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INTEGRATED PEST MANAGEMENT FOR PESTS OF HIGH VALUE CROPS IN SYSTEM B

By

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ACRONYMS

ARS	Agricultural Research Station
COP	Chief of Party
DAI	Development Alternatives Inc.
DDR	Deputy Director (Research)
IIBC	International Institute of Biological Control, Silwood Park, U.K.
IIE	International Institute of Entomology, London
IPM	Integrated Pest Management
IPC	Integrated Pest Control
MARD	Mahaweli Agricultural and Rural Development Project
MDS	Mahaweli Downstream Support
OSU	Oregon State University
PGIA	Post Graduate Institute of Agriculture
RARC	Regional Agricultural Research Centre
RO	Research Officer
UP	University of Paradeniya
USAID	United States Agency of International Development
USDA	United States Department of Agriculture

I. INTRODUCTION

This report is based on work carried out as a follow-up of my previous consultancy visits during June-July and July-August and November-December 1991, for development of Integrated Pest Management (IPM) of high value crops. This was undertaken as a short term consultancy with Oregon State University (OSU), Development Alternatives Inc. (DAI) and Mahaweli Agricultural and Rural Development Project (MARD). The Terms of Reference of consultancy are given in Appendix I.

Actually, I was asked to visit for a longer period, but because of my consultancy visit to Indonesia in May and a visit to the USA for presenting a paper on IPM of mango pests at IV International Symposium on Mango, I could stay only for three weeks.

During my stay at Aralaganwila, research work done by the post graduate students of the Post Graduate Institute of Agriculture (PGIA) was checked, data analysed and programme for Yala 1992 discussed and proposed.

Staff of the Regional Agricultural Research Centre (RARC), Aralaganwila and Agricultural Research Station (ARS), Girandurukotte were asked if they had any papers for editing. Mr. Y. Ketipearachchi RO RARC Aralaganwila and Mr. M.G. Dhanapala RO ARS Girandurukotte promised to write papers to be edited later on.

Two brochures "A Cheap and Safe Method of Controlling Fruitflies on Mango, Guava, etc in Sri Lanka" and "Safe and Effective Use of Pesticides" and one Advisory Letter on "Mechanical Control of Crop Pests" for the farmers were written. Their translation in Sinhala was done by the translators of the MARD project. The drafts of these were left with Dr. G. W. S elleck. He was requested to get these translated into Tamil.

The Identifications and identified specimens, that were despatched by me from Pakistan have been received by Mr. Ketipearachchi. Foundation of insect reference collection has been laid. If maintained, identifications of insect pests and their natural enemies can be provided to other ARSs in Sri Lanka from RARC, Aralaganwila.

Copies of the research work done on chilli by Mr. B. Ranjith Piyadasa and on greengram by Mr. I.M. Nihal Chandrasiri at RARC Aralaganwila are being sent to Mr. A. Lecamwasam, Deputy Director (Research) (DDR) for including these in his Station Annual Report.

II. WORK WITH THE DEPARTMENT OF AGRICULTURE STAFF AT GIRANDURU-KOTTE AND ARALAGANWILA TO EDIT PUBLICATIONS. TRANSLATE INTO SINHALA AND TAMIL AN EXTENSION BROCHURE ON IPM OF FRUITFLIES ON MANGO

The brochure on "A Cheap and Safe Method of Controlling Fruitflies on Mango, Guava etc in Sri Lanka" in English was finalised (Appendix II). Its translation in Sinhala has also been done (Appendix III). These have been given to Dr. G. W. Selleck for arranging their publications. Brochure on "Integrated Control of Mango Pests" published in Pakistan is being sent with the report as sample for the brochure to be published in Sri Lanka.

The negatives of the photographs, to be included in the brochure, are also being sent with the report.

Another brochure was written on "Safe and Effective Use of Pesticides" (Appendix IV). It has also been translated in Sinhala (Appendix V). Publication of these brochures will be a big service to the farmers because they were spraying pesticides without observing any safety precautions required for this purpose. They were seen spraying without any shirt on and washing the sprayers in the canal.

Dr. G.W. Selleck had also written some safety instructions for spraying weedicides. These were included in the "Crop

Recommendations Technoguide" (Anon., 1990). It was agreed that he will combine the two and produce a joint publication for the farmers.

Because the crops are grown on small plots, insects can be easily picked up and crushed or drowned in kerosene oil in jars. An Advisory Letter on "Mechanical Control of Crops Pests" has been prepared (Appendix VI). This was also translated into Sinhala (Appendix VII). It can be sent as a personal letter by Mr. Bruce Spake/ Mr. A. Lecamwasam to the farmers.

It was feared that farmers may be reluctant to use these methods because of religious reasons. However, during my visits to fields on demonstration, most of the farmers readily adapted it. Twelve plastic jars, with kerosene oil, were distributed among the farmers to see whether or not most of the farmers would adopt this method, Mr. B. Ranjith Piyadasa and Mr. I.M. Nihal Chandrasiri have been asked to follow and collect information.

Mr. Y. Ketipearachchi and Mr. D.M. Dhanapala were asked whether or not they had any papers for edlting. They promised to write these later on. Mr. Ketipearachchi will be writing a paper on "Diaphania indica and its parasitoid Apanteles sp." The identification of Apanteles sp. is still awaited from IIE, London. Mr. Dhanapala will be writing a paper on "Population trends of Dacus spp. in System C". I can edit these later on.

III. EVALUATION OF PROGRESS MADE, SUGGESTIONS FOR IMPROVEMENT OF METHODOLOGY AND RECOMMENDATIONS FOR THE NEXT STEPS FOR THE PGIA STUDENTS WORKING ON IPM OF CHILLI AND LEGUME CROP PESTS.

The progress made by the PGIA students was checked, data analysed and the work done so far was compiled. Future plan of work was discussed. Plan of work on chilli is given in Appendix VIII and on greengram in Appendix IX. The methodology to be used was discussed and the students were trained in different methods.

The details of the work accomplished by Mr. Piyadasa and Mr. Chandrasiri are given below:

WORK DONE ON CHILLI

by

B. Ranjith Piyadasa

WORK DONE ON CHILLI

by

B. Ranjith Piyadasa

1. INTRODUCTION

During Maha 1991-92 chilli was cultivated on 223 ha in System B. These are heavily sprayed with pesticides. Most of sprays are prophylactic in nature. Mohyuddin (1991) reported that 10 sprays are done on chilli during the crop period starting when the crop is two weeks old. Mostly Anthio-33, Monocrotophos-60, Lebaycid EC 50, Actellic 50 EC, and Dimethoate-40 EC are used.

For developing IPM of chilli pests, survey for insects that feed on chilli and their natural enemies was started at the end of Yala 1991 at Galtalawa and was continued at Kalukele and Sevanapitiya during Maha 1991-92.

Effect of pesticides on population trends of pests and their natural enemies was studied in sprayed and unsprayed plots at farmer's fields.

2. SURVEY FOR PESTS AND THEIR NATURAL ENEMIES ON CHILLI IN SYSTEM B.

For survey of pests and their natural enemies all parts of the plant were examined. Adults and immature stages were collected. The immature stages were reared in the laboratory for obtaining adults of the pests and their natural enemies for getting their identifications. As a result of this survey the following insects and their natural enemies were recorded.

i. Aphids

It seems that two species of aphids attack chilli. One of these has been identified as Aphis gossypii Glover and identification of the other species is still awaited from International Institute of Entomology (IIE), London.

Extremely low attack of A. gossypii was found throughout Maha. Six coccinellid, two syrphid and one chemaemyiid species were found feeding on aphids. Some of these predators were found on the crop even before the aphids appeared on the plants. The predator species recorded feeding on it are listed below:

A. Coccinellidae

a. Brumoides suturalis (Fabricius)
b. Cheilomenes sexmaculata (Fabricius)
c. Coccinella transversalis (Fabricius)
d. Harmonia octomaculata (Fabricius)
e. Propylea dissecta (Mulsant)
f. Scymnus latemaculatus Motschulsky

B. Syrphidae

g. Ischiodon scutellaris (Fabricius)
h. Paragus verburiensis Stuckenbery

C. Chamaemyiidae

i. Unidentified sp. (sent to IIE, London)

ii. Thrips

j. Scirtothrips dorsalis Hood
k. Thrips palmi Karny

Identification of thrips was obtained from U.S. Museum of Natural History, Beltsville, Maryland, USA. Extremely low infestation of thrips was found during Maha. However, very high attack was recorded on heavily sprayed fields at Galtalawa during Yala 1991 (see below).

A very effective predator was recorded feeding on thrips. It has been identified as Orius sp by IIE, London.

iii. Bemisia tabaci (Genn.) (Aleyrodidae)

Nymphs, pupae and adults of whitefly Bemisia tabaci were recorded feeding on leaves in June 1992. Its attack was negligible.

An unidentified encyrtid parasitoid was reared from the whitefly pupae.

iv. Nezara viridula Linnaeus (Pentatomidae)

Adults were found on chilli plants in June 1992.

v. ? Polyphagotarsonemus latus (Banks) (Tarsonemidae)

A few individuals of this species were recorded feeding on leaves in June 1992.

vi. Helicoverpa (Heliothis) armigera (Hb.) (Noctuidae)

This has been reported as pest of chilli (Anon., 1990). It was not recorded feeding on chilli during Maha. However, its very severe attack was recorded during Yala 1991 at Galtalawa where the farmer had heavily sprayed his crop (see below).

vii. Spodoptera litura Fab. (Noctuidae)

Larvae of Spodoptera litura were collected feeding on leaves during Yala 1991 at Sevanapitiya. Young to full grown larvae were collected.

3. EFFECT OF PESTICIDES ON PESTS AND THEIR NATURAL ENEMIES

The work was started in August 1991. At this time young chilli crop was not available. At Galtalawa two fields were selected. Both were planted on 2nd May at the same time with nursery plants obtained from the same nursery. One farmer Mr. V.G. Dingiribanda had used pesticides extensively and Mr. G. Werasena had done very little spraying on his crop.

Mr. Y.G. Dingiribanda sprayed his crop 9 times in three months (Table I) at the total cost of Rs. 1,713. Here plants were heavily attacked by thrips and mites and pods by Helicoverpa armigera (Table 2). The farmer got hardly any yield as most of the leaves and pods had fallen down. At the end of August he plou the crop in and has not planted this crop during Maha 1991-92 d Yala 1992.

Mr. G. Werasena sprayed his crop twice, once with Lebaycid and other time with Monocrotophos. His crop had extremly low attack of thrips and mites and only 3% pods were attacked by H. armigera. No pods were found on the ground.

TABLE 1 DETAILS OF PESTICIDES SPRAYED ON CHILLI CROP BY MR. DINGIRIBANDA FROM MAY TO AUGUST 1991 AT GALTALAWA.

Date of spraying	Pesticide used	Cost (Rs.)
9-10.05.91	Lebaycid	300.00
22.05.91	Anthio-33	100.00
01.06.91	Monocrotophos	137.00
12.06.91	Monocrotophos	275.00
1-05.07.91	Actellic	366.00
17.07.91	Chlorpyrifos	130.00
20.07.91	Chlorpyrifos	130.00
10.08.91	Lannate - L	275.00
	Total	1,713.00

TABLE 2. RATE OF INFESTATION OF HELICOVERPA ARMIGERA LARVAE ON CHILLI PODS IN TWO FIELDS, ONE HAD RECEIVED 9 SPRAYS OF INSECTICIDES (MR. DINGRIBANDA) AND THE OTHER TWO SPRAYS (MR. WERASENA) AT GALTALAWA.

Position of pods	Crop sprayed 9 times	Crop sprayed 2 times
On the plant	66%	3%
On the ground	98%	No fallen pods

In Maha 1991-92 two plots were selected at Sevanapitiya and two at Kalukele for trial of pesticides. On one plot at each locality the farmer was allowed to spray pesticide that he wanted to use, the other was kept as control without pesticides.

Sampling from the sprayed and unsprayed plots was done at fortnightly intervals. Each time 50 leaves were collected at random and examined under the binocular microscope for aphids, thrips and mites.

At Kalukele, the farmer sprayed 9 times (Table 3) from December to April. The cost of sprays on 363 m^2 was Rs 515. No spraying was done in the control. The infestation of the aphids, mites and thrips remained very low during Maha 1991-92. The difference in rate of infestation between the sprayed and unsprayed plots was not significant (Table 4).

TABLE 3. DETAILS OF PESTICIDES SPRAYED ON CHILLI AT KALUKELE FROM DECEMBER 1991 TO APRIL 1992.

Date of spraying	pesticide used
28.12.91	Lebaycid EC 50%
10.01.92	Monocrotophos
22.01.92	Monocrotophos
05.02.92	Lebaycid EC 50%
18.02.92	Actellic
02.03.92	Monocrotophos
21.03.92	Lebaycid EC 50%
03.04.92	Monocrotophos
20.04.92	Actellic

TABLE 4. RATE OF INFESTATION OF APHIDS, MITES AND THRIPS ON CHILLI IN PLOTS THAT WERE SPRAYED AND IN THE CONTROL PLOTS THAT WERE NOT SPRAYED AT KALUKELE, BASED ON 50 LEAVES, COLLECTED AT RANDOM, IN EACH TYPE OF PLOT.

Month	Sprayed plots			Unsprayed plots		
	Aphids	Mites	Thrips	Aphids	Mites	Thrips
December	0	16	8	1	22	6
January	13	15	3	10	8	3
February	2	4	4	3	9	7
March	8	6	2	6	5	2
April	3	3	0	0	26	1
Total	26	44	17	20	70	18

At Sevanapitiya the farmer sprayed 10 times (Table 5) at a total cost of Rs 2,005 on 3,000 m^2. The infestation of the aphids, thrips and mites was very low both in sprayed and unsprayed plots. Difference in infestation of thrips, aphids and mites between the sprayed and unsprayed plots was not signigicant (Table 6).

TABLE 5. DETAILS OF PESTICIDES SPRAYED ON CHILLI CROPS AT SEVANAPITIYA FROM DECEMBER 1991 TO MAY 1992.

