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EXPLORING THE EXTENT OF ADOPTION OF PRECISION FARMING TECHNOLOGIES IN TOMATO CULTIVATION

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ABSTRACT

The study was aimed to assess the adoption level of tomato farmers on precision farming technology. Tamil Nadu Precision Farming Project (TNPFP) is a Tamil Nadu state sponsored turnkey project implemented by Tamil Nadu Agricultural University (TNAU) at Dharmapuri and Krishnagiri districts in 400 ha to train the farmers in precision farming for a period of three (2004-2007) years. Krishnagiri district was purposively selected which consisted of five taluks and from among them, three taluks viz., Denkanikottai, Krishnagiri and Hosur were selected considering the criteria of maximum beneficiaries and area covered under precision farming project. A Sample of 110 precision farming beneficiaries were taken for the study. A well structured interview schedule was used for data collection and collected data were analyzed by using appropriate statistical tools. The salient findings are majority of the tomato farmers possessed medium to high level of precision farming technology adoption in tomato cultivation. Hundred per cent of the respondents completely adopted drip and fertigation system. More than 90 per cent of the respondents adopted the following technologies such as optimum seed rate, use of portrays for nursery preparation, stacking practice, sorting and grading. The adoption level was found minimum for the practices such ac use of yellow sticky trap, micro nutrient application.

Key words: Adoption, Precision Farming, Tomato

INTRODUCTION

It is very difficult to assume that food requirement for the population of 2020 AD will be supplied by the technology of today. To meet the forthcoming demand and challenge we have to divert towards new technologies for revolutionizing our agricultural productivity. Précising farming is an emerging concept in modern agriculture. It is a comprehensive approach to farm management and has the following goals and outcomes: increased profitability and sustainability, improved product quality, effective and efficient pest management, energy, water and soil conservation, and surface and ground water protection. (Grisso *et al.*, 2002). In precision farming technology site specific management practices are adopted giving due considerations to the spatial variability of land in order to maximize crop production and minimize the environmental damage (Harshal., 2006). There are two characteristics which are likely to drive the adoption of precision agriculture technologies. First, considering that they improve the efficiency of input use in mechanized agriculture, they are likely to be adopted first in those places where input used is already relatively efficient. Second, because these technologies use costly capital to automate human information processing, they will be most welcome where capital is abundant relative to management labor (FAO 2000).

Tamil Nadu Precision Farming Project (TNPFP) is a Tamil Nadu State sponsored turnkey project implemented by Tamil Nadu Agricultural University (TNAU) with the co-operation of the state departments of Horticulture, Agricultural Engineering, Agriculture, Agricultural Marketing and Agri-Business and the District Administration. The project area lies in the districts of Dharmapuri and Krishnagiri of Tamil Nadu state in 400 ha to train

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the farmers in Precision Farming. High value crops like tomato, brinjal, sugarcane, banana, gherkins, hybrid capsicum, paprika, baby corn, and white onion, bhendi, cabbage and cauliflower was proposed to be cultivated under the scheme. To analyse the extent of adoption of precision farming technologies and to study the factors influencing the adoption of precision farming technologies the present the present study was designed.

MATERIALS AND METHODS

Tamil Nadu Precision Farming Project was implemented at Dharmapuri and Krishnagiri districts in 400 ha to train the farmers in precision farming. Krishnagiri district was taken for this study in which Denkanikottai, Krishnagiri and Hosur taluks were purposively selected on the basis of maximum area under precision farming. A sample size of 110 precision farming farmers was fixed for conducting this study. The sample was proportionately allotted in each of all the selected taluks. The data collection was done with the use of a well structured and pre tested interview schedule covering all the aspects of adopting precision farming technology in tomato cultivation.

