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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 Government of the Republic of Zambia
by the United Nations Industrial Development Organization

*Based on the work of P. K. Ramdas,
seed dressing specialist*

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* This document has not been edited.

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SUMMARY

After discussions with the Environmental Council of Zambia, some pesticide companies in the country and the counterpart scientists, it appeared that there was sufficient scope for reducing the quantity of pesticide being used for seed treatment, employing the prototype seed dresser developed by the project. The pesticide formulation mainly used for seed dressing in Zambia is 'Thirasan M' which is a package mix of Thiram 80 WP and Malathion 50 WP; the former acts against fungi while the latter protects the grains from storage pests. However, by treating with Thirasan M, Malathion is applied ten times more than dosage recommended for storage pests. Further, the formulation settles very fast as a slurry and can cause inefficient dressing of the seeds. Trials were conducted by applying Thiram 80 WP and Malathion 1% dust separately at various dose rates, as well as by Thirasan M from different sources to confirm the above presumptions. Results are awaited. Trials are also to be conducted using Thiram SC formulation, Captan SC & WP formulations and Actellic 1% dust on the similar lines for arriving at a more cost-effective formulation for seed treatment. A seminar on 'Pesticide Formulation - an Overview with Emphasis on Newer Developments' was also conducted wherein the need for the use of more

effective/user friendly/safer formulations like Suspension Concentrates(SC), Concentrated Emulsions (EW), Wettable Granules(WG) and Encapsulated Suspensions(CS) was stressed.

RECOMMENDATIONS

1. Detailed bio-efficacy studies need to be conducted on the seeds treated with WP and SC formulations of Thiram and Captan in comparison with Thirasan M, to arrive at the most suited and cost-effective formulation for seed dressing, employing the prototype seed treating applicator developed by the project.
2. All the formulations used for the seed treatment should be analysed, based on the CIPAC or any other standard testing procedures and the physico-chemical quality assured, by any of the recognised pesticide testing laboratories.
3. The interaction with other industries involved in the chemical seed treatment activities in Zambia should be strengthened, since their involvement and assistance can be of immense help for the popularisation and commercialisation of the mobile seed dressing applicator developed by the project, as well as for the wider use of improved cost effective formulations for seed treatment recommended by the project
4. Hands on training for at least 2 persons, preferably one from the project and one from the indigenous industry, on 'Formulation of seed treatment chemicals and their testing', for a period of 2-3 weeks at an industrial R&D establishment on pesticide formulations, like the Institute of Pesticide Formulation Technology(IPFT) in India.

1. INTRODUCTION

Seed dressing is considered to be one of the most effective ways of crop protection. Chemical treatment of the seeds protects them from various soil-borne organisms promoting germinability, growth and development of seedlings with a minimal effect on the environment. Further the treatment preserves the seeds during storage also. Though it has become a common practice to use treated seeds, many farmers of relatively poor nations especially in Africa are still deprived of the privilege of using them since the seed dressing is expensive. In this context, a regional project on 'Development of Prototype Mobile Seed Dressing Applicators suitable for African Countries' was conceived by UNIDO involving the Zambia, Malawi and Tanzania with the following objectives:

- 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.

As a result, the project has come up with a prototype seed treating machine, which is pedal/tractor powered, vide copy of the brochure attached at Annexure-I. The easy to use machine can be manufactured using indigenously available inputs and expertise.

The effectiveness as well as safety of the seed treatment depend, to a great extent, on the pesticide and its formulation being

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used for seed dressing. Concerted efforts are required to make the seed treatment as user and environment friendly as possible by arriving at a right choice of the pesticide formulation most-suited to the application equipment. Considering these factors, the author was hired as a short-term consultant on pesticide formulations, for 2 weeks starting from 16th January, 1995, the duty station being Lusaka, (vide copy of the job description attached at Annexure-II).

2. ACTIVITIES

2.1 Seminar on Pesticide Formulations.

As the project personnel has been mainly concentrating on the engineering aspects of the development of the seed dressing applicator, there was an immediate need for improving their perception and understanding on the various types of pesticide formulations. Thus a seminar on 'Pesticide Formulations - an overview with special emphasis to newer developments', was organised on January 19, 1995 at the main conference hall at the Mount Mackulu Research Station. Other than the Project personnel, representatives from many of the important organisations connected with the pesticide applications, participated in the seminar.

