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STRENGTHENING OF PESTICIDE DEVELOPMENT CENTRE

DP/IND/89/128

INDIA

Technical report: Findings and recommendations\*

Prepared for the Government of India  
by the United Nations Industrial Development Organization,  
acting as executing agency for the United Nations Development Programme

Based on the work of B. Shasha, consultant on botanical  
pesticides and controlled release formulations

Backstopping officer: B. Sugavanam, Chemical Industries Branch

United Nations Industrial Development Organization  
Vienna

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\* This document has not been edited.

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**ABSTRACT**

My post title was consultant in botanical pesticides, project No.DP/IND/89/128. The purpose was to provide R&D base for the development of safer and newer formulations with greater use of locally available raw materials and also in the promotion of bio-botanical pesticides. The duration of my mission was one month starting March 25, 1990.

Lectures were delivered and demonstrations were performed concerning newer formulations of pesticides to the scientific staff of Hindustan Insecticides Ltd., Indian Agri. Research Institute and to the Delegates of the Regional Workshop on Pesticides.

The Workshop was relevant and very well organised. In general, the scientific staff at the Centre is well qualified and the laboratory equipments are modern. Closer cooperations with local industries and academic institutions are needed.

## **INTRODUCTION**

This report was written by the Consultant - Dr. Baruch S. Shasha. It deals mainly with the Workshop for the development of safer and newer formulations and with Botanical pesticides (selection and extraction of active principles, isolation of concentrate, etc. see Ann.I).

The duration of the mission was one month starting March 25, 1990 with time spent mostly on preparation of presentations and attending the Workshop.

**GENERAL COMMENTS/RECOMMENDATIONS**

Except for the last few days of the mission, my time was spent exclusively for the preparation and attending the Workshop(R&D in Pesticides Formulation Technology of Newer Formulation and Quality Control, Gurgaon, April 9-21,1990). Altogether I prepared one manuscript, delivered five lectures, gave two demonstrations on "How to prepare a controlled release formulation" and chaired a technical session including a group discussion led by Dr.Kawal Dhari - Annexure 2 and Annexure 3.

Generally speaking, the scientific personnels at the Centre are very qualified and the laboratory equipments are modern and are as good or better than most comparable institutions in the U.S.

**Recommendations:** Few points did attract my attention:

Too many projects for a small institution without the sense which one should have the highest priority. And, the research is performed without close industry support and cooperation. Since the concept here is not "publish or perish" then close cooperation with the industry is a must. I tried to stress this point repeatedly during my lectures. Also, there is lack of cooperation with major research institutions such as Delhi University.

## **WORKSHOP/RECOMMENDATIONS**

The organisers of the Workshop should be congratulated for a job well done. Long conversations with many delegates revealed that goals were accomplished-results of long and hard work. As for myself, it was an excellent learning opportunity. The topics that were covered, in most part were relevant and at level high enough to exclude boredom.

### **Recommendations :**

The 'Experts' should know-long before coming here, what exactly is expected from them. I wrote my manuscript "Economics of Newer Type of Formulations" only after arriving here. Fortunately, I brought with me large file of my previous research papers as references.

Good verbal communication between Delegates and staff obviously is essential. Since the time is relatively short may be more interaction would occur if delegates and experts reside at same location.

All lectures should be distributed at least one day in advance to familiarize the listners with subjects at hand. Since the educational and linguistic levels of the Delegates are unknown until after they arrive, then may be by the end of first day - each should be asked "How are we doing?" Accordingly, some of the lectures can be fine tuned.

Speakers should be instructed that the mission is NOT how much material, they are able to deliver, but, how much the students are able to retain. Therefore, slow clear delivery and repetition of important points should be considered.

Short, informal written quizzes related to material taught should be distributed among the delegates, by the end of each day. Answers to the quizzes will be announced and discussed the next day. All questions for the final will be from prior quizzes. It should be made clear that these exercises are learning tools and results will be kept confidentials.

