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**DEVELOPMENT OF PROTOTYPE MOBILE SEED DRESSING APPLICATORS
SUITABLE FOR AFRICAN COUNTRIES**

US/RAF/88/273

**Technical report: Findings and recommendations
(7th visit)***

Prepared for the Governments of the Republic of Zambia and the United Republic of Tanzania
by the United Nations Industrial Development Organization

*Based on the work of J. E. Elsworth,
Chief Technical Adviser*

Backstopping Officer: B. Sugavanam, Chemical Industries Branch

* This document has not been edited.

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Project US/RAF/88/273 Backstopping Officer: Dr B. Sugavanam.

**Report on 7th Visit. Maputo, Mozambique; Lusaka, Zambia; Lilongwe, Malawi;
Dar-es-Salaam and Arusha, Tanzania.**

Aug 23rd to Sep 21st 1994.

Author: J. E. Elsworth, Project C.T.A.

1. Background

The mainstay of the economies of the PTA countries is agriculture. Regional and national strategies accord the highest priority to attaining self sufficiency in food. The policy on pest control is to use Integrated Pest Management, of which Seed Treatment is an important component.

The project is to develop a mobile Seed Treating machine to be available to rural farmers for effective, safe and affordable treatment of their home saved seed. Initially, it is focusing upon Zambia and Tanzania.

The first visit by the C.T.A. was made in Sep/Oct. 1992 for familiarisation of the context for the machine. Broad recommendations for the design approach were made during that visit.

The second visit was in Nov./Dec. 93, to coincide with the Zambian planting season, for the treatment of trials seed. A European machine - the 'Rotostat' P500 - had been imported into Zambia as a basis for the project and to test the recommended principle with local seed varieties. Other aspects of the project were also progressed in both countries, particularly the choice of manufacturer.

The third visit was in March/April 93. A second European machine - the Hege - had been imported into Tanzania for the same reasons. This machine was demonstrated to enable seed to be treated for trials purposes. Other aspects of the project were progressed in both countries, including the attending of the first project workshop in Arusha and an inspection of the Zambian trials.

The fourth visit was in October/November 93. Trials were conducted in Zambian villages on the P500, and the prototype machines from the European Contractor, and Zambian Engineering Institute. A start was made on Market Research. Plans were made for trials in Tanzania in February/March 94.

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The fifth visit was to Tanzania only, and was to conduct trials on the prototype from the Tanzanian Engineering Institute, and a second prototype from the European Contractor.

The sixth visit was to check on results and to plan the next phase in Tanzania, to plan for trials in Malawi, and to check progress, plan trials and attend the second review meeting in Zambia.

The current visit - the 7th in the series - was to attend the PTA Trade Fair in Maputo, and to check on progress and assist with planning the next phase in Zambia, Malawi, and Tanzania.

2. Summary.

The visit was to four countries, with about a week spent in each. The first was Mozambique to attend the PTA Trade Fair and demonstrate the Zambian prototype. This activity positioned the trip at this particular time. Unfortunately, the machine did not arrive in Maputo so the main purpose of the whole trip was lost.

The second country was Zambia where 3 machines of a third generation prototype were in course of construction. Suggestions were made concerning the design. A specific plan for commercial proving of the machine was drawn up. The Zambian seed treatment formulation - 'Thirasan' M - has been withdrawn from the market and an alternative was sought.

The third country was Malawi where no progress had been made because funding had not been received.

The fourth country was Tanzania where further village trials were carried out and discussions were held with TPRI on the current (seed treatment) and future (seed treatment and food grains storage) trials.

3. Recommendations.

- 3.1 That the tractor mounted prototype be loaned to the Arusha seed farm for operational experience.
- 3.2 That NRI be asked officially to collaborate with TPRI on the food grain storage trial.

4. Acknowledgements.

Once again, thanks are due to Dr Kwendakwema and to Mr Msolla for facilitating the project during the visit to their respective countries. Special thanks are due to Mr Kazembe because of the particular difficulties encountered by the non receipt of the author's fax announcing the visit.

5. Mozambique.

The purpose of this part of the visit was to attend the 5th PTA Trade Fair which was combined with the 30th Maputo International Fair. The combined Fair ran from 26th to 30th August.

The Zambian prototype machine was to be demonstrated to the various officials and other attendees - perhaps including potential users. Indeed, the timing of the trip was centred on this event. It was intended to display the machine on the Zambia stand in the PTA Hall of the Fair.

This objective was frustrated by the non-arrival of the prototype machine. Despite attempts by the Director of the Zambian stand, and the members of PTA present, the machine could not be located, until the afternoon of Monday 29th, when it was found to be still in transit in Johannesburg. The main part of the Fair being over by this time, the carrier was instructed to send it straight back to Lusaka. There were other goods destined for the Zambia stand which were similarly delayed.

However, the following contacts were made:

1. Saro Agri Equipment Ltd, Lusaka - a potential manufacturer.
2. Agra-Alfa, Maputo - importers and distributors of agricultural tools.
3. Trade-Link (Africa), Maputo - distributors of oil presses, among other rural tools.
4. IMF Engineering, Bulawayo - potential manufacturer / distributor in Zimbabwe.
5. Malawian Chamber of Commerce and Industry, Blantyre.
6. Asmara Chamber of Commerce, Eritrea.
7. Sociedade Mocambicana de Produtos Agroquimicas Lda - distributors of agricultural chemicals in Mozambique.

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6. Zambia

6.1 TDAU

6.1.1 Prototype Machines.

The engineer principally involved in the project - Mr Boyd Sythes - (British - VSO) has been assigned to a World Bank project, and is in a position only to oversee the seed treater project during its further development. Mr Moffat Mwanza, his assistant up to this point, will continue with the development.

The second generation prototype had been finished and displayed at the Lusaka agricultural fair in August. Interest was expressed by some stand visitors but no actual sales enquiries were made. It was then handed over to the Ministry of Trade for transport to Maputo. It failed to arrive in Maputo and was directed back to Lusaka but had not arrived back by the end of the Lusaka visit so the author did not see it at all.

Three machines of a third design - similar to the second, but smaller, in line with the recommendation of the review meeting - were in course of construction. This design uses a 440 mm dia rotor and downstream door, without the large baffle mounted on the door of the previous model. Some suggestions regarding the design of this model were made. (See Appendix B) The intention is to finish them before the planting season and use them as follows:

- 1 - to Riverside Farm Institute - preferably on a commercial basis. To be used commercially in the neighbouring villages to test the acceptance of the service when it is charged.
- 2 - to another local NGO, or possibly to Professor Poswel of Fort Hare University in RSA. Again to develop the whole technology as a commercial business.
- 3 - to be used by TDAU for further demonstrations, publicity and development work, and by Mt Makulu for treatment of the proposed 1994/5 trial.