Date of Spraying	Pesticide used
27.12.91	Monocrotophos
15.01.92	Lebaycid EC-50%
30.01.92	Finfos 20
10.02.92	Dimethioate
25.02.92	Monocrotophos
10.03.92	Finfos 40
28.03.92	Monocrotophos
07.04.92	Lebaycid EC 50%
28.04.92	Monocrotophos
10.05.92	Finfos 40

TABLE 6. RATE OF INFESTATION ON APHIDS, MITES AND THRIPS ON CHILLI IN PLOTS THAT WERE SPRAYED AND IN THE CONTROL PLOT THAT WAS NOT SPRAYED AT SEVANAPITIYA, BASED ON 50 LEAVES COLLECTED AT RANDOM IN EACH TYPE OF PLOT.

Month	Sprayed plot			Unsprayed plot		
	Aphids	Mites	Thrips	Aphids	Mites	Thrips
December	2	3	0	0	2	2
January	2	3	3	5	4	2
February	3	6	1	8	5	1
March	5	1	4	5	1	9
April	4	5	5	4	3	6
May	6	2	5	21	2	13
Total	22	20	18	43	17	33

WORK DONE ON GREENGRAM

by

I. M. NIHAL CHANDRASIRI

INSECT COMPLEX ASSOCIATED WITH GREENGRAM (*VIGNA RADIATA*) IN MAHAWELI SYSTEM B AND STUDIES ON BIOLOGY AND ECOLOGY OF *SPODOPTERA LITURA*

I. M. NIHAL CHANDRASIRI

1. INTRODUCTION

Greengram (*Vigna radiata* L. Wilozeke) has great potential as a crop in System B. This crop is important to the farming system because it fixes nitrogen and is, therefore, ideal in crop rotations; its resource requirements are low; it has a stable market, and it is a storable commodity. Cultivation of greengram in system B has increased and was 113.4 hectares in 1991. Farmers can earn more than Rs. 30,000 per hectare (Gleason *et al.*, 1990).

Insect pests are a serious constrain for greengram production. The farmers spray pesticides for pest control almost once a week. A number of sprays are done during the crop period of two and half months. Most sprays are prophylactic in nature. The indiscriminate use of pesticides increases the cost of production unnecessarily. Mostly Lebaycid, Actellic, Monocrotophos and Tamaron are used for pests control.

Indiscriminate use of pesticides in addition to being expensive, creates a number of problems such as pollution of the environment; creates health hazard for human beings and animals; secondary pests become serious because of elimination of their natural enemies.

The present studies have been started to develop IPM which is the cheapest and safest method of pest control. This requires detailed observation on biology, ecology, etc. of the pests and their natural enemies.

At present, very little information on the pests and their natural enemies is available. Therefore, surveys for insect pests and their natural enemies and studies on biology, ecology and population trends have been started. These are reported below. However, these are of preliminary nature.

2. SURVEY FOR PESTS AND THEIR NATURAL ENEMIES ON GREENGRAM IN SYSTEM B.

For survey of pests and their natural enemies all parts of the plants are examined. Immature stages were collected and reared in the laboratory to obtain adults of pests and their natural enemies for identification.

As a result of the present survey, the following insects were recorded.

i. Aphis craccivora Koch (Aphididae)

Very low attack of the Aphis craccivora was found from February to June. Maximum attack was 0.4 aphids per leaf in the third week of February at Mahadamana.

The following predators were recorded feeding on it.

(a) Coccinellidae

(1) Cheilomenes sexmaculata (Fabricius)
(2) Coccinella transversalis (Fabriccius)
(3) Harmonia octomaculata (Fabricius)
(4) Propylea dissecta (Mulsant)

(b) Syrphidae

One unidentified species.

ii. Mites

A very low attack of mites was found during February to June. It is being sent for identification.

iii. Thrips

A very low attack was found. It is also being sent for identification.

iv. Leaf miner

Two species of leaf miners were recorded from February to June.

v. Unidentified agromyzid species

Larvae feeding in leaves by making serpentine mines.

vi. Unidentified Lepidoptera

Larvae do not make serpentine mines. They appear in the form of blotches.

vii. Leaf roller Lamprosema indicata (Fabricius) (Pyralidae)

This was found from February to June at Mahadamana and Kalukele in small numbers.

viii. Spodoptera litura (Fabricius) (Noctuidae)

Eggs and larvae of various instars were found feeding on leaves from February to June at Mahadamana and Kalukele.

Natural enemies

One species each of egg and larval parasitoids were recorded.

Telenomus sp. was reared from eggs in June.

Unidentified dipterous parasitoid was reared from larvae collected in May.

ix. Maruca testulalis (Geyer) (Pyralidae)

Larvae of Maruca testulalis feeding on flowers and young pods were recorded from February to June. This is a serious pest of greengram in System B.

Natural enemies

An unidentified ichneumonid sp was reared from its pupae.

Adults of cotton stainer, leaf hoppers, Nezara viridula, Epilachna sp. were recorded from February to June. They seem to be incidental pests of greengram and only adults were recorded.

3. EFFECT OF PESTICIDES ON PESTS AND THEIR NATURAL ENEMIES.

To study the effect of pesticide on population of pests and their natural enemies, two similar fields were selected each in Mahadamana and Kalukele. In one, farmer sprayed pesticides according to his schedule, the other was kept as control and no pesticides were sprayed. Both fields were sampled at weekly intervals. Forty leaves were collected randomly from the plants. The insects on these were counted in the laboratory under a binocular microscope.

At Mahadamana the farmer sprayed pesticides five times from February to April (Table 1). The populations of aphids, mites and thrips in the plot that was sprayed with pesticides and in the control, where no pesticides were used, was not significantly different (Table 2).

The pesticides used by the farmer at Kalukele have been listed in Table 3. The infestation in the unsprayed plot was slightly higher than in the sprayed (Table 4). However, in both the plots infestation was below economic injury level. During Yala population of Pod borers was not counted.

New plots were selected at Mahadamana, in April 1992 and at Kalukela in May 1992. The observations are being continued.

Table 1. DETAILS OF PESTICIDES SPRAYED ON GREENGRAM BY MR. J.D. JAYASINGHE FROM FEBRUARY TO APRIL 1992 ON GREENGRAM AT MAHADAMANA.

Date of spraying	Pesticide Used	Cost (Rs.)
08.02.1992	Lebaycid	180.00
22.02.1992	Lebaycid	180.00
03.03.1992	Monocrotophos	144.00
18.03.1992	Monocrotophos	144.00
01.04.1992	Monocrotophos	144.00
	Total cost	792.00

Table 2. RATE OF INFESTATION OF APHIDS, MITES AND THRIPS ON GREENGRAM AT MAHADAMANA IN PLOT THAT WAS SPRAYED WITH PESTICIDE AND IN THE CONTROL THAT WAS NOT SPRAYED BASED ON 40 LEAVES COLLECTED AT RANDOM IN EACH TYPE OF PLOT.

	Sprayed			Unsprayed		
Month	Aphids	Mites	Thrips	Aphids	Mites	Thrips
Feb. 1st week	0	0	0	1	0	0
2nd week	11	0	6	6	0	0
3rd week	17	0	3	10	0	4
4th week	07	6	4	04	0	4
Mar. 1st week	3	7	14	08	4	16
2nd week	0	9	18	7	8	12
3rd week	8	2	12	13	7	14
4th week	0	10	0	10	18	06
Apr. 1st week	9	11	11	03	07	09
2nd week	0	0	9	0	14	08
3rd week	0	0	0	0	0	2
4th week	0	0	2	0	0	0
Total	55	45	79	62	58	75

Table 3. DETAILS OF PESTICIDES SPRAYED ON GREENGRAM BY MR. WIJESEKARA FROM FEBRUARY TO APRIL 1992 ON GREENGRAM AT KALUKELE

Date of spraying	Pesticide Used	Cost (Rs.)
06.02.1992	Monocrotophos	144.00
20.02.1992	Lebaycid	180.00
04.03.1992	Lebaycid	180.00
22.03.1992	Monocrotophos	144.00
06.04.1992	Monocrotophos	144.00
	Total cost	792.00

Table 4. RATE OF INFESTATION OF APHIDS, MITES AND THRIPS ON GREENGRAM IN PLOT THAT WAS SPRAYED WITH PESTICIDE AND IN CONTROL THAT WAS NOT SPRAYED AT KALUKELE, BASED ON 40 LEAVES COLLECTED AT RANDOM, IN EACH TYPE OF PLOT.

Month	Sprayed			Unsprayed		
	Aphid	Mites	Thrips	Aphids	Mites	Thrips
Feb. 1st week	1	0	2	0	0	2
2nd week	0	4	4	3	1	2
3rd week	12	8	0	13	3	1
4th week	6	7	3	9	2	3
Mar. 1st week	8	2	0	13	8	0
2nd week	3	2	3	8	5	3
3rd week	7	7	2	8	17	3
4th week	2	0	0	2	5	7
Apr. 1st week	2	0	0	2	3	0
2nd week	0	2	0	0	1	0
3rd week	0	2	0	3	0	0
4th week	0	0	0	0	0	0
Total	41	34	14	58	45	23

Synopsis for M.Phil. thesis (Apendix X) of Mr. Chandrasiri was written. It was discussed with Prof. Dr. H.N.P. Wijeyagunasakara and Prof. Dr. D. Ahangama at the university and was submitted for approval.

OBSERVATIONS ON PESTS OF MISCELLANEOUS CROPS

In addition to chilli and greengram some other crops were also examined for pests and their natural enemies. These were reared in the laboratory and have been added to the insect collection. Details are given below:

GRAPES

Mr. C. John, Consultant (Grapes) asked me to visit Dharmasena Farm because ants were destroying the grapes and the plants were to be sprayed for their control. The next day I visited the Farm and by that time grapes had been sprayed with Lebaycid EC 50%. Ten bottles (cost Rs. 90 per bottle) had been used at the total cost of Rs. 900/=. Better control could have been achieved with half a bottle of the pesticide if a few drops of the pesticide were poured in each nest of the ants.

It was recommended not to spray the plants in future for control of the ants. Put a few drops of pesticide in ant nests with a dropper to destroy their colonies which they make mostly at the base of grape vines in the root. For long lasting effect Aldrin may be used. In Sri Lanka it has restricted use against white ants. Because only a few drops are needed for each nest therefore it should not pollute the environment to great extent. If Aldrin is not to be used. a few drops of some other insecticide will do.

CABBAGE

Its young plants were examined at the Seed Nursery. The plants had been sprayed with pesticides but alive larvae of diamond back month *Plutella xylostella* (Linnaeus) and Oriental cabbage worm *Hellula undalis* (Fabricius) were found feeding on the plants in small numbers.

BABY CORN

Maize plants growing at Dharmasena Farm were examined. Some plants had dead hearts. These were examined for stem borer attack but no stem borer larvae were found. They were attacked by ? Atherigona sp. The plants had been sprayed with Monocrotophos and Benlate a couple of days earlier.

IV. ADVICE AND MATERIAL FOR ON GOING IPM PROGRAMMES ON MANGO AND GUAVA.

A bottle of methyl eugenol was carried from Pakistan for further trials. However, Mr. Martin West had obtained methyl eugenol from Ceylon Institute of Scientific and Industrial Research Organisation, Colombo.

His staff have done excellent work on trapping for controlling Dacus spp. with methyl eugenol (see below, work on Mango). It is recommended that trapping should be continued throughout the year.

The brochures in English and Sinhala on fruitfly control with methyl eugenol have been prepared. These may be published with glossy cover with good coloured photographs for distributing to the farmers. The photographs make the brochures easy to understand and follow. Negatives and prints of the photographs are being sent with the report.

In Pakistan methyl eugenol traps were equally useful for control of fruitflies on mango and guava because the same species of fruitflies attack mango and guava. Where guava is growing these traps should be used for fruitfly control. However, at most of the places mango and guava were found growing together. In such situation the traps for mango will control infestation on guava also.

MANGO

Mr. Martin West, with the assistance of Mr. I. L. Nayeem, initiated work on control of fruitflies with methyl eugenol in December 1991.

Traps were put at 13 locations including 1 Ariyadasa (MARD Camps),2 Royal Garden,3 Rambanda (Kalukele unit),4 Ranasinghebanda (Ellewewa Unit), 5 Mathubanda (Phala Ellewewa Unit), 6 Damminna Animal Farm, 7 G. Piyasiri (Aralaganwila Unit), 8 Lokubanda (Devagama Unit), 9 A. Ransinghe (Kudawewa Unit), 10 Varuna Jayawardane (Aluthwewa Unit), 11 Thilakarathne (Weharagama Unit) 12 Nursery No. 1. and 13 Nursery No. 2.

The fruitfly males collected from December to May were 28,236 at Ariyadasa, 22,305 at Royal Garden, 21,300 at Rambanda, 28,421 at Ranasinghebanda, 17,801 at Muthubanda, 25,538 at Damminna Animal Farm, 21,468 at G. Piyasiri, 13,626 at Lokubanda, 45,533 at A.Ranasingha, 34,330 at Veruna Jayawardane 34,330 at Thilakarathue 33,415 at Nursery 1 and 11,923 at Nursery 2.

In June when fruit was ripe, rate of infestation was checked at these localities and compared with infestation a few km away where traps were not used. Two % fruits were found infested where traps were operated compared with 18% where traps were not used.

V. INFORMATION AND SUGGESTIONS TO SUPPORT THE ON-GOING RESEARCH ON IPM OF GHERKIN PESTS AT ARALAGANWILA AND IPM OF FRUIT CROPS AT GIRANDURUKOTTE.

GHERKIN

As reported earlier (Mohyuddin, 1991) gherkin could be grown successfully without using pesticides. Yield could be improved by proper care of the crop. But work on IPM of gherkin pests was not repeated during Maha 1991-92 at RARC, Aralaganwila.

Mr. Y. Ketipearachchi screened pesticides against various gherkin pests. Trichlorfon LC 50%, Carbofuran, Fenthion were tried against various pests of gherkin.

The predators of aphids *Aphis gossypii* Glover and thrips *Thrips palmi* Karny and *Frankliniella schultzei* (Trybom) gave excellent control of these pests during Yala 1991. These predators were carried to Pakistan and despatched to the Director IIE, London. They were identified as follows:

A. Coccinellidae

i. *Brumoides suturalis* (Fabricius)
ii. *Cheilomenes sexmaculata* (Febricius)
iii. *Coccinella transversalis* Fabricius
iv. *Harmonia octomaculata* (Fabricius)
v. *Propylea dissecta* (Mulsant)
vi. *Scymnus latemaculatus* Motschulsky

B. Syrphidae

vii. *Ischiodon scutellaris* (Fabricius)
viii. *Paragus yerburiensis* Stuckenberg

C. Chemaemyiidae

ix. Unidentified sp. (identification not yet received from IIE, London)

D. Anthocoridae

x. Orius sp. This is an excellent predator of thrips on gherkin.

