Tropical Agricultural Research Vol. 1 1989

Pesticide Management by the Hill Country Vegetable Farmers

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ABSTRACT. Pesticide management by vegetable farmers of hill country were studied by monitoring 204 randomly selected farmers in a community where multiple cropping is practiced. Year round intensive cultivation of both exotic and indigenous vegetables were done at both villages studied.

Among the 204 farmers interviewed 86.3% of them expected instant knockdown of pests after pesticide application. This quick kill attitude was common to many farmers irrespective of their level of education. Need to keep the crop absolutely pest free until sales forced 76.7% of the farmers to apply higher concentrations than recommended. This was true even with 60% of them who had an education of grade V or above. However 16.7% of the farmers used more diluted solutions due to financial constraints. None of them are concerned or aware about potential development of pest resistance due to such practices.

Although 97% of the farmers stored pesticide outside their homes 46% of them used common household utensils for the preparation of pesticide solutions for spraying, 81% of the operators used bare hands for pesticide mixing. Fifty five percent of the operators did not cover their head or face although 8.3% of them covered nose and mouth with a piece of cloth, 11% were top bare bodied and 14% wore minimum cloth during spraying.

We found that 92% of the farmers have never attended any training programmes or instruction courses. However 82% of them were very keen to learn skills and better pesticide management practices.

We recommend "wide participation" techniques such as group discussions and training workshop or pesticide festivals in addition to training traders, outdoor advertisements and use of mass media such as TV and news papers to improve their skills of pesticide management.

INTRODUCTION

Total pesticide market of Sri Lanka in 1984 amounted to 2705 metric tons of value $US 6.69 million, an increase of 40% in the technical grade pesticides and 42% increase in formulated product over 1982 (Atapattu, 1987). With the introduction of new improved varieties and intensive cultural practices farmers are compelled to use more and more pesticides.

The average annual growth of pesticide use for the period 1980–85 was 12–16% in Sri Lanka in comparison to 5–6% in neighbouring India (Gaston, 1986).

It was decided on the basis of a preliminary study that the pesticide management practices adapted were haphazard and as such demands a more careful investigation.

It was postulated that more insecticides both in quantity and in variety are used by the vegetable farmers than actually required and causes environmental pollution and potential health hazard to consumers.

MATERIALS AND METHODS

The two study sites selected were vegetable cultivating villages namely Kolabissa and Marassana. They were selected mainly because of the intensive nature of the vegetable cultivation practiced and also they were the traditional sources of vegetables for Kandy and nearby townships. Both villages are situated about 30° south east of Kandy about 45 km from University of Peradeniya. Marassana village is situated adjacent to a small township while Kolabissa is a remote village about 10 km interior from Hanguranketha – Kandy trunk road.

Both Marassana and Kolabissa are at 700 meters above sea level in the mid country wet zone where annual rainfall is 0.889 m. Land is steep hilly and rolling. Highland is farmed in typical Kandyan mixed garden system with cocoa, coffee, black pepper, cloves and nutmeg. More steeper terraced land is cropped with tobacco during *Maha* season (North–east monsoon – Oct., Nov., & Dec.). Lowland and valley areas are used for rice cultivation during *Maha* and intensive relay cropping with vegetables is done commencing *Yala* (March) and continue to crop

intensively for about nine months of the year. Lowlands are irrigated with major irrigation tank in Kolabissa while minor irrigation scheme supplies water for vegetable cultivation in Marassana. Many farmers also practice lift irrigation schemes in both villages.

Extent of land areas under vegetable cultivation in these village hamlets is 299.3 ha upland and 206.6 ha lowland. Total number of adult farmers in Marassana is 425 where as in Kolabissa it is 229. Among the 654 farmers 204 farmers were randomly selected for detailed interview. Survey was conducted during cropping seasons between May 1985 to end of 1986 using a structured questionnaire. All farmers were very cooperative and approximately 1 – 11/2 hours per questionnaire was spent with each farmer. Some interviews were video recorded for further analysis.

RESULTS AND DISCUSSION

Wide variety of vegetables both exotic and indigenous types are cultivated in these villages. Very often more than four different types of vegetables are cultivated in any given farm. It was interesting to note that some farmers are more specialized and they cultivated either only cucurbits (gourd family) such as lufa, momordica and snake gourd that are grown on trellis structures or exotic vegetables. Some of them were actually referred to as momordica or bean farmers.

