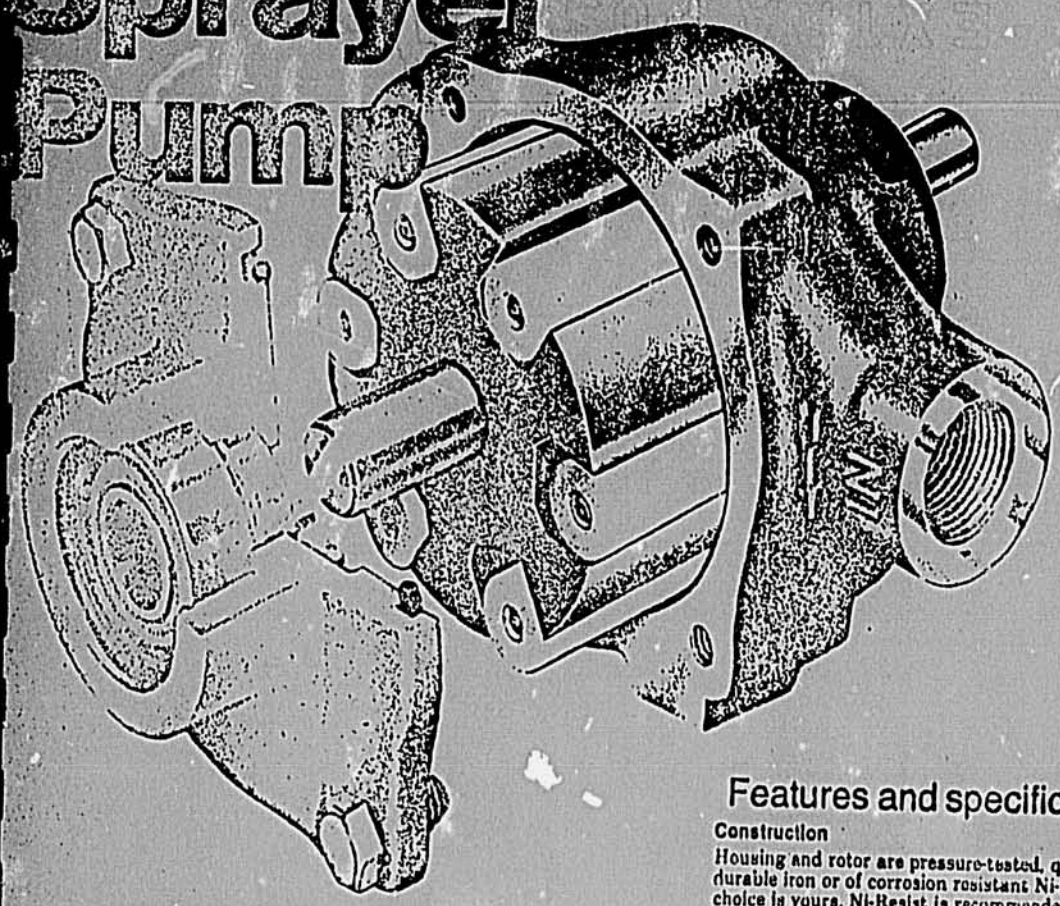
*Indicates Gallons Per Acre figures based on water. See page 5 for Conversion Factor for other liquid solutions . . . or for spacing of nozzles other than 30" and 40" row.

NOTE: Capacities listed on these two pages are the most widely used sizes. For complete information write for Data Sheets 4498, 6430 and 9928.

APPENDIX C

HYPRO SERIES 6500 ROLLER PUMP

Hypro Series 6500 Sprayer Pump



PRESSURES to 300 PSI
CAPACITY to 22 GPM
Fits both 540 & 1000 RPM PTO shafts

New scoopless rotor design with strong six-roller performance delivers more capacity at spraying pressures than previous models. Choice of rollers, seals and pump material to suit the application.

The Hypro Series 6500 pump has no valves or gears to break or wear. Easy roller replacement solves most maintenance problems. It handles wettable powder suspensions as well as many weed and pest control chemical solutions. Operates efficiently at speeds from 300 rpm to 1200 rpm; adapters are available for both 540 and 1000 rpm tractor power take-off shafts.

A formed steel base plate is available for surface mounting when the pump is driven by electric motor or gas engine through an appropriate speed reducer. See other side for picture of pump with base.

Features and specifications

Construction

Housing and rotor are pressure-tested, quality casting of durable iron or of corrosion resistant Ni-Resist alloy. The choice is yours. Ni-Resist is recommended for corrosive chemicals such as soil fumigants, phosphate insecticides, and liquid fertilizers. Each pump is pressure tested at the factory before shipment.

Rollers

Standard nylon rollers are used for all-around spraying of fertilizers, weed and insect control chemicals including suspensions. Optional Buna-N (rubber) rollers are used for pumping water, related liquids (pressure limit - 100 PSI). Other optional rollers available: polypropylene and teflon. Polypropylene rollers have proved to be an excellent replacement for both nylon and Buna-N in a number of applications with better wear characteristics than nylon in weak solutions or solutions with little or no lubricating qualities. Teflon rollers have also demonstrated multi-use chemical handling ability.

Seals

Replaceable cartridge-type shaft seals with viton element best for most agricultural spray materials. Buna-N or leather seals operional as needed.

Bearings

[illegible] heavy-duty, sealed ball bearings—factory lubricated.

Ports

Inlet and outlet and 3/4" NPT.

Shaft

5/8" diameter stainless steel solid shaft resists corrosion and wear.

Temperature Range—140° F Max.

Shipping Weight—8½ lbs.
Add 1/2 lb. for Ni-Resist
Add 1 lb. for adapter, 2 lbs. for quick coupler

ormance table: SERIES 6500 PUMPS

, in gallons per minute and Horsepower required at various speeds
ressures.

0 PSI		50 PSI		100 PSI		150 PSI		200 PSI		250 PSI		300 PSI	
GPM	HP	GPM	HP	GPM	HP	GPM	HP	GPM	HP	GPM	HP	GPM	HP
5.8	.04	3.3	.34	2.6	.46	1.8	.67	1.2	.86				
7.6	.06	5.4	.45	4.6	.63	3.5	.89	2.9	1.12	2.0	1.38	1.2	1.65
10.2	.09	8.1	.58	7.5	.83	6.7	1.16	6.0	1.45	5.1	1.81	4.1	2.14
11.4	.10	9.1	.65	8.6	.90	7.7	1.27	7.2	1.62	6.1	2.01	5.4	2.36
15.1	.17	12.9	.86	12.3	1.21	11.3	1.68	10.9	2.14	10.1	2.65	9.4	3.13
18.7	.25	16.4	1.11	15.8	1.54	14.7	2.13	14.2	2.69	13.5	3.33	12.6	3.99
21.9	.39	19.7	1.40	18.9	1.93	18.1	2.69	17.5	3.35	16.8	4.14	16.0	4.93

ING: Series 6500 pumps are self priming
ree feet and with foot valve or check
will hold prime at elevations up to 22
ove the supply level.

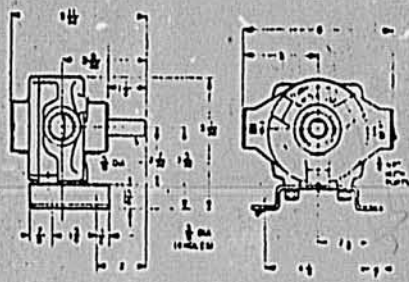
ATION: Standard rotation is counter
wise and inlet is on the left when viewed
the shaft end. Reversed (clockwise) rota-
with inlet at right), is available on special
Shaft extends from end plate on
d pump. Reversing of pump requires arbor
See Instruction Form 84.

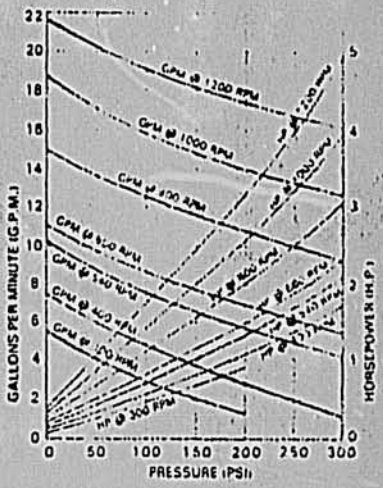
NOTE 1. Horsepower ratings are for electric motor drives, for gas engine requirements, follow engine manufacturer.

NOTE 2. Limit pressures to 100 psi when using rubber rollers.

NOTE 3. Use a one inch suction hose when operating at speeds above 800 rpm.

DIMENSIONS (inches)



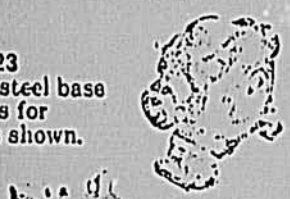


ariations

C
-iron pump with ⅞" OD shaft
cify base plate below, or shaft
ter from list at right).

N
esist pump with ⅞" OD shaft
cify base plate below, or shaft
ter from list at right).

-0023
ed steel base
bolts for
p as shown.



EC 1221
ine-driven pumping unit, includes
-iron pump with 1" shaft and 3-hp
ine with 600 rpm gearbox—all
nted on a steel plate. (Maximum
ssure is 150 psi.)

EC 1187
as above but with Ni-Resist
mp.