Most of these predators were also recorded feeding on aphids and thrips on chilli and greengram.

Mr. Y. Ketipearachchi is planning to work on gherkin. He told me that he was in contact with the farmers for trials on their fields. However, he has been selected for higher studies in Japan. Therefore, it is suggested that, if possible, a post graduate student of PGIA may be engaged to carry out work on IPM of gherkin.

Gherkin cultivation has started in System B. It is recommended that trials similar to the ones done during my visits in August - September 1991 should be repeated. Most of the insect pests and their natural enemies have been identified and identification of some species is awaited from IIE, London. The plan of work is given Appendix XI.

At Girandurukotte

Plan of work of Mr. M.G. Dhanapala is given in Appendix XII. He is continuing work on sweet potato weevil Cylas formicarius (Fabricius) and banana weevil. The pheromone of sweet potato weevil does not control it successfully. He is trying to develope an IPM package for its control.

He has still to study effect of catches of fruitfly males, with methyl eugenol, on rate of fruitfly infestation on mango. He should examine ripe fruits to determine rate of infestation of fruitfly where traps were put and a couple of Km away where traps were not used.

Two species of fruitflies Dacus zonatus and D. dorsalis infest mango, guava and uguressa in System C. These species are polyphagous. Their other hosts and abundance on these fruits during different months may be investigated.

Fruitflies can also be controlled in guava by using methyl eugenol baited traps. Mr. Dhanapala should also put traps in orchards where guava is growing.

VI. ASSESSMENT OF EQUIPMENT CURRENTLY AVAILABLE TO RESEARCHERS AT ARALAGANWILA AND GIRANDURUKOTTE AND SUGGESTIONS FOR NECESSARY ACQUISITIONS

With the articles purchased under the MARD Project (list given in my last report) the RARC, Aralaganwila has most of the equipment required for research. In my last report it was recommended that a single lens reflex camera for photography of insects may be provided to the Research Centre. It has not been purchased so far. It may be provided. Additional articles required by the Centre are given below.

1.	Single lens reflex camera (preferably Canon) with Macrolens and Extension Tubes.	01
2.	Stage and eye piece micrometer to fit on a standard microscope.	01
3.	Table top dissecting magnifier with lamp.	01
4.	Hand sprayer	02
5.	Disecction boxes	02
6.	Desiccators pyrex	06
7.	Electric balance	01
8.	Top loading mechanical balance.	01
9.	Wooden cabinets for storing insect boxes	04
10.	Wooden racks	04
11.	Entomological pins No. 0,1,2	20 packets of each size
12.	Glass tubes 2.5. cm dia	01 gross
13.	Diamond glass cutting pen	02
14.	Incubator	01
15.	Plastic (mylar) sheets	10
16.	Plastic flower pots 12 cm dia	50

17.	Plastic trays 30x30 cm	10
18.	Rotatable insect holder	01
19.	Rubber tubing 3/4"	50 m
20.	Camel hair brush	10
21.	Wooden cages small	10
22.	Cavity blocks	01 dozen

The wooden cabinets and racks were ordered locally at Aralaganwila. The carpenter had not delivered them when I left.

Requirements for the Research Station Girandurukotte

The following articles may be purchased for the Research Station.

1. Air Conditioner for the laboratory	01
2. Incubator	01
3. Binocular microscope	01
4. Thermometer (maximum & minimum)	01
5. Thermometer (dry & wet bulb)	01
6. Insect boxes	12
7. Cabinet for insect boxes	01
8. Hand sprayer	01
9. Microscope slides	05 boxes
10. Cover slips for slides	05 boxes
11. Cavity blocks	12
12. Plastic (mylar) sheets	10
13. Desiccators	06
14. Forceps fine	04
15. Hygrothermograph	01
16. Entomological pins 0,1,2	12 packets of each size
17. Counter	01

VII. ASSESSMENT OF CURRENT AGROCHEMICAL USAGE BY THE SETTLERS AND COMMERCIAL FARMERS IN SYSTEM B. VISIT A SAMPLE OF AGROCHEMICAL SUPPLY SHOPS AND CHECK AVAILABILITIES OF PRODUCTS, EXPIRY DATE, AVAILABILITY OF EXPLANATORY MATERIAL IN ENGLISH AND SINHALA. DR. MOHYUDDIN TO MEET WITH REPRESENTATIVE SETTLERS AND COMMERCIAL FARMERS TO DISCUSS AND ASSESS THEIR CURRENT PESTICIDE USE PATTERN.

The information on pesticide use, availability, etc. was obtained from 13 settlers, six pesticide dealers and three commercial farmers (Appendix XIII). Sunfrost Ltd was visited a couple of times but the Project Manager was not available.

Of the 13 farmers, from whom information was obtained, three grew only paddy; one paddy and gherkin; two paddy and chilli; one paddy, chilli and onion; one paddy, chilli, onion and vegetables; three paddy, cowpea, greengram and soya bean; one paddy and chilli and one chilli only.

All the farmers used pesticides. One to 10 sprays were done by different farmers. Maximum spraying was done on chilli (10 times) followed by gherkin (6), greengram (5), paddy (1).

The pesticides used were Monocrotophos, Tamaron, Lannate L, Baycarb, Actellic, Lebaycid, Endosulfan and Morithion. Monocrotophos was the most commonly used pesticide. It was used by 12 farmers. It was sprayed mostly on paddy.

On rice ten farmers sprayed Monocrotophos on the basis of their past experience and three were advised by Field Assistants.

All the farmers except the one who grew gherkin purchased the pesticides from the dealers. The gherkin grower was supplied pesticides by Sunfrost Ltd. on credit.

Six pesticide dealers were visited. The number of pesticides that they were selling varied from 10 to 100. The big dealers were well stocked whereas small shops had about a dozen of bottles of each pesticide. The Technical Sales Executive of BASF told that the pesticides are supplied to the dealers within a week after order is received.

Regarding availability of information to the farmers the pesticide bottles have labels in three languages, English, Sinhala and Tamil. The first portion of the label is pasted on the bottle and rest of it is wrapped around the bottle and held with a rubber band. Earlier most of the companies supplied literature in the form of leaflets but now these are rarely distributed.

The labels on the bottles have batch number, date of manufacture, and price. Shelf life is 18 months to two years. Under the date of manufacture it is printed whether the pesticide expires after 18 month or two years. The labels are printed according to the instructions given by the Registrar of pesticides.

Of all the shops visited only one small dealer had some expired pesticides. He had torn the part of the label where date of manufacture was given on some bottles. In all other shops the pesticides were within the expiry date.

The commercial farmers follow the calender of pesticide spray provided by the pesticide manufacturers. A number of companies have printed booklets in English and local languages. For example Bayer and Harcros have printed these booklets and they were found with the farmers. In these schedules for sprays for almost all the crops including rice, brinjal, mango, carrot, beetroot, tomato, potato, beans, tabacco, cabbage and other brassicas, onion, snake gourd, bitter gourd, tea and coconut are given.

It turned out that most of the farmers sprayed even more frequently than the schudules given in these booklets.

VIII. GIVE SEMINARS ON PROGRESS AND PROBLEMS TO DOA/MEA/EIED/MARD AND USAID.

Because I had to cut short my consultancy visit, seminar could not be given. However, discussions were held with the Professors of University of Peradeniya and officials of DOA.

IX. DEVELOP A SCHEDULE, INCLUDING INTERIM ACTIONS TO PROVIDE FOR COMPLETION OF IPM RECOMMENDATIONS AND EXTENSION PUBLICATIONS FOR CHILLI, LEGUME CROPS, GHERKINS AND GUAVA.

The preliminary results of work done to develop IPM on chilli and greengram by the post graduate students and on gherkin during my previous visits by Mr. Y. Ketipearachchi indicate that most of sprays of insecticides are prophylactic in nature and are not required.

The aphid population on gherkin was controlled without pesticides by predators which appeard in large numbers. (see my report for July-August 1991). However, this work needs to be repeated a couple of times during Yala and Maha before recommendation can be made to the farmers.

It is recommended that another post graduate student may be engaged to do this work. This should be done as soon as possible since nobody will be working on it because Mr. Y. Ketipearachchi will be working on his research programme, and later on will be leaving for higher studies.

Work on chilli and legume crops will be continued by the post graduate students. It has to be repeated for a couple of seasons before IPM technology can be transferred to the farmers. Therefore, at present nothing can be transferred to the farmers.

A brochure has been produced for controlling fruitflies on mango, guava, etc. It will be published soon and can be distributed among the farmers.

X. DEVELOP MATERIAL AND PLANS FOR FARMER TRAINING WORKSHOPS ON PESTICIDE SAFTY.

A brochure has been written on "Safe and Effective use of Pesticides" (Appendix IV). It has been translated into Sinhala (Appendix V). Another brochure on "A Cheap and Safe Method of Controlling Fruitflies on Mango, Guava, etc. in Sri Lanka" has been written (Appendix II). It has also been translated into Sinhala (Appendix III). These may be published with a glossy cover including colour photographs so that the farmers can understand and follow these easily. Negatives of photographs that are to be included in the brochure and sample copy of brochure on IPM of mango pests published in Pakistan is being sent with the report to the Chief of the Party MARD Project for reference.

An Advisory Letter addressed to the farmers on "Mechanical Control of Crop Pests" was prepared (Appendix VI). It has been translated into Sinhala (Appendix VII).

All these brochures were given to Dr. G.W. Selleck for translation into Tamil.

When the brochures have been published they can be handed over to the farmers in a field day/workshop and for demonstration traps, fruitflies collected in the trap may be shown to the farmers. If possible, a small bottle of methyl eugenol and a trap may be given to the farmers to start with.

XI. IDENTIFICATION OF PESTS AND THEIR NATURAL ENEMIES

During my last visit a large number of insects including both pests and their natural enemies were sent to the IIE, London, U.K. Identification of the specimens that were despatched from Pakistan have been received. These are mainly predators.

IIE has returned the specimens to RARC Aralaganwila. The other specimens are being identified by the IIE staff and their identification and the specimens will be sent in due course of time.

The post graduate students have recorded additional species of pest and their natural enemies from chilli and greengram. They were advised to prepare and send them to IIE for identification.

A foundation for reference collection has been laid. If it is properly maintained identifications of insects can be supplied to other Research Stations in Sri Lanka.

Two racks for storing the insect boxes were ordered. These will be delivered to the RARC Aralaganwila by the carpenter during June 1992.

XII. CONCLUSIONS AND RECOMMENDATIONS

At present pesticides are sprayed on prophylactic basis without knowing whether or not the pest is present. As a result of this very large quantities of pesticides are dumped into the environment when these are not needed. During Maha, most of the farmers sprayed chilli crop up to 10 times and greengram up to 5 times when they were not required.

Studies carried out by the Post Graduate students showed that difference in populations of aphids, mites and thrips on greengram and chilli in the plots which were sprayed and those kept unsprayed as control was not significant. Attack of these pests was kept below economic injury level by predators in both type of plots. Not only the farmers spend a lot of money on pesticides, they also pollute the environment. This indiscriminate use of pesticides may result in upsurge of pests that are under natural control.

To break routine habit of using pesticides there is a need for developing alternate methods of pest control. Therefore, studies on biology, ecology and population trends of major pests and their natural enemies on greengram, chilli and gherkin were started in System B. Some very promosing results have been obtained. Some effective natural enemies of aphids, thrips and mites have been identified.

During the present visit two Brochures were prepared in English. These include "A Cheap and Safe Method of Controlling Fruitflies of Mango, Guava, etc in Sri Lanka" (Appendix II), and "Safe and Effective Use of Pesticides" (Appendix IV). An Advisory Letter on "Mechanical Control of Crop Pests" was also written (Appendix VI). These have been translated into Sinhala (Appendices III, V and VII) and are being translated in Tamil for the benefit of farmers.

For controlling fruitflies methyl eugenol, a food lure, is used. It attracts the males and eliminates them from the fruitfly polulation. The females remaine unfertilized. Even if eggs are laid they do not hatch and fruit is not damaged. This method is not only safe, it is very cheap compared with the use of pesticides. This has been explained with photographs in the brochure produced for controlling fruitflies.

During the present survey it was observed that the farmers spray insecticides without taking necessary precautions required for their safe use. The farmers were seen spraying pesticides without proper clothes on. They were carrying sprays on their bare backs. They were seen washing the sprayers in canal water. Therefore, a need was felt that information on safe and effective use of pesticides should be provided to them. Precautions required in this regard have been described in detail with some illustrations.

The advisory letter on the mechanical control of crop pests was prepared because most of the settlers have small plots of high value crops. They spray the crops even if a few isolated insects are feeding on the plants when they may not be doing any economic damage. The farmers instead of spending money on pesticides can pick up insects, kill them either by crushing or by drowning in kerosene oil in jars. It was feared that the farmers may not kill the insects because of religicus tabues. During my present visit when mechanical control was demonstrated to the farmers, they readily accepted it and started crushing the insect under their feet or with their fingers.

One dozen plastic jars with Kerosene oil were left with the post graduate students for distribution to the farmers. They were asked to demonstrate its use to the farmers and collect information on the feasibility of using this method for pest control.

All the three brochures were translated in Sinhala and were left with Dr G W Selleck for translation in Tamil. It was recommended that these should be printed with photographs so that the farmers can pick up and use the technology easily.

At present, most of the farmers are not aware of presence and importance of natural enemies in pest control. To appreciate their role farmers should be able to identify them. It is suggested that charts/booklets may be prepared with coloured photographs of important pests, predators and parasitoids for distributing among the farmers. This becomes all the more necessary when the farmers are being advised to to practice mechanical control because they may kill natural enemies in their ignorance..