Most popular crop in both villages was found to be beans. Tomato, capsicum, cabbages and cucurbits were also grown. Although similar trends occurred in cropping pattern the use of insecticides in the two villages were different. About 25 different insecticides (trade names) were used by the farmers in the two villages.

Methamidophos (including monitor and tameron) was frequently used at both Kolabissa and Marassana. However preference for use of dimethoate at Marassana is more prominent. Among the other popular insecticides were parathion and fenthion. Although use of endrin is banned in Sri Lanka at present, we observed that high frequency of endrin is used by Kolabissa farmers.

It was revealed that for the control of bean fly a common pest in beans, dimethoate was used heavily at Marassana. Methamidophos

surprisingly took the place of dimethoate in Kolabissa. Most farmers at Kolabissa used methamidophos for beanfly (agromyza) control. Although methomyl, methamidophos, monocrotophos and dimethoate are the insecticides recommended by the Department of Agriculture for the use of pest control in beans, farmers at Kolabissa depended heavily on methamidophos for the control of wide range of pests in beans. They were inclined to use many other pesticides other than the recommended for example parathion was used for the control of bean pests (Figure 1). This apparent trend in the use of many pesticide irrespective of the pest attack demands closer observations on government recommendation and farmers attitude towards them.

As in many other crops for pest control in crucifers (cabbage family) both villages placed the recommended pesticide – monocrotophos at a very low priority and depended heavily on methamidophos and dimethoate (Figure 1).

Wide range of insecticides were used by both villages on tomato, and cucurbits. These crops were frequently treated with methamidophos and dimethoate. None of the farmers used the recommended pesticides for the control of cucurbit pests. However we observed that cucurbits were virtually drenched with pesticides and appeared to be the crop that takes the highest beating.

By and large methamidophos and dimethoate were widely used pesticides over a wide range of crops. Methomyl and monocrotophos were also widely used but at a lower frequency (Figures 1 & 2). In leafy vegetables however, more alarming situations were observed. Often two or more chemicals are mixed together as tank mix when applied to leafy vegetables. There were many farmers who used what is called a "Package" which contain desist (Pyrethroid), complasan (liquid fertilizer) and an undefined fungicide on cabbage. When questioned why this was done, all farmers who used this "package" mix replied that some traders recommended it for better yield and quick knockdown of pests.

Use of highly toxic compounds such as methamidophos, methomyl and monocrotophos were LD_{50} oral is 8 – 17 mg/kg body weight of rat, was at a higher frequency at Marassana. It is noteworthy that highly toxic endrin (LD_{50} = 7.5 mg/kg body weight) is widely used in Kolabissa.

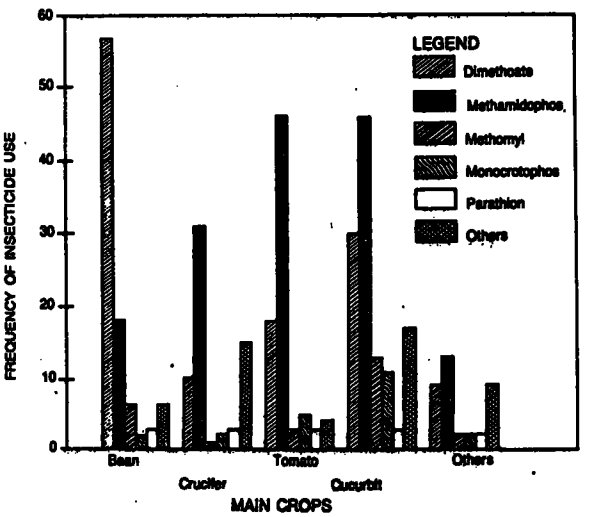

Fig.1. Insecticide use on different crops at Marassana.