The author in his presentation covered briefly the salient features of the various types of pesticide formulations especially the new generation ones, and emphasised that the main decisive factors of the choice a formulation should be

- i) Maximum efficiency with minimum use of active ingredient.
- ii) Minimum exposure hazard to the user and environment.
- iii) Minimum use of toxic and inflammable organic solvents.

In this context the advantages of water based formulations like suspension concentrates(SC) were highlighted especially for fungicides to be used as a seed dressing agents. It was pointed out that several instances have been reported where SC formulations of fungicides having significantly improved bio-efficacy, owing to the finer particle size and better adhering properties, as compared to the conventional wettable powder (WP) formulations.

The seminar aroused considerable interest among the participants, as evidenced by a short but lively discussion session preceding the lecture.

2.2 Discussions regarding the Pesticide Formulations being used/can be used for seed dressing in Zambia.

The Pesticide formulations used by the project personnel for the seed treatment trials, employing the prototype equipment developed by them, was Thirasan M., which is the main seed dressing agent presently used in the country. Thirasan M is mixture of Thiram 80% WP, Malathion 50% WP, Soduim molybdate and sugar, vide literature of the product attached at Annexure-III. The product originally of Shell chemicals is now being supplied by Cynamid Zambia. Thiram is the basic fungicidal chemical in the composition while Malathion gives protection against the storage grain pests. The main problem as far as the physical properties of Thirasan M are concerned was the fast sedimentation of the slurry, which can cause inefficient dressing of the seeds. Independent active

ingredient analysis of Thirasan M was not carried out by the project personnel and they were directly using it as per the label instructions.

Since Malathion can easily decompose (and sometimes even to isomalathion which is highly toxic) and the physical properties of the formulations were also not very satisfactory, the possibility of using an alternate seed dressing agent has to be looked into. With this view the author alongwith Mr. Sichilima, who acted as the main counterpart scientist from the project and of immense help to the author during his stay at Lusaka, discussed in detail with senior representatives from pesticide and toxic of Environmental Council of Zambia (which is responsible for the registration and use of pesticides in the country).

Environmental Council of Zambia has only initiated the actions and are in the process of framing the rules and formalities for the registration of pesticides in Zambia. Hence as on now they don't have a list of chemicals registered for use as seed treatment formulations. However, they confirmed that some companies have applied for registration of Thiram 80% WP and Malathion 50% EC separately and not for Thirasan M.

Discussions with Cynamid Zambia revealed that they are considering to withdraw Thirasan M from their product range and most probably they will continue with this formulation till the present stocks are over. They are of the opinion of using Thiram 80 WP as the seed dressing agent and to use separately a storage grain pesticide like Malathion 1% dust (Trade name Blue Cross) or Actellic 1% dust.

Discussions with Zambia Seed Corporation also endorsed the above views.

2.3 Seed Treatment Trials.

Some trials were conducted at the Mt. Mackulu Research Station, on the seed treatment using the prototype seed dressing equipment developed by the Project. Experiments were first carried out using Thirasan M formulations, received from Cynamid Zambia Ltd. as well as Zamseed Corporation. The dosage was 3g. of Thirasan M for 2 kg. batch size of Sorghum seeds (i.e. 2g of Thiram and 0.2 g Malathion as active ingredient, vide Chemical composition of Thirasan M given at Annexure-III). 3 g of the formulation was mixed with 30 ml of water and the slurry was poured on to the seeds loaded in the seed dressing equipment. The mixing was continued for further 10-15 seconds before the treated seeds were taken out. The whole operation was completed within 30 seconds.

The main drawbacks observed while treating the seeds with Thirasan M formulations were:

- i) The formulation flocculates within a few minutes after mixing with water. This can definitely cause inefficient dressing of the seeds by the chemical, since the homogeneity of seed treatment depends on the satisfactory suspensibility of the slurry. (The physico chemical incompatibility of the Malathion WP with the Thiram WP when combined as a package mix could be a reason for the immediate sedimentation of the slurry).
- ii) By treating with a package mix like Thirasan we are incorporating Malathion 10 times more than the recommended dose against storage pest, which is only 90 g per 100 kg of the seeds i.e. about 0.02g of Malathion for 3 kg of seeds.

