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PESTICIDE DEVELOPMENT PROGRAMME IN INDIA

DP/IND/80/037

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 Jurgen Hartmann, expert on packaging of pesticides

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Vienna

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2. **Summary**

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1. INTRODUCTORY NOTES

The following services were expected:

- 1.1 Critical study of the current practice of packaging pesticides in India,
- 1.2 Suggestions of suitable and practical methods for the development of packaging materials and containers for pesticides resp. pesticidal formulations,
- 1.3 Assistance to technical personnel of PDPI - at Gurgaon, Haryana - in the choice of :
 - packaging material,
 - methods of packaging,
- 1.4 proposal for basic equipment, required for an envisaged test laboratory for packaging at PDPI, Gurgaon,
- 1.5 advice on the FAO - Code of Conduct,
- 1.6 lecturing on packaging during the RENPAP - Training Programme on Quality Control of Pesticides Formulations.

This report covers the period of October 5, 1987 to November 27, 1987, while the author Jurgen Hartmann, was assigned to the PDPI - Centre at Gurgaon.

It was his objective to assist not only the personnel of the PDPI-Centre at Gurgaon, but as far as possible during this time also pesticides formulators directly.

He intended to emphasize the necessity of using only thoroughly tested packages for pesticides formulations. He wanted to animate the PDPI-centre to utilize the expertise of Indian experts in packaging

(e.g. at Indian Institute of Packaging, Bombay) in order to achieve self support in this particular field of developing pesticides products.

2. SUMMARY

2.1 During a one-week programme basic know how was transmitted to 12 participants from the industry and to PDPI on the packaging of pesticides, including legal aspects, standard packaging material for liquid and solid products and testing of packages. The course concluded with a visit to the plastic division of the Indian International Trade Fair 1987. The necessity to use only thoroughly tested containers for crop protection products was a special accent.

2.2 Two lectures were given and one session was chaired during the Training Programme on Quality Control of Pesticides Formulations, organised by HIL and by RENPAP.

2.3 Basic equipment for a test laboratory for packing material and packages was recommended. Priority should be given to tests of product in packages (shelf life studies).

The personnel of this laboratory should be well trained, also by attending indigenous training courses and frequent visits to manufacturers of packaging material.

2.4 Visits to dealers and pesticides packaging plants of small, medium and large size, to manufacturers of packaging material and to the Indian Institute of Packaging*, were the precondition for further recommendations:

*

as well as the discussions during the two seminars

- the PDPI - centre should be actively involved in the standardization of packaging material;
- the PDPI - centre should be capable to manufacture and pack newly developed products,
- Indian directions on packaging of pesticides should follow the philosophy of international regulations and UN-recommendations,
- specific proposals on particular packages were made in direct personal communications.

3. ACTIVITIES

3.1 Study of the current practice of packaging pesticides in India

The intention to visit approximately 10 companies of the small scale sector (out of about 500) could not be realized, as organizational preparations would have required a longer period and the personnel of PDPI was also intensively engaged in the RENPAP - Training Programme in Quality Control of Pesticides Formulations. (one general remark may be permitted: It is not advisable if too many UNIDO-Consultants work at the PDPI - Centre simultaneously with a long-time programme analogous to the a.m. RENPAP - seminar, as activities on either side collide).

The following visits were paid together with Mr. S. Kumar, Deputy Manager of PDPI:

- 20.10.87 - Pesticides dealers in Delhi (Hind Seeds Corp. and Tirath Ram Surinder Paul),
- Regional Sales office and godown (North) of Hindustan Insecticides Ltd., New Delhi.

A detailed report with findings and recommendations was prepared for PDPI. An extract of this report is enclosed as Appendix.1

27.10.87 to - Dhanuha Pest Ltd. at Atta near Sonar (Haryana) and
- Northern Mineral (P) Ltd. at Gurgaon (Haryana).

Dhanuha Pesticides Ltd., manufacturers Fenvalerate technical and supplies the active ingredient to the sister company Northern Mineral. Northern Mineral (P) Ltd., is a medium sized formulator of pesticides. Their product range consists of 35 different formulations (DP, WP, GR, EC, plant growth regulations).