Last Yala studies on gherkin indicated that this crop can be grown without using pesticides. The proper care of the crop will definitely improve the yield. No work was done on IPM of gherkin during Maha. It is recommended that a post graduate student may be engaged to work on IPM of gherkin pests. Mr. Ketipearachchi has been selected for higher studies abroad. Therefore, he may not work on IPM of gherkin pests. At present, a lot of pesticides and fungicides are being sprayed on this crop. Therefore, priority should be given to development of IPM of this crop. The plan of work on gherkin has been included in the report (Appendix XI). If and when a post graduate student becomes available, he may be asked to start working and follow the proposed plant of work.

Studies on biology, ecology and population trends of pest and their natural enemies on greengram and chilli have been initiated. These are to be repeated for a couple of seasons before recommendations for IPM can be made to the farmers.

XIII. REFERENCES

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XIV. ACKNOWLEDGEMENTS

I wish to express my sincerest gratitude to Dr. Bruce Spake, Chief of Party of MARD/MDS Projects for his generous help and hospitality during my visit to Sri Lanka.

I also wish to express my thanks to Dr. G.W. Selleck, Farming Systems Research and Extension Agronomist, Mr. Martin West, Horticulturist and Dr. Jane E. Gleason, Agricultural Economist for their help and cooperation.

Help of Ms. H.L. Nilanthi de Silva for typing the report is gratefully acknowledged.

Mr. A. Lecamwasam, D. D. (R) provided excellent support and collaboration, as did his staff Mr. Y. Ketipearachchi of Aralaganwila Centre and Mr. M.G. Dhanapala of Girandurukotte Station who are carrying out useful research on IPM for high value crops in Systems B and C.

Thanks are also due to Mr. P. K. De S. Gunasekera and Mr. S. Ganegama for translating the brochures from English into Sinhala.

XV. CONTACTS VISITED IN SRI LANKA
(June 1992)

01. Development Alternatives Inc.

MARD/MDS Projects

i.	Mr. Bruce Spake	Chief of Party
ii.	Dr. Max D. Goldensohn	Vice President, DAI
iii.	Dr. G.W. Selleck	Research Agronomist
iv.	Dr. Jane E. Gleason	Agricultural Economist
v.	Mr. Sena Ganewatte	Farmer Organization Consultant
vi.	Mr. K. Satgunasinghem	Irrigation Engineer, MDS
vii.	Mr. Martin West	Horticulturist
viii.	Ms. Jackie Boardman	Packhouse Manager
ix.	Mr. Challiah John	Consultant (Grapes)
x.	Mr. Minh Nguyen	Ext. Agronomist
xi.	Mr. T.C. Welikala	Training Coordinator
xii.	Mr. Y.P. de Silva	Extension Agronomist
xiii.	Mr. Amaranath Wijeyasinghe	Marketing Officer
xiv.	Mr. Nimal Wickramaratne	Water Management Engineer

B. Diversified Agricultural Research Project, Kandy.

i. Dr. Preston S. Pattie	Chief of Party

02. US Agency for Internaitonal Development, Colombo

i. Dr. Glen Anders	Head Agriculture Development
ii. Mr. Gary E. Alex	Project Officer
iii. Mr. Nimal Jayasuriya	Agronomist
iv. Mr. Avanthi Jayatilake	Environment Officer

03. Mahaweli Economic Agency

i. Mr. P.H.K. Dayaratne	Project Coordinator System B

04. Department of Agriculture, Peradeniya, Sri Lanka

i. Dr. M.H.J.P. Fernando	Director Seed Certification and Plant Protection.
ii. Mr. W. Ratnayake	Add Dy Director (Extension)
iii. Dr. S. Nagarajah	Add Dy Director (Research)

05. Central Agricultural Research Institute, Gannoruwa, Peradeniya

i. Ms. I. Padmasiri	Horticulturist

06. Faculty of Agriculture, Department of Agricultural Biology, University of Peradeniya

i. Dr. H.P.M. Gunasena	Dean & Prof. of Crop Sciences
ii. Dr. H.N.P. Wijeyagunasekara	Professor
iii. Dr. Daya Ahangama	Professor

07. Regional Agricultural Research Station, Aralaganwila

i. Mr. A. Lecamwasam	Deputy Director (Research)
ii. Mr. Y. Ketipearachchi	RO, Entomology
iii. Dr. M.A. Lathiff	RO, Soil Chemistry & Fertilizer
iv. Ms. S.W.K. Weerasinghe	RO, Agronomy
v. Mr. S.H.S.A. de Silva	RO, Water Management
vi. Mr. Shantha Peiris	RO, Horticulture

08. Regional Agricultural Research Station, Girandurukotte

i. Mr. M.G. Dhanapala	RO, Entomology

09. Sugar Research Institute, Colombo

i. Dr. N. Dharmawardane	Director
10. Farmers, etc	**(See also Appendix XIII)**
i. Mr. A. M. Jayatilake	Resident Manager, Forbes Agricultural Service (Pvt) Ltd.
ii. Mr. Wijeratne	Farmer Kalukele
iii. Mr. H.M. Somasiri	Farmer Kalukele
iv. Mr. W.M.D. Banda	Farmer Madurangala

XVI. ITINERARY FOR VISIT TO SRI LANKA
JUNE 1992

02 June	Departure Rawalpindi 0900 hrs, arrival Karachi 1230 hrs. Departure Karachi 1700 hrs, arrival Colombo 2040 hrs.
03 June	Visited USAID Office with Dr. G.W. Selleck. Discussion with Dr. Gary E. Alex and Mr. Nimal Jayasuriya. Departure Colombo 1430 hrs, arrival Pimburattewa 2015 hrs.
04 June	Discussion with Dr. Bruce Spake and Dr. G.W. Selleck. Visited Regional Agricultural Research Centre, Aralaganwila (RARC). Discussion with Mr. A. Lecamwasam accompanied by Dr. G.W. Selleck. Examined material collected by Mr. I.M. Nihal Chandarasiri and Mr. B. Ranjith Piyadasa.
05 June	Went to RARC, Aralaganwila. Visited farmers fields at Mahadamana, Kalukele, examined greengram fields where trials on pesticides were being done by Mr. Chandrasiri. Trained post graduate students in sorting out insect collection and maintenance of record.
06 June	Went to RARC Aralaganwila, visited Sevanapitiya and Madurangala, examined chilli trial run by Mr. Piyadasa. Training in sorting out the collection and maintenance of record.
07 June	Went to RARC Aralaganwila. Visited Seed Farm and Mahadamana with Dr. G.W. Selleck, Mr. Piyadasa and Mr. Chandrasiri, examined greengram trials at Mahadamana and chilli and cabbage at Seed Farm.
08 June	Went to RARC Aralaganwila. Examined material collected by Mr. Piyadasa, discussion with Mr. Y. Ketipearachchi about his work on gherkin, helped Mr. Piyadasa in writing his work on chilli.
09 June	Went to Agricultural Research Station, Girandurukotte. Discussion with Mr. Lecamwasam and Mr. D.G. Dhanapala about brochure on IPM of mango pests. Discussed Mr. Dhanapala's plan of work for the next season.
	At RARC Aralaganwila. Helped Mr. Piyadasa in sorting out his collection. Helped Mr. Chandrasiri write his M. Phil. synopsis.

10 June	Went to RARC Aralaganwila. Visited Dharmasena Farm, examined grapes and baby corn. Discussion with Mr. Dhanapala who was visiting Aralaganwila, helped Mr. Piyadasa in writing his work on chilli.
11 June	Went to RARC Aralaganwila. Trained Mr. Chandrasiri in identification and maintenance of insect collection, helped him in writing his work on greengram. Worked on IPM brochure.
12 June	Helped Mr. Chandrasiri in finalising synopsis of his thesis. Analysed Mr. Chandrasiri's data on greengram. Departure Pimburattewa 1430 hrs, arrival Kandy 1800 hrs.
13 June	At Kandy. Report writing and analysis of Mr. Piyadasa's and Mr. Chandrasiri's data
14 June	At Kandy, report writing and analysis of Mr. Piyadasa's and Mr. Chandrasiri's data
15 June	Went to University of Peradeniya with Dr. G.W. Selleck. Met Prof Dr. H.P.M. Gunasena and Dr M.H.J.P. Fernando. Discussion with Dr. H.N.P. Wijeyagunasekara and Dr. Daya Ahangama. Departure Kandy 1600 hrs, arrival Pimburattewa 1930 hrs.
16 June	Report writing. Went to RARC Aralaganwila, examined material. Helped Mr. Piyadasa in writing his work on chilli.
17 June	Went to RARC, Girandurukotte, discussion with Mr. Dhanapala. Visit pesticide dealers, commercial farmers, helped Mr. Chandrasiri in writing his work on greengram.
18 June	Compiling report, visit commercial farmers.
19 June	At RARC Aralaganwila. Departure Pimburattewa 1500 hrs, arrival Colombo 2030 hrs.
20 June	At Colombo, worked on draft of the report
21 June	Visited Sugarcane Research Station, Udawalawe.
22 June	Visited USAID office for debriefing. Report writing.
23 June	Worked on report. Departure Colombo 2140 hrs.
24 June	Arrival Karachi 0255 hrs. Departure Karachi 0700 hrs, arrival Rawalpindi 1000 hrs.

APPENDIX I

TERMS OF REFERENCE OF CONSULTANCY

1. Work with the Department of Agriculture staff at Girandurukotte and Aralaganwila to edit for publication. Translate into Sinhala and Tamil and publish an extension brochure on Integrated Pest Management of fruitflies on mango. This will be useful for commercial farmers as well as for settlers. In his latest report Dr. Mohyuddin presented a draft manual, based on his many years of work with mango pests in Pakistan.

2. Evaluate progress, make suggestions for improved methodology and recommend the next steps for the PGIA students working on IPM of chilli and legume crops. These two students are currently in the field jointly supported by the PARC/Agralaganwila and MEA/MARD.

3. Provide advice and material for on-going IPM programmes on mango and guava.

4. Provide information and suggestions to support the on-going research on gherkin IPM at RARC/Aralaganwila and fruit crops IPM at Girandurukotte.

5. Assess the equipment currently available to researchers at Aralaganwila and Girandurukotte and suggest necessary acquisitions.

6. Assess current agrochemical usage by settlers and commercial farmers in System B. To do this Dr. Mohyuddin will visit a sample of agrochemical supply shops and check products availability, expiry dates, availability of explanatory material in English and Sinhala. He will also meet with representative settlers and commercial farmers to discuss and assess their current pesticide use patterns. DOA/MEA/EIED/MARD and MED staff will assist in this task.

7. Present seminar on progress and problems to DOA/MEA/EIED/MARD and USAID.

8. Develop a schedule, including interim actions to provide for completion of IPM recommendations and extension publications for chilli, legume crops, gherkin and guava.

9. Develop materials and plans for farmer training workshops on pesticide safety.

APPENDIX II

A CHEAP AND SAFE METHOD OF CONTROLLING FRUITFLIES ON MANGO, GUAVA, ETC IN SRI LANKA

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*An Institute of CAB International

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FOREWORD

MASL and MARD, with USAID support have increased their emphasis on Integrated Pest Management (IPM) to improve yields and income for diversified cropping and to reduce the use of pesticides. The IPM technologies developed under the project will be transferred quickly to farmers and extension workers.

This is the first brochure in the series. It is based on work in Pakistan, verified by trials in Sri Lanka. I hope farmers, extension workers and people involved in plant protection will benefit from the technology described in this brochure.

Dr. Max D. Goldensohn
Chief of Party
Mahaweli Agriculture & Rural Development Project
Mahaweli Downstream Support Project
Vice President DAI
Pimburattewa
Sri Lanka.

INTRODUCTION

Over the past few years there has been an increase in mango cultivation in Sri Lanka in general and in Systems B and C in particular. Both commercial farmers and settlers are growing more and more mango trees. In system B some commercial farms such as Eriyagama Farm, Jayaratne Farm, Earth Movers Farm, etc. have already large areas under mango cultivation. In system C, Ceylon Tobacco Co. has planted mango on 30 acres at Mahiyangana. Not only the area under cultivation is increasing, better varieties of mango are being introduced by the Department of Agriculture, Sri Lanka and the MARD Project.

At present, very little insecticide is used for controlling fruitflies on mango and guava. With increase in mango production and its commercial value, farmers will certainly start using insecticides for fruitfly control.

Technology to control fruitflies on mango, guava, oranges, etc with methyl eugenol was developed at the PARC-IIBC Station, International Institute of Biological Control, Rawalpindi, Pakistan and is being extensively used by the farmers in Pakistan.

Before transferring it to the farmers, its suitability for ecological conditions in Sri Lanka has been studied by the staff of the Agricultural Research Station, Girandurukotte in System C and staff of the MARD Project in System B. It has been found extremely effective.

This technology is being presented in this brochure and it is hoped that the Extension Workers and farmers in Sri Lanka will benefit from this method. It is cheap, safe and without harmful side effects.

This brochure is being produced in English, Sinhala and Tamil for the benefit of farmers in Sri Lanka.

A. Lecamwasam
Deputy Director (Research)
Regional Agricultural
Research Centre
Department of Agriculture
Aralaganwila.

FRUITFLIES

In Sri Lanka two species of fruitflies Dacus zonatus and D. dorsalis attack mango, guava, orange, etc. They damage up to 40% mango and 70% guava fruit.

1. Dacus zonatus:

It is native to South West Asia. It is widely distributed in Sri Lanka and is a serious pest of mango, guava, orange, etc.

The adults mate 15 days after emergence. Five days later the females start laying eggs by inserting ovipositor in the fruit (Fig. 1). On hatching fruitfly larvae start feeding inside the fruit and destroy it (Fig. 2). The development is completed in about twenty days.

Fig. 1. Fruitfly adult laying eggs in mango.

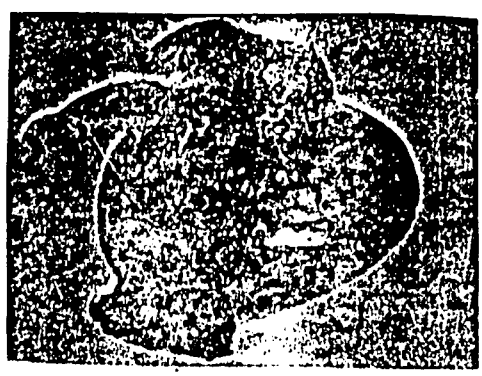


Fig. 2. Fruitfly larvae feeding in mango Fruit

2. Dacus dorsalis:

This fruitfly is widely distributed in Asia, northern Australia, Hawaii, etc. In Sri Lanka it is widely distributed. It attacks mango, orange, guava, etc.

