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A Study on Technology Dissemination, Farmer's Perceptions Towards Pesticides and Impact of KVK in the District of Salem in Turmeric Cultivation

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ABSTRACT: Several hazardous chemicals have been banned from use in crop fields and farmers as well as scientists are in search of alternatives which are less harmful to humans and the environment. Reports from the Pesticides Residue Laboratory indicate residues higher than the permissible levels in most of the vegetables available in the markets. In 2009 the area under turmeric cultivation was 169071 tonnes and in 2015 it was declined due to biotic and abiotic stresses. Krishi Vigyan Kendra, Salem came out with some novel organic technologies for production of spices as well as other crops. In this study, the aims is to improve the farmers livelihood, through trainings, demonstrations etc., and imposing the newer technologies like biocontrol agents based on the survey among the turmeric growers. The technologies were demonstrated and laid out in the farmers field of turmeric growers and the analysis for the adoption level and impact of novel technologies having bioagents in management of turmeric diseases. The percentage of adoption, the impact, the reasons for non-adoption/partial adoption during 2015-17 in the district of Salem, Tamil Nadu was analysed. Based on the survey and assessment the extent of adoption of these technologies in the field is only partial mainly due to lack of awareness, lack of farmer confidence in effectiveness of the technologies as well as non-availability of good quality inputs in time and moreover, the increase in awareness will be the positive way to increase the yield and usage of bioagents in crop production.

Keywords: Biological control, kvk, perception, pesticides, technology, turmeric.

INTRODUCTION

Agriculture continues to be the most predominant sector of the District economy and engaging major occupation in agriculture and allied activities for their livelihood. Salem district, has as an area of 520530 ha with net cultivated area of around 220138 ha. A large number of small and marginal farmers and landless agricultural workers in the district depend on agriculture for their livelihood. As per the cropping pattern of the Salem District there are fourteen crops widely occupies and comprising agri-horti and plantation cropping ecosystem. Among the fourteen crops Turmeric, Oilseeds, Tapioca, Paddy and Maize were the top five crops and cropping intensity result shows that the highest cropping intensity found in Tharamangalam, Veerapandi, Panamarathupatty. (Jegankumar *et al*., 2015). The first and foremost crop preferred by the farmer is turmeric in 2010, because it is an annual crop, it requires minimum water and post planting operations like weeding etc. Turmeric traders at Erode district preferred the Salem Hybrid turmeric as they have received export orders from North India. (The Hindu, 2015).

In 2009 the area under turmeric cultivation was 169071 tonnes and in 2015 it was declined to 2017. Small and marginal farmers spent their own labours for successful cultivation of the crop to save the input cost from sowing to harvest. (Swaminathan, 2005; Bhandari, 2015; Devi *et al*., 2017). The decreasing in area is due to cost for seed, ploughing, sowing, weeding, plant protection, harvesting, threshing and post harvest

technology. Rather than usual period during the crop cultivation, if adverse climatic condition prevails, the input cost for plant protection constitutes 3/4th of the cost of cultivation. The crop is affected by several fungal pathogens like *Pyhtium aphanidermatum* (rhizome rot), *Taphrina maculans* (leaf blotch), *Colletotrichum capsici* (leaf spot) but soil borne diseases starts infection from on 4th month after planting to till harvest and caused huge economical loss. Due to the lack of knowledge on diagnosis of the disease, farmers are realizing the symptom during on 8th month after planting and stage of infection of rhizome rot is attaining severe damage in fingers which leads to indiscriminate use of pesticides that maximize the cost inputs (Sudha and Lakshmanan, 2007a, 2007b, 2009). The Various biological agents who help in pest and disease control as well as promote plant growth are available in the market (Pal and Gardener, 2006) and their demand is going up day by day consequent to the increasing food safety, ecological and environmental concerns. The Government of India has also placed considerable thrust on safe to eat products and is in a drive to promote organic farming in the State. In the wake of climate change and change in cropping pattern with an emphasis on intensive monocultures, newer and newer pests and diseases are being reported. In 2015 a report on pesticide residue reveal that "A total of 16,790 samples have been analysed, out of which, 509 samples were found above maximum residue limit (MRL)" as prescribed under Food Safety Standard Authority of India (FSSAI) under Ministry of Health (Prashar *et al*., 2015). The residue levels were very high in food products etc.