PRINTED IN U.S.A. (WC)

OPTIONAL ADAPTERS

1321-0006
Quick Coupler for 6-spline 540 rpm PTO shaft

1321-0008
Quick Coupler for 21-spline 1000 rpm PTO shaft

1320-0022
Adapter with smooth bore for 1¾" diameter PTO shaft

1320-0053
Adapter for 1¾" diameter 21-spline, 1000 rpm PTO shaft

1400-0001
Reducing sleeve for fitting 1320-0022 adapter to 1¾" PTO shaft

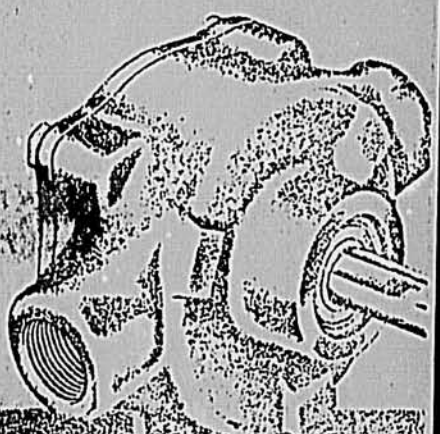
1320-0024
Adapter for IHC Cub Tractor

1320-0061
Adapter for 1¾" PTO shafts on Ford and Ferguson tractors

1320-0015
Adapter for ⅞" engine shafts

HYPRO SERIES 6500 Roller Pump

for 540 or 1000 rpm PTO shafts.



Hypro
A DIVISION OF LEAR SIEGLER, INC.
375 5th Ave. NW • New Brighton, MN 55112 • (612) 636-3000
HIGH PERFORMANCE SPRAYER PUMPS

...KIT No. 3430-0027
...Six No. 1004-0004 Nylon Rollers and one No. 1720-0008 O-Ring for End Plate

PARTS KIT NO. 3430-0027
Contains Six No. 1004-0004 Nylon Rollers, one No. 1720-0008 O-Ring for End Plate and two No. 2107-0002 Viton Seals.

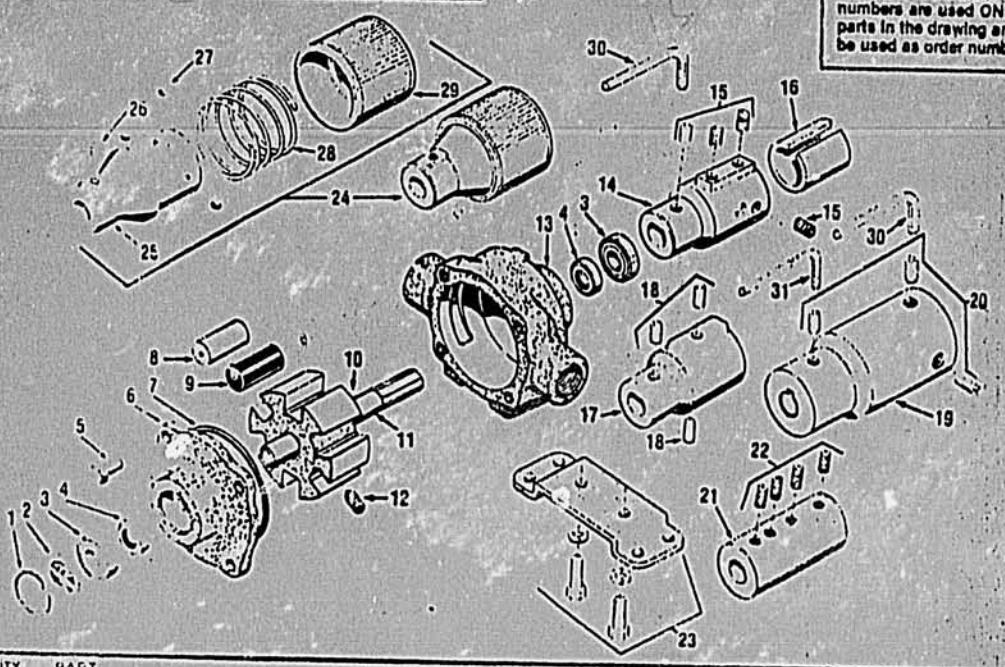
PARTS KIT NO. 3430-0174 (Delta Letter T3 Pump)
Contains: Six No. 1003-0004 Polypropylene Rollers and one No. 1720-0008 O Ring for End Plate

PARTS KIT NO. 3430-0175 (Delta Letter T3 Pump)
Contains: Six No. 1003-0004 Polypropylene Rollers, one No. 1720-0008 O Ring for End Plate and two No. 2107-0002 Viton Seals.

Hypro PARTS LIST
MODELS 6500C, 6500N

SERIES 6500 ROLLER PUMPS
Form 1304 (6-81)

NOTE: When ordering parts, give QUANTITY, PART NUMBER, DESCRIPTION, and COMPLETE MODEL NUMBER. Reference numbers are used ONLY to identify parts in the drawing and are NOT to be used as order numbers.



REF. NO.	QUANTITY REQUIRED	PART NUMBER	DESCRIPTION
1	1	1800-0001	Retainer Ring
2	1	0600-	Name Plate (Specify Pump Model Number)
3	2	2000-0004	Ball Bearing (Sealed)
4	2	2107-0002	Seal (Viton)-Standard
4	2	2102-0001	Seal (Buna-N)-Optional
4	2	2103-0001	Seal (Leather)-Optional
5	4	2210-0004	Bolt for End Plate
6	1	0200-6600C	End Plate (Cast Iron)-Includes Standard Seal (Ref. 4)
6	1	0200-6600N	End Plate (Ni-Resist)-Includes Standard Seal (Ref. 4)
7	1	1720-0008	O Ring for End Plate
8	6	1000-0004	Roller (Nylon) Standard
8	6	1002-0004	Roller (Polypropylene) Optional
8	6	1003-0004	Roller (Teflon)-Optional
8	6	1001-0004	Roller (Buna-N)-Optional
10	1	0300-6600C	Rotor (Cast Iron) with Shaft
10	1	0300-6600N	Rotor (Ni-Resist) with Shaft
11	1	0500-6600	Shaft Only
12	1	2230-0003	Set Screw Only
13	1	0100-6600C	Body (Cast Iron) Includes Standard Seal (Ref. 4)
13	1	0100-6600N	Body (Ni-Resist) Includes Standard Seal (Ref. 4)
14	1	1320-0022	Standard Adapter for 1 3/8 inch, 6-spline, 540 RPM PTO (Includes Accessory Kit No. 3410-0001).
15	1	3410-0001	Accessory Kit (4 Set Screws) for Adapter No. 1320-0022
16	1	1400-0001	Spacer Sleeve for Adapter No. 1320-0022 (1 3/8-inch PTO)
17	1	1320-0053	Standard Adapter for 1 3/8-inch, 21-spline, 1000 RPM PTO (Includes Accessory Kit No. 3410-0027)
18	1	3410-0027	Accessory Kit (3 Set Screws) for Adapter No. 1320-0053
19	1	1320-0082	Standard Adapter for 1 3/4-inch, 21-spline, 1000 RPM PTO (Includes Accessory Kit No. 3410-0030)
20	1	3410-0030	Accessory Kit (3 Set Screws) for Adapter No. 1320-0062
21	1	1320-0024	Adapter for Farm-All Cub 1-inch PTO (Includes Accessory Kit No. 3410-0003)
22	1	3410-0003	Accessory Kit (4 Set Screws) for Adapter No. 1320-0024
23	1	3420-0023	Base Kit (Includes No. 1510-0042 Base (2) No. 2200-0002 Lockwashers and (2) No. 2210-0003 Hex Head Bolts)
24	1	1321-0006	Quick Coupler Adapter, Complete for 1 3/8-inch, 6-spline, 540 RPM PTO
24	1	1321-0008	Quick Coupler Adapter, Complete for 1 3/8-inch 21-spline, 1000 RPM PTO
25	1	1320-0031	Body Only (1 3/8-inch bore) for Quick Coupler Adapter No. 1321-0006
25	1	1320-0032	Body Only (1 3/8-inch bore) for Quick Coupler Adapter No. 1321-0008
26	1	2230-0003	Set Screw
27	3	3250-0004	Nylon Ball
28	1	1900-0008	Compression Spring
29	1	1400-0008	Sleeve
30	1	3020-0002	5/32" Allen Wrench for Set Screws—Adapter No. 1320-0022 No. 1320-0024, No. 1320-0053 No. 1320-0062, No. 1321-0006 & No. 1321-0008.
31	1	3020-0001	3/16" Allen Wrench for pump shaft set screw on Adapter No. 1320-0062

ORDER PARTS FROM YOUR REGULAR SUPPLIER
Prices in effect at time of [illegible] will apply

Printed in the U.S.A. (PC)