An extended contractual agreement for at least one year duration and for a nominal fee should be drawn between UNDP and Experts that will allow delegates to receive consultation after the termination of the Workshop.

## LECTURES AND DEMONSTRATIONS

### Lectures

Followings are a list of my lectures and demonstrations:

1. Location: Pesticide Development Centre  
Date : April 2,1990.  
Topic : Encapsulation of Biological & Chemical Pesticide within starch matrices.  
  
Audience: Scientific staff of the Centre.
2. Location: Pesticide Development Centre  
Date : April 10,1990  
Topic : Economics of newer types of formulations.  
Audience: Members of the Regional Workshop.
3. Location: Pesticide Development Centre.  
Date : April 12,1990  
Topic : Granular formulations.  
Audience: Members of the Regional Workshop.
4. Location: Pesticide Development Centre  
Date : April 13,1990  
Topic : Controlled release formulations.  
Audience: Members of the Regional Workshop.
5. Location: Indian Agricultural Research Institute.  
Date : April 16,1990  
Topic : Pesticides Research : Past & present.  
Audience: Scientific staff of the Institute.

### Demonstrations:

The demonstrations were held at the Centre on April 2 and April 12,1990. Cooking oil which was used as substitute for pesticide was encapsulated within starch using the calcium, borate and Miragel procedures. The procedures were discussed earlier at the Workshop including their advantages and limitations. All starch samples were sent for this purpose from the U.S. before my arrival. The calcium and borate procedures were used for the encapsulation of chemical pesticides while the Miragel procedure for biological pesticides.



**DISCUSSIONS:**

Following each lecture and demonstration and on many other occasions, long discussions were held with many of the delegates concerning theories and mainly applications of controlled release formulations.

Here some of the questions and summarized answers:

**Q.** Starch was used in each of the formulation for controlled release of pesticides you have discussed. Why?

**A.** Starch is available in very large quantities in the U.S. at a very reasonable price especially in comparison to petroleum products. Besides starch is biodegradable and is film forming polymer.

**Q.** Are we restricted to source of starch?

**A.** Although in our research we used mainly corn starch, other starch can be adopted as long as they are not degraded.

**Q.** How about other agricultural commodities?

**A.** Research has to be done for each commodity and for each specific use.

**Q.** What are the basic differences in encapsulation of chemical versus biological pesticide?

**A.** With biological pesticide such as *Bacillus thuringiensis* (BT) we are restricted in terms of pH, temperature, salt concentration and other factors.

**Q.** Can we use starch encapsulated BT for mosquitoes abatement?

**A.** Although these formulations were not yet tried for this purpose, my guess is, they have to be modified.

**Q.** Any field studies has been carried out to-date?

**A.** Yes, several publications are available upon request.

**Q.** What trigger the release of pesticides?

**A.** By physical means the active ingredient is released due to moisture and by biochemical means due to amylase type enzymes, abundant in soil.

**Q.** Can the formulations be modified to change the rate of release of active ingredient?

**A.** Yes, some of the procedures to modify the rate of release were described in the articles you have received.

Q. Can we make sprayable controlled release formulation using starch.

A. Yes, it was accomplished for both biological and chemical pesticides. Due to time limitations, the technologies were not presented in my lecture.

## **BOTANICAL PESTICIDES/RECOMMENDATIONS**

Alcohol extracts of leaves collected by B.C.Mandal from West Bengal revealed potent activities against mosquitoes larvae among other insecticidal activities. The research which was carried out for the last 6 months was confined almost exclusively to laboratory trials. Dr.Y.P.Ramdev, Entomologist and Dr.N.R.Bhateshwar (Manager, Product Development) are supervisors and cooperators in this project. Several meetings with the scientists involved were held.

### **Recommendations**

The administrative Officer of the Centre (Dr.S.P.Dhua and Dr.K.Dhari) should be made aware that this is a pioneer project with minimum duration of 1-3 years and be asked for their approval and support.