The manpower is approx. 40 at Atta and 200 at Gurgaon. Research and development, analytical activities at Gurgaon can make use of GC, Spectro-photometer and chemical analysis. The introduction of testing packaging material is envisaged.

Numerous very detailed questions relating to the packages of Northern Mineral were discussed with the General Manager, the Works Manager, Manager Quality Control and - during inspection of the filling processes - with the Plant Supervisors. Possible improvements were elaborated, proposals gratefully acknowledged.

29.10.87 - to Artee Minerals (Agro-Chemicals Div.)
at Faridabad (Haryana)

A small scale formulator (80 workers incl. staff members), with 20 different formulations in the production programme (WP, DP, GR,EC,SC). Package sizes range from 100 ml to 5 l (general agricultural use) and 25 and 50 Kg for public health. Also here, the opportunity of the visit was utilized for a detailed analysis of the packaging material, resulting in recommendations for

improvement. Artee Minerals have a quality control laboratory in which also basic packaging tests (shelf life studies) are being performed.

9.11.87 - to Hindustan Isecticides Ltd., at Rasayani, Dist. Raigad (Maharashtra, approx. 70 km east of Bombay).

Formulation - and packaging facilities for DDT WP50, Malathion WP25 and EC were shown.

As there was no packaging activity at the time of the visit to the plants, packaging questions were intensively discussed in a meeting with:

Mr. R.B. Dabas , General Manager
Mr. Munni Lal , Deputy General Manager (Production)
Mr. Wadia , Deputy General Manager (Projects)
Mr. Mathew , Deputy General Manager (Engineering)

Major problems appear to be the improvement in testing of packaging material as a part of the regular control of raw materials, prior to its use in the process and the avoidance of external contamination of WP-woven bags.

9.11.87 - to Dimple Drum Manufacturers at Rasayani

Although no acute problems with drums 200 l (e.g. leakages) were reported during the meeting with HIL (see above), this medium sized drum manufacturer was visited, along with Mr. Wadia and Mr. Mathew. The inspection of the production plant with mainly manual operations indicated the following weaknesses:

- preparation of the sheets prior to lacquer-coating,
- imperfection of endjoints,
- no removal of traces at the welded seam,

- inadequate internal pressure tests.

The a.m. shortcomings were discussed with the Works Manager on site and possible improvements were proposed.

- 10.11.87 - to Indian Institute of Packaging, Bombay (please refer to 3.4 and 4)
- 12.11.87 - to Rollatainers Ltd., manufacturers of carton board, laminates, folded carton board boxes and cartons with liners, as well as packaging machines at Faridabad (Haryana).

The visit served the purpose to find out the state-of-art in India in respect of lined cartons and appropriate packaging machines. Lined cartons are one of the standard-concepts for packaging of pesticide - WP's and WG's (refer to part 4, recommendations).

This Company has an annual turn over of Rs.20 crores, a personnel of 240 at Faridabad, where daily 600,000 boxes are made. 34 packaging machines have been made so far. Management, quality assurance and housekeeping are exemplary.

Broader studies of the current practice of packaging pesticides were not possible, however, the author has good knowledge from previous business trips to India.

3.2 Suggestions of methods for the development of packagings

This part is covered under para 4, Recommendations.

3.3 Assistance to technical personnel of PDPI at Gurgaon on the choice of packaging material and methods of packaging.

In a meeting with D. Kehtan and Mr. S. Kumar on 7.10.87, it was decided to organize a one-week training programme for the personnel of PDPI and for its industrial members, from November 16 to November 20, 1987 (immediately after the REMPAP - Training Programme).

21 member - companies were invited, inclusive Hindustan Insecticides Ltd. and Bayer (India) Ltd.

The intention was to transmit to participants the policy, concepts and the approach in respect of development of pesticides packages.

The structure was planned to have group work, external lectures and lectures presented by J. Hartmann, approx. one third each.