The Adults mate 21-22 days after emergence and the females start laying eggs two days later in the fruit. A female lays up to 1,318 eggs in about 73 days. The development is completed in 21 days. Thus a number of generations are completed during the year.

The larvae of both the above mentioned species when fully developed leave the fruit and fall on the ground, where they enter the soil and pupate. From the pupae adults emerge. After mating the females start laying eggs in the fruit. Thus a number of generations are completed during the year.

CONTROL MEASURES

A number of pesticides such as Diptrex, Nogos, Dimacron, Lebaycid, etc. are used for controlling the fruitflies but in addition to being expensive, they have other harmful side effects such as outbreak of other pests because of elimination of natural enemies, pollution of the environment, etc.

PARC-IIBC Station, International Institute of Biological Control, Rawalpindi, Pakistan developed technology for fruitfly control. It is inexpensive, safe without harmful side effects. This method involves the use of an attractant (lure) methyl eugenol in traps.

METHODOLOGY OF USING THE LURE

Method of using methyl eugenol for controlling fruitflies is briefly described, below:

Small cotton swab soaked with the lure is kept in the trap. The trap is a plastic jar about 25 cm by 15 cm. On two ends of the jar, after cutting holes about 2.5 cm in diameter, 5 cm long tubes of the same diameter are fitted. The cotton swab is almost soaked with lure and put in the trap. It is suspended 1-2 m from the ground on the branches of the trees (Fig. 3).

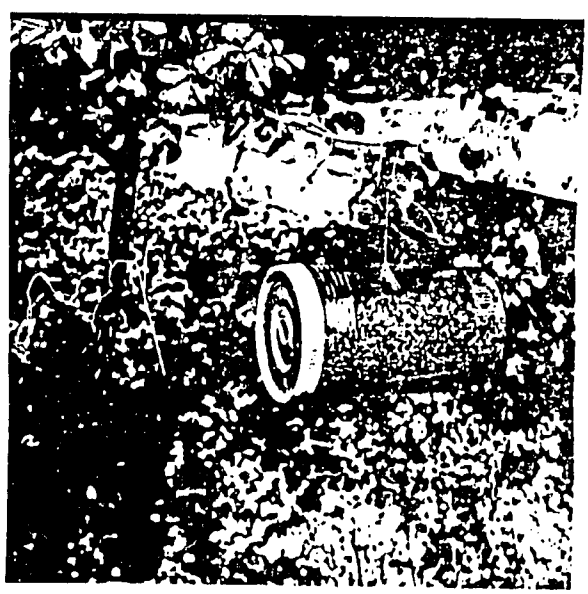


Fig. 3. Trap hanging on a branch of a tree.

The openings of the trap should not be covered with leaves. At fortnightly intervals dead fruitflies (Fig. 4) are removed from the trap and more lure is applied either on the same swab or on a new cotton swab soaked with lure is replaced.

Two traps per acre give an excellent control of fruitflies.

This method is cheap because only very little lure is used and the traps can be used for a number of years.

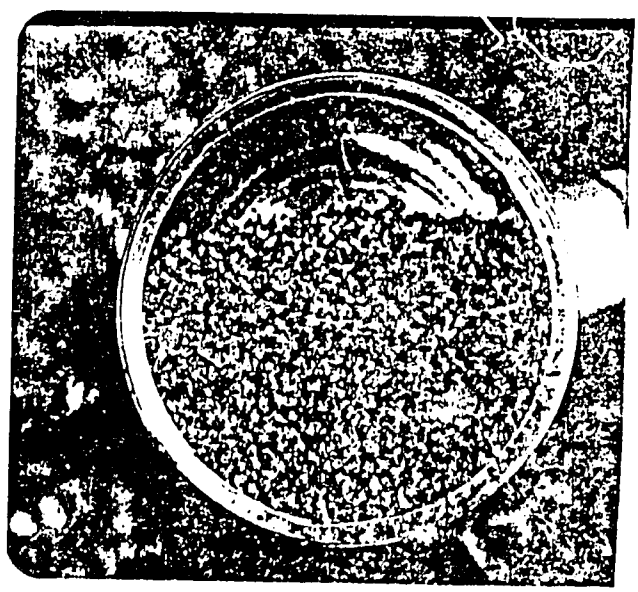
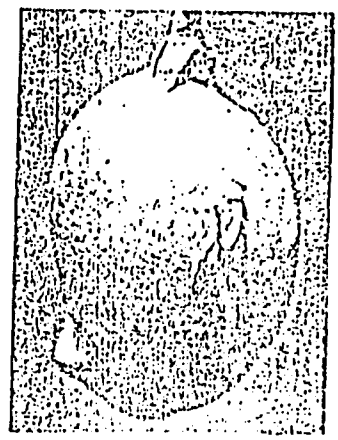


Fig.4. Trap containing dead fruitflies collected during a fortnight.

APPENDIX 111

ලාභදායී හා ආරක්ෂිත අලුත් ශ්‍රී ලංකාවේ අඹ,පේර ආදී පලතුරු බෝග වල පලතුරු මැස්සන් පාලනය නිර්දේශ කුමය.



ඒ.අයි. මොහියුද්දීන් PARC - 11 BC ස්ථානය, අන්තර්ජාතික ශෛව පාලන ආයතනය, තැ.පෙ.8. රාවල්පින්ඩි, පාකිස්තානය.

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මහාවැලි කෘෂිකාර්මික හා ග්‍රාමීය සංවර්ධන (මාර්ඩ) ව්‍යාපෘතිය, පිඹුරන්නෑව.

පෙරවදන.

එක්සත් ජනපද ජාතික්තර සංවර්ධන ආධාර ආයතනයේද සහාය සහිතව ශ්‍රී ලංකා මහවැලි අධිකාරිය හා මහවැලි කෘෂිකාර්මික හා ග්‍රාමීය සංවර්ධන ව්‍යාපෘතිය විසින් පළිබෝධ නාශක භාවිතය අවම කොට කෝෂා විවිධාංගීකරණය තුළින් අස්වැන්න හා ආදායම වර්ධනය කරලීමේදී ඒකාබද්ධ පළිබෝධ පාලනය කෙරේ දැඩි අවධානය යොමු කිරීමට සාටයුතු කරනු ලැබේ. මෙම ව්‍යාපෘතිය යටතේ දියුණු කරවන ලද ඒකාබද්ධ පළිබෝධ පාලන තාක්ෂණ තුම භාවිතාත් කඩිනමින් ගොවි මහතුන්ට හා ව්‍යාප්ති කාරකයින් මෙන ලබා දීමට පියවර ගනු ඇත.

මෙම දැනුම් මාලාවේ ප්‍රථම පොත් පිංම මෙය වේ. එහි සඳහන් විස්තර පාඨිස්ථානයේදී කර ඇති කාර්යයන් මත පදනම් වන අතර ශ්‍රී ලංකාවේදී පමන්වන ලද අත්හදා බැලීම් වලින් සනාථ කරවා ගෙන තිබේ. මෙම කුඩා පොත් පිංවේ විස්තර වන ශිල්පීය තුම වලින් ගොවි මහතුන්වන්, ව්‍යාප්ති කාරක මහතුන්ට හා පැලැටි සංරක්ෂණ සාටයුතු වල නිරත වන්නන්වන් ප්‍රයෝජනවත් සේවාවක් සිදු වෙනු ඇතැයි විශ්වාසයි කරමි.

ආචාර්ය මැක්ස් ඩී. ගොල්ඩන්සන්
කළමනාකරු නායක,
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ශ්‍රී ලංකාව

<u>හැඳින්වීම</u>

ශ්‍රී ලංකාවේ අඹ වගාව ක්‍රමයෙන් දියුණු වෙමින් පවතිනා අතර, විශේෂයෙන් මහමැලි සී තා සී කලාප වල අඹ වගාව සුළුවූ ලෙස ව්‍යාප්ත වෙමින් පවතී. මාණික්‍ය පදනමින් වගා කරන ගොවීන් මෙන්ම පදිංචි කරුමින් විසින්ද අඹ වගාව කරගොන යනු ලබයි. සී කලාපයේ ප්‍රධානම ගොවිපල, රයරන්න ගොවිපල අර්ගත් සුමර්ස් ගොවිපල ආදී ගොවිපලවල් කිහයක කිහාලු සිව් ප්‍රමාණයක් අඹ වගා කර ඇත. සී කලාපයේ ලංකා දැවකොලු සමාගම අක්කර 30 ක පමණ අඹ වගා කර තෙයි. අඹ වගා කරන ඉඩම් ප්‍රමාණය වැඩි වෙනවා මෙන්ම වැඩි දියුණු කලු වර්ග වලින් වගා කිරීම, දිවයින පුරාම කෘෂිකර්ම දෙපාර්තමේන්තුව මගින් ද සී කලාපය තුලු මාර්ග වගාපනිය මගින්ද සොයෙනු ලැබේ.

පලතුරු මැස්සන් මර්දනය සඳහා අඹ ගස ලෙස වගාවන්හි දැනට කෘෂිකාගත යොදීම නොකෙරෙන තරමය. අඹ වගාවේ සිව් ප්‍රමාණය වැඩි වීම හා එහි වාණිජ අගය වැඩි වීමත් සමග ගොවීන් කෘෂිකාගත වාවිතයට නැඹුරුවීම අභිමාර්ගයෙන්ම සිදුවෙනු ඇත. මේ නිසා පලතුරු මැස්සන් මර්ධනය සඳහා විශා ලාභදායී ආරක්ෂිත වෙනත් ක්‍රම භාවිතා කිරීම අවශ්‍ය වේ.

අඹ ගෙවතු ලෙස ආදී වගාවන්හි පලතුරු මැස්සන් මර්ධනය කිරීමට මිනක්ලි ඉදුරුවෙනෝලි යොදා ගැනීම පහසුවෙන්ම අත්කර ගතිය ලෙස පාලන ආයතනය මගින් භාවිතා කළ හැක. එම ක්‍රමය දැන් එහි සුළුවිය වාවිතා වේ. ගොවීන්ට භාවිතා කිරීමට ලෙස මෙම ක්‍රමය පිළිබඳ අධ්‍යයනයක් මහමැලි සී කලාපයේ ගිරිදුරුකොට්ටේ කෘෂිකර්ම පර්යේෂණ ස්ථානයේ දියු කලාප සීට සොයාගන යයි. මහමැලි සී කලාපයේ මාර්ග වගාපනිය මගින්ද මෙම ක්‍රමය යොදා ගැනීම පිළිබඳ කටයුතු කරගොන යයි. මෙම ක්‍රමය ඉතා සාර්ථක ප්‍රතිඵල ලබා දී ඇත.

මෙම ලෙසින් පිංවෙන් සඳහන් වන කරුණු වගාවකි ගෙවතුවන්ට හා ගොවීන්ට ලාභදායී අතුරු භාවී නැති ආරක්ෂිත ක්‍රමය යොදා ගැනීමට, උපකාර වනු ඇතැයි විශ්වාස වේ.

මෙම ලෙසින් පිංවෙ ශ්‍රී ලංකාවේ ගොවීන්ගේ ප්‍රයෝජනය සඳහා මෙලෙස ඉංග්‍රීසි හා දෙමල බසින්ද පලු වේ.

ඒ. ලෝකම්වයම්,
කීටයෝජ අධ්‍යක්ෂ (පර්යේෂණ),
ප්‍රාදේශීය කෘෂිකර්ම පර්යේෂණ මධ්‍යස්ථානය,
කෘෂිකර්ම දෙපාර්තමේන්තුව,
අර්ලගංවිල.

පළතුරු මැස්සන්.

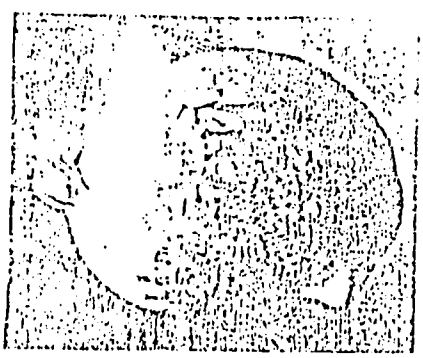
ශ්‍රී ලංකාවේ ඩේකස් සොනේටස් හා ඩේකස් ඩෝර්සාලිස් යනුවෙන් පළතුරු මැස්සන් දෙවර්ගයක් ඇත. මේ පළතුරු මැස්සන් අඹ, පේර, දොඩම් ආදී බොහෝ පළතුරු වලට හානි කරයි. අඹ වලට 40% සා පමණද, පේර වලට 70%ක් පමණද හානියක් සමහර කන්න වලදී සිදුවේ.

ඩේකස් සොනේටස් (Dacus Sonatus)

දකුණු ආසියාවේ මෙම වර්ගය හමුවේ. ශ්‍රී ලංකාවේ පුළුල් ලෙස ව්‍යාප්තව තිබෙන මෙම පළතුරු මැස්සා අඹ, පේර, දොඩම් ආදී පළතුරු වලට හානි කරයි.

නිර්මිතමෙන් දින 15කට පසු පළතුරු මැස්සන් ගේ සංවාසය සිදුවේ. දින 5කින් පසු ගැහැණු සතා බිත්තර දැමීමට පටන් ගනී. ඩිම්බ නිධානයකය මගින් ගොඩිය සිදුරු කර ගොඩිය තුලට බිත්තර දමයි. පිටමන කිමයා පළතුරු ගොඩිය තුල පෝෂණය වෙමින් ගොඩිය විනාශ කරයි. වර්ධනය දින විස්සකින් පමණ සම්පූර්ණ වේ.

1 වන චිත්‍රය.



මැසිපුණු පළතුරු මැස්සා අඹ ගොඩියක බිත්තර දමයි.

2 වන චිත්‍රය.

පළතුරු මැස්සාගේ කීටයන් අඹ ගොඩිය කා දමන අයුරු.

ඩේකස් ඩෝර්සාලිස් (Dacus Sonatus)

මෙම පළතුරු මැස්සා ආසියාවේ, උතුරු ඕස්ට්‍රේලියාවේ, සහ හවායි ආදී රට වලද, හමුවේ. ශ්‍රී ලංකාව පුරාම ව්‍යාප්තව තිබේ. මෙම පළතුරු මැස්සා අඹ, දොඩම්, පේර ආදී පළතුරු බොහෝමයකට හානි කරයි.