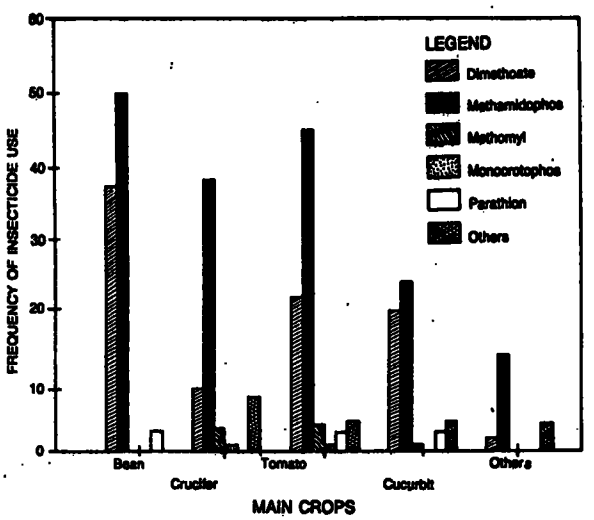

Fig.2. Insecticide use on different crops at Kolabissa.

In general, use of insecticides were not based on any logical/scientific reasons other than observed degree of toxicity.

Clean crop attitude and quick kill belief

The prime objective and the general attitude of the farmers in both villages were to have an absolutely pest free crop. This was mainly a reflection of what is expected from the farmers by most vendors who purchased vegetables at the farm gate. Among the 204 farmers interviewed 86.3% of the farmers expected instantaneous knocked off of pests after spraying, 8.3% in half a day, 4.9% in one day. Only 0.5% of the farmers were expecting the pest control to be effective in 2–3 days after pesticide application.

We believe that this attitude is a direct impact of pesticide advertisements that frequently appear on TV and radio and the demand as well as the higher price paid for pest free vegetables.

It is unfortunate with respect to environmental pollution and health hazard that this absolutely clean crop attitude and quick kill belief has made 76.7% of the farmers to use strong concentrations of insecticides than recommended by manufacturers. Only 6.8% of the farmers used recommended dilutions in the preparation of spray solution. However 16.7% of the farmers still used more diluted solutions than the recommended concentration, mainly due to financial constraints.

Use of higher concentrations are hazardous to persons who are spraying, which most farmers are well aware of. It is also a environmental hazard by way of drift of toxic products and elimination of natural enemies of pests.

Using low dilutions than recommended is however equally worse in creating pests resistance. This is the initiation of a vicious cycle that eventually leads to use of many pesticides and more unacceptable and highly toxic concentrations for the eradication of the resultant insecticide resistant pests. However farmers express the view that "it is difficult to believe that lower concentrations are more detrimental in encouragement of emergence of resistance to insecticides".

Pest management skills

Although most commonly cultivated crops in the study areas were cabbages, tomato, beans and cucurbits most farmers were unable to recognise or give a common local name of any one of the pests of these crops (Table 1). The specialised nature of cucurbit farming was again reflected in the capability of the cucurbit farmers in the identification of cucurbit pests.

No association was observed between farmers ability to identify pests, with their level of education. It is evident from these observations that they have not had any formal or informal training on pest management even in the crops that are most commonly cultivated in these villages. The "inbreeding of incorrect skill" especially in the use of new technology such as pesticide use was evident in 83.3% of farmers seeking advice from fellow farmers and 16.6% from local trader who sold pesticides. We have observed and video recorded an incident of mancozeb being used for the control of caterpillar on radish foliage on the recommendation of the local trader at Marassana.

Although most farmers preferred and actually read the information/instructions given on the pesticide bottle or package (Table 2). They were either not followed or followed partially particularly due to difficulties in understanding the instructions given. The number of farmers who always read instructions were relatively high 79.9% compared to those who do not read at all *i.e.* 2.9%. There was a moderate positive association in reading instructions to the level of education (Crammer's V = 0.26 phi = 0.2662). Although 77.94% said that the instructions are clear enough only 57.8% of the farmers said they actually followed instruction given in the pack for pest control (Table 3).

On further analysis of instructions by education level of farmers it was revealed that more of the educated farmers felt that the instructions on the packs are not clear enough (Table 4). Education by clarity of instructions, contingency table statistics showed that phi coefficient was 0.23 and Crammer's V = 0.232 with a Chi square of 11.0315 at 3 degrees of freedom, suggesting a moderate association to level of education. Even such association was not observed between education level and following instructions (Table 3, Crammer's V = 0.1192 & phi = 0.20)

Table 1. Ability to name (Local name) at least one pest of the main cultivated crop.