6.1.2 Administration.

The computer requested by TDAU from UNIDO has not arrived. TDAU is geared to computer generated drawings and no longer employs a draughtsman for manual drawing. However, its current computer has broken down. Formal drawings are therefore not available and this will frustrate efforts to progress the technology with potential manufacturers.

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6.2 Mt Makulu.

The secondment of Mr Chalabesa at the Environment Council has come to an end, and he was in course of moving back to Mt Makulu. Unfortunately, it was not possible to meet him at all.

A brief meeting was held with Mr G Mulenga, at which preliminary ideas about a trial to be laid down in the forthcoming planting season were discussed.

The preliminary plan is as follows:

Seed types: Maize - open pollinated type
 Sorghum
 Millet
 Beans (local varieties - not soya because they are hybrid.)

Machine types: TDAU's new prototype
 The P500 imported from UK
 Zamseed machine. (Gustafson)
 and untreated.

The author has reservations about the use of Zamseed because it will inevitably come from a different seed lot to the remaining treatments.

Chemical products: 'Fernasan' D ('Thirasan' M is to be withdrawn from the market - see 6.4)

Application rate: Manufacturer's recommended rate. (Only one rate to be used.)

Sites: Chipata (Eastern province.)
 Misamfu (Northern province.)

The Golden Valley (near Lusaka) site, used in the previous trial is not now available.

Mr Mulenga complained that no money had been received from UNIDO for the work they have done to date. It was explained to him that Mt Makulu must send an invoice to UNIDO after which they will be paid.

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6.3 Riverside Farm Institute.

Unfortunately the two key staff members were on furlough in America. However, an impromptu meeting was held with some teachers from Mulawo School where some of the village trials were held, to try to ascertain typical seed to crop ratios on which to base the commercial case for the machine. The discussion resulted in an agreed ratio of 2.5 bags (each 90kg) of crop for every kg of seed planted. This gives a farmer profit ratio of 10 to 1 on his investment in seed treatment, assuming a cost of Kw80 per kg for the treatment service, a yield improvement of 5%, and a crop value of Kw6,500 per bag (the price paid by Riverside.) See Appendix C for a more detailed argument.

Later, a brief meeting was held with a member of Riverside staff, Mr Kabugu, in Lusaka. (He had assisted in the earlier village trials and visits.) A meeting was set up between TDAU and Riverside at which the whole commercial test operation will be planned. Some preparatory notes for this meeting were drawn up. (See appendix D)

6.4 Chemical Suppliers

A visit to Cyanamid (formerly Shell Chemicals) revealed that their seed treatment product, 'Thirasan' M, has been withdrawn from the market, following the take-over. The commercial test will require about 50 kg of chemical, and in the light of the future non availability of this product (even if the remaining stocks would provide supplies this year) it is recommended that 'Fernasan' D be brought in from Tanzania or Kenya.

In view of this, a visit was made to the Environmental Council for permission to import agrochemicals. There it was learned that Zambia now has a registration scheme with a procedure for registering new products.

A visit to Agrochem - the Zeneca agency - was therefore made to discuss the importation of 'Fernasan' D and Mr Luke Chisela, Agrochemicals Manager, agreed to investigate the best route for the importation of the 50 kg of 'Fernasan' D that will be needed for the Riverside commercial trial and the Mt Makulu trial.

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6.4 Manufacturers

Visits were made to three manufactures:

Saro Agri Equipment Ltd.
BMS Engineering (Part of the Appolo group of companies.)
Turning and Metals Ltd.

All expressed interest. BMS appear the most suitable, partly because they have an aluminium foundry - needed for the new TDAU design. They also offered to make two machines to give themselves an introduction into the technology and to the market.

Since formal engineering drawings appear to be still some time off, the production managers from all three companies will visit TDAU a little later, when the second prototype is back from Johannesburg, and the 3 new machines are a little more advanced. Mr Mwanza will contact them when visits are warranted.

6.5 PTA

The market survey being conducted by Mr Sichilima was not sufficiently advanced for any preliminary results to be available.

A visit by Dr Rameas is planned but did not take place during the visit of the author.

Mr Opio suggested that a prototype of each design be offered to Professor Poswel in RSA at a price slightly above cost, in order for developments to start in that country. He also suggested that the tripartite review be held in Malawi in 1995, with a Malawi built prototype on display.

Mr Sichilima also reported that there are two other agencies at Mt Makulu who are interested in the seed treater and could possibly give assistance to the trial. These are:

The Adaptive Research Team, led by Mr Ndiyoi. They are interested in the value of seed treatment in the various parts of the country.

The Legume Seed Project (an FAO project) led by Dr Muhila.

Attempts to see them at Mk Makulu were made but unfortunately without success.

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7. Malawi

7.1 Chitedze Agricultural Research Station.

7.1.1 General Situation.

Communications with Chitedze had been difficult. Faxes going both ways had failed to arrive and Mr Kazembe was not aware of the current visit. The author was in Lilongwe for 48 hours before meeting him.

An internal meeting had taken place in Chitedze, following Mr Kazembe's return from Zambia with the SRI prototype, to plan the work in Malawi. The minutes of the meeting are given in Appendix E. Following this a request for the payment of the anticipated funds was made to UNIDO. However, those funds were not forthcoming. Mr Kazembe had then tried, unsuccessfully, to borrow funds from other sources, to be refunded by UNIDO. The UNIDO funds still not being available, no progress has been made with the project. This made the current visit uneconomic.

7.1.2 Dr Luhanga.

Dr Luhanga is the Deputy Chief Agricultural Research Officer and Head of Chitedze Research Station. He is also the Chief Seed Technologist. He welcomed the idea of holding the 1995 tripartite review meeting at Chitedze. The lack of progress in Malawi, caused by the lack of funds, is unfortunate and the season is virtually lost to us.

The formulation to be used was discussed and Dr Luhanga stressed the need to keep water application to a minimum. However, the 10 ml / kg suggested for 'Fernasan' D was acceptable.,

7.1.3 Dr Chimbe

Dr Chimbe is an entomologist in charge of seed storage. He expressed interest in the proposed storage trial in Tanzania and requested further information on the protocol when it is agreed.

7.2 Manufacturers.

Visits were made to two manufacturers in Lilongwe.

B & C Ltd
Costantini & Co (1985) Ltd

Both had suitable manufacturing facilities and would be willing to quote once manufacturing drawings are available.

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8. Tanzania.

8.1 Dar-es-Salaam.

8.1.1 Mr Felix Mathenge, FAO

The FAO / Ministry of Agriculture Seed Improvement project has been led by FAO up to this point and will be taken over by the ministry very shortly. FAO will then adopt a backstopping position.