නිර්මිතමෙන් දින 21 - 22 පසු සංවාසයේ යෙදීම සිදුවේ. ඉන් දින දෙකකට පසු පළතුරු ගොඩිවල බිත්තර දැමීමට පටන් ගනී. දින 73 කදී පමණ බිත්තර 1318 ක් පමණ දමයි. වර්ධනය දින 21කදී සිදුවේ.

ඉහත සඳහන් කල පළතුරු මැස්සන් දෙවර්ගයේම කීටයන් හොඳින් මැසිපුණු පසු පළතුරු ගොඩිය අහසාර පොලොවට වැටේ. පස තුලට ඇතුළුවී පසේ පිලිමා බිමට පත්වේ. පිලිමාගෙන් පුළුල්ලේ පළතුරු මැස්සන් පිටවේ. සංවාසයෙන් පසු මලි ගැහැණු සතා පළතුරු ගොඩි මත බිත්තර දමයි. මේ අවස්ථාවේ [illegible]

<u>පළතුරු මැස්සන් පාලනය කිරීම.</u>

රසායනික මර්ධනය සඳහා පෙෆන්ගියෝන්, ට්‍රයිග්ලෝපෝන් වැනි කෘමි නාශක යොදාගත හැකිය. මෙම කෘමිනාශක භාවිතය අධික වියදම් සහිත වන අතරම ඉන් ස්වභාවික සතුරන් විනාශවී වෙනත් පලිබෝධකයන්ගේ බාධා ඇතිවීමත් පරිසර දූෂණය වීමත් සිදුවේ.

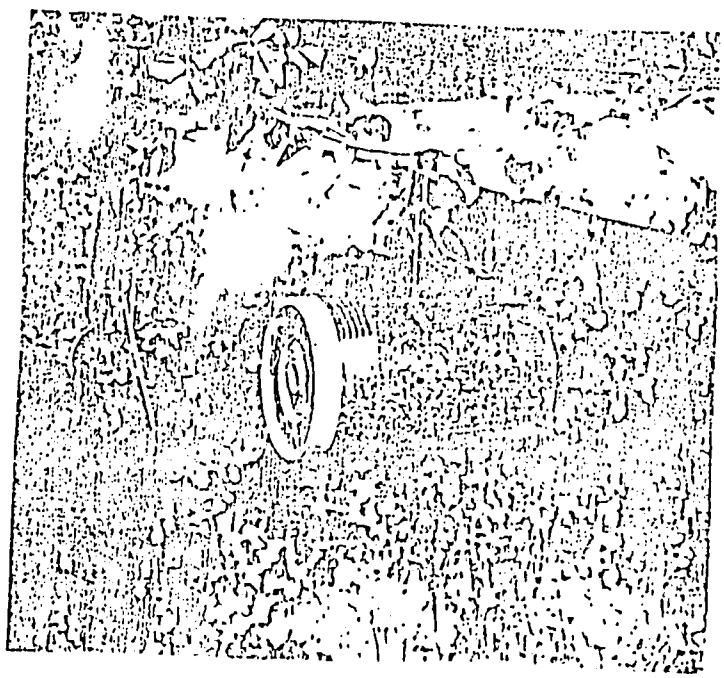
පළතුරු මැස්සන් මර්දනය කිරීමේ කෘෂිකර්ම කුම පාර්ශ්වස්ථානයේ රාවල්පිණ්ඩි නුවර අන්තර්ජාතික ශෛව පාලන ආයතනයේ PARC - 11BC ස්ථානය මගින් මැඩ දියුණු කර තිබේ. මෙය වියදම් අඩු අනුරූපාකෘති නොමැති කුමයක් වේ. මේ අනුව මිතයිල් ඉයුජිනෝල් කෘමි ආකර්ෂකයක් ලෙස යොදා ගැනේ.

<u>කෘමි ආකර්ෂකය භාවිතා කරන අයුරු.</u>

කෘමි ආකර්ෂකය භාවිතා කරන අන්දම සරලම කෙටියෙන් මෙසේය.

කෘමි ආකර්ෂක ද්‍රව්‍යයෙන් පොහවූ පුළුන් කැබැල්ලක් උගුලේ මැදින් සවිකර ඇති කොක්කක රඳවයි. උගුල සෙ.මී.25 ක් පමණ දිග සෙ.මී.15 ක් පමණ විෂ්කම්භය (ඇති ප්ලාස්ටික් බෝතලයකි. බෝතලයේ දෙපස සෙ.මී. 2.5 පමණ විෂ්කම්භයක් සහිත සිදුරු දෙද සෙ.මී. 5 ක් පමණ වන එම විෂ්කම්භයේම කුඩා බට කැබැලි සවි කරයි. පුළුන් කැබැල්ල කෘමි ආකර්ෂක ද්‍රව්‍යයෙන් පොහවා උගුලේ තබයි. උගුල මීටර් 1 - 2 පමණ උසකින් (3 රූප සටහන බලන්න.) උද්‍යානයේ එල්ලා තබයි.

<u>3 වන චිත්‍රය.</u>

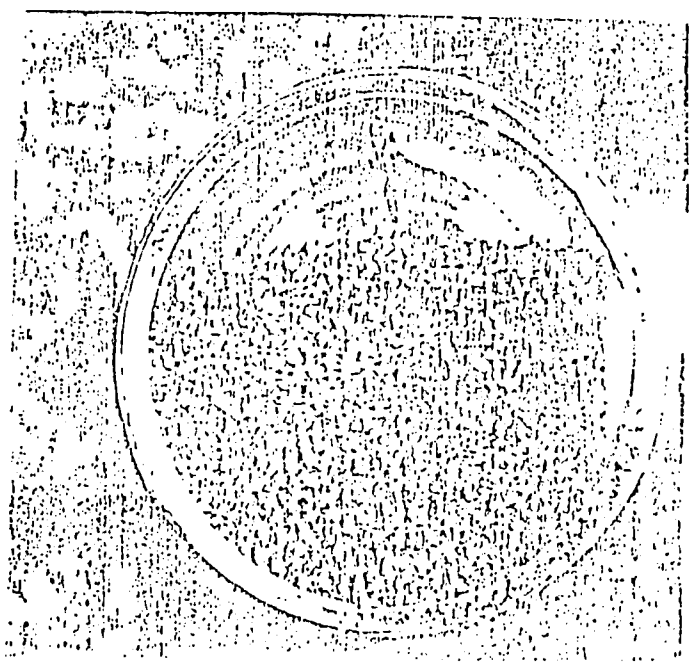


[illegible]

උගුළේ විවර, පතු වලින් ආවරණය වී නොතිබිය යුතුය. දෙසතියකට වරක් මිය ගිය මැස්සන් ඉවත් කර (4 වන රූප සටහන බලන්න.) එම පුළුන් කැබැල්ලට ඉයුජිනෝල් යෙදීම හෝ අලුත් පුළුන් කැබැල්ලක් ආකර්ෂකයේ තිල්වා තැවත තැබීම කළ හැක.

අත්කර්යකට උගුල් දෙකක් ප්‍රමාණවත් වේ. ආකර්ෂකය ඉතා සුළු ප්‍රමාණයක් වැය වන නිසා සහ උගුලක් වසර කීපයක් භාවිතා කළ හැකි නිසා, මෙම ක්‍රමය ඉතාමත් ලාභදායී ක්‍රමයක් වේ.

<u>4 වන චිත්‍රය.</u>



සති 2 ක් තුළ විනාශයට පත් පළතුරු මැස්සන් අඩංගු උගුලක්.

APPENDIX IV

ADVISORY BROCHURE

ON SAFE AND EFFECTIVE USE OF PESTICIDES

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AND

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FSRE Agronomist
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FOREWORD

All crop protection chemicals can be dangerous for human life if proper precautions are not taken while handling. As reported in Worldwatch Paper 79 (1987, Worldwatch Institute, Washington) between 400,000 and 2,000,000 pesticide poisoning occur worldwide each year, most of these among farmers in developing countries and 10,000 to 40,000 such poisioning result in death each year.

At present in System B, pesticides are used, and overused, indiscriminately without taking necessary precautions required for their safe application. MEA/MARD has produced this Advisory Brochure to inform the extension workers and farmers about the precautions that should be taken for the safe and effective use of pesticides.

This Advisory Brochure is available in Sinhala, Tamil and English I hope that extension workers and farmers will find the Brochure useful and will, in there own interest, follow the instructions given therein.

Mr. Bruce Spake
Chief of Party
Mahaweli Agricultural & Rural Development Project
Mahaweli Downstream Support Project
Pimburattewa.

INTRODUCTION

The information on safe and effective use of pesticides is the urgent need of the day. Pesticides are extensively used by farmers. Their use without proper care and precautions is dangerous to human beings and can result in death.

The production of this brochure by the MEA/MARD Project on the safe and effective use of pesticides is highly commendable.

I hope extension workers and farmers will benefit equally from the instructions given in the brochure.

A. Lecamwasam
Deputy Director (Research)
Regional Agricultural Research Centre
Department of Agriculture
Aralaganwila.

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SAFE AND EFFICIENT USE OF PESTICIDES

Crop protection chemicals are dangerous for human life and pollute the environment and are expensive to use. Therefore, they must be used carefully, and applied correctly. The following are guidelines for the safe and efficient use of pesticides.

1. <u>Choice of Pesticides</u>

   (a) Avoid prophylactic use of pesticides, get the crop problem correctly identified so that the right pesticide is used for control.

   (b) Is the use of a pesticide really needed or can control be achieved by cultural, mechanical or biological method?

   (c) If advice is not available, read the pesticide product label - will it control the pest?

   (d) Select the least hazardous effective product.

2. <u>Safety</u>

   (a) All pesticides are harmful. Poison can enter the Systems of people and animals by way of skin, mouth and breathing. Therefore:

   - Avoid skin contact - cover as much of the body as possible when spraying.

   - Do not eat, drink or smoke when spraying.

   - Always wash hands after use and especially before eating.

- Avoid breathing in spray or dust. Spray with the wind direction.

- Keep domestic animals off treated areas.

(b) Protective Clothing

- Use special clothing for pesticide spraying and cover as much of the body as possible to reduce the risk of skin contact. Use adequate head cover to protect the head and neck.

- Some very hazardous chemicals mention specific clothing to be worn when using them. If you have not got the clothing do not use the most hazardous pesticides.

- Wear gloves when mixing and handling the concentrated pesticides. Do not mix the chemical with your bare hand.

(c) Pesticide Containers

- Keep pesticides in their original containers. Do not re-pack the chemical in another container and especially not in food or drink containers.

- Avoid damage to pesticide containers. Take care not to damage the label or instructions for use.

- Dispose off the empty pesticide containers safely. Do not leave them lying about. Bury them deep (at least 20 ins or 50 cm below ground). NEVER use old pesticide containers for food or drinking water.

3. <u>Pesticide Application</u>

(a) Read pesticide label before use, i.e. check:

i. Will it control the problem?
ii. Poison hazards.
iii. Safety precautions.

(b) Read the pesticide label for dose rate. Stick to the dose rate stated. If you use more, you may damage the crop or yourself. If you use less, the pesticide may not control the problem.

(c) Check the pesticide label for mixing instructions and the type of spray equipment needed.

(d) Stand up-wind when mixing the pesticides so splashes and dust blow away. Never mix or measure the pesticide with bare hands - always wear gloves. Do not use mixing buckets for other purposes and especially not for collecting drinking water.

(e) Keep children and animals away when spraying and do not leave pesticide containers or spray equipment unattended.

(f) Do not use faulty or contaminated equipment - wash the outside of the sprayer after each filling.

(g) Do not spray into the wind. Do not work in strong winds.

(h) Do not spray during the hottest time of the day - crop damage may occur and perspiring makes the skin more sensitive.

(i) Do not smoke or chew tobacco when spraying.

(j) Make sure harvest interval (interval between last spray and when crop can be harvested) on label is adhered to. Wait at least 24 hours before entering sprayed crops or allowing animals in, and longer if product label says so.

(k) Plan application so you do not make up more spray liquid than needed

4. <u>After Spray Application</u>

(a) Do not dump left-over spray and washing water in ponds and streams or on roadsides. Dispose off waste in a hole in ground, away from crops and people.

(b) Clean spray equipment at the end of the job. Do not wash sprayer in a stream. Use a bucket to collect water from the stream and clean bucket, self and wash equipment in this. Pour washing water in ground and bury.

(c) Wash contaminated skin and clothing after handling or spraying pesticides and especially before eating, drinking or smoking.

(d) If you feel ill (sick, dizzy, headache, diarrhoea, skin irritation, stomach pains, etc.) visit a doctor immediately and take the pesticide label with you.

(e) If chemical is splashed in your eyes, wash with clean water for at least 10 minutes.

(f) Keep pesticides stored under lock and key before and after use. Keep chemicals away from human and animal food.

ACKNOWLEDGEMENT

The diagrams used in this brochure are through the courtesy and artistry of Dr. B.M.K. Perera, Research Officer, Mahaweli Regional Agricultural Research Centre.

APPENDIX V

ආරක්ෂාකාරී හා වගුදායී අස්වැන්න වලිශබ්ධනාගත තාවනා කිරීම පිළිබඳ උපදේශනයන්

අස්වලාන

ඒ.අයි. මොහිදීන්
සහ
ඒ.සිබ්ලිම් පොලෙස්

මහවැලි කෘෂිකාර්මික හා ග්‍රාමීය සංවර්ධන මධ්‍යස්ථානය
පිළියන්දලාව

අපරවිදන

අග්නි ආරක්ෂා කරන්නාවූ සියළුම රසායනික ද්‍රව්‍ය භාවිතා කිරීමේදී කුමාණුකූල ආරක්ෂාකාරී පියවර අනුගමනය නොකළහොත් ඒවා මනුෂ්‍ය ජීවිතයට ආන්තරායකාරී විය හැක. පළිබෝධනාශක විශවිෂ වෝතලයට ගොන ලෙල්කයේ 400,000 කට වැඩි දෙනෙක් මියයන බව ඇමරිකා එක්සත් ජනපදයේ වොෂින්ටන්හි ලෙල්ක පරිසරය පිළිබඳව තවසුනු කරන "වර්ල්ඩ් වොච්" සංවිධානය විසින් මෑතකදී කරන ලද අධ්‍යයනයකින් හෙළිදරව් වේ. මෙයින්ද වැඩි සංඛ්‍යාවක් මියයන්නේ දියුණු වෙමින් පවතින රටවල් වල බවද පැවසේ.

