Extension Strategies to Promote Non-Polluting Environment in Fruit Eco System for Sustainable Agriculture

Noorjehan A.K.A. Hanif[1] and I. Mohammed Iqbal[2]

1. Asstt. Prof. (Agrl. Ext.), Department of Social Sciences, Anbil Dharmalingam Agricultural College & Research Institute, Navalur Kuttapattu (Post), Tiruchirapplli (Tamil Nadu Agricultural University), Tamil Nadu,
2. Prof. (Late) (Agrl.Ext.), Tamil Nadu Agricultural University

Corresponding author e-mail: noorjehantry@gmail.com

ABSTRACT

India's farmers suffer from an aversion to fruit growing as this requires high initial investment and long gestation period. At present our agriculture or horticulture should focus on eco-friendly farming including biopesticides, farmers' practices and other alternative methods of pest control to promote sustainable agriculture. In this regard, a research was undertaken to study the present problems in horticulture and the instinct required to boost it through efficient extension delivery system. The overall awareness on the causes for environmental pollution among the growers of banana, guava, and grapevine was high while it was medium for mango and acidlime fruit growers. The overall knowledge on recommended practices in banana, guava, mango, grapevine and acidlime was found to be medium. The overall adoption of recommended practices was medium for the fruit crops mango, grapevine and acidlime while it was high for banana and guava. The common extension strategies used to deliver the recommended practices included broadcasts, exhibitions, farmers/field days, lectures and newspapers followed by printed materials and method demonstrations.

Key words: *Eco-friendly farming; Sustainable agriculture; Environmental pollution; Extension strategies;*

The scientific technologies developed in horticultural and plantation crops have helped in increasing both their production and productivity. In fruits, a production level of 394.7 lakh tonnes has been reached largely due to superior vegetatively propagated planting material, regular-bearing hybrids of mango, high yielding varieties of grapes, pomegranate, banana, ber, aonla, lime and kino etc., coupled with better crop production technologies, pests and diseases control measures. High plantation to increase production per unit area has been standardized in pineapple and banana. Tissue culture techniques have been standardized in banana and taken to field level.

Although India is the largest producer of fruits in the world, the production per capita is only about 100 gm per day. However, it is estimated that more than 20-22% of the total production of fruits is lost due to spoilage at various post harvest stages. Thus the per capita availability of fruits is further reduced to around 80 gm per day which is almost half the requirement for a balanced diet. The fruit production in India has recorded a growth rate of 3.9%. However, the growth rates have been extensively higher for frozen fruits & vegetables (121%) and dehydrated fruits & vegetables (24%). There exist over 4000 fruit processing units in India with an aggregate capacity of more than 12 lakh Mt. (less than 4% of total fruits produced). It is estimated that around 20% of the production of processed fruits is meant for exports, the rest caters to the defense, institutional sectors and household consumption.

India's farmers suffer from an aversion to fruit growing as this requires high initial investment and long gestation period. Poor quality of seeds and other planting material available affect the yield of fruits and thereby returns to the farmers. For low educational level coupled with poor technical training/extension facilities available to the farmers, adoption of new technologies has always been a problem area. These result in non-uniform quality of fruits produced in India. At present our agriculture should focus on eco-friendly farming including

biopesticides, farmers' practices to promote sustainable agriculture.

India, since 1992 is promoting Integrated Pest Management* and offers trainings to farmers on areas of plant resistance, cultural methods, mechanical methods, physical methods, insect growth regulators, plant origin materials and biological controls. The proceedings of the International Workshop (1997) on "Safe and Efficient Application of Agro-chemicals and Bio-products in South and Southeast Asia" stressed the Food and Agriculture Organization (FAO) member governments to foster more regional workshops on alternative methods of pest control. Hence, present agriculture should focus on eco-friendly farming including biopesticides, farmers' practices and other alternative methods of pest control to promote sustainable agriculture. This paper will throw light on the following specific objectives:

1. To assess the awareness of fruit growers on the causes for environmental pollution in the fruit eco system.
2. To investigate the awareness, knowledge and adoption of recommended practices influencing non-polluting as well as polluting environment in the fruit eco system.
3. To identify the problems faced and the suggestions offered by fruit growers in the adoption of eco-friendly non-polluting practices.
4. To suggest an extension strategy for effective transfer of technologies for non–polluting environment in fruit ecosystem for sustainable agriculture.