The village seed multiplication programme is to be studied by UNDP / FAO with a view to an input. The study will take at least two years.

8.1.2 Twiga Chemicals Ltd.

A meeting was held with Mr Gervais Uiso, Agricultural Manager. The following information emerged.

8.1.2.1 'Fernasan' D

This product now appears to be central to the project as the only seed treatment being actively marketed. However, the ramifications of the recent take-over of Twiga have not yet finished, and the product has not performed well in recent years. 7 tonnes imported in 1988 have only just been finished. Thus Twiga are now out of stock and the importation of further quantities is far from certain. It is currently sold through two agents in Arusha, namely Trichem and TFA. Trichem is run by an entrepreneur operating in Nairobi, Mr Stuart Miller, assisted by Mr E. Ndemasi based in Arusha. They source their products from Twiga Chemicals, Nairobi where the supply position is not known. This information will be sought.

8.1.2.2 'Actellic' Super.

This product sells well, but is subject to Japanese aid. A Japanese competitive product has recently been registered in Kenya and is under registration trial in Tanzania. This is 'Sumicombi' a mixture of Fenitrothion and Fenvalerate. (Organo-phosphorous - against weevils - and pyrethroid - against LGB - respectively.) Like 'Actellic' Super, it is a powder product. It is likely to take a large part of the market because of the aid ramifications.

8.1.2.3 IFAD / SHRFS Project.

Based in Mbeya in the south, the most intensive maize area, this is Southern Highlands Extension and Rural Financial Services Project. A recent newspaper advertisement invited registration of Agricultural Input and Machinery Suppliers. The author will inform this project of the development of the Seed Treater prototypes, and ask what help may be available in the form of finance to potential entrepreneurs.

8.1.3 Ministry of Agriculture.

A meeting was held with Mr D Msengi, a seed specialist, and Mr Mbagu. This was mainly to provide information to the ministry about the project. Mr Msengi expressed concern about competition with the seed industry. He did not appear to be aware of the village seed production project.

DANIDA, the Danish aid agency has been supplying vegetable seeds to Tanzania but this is to stop forthwith. The vegetable seed production unit at Tengeru (near Arusha) will take over.

8.2 Arusha.

8.2.1 TEMDO

8.2.1.1 Prototype Machines.

The prototype tractor machine modifications were complete, and it had undergone some further village trials, with limited success. Parts for a further 3 tractor machines and 5 pedal machines were ordered.

The Dar-es-Salaam and Arusha shows, at which it had been intended to show the machines, were not, in the event, attended because of lack of funds. (There were delays in the payment of the instalment to TEMDO.) However, plans were made to attend the Nairobi Agricultural show at the end of September.

8.2.1.2 Village Trial.

Another village trial was conducted. This was at King'ori Township. (Off Moshi road, between Kikatiti and KIA turning, 17km north.) 6 batches of about 5 kg per batch were treated in the Silso machine, and some further work done in the TEMDO machine. The usual difficulty with the mixing of slurry was experienced. The intention of the trial was to further develop the interest of the villagers in a future treatment service at - say - TSh 50 per kg.

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8.2.2 T.P.R.I.

8.2.2.1 Trial on Storage Chemicals.

A meeting was held with Dr Uronu concerning the planned storage trial. Prior to the visit, the author had met with Dr P.Golob of NRI, UK, and some suggestions made by him were used as a basis for the drawing up of a protocol.

The details of this protocol are as follows:

Sites: Two in number.

- 1) Akheri Juu (near Arusha) - very high.
- 2) Rundugai (Kilimanjaro region) - low and hot.

Seed types: Three in number.

- 1) Maize - hybrid type.
- 2) Maize - composite.
- 3) Beans.

Infestation: Choose a farmer with a relatively high infestation of weevils and prostephanus, and then add 8 individuals of each type to each bag.

Treatments: Seven in number.

- 1) Untreated Control
- 2) Normal rate of standard product (assumed to be 'Actellic' Super powder.)
- 3) 1/3rd of seed treated with 3 times normal rate. Standard product.
- 4) 1/3rd of seed treated with 3 times normal rate.
Liquid equivalent of standard product. ('Actellic' 20% EC + Permethrin EC)
- 5) 1/3rd of seed treated with 3 times normal rate.
Alternative LGB product. 'Actellic' 20% EC + Deltamethrin EC. *
- 6) 1/3rd of seed treated with 3 times normal rate.
Alternative powder product. 'Supercombi'
- 7) Farmer method. ('Actellic' super applied to all the grain by jembi hoe.)

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Treatments to be made on site to avoid separation of powder during transport.

All treatments, except 1) and 7), to be applied in 5 kg batches in Silso seed treater.

*Note: Lambda Cyhalothrin should be used in place of Deltamethrin if it is CODEX cleared.

Method of treatment:

Maize: Treat seed in 5 kg batches. Place 3 batches into a 90 kg bag. Add 8 live weevils and 8 live LGBs. Stir the seed roughly by hand. Repeat 6 times to fill the 90 kg bag. In the case of treatments 3,4,5 & 6 the middle batch of each group of 3 should be the treated batch.

Beans: As above but using 3.33 kg batches of grain rather than 5 kg and using only one set of three per bag instead of 6. (To yield 10 kg bags.)

Replicates: 6 replicates of each seed type at each site.
Replicates of all treatments to be stored in the same area (e.g. barn) in rows.
Each row to contain one of each treatment - in random order.

Duration: One year.

Assessments: According to the table below.

	Start	3 months	6 months	9 months	1 year.
Moisture content	Yes	Yes	Yes	Yes	Yes
Number of live weevils.	No	Yes	Yes	Yes	Yes
Number of dead weevils.	No	Yes	Yes	Yes	Yes
Number of live prostephanus.	No	Yes	Yes	Yes	Yes
Number of dead prostephanus.	No	Yes	Yes	Yes	Yes
Germination.	Yes	No	Yes	No	Yes
Amount of dust.	Yes	Yes	Yes	Yes	Yes

Timing: If possible, the trial to be laid during the short rains harvest. Hence: Dec / Jan 95.

Application Machine: Silso built pedal driven seed treater.

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Cost of Grain: Maize: 2 types x 7 treatments x 6 replicates x 2 sites = 168 x 90 kg bags.
Estimated cost: TSh 6,000 per 90 kg bag.
Total: TSh 1,008,000 (Approx US\$ 2,000)

Beans: 1 type x 7 treatments x 6 replicates x 2 sites = 84 x 10 kg bags.
Estimated cost: TSh 28,000 per 90 kg bag.
Total: TSh 261,000 (Approx US\$ 500)

However, the grain can be sold at the end of the experiment.