RESPONSE	CORRECT		INCORRECT		DON'T KNOW	
CROP	f	%	f	%	f	%
Cucurbits	81	39.70	74	36.37	49	24
Cabbage	32	15.68	114	55.88	58	28
Bean	13	6.37	140	68.62	51	25
Tomato	21	10.29	147	72.05	36	17

Table 2. Frequency of reading of instructions on the pesticide pack by farmers based on their level of education

READING HABIT	LEVEL OF EDUCATION				
	No school	upto 5	5 to 10	O Level	Total
Yes	4 (44.4)	53 (75.7)	99 (86.1)	7 (70.7)	163 (79.9)
No	1 (11.1)	1 (1.4)	4 (3.5)	0 (0.0)	6 (2.9)
Sometimes	4 (44.4)	16 (22.9)	12 (10.4)	3 (30.0)	35 (17.2)
Total	9	70	115	10	204

Values within parenthesis are percentages computed on independent variable education total.
Chi square = 14.45 df = 6
Crammer's V = 0.26 phi = 0.2662

Table 3. How instructions on the pack are followed by farmers.

HOW ARE INSTRUCTIONS FOLLOWED	LEVEL OF EDUCATION No school	upto 5	5 to 10	O Level	Total
Always	3 (2.5)	40 (33.8)	70 (59.3)	5 (4.23)	118 (57.8)
Sometimes	2 (8.3)	8 (33.3)	14 (58.3)	0 (0)	24 (11.7)
Partially	1 (20.1)	2 (40.1)	2 (40.1)	0 (0)	5 (2.4)
Not at all	3 (5.2)	20 (35.1)	29 (50.8)	5 (8.77)	57 (27.9)
TOTAL	9 (4.4)	70 (34.3)	115 (56.4)	10 (4.9)	204

Chi square = 8.69957 with 9 df; phi coef. = 0.2065
Crammer's V = 0.119; contingency coef. 0.2022

Table 4. Clarity of instructions on the pack

Level of education of farmers	Clear f	Clear %	Not clear f	Not clear %	Total f
No School	4	2.5	5	11.11	9
Upto 5	52	32.7	18	40.01	70
5 to 10	97	61.01	18	40.01	115
O level	6	3.7	4	8.88	10
Total	159	77.9	45	22.05	204

Chi square = 11.03519 with 3 df; phi coeff. = 0.23258
Crammer's V = 0.23258, contingency coef. 0.226

Although 97% of the farmers stored pesticide outside their homes 46% of them used common household utensils for the preparation of pesticide solutions for spraying, 81% of the operators used bare hands for pesticide mixing. Fifty five percent of the operators did not cover their head or face although 8.3% of them covered nose and mouth with a piece of cloth, 11% were top bare bodied and 14% wore minimum cloth during spraying.

It was encouraging to observe that 82.35% of the farmers were keen to learn about pest management. It is suggested that the existing high level of education could be used to train farmers who are definitely willing to learn. The major problem of over-use/mis-use of pesticides appears to be lack of technical skill and knowledge most probably due to insufficient opportunities available. We have seen that farmers continuously seek advice, but from fellow farmers although information is available through the government extension service.

If more effective farmer contact/training programs could be organised either through the existing structure or by special project personnel on IPM and pest identification, over-use and mis-use of pesticide could be easily avoided.

It was also seen that the general opinion of the farmer on the instruction given on the pack are grossly inadequate. We feel that large number of trade names has confused the farmers and as such use of better labels and generic name could no doubt help the farmers in adopting proper pest management practices.

We realize the difficulty of adopting personal approach on a one-to-one basis. However "wide participation" technique where group discussions, agrochemical festivals or seminars could be effectively used in view of the fact that most farmers are literate. Educating process could also utilize the existing habit of seeking advice from fellow farmers. Use of indirect channels for communication could meet most of the requirements of farmers.

We propose a training program for traders, and use of "pretested" literature on pest management, outdoor advertisements and use of mass media such as TV, radio and news papers for improvement of communication to farmers on pesticide use.

ACKNOWLEDGEMENT

We greatly appreciate the untiring effort of Technical Staff of Department of Agric. Biology, Mr. Gamini Abeysinghe, Mr. Sarath Dissanayake, Mr. Mahinda Nilaweera in Video recording/photographing of farmer operations in the two villages and specially tolerating the very bad terrain of both village farms.

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