

Survey of Three Agricultural Research Stations in Nepal
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on Integrated Cereals Project

At the invitation of HMG, IADS and yourself, ICRISAT had agreed that I should visit some of the Research Stations in Nepal and perform the following services as indicated in your letter of October 15, 1976.

1. Assess the present list of items to be procured and finalize specifications etc.
2. Review the existing equipment available at the research stations and evaluate the needs for spare parts and for replacement.
3. Review the present status of experiment station development, buildings and equipment needs if further development is required.
4. Develop plans for the establishment of service divisions for experiment station operation and management, including staffing and staff training requirements.

The objective on this first visit was to help in completing item No.1 and make a brief review of items 2, 3, & 4 with the plans to return for a longer period in the future to work on these last three items in more detail.

The stations visited were:

1. Central Research Station at Kumaltar
2. Rice Research Station at Parwanipur
3. Maize Research Station at Rampur
4. Wheat Research Station at Bhairawa

GENERAL:

At each station the farm equipment and workshop facilities were reviewed. A detailed list of the farm equipment was compiled and is attached.

In reviewing the workshop facilities and comparing them with the list of equipment necessary for a basic workshop as suggested by John Stewart and others it was found that many of the items are currently available at the different research stations and therefore need not be purchased. A revised list with comments is attached.

WORKSHOP:

It was observed that one of the major problems facing all the research stations was the shortage of enthusiastic and technically qualified Tractor Operators, Mechanics and Engineers to operate and maintain the research stations and its machinery.

Until properly qualified technical staff can be obtained, any amount of money put into new equipment and workshop facilities will produce minimum short term results, as the machinery will more than likely be misused and thus produce minimum returns and have a very short life.

Apparently one of the major problems in obtaining qualified Operators, Mechanics and Engineers is that of the relatively low salary of the Government compared with the competitive private industries. Unless the salary levels of these qualified people on the Research Stations can be properly adjusted, it seems to be of little use to train people for these jobs, as they will normally stay with the research station only until they have finished their training and can secure a better paying job in the private sector.

a) Central Workshop:

The best program for the maintenance of the farm tractors and equipment has yet to be worked out. One suggestion has been that a Centralized Workshop be established somewhere in the Terai or the Inner Terai area. A Central Workshop would be much less expensive to establish and operate than a well-equipped shop at each station. The major and apparently insoluble problem regarding the centralized workshop is that of moving equipment to and from the workshop for repairs. With the current transport limitations within Nepal, the amount of time and expense of moving this equipment to and from a central workshop would be prohibitive.

At the present time a team of Agricultural Mechanics is understood to be stationed at Shree Mahal and that they travel by air or any other means from station to station to maintain the machinery. In discussing the effectiveness of this team with the end users, it was discovered that some of them were not aware of the availability of this team. Those that were aware of the availability of these mechanics stated that they were ineffective, in that, - when they visited the stations they did not come equipped to work, nor did they have any spares for the repair of the equipment.

b) Suggestions for consideration:

It was found that all the stations were having similar types of tractors and equipment. Therefore, it seems that it would be advantageous to establish a central parts depot that would maintain a good stock of the major repair parts required for overhauls and heavy maintenance. Fast

turn-over maintenance items, such as fuel and oil filters, fan belts, radiator hoses, etc., should of course, be maintained at the different research stations.

A team of trained mechanics, attached to the parts depot and equipped with the necessary spare parts and proper precision tools, could be sent to the different research stations for major overhaul and maintenance problems.

The accountability of all spare parts at both the research stations and the central parts depot should be very strictly maintained. It has been found that in many countries the mechanics and others service personnel derive the major part of their income from the sale of these scarce, expensive, imported spare parts, and are therefore willing to work for the Government Agencies at a low salary in order to be in contact with the source of supply.

Each station would still be required to maintain at least one qualified Mechanic and, perhaps, one or more Asst. Mechanics and two or three Workshop Helpers. The Asst. Mechanics and Workshop Helpers should also be trained as Tractor Operators, and be used as service personnel only when required to assist the Mechanics and/or the visiting team of Mechanics.

CENTRAL RESEARCH STATION AT KHUMALTAR:

a) Workshop Facilities:

Almost no workshop facilities exist at the Khumaltar Station and it is understood that the maintenance and repair of the farm equipment is carried out by the Shree Mahal Mechanics.