8.2.2.2 Existing Seed Treatment Trial.

The trial plots in the TPRI grounds were inspected, but no differences between treatments were evident. Dr Uronu reported that the formal assessments made so far indicated superior growth in the treated bean plants compared to untreated. Bean fly infestation was reduced. There was some disease present - rot and rust. Again it was reduced in the treated plots compared to untreated. No information was available on the Maize plots.

8.2.2.3 Further Seed Treatment Trials Programme.

Dr Uronu indicated that a further trial was planned for the forthcoming short rains season.

Appendix A P. 1

Institutions / Personnel visited.

Mozambique.

1. P.T.A. Mr A. Mwakijungu Senior Trade Policy Adviser
 Mr E. Twagirumukiza Statistician
 Mr Tembo Customs expert.
 Mr Megistu Consultant, organising Fair.
2. UNIDO Mrs Gabriele Ott JPO.
3. Zambia Ministry of Trade and Industry
 Mr John Chirwa Director of Zambia stand at PTA Fair.
4. Sociedade Mocambicana de Produtos Agroquimicas Lda
 Mr Vlassios Pantazis Principal.
5. Trade-Link (Africa)
 Mr Colin Lovegrove Director General.
6. Asmara Chamber of Commerce
 Mr Kiflemaziam Feram Secretary General.
7. IMF Engineering Mr Marcus Graf Technical Representative.
8. Malawi Chamber of Commerce and Industry
 Dr Jerry Jana Executive Director.
9. Saro Agri Equipment Ltd
 Mr Chirade Oza Principal.

Zambia

10. UNIDO Dr Taylor Country Manager
 Mr A Brevig JPO
11. P.T.A. Mr J E O Mwencha Director of Industry and Energy.
 Mr J.J.A. Opio Senior Industrial Expert. Project Manager.
 Mr M. Sichilira Statistician
12. TDAU Dr N. Kwendakwema
 Manager
 Mr B. Sythes Project Engineer
 Mr M Mwanza Project Engineer
13. Mt Makulu Mr G. Mulenga Plant Pathologist.

Appendix A P. 2

Institutions / Personnel visited. - cont.

Zambia (cont.)

- | | | |
|-------------------------------------|---|--|
| 14. BMS Engineering | Mr D Stonelake | Works Manager |
| 15. Saro Agri Equipment | Mr M. Amin | General Manager |
| 16. Turning and Metals | Mr K. Nair | Technical Manager |
| 17. Riverside Farm Institute | Mr P. Kubugu
Mr E. Muyenga | Horticultural Manager. |
| 18. Cyanamid | Mr C. Shanduba | Technical Manager |
| 19. Agritech Zambia Ltd. | Mr L Chisela | Agrochemicals Manager. |
| 20. Environmental Council of Zambia | Miss M. Phiri | Inspector - Pesticides Unit. |
| 21. Mulawo School | Mr Chimbwali
Mr Simbale
Mr Hamainda | Head Teacher
Asst. Teacher
Asst. Teacher |

Malawi

- | | | |
|--|---|--|
| 22. UNIDO | Mr V. Post | JPO. |
| 23. Chitedze Agricultural Research Station | Mr H. Kazembe-Phiri,

Dr J. Luhanga

Dr C. Chimbe | Farm Machinery Research Officer.
Contact person for the project in Malawi.
Deputy Chief Agricultural Research Officer, Head of
Chitedze Agricultural Research Station, and Head of
Seed Services Dept.
Entomologist in charge of Seed Storage Dept. |
| 24. B&C Engineering. | Mr G. Anderson | Regional Manager, Lilongwe. |
| 25. Costantini & Co (1985) Ltd | Mr E. Sabelli | Manager. |

Appendix A P. 3

Tanzania - Dar-es-Salaam

- | | | |
|--|--|---|
| 26. UNIDO | Mr Krasiakov
Mr F. Gestblom
Mr Akim | Country Manager
JPO
Assistant to Mr Krasiakov |
| 27. Ministry of Agriculture | Mr D. Msengi
Mr Mbagu
Mr Mtolera
Mr Swai, | Seeds Specialist

Asst to National Seed Co-ordinator. (Mr E.J. Lujoo)
General Manager of Arusha Seed Farm. |
| 28. FAO | Mr Felix Mathenge | Seed Technologist |
| 29. Twiga Chemicals | Mr G. Uiso | Agrochemicals Manager. |
| 30. SADC | Mr Z.J. Masanja | Senior Industrial Economist. |
| 31. AgrEvo (Formerly Hoechst - now with Schering.) | Mr R. Mbonika | Country Agricultural Manager |

Arusha.

- | | | |
|----------------------------------|------------------------------------|---|
| 1. T.E.M.D.O. | Mr G.Msolla,

Mr W. Beytani, | Director General. Contact person for the Project in Tanzania.

Project Engineer for the project. |
| 2. T.P.R.I. | Dr F.Mosha,
Dr B. Uronu, | Director.
Principal Scientific Officer. |
| 3. National Seed Foundation Farm | Mr Assenga | Assistant Manager |
| 4. Ministry of Agriculture. | Mr Mwale
Mrs M ? | District Agricultural Mechanisation Officer.
District Livestock Officer. |
| 5. King'ori Township | Mr Joseph
Mr Melkzedelenko | Divisional Officer, King'ori Division.
King'ori Extension Officer. |

Appendix B

Note addressed to Mr M. Mwanza - TDAU engineer working on the seed treater project.
Copied to Dr N. Kwendakwema - manager of TDAU.

Comments on the current TDAU prototype seed treater design.

Having seen the three machines currently under construction, I would like to make the following comments and recommendations concerning the design, and concerning your future actions.

1) Fit between the rotor and rotor housing.

This is now excellent, and I believe these machines will treat sorghum very well. I do not believe it will be possible to improve on the current standard with the current inexpensive design philosophy, so if the machine proves not to work with millet, then we will have to accept that limitation.

2) Rotor bearings.

I believe that it is un-necessary to use a taper roller bearing as the axial load on the rotor will not be large and the speed is low. I recommend using the same ball bearing unit at the bottom of shaft, as currently used at the top. The use of the same bearing minimises the administration of buying in components and stocking of spares. Ideally the bearing should be deep groove, but I think it well worth using normal bearings in these prototypes if they are more readily available. Triple seals should be specified if available. I assume that the bearings are lubricated for life.

I attach a sketch showing a suggested bearing assembly. One bearing - I suggest the bottom one - is located positively in both directions relative to both the shaft and the housing. This controls the position of the shaft in the housing. The top bearing is located positively in the housing, although only on the underside. It could be retained by a plate but I suggest that it be tried without. The top bearing is fully floating on the shaft so that there is no thrust generated by the bearings against each other.