There was sufficient time for discussions and exchanges of experiences. The course concluded with a visit to the India International Trade Fair 1987 with a special division on plastics, where standard manufacturing processes for packages could be demonstrated and explained.

External lectures:

- Mr. V.C. Bhargava - Deputy Director/Packaging Central Insecticides Board.
- Mr. S. Purushothama - Assistant General Manager, Loss Prevention Association of India Ltd.,
- Mr. V. Toley - Techno Commercial Manager R & D Rollatainers Ltd.,
- Mr. A.R. Gulati, - Joint Director (MCPD) Burea of Indian Standards.

From PDPI

Dr.S.Y. Pandey and Mr. S. Kumar.

For further details of the programme, for the list of participants (12 from 8 companies) and for the presented lectures, please refer to appendix 2, 3 and 4.

The following conclusions were drawn at the end of the course:

Policy

- The development of packages for pesticides has to start with the testing of products in sales containers at a very early stage

of formulation development (shelf life studies),

- every packaging plant must be in a position to test also its packing material. Simple, but essential test methods which do not require a high investment in test equipment were recommended in one lecture.
- Further, coming indian regulations will be based on UN recommendations in packaging and transport of dangerous goods, which should therefore already now be considered as guidelines.

Concepts

- Basic guidelines on packaging concepts, which take into account the predominance of safety, can be found in relevant FAO-guidelines (pls. refer to the enclosures).
- Advanced packaging concepts for pesticides were elaborately commented:
 - Coextruded multilayer plastic bottles,
 - lined cartons,
 - water soluble PVAL - films.

Approach

Only in closed cooperation of

- the pesticides industry,
- manufacturers of packaging material,
- reputable test institutions,
- executive powers

achievements in safer more advanced pesticides packages will be possible, taking care also of consumer needs.

This training programme could stand as a model for similar courses on pesticides packaging, not necessarily with participation of UNIDO-experts, but with indian experts from Indian Institute of Packaging, packaging material manufacturers and from the pesticide industry.

3.4 Proposal to basic equipment for an envisaged packaging test laboratory at the PDPI - centre.

A list with recommended equipment has been prepared for the PDPI-centre, classified in 3 priority - stages:

- I - for tests of direct interaction between product and package as part of the development of formulations,
- II- for basic tests of packaging material and packages,
- III-optional equipment.

This list was also basis for a discussion with Mr. M.R. Subramanian, Director of Indian Institute of Packaging, and Mr. Nagarshekar of the same Institute, which was visited on 10.11.87.

For further details : see appendix

3.5 Advice on the FAO - Code of Conduct

The FAO - Code of Conduct formed part of the training programme (16-20.11.87), in which its content, as far as relevant for packaging, was elaborated in a group work and thoroughly discussed.

3.6 Lecturing during the RENPAP-Training Programme on Quality Control of Pesticides Formulations.

The author presented two lectures:

-"packaging materials for crop protection products"on October 15,1987.

(please refer to appendix) and

"basis tests for packaging of pesticides" in October 29, 1987.

This lecture was similar to that presented in the one-week programme and its text is included in the appendices there for reference.

The water soluble PVAl-film was demonstrated at Gurgaon. The last session, on November 12, 1987, was chaired by the writer, in which the official recommendations from the participants of the Training Programme were formulated.

4. Recommendations

4.1 Newly developed formulations have to be tested in shelf life studies and this must be done in various packing materials (in initial stages) and in the sales packs (in the advanced stage of development).

Data from the latter tests are a basic requirement for the registration of pesticides.

In future, shelf life studies will play an even more dominant role in any R & D - institute for plant protection products. Therefore, any-envisaged - strengthening of the PDPI - Centre with diversification of its activities in packaging should primarily be concentrated on shelf life studies under accelerating conditions (refer to 3.4).

The author is of the opinion that principle packaging tests could be delegated to the Indian Institute of Packaging with its well equipped laboratories, wide experience and good contacts to other foreign test institutes on packaging. However, studies of products in containers have to be performed in a chemical laboratory, in which the specific properties of pesticidal products are known and analytical know-how as well as equipment are available.