A new workshop is being constructed at the Khumaltar Station and when finished will serve as a major maintenance shop. This same shop could perhaps serve as the Central Parts Depot.

b) Farm Tractors & Equipment:

In addition to the four Massey Ferguson 1035 Tractors and numerous pieces of tillage equipment, the following items were located at the Agronomy Farm.

Description	Quantity	Remarks
VAC-A-WAY Seed Cleaner with Elevator	1 no	This piece of equipment is in good condition and unused.
ALAMCO HEAD or plot thresher with petrol engines	3 nos	New and unused
Japanese Rice Threshers	2 nos	-
Clipper Seed Cleaners - with numerous acreens	2 nos	These are small size cleaners measuring about 2' in length and 1' in width.
Clipper Thresher with Elevator	1 no	This unit is also in fairly good condition and is presently unused
Soil Sterilizer	1 no	This is a massive piece of equipment measuring approximately 5' sq x 10' tall. This soil sterilizer is new and has never been installed.
SIEBRING Portable Seed Drier	1 no	This unit is still in the original shipping crate.

A Siebring seed drier has been supplied to each of the other three research stations. It was found that none of the units were in working order due to electrical problems. The driers are equipped with a 110 volt generator to supply the current for the heater blower and the fire control mechanism. It is the generator that often fails. The driers are also equipped with petrol powered Onnan Engines which makes the driers rather expensive to operate. One of the seed driers at the Rice Research Station at Parwanipur has been equipped with an electric motor powered fan in order to replace the troublesome and expensive petrol engine. However, the 110 volt generator still gives trouble. The generator might be replaced with a 220 volt to 110 volt step down transformer of 1000 watts capacity.

The equipment found at the Khumaltar Station that is in new and/or good operating condition is not being operated for one or more of the following reasons:

1. The requirement of the station is such that the equipment is not necessary for its operation.
2. Interested and Technically competent operators are not available.
3. Some of the units are equipped with petrol engines which are expensive to operate.

It is suggested that the requirements of the station for this equipment be evaluated. If it is found that the equipment is not required for this station, then the equipment should be transferred to one of the other research stations.

c) Land And Irrigation Facilities:

A 12" concrete irrigation pipe line was installed about 6 years ago to bring irrigation water from an open canal, about a mile away from the farm, to an above ground reservoir which is located at a high point on the research station.

This pipeline runs about 1 meter deep underneath many farmer's rice and wheat fields before it reaches the station. At the present time this pipeline is not in working order due to the fact that it has been broken and silted up in many places. The pipeline was constructed with open risers for breathers. Through these risers the farmers have thrown stones and plugs of earth in order to plug the down stream side of the pipe line and force the water to flow out through the breather pipes into the fields. It is also suspected that the pipe line may have settled in many places as it runs under rice fields on its way to the research farm.

If this pipe line is to be recommissioned it will require a major effort. The reconditioning will have to be done during the winter season and even then it is expected that a major resistance may be encountered from the farmers. It is suggested that a closed type float ball air and vacuum relief valve similar to those manufactured by Waterman Industries Inc., Exeter, California (see appendix 1.), be used to prevent the farmers from plugging the existing risers.

The water storage reservoirs are currently in dis-repair. They could be manually repaired at a minimum expenditure through the use of some of the existing farm labor.

It was found that proper irrigation of most of the fields was relatively impossible due to their unlevel conditions. The fields at one time were apparently fairly level, as they were used for rice cultivation. However, at the present time they are extremely uneven, as they have been incorrectly ploughed for a number of years with a one way tractor plough. That is, the tractor has been operated round and around the fields from the outside to the center, thus creating a large "dead furrow" in the center of the fields.

This condition could be corrected by starting the ploughing from the center and working outward for a number of years. This is not a completely satisfactory procedure, as it will take a number of ploughings and even then the field will not be perfectly shaped. A better solution would be to use a back fill blade or a small land plane to level the fields. If this equipment cannot be obtained then an alternate solution would be to put one or two of these fields each year into paddy cultivation and water level the fields as the neighbouring farmers have done. Once the fields

are brought back into level, the correct tractor operation procedure would be to plough the fields in strips and land plane them about every three years, or better yet, to plough them each year with a reversible plough, and land plane every fifth year.