Appendix B - P2

3) Rotor / Hub Fit.

I think the idea of welding the hub to the rotor is worth trying. To facilitate a reasonable weld and avoid distortion of the rotor, I recommend that the flange on the hub be sloped to the rotor so as to locate on its outer edge. This will also make the alignment more positive, will be cheaper than a bolted construction and will eliminate the need for a square on the shaft. The hub should be bored after welding to the rotor (as you are doing) and concentricity must be maintained. Thus the location of the assembly in the chuck should be from the rotor edge.

An alternative design idea is to weld the two together before machining either, and then to machine both in the same lathe setting, using a single bore in the hub (instead of a step as at present). The outside edge of the hub would be gripped in a three jaw chuck, and care would be needed to see that the un-machined assembly ran as true as possible before machining started. The hub would be bored first and the hole could then be used to clamp a wooden disc of about 430 mm dia to the rotor to dampen the inevitable vibrations when machining the outer edge of the rotor. Advantages of this idea are that the single bore would be cheaper than the stepped one, and the single lathe setting would automatically generate concentricity. A disadvantage is that a plate would need to be attached to the rotor to retain it on the shaft. I attach a sketch showing this idea, which also shows the assembly with the shaft and spinning disc.

4) Fit of hub onto shaft.

The one assembly which had reached this stage had been badly made and the fit was extremely loose. A reasonable transition fit should be used with tolerances to the British Standard on Fits and Limits - or an alternative standard if normally used by you. The alternative idea above might help in that a single bore can be reamed.

5) Rotor Housing.

The general design is going to work well, and it is appreciated that the casting of the aluminium was done in a non commercial foundry. Some modifications could be considered for a commercially produced successor. The general section could be a lot thinner. The height of the cylindrical part can clearly be reduced, as we saw that the rotor sits far too low compared to the top of the housing. The horizontal land at the top should be minimal - say 1 mm. There is no need to adhere to a flat bottom and cylindrical sides design. A bowl shape would be practical, with three buttresses for mounting the housing onto the frame. Again, I attach a general sketch.

Appendix B - P3

6) Jockey pulley.

The jockey should be angled as in the SRI design so as to align with the driven pulley in the plan view and with the driver pulley in the side view. This will increase the life of the belt, and reduce the pedalling effort.

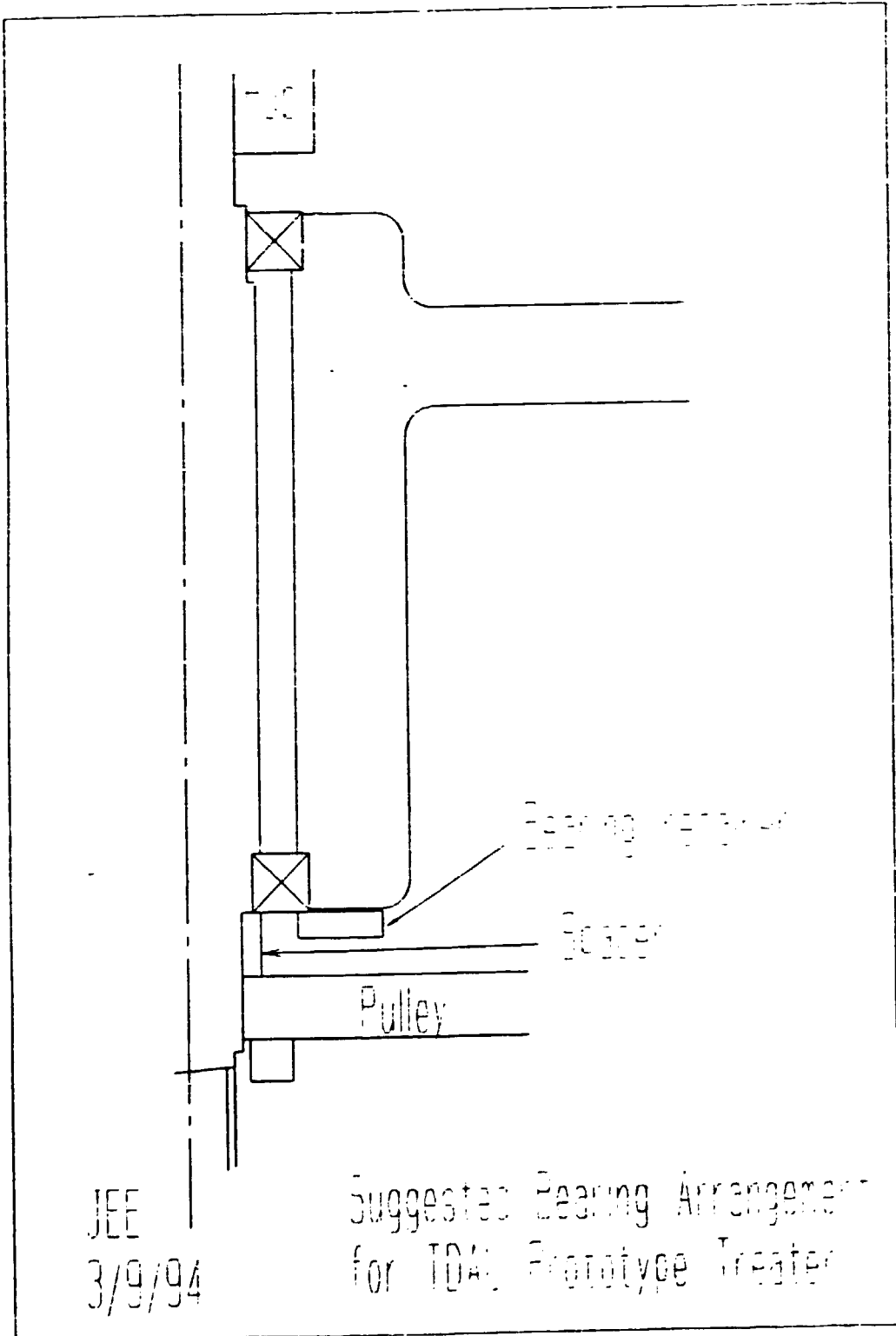
As far as testing is concerned, you have my "preparatory notes" for the meeting with Riverside. These do not need to be regarded as confidential and can be given to Riverside if appropriate.