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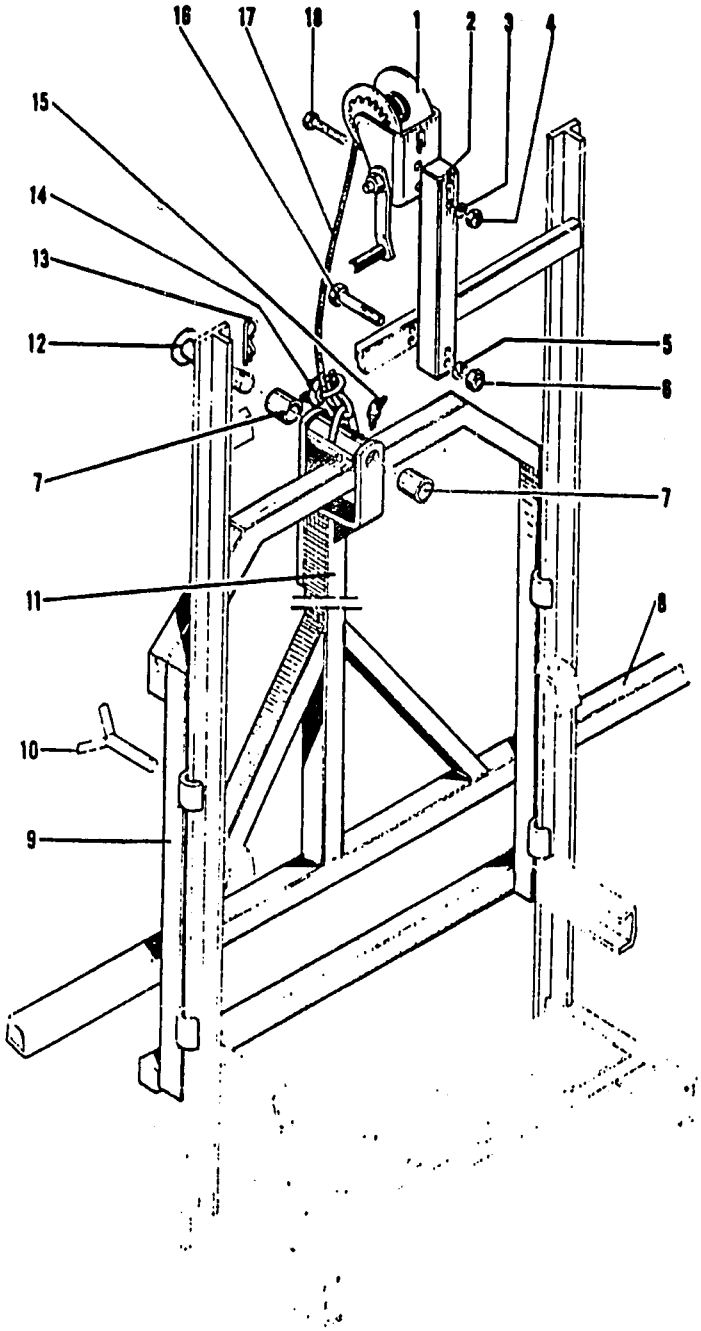
375 Fifth Ave NW St Paul MN 55112 • (612) 633-5010

APPENDIX D

EXAMPLE OF A BOOM MOUNTING AND BOUNCE CONTROL MECHANISM FROM NIR DAVID MODEL 30 OPERATORS MANUAL

PENDULUM, PULLEY BLOCK

Fig. F



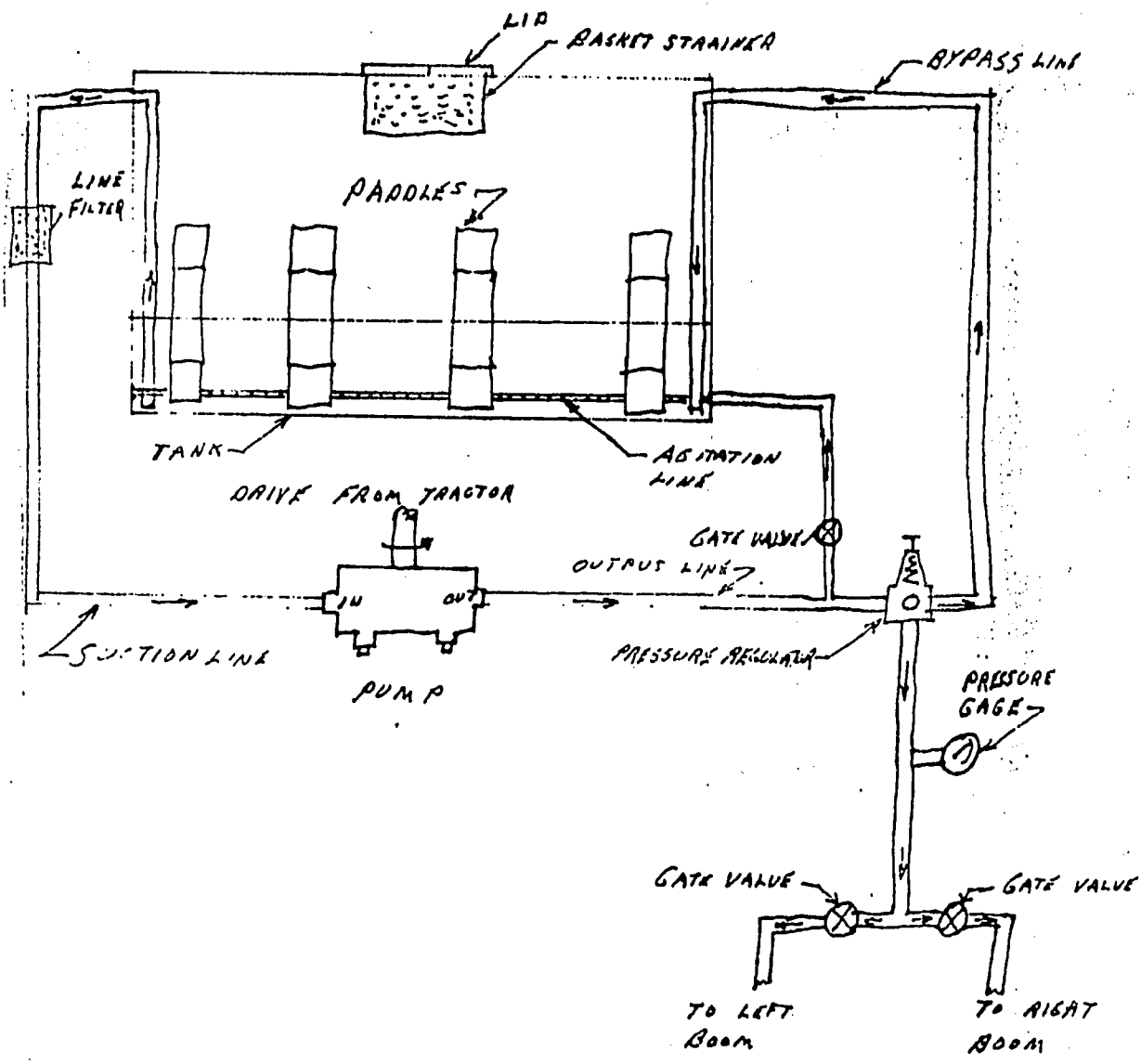
PENDULUM, PULLEY BLOCK

PART No.	CATALOGUE No.	DESCRIPTION	SIZE	QUANTITY
1		Pulley		1
2		Pulley support arm		1
3		Spring washer	3/5"	6
4		Nut	3/8" NC	6
5		Spring washer	5/16"	2
6		Nut	5/16" NC	2
7		Bronze bearing		2
8		Spray rod - center part		1
9		Pendulum frame		1
10		Lock screw		4
11		Pendulum arm		1
12		Pendulum pivot pin		1
13		Spring loaded lock spin		1
14		Steel cable clamp		1
15		Grease cup		1
16		Screw	5/16" X 82 NC	2
17		Steel cable		1
18		Screw	3/8" X 57 NC	2

APPENDIX E

SCHEMATIC OF SUGGESTED HYDRAULIC CIRCUIT

FOR BEHERA SPRAYER

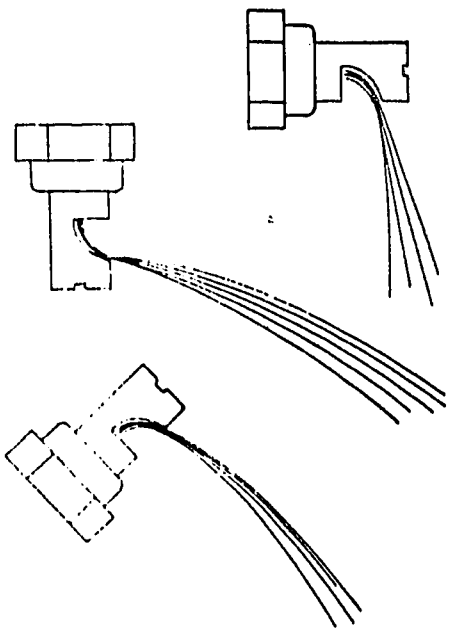


SCHEMATIC OF SUGGESTED HYDRAULIC CIRCUIT FOR BEHERA SPRAYER.

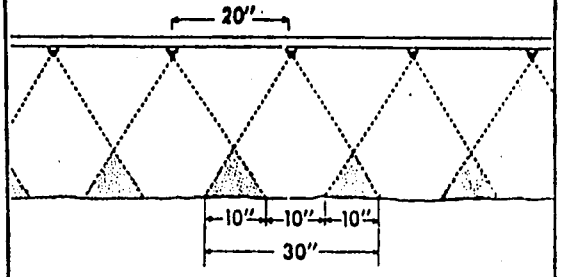
APPENDIX F

EXAMPLES OF OVERLAP, NOZZLE TYPE AND SPRAY PATTERNS

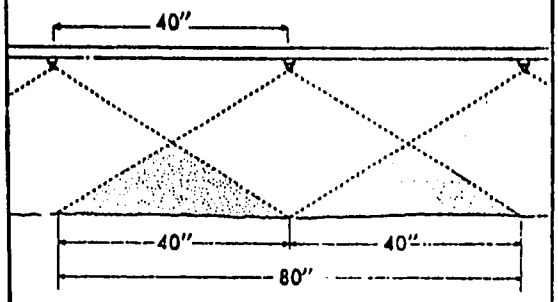
Flooding Nozzle Operating Positions



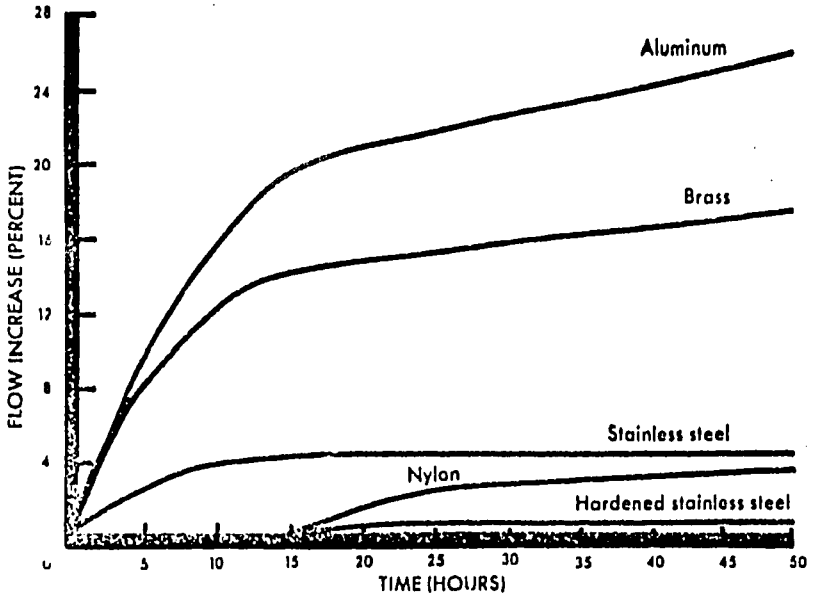
Spray Overlap (50 Percent)