II. RICE RESEARCH STATION AT PARWANIPUR:

Land Shaping And Irrigation:

Very little land shaping is required at the Parwanipur Station. Nevertheless, there is some requirement for the use of the 329 Land Leveller in some of the fields, in order to improve the levels after ploughing in the winter wheat straw. The irrigation system is fed from a deep bore well equipped with a Johnston Turbine Pump which produces about 14 cubic feet per second. The pump is operated 16 hours a day and even then often falls short of the necessary water requirements. It was found that almost all the alfalfa valves were leaking, and some of them rather badly, thus making it extremely difficult to prepare the fields for the winter wheat crop, as it was not possible to dry them out sufficiently to use a tractor, especially near the valves.

The Irrigation System was installed without any sluice valves on any of the laterals, therefore, whenever the system is activated all laterals are also activated. It is almost impossible to do any repair work on the laterals without stopping the entire system for several days while the laterals are under repairs.

It is suggested that sluice valves or gate valves of the type seen in appendix 3. may be either purchased or manufactured and installed on each lateral so that better control can be made of the water sources. Also, repairs can then be made as required, while other parts of the system are in operation.

It was reported that it had not been possible to repair the leaking alfalfa valves, as the station had been unsuccessful in obtaining gun metal or brass rods to be machined to replace the current defective valve acrows. Dr. Lyons at the Bhairawa station has been able to locate the brass rods and has had them machined locally to repair the alfalfa valves at Bhairawa station. It is suggested that he may be contacted and asked to arrange for the manufacture of these screws for the Parwanipur station.

Farm Machinery:

The inventory list of the machinery that is located at Parwanipur is attached.

Seed Processing Equipment:

The Parwanipur Station processes approximately 40 tons of paddy and 40 tons of wheat per year. All the seed processing equipment at the station was in a very bad mechanical condition and will need to be replaced very soon or major repairs carried out in order to keep the equipment in operation.

Increased efficiency could be obtained if the equipment were better organized, in order that the seed materials during threshing and after, flowed properly from the threshers to the seed cleaners etc,. A high capacity screen type seed cleaner with a blast fan is urgently required to clean the paddy after threshing on the loop type threshers.

Seed Drying Equipment:

The four stations located at Khumaltar, Parwanipur, Rampur and Bhairawa are equipped with the Seibring type drier and a grain storage-cum-drier structure with slatted floors.

A diagram of the grain drying storage structure is attached, appendix 2. This structure is designed to be filled from a small window at the top with loose grain. The loose grain is supposed to be extracted from a 6" tube at the bottom of the grain bin. This type of storage and drying facility is extremely difficult to fill and it is impossible to take out all the grain through the 6" hole without getting inside and shovelling it out. This structure is not satisfactory for a research station where many different varieties of crops must be dried at one time, and not mixed during the drying cycle. It was therefore suggested, that the structure be modified by opening a door, (see sketch) through which half filled bags of grain can be carried and stacked on the slatted drying floor. The bags should be stacked in such a manner that air will not pass around the bags but will pass through the grain. The bag required for this type of drying procedure should be a loose woven bag somewhat like a gunny bag or a loose woven cotton bag. Ear heads, as well as threshed grain, can be dried effectively in this manner, at the same time keeping the varieties separated.

The petrol engine on the Seibring drier at Parwanipur has been replaced with an electric motor, thereby eliminating some of the maintenance problems normally encountered with these petrol powered driers. The 110 volt generator which supplies power for the heater ignition coil and the heater fan has burned out, making it impossible to operate the heater mechanism of the drier. This is a common fault of the Seibring Driers and some modifications need to be made to replace the 110 volt generator. Some alternatives would be.

- 1) Replace the 110 volt generator with a 220 volt step down transformer and use the same oil fired burner and fan motor.

- 2) Replace the oil fired burner with 220 volt electric calrod heaters.
- 3a) Replace the oil fired burner with an electric hot water heater and a radiator type heat exchanger through which the fan may pull the hot air.
- b) Use an oil fired hot water heater in place of the electric hot water heater.

MAIZE RESEARCH STATION AT RAMPUR:

A list of the equipment located at Rampur Station along with comments regarding its condition and necessary repairs is attached.

Regarding the seed drying equipment the same comments made under Parwanipur apply to the Rampur Station.

Land Shaping Requirements;

Fairly good roads have been constructed through the research farm, but the ditches and drains for these roads need further improvement as many of them are too steep and deep for adequate maintenance. This also makes it extremely difficult for the farm machinery to move from the road into the fields.