METHODOLOGY

Tamil Nadu state in India is one among the leading producers of fruit crops with an area of 2.275 lakh ha and a production of 43.424 lakh tones (productivity of 19.1 Mt/ha) during 2001-'02. Five major fruit crops viz., Banana, Mango, Guava, Grapevine and Acid lime having the highest percentage share of coverage at the National level in Tamil Nadu had been selected for the study. In Tamil Nadu, based on the area, production and productivity of banana, mango, guava, grapevine and acid lime, the following districts were selected.

The present study was conducted during 2005 in four districts of Tamil Nadu covering five fruit crops viz., Banana in Lalgudi block of Tiruchirappalli district, Mango in Burgur block of Krishnagiri district, Guava in Palani block of Dindigul district, Grapevine in Cumbam block of Theni district and Acid lime in Dindigul block of Dindigul district. A sample of 150 respondents with 30 fruit growers in each fruit crop was selected from the identified 15 villages (at the rate of three villages for each fruit crop) following the proportionate and random sampling procedure. Data collection was done with the help of a well constructed and pre-tested interview schedule and analysis was done with suitable statistical techniques. The percentage analysis, cumulative frequency, preference ranking, Garrett ranking, Correlation analysis, Multiple regression analysis, Stepwise multiple regression analysis and Factor analysis statistical tools were used for the analysis and interpretation of the data.

Garrett ranking: This was used for ranking the items in problems/constraints faced by the fruit growers. As all the items were not ranked by all the respondents, the method of combining of incomplete order of merit ratings as suggested by *Garrett (1981)* was followed. The formula for percent position as suggested by *Garrett (1981),* is

$$\text{Percent position} = \frac{100\ (R\text{-}5)}{N}$$

Where,

R is the rank of the individual item in the series and,

N is the number of individual items ranked

Scores after transmutation of orders of merit as per *Garrett (1981)* were obtained by referring the respective statistical table. To obtain the final order of merit for each category of constraints, the scores for all the respondents in the respective category were summated and the mean values were found out. In finding the mean values, the sum of scores for each item was divided by its frequency of responses.

Factor analysis: Principal component analysis is widely used for the selection of a minimum number of meaningful and useful factors, considerably fewer in number than the original variables, which account for the most of the variances in the data set and therefore, convey the same information. Kaiser's Varimax criterion was used for selecting the factors. For interpretation of factors, variables with high factor loadings and high communality were taken into consideration.

RESULTS AND DISCUSSION

Awareness on Causes of Pollution among Fruit Growers : The overall awareness of banana growers on the causes for environmental pollution was nearly equally distributed in high and medium categories followed by low category. The overall awareness on causes of pollution among mango growers was found to be medium followed by an equal percentage in high and low awareness categories. The guava growers belonged to high overall awareness category followed by low and medium awareness categories on causes of pollution. The grapevine growers possessed high overall awareness and low awareness on the causes of pollution. The overall awareness of acid lime growers on the causes for environmental pollution was found to be medium followed by equal percentage of low and high categories (Table 1).

The banana growers had cent per cent awareness on causes of pollution such as use of contaminated water and improper disposal of untreated waste from nearby factories which manufacture inorganics. They lacked awareness and knowledge on the hazards of agro chemicals to human health and to the environment.