Adoption is a decision to continue 1971 full use of an innovation (Rogers and Shoemaker). In this study, adoption refers to, following the critical technologies in tomato cultivation under precision farming as recommended by extension agency. The list of items to assess the adoption level was finalized based on consultation with, extension scientists and by referring literature. The extent of adoption of precision farming technologies in tomato cultivation was measured by means of adoption index. Adoption of each technology was measured on the three point continuum. Score 3 for fully adopted, score 2 for partially adopted and score 1 for not adopted was assigned. The scores obtained on individual items under a practice were summed to arrive at the total score for that practice. Similarly, the scores for all the practices were worked out and finally the scores were added to arrive at the adoption score of a respondent. The adoption index was worked out to find out the extent of adoption by using the following formula which was followed by Usharani (1998).

$$\text{Adoption index} = \frac{\text{Respondent's total score}}{\text{Total possible score}} \times 100$$

Respondent's total score = Total number of technologies adopted by a farmer multiplied by the respective practice weightage and summated.

Total possible score = Total number of practices recommended, multiplied by the respective weightage and summated.

The respondents were categorized as low, medium and high using mean and standard deviation. For extent of adoption level, percentage analysis was worked out to study the practice wise – adoption level of respondents on critical technologies of tomato cultivation under precision farming.

To study another objective,(*ie.*,) the factors influencing adaption of precision farming technology, a list of factors which favours adoption were collected by reviewing various relevant literature, discussion with scientists and progressive farmers. Each respondent was requested to indicate his/her preference towards the factors that influenced adoption and that was expressed in ranks. Garette ranking method was used to translate the order of merits into scores. In this method the ranking of the respondents for each option was translated into scores. With the help of the following formula, initially the percentage position for each respondent was worked out.

$$\text{Per cent position} = \frac{100 \times (R-0.5)}{N}$$

Where,

R= the rank assigned by the individual respondent

N = the total number of respondents

From the per cent position, the respondents score was worked out with the help of conversion table. All the scores assigned for each motive was combined and the mean score was worked out a given below

Score	Statements 1 2 3 4 5 6
1st Respondent's ranking score	
2nd Respondent's ranking score	
.	
.	
.	
.	
.	
.	
110th Respondent's ranking score	

Sum of scores mean

From the mean, the order of merit was arranged. Thus all the factors were ranked.

RESULTS AND DISCUSSION

Future research on innovations solely depends on the decision of adoption or rejection of the existing technology and also paves way for implementation of various special schemes. Hence, it was felt necessary to assess the adoption level of farmers on tomato cultivation under precision farming. The pertinent data with regard to overall adoption and technology-wise adoption were collected and furnished below.

It is inferred from the data in Table.1, that 81.82 per cent the respondents had medium to higher level of adoption. About 18.18 per cent of the respondents had lower level of adoption. This trend might be due to the possible reasons viz., increased income, extension agency contact, mass media exposure, scientific orientation and economic motivation. Further the subsidy given through Tamil Nadu Precision Farming Project for adopting the precision farming technologies, training conducted by agricultural scientist, success stories of fellow farmers and market preference for the produce cultivated under precision farming were the contributing factors for the increased adoption level. Efforts were made to find out the technology wise adoption level of the respondents to tomato cultivation. The results were analyzed, discussed and presented below.

It could be understand from data in the Table.2, that hundred per cent of the respondents completely adopted drip and fertigation system. More than ninety per cent of the respondents adopted the following technologies such as optimum seed rate, use of portrays for nursery preparation, stacking practice, sorting and grading. The adoption level was found minimum for the practices such ac use of yellow sticky trap, micro nutrient application. The use of drip irrigation system is an important component and backbone of precision farming. Hundred per cent of the respondents were found to have adopted the drip irrigation and fertigation system due to advantages of decreased water consumption, increased water use efficiency, ensured uniformity in irrigation of individual plants, reduced run-off , soil erosion, reduced wastage of fertilizers and labour cost. 95.45 per cent of the respondents were found to have optimum seed rate to maintain the optimum plant population. This might be due to majority of the respondents had high level of awareness regarding appropriate spacing and benefits.

More than ninety per cent (92.73)of respondents had practiced the use of portrays for nursery preparation. This might be due to the

TABLE 1: Adoption level of farmers on tomato cultivation under precision farming.