This includes all requirements referred to in the Good Laboratory Practice (OECD-report), the safe handling of the chemicals and the disposal after completion of the tests (FAO-guidelines).

The safety aspect and consequences were also discussed with Mr. Subramanian of the Indian Institute of Packaging on 10.11.87 at Bombay.

(For reference, shelf life studies, see Technical Report of Dr. Stefan Mosinski, expert in pesticide formulations, dated 24.1.86, pages 8 and 16.)

Based on the experience, to be collected at the PDPI - Centre, also associated members of PDPI could make use of this laboratory.

4.2 The personnel, appointed to this packaging laboratory should have basic knowledge of packaging and of pesticides formulations.

It is therefore advisable that members of the PDPI - centre make intensive use of the various training programmes of Indian Institute of Packaging.

They should be familiar with the manufacturing processes of packaging material too. Regular visits to packaging material production sites are recommended. Such visits would furthermore improve the quality consciousness of the manufacturers and assist them in introducing process control systems.

4.3 In its desire to offer technical assistance to the industry, the PDPI - Centre should be actively involved in the standardization of packaging material.

Widely standardized containers will help small scale companies to obtain their requirements also from manufacturers with a higher quality level, without having the necessity to order too large quantities of specific containers with a long delivery time.

4.4 One objective of PDPI is to generate know-how in pesticides formulations to the industry. The author finds it essential that a R & D institute with an attached pilot plant is also capable of producing formulations and packages, e.g. manufactures the requirements for field trials, for storage-transportation-and handling tests of packed products, also for the initial introductory phase of a new product. However, this function as a small but flexible (multi-purpose) formulation and packaging plant shall not be misused as a production facility of HIL.

A handicap could be the link of the PDPI Centre to HIL, as members from the private industry, competitors of HIL, may not feel so free to cooperate with PDPI in the development of formulations and packaging concepts. One possibility for improvement could be a more independent management of the PDPI. (The author experienced that his counterpart scientist, Mr. S. Kumar, and another scientist were transferred to HIL - production at Rasayani without consideration of ongoing PDPI - work.)

4.5 With the Insecticides Act India has stringent regulations for the pesticides industry, however, the inspection of packages at the point of sales has indicated that the implementation of the rules seems not comparably strict.

It is the philosophy of international regulations (e.g. IMDG-Code, based on UN-recommendations), to accept registered packages provided they have passed specified tests (which are based on the hazardous nature of the product), but without giving detailed directions on the material of construction and the design.

This procedure should be adapted to the indian regulations, in order to permit the introduction of newly developed packaging material at an early stage and support the progress in this industry.

Advanced standard concepts for the packaging of pesticides formulations are multilayer coextruded plastic bottles, lined cartons and water soluble film, which require still registration by the Indian authorities.

4.6 Concrete recommendations in the improvement of packages are given in the report, dated 20.10.87, which is enclosed.

Phorate 10 GR is packaged in 1 kg and 5 kg polyethylene cans. At the visit to Northern Mineral (P) Ltd. it was recommended to substitute the cans by bags of PA/PE - composite film, thickness min. 0,030/0,050 mm, packed in corrugated carton boxes (e.g. 10X1 Kg and 4X5 Kg).

It is suggested herewith to endorse the appropriate licenses (CIB) respectively standards (BIS) accordingly.

There is a newly developed concept of open-top Al-cans for liquid pesticides on the level of debate. The disadvantages of this type of containers were discussed with Mr. Gulati (BIS) in the Training Course on 19.11.87:

-spillage risks during the filling process,

-need of a "tool" for the opening of the containers

(which is against the principles of the FAO-Code of Conduct),

- insufficient re-closure
 - no safe possibility for triple rinsing(which is an internationally accepted and officially recommended obligation of the consumer of crop protection products prior to the disposal of the containers).
- Data upon the quantities of remaining products after use are not known.

