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DEVELOPMENT OF PROTOTYPE MOBILE SEED DRESSING APPLICATORS
SUITABLE FOR AFRICAN COUNTRIES

US/RAF/88/273

Technical report: Findings and recommendations*

Prepared for the Governments of the Republic of Zambia, the Republic of Zimbabwe, the Republic of Malawi, the United Republic of Tanzania, the Republic of Kenya and the Rwandese Republic
by the United Nations Industrial Development Organization

Based on the work of Cyrus A. Macfoy,
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* This document has not been edited.

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1. ACKNOWLEDGEMENTS

Thanks are expressed to all the numerous people who have assisted during this mission. These include those in Zambia, Tanzania, Vienna and the United Kingdom who have spent some of their valuable time to supply useful information and to engage in productive discussions with me.

2. SUMMARY

The mission commenced on 13 July 1992 from London and covered Lusaka in Zambia, Dar-es-Salaam and Arusha in Tanzania and Vienna in Austria.

In Zambia, the Technology Development Advisory Unit (TDAU) in the University of Zambia has been identified as the focal point for participation in the design and fabrication components of the project. Two engineers namely Dr. N. Kwandakwena (Coordinator) and Mr. Tambatamba together with their technicians are ready to start as soon as possible. The TDAU does possess the basic facilities including a foundry to participate in this project, but can collaborate with Northlands in Ndola if necessary.

In Tanzania on the other hand, TEMDO i.e. the Tanzania Engineering and Manufacturing Design Organisation in Arusha, has been identified as the focal point for the design and fabrication work and the two engineers appointed to this project are Mr. G. Msolla (Coordinator) and Mr. M. Tango. These will normally be assisted by a team of engineers. TEMDO does possess the basic facilities for the collaborative R&D project and can use the foundry present in Moshi. They can also collaborate with CAMARTEC and Tanseed if necessary.

Thus it is envisaged that a subcontract will go to the TDAU and another to TEMDO and the third to a European company with experience in seed dressing technology. All three will collaborate in this project, with the European company providing the basic design which could then be adapted or modified to suit African conditions. In addition, this latter company will also be required to provide suitable training programmes.

In the end, it is hoped that two or three units of the final prototype will be fabricated in Zambia and Tanzania respectively.

Once the prototype has been fabricated, CAMARTEC (the Centre for Agricultural Mechanization and Rural Technology) in Arusha will perform tests on the machinery against performance/design criteria. Mr. Kaaya will be in charge of this component.

With regard to biological testing, the Mount Makulu Research Station has been identified as the main institution in Zambia. They can collaborate with the Crop Science Department at the University and with Zamseed if necessary. Personnel identified at Mount Makulu are Mr. A. Chalabesa (Coordinator, Entomologist), Miss I. Nawa (Plant Pathologist), Mr. G. Mulenga (Plant Pathologist) and Mrs. M. Taguma (Entomologist).

Biological testing in Tanzania will be undertaken by the Tropical Pesticides Research Institute (TPRI) in Arusha in collaboration with Tanseed also in Arusha. Both possess qualified staff to undertake this task.

The TPRI personnel identified are Mrs. D. Matemtu (Formulation Chemist), Dr. B. Urono (Entomologist) and Mrs. A. Urono (Plant Pathologist).

Testing would include making suitable formulations, testing efficiency of seed coating and field trials using maker diseases and pest infections.

To coordinate the project, a CTA and a Biologist/Formulation Chemist have been appointed as external experts. Local engineering experts are Dr. N. Kwandakwena (TDAU, Zambia) and Mr. G. Msolla (TEMDO, Tanzania) to whose institutions subcontracts will be offered. These two engineers will be provided for under the subcontract arrangements. Local biology experts who will coordinate the biology components are Dr. Urono (TPRI, Arusha) and Mr. Chalabesa (Mt. Makulu, Zambia).

An overall National Expert Project Director could be the Formulation Chemist, i.e. Mrs. D. Matemtu as in the project document.

Once the subcontracts have been signed between UNIDO and the focal institutions, recruitment of local experts (budget line 17-00) could start. As these local experts are expected to participate on a part time basis, keeping their present jobs, compensation for these services could be provided by

reimbursable loan arrangement with the institutes to which they are attached. An updated workplan is also needed as soon as possible.

The need for the provision of adequate shelling, cleaning and grading facilities of the seeds for farmer groups, cooperatives, NGO's or individual farmers who can afford them seems inevitable, if it is envisaged that these groups will be treating their own seeds.

Training requirements, trainees and possible institutions for training both in Europe and within the region were also identified.

All participants are anxiously awaiting the arrival of the CTA in September to start the project.

3. INTRODUCTION

Following the preparatory assistance conducted in 1989, a report together with a draft project document in accordance with the new UNDP format was submitted to the UNIDO by Macfoy & Nicholson (Consultants) on the development of prototype mobile seed dressing applicators suitable for African countries. The UNIDO developed and submitted the project document to the Germans and an IDF special purpose contribution was offered to UNIDO worth \$762,000 for the UNIDO execution of this PTA project i.e. to utilise in the implementation of the project whose main objectives are as follows:

(i) To validate the techno-economic viability of the seed dressing technology through the development of prototype mobile seed dressing applicators specifically tailored to the needs of the African farmers with a view to promoting its wide-spread utilization in the Eastern and Southern African subregion - PTA/SADCC subregion.