This station requires the maximum amount of earth movement in order to properly shape the fields for good irrigation. If the old Oliver Tractor located at this station can be put into working order (Emergency spare parts list previously submitted) it can be used as a prime mover to operate the two SD Eversman Scrapers. The MF 165 could then be used to operate the TM-212 three point hitch leveller. However, it is suggested that one of the 329 Land Planes be shifted from Bhairawa or Parwanipur to work on this station.

In some of the fields major cuts may be necessary in order to bring the fields to a proper level. To do this, as the top soil in some areas is very shallow, it will be necessary to first strip back the top soil so that the sub soil can be graded and then replace the top soil. A crawler tractor with a bulldozer blade and an appropriately matched scraper will be necessary along with technically competent engineering staff to supervise the operations.

Note: Four new D4C Caterpillar Bulldozers were seen at the Narayani river irrigation scheme headquarters in Bharatpur. It is suggested that the possibility of using one of these machines for a few months be investigated.

Three new bridges are planned for the roads across the swamp at a cost of Rs.80,000/-. It is suggested that this money may be used to construct three dams across the swamp with a road on top and a bridged spillway at the end. Thus these dams may be used for both roads and the storage of water. It would also be necessary to install pipes through the dams with sluice valves so that the lakes can be drained when required.

WHEAT RESEARCH STATION AT BHAIRAWA:

A list of the farm equipment at Bhairawa Station is attached.

Land Shaping:

The station has been in rice for several years and, therefore, the fields are fairly level. However, Dr. Lyons indicates that some reverse leveling will be required in order to irrigate the wheat during the winter season.

This work can be done with the existing 2 SD Eversman Scrapers, 329 Land Plane and the 165 Tractor at the station.

Some problems had been encountered in connecting the scraper with the tractor. The problem was found to be in the hydraulic hose couplers. The scraper was connected to the tractor and a demonstration was given to the tractor operator.

Some extensive earthmoving is required at one corner of the station in order to reclaim some of the low wet land for wheat. Dr. Lyons and I discussed the possibilities and it is believed that it can be done with the existing equipment and manual labor as soon as the area is dry enough to be worked.

GENERAL:

The enthusiasm of the staff at all the stations, as well as the courtesy and help extended in making the survey is greatly appreciated.

One of the major problems facing all the stations was the lack of technically qualified tractor operators and mechanics to operate and maintain the numerous pieces of equipment already located at the stations.

Properly trained and motivated Farm Managers are desperately needed in order that the Research Stations may fulfil their assigned research programs.

EQUIPMENT AT RAMPUR

Sr.No.	Particulars of Equipment	Qty	Remarks
1.	John Deere Gyro Mower 5'	2 nos	Type KC 205 Sr. No.004111W
2.	Leveller - model TM1 S.No.1124	1 no	for category I hitch, category II hitch required to fit MF 165
3.	Flail type silage cutter (John Deere)	1 no	Type EC15A Sr. No.030174 E
4.	Oliver Disc Harrow 36 blades	1 no	Model 252
5.	Oliver 3 disc plough	1 no	Old model wheel, pull type
6.	Two Row Corn Planter (John Deere)	2 nos	Cne planter needs seed hoper 3/4" drive shaft and sprockets
7.	Corn Planter	1 no	International
8.	Cultivator	1 no	International - Two Row - 3 point Hitch needs showels
9.	Cultipacker 7' double rollers	1 no	(Briellion)
10.	Cultipacker 8' single	1 no	-
11.	Eversman Hydraulic Scraper	1 no	Sr. No. SD 6258 (needs cutting edges)
12.	John Deere Fertilizer Distributor	1 no	8' (2 wheel E.Z. flow type)
13.	24" John Deere Seed-cum- Fertilizer Drill	1 no	Type F.D.137B Sr. No.002130N
14.	Pioneer Thresher with Engine	1 no	out of order needs many repairs also engine needs magnato
15.	International Combined Harvester - model 82	1 no	6' PTO model - needs some sheet metal works and belts
16.	12 Tandem Disc Harrow model 722 Sr.No.F24762	1 no	MF 3 point flexer hitch - needs bearing (wooden) and disc
17.	Three Farrow M.B. Plough model 793 Sr.No.B051092	1 no	MF Bar type - needs bars & shears (12")