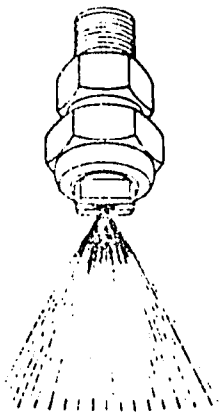
Spray Overlap (100 Percent)



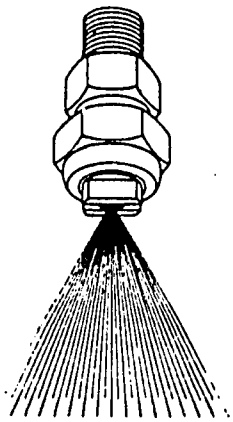
Wear Rates of Various Materials (Regular Flat-Fan Nozzle)



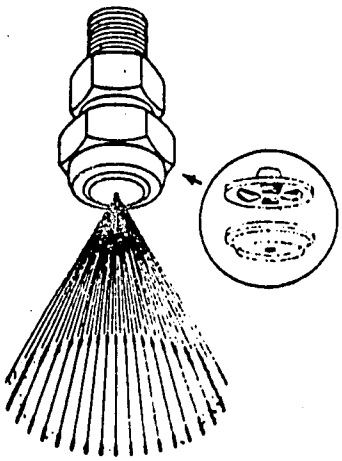
Nozzle Spray Patterns



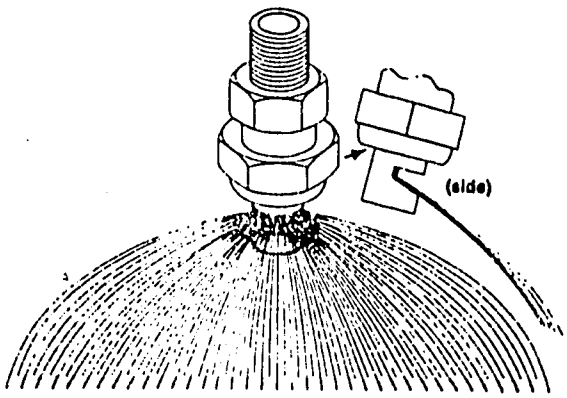
Regular Flat Fan



Even Flat Fan

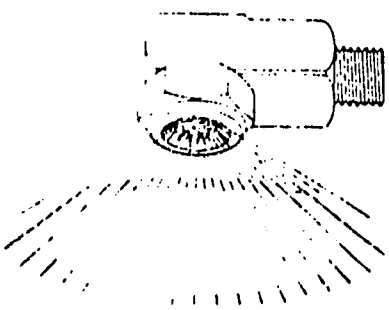


Hollow Cone

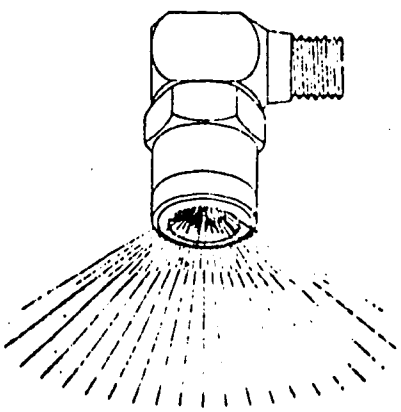


Flooding Flat Fan

(front)



Whirl Chamber



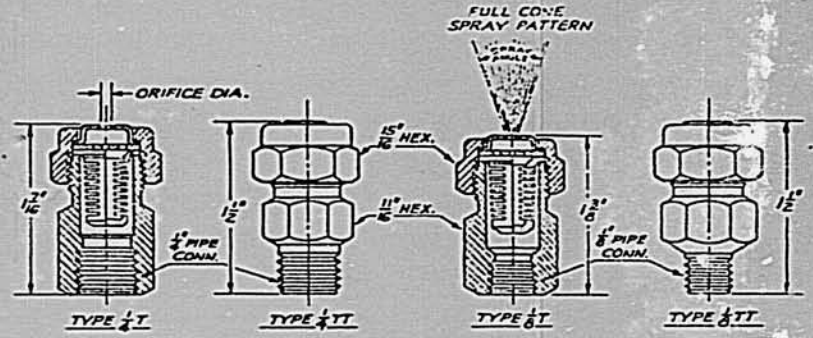
RA Raindrop[1]

APPENDIX G

CAPACITY AND SPRAY ANGLE AT VARIOUS PRESSURES OF ALL REASONABLE COMBINATIONS OF HOLLOW CONE DISC AND CORE (WHIRL PLATE) NOZZLE TIPS

NOZZLE NO TYPE T FEMALE CONN.	NOZZLE NO TYPE TT MALE CONN.	ORIFICE NO	CORE NO	ORIFICE DIA	CAPACITY G.P.M. (Gallons Per Minute) AND SPRAY ANGLE AT p.s.i. (Lbs per sq inch) 10	15	20	25	30	40	60	80	100	150	200	300	400
1/8TDI-31	1/8TTDI-31	D1	31	.031"	.03	.10	.11	.12	.13	.15	.18	.20	.23	.27	.31	.37	.42
1/4TDI-31	1/4TTDI-31				35°	42°	48°	52°	51°	47°	45°	43°	41°	37°	33°	30°	30°
1/8TDI.5-31	1/8TTDI.5-31	D1.5	31	.036"	.10	.12	.14	.16	.17	.19	.23	.26	.29	.35	.40	.48	.55
1/4TDI.5-31	1/4TTDI.5-31				46°	54°	57°	62°	64°	65°	60°	53°	52°	48°	42°	40°	38°
1/8TD2-31	1/8TTD2-31	D2	31	.041"	.12	.14	.16	.18	.19	.22	.26	.30	.33	.40	.45	.55	.62
1/4TD2-31	1/4TTD2-31				48°	56°	62°	66°	65°	63°	62°	61°	59°	54°	52°	43°	48°
1/8TD3-31	1/8TTD3-31	D3	31	.047"	.13	.15	.18	.20	.21	.24	.29	.33	.37	.44	.50	.60	.68
1/4TD3-31	1/4TTD3-31				49°	58°	63°	67°	66°	65°	64°	63°	62°	67°	60°	58°	56°
1/8TDI-33	1/8TTDI-33	D1	33	.031"	.09	.10	.11	.114	.12	.14	.17	.20	.22	.26	.30	.37	.42
1/4TDI-33	1/4TTDI-33				79°	24°	27°	30°	31°	32°	34°	35°	36°	37°	38°	37°	27°
1/8TDI.5-33	1/8TTDI.5-33	D1.5	33	.036"	.12	.14	.15	.16	.17	.19	.23	.26	.30	.36	.41	.50	.57
1/4TDI.5-33	1/4TTDI.5-33				31°	34°	37°	39°	40°	43°	44°	45°	45°	46°	46°	45°	43°
1/8TD2-33	1/8TTD2-33	D2	33	.041"	.13	.15	.17	.19	.21	.24	.29	.33	.37	.45	.52	.63	.72
1/4TD2-33	1/4TTD2-33				40°	42°	45°	47°	49°	52°	55°	55°	55°	55°	55°	52°	48°
1/8TD3-33	1/8TTD3-33	D3	33	.47	.15	.18	.21	.23	.25	.29	.36	.41	.45	.55	.63	.76	.88
1/4TD3-33	1/4TTD3-33				45°	46°	48°	50°	52°	54°	56°	57°	57°	57°	57°	56°	54°
1/8TD4-33	1/8TTD4-33	D4	33	.063"	.20	.24	.28	.31	.34	.39	.47	.54	.60	.73	.83	1.02	1.17
1/4TD4-33	1/4TTD4-33				47°	48°	50°	52°	53°	56°	59°	61°	62°	63°	63°	63°	58°
1/8TDI-35	1/8TTDI-35	D1	35	.031"	.08	.09	.11	.12	.13	.14	.17	.20	.22	.26	.29	.35	.40
1/4TDI-35	1/4TTDI-35				11°	16°	19°	21°	22°	23°	25°	26°	27°	27°	27°	27°	26°
1/8TDI.5-35	1/8TTDI.5-35	D1.5	35	.036"	.10	.12	.14	.16	.17	.19	.23	.26	.29	.34	.39	.46	.52
1/4TDI.5-35	1/4TTDI.5-35				15°	19°	23°	25°	26°	27°	28°	29°	30°	30°	30°	30°	29°
1/8TD2-35	1/8TTD2-35	D2	35	.041"	.14	.16	.18	.20	.24	.25	.30	.34	.37	.45	.51	.60	.68
1/4TD2-35	1/4TTD2-35				35°	38°	40°	42°	43°	44°	45°	47°	47°	45°	44°	40°	38°
1/8TD3-35	1/8TTD3-35	D3	35	.047"	.16	.18	.22	.24	.26	.30	.36	.41	.45	.55	.62	.74	.85
1/4TD3-35	1/4TTD3-35				37°	42°	45°	47°	49°	50°	51°	52°	52°	48°	45°	42°	40°
1/8TD4-35	1/8TTD4-35	D4	35	.063"	.27	.32	.37	.41	.44	.50	.60	.70	.79	.93	1.1	1.3	1.5
1/4TD4-35	1/4TTD4-35				61°	65°	68°	69°	70°	70°	71°	71°	70°	68°	63°	60°	54°
1/8TD5-35	1/8TTD5-35	D5	35	.078"	.34	.42	.48	.53	.58	.66	.80	.92	1.0	1.2	1.4	1.7	1.9
1/4TD5-35	1/4TTD5-35				61°	65°	67°	68°	69°	69°	70°	71°	71°	69°	65°	62°	59°
1/8TD2-56	1/8TTD2-56	D2	56	.041"					.21	.25	.30	.35	.39	.47	.55	.67	.77
1/4TD2-56	1/4TTD2-56								12°	14°	16°	17°	16°	15°	17°	16°	16°
1/8TD3-56	1/8TTD3-56	D3	56	.047"				.27	.29	.34	.41	.48	.53	.65	.75	.92	1.07
1/4TD3-56	1/4TTD3-56							16°	18°	20°	22°	23°	24°	24°	23°	22°	22°
1/8TD4-56	1/8TTD4-56	D4	56	.063"		.34	.39	.44	.48	.55	.67	.78	.87	1.06	1.23	1.51	1.74
1/4TD4-56	1/4TTD4-56					18°	20°	22°	24°	26°	28°	29°	30°	30°	29°	28°	28°
1/8TD5-56	1/8TTD5-56	D5	56	.078"	.38	.46	.54	.60	.66	.78	.93	1.08	1.20	1.47	1.69	2.08	2.45
1/4TD5-56	1/4TTD5-56				20°	24°	28°	28°	30°	32°	33°	34°	35°	35°	34°	33°	33°
1/8TD6-56	1/8TTD6-56	D6	56	.094"	.55	.67	.78	.87	.95	1.10	1.35	1.55	1.74	2.13	2.46	3.02	3.48
1/4TD6-56	1/4TTD6-56				27°	31°	34°	36°	37°	39°	40°	41°	41°	40°	39°	38°	38°
1/8TD7-56	1/8TTD7-56	D7	56	.109"	.76	.93	1.07	1.20	1.32	1.52	1.86	2.15	2.40	2.94	3.40	4.16	4.80
1/4TD7-56	1/4TTD7-56				37°	42°	45°	48°	50°	52°	53°	54°	54°	53°	52°	51°	51°
1/8TD8-56	1/8TTD8-56	D8	56	.125"	.98	1.18	1.36	1.52	1.67	1.93	2.36	2.73	3.05	3.73	4.32	5.25	6.12
1/4TD8-56	1/4TTD8-56				42°	48°	51°	54°	55°	57°	58°	59°	59°	58°	57°	56°	55°
1/8TD10-56	1/8TTD10-56	D10	56	.156"	1.35	1.65	1.91	2.15	2.34	2.70	3.31	3.82	4.26	5.22	6.03	7.33	8.56
1/4TD10-56	1/4TTD10-56				54°	57°	62°	63°	64°	65°	66°	67°	67°	66°	65°	64°	64°