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One of ways to overcome the above problems and to make the seed treatment more cost effective was to treat the seeds separately with Thiram and Malathian instead of a package mix like Thirasan M. So trials were conducted by treating the seeds first with Thiram 80 WP made into a slurry as before (i.e. 2.5g in 25 ml. of water for 2 kg. seeds). Subsequently the seeds were treated with 2.2g of Malathion 1% dust (trade name Blue Cross). Samples of both these formulations, which are widely used in Zambia, were supplied by Cynamid Zambia. In the physical sense the treatment could be carried out without any practical problems using the seed dressing equipment, even though Malathion was applied as dust. However, only the actual storage followed by bio-efficacy studies can confirm the advantages of applying separately Thiram 80 WP and Malathian 1% dust vis-a-vis the treatment with Thirasan M.

The author has advised Dr. Mulenga, the counterpart scientist from Mt. Mackulu Research Station, to conduct similar trials using Actellic 1% dust also, in place of Malathian 1% dust, since Actellic dust is widely used in Zambia, against storage grain pests.

The performance and the ease of operation of the prototype seed treatment equipment were quite satisfactory. However it would be better if the gap between rotating plate and the body is further reduced to avoid trapping and damaging of the seeds, especially the smaller sized ones.

Quantitative analysis of the homogeneity of the seed coating could not be carried out since the colorimeter was not operational and facilities for GC/HPLC analyses was not available.

3. FINDINGS

- 3.1 Immense scope is there to improve the cost effectiveness of the seed dressing by judicious selection of the pesticide formulation to be used for the treatment. As an example, the author demonstrated the separate use of Thiram 80 WP and Malathion 1% dust in place of Thirasam M, whereby the dose of Malathion can be reduced to the order of 10 times. In order to arrive at a more cost-effective formulation, comparative bio-efficacy trials need to be conducted using the seeds treated with different pesticide(s)/their different formulations viz. Thiram 80 WP or captan 50 WP as a fungicide and Malathion 1% dust or Actellic 1% dust as an insecticide. There is also a possibility of further increasing the effectiveness of the fungicide by employing SC formulations instead of WP formulation i.e. Thiram 50 SC and captan 50 SC.
- 3.2 Physico-chemical analysis of the formulations based on CIPAC methods should be carried out, prior to the bio-efficacy trials, to confirm that they are as per specifications. Since there is no instrumentation facility like GC/HPLC or manpower, is available with the project, the samples should be got analysed from any of the recognised pesticide testing laboratories. It is obvious, that without verifying the actual a.i. content with formulation, it is not possible to arrive at any sensible conclusion on the bio-effectiveness of the product.

- 3.3 There is an immediate need for getting some persons trained on formulations of seed treating chemicals and their testing at an industrial R&D establishment. Such a training could well be arranged at the Institute of Pesticide Formulation Technology(IPFT), which is well-experienced in imparting exclusive hands-on training on formulations for UNIDO. Further, since the author also works at IPFT, the training can be tailormade to suit to the needs of the project.
- 3.4 The interaction with other industries involved in the chemical seed treatment activities in Zambia should be strengthened, since their involvement and assistance can be immense help for the popularisation and commercialisation of the mobile seed dressing applicator developed by the project, as well as for the wider use of improved cost effective formulations for seed treatment based on the recommendations of the project.

Two New Seed Treating Machines

OPERATING ON A BATCH PRINCIPAL

- Pedal Powered – 5 kg capacity (minimum 0.2 kg)
- Tractor Powered – 25 kg capacity (minimum 1.0 kg)

Both machines treat all types of seed **VERY EVENLY** with *Liquid, Slurry* or *Powder* chemicals, including food grain storage chemicals.