Sr.No.	Particulars of Equipment	Qty	Remarks
18.	Three Farrow Ramsun M.B. (14")	1 no	good condition
20.	Ramsun M.B. Reversabile three furrow (14")	1 no	Good condition
21.	Reser Three Bottom Plough	2 nos	
22.	Towner Reversible 2 disc plough	1 no	Sr. No. TR228B type 108 USA
23.	Nine Tine Cultivator 3 MF	2 nos	spring trip
24.	Offset Disc Harrow 2 MF	2 nos	12 blades 5'
25.	Two Disc ploughs MF	2 nos	
26.	Trailers	3 nos	
27.	3 point lift boom	1 no	
28.	3 point hitch flip scraper MF	1 no	
29.	2 Row ridger	2 nos	
30.	2 Korien 2 batters ploughs 12" cut with 1 1/8" hitch pins	1 no	
31.	MF Paddy Harrow	1 no	
32.	Briellion 6 point rotary chopper No.506 Sr.No.8103	1 no	needs clutch parts, blades, toil wheel bearing, tyre 4.00 x 8, bolts and bushing for blades, PTO shaft
33.	One coler 3 point hitch 2 row side dresser	1 no	
34.	ISEKI KS 600 hand tractor with rotary tiller and plough	1 no	
35.	New Kebata power tiller	1 no	
36.	Old Kebata power tiller	1 no	
37.	Seibring Grain Drier - model H Sr. No.LE 3578 (36")	1 no	needs Generator or 110 volts transformer (1 HP)

Sr.No.	Particulars of Equipment	Qty	Remarks
38.	New 3 point Hitch Boom Sprayer	1 no	American Spring & Press (Bombay) (one old junk for spare parts)
39.	Corn Sheller	1 no	Hans Engineering Works Pvt. Ltd Surya Kumar, Meerut City, Punjab (New 2nd 1/8 pillow block bearing)
40.	Small Corn Shellers (single ear)	2 nos	(Indian)
41.	AV-2 Kirloskar pumps sets	3 nos	needs repairs (2 nos - 5" x 4" and 4" x 3")
42.	AV-1 Kirloskar pump 4 x 3	1 no	needs repair parts
43.	Kirloskar RA-2 Air cooled engine water pump 4" x 6"	1 no	new
44.	Kirloskar RA-2 pump	1 no	with high pressure 4" x 4" pump
45.	Battery 12 volts	1 no	
46.	25 KW Kirloskar Generator Type B4 Series 11 BHP 40 RPM 1500 Engine No.20/141166	1 no	Coupling required to connect engine to generator

LIST OF PHYSICAL FACILITIES AT BHAIRAWA AGRICULTURAL FARM

Sr.No.	Particulars of Equipment	Qty	Remarks
1.	Pick-up (Toyota)	1 no	-
2.	Tractors	3 nos	2 nos (MF 1035 and 1 no. MF 65)
3.	Hand Tractor - Kuboth KR850	1 no	-
4.	Pumping Set	3 nos	two not in working condition
5.	Mould Board Plough		
	(a) Two bottom plough	2 nos	One Massey Ferguson and One International with a broken mould board
	(b) Three bottom plough	2 nos	
	(c) Reversible three bottom plough	1 no	
6.	Disc plough	1 no	No tail wheel (International)
7.	Harrow	6 nos	1 no. Disc Off set (not used) needs lift pins 1 no. 10 Disc Off set (slightly used) 2 nos. 24 Disc Massey Ferguson flexable lift type tandums 2 nos. Massey Ferguson Paddy Harrows
8.	Nine Tine Cultivator	1 no	-
9.	Eleven Tine Cultivator	1 no	-
10.	Leveller - 329 Eversman	1 no	Not yet used
11.	Scraper 2 SD Eversman	1 no	
12.	Rotary Mower 5'	1 no	John Deere No.205 Rotary Mower
13.	Seed Drill	1 no	John Deere FB 137B

Sr.No.	Particulars of Equipment	Qty	Remarks
14.	Paddy Thresher	5 nos	Three local + one Coco + one Indian Ludhiana
15.	Wheat Thresher	1 no	
16.	Pioneer Thresher	1 no	Not in working condition
17.	Microscope	1 no	
18.	Calculating machine	2 nos	One is not in working condition
19.	Camera	1 no	
20.	Slide projector	1 no	
21.	Grain Dryer Seibring	1 no	Not yet used
22.	Typewriter (English & Nepali)	2 nos	
23.	Cattledung gas plant	1 no	
24.	Air Compressor Grinder	1 no	
25.	Korean paddy thresher	2 nos	5' long with wire loops