(ii) To develop/upgrade skills of technical personnel in operation and maintenance of the mobile seed dressing applicators.

This report sets out the groundwork for the project implementation. It identifies personnel and institutions in Zambia and Tanzania to be involved in both design, fabrication and testing of the seed

dressing applicator together with possible crops and formulations, availability of pesticides and locally available materials to be utilised. In addition, the logistics for collaborative R&D between institutions and between countries in the PTA subregion and a developed country were investigated and where possible developed.

At a meeting held in the UNDP Dar-es-Salaam (17/3/92) between UNIDO/PTA/SADCC to discuss modalities of implementation of the project, two focal points were identified viz. Zambia and Tanzania. In Zambia, Mount Makulu Research Station will collaborate with TDAU, the School of Agriculture, UNZA and Zamseed, while in Tanzania, TEMDO will collaborate with CAMARTEC, TPRI and Tansseed, all in Arusha. Other coordinating institutions are located in Malawi, Zimbabwe, Kenya and Rwanda. For Malawi, the lead institution would be Chitedze Agricultural Research Station in collaboration with Banda College of Agriculture, University of Malawi and the National Seed Company. In Zimbabwe, the Development Technology Centre, University of Zimbabwe will be the lead centre institution. In Kenya, following another meeting in Nairobi (10/4/92), the focal institution identified was KIRDI (Kenya Industrial Research Development Institute) who could collaborate with other institutions like KARI, ICIPE and Kabete Campus.

For Rwanda, the PTA would identify suitable institutions and personnel to be trained.

4. SELECTION OF INSTITUTIONS AND EXPERTS TO PARTICIPATE IN R&D PROGRAMME

It has been proposed by UNIDO that three institutions: one in Europe, one in Zambia and one in Tanzania should be subcontracted to conduct the R&D under the following terms.

DUTIES OF THE SUBCONTRACTOR (IN EUROPE)

The subcontractor in collaboration with selected institutes in Tanzania and Zambia will assist in design and fabrication of four (4) prototype seed dressing machines for testing their viability for use in 4 African states viz. Zambia, Malawi, Tanzania, and Rwanda.

The design could be adapted from the existing machines and modified to suit African conditions especially with regards to:

- mobility of the machine;
- flexibility of use (from mains, generator or manual operation);
- ease of collection of waste and cleaning;
- dosage requirements;
- safety during operation;
- security of machine;
- cost effectiveness.

In his involvement with the project, the subcontractor is expected to assist with his staff preferably with experience in design/fabrication engineering and marketing specialization. The focal point institutes in Tanzania and Zambia are:

Tanzania:

Tanzania Engineering and Manufacturing Design Organization (TEMDO),
Arusha
Centre for Agricultural Mechanization and Rural Technology (CAMARTEC),
Arusha
Tropical Product, Research Institute, Arusha
Tanzania Seed Company, Arusha

Zambia:

University of Zambia - Technology Development and Advisory Unit
Zamseed Company

In his participation he will select suitable design material of construction (easily available in participating African countries) and fabricating equipment according to requirements so as to make four (4) prototype machines.

The subcontractor, as and when 'needed' during the time of implementation of the project (36 months), should provide suitably qualified staff for a minimum of 4 m/m in Tanzania and Zambia and 6 m/m in his plant/office premises, and also provide his staff for any trouble shooting exercise to be carried out in the field.

The subcontractor is expected to provide suitable training in his place of operation and also arrange in other suitable organization(s) in his country. The training will include design, fabrication of agricultural tools, seed dressing technology, bio-assay. UNIDO will bear the cost of the trainees' travel and living expenses. In case any reasonable training fees are charged by any institution other than his own, UNIDO will pay the fees for such training.

The training would be in the following areas (likely to be revised):

- | | | | |
|---|---|------------|--|
| 1. Crop protection strategy in tropical countries | 1 | 3 months | UNIDO will arrange |
| 2. Chemical formulations with emphasis on seed dressing | 1 | 3 months | UNIDO will arrange |
| 3. Agricultural engineering fabrication of tools | 4 | 1.5 months | Subcontractor
UNIDO will cover expenses |
| 4. Visit of two national experts to different institutions in Europe to see institutions on crop protection | 2 | 2-3 weeks | Subcontractor |

UNIDO at its own expense will provide to the project, international and national experts on seed dressing technology, quality control, bio-assay and market analysis. They will be in contact with the subcontractor and the selected institutions in African countries.

Apart from training and consultancy mentioned above he is expected to provide specialized items of equipment and tools needed for fabricating the prototype machines. He will also assist, after completion of necessary trial runs, a techno-economic assessment of the machines.

The subcontractor during his involvement in the project will submit progress reports (40 copies) every year to UNIDO in English for distribution to the participating African countries. The draft final report should be submitted at least two months prior to the completion of the subcontract.