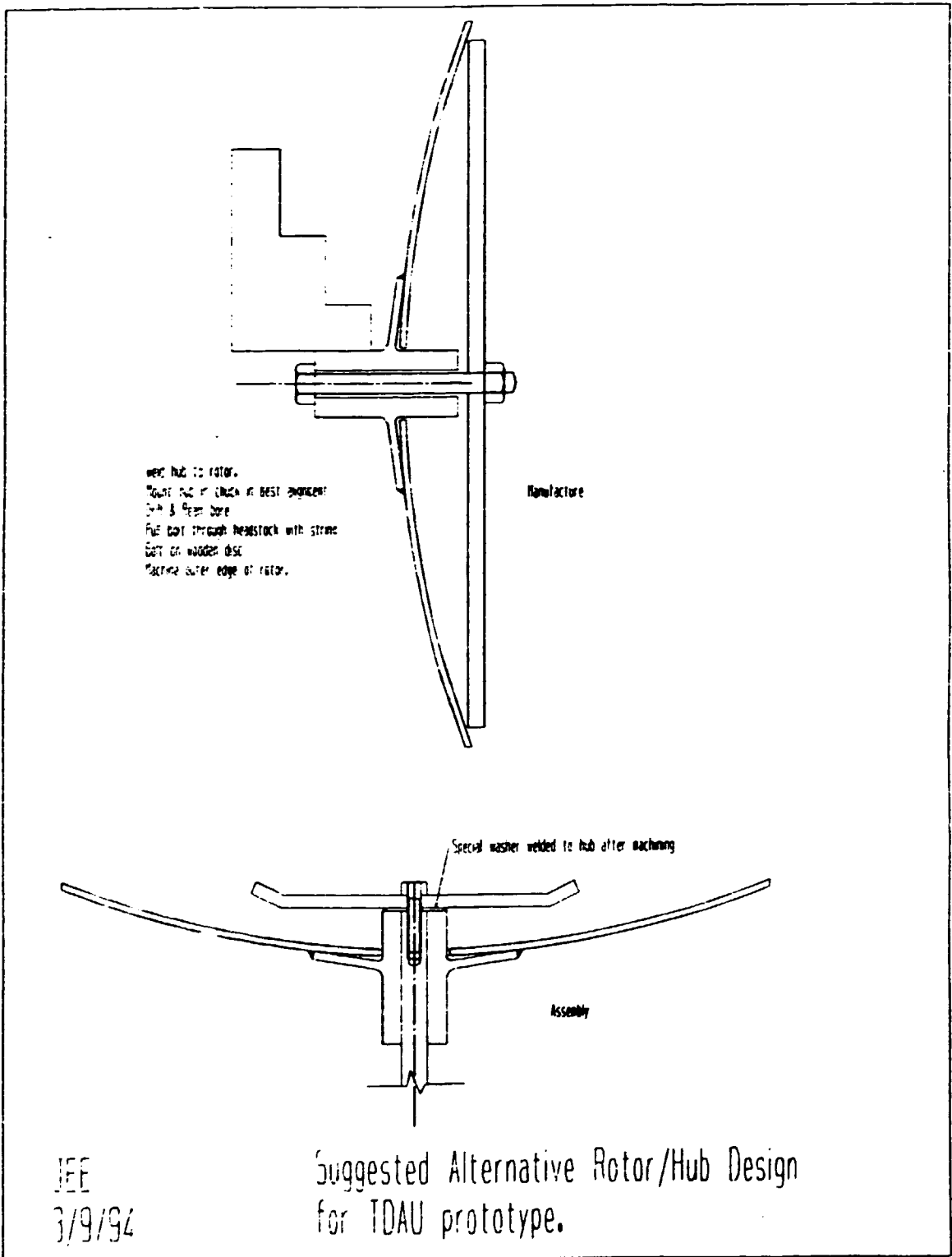
Future tasks include:

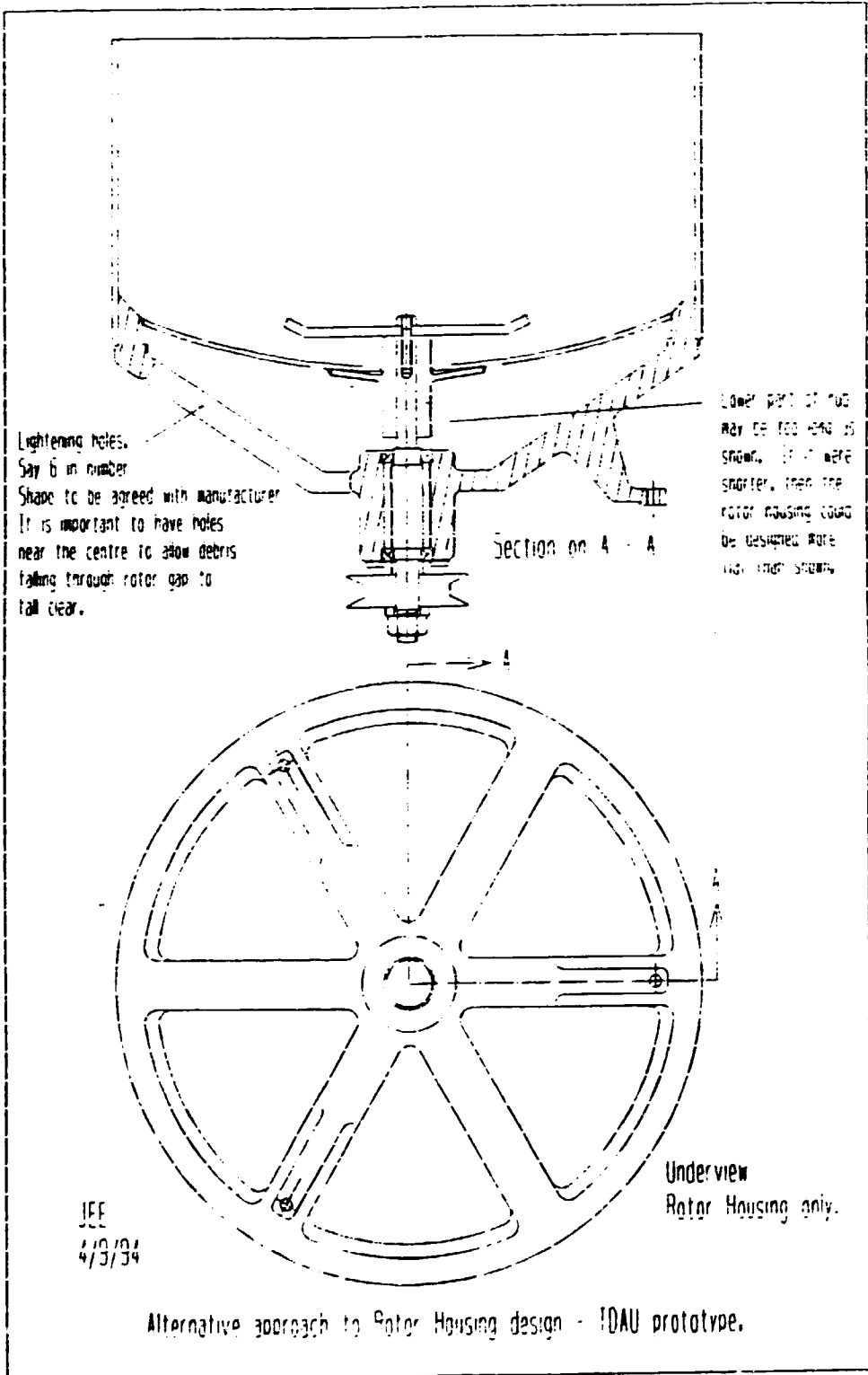
- 1) Making a metering ladle along the lines of the one we made when we did the first village tests, for 25 ml of slurry.
- 2) Liaising with Agrotech to ensure the importation of 50 kg of Fernasan D - or other formulation.
- 3) Acquiring a suitable spring balance. Capacity: Preferably 10 kg. Max 20 kg.
- 4) Acquiring suitable rubber (nitrile) gloves and shell type masks.