LIST OF FARM MACHINERY & EQUIPMENT OF PARWANIPUR AGRICULTURAL STATION

Sr.No.	Particulars of Equipment	Quantity	Remarks
1.	165 Model M.F. Tractor	1 no	(Chassis no.104719 Engine No.116244)
2.	135 Model M.F. Tractor	3 nos	(All more than six to ten yrs old)
3.	John Deere Seed-cum-Fertilizer Drill	1 no	Model FB 137B/Sn 002129N (needs 13 seed tubes)
4.	Toyota Van	1 no	(Chassis No.11-052940, Engine No.12R-0682938)
5.	Toyota Land Cruiser	1 no	(Chassis No.FJ55-17458, Engine No.F317227)
6.	Willy's Jeep	1 no	(M No.CJ 3B, S.No. 66398) needs distributor gear
7.	Willy's pick-up	1 no	Chassis No.13955, Engin No.DW 6c 20732
8.	2 Disc Plough	1 no	
9.	M.B. Plough	1 no	(two bottom)
10.	Reversible M.B. Plough	1 no	(three bottom)
11.	M.B. Plough	4 nos	(two bottom)
12.	REversible M.B. Plough	1 no	(two bottom)
13.	MF Paddy Disk Harrow	2 nos	
14.	Offset Disk Harrow	1 no	
15.	Tendum Disk Harrow	1 no	
16.	Nine Tine Tiller	3 nos	
17.	Eleven Tine Tiller	1 no	
18.	Eversman Leveller	1 no	(m.n.329, S.No.17338)
19.	Earth Scoop (small)	1 no	3 point "flip scraper"

Sr.No.	Particulars of Equipment	Quantity	Remarks
20.	Blade tresser (small)	1 no	3 point hitch
21.	Cage wheel for 1035 tractor	3 sets	
22.	Kutota Power Tiller	1 no	(engine model ER 65, chassis model KR 850)
23.	Eversman Hydraulic scraper	1 no	(model No.2 SD, Sr.No. SD 6259)
24.	SieBering Grain Drier	1 no	(model no.FR2ACC, Sr.No.171-1664)
25.	Indoair Air Compressor 220 psi	1 no	(model no.2-30, S.No.683) Indo Air Industries)
26.	Standard Welding Machine	1 no	(upto maximum 300 amps)
27.	Wolf Grinder (small)	1 no	
28.	Power Harrow (spike tooth)	1 no	(Vicon (new)
29.	John Deere Rotary Mower 205	1 no	5 feet

SHOP EQUIPMENT LIST FOR NEPAL UNDER THE INTEGRATED CEREALS PROJECT

TABLE

1. Air Compressor 10 to 20 cfm 150 to 175 psi motor 305 hp 220-440 three phase 50 cycle. All stations had air compressors brought from India which are satisfactory.
2. Electrical Welder 0-250 amps. All stations have welding machines of the AC transformer type - note: one Onnan Engine driven DC welder is located at the Agricultural Engineering Development Research Station at Ranighat. It is not being used as they have an AC transformer welder.
3. Acetylene Welder with cutting torch. It is doubtful that bottled acetylene gas will be readily available at any station other than Kathmandu. This should be checked out for each of the locations and if the bottled gas is not available then a calcium carbide gas generator should be supplied. One calcium carbide acetylene generator unit with a good supply of carbide is located at the Rampur station. Welder needs some repairs and a cutting torch is required.
4. 5080A-GS-B Set (1/2" sq drive socket set with other basic tools for Mechanics) page 26 one set required for each Mechanic and Asst Mechanic.
5. 5252A-GS BA Maintenance Set (page 29) This set includes 3/8" & 3/4" Drive Socket sets and all of the other wrenches, screws drivers, chisels, pliers etc.,. required to do any maintenance work. recommend one set for each station.
6. A TEC-250 Torquwrench... English & Metric Dial Metric range 35 kg m, English 250 lb ft (page 93) recommend only one wrench for the parts depot if they already do not have one.
7. OEM-813-K set (page 113) Metric open end wrench set consisting of 13 wrenches ranging from 6 mm to 32 mm. One set for each station.