PATENT PENDING



- TABULATION IS BASED ON WATER AT TEMPERATURE OF 70°F.
- NOZZLE CAPS AND BODIES ARE THE SAME AS USED ON ALL TEEJET NOZZLES; THEREFORE, STANDARD TIPS AND STRAINERS ARE INTERCHANGEABLE WITH THOSE OF THE DISC TYPE TEEJET.
- THE ORIFICE DISCS ARE INTERCHANGEABLE, AS ARE THE CORES.
- ORIFICE DISCS ARE MADE OF HARDENED STAINLESS STEEL. ALL OTHER PARTS ARE MADE OF BRASS.
- STRAINER IS APPROXIMATELY EQUIVALENT TO 25 MESH SCREEN.
- FOR OTHER DISC TYPE TEEJETS SEE DATA SHEET 4498.
- SUPERSEDES DATA SHEETS 4947, 6208 AND 8677.

DESCRIPTION

FULL CONE SPRAY
DISC TYPE TEEJET NOZZLES

SPRAYING SYSTEMS CO.
Engineers and Manufacturers
3201 RANDOLPH ST. BELLWOOD, ILL.
DR. BY L.R.
DATE 5-24-60
DWG. NO. 4498-1

C-1

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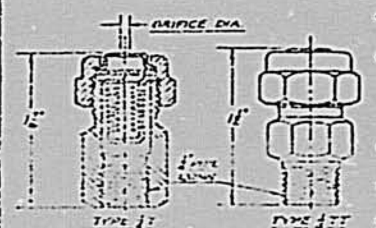
-220-