Qualification of the Subcontractor

The subcontractor should have enough experience in dealing with seed treatment technology including production of seed treaters (small, medium-size) and other agricultural tools and implements. He should have qualified staff, mechanical engineers and design engineers with experience in fabrication of small agricultural tools and implements. He should have facilities for computer assisted design. Experience in fabrication of small-scale seed dressing machines would be an added advantage.

DUTIES OF THE SUBCONTRACTOR (IN ZAMBIA AND TANZANIA)

The subcontractor is expected to provide the necessary staff such as design/fabrication engineer, market analyst, secretarial staff and cooperate with other institutions in the countries (Tanzania, Rwanda and Kenya) and assist in carrying out R&D work in fabricating prototype seed dressing machines and in conducting trials in various parts of the country.

In this he will cooperate with international experts, national experts and with other contractors involved in the project. Whenever needed, the subcontractor is expected to provide necessary assistance to trainees from various institutions in his premises and also arrange suitable staff from other participating institutions in the subregion (Tanzania, Rwanda and Kenya).

The subcontractor should facilitate use of machines available in his place of operation and also negotiate with other institution(s) participating in the project to provide space, equipment and skilled and semiskilled personnel. Any travel of his staff within the subregion should be at the subcontractor's expense.

The subcontractor, in collaboration with national and international experts, should provide annual reports on the project and make record of the seed dressing process, data on field trials, interpretation of data and provide alternatives to optimize the results.

The utmost importance is given to safe usage and non-exposure of operators to chemicals as well as proper collection of waste for disposal.

Qualification of the Subcontractor

The subcontractor should have the necessary facilities for design and fabrication of agricultural machinery suitable to African countries. He should have enough skilled and semiskilled personnel, such as design/fabrication engineers, tool makers and furnace and lathes as needed. Facilities and experience in computer based design would be an added advantage.

EUROPE

The UNIDO has already appointed a CTA - Mr. J. Elsworth and a Biologist/Formulation Chemist/Biochemist - Dr. C.A. Macfoy. Institution(s) in Europe to participate in the design and fabrication are being identified by UNIDO.

In both Zambia and Tanzania institutions have been identified and personnel interviewed by the consultant.

ZAMBIA

In Zambia, the Technology Development Advisory Unit (TDAU) in the University of Zambia has been identified as the focal point with the following engineers: (1) Dr. N. Kwandakwena - Director/Coordinator and (2) Mr. Tambatamba.

It is proposed that the subcontract for Zambia will be made to the TDAU (Zambia focal point). TDAU could collaborate with other engineering institutions for fabrication e.g. Northlands Engineers, and with the Mt. Makulu Research Station and the Crop Science Dept., UNZA and Zamseed for testing and field trials. In this regard an official letter should be sent to the General Manager of Zamseed, formally requesting Zamseed's participation. Contact at Northlands is Mr. M. Jackson, Mechanical Sales Engineer, Northlands, Ndola who indicated Northlands pertinent capability to fabricate the prototype if required.

Several personnel have been identified at both the Mount Makulu Research Station in Chilanga about 30 km from Lusaka and the University, who could participate in testing and field trials namely:

Mount Makulu Research Station

Mr. A. Chalabesa - Entomologist/Coordinator
Miss I. Nawa - Plant Pathologist
Mr. G. Mulenga - Plant Pathologist
Mrs. M. Tanguma - Entomologist

Crop Science Dept. UNZA

Dr. C. Mwindillila - Plant Pathologist
Dr. C. Dedaat - Entomologist
Dr. C. Naciwa - Plant Pathologist

Crop Science Department of the University in Lusaka does possess basic facilities to participate in the project.

One possible collaboration is replicated trials to be conducted at both locations, (Mt. Makulu and University) since Mt. Makulu is some distance from the University. Like Mt. Makulu, the University has a university farm about 20 km from the Lusaka Campus and field plots on Campus. Both Mt. Makulu and the University are ready and enthusiastic about the project.

TDAU does possess the basic facilities including a foundry, and personnel to design and fabricate a prototype (2 units). The personnel identified are both Engineers in the Department with experience in design and fabrication. They are quite enthusiastic about the project and together with eight technicians in the department, are ready to start the project on a multi-purpose mobile seed dresser. Of extreme importance will be the necessity to produce a prototype that is low in cost, hence affordable by the main target group, the small scale rural farmers; minimal maintenance requirements including availability of parts preferably in the rural areas.

Mount Makulu Research Station does have substations in all the three identifiable agro-ecological zones in the country hence field trials in these

zones should pose no problems. They can also collaborate with the Crop Science Department of the University if required. In addition, Mount Makulu can conduct trials during the normal planting season (November-December) i.e. rainfed, or off-season by irrigation (May/June/July).

Furthermore the Seed Control Certification Institute (SCCI) of the M.O.A. also located at Mount Makulu can collaborate with the Research Station in view of the existence of expertise at the SCCI in this area.