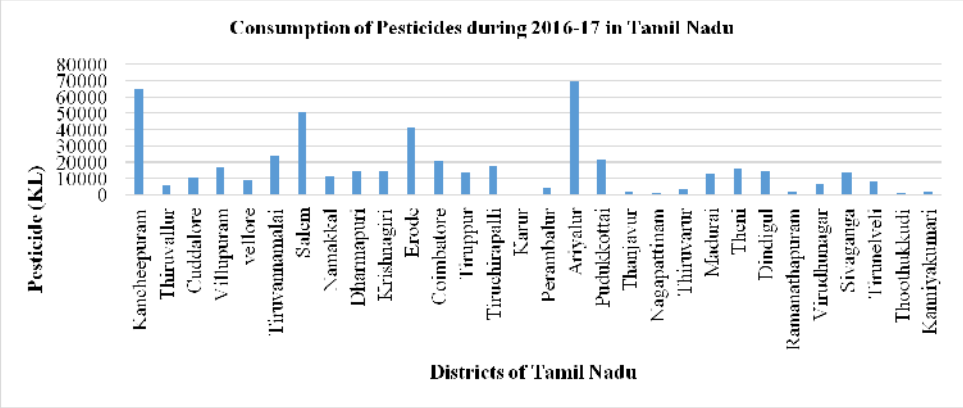

Fig. 1. Consumption of pesticides during 2016-17 in Tamil Nadu.

Consumption of pesticide in salem district ranked third it shows increasing every year. Consumption of fertilizers is also high in this region (40608 MT of NPK) Yadav and Dutta, (2019). Hence, to increase the production by two or three fold the farmers moved to use of pesticides and chemical fertilizers and it leads to deterioration of soil and farmers perception. Based on the study report the pesticide consumption rate was increased and it has to be assessed after this study in farmer's cultivation practices. The study fails to document the technology perception after and before treatment. The present study aims to assess the consumption pattern of pesticides, the farmer's knowledge about pesticides, biocontrol agents, and the impact of KVKs in enhancing income and employment among the farm households. Moreover, it is to analyze the technology induction, dissemination approaches and its impact at macro level (district level).

METHODS

The Krishi Vigyan Kendra (KVK), Salem is a Farm Science organization functioning under Tamil Nadu Agricultural University in the district. Samples of turmeric leaves, rhizome was brought by the farmers frequently for problem diagnosis and advisory services to this KVK lead the steps for the permanent solution for these disease problems. In this regard, focus was given on integrated disease management technologies with special emphasis of biological control methods for eco friendly and sustainable management. As the problem was regular and alarming in all the blocks of Salem district. Farmers were unaware of taking up the control measures at initial occurrence of the disease and at appropriate time. Hence, Tamil Nadu Agricultural University has come out with several organic technologies for production of spices as well as other crops. Analysis for the adoption level and impact of bioagents in turmeric crop cultivation and the reasons for non-adoption/partial adoption during 2015-17 in the district of salem, Tamil Nadu were presented.

A. Case study conducted at Krishi Vigyan Kendra, Salem

The study was conducted based on both primary and secondary data on technology generation and field level adoption of technologies/varieties evolved through KVK Salem of Tamil Nadu Agricultural University. A reconnaissance survey was conducted to gain preliminary insights into the adoption of production technologies and constraints farmers faced in turmeric

cultivation. This was followed by the collection of secondary data and discussions with officials of KVK and other research institutes and representatives from the State Department of Horticulture. The list of turmeric growers from the major turmeric growing blocks of salem namely Panamarathupatty, Ayodhiapattinam, vazhapaadi, veerapandi, Omalur and Attur were collected from the state department of Horticulture offices. A total of 5 farmers were randomly selected from each block to form a sample of 30 farmers for this study.