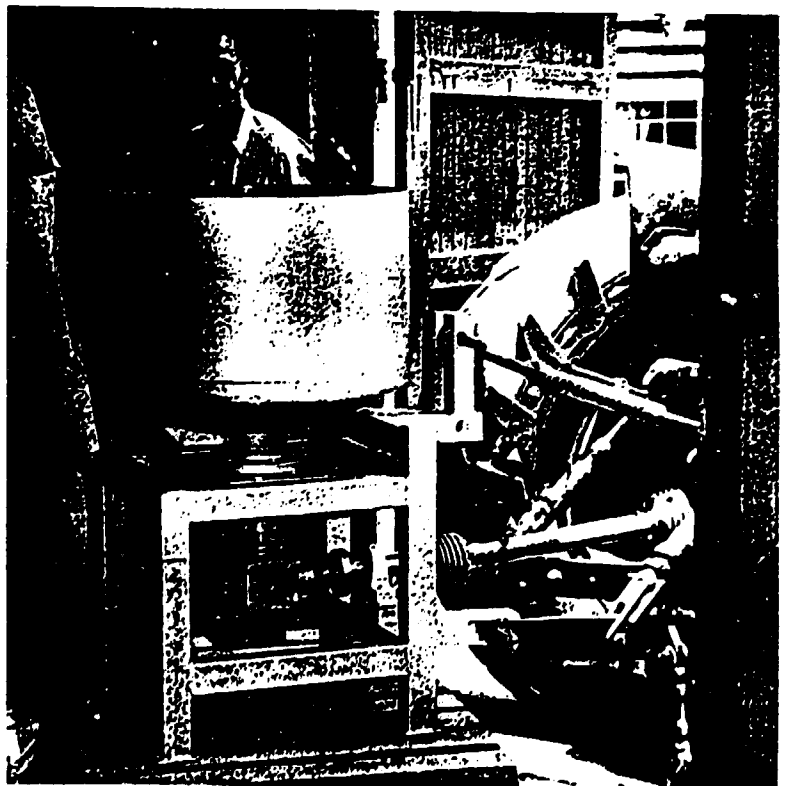
VERY SIMPLE OPERATION

1. Load seed into machine.
2. Inject liquid or slurry chemical – or just add powder.
3. Leave mixing for 10 seconds.
4. Open discharge gate and catch treated seed in sack.

For further information, please contact:

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Tractor machine on test at Tanzanian Seed Farm

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

Job Description

US/RAF/88/273/11-51

Post title: Seed Dressing Specialist

Duration: Two weeks

Date required: As soon as possible

Duty Station: Lusaka

Purpose of project: (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.

Duties: The consultant is expected to assist in the formulation for various seed dressing and assess the quality of seed dressing. He should give lectures on pesticide formulation in general and organize discussion groups to discuss different choices of selecting pesticide formulation for different type of seeds.

He should also assist them in finding the quality of coating of the seeds with regard to their uniformity to wash the various seeds.

He should also give necessary instructions regarding safety, quality control and in management of any waste generated.

Qualifications: A chemist or a chemical engineer with extensive experience in pesticide formulation including seed dressing formulations. He should have experience in R&D in an industry or Govt. institution and should have experience to deal with problems faced in developing countries.

Language: English

Background Information: Pesticides also called crop protection agents, are vital to protect crops from devastation by pests. However, excessive use of these pesticides in the past and also using traditional formulations especially as sprays have fraught with safety problems both for the

users and the environment. Today, the formulation and application technologies are moving towards greater sophistication so as to reduce the overall load in the environment. One of the technologies, seed dressing, has been in use for decades and will dominate pesticide formulation and application due to protection of crops at an early stage, precise and controlled application to the seed, avoid unnecessary exposure of workers and the environment to toxic chemicals. The technology has advanced to strict control of seed quality and the type of formulations that are applied to the seed. While seed dressing has become a common practice, many least developed countries especially to some African countries, access to treated seeds is very remote and mostly they use untreated seeds. Therefore it is proposed to develop a suitable mobile seed treater, that could produce quality treated seeds and at the same time take into account the safety aspects both while applying to the seed and also during germination of the seed. Three countries viz. Zambia, Malawi, Tanzania will be the focal points to participate in the project. The project is R&D in nature with aim to develop skill and knowledge of African experts and in transfer of technology.

THIRASAN M

GENERAL INFORMATION

THIRASAN M is a Thiram based fungicide seed dressing with added insecticide and Sodium molybdate. It controls seed and seed borne diseases that cause pre and post-emergence damping off, seed decay and seedling blights. It also protects stored seed from attack by insects, and provides molybdenum, an essential trace element deficient in most Zambian soils.