TANZANIA

In Tanzania, the Tanzania Engineering and Manufacturing Design Organisation (TEMDO) in Arusha has been identified as the focal point for the design and fabrication. Two engineers have been recommended: (1) Mr. G. Msolla - Director/Coordinator and (2) Mr. M.S.A. Tango - Design Engineer.

TEMDO possesses the basic facilities and personnel necessary to undertake this project and has access to a foundry in Moshi. In addition to the two engineers there are nine other engineers who usually work as a team. Four of their engineers have MSc degrees. Other personnel include 13 artisans and one technician, together with the administrative staff, making a total manpower of 65.

TEMDO is a parastatal under the Ministry of Industry and Trade whose inception in 1982 was marked by the appointment of a Board and a Director (Mr. G. Msolla). Prior to this, a UNIDO feasibility study in 1978/79 was conducted to ascertain its viability. TEMDO's status is about to be modified to a National Institute as opposed to a commercial parastatal. Their main objectives are to design and promote design capabilities; manufacture and develop prototype; pilot manufacture of a few units; design and manufacture consultancies (presently 70-80% of man hours); on the job training for other industries; promote commercialisation - involves manufacturers e.g. United Engineers, Manic Engineers, SIDO (Small Industries Development Corporation), Daramsin, *et al.*

The design facilities presently available were provided with SIDA funding (Equipment) together with training. Three computers from SIDA using

Autocad are available together with another from a PTA/UNIDO project (since 1989) on "Spare parts manufacturing promotional centre". These are used in computer aided designs. TEMDO being one of two designated centres, the other being based in Ethiopia. TEMDO is a member of WAITRO (World Association of Industrial Technology and Research Organisation). Funding is by Government subvention, consultancies and external projects.

Although TEMDO has some facilities, when necessary they subcontract to workshops elsewhere using their drawings. Many spare parts for industrial machines, stainless steel materials, gears, shafts, rollers, tool steel spring etc. are being produced. They have also undertaken parts modification and can manufacture simple tools and die. More complicated ones are subcontracted to workshops in Arusha. Also, although a few units of prototypes can usually be produced at TEMDO, mass production has to be done outside. Other items so far designed and fabricated include oil expeller; casted parts - subcontracted components in Arusha; grain dryer; cardamon dryer. Facilities are available for training of draughtsmen, technicians and engineers.

Meeting of TDAU and TEMDO

A preliminary informal meeting was held in Arusha in July 1992 between the Directors of TDAU (Lusaka, Zambia) and TEMDO (Arusha, Tanzania) on the collaborative R&D project of the prototype seed dressing applicator.

CAMARTEC

CAMARTEC (The Centre for Agricultural Mechanisation and Rural Technology) in Arusha is a parastatal organisation under the Ministry of Industries. It was set up by an act of parliament in 1981 with the aim being to improve the quality of rural life through development, adaptation and implementation of appropriate technologies in the fields of agricultural mechanisation, water supply, building construction and sanitation, rural transport and energy. Thus the functions of the centre include the following:

- a) To carry out applied research designed to facilitate the designing, adaptation and development of machinery and equipment suitable for use in agricultural and rural development.

- b) To develop and manufacture approved prototypes, components and cultural techniques and technologies, and evaluate their suitability for local adaptation.
- c) To adopt foreign designs of agricultural machinery and equipment to suit local conditions of manufacture and maintenance.
- d) To perform tests on all types of machinery and equipment intended for use in agricultural and rural development in the United Republic and to publish their results.
- e) To conduct short training courses designed to provide practical training and knowledge to village communities in the use and maintenance of agricultural machinery and other appropriate technology devices.
- f) To offer consultancy services on the designing, testing and other technical aspects of agricultural mechanization.
- g) To act as the National link with other national and international institutions engaged in activities related to the functions of the centre.

There are three directorates under the Director General i.e. Directorate of Technology Development; Testing and Production; and Extension and Training, all staffed by professional technicians and artisans.

The centre has a number of proven technologies in the fields of Agricultural Mechanisation and Rural Technology and presently offers both centre-based and field training as well as consultancy services for the production and use of farm implements, rural transportation, low-cost house construction, water and energy. Farm implements include hand planter, Kifaru plough, cultivator, seed attachment, Kifaru plough with seed attachment, ground-nut sheller, winnower and spike tooth harrow.

CAMARTEC can perform tests on agricultural machinery against performance/design criteria. Indeed they have tested and published the results in 1988 of a cobmaster Maize Sheller/Duster from the U.K. This Cobmaster machine is a stationary/pedal hand operated machine designed to shell maize while applying super actellic insecticide dust at recommended

rates to the shelled grain. The machine is also equipped with a winnowing machine which cleans the shelled maize by blowing off the chaff from the shelled grain as it flows down into the collecting tray/container. The shelled cobs are simultaneously separated from the shelled grain during the shelling operation. Also in 1988, they tested a bagged grain swinger duster from the U.K. This is a hand operated machine designed to mix different types of grains with various types of insecticide dusts e.g. Actellic dust.

Usually, a testing fee is charged for the operation and if special instruments are needed payment may be required in foreign currency. Cost effectiveness is usually an added criterion.