Cent per cent of the mango growers had awareness on the use of contaminated water. They lacked awareness and knowledge on the hazards of the agro chemicals to human health and the environment. A vast majority of the mango growers had awareness on the disposal of untreated wastes from nearby factories which manufacture inorganics, improper disposal of pesticide containers after usage, indiscriminate spraying of inorganic plant protection chemicals and residual toxicity of the applied chemicals /pesticides as the causes for environmental pollution.

It was found that a vast majority of the guava respondents had awareness on use of contaminated water followed by improper disposal of untreated waste from nearby factories which manufacture inorganics. They lacked awareness and knowledge on the hazards of agro chemicals to human health and the environment. More than three-fourth of the farmers had awareness on causes of pollution viz., continuous use of banned pesticides such as BHC, DDT etc., residual toxicity of the applied chemicals/pesticides, indiscriminate spraying of inorganic plant protection chemicals, improper disposal of pesticide containers after usage and not harvesting fruits after specified waiting periods.

The grapevine growers possessed cent per cent awareness on causes of pollution viz., use of contaminated water and improper disposal of untreated wastes from nearby factories which manufacture inorganics. They lacked awareness and knowledge on the hazards of agro chemicals to human health and the environment and improper disposal of pesticide containers after usage. They had awareness on the causes of pollution like indiscriminate spraying of inorganic plant protection chemicals and residual toxicity of the applied chemicals/pesticides. They were not harvesting fruits after specified waiting periods.

Majority of the acid lime growers had awareness on improper disposal of untreated waste from nearby factories which manufacture inorganics. They lacked awareness and knowledge on the hazards of agro chemicals to human health and the environment. They were not harvesting fruits after suitable, specified waiting periods which allow the pesticides to degrade to safe levels. The findings are in confirmity with the findings of *Venkatakumar (2000)* who found medium to high awareness on environmental pollution due to tannery effluents.

Table 1. Awareness on causes of pollution among fruit growers

Causes of Pollution/ Fruit growers awareness	Banana	Mango	Guava	Grapevine	Acidlime
Use of contaminated water	100.0	100.00	93.33	100.00	90.00
Improper disposal of inorganic factory waste	100.0	100.00	83.33	100.00	70.00
Hazards of agrochemical Usage	100.0	93.33	80.00	100.00	66.67
Indiscriminate inorganic spray	86.67	83.33	76.67	100.00	53.33
Improper disposal of pesticide container	83.33	80.00	76.67	80.00	36.67
Residual toxicity –chemicals/pesticides	80.00	73.33	73.33	80.00	36.67
Continuous use of banned pesticides	60.00	23.33	73.33	70.00	30.00
Not following specified waiting periods	40.00	20.00	63.33	23.33	13.33

Overall Awareness, Knowledge and Adoption of recommended practices among fruit growers: The results of Table 2 indicate the common extension strategies used to deliver all the eleven practices in banana included broadcasts, exhibitions, farmers /field days, lectures and newspapers followed by printed materials and method demonstrations. The overall awareness of banana growers on recommended practices was found to be either high or low category.

In general**,** the common/repetitive extension strategies used to deliver all the eleven practices in mango included broadcasts, exhibitions, farmers /field days, lecture and newspapers (cent per cent) followed by printed materials, roadside posters and method demonstrations (more than three- fourth). Many were mass media followed by group and individual methods. More than one third of the mango growers each had medium and high overall awareness on recommended practices. The major extension strategies used for guava farmers to deliver information on recommended practices were broadcasts, exhibitions, farmers' days and field days, lectures and newspapers followed by printed materials, method demonstrations and roadside posters. Trainings and video lessons were not at all reported by the respondents. Overall awareness of recommended practices in guava was found to be high followed by low.

The extension strategies adopted by the cent per cent of the grapevine growers were broadcasts, exhibitions, farmers' and field days, lectures and newspapers and a vast majority of the respondents reported printed materials, method demonstrations and roadside posters. Study tours, trainings and video lessons were not at all reported by the respondents to get information. The overall awareness on recommended practices among the grapevine growers was high followed by low and medium.