Next, the plant has to be identified botanically to find out if other members of the same family or same Genus contain same or similar active ingredient and at what level. Scientific literature such as Chemical Abstract, Biological Abstract besides computer search has to be initiated to find out what is already been reported. Large quantities(200-300 kgs) of the plants containing highest amount of active ingredient should be thoroughly washed, dried and stored at 5 degree C. If it is feasible, the plants will be freeze-dried to prevent degradation of active ingredient. Large supply of starting material is important for reproducibility of results.

Extraction will be carried out with three types of solvents at room and at boiling temperatures of the solvents. The plants as fine powder are not discarded followed extractions but tested for residual activities. The solvents are: water, ethanol and carbon tetrachloride.

The solvents of extracts will be evaporated and residues will be weighed and tested for insecticidal activities. Attempts will be made to purify a sample for structural analysis. Purification will be performed by differential extractions, absorption, desorption, thin layer and column chromatographic techniques. Structural analysis will be carried out using established procedure such as UV, IR, NMR and Mass spectra analysis.

At later stage - if the project seems to have an economic potential, then use patents should be filed and confidential cooperative agreements should be signed with interested industries and academic institutions.

**MAJOR CONTACTS**

- Dr.K.Dhari : Hindustan Insecticides Limited**
- Dr.S.P.Dhua : Regional Cordinator, RENPAP.**
- Mr.R.S.Mathur: Joint Secretary(Chemicals) & National Project Director, PDC.**
- Mr.E.Dessau : Resident Representative, UNDP.**
- Dr.B.Sugavanam : UNIDO.**
- Mr.D.R.Sharma : Deputy General Manager,HIL.**
- Dr.S.K.Khetan : General Manager, HIL.**
- Dr.B.S.Parmar: Indian Agricultural Research Institute.**
- Dr.R.B.Mitra : Central Leather Research Institute, Madras**
- Mr.M.Islam : Country Director, UNIDO.**
- Mr.Sat Pal : UNDP.**
- Dr.V.P.Narayanan : Indian Institute of Packaging, Bombay.**
- Dr.Virender Dhingra: Shriram Institute for Industrial Research**



Annex I

**UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION**

**JOB DESCRIPTION**

DP/IND/89/128/11-51

**Post title** Consultant in botanical pesticides

**Duration** 1.0 m/m

**Date required** As soon as possible

**Duty station** New Delhi with travel to Gurgaon (India)

**Purpose of project** To provide a R&D base for the development of safer and newer formulations with greater use of locally available raw materials and also in the promotion of bio-botanical pesticides.

**Duties** The consultant, in collaboration with the project authorities, is expected to advise:

- on the selection and extraction of active principles from botanical sources;
- on the isolation of concentrates and the type of species to be tested;
- on the type of mixtures (with synthetic pesticides) that could be used;
- on the laboratory facilities and analytical work that are needed to carry out screening of botanical pesticides;
- on the type of collaboration they can have with other institutions e.g. Regional Research Lab. Hyderabad;
- on concentrating efforts to commercialize botanical pesticides.

He is also expected to give lectures on botanical pesticides, if necessary, and visit other laboratories. At the end of the mission he will submit a report based on his findings and recommendations.

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Applications and communications regarding this Job Description should be sent to:

Project Personnel Recruitment Section, Industrial Operations Division

**Qualifications** An organic chemist or applied botanist (Ph.D) with extensive experience in the field of natural products, exploring their potential for biological activity especially as botanical pesticides. He must have done original work as reflected from his publications. Experience in commercializing botanical pesticides would be an added advantage.

**Language** English

**Background information** Pesticide Development Centre India is the first institution in the country to deal with the aspects related to R&D in pesticide formulations to promote the newer and safer formulations and also in using locally available raw materials. In addition, the Centre looks into the development of bio- and botanical pesticides with a view to commercializing promising compounds (already known). In India and elsewhere voluminous work has been done on botanicals but very little in the way of applied work taking to commercial outlets. This is one of the aims of the Centre and UNDP/UNIDO is providing technical assistance in achieving this goal.