Note: UNIDO have a specific budget for chemicals and safety equipment. The extent of it is not known but could be discussed with Dr Sugavanam.

JEE 6/9/94







Appendix C

Note addressed to Mr M. Mwanza - TDAU engineer working on the seed treater project.
Copied to Dr N. Kwendakwema - manager of TDAU.

Preparatory notes for meeting between TDAU and Riverside.

The meeting is planned for 25th September 1994 at Riverside.

The object is to agree an action plan to test the 5kg pedal powered seed treater being developed by TDAU commercially at Riverside.

Earlier tests on a non commercial basis are judged to have been very successful - e.g. one farmer planted treated (home saved) seed adjacent to the same seed without the treatment. The crop from the treated seed grew better in the early stages and remained ahead through the season. It yielded poorly when the rains stopped early but the crop from the untreated seed yielded nothing.

We now seek to show that the machine can be sold at a price which will be attractive to a manufacturer, and used profitably by an entrepreneur. The price he charges to a farmer can be a small fraction of the value of the increased yield.

Thus we seek to show that there is profit available to all three parties.

The manufacturer.
The entrepreneur (user).
The farmer.

If we can successfully demonstrate this to a venture capital company, then finance could be made available for rapid dissemination of the technology.

Specific proposals.

- 1) TDAU sell one of the machines currently being made to Riverside for \$750.
This should be on a "money up front" basis to emphasise that the operation is not subsidised by project funds.
- 2) Riverside appoint a person, or a small team, to take the machine around to the villages to offer a treatment service to the farmers.
- 3) TDAU provide training to this person (these people) in the safe handling of the chemicals and the correct use of the machine.

Preparatory Notes for meeting on seed treater commercial tests. Page 2

- 4) TDAU provide all the other necessary equipment, currently listed as:

Spring balance for weighing the seed. Capacity - 10 to 20 kg.
Set of ladles for metering the slurry.
Gloves and masks for personal protection.
Chemical.

- 5) The Riverside team then take the machine to as many local villages as possible, and treat as much home saved seed as possible in each village. The service should be offered on a "take it or leave it" basis at a suggested price of Kw80 per kg. The amount of seed treated and the comments of the farmers should be noted. These operators should be rewarded on a quantity treated basis to give an incentive for maximum usage of the machine.

Notes:

- 1) It is expected that Riverside will make a profit from the exercise, which will make the outlay of \$750 a very good investment. However, if they are unable to find the money, then they should be given credit, and pay after the season.
- 2) The actual formulation to be used has to be decided. Shell formally sold 'Thirasan' M but have now sold their agrochemical business to Cyanamid who have withdrawn this product from the range. It is recommended that 'Fernasan' D be used. Agrotech appear to be the natural company to carry out this importation and any registration formalities necessary.

Preparatory Notes for meeting on seed treater commercial tests. Page 3

- 3) If 'Fernasan' D is used the following procedure for mixing and treatment should be adopted.

Mix the powder with water in the ratio of 300g of powder with 1 litre of water. Mix this slurry thoroughly.

Weigh each batch of seed and place it in the mixing chamber. If a farmer brings too much seed for one batch, it should be split into two or more batches. The maximum batch size will have to be determined. Provisionally, it would be expected to be approximately 6kg.

Measure out 25 ml of slurry (by using the special ladle made by TDAU) for every 2 kg of seed in the mixer. A judgement must be made for "in between" seed batches. For example, for a 5kg batch, two ladles full, plus one half by judgement.

Pour this slurry down the funnel of the seed treater while the pedals are being turned vigorously. Turn the pedals a further 5 seconds after the last of the chemical has finished running down the tube.

With the pedals still turning, hold a receiving vessel (e.g. a sack) under the discharge and open the discharge door.

- 4) TDAU should make the ladle. An approximately square design is suggested, e.g. 32mm dia x 32 mm high. A long handle should be fitted so as to avoid putting hands into the slurry mix.

- 5) Possible economics would be as follows:

- a) For the farmer.

Expected yield per kg of seed planted:	2.5 x 90kg.
Cost of treatment:	Kw80 per kg
Yield improvement due to treatment	5%
	= 11.25kg per kg seed
Value of grain per 90kg	Kw6,500
Hence value of extra grain produced by seed treatment	Kw812.

Hence the farmer gains 10 times his outlay.

- b) For the users

Working for 40 days with 40 farmers bringing an average of 10kg each gives the amount treated over the season as:	16 tonnes.
Say Kw5 per kg is retained by the users as commission	Kw80,000
If this is shared between 3 people, then commission is	Kw667 per man day.

Preparatory Notes for meeting on seed treater commercial tests. Page 4

c) For Riverside

Expenses:	Machine	\$750
	Say:	Kw500,000
	Chemical - say 48kg purchased at	Kw160,000
	Payment of 3 people over 40 days	Kw120,000
	Payment for transport - say	Kw120,000
		<hr/>
	Total:	<u>Kw900,000</u>
		<hr/> <hr/>
Income:	16 tonnes x Kw75 per kg	Kw1.2m

Thus the capital cost of the machine is recovered in one year.

It is perhaps worth noting that the target amount of seed to be treated in the present exercise will enable the farmers concerned to produce extra crop conservatively estimated at 0.8 tonne. In a full season this would be considerably larger. The treatment of grain for storage pests will further improve food availability. It might be argued that the existence of 50,000 machines could produce enough extra crop nationally to avoid the need to import the 950,000 bags of maize reported in the "Times of Zambia" today.

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Appendix D

Possible economic case for seed treater.

Pedal powered model.