5. Acknowledgement

The author would like to convey his sincere gratitude for the invitation to serve PDPI and the Government of India in the field of development of packaging material. He would like to express his gratitude also to Mr. Ramachandran, Mr. Sat Pal, and Mrs. Sukuntha of the UNDP India for their constant assistance in all organizational matters.

He also would like to acknowledge his great thanks to Dr. S.P. Dhus, Dr. S.K. Khetan, Dr. S.Y.Pandey, Dr. P.K. Ram Das and especially to Mr.S.Kumar of HIL respectively PDPI for their constructive support given at all times. A very special thanks given to Mr. K.S. Kohli for the patient typing of the manuscript.

Mr. J. Hartmann
c/o PDPI Centre
Gurgaon

Date : 20.10.87

Ref : Report

Visits to

- Hindustan Insecticides Ltd.,
Regional Sales Office (North)
- Dealers

Hind Seeds Corp. and

Tirath Ram Surinder Paul,

Participants:

Mr. S.N. Misra, HIL

Mrs. S. Kumar, PDPI

Mr. J. Hartmann, Consultant

i. Liquid Products

1.1 Aluminium bottles

1.1.1 Observations

- a) There are complaints because of leaking bottles
- b) The dealer responded negatively upon quality of Al-bottles.
- c) The individual over bags of poly-ethylene do not have uniform film thickness and it is observed that most of the pouches are made of very thin poly-ethylene film.

Two companies shrink wrap their EC's additionally.

1.1.2 Recommendations

- a) Checks should be part of the final control of sales packs, to establish whether the closing operation may be improved by obtaining of uniform torque. The closing concept - Al-bottle with internal thread, screw cap, sealed over cap - is principally suitable.
- b) The tamper proof - protection by means of shrink wrapping the bottles and closures is recommended as an economical and relatively safe method.

1.2 Tin Cans

1.2.1 Observations

Cans leaking from neck or closure (upto 5l) were observed.

1.2.2 Recommendations

The reason for leaking containers should be studied.

Procedure:

- a) Are the inner plastic stoppers compatible with the product, or does the product influence the hardness, the dimensions and / or stress cracking of the poly ethylene cap?

(To be checked by shelf studies of fresh sales packages).
- b) Are the dimensions of the PP screwcap as per specified requirements? The BIS specification if any may be looked into.
- c) Is the closing operation correct?
- d) Does the leaking occur from the joint between top end and neck?

This aspect is to be carefully checked as a dealer confirmed that one - piece top ends are superior.

1.3 HDPE - bottles

It was reported that bottles, made out of HDPE, tend to leak. As no samples were available, comments cannot be given.

Solid Products

2.1 Polyethylene cans

2.1.1 Observations

For products packed in polyethylene cans, the following proposals are made:

2.1.2 Recommendations

- a) White containers tend to acquire the colour (migration of the dye), therefore blue containers are favourable.
- b) If tamper proof protection is obtained with heat sealing, it is recommended to introduce visible means of tamper proofness.
- c) If heat sealing is required to achieve dust - tight containers, the dimensions and design of heat sealing disks need improvement.

2.2 Corrugated carton boxes:

2.2.1 There is a wide variation in paper quality and box design, the method to reinforce the boxes on all the four sides is favourable.

2.2.2 Recommendations

Cartons need be checked with cobb test (target max.135g/m².
30 minutes, as per ISO 535/1976)

Signed: J. Hartmann, 26.10.87.