RESULTS

A. Constraints in turmeric rhizome production

The farmers in Salem district face a number of constraints in the production of turmeric. The most important problems in the production of turmeric were losses due to insect- pest incidence, non-availability of quality seed rhizome, high variations in yield, lack of suitable location specific varieties, lack of knowledge about identification of pest and diseases, unaware about biological control methods etc. The production risks are high, primarily because of considerable production losses caused by pests. The post-harvest losses are also quite high due to their storage and price fixation. Other problems included lack of knowledge about production technology, labour shortage, lack of processing and storage etc. The local type turmeric is highly preferred by the traders of erode market, which is a market prone area of turmeric. The major constraints in turmeric production utilizing new technologies as listed by the respondent farmers in different age group are given in Table 1 & 2.

The farmers were divided into two age groups (I & II) from 26-35 and 36-45 (Group I) and another is from 46-55 and 56-65 (group II). Both of the two groups were voted for Non availability of quality biocontrol agents, next to that group I voted for Non availability of quality fertilizers followed by High cost of plant protection chemicals. As per the rank, group II voted for high cost of plant protection chemicals followed by high cost of plant protection chemicals. Compared to the group II, group I have the knowledge on identification of the peat and diseases, this is because of the reasons

1. Scientific knowledge or technologies shared by the KVK to the young farmers through trainings, demonstrations, group discussions, visiting to SAUs, ICAR institutes, Exhibitions.
2. Their receptive age of the farmer for scientific technologies behind 35-40.
3. Searching for solving the problems raised by majority of the farmers.
4. Frequent visiting of young farmers to KVK, to know about the new technologies.

The young farmers were spent most of the input for plant protection chemicals and they voted for lack of awareness about plant protection measures. When compared to group I, group II farmers also having the problem in identification of pest and disease and the knowledge on plant protection measures is also low. The reason for the difference in group I & II farmers are level of education, searching of scientific factors for the low yield and net profit.

Table 1: Analysis of factors for different age group of farmers.

Sr. No.	Key factors	Group I farmers	Group II farmers
1.	Knowledge (based on education)	High	Medium
2.	Visit to science centres	High	Low
3.	Attending meetings, exhibitions and group discussions	High	low
4.	Searching for solutions raised frequently in cultivation	high	Medium
5.	Experience in solving field problems	low	High
6.	Experience in selection seed rhizome	Low	High
7.	Searching for new technologies	High	medium

Table 2: Major constraints in turmeric production in Salem district (expressed as percentage).

Constraints	Farmers age group		Avg.	Rank	Farmers age group		Avg.	Rank
Seed	26-35	36-45			46-55	56-65		
Impure rhizome	34	31	32.5	VIII	36	28	32.0	XI
Non–availability of quality rhizome	48	54	51.0	V	63	72	67.5	IV
Fertilizers								
High cost of fertilizers	26	32	29.0	IX	36	41	38.5	X
Non availability of quality fertilizers	65	61	63.0	II	58	55	56.5	VII
Plant Protection Measures								
Lack of awareness	56	57	56.5	IV	62	67	64.5	V
High cost of plant protection chemicals	59	62	60.5	III	65	72	68.5	II

Lack of knowledge about the pest and diseases for selection of pesticides	47	56	51.5	V	66	70	68.0	III
Adulterated plant protection chemicals	22	27	24.5	XI	39	44	41.5	X
Non availability quality biocontrol agents	62	70	66.0	I	75	81	78.0	I
Others								
Labour shortage	43	40	41.5	VII	47	45	46.0	IX
Price fluctuation	31	25	28.0	X	52	56	54.0	VIII
Lack of knowledge about storage and processing	42	47	44.5	VI	53	61	57.0	VI

Application of crop protection chemicals has been used in indiscriminate dosages for the management of pest and diseases. As well the dosages were also doubled and spraying was also done frequently. Likewise the fertilizer applications are also increased in maturation stage also when compare to recommended dose. Hence, it is to infer that, owing to the crop cultivation in farmers practice, to maintain the soil and environment healthy, the focus was given to integrated and biological management of pest and diseases.