Cost of machine to produce:	US\$	500
Cost to user	US\$	1000
Price of service charged by user to farmer -	US\$ / kg	0.12
Cost of chemical - say -	US\$ / kg seed	0.02
No of days treating per year	days	50
Average no of farmers using service per day -		40
Average amount of seed treated per farmer -	kg	10
Hence:		
Amount of seed treated per day -	kg	400
Daily income to user -	US\$	48
Daily expenses to user	labour, say	US\$ 5
	chemical	US\$ 8
Hence gross margin per day to user	US\$	35
Gross margin over the year	US\$	1750
Thus payback period	months	8
Thereafter annual net profit	US\$	1750

Additional profit is available by application of preservatives to food grains.

Appendix D - P2

Tractor powered model

Cost of machine to produce:	US\$	1200
Cost to user	US\$	2400
Price of service charged by user to farmer -	US\$	0.12
Cost of chemical - say -	US\$ / kg seed	0.02
No of days treating per year	days	50
Average no of farmers using service per day -		20
Average amount of seed treated per farmer -	kg	50
Hence:		
Amount of seed treated per day -	kg	1000
Daily income to user -	US\$	120
Daily expenses to user	labour, say	US\$ 5
	chemical	US\$ 20
	tractor hire	US\$ 60
Hence gross margin per day to user	US\$	35
Gross margin over the year	US\$	1750
Thus payback period	months	17
Thereafter annual net profit	US\$	1750

If user also owns tractor, profit is much higher.

Additional profit is available by application of preservative to food grains.

Appendix D - P3

Farmer's case - based on maize.

Planting rate:	kg / acre	10
Yield	kg / acre	2250
Assume %age yield increase from treatment	%	5
Hence actual yield increase	kg / acre	112.5
Price	US\$ / kg	0.10
Hence additional income	US\$ / acre	11.25
Cost of treatment	US\$ / kg	0.12
Hence	US\$ / acre	1.2
Return on Investment	%	940

The average yield increase to be expected is more like 15%, giving a return of more like 28 times the investment.

Ref. No. US/RAF/88/273-MALAWI

23rd June, 1994

FROM : THE COMMODITY TEAM LEADER, FARM MACHINERY UNIT, P.O. BOX 158, LILONGWE

TO : THE NRC- SOILS AND AGRICULTURAL ENGINEERING, P.O. BOX 158, LILONGWE.

: THE CTL - AGREDAT, P.O. BOX 158, LILONGWE.

: THE CTL - SEED TECHNOLOGY SERVICES, P.O. BOX 158, LILONGWE.

: THE CTL - CROP STORAGE, P.O. BOX 158, LILONGWE.

: THE CTL - SOIL MICROBIOLOGY, P.O. BOX 158, LILONGWE.

MINUTES FOR THE TECHNICAL MEETING ON THE PLANNING OF TESTING OF A MOBILE-PEDAL OPERATED SEED/PRODUCE APPLICATOR (UNIDO PROJECT US/RAF/88/273) IN MALAWI HELD AT CHITEDZE RESEARCH STATION ON 20TH JUNE 1994

(A) Present

Mr. H.W.C. Kazembe-Phiri (Project Leader - Farm Machinery CTL Representative)

Dr. J.H. Luhanga (CTL - Seed Technology Services)

Mr. Kantikana (Seed Technology Services)

Dr. C. Chimbe (CTL - Crop Storage)

(B) Absent

Soil Microbiology - CTL Representative

AGREDAT - CTL Representative

(C) Details of the Meeting:

- (i) The meeting was chaired by the Project Leader who first of all thanked everyone for coming. He let the house know the objective of the meeting that it was mainly intended to discuss and plan the testing of the above equipment with the participating commodity team at Chitedze Research Station.

(ii) Order of Test

The house agreed that the equipment should be on-station tested first, so as to collect as much data as possible about its performance as well as to ascertain that its working for its intended functions. In this test the following commodity teams will be involved in:

- (a) Farm Machinery Unit - looking at necessary modification possibilities
 - looking at equipment capacity with seed/produce of variable sizes
 - any other necessary engineering improvements as felt necessary
- (b) Seed Technology Services
 - Mechanical damage of seed - visually observed
 - chemical distribution on the seed i.e. critical tests where dye will be used and determined using spectrophotometric analysis in the laboratory
 - biological tests of treated vs untreated seeds
 - seed cleaning
 - chemicals to be used: Slurry as used by seed companies in Malawi 'FERNAJAN' D
- (c) Crop Storage Section - Actual storage . chemical application rates
 - chemical distribution
 - biological tests
 - chemicals to be used: liquid and dust actellic.
- (d) Soil Microbiology
 - Inoculant application rates
 - inoculant distribution (degree of coating)
 - biological tests (if any)
 - chemical to be used: inoculant
- (e) AGRE DAT
 - Carry out an economic analysis of the machine

The house agreed that after the above tests then field demonstrations of the machine be carried out in ADDs. The participating commodity teams will be involved in this exercise. Thereafter Farm Machinery Unit will carry out the equipment popularisation procedures.

(iii) Crops to be used:

The house agreed that the following crops will be used in the test: Maize, beans, pigeon peas, soyabeans, sunflower and groundnuts.

(iv) Apparatus required:

The house requested that the following is needed:

- protectives
- germination papers

(v) The meeting ended by the Project Leader remarking that in terms of:

- (a) Transport - Farm Machinery vehicle will be maintained using the project funds for mobility of the project activities.
- (b) Funds - About \$20,000 has been proposed and submitted to the donor-only that they (funds) will be in at a later date say mid July, 1994.
- (c) Preparatory activities
 - Each commodity to prepare a small budget for the materials required.
- (d) Action - The immediate fax will be sent to UNIDO - Austria for funds so that the tests could start by July 20th 1994.

He also thanked all the members for active planning contributions on the test exercise and further stated that more meetings will be convened as the project progresses.

for:

H.W.C. Kazembe-Phiri
CTL - FARM MACHINERY UNIT

UNIDO COMMENTS

The seventh report in the series clearly brings out the fact that the project is definitely on the right track, but the generally poor physical infrastructure is hampering progress. The non-reliable supply of chemicals will have to be discussed in detail and measures should be worked out to obtain chemicals at the right time. In this respect, the Governments and the industries should have a good understanding about the supply of registered formulations

It is important to note that many private companies are interested in the project, but the performance of the machine will have to be further optimized and safety aspects should be taken up.

The basic economic figures are very encouraging but does not take into account interest in case the user borrows the money from a financier. Cost of the machine and the mark-up price could be reduced further.

Additional outlet for post-harvest treatment and possible collaboration with seed production cooperatives would be very advantageous to the project.