In addition to the manpower necessary to conduct the testing, CAMARTEC does possess Agricultural Engineers capable of participating in the design and fabrication if needed by TEMDO. They may also be able to participate in the production of any shelling, cleaning, grading facilities that may be required. Indeed, a grading machine does exist at CAMARTEC together with a winnower for cleaning seeds. As far as shelling goes, present methods used are manual, hand operated shellers or hired tractors. Grading is usually done by the large seed dealers who also do the treating.

TROPICAL PESTICIDES RESEARCH INSTITUTE (TPRI)

The TPRI in Arusha is a parastatal institute charged with the responsibility of carrying out research on the control of tropical pests by ground/aerial-spraying techniques of pesticides; maintain a National Herbarium; a National Plant Gene Bank; function as the national Plant Quarantine Station; and to supervise and regulate the manufacture, importation, distribution, sale and use of pesticides. Among other facilities, TPRI does possess laboratories for analysis of pesticide formulations and residues as well as facilities for carrying out research on pesticides and application technology; Entomology and Plant Pathology Laboratories *et al.*

Thus the TPRI does possess qualified staff with some experience in formulation using international standards and methodologies; pesticide analysis; and insect pests and plant disease control.

Although basic instrumentation is available, there may be the need to provide selected spare parts for the GC, IR and UV spectrophotometers. Germination tests could be carried out by the Plant Pathologist, although the government seed testing laboratories in Tengeru, Arusha, are willing to participate if needed. With regard to quality control, in view of past experiences, TPRI may need to develop interlaboratory collaboration if necessary for cross referencing with laboratories in e.g. Kenya and Zimbabwe. Screenhouses are available as well as TPRI farms for field trials. Some experiments could also be conducted in selected farmers fields.

A precise workplan of the project implementation including timing of training activities is needed by TPRI in order to plan ahead and make projections.

Scientists identified at the TPRI for participation in the project are as follows:

Mrs. D. Matemu - Formulation Chemist

Dr. B.E.M. Urono - Entomologist

Mrs. A.B. Urono - Plant Pathologist

TANSEED

Tanseed employs the services of contract growers for the production of seeds. This seed company provides the basic seeds (at a price) and gives technical advice to the growers in addition. Once produced the seeds are delivered untreated, uncleaned and ungraded to Tanseed. A few growers do however own cleaning and grading facilities. Tanseed's cleaning and grading facilities are located in Arusha, Morogoro, Jumbe and Irunga, each of the latter three with a Gustafson treater as well. The approximate present operating capacity is 1 tonne/hour and most seeds are usually treated with Farnasan D (lindane + thiram + blue dye) at the recommended dose i.e. 20 litres water + 22 kg. Three of the five foundation seed farms where basic seed production is undertaken also have their own grading and treating facilities, usually a West trap cleaner and an auger type treater.

Tanseed would actually prefer their growers to carry out basic cleaning, grading and treating on-farm before selling to them. In Arusha alone, there are 30-35 growers producing about 13 seed varieties in farms approximately

20-60 ha/farmer. The seed varieties include two hybrids and two composites of maize; and two varieties each of beans, wheat and sorghum. Only hybrids for the high altitudes are presently available. The distribution network is also not very good. Sunflower and wheat are usually treated with the fungicide, Vitavax (+ pink dye).

Small scale farmers could also be potential users of a seed dresser since some still save their seeds although with decreased yields e.g. wheat. At the initial stages, groups of farmers or cooperatives would be able to afford the dresser. Other potential users are NGO's and foundation seed farms, etc.

Two potential participants have been identified at the Tanseed i.e. Mr. M. Kibada, Branch Manager and Mr. E.M. Lwengenye, Seed Processing Engineer.

SEED TESTING LABORATORIES

The government seed testing laboratory in Tengeru, Arusha is a branch of the main laboratory in Morogoro. They test seeds destined for both the export and domestic markets before issuing an International Certificate. For this, standard methodologies are used which are in full accordance with the International Seed Testing association (ISTA) rules and annexes. These tests include physical purity, cultivar purity, moisture content, germination, vigour and disease purity (this latter will commence in 1993 with FAO funding). A major activity of the laboratories is working with the foundation seed farms (five in the country; one in Arusha 1000-2000 ha). At these farms breeders seeds are multiplied, the maize are shelled, cleaned, graded and dressed with Farnasan D, bagged and sold to Tanseed, then multiplied once and certified by the Seed Laboratory, following routine tests.

SADCC/CIAT Regional Programme of Beans

This project based in Arusha is conducting research on the bean fly - bean (*Phaseolus*) interaction. This latter is a major problem in the region and alternatives to endosulphan as a seed dressing viz. natural seed dressings or other are being sought presently e.g. Neem, Tephrosia.

Crops

Most agricultural seed products can be treated with the exception of soyabean (phytotoxicity problems), and sunflower (more valuable undressed, as surplus can then be sold for oil extraction).