Pest Management in turmeric – Integrated approach: A significant proportion of potential production is lost due to insect pests and diseases. Owing to continued increasing incidence of these biotic stresses, the use of chemical pesticides has been increased many folds. Tamil Nadu Agricultural University has made significant contributions in the field of integrated management of pest and disease management chemical interventions in pest and disease control. With rising public concerns about economic and ecological externalities of the chemical pesticides, the emphasis of plant protection research and development strategies has gradually been shifting from chemical to non-chemical approaches. Among the non-chemical approaches, integrated insect Pest and disease Management (IPDM) has emerged as one of the important alternatives. It includes application of bio-organism in conjunction with chemical pesticides, agronomic practices and mechanical control. The use of biocontrol agents and bio inputs is an important factor in the integrated pest and disease management approach which will reduce the indiscriminate use of chemical pesticides.

B. KVK- Intervention on Disease Management

The institutional approach of Salem KVK, identified the turmeric farmers based on the major growing areas viz., Panamarathupatti, Ayodhiapattinam, vazhapadi, veerapandi, Omlur, Attur block of Salem district. The extension activities like demonstration in farmers filed, awareness campaign, meetings, hands on trainings and method demonstrations on Integrated disease management technologies as well as biocontrol methods with improved cultivation technologies were conducted to expose the farmers on usage of biological control agents (Nagaraj *et al*., 2017). Through the KVK activities, frequent field diagnostic visits made, disease incidence was 65%, and yield level of 12-16 t/ha. Group discussions were made at different locations to make the farmers aware of the disease management technology (Fig. 2.).

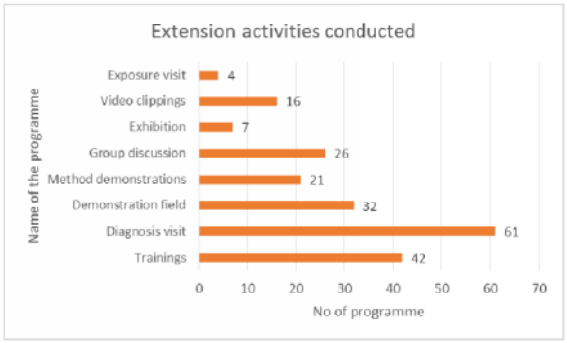

Fig. 2. Extension activities conducted through KVK, Salem.

Economic viability of technology during next year (2016-17) of crop cultivation. In turmeric the farmers have saved 2 sprays of fungicides in turmeric and got yield about 22 tonnes of turmeric on an average with net income of Rs. 2,74,000/ha and BC ratio of 3.97. in IDM demonstration compared to the farmers practice with the yield of 13.6 q/ha with net income of Rs. 133600/ ha and BC ratio of 2.64 (Table 3).

Sale of bio control agents and bio inputs from various government agencies in the State has been collected and presented as an indicator of the popularity of these inputs among farmers. An assessment of the sales of biocontrol agents like *Pseudomonas* and *Trichoderma* revealed that the sales has increased considerably over the years (Table 4).

Table 3: Economical parameter for Technology Benefits.

	Yield (q /ha)				% Increase	Economics of demonstration (Rs./ha)				Economics of check (Rs./ha)			
	Demo			Check		Gross Cost	Gross Return	Net Return	BCR	Gross Cost	Gross Return	Net Return	BCR
	H	L	A										
Turmeric	24.2	19.8	22.0	13.6	38.18	92000	366000	274000	3.97	81400	215000	133600	2.64

Table 4: Sale of bio control agents in selected and unselected blocks of Salem districts.