Nozzle No. Type T Female Conn.	Type TT Male Conn.	Disc No.	Core No.	Orifice Dia. Inches	10	15	20	25	30	40	60	80	100	150	200	300	400
					Capacity G.P.M. (Gallons Per Minute) and Spray Angle at p.s.i. (Lbs. per sq. inch)												
1/8T D1-13	1/8TT D1-13	D1	13	.031				.035	.050	.060	.072	.085	.097	.115	.129	.152	.172
[illegible]	1/4TT D1-13							42°	46°	51°	59°	62°	64°	66°	[illegible]	[illegible]	[illegible]
[illegible]	1/8TT D1.5-13	D1.5	13	.036			.057	.062	.067	.075	.085	.095	.110	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	1/4TT D1.5-13						38°	45°	49°	55°	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1/8T D2-13	1/8TT D2-13	D2	13	.041		[illegible]	[illegible]	.070	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1/4T D2-13	1/4TT D2-13					[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1/8T D3-13	1/8TT D3-13	D3	13	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1/4T D3-13	1/4TT D3-13					[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1/8T D4-13	1/8TT D4-13	D4	13	.063	[illegible]	[illegible]	[illegible]	.10	.11	.12	.14	.16	.17	.20	[illegible]	.27	.30
1/4T D4-13	1/4TT D4-13				[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	81°	83°	85°	84°	[illegible]	85°	85°
1/8T D1-23	1/8TT D1-23	D1	23	.031					.064	[illegible]	[illegible]	.090	.107	.124	.139	.164	.184
1/4T D1-23	1/4TT D1-23								[illegible]	47°	[illegible]	58°	60°	65°	66°	65°	65°
1/8T D1.5-23	1/8TT D1.5-23	D1.5	23	.036			[illegible]	[illegible]	[illegible]	[illegible]	.107	.117	.130	.155	.175	.210	.230
1/4T D1.5-23	1/4TT D1.5-23						34°	43°	45°	51°	56°	62°	65°	66°	67°	67°	67°
1/8T D2-23	1/8TT D2-23	D2	23	.041		.070	.078	.085	.092	.10	.13	.14	.16	.19	.21	.25	.28
1/4T D2-23	1/4TT D2-23					43°	51°	55°	59°	63°	[illegible]	70°	71°	72°	[illegible]	72°	72°
1/8T D3-23	1/8TT D3-23	D3	23	.047	.065	.072	.077	[illegible]	.10	.12	.14	.16	.18	.21	.22	[illegible]	.32
1/4T D3-23	1/4TT D3-23				39°	[illegible]	58°	62°	65°	69°	73°	75°	76°	77°	77°	77°	77°
1/8T D4-23	1/8TT D4-23	D4	23	.063	.082	.100	.113	.13	.14	.15	.19	.21	.23	.28	.32	.39	.44
1/4T D4-23	1/4TT D4-23				54°	62°	65°	74°	77°	82°	83°	87°	85°	85°	[illegible]	[illegible]	85°
1/8T D5-23	1/8TT D5-23	D5	23	.078	.095	.117	.13	.15	.16	.18	.22	.25	.28	.34	.38	.45	.53
1/4T D5-23	1/4TT D5-23				62°	73°	79°	[illegible]	85°	89°	92°	94°	95°	96°	96°	95°	95°
1/8T D6-23	1/8TT D6-23	D6	23	.094	.112	.132	.15	.17	.19	.21	.26	.29	.32	.39	.45	.54	.62
1/4T D6-23	1/4TT D6-23				70°	75°	84°	87°	89°	93°	96°	98°	99°	100°	100°	99°	97°
1/8T D1-25	1/8TT D1-25	D1	25	.031					.055	[illegible]	.122	.138	.154	.185	[illegible]	[illegible]	[illegible]
1/4T D1-25	1/4TT D1-25								22°	27°	35°	43°	45°	49°	[illegible]	[illegible]	[illegible]
1/8T D1.5-25	1/8TT D1.5-25	D1.5	25	.036				.10	.113	.135	[illegible]	.155	[illegible]	.245	[illegible]	.33	.35
1/4T D1.5-25	1/4TT D1.5-25							[illegible]	30°	35°	45°	49°	51°	[illegible]	55°	55°	55°
1/8T D2-25	1/8TT D2-25	D2	25	.041		.10	.12	.13	.14	.16	.19	.22	.25	.29	.34	[illegible]	[illegible]
1/4T D2-25	1/4TT D2-25					32°	35°	[illegible]	45°	51°	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1/8T D3-25	1/8TT D3-25	D3	25	.047	.10	.12	[illegible]	.15	.17	[illegible]	.23	[illegible]	[illegible]	.35	[illegible]	[illegible]	.55
1/4T D3-25	1/4TT D3-25				[illegible]	[illegible]	[illegible]	55°	55°	61°	65°	[illegible]	[illegible]	[illegible]	69°	69°	[illegible]
1/8T D4-25	1/8TT D4-25	D4	25	.063	.15	.18	.21	.23	.25	.29	.35	.40	.45	[illegible]	[illegible]	[illegible]	[illegible]
1/4T D4-25	1/4TT D4-25				53°	63°	[illegible]	70°	75°	[illegible]	75°	80°	81°	82°	82°	82°	81°
1/8T D5-25	1/8TT D5-25	D5	25	.078	.18	.22	.25	.28	.30	.35	.42	.45	.54	.65	.75	.90	[illegible]
1/4T D5-25	1/4TT D5-25				65°	70°	73°	75°	77°	79°	83°	85°	85°	85°	85°	85°	84°
1/8T D6-25	1/8TT D6-25	D6	25	.094	.22	.26	.32	.35	.39	.44	.54	.62	.70	.85	.97	1.19	1.37
1/4T D6-25	1/4TT D6-25				75°	77°	79°	81°	83°	85°	[illegible]	[illegible]	88°	89°	[illegible]	[illegible]	85°
1/8T D7-25	1/8TT D7-25	D7	25	.109	.26	.32	.37	.41	.45	.52	.63	.73	.81	[illegible]	1.12	1.37	1.55
1/4T D7-25	1/4TT D7-25				79°	83°	85°	87°	89°	91°	92°	93°	91°	92°	92°	91°	[illegible]
1/8T D8-25	1/8TT D8-25	D8	25	.125	.31	[illegible]	.43	.48	.53	.61	.75	.89	.97	1.19	[illegible]	[illegible]	[illegible]
1/4T D8-25	1/4TT D8-25				85°	[illegible]	91°	93°	94°	96°	97°	97°	97°	96°	95°	95°	95°
1/8T D10-25	1/8TT D10-25	D10	25	.156	.39	[illegible]	.54	.60	.65	.76	.93	1.07	1.21	1.45	1.71	2.1	2.4
1/4T D10-25	1/4TT D10-25				[illegible]	[illegible]	97°	98°	[illegible]	[illegible]	105°	[illegible]	105°	102°	102°	101°	101°
1/8T D12-25	1/8TT D12-25	D12	25	.188	.46	.57	[illegible]	.73	.80	.93	1.15	1.32	1.47	1.81	[illegible]	[illegible]	[illegible]
1/4T D12-25	1/4TT D12-25				[illegible]	[illegible]	103°	105°	107°	109°	111°	[illegible]	[illegible]	111°	[illegible]	[illegible]	[illegible]
1/8T D14-25	1/8TT D14-25	D14	25	.219	.51	.62	.72	.81	.88	1.01	[illegible]	1.47	1.65	[illegible]	[illegible]	[illegible]	[illegible]
1/4T D14-25	[illegible]				[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	D1	45	.031						.125	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]									[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	46°
[illegible]	[illegible]	D1.5	45	.036				.13	.14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]							[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	D2	45	.041		.13	.12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]					[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	55°	55°	55°	[illegible]
[illegible]	[illegible]	D3	45	.047		.14	.17	[illegible]	.20	.23	[illegible]	.33	[illegible]	.44	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]					[illegible]	[illegible]	[illegible]	[illegible]	53°	57°	[illegible]	61°	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	1/8TT D4-45	D4	45	.063	.19	.22	.25	[illegible]	.31	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	1/4TT D4-45				52°	59°	[illegible]	65°	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	D5	45	.078	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.45	.55	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]				57°	[illegible]	67°	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	D6	45	.094	[illegible]	[illegible]	[illegible]	.45	[illegible]	[illegible]	[illegible]	.93	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]				[illegible]	[illegible]	[illegible]	75°	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	D7	45	.109	.39	.41	.45	.53	.59	[illegible]	[illegible]	.87	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]				73°	75°	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Nozzle No. Type T Female Conn.	Type TT Male Conn.	Disc No.	Core No.	Orifice Dia. Inches	10	15	20	25	30	40	60	80	100	150	200	300	400
					Capacity G.P.M. (Gallons Per Minute) and Spray Angle at p.s.i. (Lbs. per sq. inch)												
[illegible]	[illegible]	[illegible]	45	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.72	.84	1.04	1.21	1.35	1.68	1.93	2.40	2.78
[illegible]	[illegible]				[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	90°	90°	90°	[illegible]	89°	85°	85°
[illegible]	[illegible]	D10	45	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.35	[illegible]	1.77	2.18	2.50	3.10	3.60
[illegible]	[illegible]				[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	91°
[illegible]	[illegible]	D12	45	.188	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3.50	4.40
[illegible]	[illegible]				[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	1/8TT D14-45	D14	45	.219	.75	[illegible]	1.07	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1/4T D14-45	1/4TT D14-45				[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1/8T D16-45	1/8TT D16-45	D16	45	.250	[illegible]	1.08	1.25	1.40	1.54	1.79	[illegible]	2.57	[illegible]	3.51	4.11	[illegible]	[illegible]
1/4T D16-45	1/4TT D16-45				105°	106°	105°	109°	110°	111°	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1/8T D1-46	1/8TT D1-46	D1	46	.031						.145	.178	.205	.23	.28	.32	.39	[illegible]
1/4T D1-46	1/4TT D1-46									13°	14°	15°	16°	17°	17°	17°	[illegible]
1/8T D1.5-46	1/8TT D1.5-46	D1.5	46	.036						.213	.260	.300	.33	.41	.46	.56	[illegible]
1/4T D1.5-46	1/4TT D1.5-46									15°	16°	17°	[illegible]	19°	18°	18°	17°
1/8T D2-46	1/8TT D2-46	D2	46	.041				.22	.24	.27	.33	.37	.42	.50	[illegible]	.68	.78
1/4T D2-46	1/4TT D2-46							14°	15°	18°	20°	21°	21°	20°	19°	18°	18°
1/8T D3-46	1/8TT D3-46	D3	46	.047			.23	.25	.28	.32	.39	.45	.51	.61	.70	.86	.93
1/4T D3-46	1/4TT D3-46						14°	16°	18°	20°	23°	24°	24°	23°	22°	21°	21°
1/8T D4-46	1/8TT D4-46	D4	46	.063	.28	.34	.39	.44	.48	.56	.68	.78	.88	1.07	1.23	1.52	1.76
1/4T D4-46	1/4TT D4-46				16°	20°	23°	25°	26°	29°	32°	33°	33°	32°	32°	31°	31°
1/8T D5-46	1/8TT D5-46	D5	46	.078	.38	.47	.54	.60	.66	.77	.94	1.10	1.25	1.50	1.73	2.13	2.47
1/4T D5-46	1/4TT D5-46				22°	28°	33°	35°	37°	39°	41°	42°	42°	41°	41°	40°	40°
1/8T D6-46	1/8TT D6-46	D6	46	.094	.55	.67	.78	.87	.95	1.10	1.35	1.58	1.73	2.16	2.50	3.06	3.52
1/4T D6-46	1/4TT D6-46				31°	35°	42°	45°	47°	45°	49°	50°	50°	49°	48°	47°	47°
1/8T D7-46	1/8TT D7-46	D7	46	.109			.98	1.10	1.22	1.39	1.72	1.97	2.22	2.73	3.15	3.55	4.42
1/4T D7-46	1/4TT D7-46						48°	50°	51°	53°	55°	56°	56°	55°	54°	53°	53°
1/8T D8-46	1/8TT D8-46	D8	46	.125				1.45	1.59	1.84	2.25	2.61	2.93	3.60	4.17	5.05	5.85
1/4T D8-46	1/4TT D8-46							57°	58°	60°	61°	62°	62°	61°	60°	59°	58°
1/8T D10-46	1/8TT D10-46	D10	46	.156					2.15	[illegible]	3.05	3.53	[illegible]	4.83	5.59	6.8	7.9
[illegible]	[illegible]								65°	[illegible]	67°	[illegible]	65°	66°	65°	64°	64°
[illegible]	[illegible]	D1	56	.031							.180	[illegible]	.23	[illegible]	.33	[illegible]	.45
1/4T D1-56	1/4TT D1-56										12°	13°	14°	14°	14°	[illegible]	13°
1/8T D1.5-56	1/8TT D1.5-56	D1.5	56	.036							[illegible]	.302	.33	.41	.47	.57	.65
1/4T D1.5-56	1/4TT D1.5-56										[illegible]	15°	16°	16°	16°	16°	15°

PATENT PENDING

HOLLOW CONE SPRAY PATTERN



- TABULATION IS BASED ON WATER AT TEMPERATURE OF 70°F.
- NOZZLE CAPS AND BODIES ARE THE SAME AS USED ON OTHER TEEJET NOZZLES. THEREFORE, REGULAR TEEJET TIPS AND STRAINERS ARE INTERCHANGEABLE WITH THOSE OF THE DISC TYPE.
- THE DISC ORIFICES ARE INTERCHANGEABLE AS ARE THE CORES.
- BRASS CONSTRUCTION WITH DISC ORIFICE MADE OF HARDENED STAINLESS STEEL.
- STRAINER IS APPROXIMATELY EQUIVALENT TO 25 MESH SCREEN.