Thus the following seeds can be treated:

1. Maize
2. Beans e.g. Phaseolus
3. Groundnuts
4. Sorghum
5. Wheat
6. Millet
7. Sunflower
8. Any other available e.g. vegetables

5. SEED DRESSINGS

In Zambia, the following seed dressings have been used in the past:

1. Thirasam M (mixture of the fungicide Thiram and 1% malathion)
2. Captasan (mixture of the fungicide Captan and 1% malathion).

Usually, 1% sodium molybdenate and a red dye serving as a warning agent are added.

Other seed dressings used depending on availability are the fungicides Vitavax (safety problems), and Baytan.

Likewise, in Tanzania however, several pesticides have been registered for seed dressing under the general purpose and experimental category (Table 1 - see Annex).

Thus some of these seed dressings can be used in the trials, depending on which is available in the country, since in Zambia they are usually obtained from Shell, Zamseed directly from South Africa, and in Tanzania from various companies.

Also, safe traditional biological pest control methods e.g. certain plants, can be researched for their efficiency in seed treatment.

Furthermore the possibility of formulating seed dressing(s) in the PTA subregion should be investigated since some member countries possess sources of possible locally available inert carriers e.g. in Zambia there is significant non-utilisation of large quantities of talc, mica, kaolin, clay with high percentage montmorillonite, feldspar and agricultural lime. Most of these are already being mined in small quantities and used in local industries such as talc - detergent and cosmetics industries (Johnson & Johnson), clays - glass industries, mica - exported, kaolin - pottery.

Also in Tanzania, several possible locally available carriers have been identified for the formulation of pesticides (Table 2 - see Annex).

Thus research could be conducted on identification of the most suitable material that can act as an inert carrier to facilitate adhesion to the seed of the active chemical ingredient of the seed dressing.

6. SEED DRESSING IN ARUSHA

Apart from Tanseed, there are private seed companies in Arusha, namely Cargill Hybrid Seeds and Rotian Seeds respectively. The latter, a Dutch company (more than ten years in Arusha) specialises in beans, by commissioning farmers to produce the beans. Rotian seeds then clean, grade and treat (as required) with either Farnasan D or Aatifon (from Netherlands) - active ingredients dichlofenthlon en thiram (red on the seeds). Applied at a rate of 15 kg chemical + 15 kg water for 6000 kg seeds. The loading capacity of this German made treater is 250 bags of 50 kg for 8 hours (for both maize and beans). This treater can even handle smaller quantities of seeds e.g. 10 kg or even 1 kg. Tanseed, on the other hand, presently market treated maize (two hybrids and two composites), beans (two composites), wheat (two varieties) and sorghum (two varieties). They are produced by contract farmers.

Cargill Hybrid Seeds, an American company, produces maize, sunflower and sorghum seeds by commissioning large scale growers (60-150 ha), who treat seeds on-farm with Actellic Super by hand mixing and sell to Cargill. Cargill then have the seeds dressed with a Cargill formulation i.e. Mancozeb and

Actellic (3g/kg) at Rotian Seeds using their German made treater and bag them in 1 kg and 10 kg bags for sale.

Possible Modus Operandum of Seed Dressing Applicator

In centres in various localities where cleaning and grading is undertaken. Some machines shell, clean and grade. Cooperatives farmers groups or village ownership. A machine designed by TEMDO does shell and grade but with no blower so does not clean. This may be necessary since the average farm is about 4 ha with yields of 2000-3000 kg/ha (with good husbandry). If the unit cost is reasonable enough individual farmers could own theirs e.g. the contract farmers with more than 30 ha. For the very small scale farmers (2-4 ha) either a smaller unit should be designed or the unit cost of a larger one affordable by the farmer groups, cooperatives or village as the case may be. Other target beneficiaries for the utilisation of this machine are commercial farmers, seed companies, research institutions, and NGO's.

7. OTHER CROP PROTECTION ACTIVITIES IN ARUSHA AREA

In Moshi, several kilometres from Arusha, there is the Moshi Pesticide Company which when operative could manufacture a number of pesticides e.g. copper oxychloride. UNIDO funding has provided technical assistance while Italian funding has been used for the plant and machinery. Although three separate independent studies have been completed to date, the manufacturing has still not commenced, apparently due to environmental concerns by the residents. The studies were, firstly, the original feasibility studies, a UNIDO report (positive) and a national task force report recommending an environmental impact assessment as a necessity.

The plant possesses three lines. Line one for hydrochloric acid production and copper oxychloride production, then copper oxychloride formulation. Line two for wettable powders and Line three for liquid and flowable herbicides. When in operation this Moshi plant should prove an invaluable asset to the seed dressing manufacture using locally available raw materials as much as possible.

8. TRAINING REQUIREMENTS

Training in the following areas is recommended:

- a. Design Training - overseas
- b. Operation and Maintenance - overseas
- c. Agricultural Engineering - overseas
- d. Crop Pest Biochemistry - overseas
- e. Pesticide Formulation - overseas
- f. Quality Control - overseas
- g. Study Tours - Plant Protection - overseas
 - Agricultural Engineering - overseas
- h. In-service Training - Operation Maintenance
 - Formulation
 - Field Trials
 - Safety Aspects
- i. Training of extension workers and farmers - In service.