The acid lime growers reported that the extension strategies like broadcasts, exhibitions, farmers' days and field days and newspapers followed by roadside posters and lectures were widely utilized. Study tours, telecasts, trainings and video lessons were not at all reported. The overall awareness of recommended practices among acid lime growers were medium followed by high and low categories. (Table 2.)

Table 2 also reveals that overall knowledge on recommended practices in banana was found to be nearly equally distributed in the three categories low, medium and high. The mango growers in overall knowledge was found to be medium followed by high and low in respect of the recommend practices. The guava growers had nearly equally distributed overall knowledge on recommended practices in high, low and medium categories. The overall knowledge on recommended practices among the grapevine growers was found to be high followed by medium and low categories. The acid lime growers had medium knowledge on recommended practices followed by low and high. The findings are in line with *Senthilkumar (2001)* who found medium to high knowledge on banana cultivation. The findings disagree with the findings of *Ilayaraja (2001)* and *Sukitha (2003)* who reported medium to high knowledge while *Ramani (2004)* found low to medium knowledge on grapevine cultivation aspects.

Table 2. Overall awareness, knowledge and adoption of recommended practices influencing non- polluting as well as polluting environment

Recommended practices		Low	Medium	High
Banana	Awareness	33.33	—	66.67
	Knowledge	30.00	36.67	33.33
	Adoption	33.33	30.00	36.67
Mango	Awareness	6.67	46.67	46.67
	Knowledge	6.67	66.67	26.67
	Adoption	30.00	46.67	23.33
Guava	Awareness	23.33	—	76.67
	Knowledge	33.33	30.00	36.67
	Adoption	33.33	30.00	36.67
Grapevine	Awareness	33.33	6.67	60.00
	Knowledge	23.33	33.33	43.33
	Adoption	30.00	36.67	33.33
Acidlime	Awareness	20.00	46.67	33.33
	Knowledge	30.00	43.33	26.67
	Adoption	33.33	40.00	26.67

The overall adoption of recommended practices in banana was high followed by low adoption and medium adoption. The overall adoption among the mango growers was medium, followed by low and high. The overall adoption of recommended practices in guava was high followed by low and medium. A little above one third of the grapevine growers had medium level of overall adoption followed by high and low on recommended practices. The overall adoption of

Variables representing the factors and the attributes derived from the factors for the adoption of recommended practices in overall fruit growers

Variables	Factors	Attributes
Perception on use of organic manures and pesticides	Production sustainability	Ability to sustain production
Perception on use of inorganic fertilizers and pesticides		
Perception on environmental degradation		
Perception on profitability of organic farming		
Perception towards value addition of fruit products		
Annual income		
Information seeking behaviour	Personal motivation	Ability to utilize information sources
-Training needs		
-Scientific orientation		
-Personal hygiene of farm labourers		
Area under fruit cultivation	Farm possession	Ability to intensify farming
Knowledge of recommended practices	Decision making	Ability to make decisions for adoption
Occupational status	Occupation	Ability to concentrate more on farming
Training participation	Training	Ability to gain more knowledge for adoption

recommended practices was medium followed by low and high among the acid lime growers.

The findings are in line with *Subbulakshmi (2003)*. The findings are contradictory to the findings of *Senthilkumar (2001)* who reported only medium adoption in banana.

Relationship between independent variables and adoption of recommended practices influencing non-polluting environment in the fruit ecosystem (Factor analysis): Factor analysis was carried out to arrive at the factors which are responsible for the adoption of recommended practices influencing non-polluting environment in the fruit ecosystem. The variables representing the factors and the attributes derived from the factors for the adoption of recommended practices are summarized as below which depicts a generalized form applicable to fruit growers irrespective of their location and enterprise.