දැනට, "බී" කලාපය තුළ, පළිබෝධ නාශක භාවිතා කිරීමේදී අනුගමනය කල යුතු ආරක්ෂාකාරී පියවර නොගෙන වග විනාශයකින් තොරව ඒවා අවශ්‍ය ප්‍රමාණයටත් වඩා පාවිච්චි කරන බව පෙනේ. මෙම කරුණු සැලකිල්ලට ගෙන පළිබෝධනාශක භාවිතා කිරීමේදී අනුගමනය කල යුතු ක්‍රියා පිළිවෙල පිළිබඳව ව්‍යාපෘති කාරයන්ගේ සහ ගොවීන් දැනුවත් කිරීම උදෙසා මහාවැලි ආර්ථික ඒජන්සියත්, මහාවැලි කෘෂිකාර්මික හා ග්‍රාමීය සංවර්ධන ව්‍යාපෘතියත් එක්ව මෙම උපදෙස් අන්තර්ගත සඳහන්කොට තිබේ.

මෙම උපදෙස් සිංහල, දෙමළ හා ඉංග්‍රීසි යන භාෂා තුනෙන්ම මුද්‍රණය කොට ඇත. මෙය ව්‍යාපෘතිකාරයන්ටත් ගොවීන්ටත් බෙහෙවින් ප්‍රයෝජනවත් වේයැයි විශ්වාස කරන අතර බිමුත්ගෝම යෝජනා උදෙසා මෙහි අඩංගු උපදෙස් පිළිපදිනු ඇතැයි අපේක්ෂා කරමි.

ඩී.ඒ.ඩී. ජයරත්න
කළමනාකරු නායක
මහාවැලි කෘෂිකාර්මික හා ග්‍රාමීය සංවර්ධන සහ
මහාවැලි පහල නිම්න (සංවර්ධන) සහාය ව්‍යාපෘතිය
පිලියන්දුව

<u>හැඳින්වීම</u>

පළිබෝධනාශක ආරක්ෂාකාරී අන්දමින් හා වැරදි අන්දමින් භාවිතා කිරීම පිළිබඳව නොරැකුණු කඩිනමින් තවදුරටත් කිරීම වූ කලී කාලීන අවශ්‍යතාවයකි. ගොවීන් විසින් පළිබෝධ නාශක වැනි අන්දමින් භාවිතා කරනු ලැබේ මෙම පළිබෝධනාශක ප්‍රවේශයෙන් හා ආරක්ෂාකාරී අන්දමින් පාවිච්චි නොකලහොත් එය මනුෂ්‍යයාට ආන්තරායකාරී වියහැකිවාක් මෙන්ම මරණය පමා ගෙනදිය හැකිය.

පළිබෝධනාශක භාවිතා කිරීම පිළිබඳව " මාර්ග" මහාචාර්ය විසින් සකස්කොට ඇති මෙම උපදෙස් අත්පොත පැරණිය යුත්තකි.

මෙම පුකාශණයෙන් අඩංගු උපදෙස් මහාචාර්යතාරකයින්ට මෙන්ම ගොවීන්වන් එක්වෙස් ප්‍රයෝජනවත් විය හැකි යැයි විශ්වාස කරමි.

ඒ. ලේනම්බයම්
නියෝජ්‍ය අධ්‍යක්ෂ (පර්යේෂණ)
පුරාවේදීය කෘෂිකාර්මික පර්යේෂණ මධ්‍යස්ථානය
කෘෂිකර්ම දෙපාර්තමේන්තුව
අම්පාරෙයිලු

පළිබෝධනාශක ආරක්ෂාකාරී අන්දමින් හා ඵලදායී අන්දමින් භාවිතා කිරීම

රෝග ආරක්ෂා කරන්නාවූ රසායනික ද්‍රව්‍ය පරිසරය අපවිත්‍ර කරන්නාවේම එවා භාවිතා කිරීම සඳහා අධික වියදමක් දැරීමටද සිදුවේ. තවද, මෙම රසායනික ද්‍රව්‍ය මගින් මනුෂ්‍ය ජීවිතයටද හානි පැමිණිය හැක. එම නිසා එවා ප්‍රවේශයෙන් හා ප්‍රමාණයකින් පාවිච්චි කළ යුතුය.

මෙම රසායනික ද්‍රව්‍ය ප්‍රවේශයෙන් හා ඵලදායී අන්දමින් පාවිච්චි කිරීම සඳහා උපදෙස් සමාරක් පහත දැක්වේ:

1. පළිබෝධනාශක තෝරාගැනීම:

(අ). පළිබෝධ නාශක රෝග බෝවීම වැළැක්වීමේ ක්‍රමයක් වශයෙන් භාවිතා නොකරන්න. පළමුව, රෝගයට වැළඳී ඇති රෝගය නිශ්චිතවම හඳුනාගෙන රෝග මර්දනය සඳහා එම නියමිත පළිබෝධ නාශකය පාවිච්චි කරන්න

(ආ). රෝගයට වැළඳී ඇති රෝගය මර්දනය කිරීම සඳහා පළිබෝධනාශක අවශ්‍යමද නැතහොත් යොදවිතැන් ක්‍රම මගින් හෝ යාන්ත්‍රික ක්‍රමයක් මගින් හෝ ස්වභාවික සමතක් වීම් මගින් හෝ එම රෝගය මර්දනය කළ හැකිදැයි සොයා බලන්න.

(ඇ). අවශ්‍ය උපදෙස් ලබා ගැනීමට ඔබට නොහැකි නම් පළිබෝධනාශක අමතර බෝතලයේ ලේබලය හොඳින් කියවා එමගින් මැඩිදී ඇති රෝගය මර්දනය කළ හැකිදැයි බලන්න.

(ඈ). ආන්තරායෙන් ඉතාමත්ම අඩු, රෝගය හොඳින් මර්දනය කළ හැකි පළිබෝධ නාශකයක් තෝරා ගන්න.

ආරක්ෂාව සඳහා ගැනීම

(අ). සියලුම පළිබෝධනාශක අනතුරු සහිතයි. මෙම අවස්ථා වල සත්වා නොවන සමතුලිතයන්ද ශුද්ධියන්ද ආරක්ෂා කිරීමත්ද මනුෂ්‍යයන්ගේත්, සතුන්ගේත් පරිත්‍යාගය ඇතුළුවිය හැක.

එම නිසා

- පළිබෝධනාශක ඒවායේ හැම්ම වලුක්වන්න. ඒවා ඉවත දමා ඒවා බැඳිවාක් දුරට ගෙදිය ආරක්ෂාව කරන්න.
- ඉවත දමා ඒවා හැම්ම එම යොදාගන්න. දුම්පානය නොකරන්න. සෑමවිටම අවශ්‍යතා ඒ ඒවායේ මිශ්‍රණයන්ම හැම ගැනීමට වගර අනතුරු, ශ්‍රීතනට යොදා ගන්න.
- ඉවත ද්‍රව්‍ය හෝ කුඩු ආරක්ෂාව යොදාගන්න ලෙස්ලි ශ්‍රේෂ්ඨ ගෙන දිනවල්ම හෝ ගෙදිය ඇතිවන්න
- පළිබෝධ නාශක ඉවත දමා ශ්‍රීතගන්නා කොටස් ඇතිවන්න සඳහන් කොටස්වන්න

(අ). ආරක්ෂිත ආවරණ:

පළිබෝධනාශක සම මගින් ශරීරයට ඇතුල්වීම වැළැක්වීම සඳහා හැකිතාක්දුරට ශරීරය වැසෙන සේ විශේෂ ඇඳුමක් ඇඳ ගන්න, හිස සහ බෙල්ල හැකිතාක්දුරට ආවරණය කර ගන්න

* සමහර ඉතාමත් ආන්තරාකාරී රසායනික ද්‍රව්‍ය භාවිතා කිරීමේදී විශේෂ ඇඳුම් ඇඳීමට නියම නොවේ ඇත. එම විශේෂ ඇඳුම් ඔබට සොයාගත නොහැකි නම් එම අති ආන්තරාකාරී පළිබෝධනාශක භාවිතා නොකරන්න.

* පළිබෝධනාශක මිශ්‍ර කිරීමේදීත් ඒවා අනපහා හැසිරේදීත් අත්වැසුම් පාවිච්චි කරන්න. හිස් අතින් ඒවා මිශ්‍ර නොකරන්න.

(ආ) පළිබෝධනාශක අඩංගු භාජන:

* පළිබෝධ නාශක යමකින් භාජන වලට නොදමා ඒවා මුලින් අනුරා තිබූ භාජන වලම තබන්න. විශේෂයෙන්ම කෑම බීම දමන භාජන වලට නොදමන්න

* ඒවා අඩංගු භාජන වලට කුමාලු ස්ප්‍රේ නොකරන්න. එහි අලුවා ඇති ලේබලයට හෝ උපදෙස් වලට හානි නොකරන්න

* හිස් වූ පළිබෝධ නාශක බඳුන් ලුවම්බාගමක් අස්කර දමන්න. එම හිස් බඳුන් කෑමේත් කෑම නොදමන්න. ඒවා අළු දෙකක් පමණ වලින් කපා බිලලා දමන්න. හිස් බඳුන් කෑමට හෝ වතුර බීමට කිසි විටකත් පාවිච්චි නොකරන්න.

3. පළිබෝධනාශක යෙදීම:

(අ). යෙදීමට පෙර පළිබෝධ නාශක අඩංගු භාජනයේ ලේබලය හොඳින් කියවන්න

i. මෙම පළිබෝධනාශක යෙදීමෙන් බිලව් භෝගයට වැළඳී ඇති රෝගය මර්දනය කල හැකිද

ii. මෙය යෙදීමෙන් අනුරු අත්තරා සිදුවේද

iii. මෙය අනතුරක් නොමැත අත්දැවීම් යොදන්නේ කොහේද යන්න ලේබලය කියවා සොයා බලන්න

(ආ). යොදන ප්‍රමාණ දැනගැනීම සඳහා ලේබලය කියවන්න. එහි නියම කොට ඇති ප්‍රමාණය පමණක් යොදන්න. ඊට වැඩියෙන් පාවිච්චි කලහොත් භෝගයට හෝ බිලව් අනතුරක් සිදුවිය හැක. ඊට එහා අඩුවෙන් පාවිච්චි කලහොත් රෝගය මර්දනය නොවේ.

(ඇ). මිශ්‍ර කරන ආකාරය දැනගැනීමත් ඉතිරි සඳහා යොදාගත යුතු උපකරණ මොනවාදැයි දැනගැනීම සඳහාත් පළිබෝධනාශක අඩංගු භාජනයේ ලේබලය කියවන්න

(ඇ) පළිබෝධනාශක මිශ්‍ර කරන විට දියර හෝ කුඩු සුළඟට ගසායාමට ඉඩහැර සුළඟ හමන දිශාවට මුහුණලා සිට ගන්න පළිබෝධනාශක මැනීම හෝ මිශ්‍ර කිරීම කිසි විටකත් හිස අතින් නොකරන්න. සෑම විටම අත්වැස්මක් පාවිච්චි කරන්න. මිශ්‍ර කරන භාජන, බාල්දි ආදිය මෙනත් වැඩකට විශේෂයෙන්ම බිමට ගන්නා ජලය දැමීමට නොගන්න.

(ඉ). ඉසින විට ලමයින් හෝ වෙනත් සොදර ඇතිකරන සතුන් එම ප්‍රදේශයෙන් ඉවත්කර තබන්න. පළිබෝධනාශක දැමූ භාජන හෝ උපකරණ පැන්නකට දමා ගණන් නොගෙන නොසිටින්න.

(ඊ). පලුදු වූ භාජන හෝ පළිබෝධනාශක තැමරුණු උපකරණ පාවිච්චි නොකරන්න. පළිබෝධනාශක පිරවූ සෑම අවස්ථාවකම භාජනයේ පිටපැන්න සෝදා දමන්න.

(උ) සුළඟ හමන දිශාවට නොඉසින්න. එමෙන්ම නදින් සුළඟ හමන විට නොඉසින්න.

(ඌ) ඉතා නදින් අවම පායා ඇතිවිට පළිබෝධනාශක ඉසීම නොකරන්න. එසේ කලහොත් හෝගයට හානි පැමිණෙනවාත් හැර දානිය දමන නිසා සම මොළොක් වී ඔබේ ශරීරයටද හම්මා ඇතුල්විය හැකිය.

(එ) පළිබෝධනාශක ඉසින විට දුම්බීම හෝ බුලත්විට කෑම නොකරන්න ලේබලයේ දක්වා ඇති අස්වැන්න නෙලීමේ කාලය (අස්වැන්න නෙළීමට පෙර පළිබෝධනාශක ඉසීම හැඟැන්විය යුතු කාලය) හැන සැලකිලිමත් වන්න. පළිබෝධ නාශක ඉසීමෙන් පසු අඩුතරමින් පැය 24 ක් වත් ගතවන තුරු ඒ ප්‍රදේශයට සතුන් නොයවන්න. එවිට වැඩි කාලයක් ඉසින ලද ප්‍රදේශයෙන් ඉවත් ව සිටින්නැයි ලේබලයෙහි දැක්වෙන්නේ නම් එසේ ඉවත්ව සිටින්න.

(ඔ) ඉසීමට අවශ්‍ය ප්‍රමාණයට වඩා වැඩිපුර දියර මිශ්‍රණ පිළියෙල නොකිරීමට සැලැස්මක් සාදා ගන්න.

4. පළිබෝධ නාශක ඉසීමෙන් පසු

(අ). ඉතිරිවන පළිබෝධනාශක දියර මිශ්‍රණය හෝ ඉසින භාජන සෝදන ජලය ඇළ මාර්ගවලට හෝ ජලය රැස්කර ඇති ස්ථාන වලට හෝ පාර අසලින් නොදමන්න ඉතිරිවන දුවය හෝගයටත් මිනිසුන් හැමසෙන ස්ථානයටත් ඇතින් වලක් කපා වලලා දමන්න.