TABLE

8. XM-614-K Set (page 114)
Metric Box End Wrench Set consisting of 14 wrenches ranging from 8 mm to 32 mm one per station.
9. DB-115 Fractional Drill Set. 15 drills, 1/16" through 1/2" by 32nds, in B-129 Holder. (page 138) one per station.
10. 1/2" diameter shank drills
CSE-345 (17/32") CSE-485 (3/4")
CSE-365 (9/16") CSE-505 (25/32")
CSE-385 (19/32") CSE-525 (13/16")
CSE-405 (5/8") CSE-565 (7/8")
CSE-425 (21/32") CSE-605 (15/16")
CSE-445 (11/16") CSE-645 (1")
CSE-465 (23/32")
(page 138) Recommend one set for each station.
11. TF-7A Flaring Tool for tubing 3/16", 1/4", 5/16" 3/8", 7/16" and 5/8" (page 140) recommend one for each station.
12. TC-28A Tubing Cutter (page 140) one for each station.
13. CM-212 Dial Caliper, with thumb wheel, graduations of .001" with a range of 0"-6" (page 144) recommend one for each station.
14. TD-7800 English Taps and Dies Sets for N.C. and N.F. thread sizes 1/2" thru 3/4" (page 146) recommend one for each station.
15. TD-2425 Delux Set - English Taps & Dies Set 1/4" thru 1/2" (page 146) recommend one for each station.
16. TDM-117 Metric Tap & Die Set (page 147) recommended one for each station.
17. CG-470-HYA 20 Ton Hydraulic Press (page 158) recommended one per station.
18. CJ-282B-B Interchangeable Puller Set (page 164) recommended one per station.

TABLE

19. GA-22A Midget Grease Fitting Tool
(page 189) recommended two sets per station.
20. GA-340 Oil Filter Wrench up to 4" diameter
(page 189) recommended one per station.
21. GA-473 Grease Gun (hand held) page 189)
recommend three per station.
22. OC-5A Small Oiler (page 189) recommended
one per Mechanic
23. GA-315 Air-Liquid Tire Gauge (page 187)
recommended one per Mechanic.
24. GA-477 Automatic Tire Gauge (page 187)
recommend one for each Air Compressor
25. CJ-105A-B Set Interchangeable Puller Set
for general use in metal box (page 165)
recommend one per station.
26. RC-40C Compressor, Piston Ring (page 211)
recommend one per station.
27. Bucket type grease gun, High Pressure
recommend this be an imported grease gun
one per station.
28. Electric Grinder, bench type, with minimum
1/2 HP motor. Good models are available
from "Wolf Manufacturing" in India. Most
stations visited have grinders.
29. Portable Hand Held Grinder. May be obtained
from "Wolf Manufacturers" recommend one per
station.
30. GA-197A Lifting-Pulling Tool (page 201)
(This is a 4000 lb hand operated block
and tackle set. Recommend one per station.
31. HJ-2030 (1 1/2 ton) hydraulic jack (page 201)
This is a four wheel hydraulic floor jack
recommend one per station.
32. A-238 Engine Sling (page 201) recommend one
per station.

TABLE

33. Air painting outfit - these should be locally available. I recommend one set only for the depot, as these outfits would normally only be required for repainting of vehicles and tractors on rare occasions.
34. Battery Charger, 220 volt, with capacity to charge atleast four 12 volt batteries at one time. Good Indian make models should be available locally. Most stations already have a battery charger.
35. Vises, 6" or larger. Most stations already have the item on hand, if not satisfactory models should be locally available.
36. MT-51 Timing Light (page 226) recommend one per station.
37. GA-376 Vacuum Tester (page 226) recommend one for depot only as it requires a very well trained Mechanic to use this tester correctly.
38. Injector Tester. Recommend one only for General Depot as a injector tester can only indicate the condition of the injectors, This information can also be found out by looseing the injector tubes while the engine is running. The injectors usually must be sent to a specially equipped repair station for repairs.
39. RPM Counter. One per station.
40. Extractors, assorted sizes one set per station.
41. CF-11E Universal Type Valve Spring Remover (page 214) one per station.
42. Battery tester. The tester should be capable of testing both 6 and 12 volt batteries.
43. Volt-Ome-Ampier meter. To measure resistance of both A/C & D/C voltage from 0 to 5000 volts.