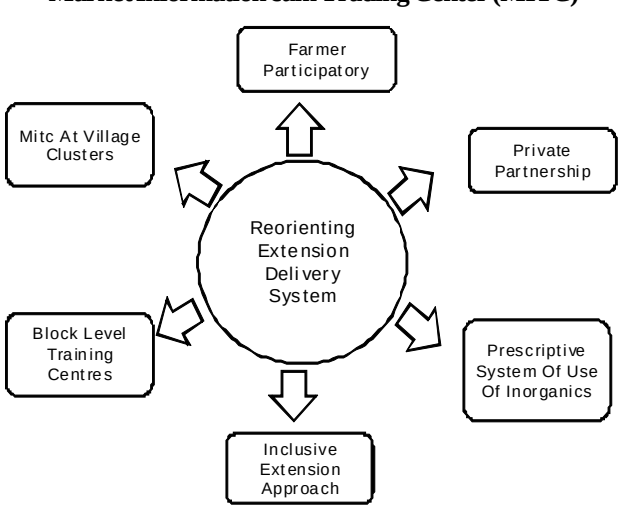

Figure 1. Suggestive model for reorienting extension delivery system

Constraints and Suggestions offered by the fruit growers : By using Garrett Ranking method, the major constraints experienced by the fruit growers were non-availability of resistant varieties, non-availability of bio pesticides, bio control agents and organic manures under *physical constraints;* non-availability of crop insurance and loan, inadequate credit facilities, higher labour wages as the *financial constraints;* susceptibility of varieties to pests and diseases, difficulty in using bio control agents and botanical pesticides, complex nature of Integrated Pest Management (IPM) technology as *technological constraints;* lack of diagnostic skill in identifying the major pests, lack of knowledge about the beneficial insects in pest management as the *personal constraints;* among the social constraints were lack of organized groups and lack of innovativeness; limited contact between farmers and extension workers and inadequate training in plant protection measures as the major *extension constraints*; lack of information and lack of clarity of information were the *communication constraints* and seasonal fluctuations in market, low price for fruits,

Table 3. Constraints faced by the Fruit Growers in the Adoption of Eco-friendly Non-polluting Practices in Tamil Nadu

Constraints	Mean score				
	Banana	Mango	Guava	Grapevine	Acidlime
Physical constraints					
Non-availability of resistant varieties	64.50	53.3	44.83	64.50	67.00
Non-availability of bio pesticides	58.50	44.8	58.50	53.00	48.00
Non-availability of bio control agents	56.34	55.7	56.34	57.00	44.67
Non-availability of organic manures	54.17	70.3	54.17	35.20	65.33
Financial constraints					
Higher cost of bio-inputs	39.60	57.7	72.00	54.80	56.54
Cost for crop insurance	60.00	27.0	—	09.00	29.87
Inadequate credit facilities	52.80	56.1	49.20	53.60	63.47
Higher labour wages	46.63	58.1	50.80	63.60	36.54
Technological constraints					
Susceptibility of varieties to pests and diseases	65.00	42.3	33.76	57.00	59.34
Difficulty in using bio control agents	55.50	65.2	61.00	67.30	53.37
Difficulty in using botanical pesticides	51.87	61.8	68.50	56.10	53.94
Personal constraints					
Lack of diagnostic skill in identifying the major pests	73.27	65.9	58.14	74.20	68.00
Lack of knowledge about the beneficial insects in	66.73	67.9	62.70	63.10	54.77
Lack of knowledge and skill about the use of pesticides	46.63	49.5	55.84	51.60	54.90
Social constraints					
Lack of organized groups such as FDG, WFDG, SHG, RRF etc.	65.67	53.0	28.26	57.50	49.70
Lack of innovativeness	54.33	60.0	56.34	62.50	50.00
Non- cooperation among neighbourhood farmers	45.33	60.8	64.84	34.80	43.34
Extension constraints					
Limited contact between farmers and extension workers	64.53	60.9	65.07	72.00	75.00
Inadequate training in plant protection measures	56.67	65.1	34.37	38.90	44.67
Lack of adequate technical guidance from extension workers	43.07	38.6	31.20	56.00	54.67
Communication constraints					
Lack of adequate information	55.20	51.7	57.20	42.20	46.84
Lack of clarity of information	44.80	48.3	61.40	57.80	66.47
Marketing constraints					
Seasonal fluctuations in market	81.00	81.00	73.24	81.00	81.00
Low price for fruits	67.13	56.5	67.46	66.90	69.00
Exploitation by middlemen	62.07	52.9	20.44	60.20	56.27

exploitation by middlemen, poor keeping quality of fruits and lack of regulated markets in the *marketing constraints* category. (Table 3)