DESCRIPTION	PRINTED IN U.S.A. SPRAYING SYSTEMS CO. Engineers and Manufacturers NORTH AVENUE AT SCHMALE ROAD WHEATON, ILLINOIS 60187	
DISC TYPE TEEJET NOZZLES	DR. BY L.R.	DWG. NO. 4498
	DATE REVISED 8-25-60	

ANNEX E

FINAL REPORT: MR. MATHEW PERT, MECHANIZATION SPECIALIST

بسم الله الرحمن الرحيم

AGRICULTURAL MECHANIZATION PROJECT
A. I. D. Proj. NO. 263 - 0031
EGYPTIAN MOA/USAID
5 th. Floor - Building of the
General Society For Land Reform
P. O. B. 256 Dokki - Giza, ARE.
704660 - 704720
704364 - 707247

مشروع الميكنة الزراعية
وزارة الزراعة المصرية - وكالة التنمية الأمريكية
الدور الخامس - مبنى الجمعية العامة للاصلاح الزراعى
صندوق بريد ٢٥٦ - الدقى - جيزة ج م ع
٧٠٤٦٦٠ - ٧٠٤٧٢٠
٧٠٤٣٦٤ - ٧٠٧٢٤٧

DATE Feb. 6, 1983 التاريخ

SUBJECT ..... الموضوع

REF. No. ..... ATTACH ..... مرفقات ..... الرقم

TO: Mr. Fred Schantz, Training and Extention Coordinator

FROM: Matt Peart, Short Term Consultant

SUBJECT: A Summary of My Accomplishments, Concerns and Recommendations as a Result of My Short Term Consulting on A.I.D. Project No. 263-0031

During my short term consultancy (November 22, 1982 to January 20, 1983), I was asked to accomplish the following:

1. Follow-up and assist with the operation of the seed drills, silage mowers, and other field equipment.

2. Chart the location of and evaluate the field equipment condition and needs.

3. Identify needed support pertaining to tools, facilities, personnel, etc.

4. Provide weekly written activity reports including observations and recommendations.

Below I have identified my accomplishments, concerns, and recommendations. I feel that I accomplished what was expected of me and hope that you feel the same.

Accomplishments

1. Supervision of field operations for wheat planting.

   Seed bed preparation: The ground was typically chisel plowed twice, disced once, if a disc was available, and leveled. Phosphorus and potassium were hand broadcasted prior to planting.

   Planting: A Gallignani seeddrill was used to plant the wheat at a rate of 52 to 55 kilos per feddan.

Irrigation: Flood type irrigation was employed. It was critical that this was done slowly to prevent the seeds from washing out of the soil and that the ground was level to avoid standing water.

Population Counts: Population counts were completed roughly 3 weeks after planting and comparisons were made between the drilled and the hand broadcasted areas. The drilled areas were typically 1/3 denser. The procedure for conducting a population count was demonstrated to the village engineers.

Repair of Equipment: During and after planting the seed drills were repaired. Most repairs were done in the villages and involved straightening parts. A spare parts list was developed and spare parts were ordered.

2. Supervision of Cotton Stalk Mowing.

   The condition of the silage mowers and the fields being mowed were checked. It was found that the farmers insisted on adjusting the knives too close to the ground causing them to dull. The knives were sharpened. Workshops to teach the village farmers how to sharpen the knives were conducted. A spare parts list for the mowers was prepared and spare parts ordered.

3. Time was spent establishing good relations with the village leaders and engineers, key farmers, and governorate leaders. I feel that this effort is essential to the success of the project.

4. Parts catalogues for the silage mowers and grain drills were secured for the use of the village engineers. These were to be copied and distributed so that needed parts could be identified without having to see the piece of equipment.

5. Efforts were begun to alter existing equipment storage areas so that they were secure. The cooperative managers obtained and presented bids for the construction of gates for the existing storage areas. They were to be approved by the office before construction began.

6. Field days were conducted in all the governorates to teach key farmers about the benefits of mechanization. I attended as many of these as I could and gave assistance whenever possible.

7. The location of field equipment was charted, as can be seen in the attachment to this report. But, due to the wide use and mobility of the equipment the list may be obsolete.

8. Lists of tools that were needed by the village engineers and the regional extention specialists were prepared and these tools were ordered.

9. Assistance was provided to the Data Collection Team, in the pick-up of the bicycles that had been used by the enumerators.

10. By describing the operation and identifying the parts of the laser plane equipment I was able to expedite its clearance through customs.

11. Weekly reports of the past week's activities and the plans for the next were prepared.

Concerns:

1. Some fields were not adequately leveled presenting problems in using flood irrigation.

2. Farmers often irrigated too quickly causing seeds to float to the surface.

3. Insufficient equipment, such as disc harrows,cultivators, and fertilizer spreaders resulted in the improper preparation of the seed bed.

4. Lack of tractors with dual external hydraulics limits the use of implements requiring external cylinders, such as scrapers.

5. Tractor drivers did not like to use the row markers, resulting in a large number of skips and overlaps in the field.

6. The engineers need more practical experience in the use and repair of equipment. For example, the engineers had difficulty setting the markers on the grain drills, resulting in improper spacing of the rows.

7. The silage mowers' knives are being damaged by the farmers running them too close to the ground.

8. Parts catalogues were not copied for distribution to the village engineers.

9. Equipment was excessively damaged in transport.

10. In the villages there is no one person accountable for the equipment and there is no area where it can be secured.

11. There are insufficient tools for the village engineers and the regional extention specialists.

12. The extension specialist in the governorate of Oualibya lacks field experience.

13. Recent personnel problems in the governorate of Sharkia has limited the success of the program in this area.

Recommendations:

1. Work to insure that the village engineers stress the criticalness of leveling the fields, irrigating slowly and using the row markers when planting and keeping the silage mower knives sharpened.

2. Obtain the following needed equipment:
Disc harrows, fertilizer spreaders, cultivators and small ditchers for irrigation ditches. These items are in addition to the equipment that has already been ordered.

3. Find out if external hydraulics are available for the Zetor tractors. If so, obtain conversion kits.

4. Provide the village engineers with more technical training.

5. Get the parts catalogues copied and distributed to the village.

6. To lessen damage to equipment in transport either build loading ramps at each village or equip the tractors with 3-point hitch booms.

7. Assign the responsibility of the equipment to one person in each village and continue with plans to construct a secure area for equipment storage.

8. Make sure that the tools that were ordered get to the extention specialists and to the village engineers.

9. With time the extension specialist in Oualibya will gain the field experience he needs.

10. Because of recent changes in personnel in Sharkia, the success of the program should improve.

LOCATION OF EQUIPMENT

Governorate	Village	Equipment
Behera	Shiek Ahmed	David Brown Tractor Silage Mower Scraper Disc Ridger Cultivator Seed Drill Back Hoe Chisel Plow
	Ezab Besentali	Seed Drill Silage Mower Ridger Scraper
	El Gorn	Seed Drill Silage Mower
Gardya	Kafr Dima	Silage Mower Seed Drill
	Kafr Damshit	Seed Drill Scraper Silage Mower Ridger
Sharkia	Sardeen	Seed Drill Scraper Silage Mower Back Hoe
	Shoduk	Seed Drill Ridger Silage Mower Scraper
	Tiline	Seed Drill
Qualibya	Deltan	Seed Drill
	Shamut	Seed Drill Silage Mowers Scraper Ridger

ANNEX F

PRELIMINARY TESTS WITH THE BEIT HASHITTA THRESHER

PRELIMINARY TESTS WITH THE BEIT HASHITTA THRESHER

The Beit Hashitta radial type sheller was delivered and assembled by the last week of October, 1982. It supposedly had been developed for shelling maize and beans. This machine is advertized as a thresher, but the only final cleaning facility is a rotating drum without forced air assist. It is doubtful that this machine has adequate cleaning capability for the entire maize or bean plant, and it will be called a sheller until proven otherwise. Hence, initial tests will be conducted with only ears of maize and pods of beans. The machine is advertised as being capable of shelling as much as 4500 kg. of maize per hour under good conditions.

By the time the machine was ready to be tested the maize harvesting period was essentially finished. The Alexandria University did supply a limited quantity of grain on cob but without husk that had been harvested and stored for sometime. Hence the moisture content was rather low, and it could be expected that the precent of grain damage might be relatively high. A very small quantity of ear maize with husk was obtained but the moisture content was excessively high. It was spread out at the University Stores to dry and in the meantime rodents caused excessive damage and this material was not tested. Average ear diameter, cob plus grain, was 4.9, 4.6, and 4.1 cm. for shank or butt end, center, and outer or small end respectively. The average moisture content on a wet basis was 14.0% for the grain and 13.8% for the cob.

Test Procedures

The machine was checked for proper assembly and serviced. The beater bars were removed, concave clearance was carefully adjusted to the recommended 30 mm., and all agitator pegs were removed. Openings in the threshing concave were 19 mm. in diameter. Screen sizes installed on the cleaning rotor had 6, 10, and 16 mm. diameter holes on the grain entrance, center and grain exit sections respectively. With preliminary traisl the machine was positioned such that the cleaning rotor was tilted downward on the exit end sufficiently for the shelled grain to progress across the sieves. A tachometer was used to calibrate the tracor RPM indicator. Air flow restricters were experimentally adjusted by shelling a small quantity of maize. Due to the limited quantity of available maize tests could not be replicated and each test had to be limited to one minute. All grain that was exhausted through the chaff discharge chute plus any other exit was carefully collected and weighed.