Possible institutions for training in a, b & c above are the Institute of Engineering Research, Bedford, U.K.; for d, e & f the NRI (Natural Research Institute), Chartham, Kent, U.K.; the CIRAD, Montpellier, France; KWIZDA Gesellschaft, Agrochemie, Vienna, Austria, the Rothamstead Experimental Station, U.K. and similar institutions in Germany.

Individuals nominated for these are as follows:

Design Training

Mr. Tambatamba - TDAU, Zambia

Mr. M.S.A. Tanga - TEMDO, Tanzania

Operation & Maintenance & Agricultural Engineering

Mr. Tambatamba - TDAU, Zambia

Mr. A.N. Kaaya - CAMARTEC, Tanzania

Crop Pest Biochemistry

Mr. A. Chalabesa - Zambia

Mrs. A. Urono - TPRI, Tanzania

or

Dr. B. Urono - TPRI, Tanzania

Pesticide Formulation/Quality Control/Safety

Mrs. D.S.K. Matemtu - TPRI, Tanzania

or

Mr. E.E. Lekei

For the study tours, officials will be required to visit agricultural engineering institutions in Europe fabricating seed dressing applicators and those involved in pest control research for Africa/Asia to gain first hand experience in the operation of such technology and in the use of environmentally safe chemical formulations. Institutions could include ICI in the U.K. in addition to the ones already mentioned above.

Nominated personnel are:

Dr. N.J. Kwandakwema - TDAU, Zambia

Mr. G. Msolla - TEMDO, Tanzania

Dr. F.W. Mosha - TPRI, Tanzania

Mr. A. Chalabesa - Mt. Makulu, Zambia

Regarding the in-service training courses, and the training of extension workers, these could be conducted at the following institutions, all containing the necessary facilities for such activities.

TEMDO & TDAU - Design

CAMARTEC & TDAU - Operation & Maintenance

TPRI - Formulation, Plant Protection

TPRI & Mt. Makulu - Field Trials and Quality Control & Safety

These institutions can collaborate with the relevant government ministries organising the courses.

The TPRI have already produced a Pest Management Training Programme for 1993-1995 aimed at disseminating information on appropriate pest management strategies necessary for dealing with increasing pest problems in plant protection, livestock and public health. The target groups include executives, research scientists, extension officers and pest controllers. Thus, the proposed training programme should fit in quite well with the above.

9. SUGGESTED TESTS TO BE CONDUCTED

The following tests are recommended to assess the efficiency of seed dressing:

- Experiments with powder, liquid or slurry; powder plus adhesive, using different pesticide rates (fungicides, insecticides or mixtures of both).
- Assessment of loading (ug pesticide/g seed) and distribution (ug pesticide/seed), using a fluorescent tracer dye or simple extraction and quantification.
- Effects of humidity (dry days vs. wet days).
- Assessment of pesticide retention onto seeds.
- Effect of pesticide on seed germinability.
- Phytotoxicity of pesticides.
- Standard field trial experiments: Replicated trials using statistically appropriate methodologies such as randomised blocks of plots for assessment of level and severity of disease, insect damage, seedling emergence and crop yield.

10. ANNEX

Table 1

PESTICIDES REGISTERED IN TANZANIA FOR SEED DRESSING UNDER
GENERAL PURPOSE AND EXPERIMENTAL CATEGORY

<u>TRADE NAME</u>	<u>COMMON NAME</u>	<u>REGISTRANT</u>
1. Farnasan D	Thiram + Lindane	ICI
2. Baytan Universal 31.3DS	Triadimenol	Bayer Ag
3. Broncot 10 P	Bromopal	ICI
4. Bronotak 10w/w	Pronopal	Schering
5. Nordox SD-45	Cuprous oxide	Nordox A/S
6. Roural TES FIO	Iprodione + Carbendazin	Rhonepoulene
7. Percot 45 W/P	Cuprous oxide	ICI
8. Vitavax 200F	Carboxin + Thiram	Uniroyal-chem
9. Raxin 10 W S	Terbuconazole	Bayer Ag
10. Raxil Combi 6W/S	Terbuconazole-Triacoxide	Bayer Ag
11. GTA Radam	Guazaline	Rhonepoulene
12. Folicur Combi 375CC	Fenetrazole Triadimenol	Bayer Ag
13. Derosal 60% WP	Carbendazin	Hoechst
14. Banvistin 50% WP	Carbendazin	BASF

Table 2

CARRIERS AVAILABLE IN TANZANIA FOR FORMULATION OF PESTICIDES

INORGANIC CLAYS AND MINERALS

Attapulgit

Montmorillonite (Bontonite)

Diatomaceous Earth

Kaolinite

Calcium Carbonate (Chalk)

Vermiculite

Pyrophyllite

Talc

ORGANIC

Maize Cob Grits

Coconut Shell Powder

Coffee Husk Powder

Saw Dusts

Rice Husk Powder

List of Personnel Interviewed:

Zambia

1. Mr. A. Chalabesha
Mount Makulu Research
Station, Zambia
2. Ms. C.S. Lowley
Zambia Farmers Cooperative Society
Lusaka
3. Mr. B. Coxe
Zambia Farmers
Cooperative Society Ltd.
Lusaka
4. Mr. M. Jackson
Northlands
Ndola
5. Mr. R.Z. Kapila
Zambia Cooperative
Federation Ltd.
Lusaka
6. Dr. N.J. Kwendakwena
TDAU
UNZA
Lusaka
7. Mr. Lloyd
Production Manager
Zamseed
Lusaka
8. Mr. S.I. Matundiko
Shell Chemicals
Lusaka
9. Mr. N.J. Money
Director
Geological Survey Dept.
Ministry of Mines
Lusaka
10. Mr. G. Mulenga
Mount Makulu Research Station
Zambia
11. Mr. Mutale
Box 410232
Kasama
Champu Farms, Matengele
12. Mr. Mwencha
PTA
Lusaka
13. Dr. C.N. Mwiindilila
Dept. of Crop Science
UNZA
Lusaka
14. Miss I. Nawa
Mount Makulu Research Station
Zambia
15. Mr. Opio
PTA
Lusaka
16. Dr. T.J. Ruredzo
SADCC Regional Gene Bank
Lusaka

17. Mr. Sallah
PTA
Lusaka
18. Mr. M. Sichilima
PTA
Lusaka
19. Mr. S. Sikuka
Zambia Cooperative
Federation Ltd
Lusaka
20. Mrs. M. Taguma
Mount Makulu Research Station
Zambia
21. Mr. Tambatamba
TDAU
Lusaka

Tanzania

1. Dr. K. Ampofo
SADCC/CIAT Regional
Programme of Beans in
Southern Africa, Arusha
2. Dr. A. Forster
Sasakawa - Global 2000
Arusha
3. Mr. A.N. Kaaya
Director of Testing
CAMARTEC
Arusha
4. Mr. S. Kanga
Director
Tanseed
Arusha
5. Mrs. F.F. Katagira
Plant Protection Dept.
Ministry of Agriculture
Dar-es-Salaam
6. Mr. G.G. Kavishe
Cargill Hybrid Seeds
Arusha
7. Mr. M. Kibada
Branch Manager
Tanseed
8. Mr. C. Kishala
TEMDO
Arusha
9. Mr. A.T. Kisimbo
TEMDO
Arusha
10. M. Lugwisha
TEMDO
Arusha
11. Mr. E.J.N. Lujuo
National Seed Coordinator
Ministry of Agriculture
Dar-es-Salaam
12. Mr. E.M. Lwegenzye
Seed Processing Engineer
Tanseed
Arusha
13. Mr. R.C. Malima
TEMDO
Arusha
14. Mrs. E.E. Mangesho
Snr. Economist
UNIDO Desk Officer
Ministry of Industries
Dar-es-Salaam

- | | |
|--|---|
| 15. Mr. P.B. Marwa
Snr. Industrial Engineer
Ministry of Industries
Dar-es-Salaam | 16. Mr. Z.J. Masanja
SADCC
Dar-es-Salaam |
| 17. Mr. J.K. Matema
Seed Testing Laboratory
Tengemu
Arusha | 18. Mrs. D. Matemu
TPRI
Arusha |
| 19. Mr. F. Mathenge
FAO Project Officer
National Seed Protection
Project
Dar-es-Salaam | 20. Mr. J.S.K. Mhina
SADCC
Dar-es-Salaam |
| 21. Dr. F.W. Moshia
Director
TPRI
Arusha | 22. Mr. G. Msolla
Director General
TEMDO
Arusha |
| 23. Mr. Mungongo
TEMDO
Arusha | 24. Mr. A.M. Mushi
Asst. Commissioner of Agriculture
(Plant Protection Section)
Ministry of Agriculture
Dar-es-Salaam |
| 25. Mr. E.M. Ngaiza
Director General
CAMARTEC
Arusha | 26. Mr. A.R. Ngemera
Snr. Economist
Development Resource
Coordination
Ministry of Industries
Dar-es-Salaam |
| 27. Mr. E. Richard
TEMDO
Arusha | 28. Mr. M.S.A. Tango
TEMDO
Arusha |
| 29. Mrs. E. Undiri
National Chemical Industries
Dar-es-Salaam | 30. Mr. D.M.B. Nguma
Rotian Seeds
Arusha |

Vienna

- | | |
|---------------------|-----------------|
| 1. Dr. B. Sugavanam | 2. Ms. R. Toure |
|---------------------|-----------------|

11. UNIDO Comments

The report provides the facilities that are available in various institutions in Africa that could be used for implementing the project. The project puts emphasis both on seed dressing and also for post harvest grain treatment. The later possibility can be looked at once the main aim of the project for seed dressing is achieved.

The report also mentions the type of seed dressing used in Africa and UNIDO will have to select those which are registered in countries participating in the project and those which are less toxic for handling.

The report clearly brings out the complex coordination that need to be established for implementing the project.

It also indicates the possible use of some of the pesticide formulators in these countries to provide suitable formulations. The testing procedure needed for assessing the quality of the dressed seeds should be followed in consultation with the international and national consultants.