**PROGRAMME FOR A FIVE DAY COURSE ON PACKAGING FOR PESTICIDE
INDUSTRY PERSONNEL**

**Monday
November 16, 1987**

**Tuesday
November 17, 1987**

General aspects

**Technical aspects, properties of packaging material
and containers for pesticide formulations**

Liquid Products

**10.00 Welcome, general
informations/PDPI
(Mr.M.Lall,HIL,
Dr.S.Khatan,PDPI)**

**Inaugural Speech
(Dr.S.P.Dhua,HIL)**

**10.45 Conception of the
Course
(J.Hartmann)**

**11.00 FAO - Code of
Conduct, FAO-Guide-
lines in Packaging and
Storage and
Disposal of Containers,
group work.**

**11.30 Presentation of results
and discussion**

13.15 Lunch

**14.00 Package Requirements
as per Indian
Insecticides Act
(Mr.Bhargava,CIB,
Faridabad)**

14.45 Discussion

**15.45 Transport Regulations
Group work**

**16.15 Presentation of results
and discussion**

17.00 Conclusion.

**10.00 Plastic bottles (HDPE,
modified HDPE, other resins
and blends)**

10.45 Discussion

11.15 Coextrusion

12.00 Discussion

12.30 Lunch

13.15 Metal containers.

14.30 Discussion

**15.30 Labels (Al,tinsheet,
ECCS)**

16.00 Discussion

16.30 Conclusion

**PROGRAMME FOR A FIVE DAY COURSE ON PACKAGING FOR PESTICIDE
INDUSTRY PERSONNEL**

Wednesday
November 18, 1987

General aspects	Technical aspects, properties of packaging material and containers for pesticide formulations	Testing
	Liquid Products	Solid Products
		10.00 Corrugated carton board (J. Hartmann)
		10.30 Discussion
		11.00 Lined carton boxes, bag-in-boxes (J. Hartmann)
		11.30 Video-film and discussion
		12.00 Water-Soluble PVAL-film, incl. demonstration (J. Hartmann)
		12.30 Lunch
		13.15 Storage and Transportation of Insecticides, Safety aspects (Mr. S. Purushothama, Loss Prevention Ass. of India Ltd.)
		14.30 Discussion
		15.00 Film Prevention of transport emergen- cies
		15.45 Lined carton boxes, manufacturers' view (Mr. V. Toley, Rollainers Ltd.,
		16.30 Discussion
		17.00 Conclusion.

**PROGRAMME FOR A FIVE DAY COURSE ON PACKAGING FOR PESTICIDE
INDUSTRY PERSONNEL**

		Thursday November 19, 1987	Friday November 20, 1987
General aspects	Technical aspects, properties of packaging material and containers for pesticide formulations		Testing Specifications
	Liquid Products	Solid Products	
		10.00 Good laboratory practice in testing of chemicals (Dr. S.Y.Pandey, PDPI) Inagural speech (Dr.S.P.Dhua, HIL)	10.00-1300 Visit to India International Trade Fair 1987, New Delhi. (Theme :Plastics, manufacturing process of containers.
		11.00 Discussion 11.30 Packaging of Pesticides, testing of packaging containers (Mr. A.R.Gulati, Bureau of Indian Standards).	
		12.30 Discussion 13.15 Lunch 14.00 Basic Test Methods for Packages of Crop Protection Products, Specifications (J. Hartmann)	
		1500 Discussion 1530 Test Laboratory Equipment, recommendations (Dr.S.Kumar, PDFI)	
		16.15 Discussion 16.30 Summary (Dr.S.Khetan, J. Hartmann)	
		17.00 Conclusion.	

Abstract

Packaging Materials For Crop Protection Products

by Mr. Jurgen Hartmann
(UNIDO expert)

The lecture covered in detail the most important general requirements for crop protection packaging materials. These included.

1. Product compatibility
2. Pack size
3. Closure concept
4. Design for handling and filling
5. Distinction from foodstuff packaging
6. Labelling
7. Transport and storage
8. Disposal

The type of packaging required for various important types of formulations were described to cover EC, SC, WP, WG, DP.

The quality assurance measures, statutory requirements covering FAO Guidelines, the UN recommendations on the transport of dangerous goods and waste disposal legislation were described and discussed in detail.

The lecture also covered the future trends and prospects in packaging industry, the customer protection and better co-operation among the various disciplines that go to make the nearly ideal containers.

List of Participants

COURSE ON PACKAGING FOR PESTICIDE INDUSTRY PERSONNEL.

16-20 November 1987

1. Mr. H.B. Bhonsle
Manager (Production)
The Atul Products Limited
Atul- 396 020
2. Dr. J.M. Turel
Manager (Laboratory)
The Atul Products Limited
Atul-396020
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