Selected blocks				Unselected blocks	
Year	Pseudomonas (Kg)	Trichoderma (Kg)		Pseudomonas (Kg)	Trichoderma (Kg)
2015-16	250	351		103	142
2016-17	322	462		149	182
2017-18	399	602		212	268
2018-19	475	704		389	412

Source: Various government sales outlets

The increase in the sale of vermicompost and earth worms for composting shows that the farmers have successfully adopted the application of this technology for recycling of farm wastes in their field to improve the yield. Although several improved and integrated technologies of pest and disease management in vegetable crops have been developed, their adoption has not been very encouraging. The adoption behaviour of farmers with respect to these practices has been examined, along with the reasons for non-adoption.

It is to infer that maximum adoption was in the case of *Trichoderma* followed by *Pseudomonas*. *P. fluorescens* liquid formulation and coconut tonic stood next in the adoption chart. Reasons for non-adoption of the technologies were explored and it was found that lack of aware of the technological recommendations and lack of confidence of effectiveness were the reasons suggested by majority of the farmers (Table 5). The reasons are presented in Table 6.

Table 5: Adoption patterns of technologies related to bio control agents and bio inputs by farmers for the major crops during the subsequent years 2017-18.

Sr. No.	Recommended practices	Fully adopted		Partially adopted		Not adopted		Total score	Mean	Rank
		No	%	No	%	No	%			
1.	*T.viride*	73	66	19	17	18	16	82.5	0.75	I
2.	*P.fluorescens* talc formulation	65	59	26	24	19	17	78.0	0.71	II
3.	*P.fluorescens*liquid formulation	20	18	38	35	52	47	39.0	0.35	VII
4.	Vermicompost	46	42	39	35	25	23	65.5	0.60	VI
5.	VAM	12	11	15	14	83	75	19.5	0.18	VIII
6.	Azospirillum	52	47	31	28	27	25	67.5	0.61	IV
7.	Phosphobacteria	50	45	28	25	32	29	64.0	0.58	V
8.	Vegetable booster	09	08	16	15	85	77	17.0	0.15	IX
9.	Coconut tonic	60	55	29	26	21	20	74.5	0.68	III

Table 6: Reason for lack of adoption of bioagents in turmeric production.

Reasons	No of farmers reporting as major problem	Rank
Lacking in aware of the technology	78	I
Not convinced of result in farmers field	52	II
Non availability of bio-input	42	III

RESULTS AND DISCUSSION

The study revealed that research expenditure in KVK has yielded positive and effective results in respect of biological inputs in turmeric production as well as in pest and disease management. However, the extent of adoption of these technologies in the field is only partial mainly due to lack of awareness, lack of farmer confidence in effectiveness of the technologies as well as non-availability of good quality inputs in time. In recent years, more emphasis need to be given to the use of eco-friendly pesticides for crop production in view of their less toxic nature and low residue problems (Anchal, 2013; Pertot *et al*., 2015; Lwin *et al*., 2012). Based on the above results greater efforts have to be taken for increasing farmer awareness on biological inputs in turmeric production and integrated pest and disease management so as to lessen the use of harmful chemicals in agriculture and to pave way for organic agriculture and safe to eat food in the State.

KVKs switch of technology programme has contributed immensely in increasing the productiveness of selected interventions (Kavitha *et al.,* 2018).

This really displays that KVKs interventions helped in the improvement of socio-conomic repute amongst farming community so that farmers/trainees are now not only self-employed but also created possibility for unemployed (Veeresh and Hosmani, 2017). Before the KVK intervention, majority of the respondents were under the low class of socio-economic status. These chosen KVK interventions made farmers to generate enough income, by way of appearing as a subsidiary source of income this led to the transformation of respondents from low socio-economic reputation to the medium category. Still there is a scope for KVK to increase the number of farmers being skilled through increasing the off-farm education programmes and KVKs beneath extraordinary systems- SAU, NGO and ICAR, which have to jointly get involved in the positive factors of working with each other to prove it to be greater effective.

There is a need to construct stipulations for more suitable crop productivity in the existing climate alternate scenario (Kandwal, 2013). KVK would put each and every efforts to improve the farming situation of farmers by way of working in cluster villages and their via involving line departments to in addition up-scale the technologies.

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Conflict of Interest. The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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