(ආ). ඉසීමේ කාටසුතු අවසානවූ වහාම උපකරණ සෝදා පවිත්‍ර කර ගන්න. ඉසින ලද භාජන ජල මාර්ග මල සෝදීමෙන් මලකින්න. බාල්දියකට ජලය ගන්න ඉන් උපකරණත් තමුන්ගේ සෝදා පිරිසිදු වී එම ජලය වලලා දමන්න.

(ඇ). පළිබෝධනාශක යෙදූපසු ඒවා තැමරුණු තමන්ගේ සමත් පාවිච්චි කල ඇඳුම් ද සෝදා දමන්න. විශේෂයෙන් කෑම බීම ගැනීමටත් දුම්පානය කිරීමටත් පෙර මෙසේ සෝදා ගත යුතුය.

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(අ). ඔබට අයත්ව ගතියක් දැනෙන්නේ නම් (කැරකිල්ල, හිරුදැවීම, පාමිනය, සමේ දැමිල්ල, උදර ප්‍රදේශයේ කැක්කුම ආදිය) මහාම සමෙදැවෙන්නෙමි බලාපොරොත්තු වෙමි. එසේ වනවිට පළිබෝධනාශක භාවනයේ අලුතා ඇති ලේබලය ඒගැන කියවා අමතක නොකරන්න

(ඉ). පළිබෝධනාශක ඉසින විටදී ඔබේ ඇස්වලට වැටුණු නම් අසූ තරමින් විනාඩි 10 ක් ගතකරන තුරුම් ඇස් පිරිසිදු ජලයෙන් සෝදන්න.

(ඊ). පළිබෝධනාශක පාවිච්චි කිරීමට පෙරත් පාවිච්චි කිරීමෙන් පසුවත් ඒවා පෙට්ටියක් වැනිදේක දමා අගුලු දමා මගා තබන්න. කෑම බීම හෝ සත්ව ආහාර සමඟ පළිබෝධනාශක නොතබන්න.

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APPENDIX VI

ADVISORY LETTER ON MECHANICAL CONTROL OF CROP PESTS

Dear farmer,

On your crop insect pests can be killed by spraying pesticides. But they cost money and are poisonous. They can be hazardous to your health and to your domestic animals.

There are other ways to kill crop pests. These ways are not dangerous to your health and do not effect your domestic animals. These ways are:

Pick off the plants by hand pests destroying your crop. Throw the insects on the ground and smash them with a shoe or on the leaves between your fingers. If you do not want to smash the insects, then use the following method.

Pick the insects up and put them in a pot, jar, or can one quarter filled with kerosene oil. The insects will die in the container.

These methods kill the insect pests in a very short time, perhaps giving them a less prolonged death than pesticides.

As an alternative to pesticide use, please try these methods.

Bruce Spake
Chief of Party
Mahaweli Agricultural & Rural Development Project
Mahaweli Downstream Support Project
Pimburattewa.

APPENDIX-VII

උපදේශාත්මක වචනයක්

ගිනවන් ගොවි මහතාණෙනි,

ඔබේ වගාවන්ට හානි පමුණුවන්නාවූ කෘමීන් පළිබෝධ නාශක භාවිතයෙන් විනාශ කර දැමිය හැකිය. එහෙත්, ඒ සඳහා මුදල් වියදම් මත අතර පළිබෝධනාශක විෂ සහිත වෙයි. එවා ඔබේත් ඔබේ ගෙදර දොරේත් ඇති දැඩි කරන්නාවූ සතුන්ගේත් ශරීර සෞඛ්‍යයට හානිදායක විය හැකිය.

රෝග වලට හානි කරන්නාවූ කෘමීන් විනාශ කර දැමීම සඳහා වෙනත් ක්‍රම තිබේ. මෙකී ක්‍රම ඔබේ හෝ ඔබේ ගෙදර දොරේ ඇති කරන්නා වූ සතුන්ගේ හෝ ශරීර සෞඛ්‍ය කෙරෙහි අහිතකර අන්දමින් බලපෑමක් නැත්තේය.

හානිකර කෘමි සතුන් විනාශ කර දැමීමේ ක්‍රම කිහිපයක් මෙසේ දැක්විය හැකිය.

ඔබේ වගාවන්ට හානි කරන්නාවූ කෘමීන් අතින් අල්ලා දමන්න. ඔවුන් බිම දැමීම කකුළුවන් පාගා දැමීම හෝ සොල අතරේ තබා ඇඟිලි මිලින් ඉතාමත් දැමීම හෝ කළ හැකිය. කෘමීන් පොඩිකර දැමීම ඔබ ප්‍රිය නොකරන්නේ නම් පහත දැක්වෙන ක්‍රමය අනුගමනය කරන්න

කෘමීන් අල්ලා තුම්බෙල් කාලක් පමණ පිරවූ භාජනයකට දමන්න. එවිට කෘමීන් භාජනය තුළ විය යනු ඇත.

මෙම ක්‍රමය භාවිතා කිරීමෙන් පළිබෝධ නාශක මිලදී ගැනීමෙන් කෘමීන් විනාශ කර දැමිය හැකිවේ. එම නිසා පළිබෝධ නාශක පාවිච්චි කිරීම වෙනුවට මෙකී ක්‍රම භාවිතා කර බලන්න.

බිමල් ජයලත්
කෘෂිකාර්යවේදී නායක
මහවැලි කෘෂිකාර්මික ග්‍රාමීය සංවර්ධන සහ මහවැලි පාලන නිලමන
(සංවර්ධන) සහාය ව්‍යාපෘතිය
පිඹුරන්හැව

APPENDIX VIII

PLAN OF WORK ON CHILLI

Studies on biology and ecology of some chilli pests in system B for development of IPC

B. Ranjith Piyadasa

1. For survey of pests and their natural enemies collect adults and immature stages of insects and mites associated with chilli plants. Rear the immature stages in the laboratory for the narural enemies and adult stage of the pests, for obtaining identification.

2. Preserve the insects recorded and send these for identidication to IIE, London.

3. Study population trends of major pests and their natural enemies in fields sprayed with pesticides and without pesticides. Number of aphids, thrips, mites, etc. and other pests will be counted on 50 leaves collected at random. Population of pod borer will be studied on 300 pods examined at random.

4. Some observations on biology, ecology including phenology will be made both in the field and laboratory.

5. Establish culture of Helicoverpa (Heliothis) armigera to study its biology and ecology.

6. Possiblities of encouraging the endemic natural enemies will be investigated.

7. Effect of various cultural practices on population trends of pests and their natural enemies will be investigated.

APPENDIX IX

PLAN OF WORK ON GREENGRAM

Studies on biology and ecology of some greengram (*Vigna radiata*) pests with a view to develop their integrated pest control

I.M. Nihal Chandrasiri

1. For survey of pest and their natural enemies collect pests attacking different parts of the palnt and rear the immature stages in the laboratory for obtaining the adults of the pests and their natural enemies for identification.

2. Preserve the adults of pests and their natural enemies and send these to IIE, London or USDA, Beltsville, for obtaining their identification.

3. For studing population trends of major pests and incidence of their natural enemies in plots treated with pesticides and without pesticides sampling is to be continued.

4. Start studies on biology and ecology of *Spodoptera litura*.

5. Effect of cultural practices on infestation of major pests are to be investigated.

6. Investigate possibilities of encouraging the endemic natural enemies for control of various pests.

APPENDIX X

M PHIL SYNOPSIS OF I.M. NIHAL CHANDRASIRI
BOARD OF STUDY - AGRICULTURAL BIOLOGY

SUPERVISORY COMMITTEE - DR. A.I. MOHYUDDIN AND OTHERS

INSECT COMPLEX ASSOCIATED WITH GREENGRAM (*VIGNA RADIATA*) IN MAHAWELI SYSTEM B AND STUDIES ON BIOLOGY AND ECOLOGY OF *SPODOPTERA LITURA*

INTRODUCTION

Greengram (*Vigna radiata* L. Wilozeke) has great potential as a crop in System B. This crop is important to the farming system because it fixes nitrogen and is, therefore, ideal in crop rotations; its resource requirements are low; it has a stable market; and it is a storable commodity. Cultivation of greengram in System B has increased and was 113.4 hectares in 1991. Farmers can earn more than Rs. 30,000 per hectare (Gleason *et al.*, 1990).

Beanfly, *Ophiomyia phaseoli*; pod boers *Maruca testulalis*, *Heliothis armigera*, *Lampides boeticus*; leaf hopper, *Empoasca* sp.; aphids; *Spodoptera* sp.; and whitefly, *Bemisia tabaci* are its major pests (Anon., 1990).

Farmers spray insecticides indiscriminately to control pests. Most sprays are prophylactic in nature. Farmers usually spend more than one-third of their total costs of production on pesticides. Use of pesticides also creates environmental pollution, resulting in health hazards; resurgence of secondary pests can occur due to elimination of their natural enemies. Moreover, pests develop resistance to pesticides and higher doses or more poisonous insecticides are required for their control.

The cheapest and safest method of pest control is Integrated Pest Management (IPM). In order to develop IPM, detailed observations on biology, ecology and phenology of pests and their natural enemies are required. In the present project, it is intended to collect this information for possible development of IPM for greengram pests.

OBJECTIVES

1. Study insects associated with greengram in System B.

2. Study the biology and ecology of *Spodoptera litura*.

3. Study the population dynamics of major pests and their natural enemies.

4. Study the effect of insecticides on pests and their natural enemies.

5. Study the damage caused by major pests.

6. Some observations will be made on greengram pests which also feed on cowpea (*Vigna unguiculata*).

EXPERIMENTS

1. A survey will be made for greengram pests and their natural enemies by visiting farmers' fields on a regular basis. Pests and their natural enemies will be collected. Immature stages will be reared to adult in the laboratory. Adults will be preserved, labelled and sent to the Institute of Entomology, London for identification.

2. *Spodoptera litura* culture will be established in the laboratory for investigation on its biology and ecology. Observations will also be made on its biology and ecology in the field.

3. To study population trends of greengram pests and their natural enemies, 50 leaves will be collected randomly from plants at 2-week intervals. These will be counted in the laboratory, using a binocular microscope. The data will be recorded and analyzed. Graphs will be prepared showing the population dynamics of these pests and their natural enemies.

4. To study the effects of insecticides on pests and their natural enemies, two similar fields will be selected. One will be sprayed with pesticides while the other will be kept as a control. Both fields will be sampled at intervals of a fortnight. Population trends of the pests and their natural enemies will be compared.

5. To determine pest damage, rates of infestation will be recorded and an effort will be made to determine reduction in yield.

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REFERENCES

Anon. (1990). Crop Recommendations Technoguide. Ministry of Agricultural Development and Research, USAID and the MARD Project, 320 pp.

Gleason, J.E., W.H.A.S. Dinatissa, and N.P. Tittagalle (1990). Diversification Report: Yala 1990, Mahaweli, System B. MARD/MDS Porjects, Pimburattewa. 22 pp.(mimeographed)

APPENDIX XI

PLAN OF WORK ON GHERKIN

It is suggested that trials similar to the ones done earlier, at Sunfrost Farm and at least at one out grower's field should be repeated. The details are as follows:

1. Additional insect and mite species associated with gherkin crop should be recorded. Immature stages collected from various parts of the plant in the field should be reared in the laboratory for adult stage of the pests and their natural enemies.

2. Identifcation of additonal pests species and their natural enemies should be obtained either from IIE, London,, UK or USDA, Beltsville, Maryland, USA.

3. Population trends of the pests and their natural enemies should be investigated in plots receiving the usual insecticide treatment and without insecticides.

4. Effect of various cultural practices on population trends of pests and their natural enemies should be investigated.

5. Possibilities of encouraging the endemic natural enemies may be studied.

6. Based on the above mentioned studies integrated control of gherkin pests can be develop.

APPENDIX XII

RESEARCH PROGRAMMME OF MR. M.G. DHANAPALA (RO)

FOR MAHA 1992/93

1. Survey for pests and their natural enemies on sweet potato in different agro-ecological regions.

2. Evaluation of IPM package for sweet potato weevil *Cyclas formicarius* (Fab.).

3. Studies on population dynamics of banana weevil and long term effects of weevil control programme.

4. Screening of varieties on leaf curl in tomato.

5. Damage estimation trap and without trap.

FOR YALA 1993

1. Evaluation of IPM package for sweet potato weevil control.

2. Studies on population dynamics of banana weevil and long term effects of weevil control programme.

3. Screening of varieties on leaf curl in tomato.

4. Studies on biology and ecology of mangohoppers and their control using insecticides.

APPENDIX XIII

List of farmers, dealers and commercial farmers contacted regarding pesticide distribution, etc.

Name	Address
1. W.G. Somadasa	88 Madurutenna, Wijayabapura
2. W.M.A. Senaviratne	107 Track 04, Wijayabapura
3. M.R.M. Kalubanda	81 Devagama, Wijayabapura
4. M. Kalugalla	101 Aralaganwila, Wijayabapura
5. P.G. Ukkubanda	190 Tispanegama, Dimbulagala
6. W. Somadasa	159 Tispanegama, Dimbulagala
7. U.M. Heenbanda	151 Tispanegama, Dimbulagala
8. H.R.M. Muthubanda	209 Tispanegama, Dimbulagala
9. I.M. Ukkubanda	194 Tispanegama, Dimbulagala
10. J.D. Jayasinghe	Mahadamana, Ellewewa
11. Buddist priest	Sevanapitiya
12. D.R. Punchibanda	36/2 Kalukele, Ellewewa
13. Wijesekara	Kalukele

Pesticide Dealers

1. Samarakoon Seed Co, 829, Peradeniya Road, Kandy
2. Uniqchem Dalada Weediya, Kandy
3. Don & Sons Agro Centre Sandunpura. At this shop also met Mr. Rohan P. Piyasena BASF Technical Sales Excutive and obtained information
4. Nihal Chemicals, Manampitiya
5. Agrochemical Co., Manampitiya
6. Mahinda Hardware Store, Aralaganwila

Commercial Farmers

1.	J & P. Farm	Mr. R.M. Jayaratne (Owner)
2.	Royal Garden Farms	Mr. D.S. Dharmadasa (Manager)
3.	Forbes Agricultural Services (Pvt) Ltd.	Mr. A.M. Jayatilake (Resident Manager).