Four tests were run for the first series at a rotor speed of 540 PRM and a concave clearance of 30 mm. Initial examination of the data, Table 1, indicated that grain damage was rather high. In an effort to decrease grain damage the concave clearance was increased to 40 mm. and a series of three tests were run at 540 RPM, Table 2. This greater concave clearance increased grain loss considerably by not cleaning all grain off of the cobs. The next attempt was to readjust the concave clearance to 30 mm. and decrease the RPM, Table 3, but the grain damage was still rather high. By observation it was suspected that a large part of the grain was being dam-

aged by the augers. The bottom half of the auger housing below the threshing cylinder was removed, threshed material was caught in a cloth, and grain separation was performed by hand. This means that the decreased damage could be attributed to the threshing drum auger, the auger that elevates grain to the cleaning rotor, plus the cleaning rotor. Results are given in Table 4.

Discussion of Data

Examination of Table 1 shows that with a rotor speed of 540 RPM and a 30 mm concave clearance:

1. As the feed rate increased from 3,600 to 6,600 kg/hr. the percent of total grain loss increased from 0.60 to 1.40 and then decreased to 0.80. This maximum total loss is considered very acceptable and it occurred at a feed rate of 4,500 kg/hr. which is the rate that the manufacturer recommends.

2. As the feed rate increased from 3,600 to 6,600 kg/hr. the percent of total grain damage decreased from 14.00 to 9.50 and then increased to 14.75. The minimum damage occurred at a feed rate of 4,500 kg/hr. which is the manufacturer's recommended rate. This rate of damage is too high and would not be acceptable if the grain is to be used for seed. Perhaps this damage would not be objectionable if the grain is to be used for animal feed or human consumption. This damage consisted of two [illegible] end of kernel knocked off and cracked grain and percentages will be given later in this report.

Table 2 shows that maintaining a rotor speed of 540 RPM and increasing the concave clearance from 30 mm. to 40 mm.:

1. At a feed rate of 3,600 kg/hr. the percent of loss grain increased from 0.6 (Table 1) to 7.0, although the percent damaged decreased from 14.0 to 12.5. This is an unacceptable grain loss and the decrease in grain damage was insignificant. The large increase in grain loss was attributed to grain not threshed from the small or outer end of the cob.

2. At a feed rate of 5,400 kg/hr. the percent of loss grain increased from 1.12 (Table 1) to 4, and the percent of damage increased from 12.0 to 18.2. These rates of loss and damage are not acceptable. No apparent reason was observed for the large increase in damage.

3. At a feed rate of 6,600 kg/hr. the percent of grain loss increased from 0.8 to 1.0 but the percent damage decreased from 14.7 to 10.5. Both loss rates are acceptable. The only logical explanation for the large decrease in grain loss as the feeding rate increased was that the greater density of material in the threshing cylinder permitted more efficient shelling.

Table 3. Although a sufficient quantity of maize was not available to precisely establish the effects of decreasing rotor speed these data do indicate a trend. Maintaining the concave clearance at 30 mm. and decreasing rotor speed from 540 to 500 RPM slightly increased grain loss and decreased grain damage. A decrease in speed from 540 to 450 RPM had no effect on grain loss and damage the same percent as did 500 RPM. Even though these slower speeds did decrease the percent of grain damage the level of 10% is still high. This improvement is perhaps not enough to justify the decrease in the maximum possible shelling rate.

Table 4 shows that, as expected, 50% of grain damage was caused by the two augers and possibly the cleaning rotor. For this particular size of grain apparently the clearance between the thresher auger and it's housing is such that some of the grain wedged between the two and was crushed.

There were five bagging chutes on the machine for collecting shelled grain. Due to the screen opening arrangement a small quantity was collected in the first chute and the majority of grain was collected in chute numbers 2, 3 and 4. The percentage of damaged grain varied widely for the different chutes from test to test and also within tests. In general the percentage of damaged grain ranged from 50-90 in chute 1 and from 10-15 in the other four chutes. Damaged grain was divided into two categories, complete and partially. This division made by personal inspection and there was some judgment involved, but in general complete consisted of cracked grain and partial consisted of the germ end of the kernel missing. The percent of complete damage ranged from 65 to 75 of the total damage.

Conclusions

1. This machine shows good potential for shelling maize, but it need further development to decrease grain damage.

2. The capacity of shelling at least 4,500 kg/hr. is satisfactory.

3. The sheller is simple constructed, easy to change screens, adjust, and operate.

4. Similar machines could be manufactured locally.

Future Work Needed

1. This machine should be evaluated more intensively during the next maize harvesting season. In the meantime the auger feed arrangement should be modified so the clearance can be adjusted, or some other type of system should be developed. Tests should be designed to determine the percentage of damage caused by each auger.

2. This machine should be evaluated with other crops such as beans and sunflower.

Table 1

The Beit Hashitta Threshing Machine Operating at 540 RPM with a 30 mm Concave Clearance November, 1982							
Test No.	Rotor RPM	Total Wt. of Maize kg.	Feed Rate Kg./hr.	Threshed Grain kg.	Threshed Grain %	Lossed Grain %	Damaged Grain %
1	540	60	3,600	48.8	81.0	0.6	14.0
2	540	75	4,500	58.0	77.3	1.4	9.5
3	540	90	5,400	70.8	78.6	1.1	12.0
4	540	110	6,600	82.5	75.0	0.8	14.8

Table 2

The Beit Hashitta Threshing Machine Operating at 540 RPM with a 40 mm Concave Clearance November, 1982							
Test No.	Rotor RPM	Total Wt. of Maize kg.	Feed Rate Kg./hr.	Threshed Grain kg.	Threshed Grain %	Lossed Grain %	Damaged Grain %
5	540	60	3,600	41.0	68	7	12.5
6	540	90	5,400	63.0	70	4	18.2
7	540	110	6,600	93.4	84	1	10.5

Table 3

The Beit Hashitta Threshing Machine Operating at a 30 mm Concave Clearance and Different Rotor Speeds November, 1982							
Test No.	Rotor RPM	Total Wt. of Maize kg.	Feed Rate Kg./hr.	Threshed Grain kg.	Threshed Grain %	Lossed Grain %	Damaged Grain %
3	540	90	5,400	70.8	78.6	1.3	12.0
8	500	90	5,400	57.6	64.0	1.4	10.5
9	450	90	5,400	69.8	77.5	1.1	10.8

Table 4

The Beit Hashitta Threshing Machine Operating With and Without the Auger at 540 RPM and with 30 mm Concave Clearance November, 1982							
Test No.	Auger	Total Wt. of Maize kg.	Feed Rate Kg./hr.	Threshed Grain kg.	Threshed Grain %	Lossed Grain %	Damaged Grain %
10	With	60	3,600	46.8	77.9	0.3	16.3
11	With	90	5,400	59.9	66.5	0.1	17.4
12	Without	60	3,600			0.3	7.7
13	Without	75	4,500			0.1	9.0

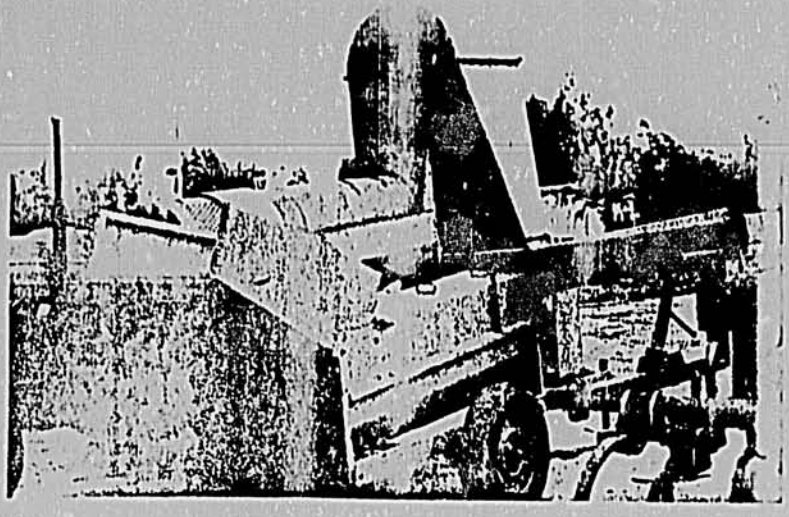


Fig. (1) Kait Hashitta Threshing Machine, 1982
Capacity - 4,500 kg. per hour, concave length - 1800 mm,
Concave diameter 390 mm.

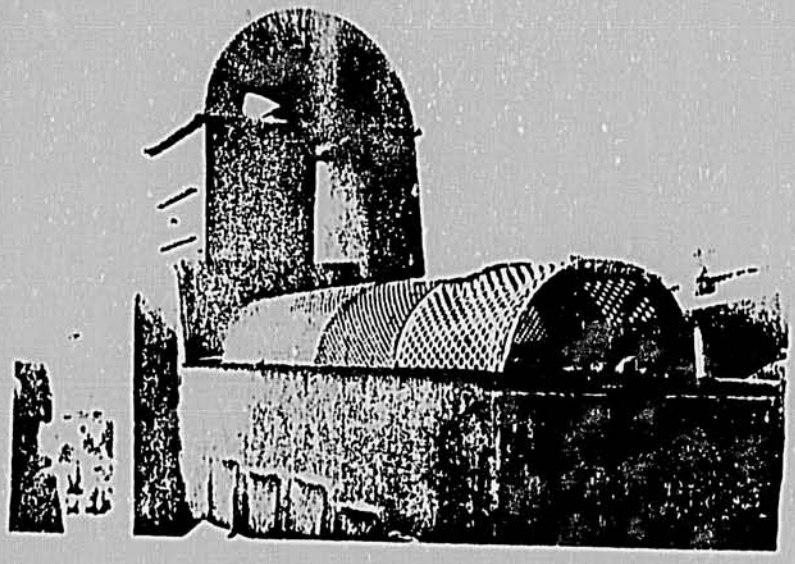


Fig. (2) Kait Hashitta Threshing Machine, 1982.