Suggestions and Implications: Major suggestions offered by the fruit growers in the study area are that Government policy measures should be directed to fruit crop insurance, availability of crop loan and input subsidies, Government should fix the procurement price for fruits, Marketing Information cum Trading Center at cluster of villages / block could be set up for fruits to avoid exploitation of middlemen/commission agents, Reorientation of extension system as Participatory Extension Approach or Farmer demand driven extension approach or Extension through Farmers' Organizations, Adequate staff and extension methods are required in the Department of Agriculture and Department of Horticulture and Plantation Crops (DHPC) to cover maximum number of farmers or area and Adequate

training and awareness camps were needed on cultivation aspects, environmental pollution aspects, pesticides usage, organic farming *etc.*

The first has suggested a model for improving the extension strategies to be utilized to a larger extent; government policy framers/makers shall take into account the following suggestions:

- Establishment of Market Information cum Trading Center (MITC) at cluster villages
- Fixation of procurement price for each fruit crop
- Providing adequate credit and export facilities and crop insurance
- Providing Subsidized irrigation
- Encouraging formation Fruit growers associations
- Giving trainings on value addition
- Providing subsidies for establishment of processing units / cold storage
- Giving importance for documentation of Indigenous technical knowledge or Farmer's practices and carrying out need based / crop specific/ location specific Research
- Employing agricultural graduates in Agricultural Input Shops and to follow prescription way of usage of agro inputs

CONCLUSION

On analyzing the extension strategies which have been found used and prevalent among different fruits growers in the study area revealed that for all the fruit crops growers, mass media were widely used followed by group and individual contact methods. In a nutshell, the findings reveal the eminent need for enhancing the budget for employing the methods like field trials, field visits, result demonstrations, telecasts, video lessons, trainings and study tours in dissemination of horticultural technologies. The suggestions offered by the fruit growers along with the suggested model shall be taken into account for effective delivery of latest technologies within the stipulated period of time.

Acknowledgements: I extend my bountiful thanks to the Jawaharlal Nehru Memorial Fund, New Delhi for funding this study through fellowship.

Paper received on : November 23, 2011
Accepted on : July 12, 2012

REFERENCES

Ilayaraja, N.M. (2001). A Study on the knowledge level and adoption behaviour of grape growers. M.Sc. (Ag.) Thesis (unpub.), Annamalai University, Annamalai Nagar.

Ramani, R. (2004). Yield gap analysis and constraints in grape cultivation. M.Sc.(Ag.) thesis (unpub.), TNAU, Madurai.

Senthilkumar, S. (2001). Adoption gap in critical technologies among banana growers of Namakkal district. M.Sc. (Ag.) thesis (unpub.), TNAU, Madurai.

Subbulakshmi, T. (2003). Evolving an effective TOT Model for the transfer of plant protection technologies by plant clinic centre. M.Sc.(Ag.) Thesis (unpub.), TNAU, Coimbatore.

Sukitha, R. (2003). An analysis of technical utilization by grape growers. M.Sc.(Ag.) thesis (unpub.), TNAU, Madurai.

Venkattakumar, R.(2000). Impact of Tannery Effluent Pollution on Agriculture and Socio-Economic Conditions of the Farming Community. Ph.D. thesis (unpub.), Dept of Agril. Ext. and Rural Sociology, TNAU, Coimbatore.

• • • • •