PRECAUTIONS

1. Handle THIRASAN M with care; wear full protective clothing ie. overalls, rubber gloves and boots and always wear respirator where danger of inhalation of dusts exists.
2. Remove protective clothing after work with this product and wash with soap and water.
3. TREATED SEED MUST NOT BE FED TO HUMANS OR ANIMALS.
4. Store THIRASAN M and treated seed away from domestic pets and livestock.
5. Keep THIRASAN M treated seed away from food and feedstuff.
6. Store in original container under lock and key.
7. Destroy empty container - do not use for any other purpose.
8. Do not eat, drink or smoke when handling agricultural chemicals.

SYMPTOMS OF POISONING

May cause irritation of the nose, throat, eyes and skin.

FIRST-AID

In cases of accidental poisoning arising from contamination or gross exposure, wash affected parts immediately with clean water and in cases of eye irritation, medical attention must be sought.

MEDICAL TREATMENT

Treat symptomatically.

DIRECTIONS FOR USE - USE ONLY AS DIRECTED

Maize, Ground-nuts, Beans.	Seedborne diseases, Seed storage insect pests	150g/100kg seed	Ensure full coverage of each grain by mixing in a rotating drum or in a seed dressing machine which should run for at least 3 minutes with each filling.
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wheat Sorghum	As above	250g/100kg seed	As above
Rice and small seeds	As above	375g/100kg seed	As above

N.B.

It is necessary that bags be sprayed prior to filling with treated seed, and so should the storage area to keep it free of storage pests.

Do not apply to grain destined for human or livestock consumption.

COMPOSITION

Thiram 80 % WP	82.5 %
Malathion 50 % WP	14.0 %
Sodium Molybdate	0.5 %
Dye	2.0 %
Sugar	1.0 %

ANNEXURE IV

LIST OF PEOPLE MET

1. EARL TAYLOR
UNIDO COUNTRY DIRECTOR
UNDP, 10101 LUSAKA
2. ARMAND BREVIC
PROGRAMME OFFICER
UNDP, 10101 LUSAKA
3. JEO MWENCHA
DIRECTOR OF INDUSTRY & ENERGY
COMESA, NDEGE HOUSE ANNEXE
HAILE SELASSIE AVENUE
10101 LUSAKA
4. J.A. ALELE OPIO
COMESA, NDEGE HOUSE ANNEXE
10101 LUSAKA
5. M. SICHILIMA
STATISTICIAN
COMESA, NDEGE HOUSE ANNEXE
10101, LUSAKA
6. MR. GEORGE MULENGA
ENTOMOLOGIST
MOUNT MACKULU RESEARCH STATION
CHILANGA, ZAMBIA
7. KWENDA KWEMA
MANAGER
TDAU, UNIV. OF ZAMBIA
LUSAKA
8. M.M. ANZA
TDAU, UNIV. OF ZAMBIA
LUSAKA

9. JAMES S. PHIRI
SENIOR INSPECTOR
PESTICIDES AND TOXIC SUBSTANCES UNIT
ENVIRONMENTAL COUNCIL OF ZAMBIA
P.O. BOX 35131, LUSAKA

10. LYTTON K. ZULU
AGRICULTURAL MANAGER
CYNAMID ZAMBIA LTD.
LUMUMBA ROAD
POST BOX No. 31994, LUSAKA

11. PAMELA N. THOLE
PRODUCTION MANAGER
ZAMBIA SEED COMPANY LTD.,
POST BOX No. 35441, LUSAKA

UNIDO COMMENTS

The report covers the work carried out by the author during his short visit to Lusaka. The author correctly points out that at the early and the middle stages emphasis was given to engineering side and his mission was timely to expose the biologists and the formulation chemists to the science of pesticide formulation. This was well received by staff at Mount Makulu Research Station and other representatives from pesticide applications. The seminar organized by the author covered salient features of user/environment friendly pesticide formulations.

The observation of the author is very relevant to African conditions because many formulations are applied without the knowledge as to how much is actually needed so that farmers do not unnecessarily overdose crops with pesticides and also pay for it. Obviously this observation needs further detailed scientific studies.

The author's recommendation will slowly take the Africa region towards understanding of national and international requirements and the right way of using seed dressing formulations.

Regarding training in India, it is better to have another project (probably supported by India) to take group of trainees to have a 3 week workshop with hands on training.