Category	Number	Percentage
Low	20	18.18
Medium	51	46.36
High	39	35.46
Total	110	100.00

TABLE 2: Technology wise adoption level of the tomato growers under precision farming.

Technologies	Fully adopted		Partially adopted		Not adopted	
	No	%	No	%	No	%
Chisel ploughing	81	73.64	15	13.64	14	12.73
Optimum seed rate	105	95.45	5	4.55	-	-
Seed treatment with Trichoderma viridi	72	65.45	-	-	33	30
Use of portrays for nursery preparation	102	92.73	-	-	8	7.27
Appropriate spacing	98	89.09	10	9.09	2	1.82
Fertilizer recommendation (NPK)	84	76.36	14	12.73	12	10.91
Application of water soluble fertilizer	73	66.36	17	15.45	20	18.18
Drip irrigation and fertigation	110	100	-	-	-	-
Micro nutrient application	18	16.36	23	20.91	41	37.27
Use of yellow sticky trap to control white flies	4	3.63	5	4.55	101	91.82
Staking practice	102	92.73	5	4.55	3	2.73
Sorting and Grading	100	90.90	7	6.36	3	2.73

uniform growth of seedlings, reduced seedlings mortality and reduced occurrence of pest and diseases. Stacking is an important practice in tomato cultivation under precision farming. Exactly 92.73 per cent of the respondents adopted the stacking practice in tomato cultivation. Use of supporting poles had many advantages like decreased rotting and cracking of fruits, increased plant duration, easy intercultural operation and harvesting. 76.73 per cent of the farmers had fully adopted the fertilizer application dosage as per the recommendation, since the farmers were aware of the implication of excessive fertilizer application, such as increased pest and disease incidence.

Use of micro nutrients had minimum level of adoption. This might be due to lack of knowledge on the principle behind the use of micro nutrient application. Yellow sticky trap used to control the white flies in tomato cultivation. Use of yellow sticky trap had minimum level of adoption due to lower level of white flies infestation in the study area. Further the respondents preferred application of chemicals to control the pests because of the immediate effect.

Factors influencing the adoption of precision farming technologies in tomato cultivation

There are various factors which favor the adoption of precision farming technologies. Three major factors viz, economic, extension and social factors. In this section an attempt was made to know the factors which were favoring adoption of the precision farming technologies. Some economic factors were identified from the pre-test. The results are presented in the following Table 3.

The data in table reveals that most of the respondents gave first preference to the higher yield as their reason of adoption followed by yield increase, availability of subsidy, increased profit, and savings in time, less labour requirement, savings in fertilizer and less cost of cultivation. Most of the respondents gave first preference to the increased yield as their reason for adoption. This might be due to the fact that cultivation under precision farming brings increased yield over conventional method of cultivation. So, the Precision farmers got higher return for their better livelihood. The respondents gave second preference to provision of subsidy, since subsidy was given by state government of Tamil Nadu under Tamil Nadu Precision Farming Project (TNPFP) to implement the precision farming technologies. Hence most the farmers showed interest to implement the precision farming technologies in their field. Third preference was given for higher profit. This might be due to the fact that cultivation under precision farming brings increased yield, which leads to increased profit. Drip irrigation and fertigation system decreased the labour requirement and save the time of operation. Hence majority of the respondents gave fourth and fifth rank to savings in time, less labour requirement respectively. Sixth and seventh rank was to reduced in fertilizer usage and low cost of cultivation. Cultivation under precision farming requires water soluble fertilizer. Cost of water soluble fertilizer was relatively high

TABLE 3: Economic factors influencing for adoption of precision farming technologies in tomato cultivation.

Economic factors	Mean score	Rank
Yield increase	71.40	I
Provision of subsidy	66.40	II
Higher profit	65.40	III
Time savings practice	45.00	IV
Minimum labour requirement	42.80	V
Savings in fertilizer usage	34.00	VI
Low cost of cultivation	25.40	VII

TABLE 4: External factors influencing for adoption of precision farming technologies in tomato cultivation .

External factors	Mean Score	Rank
TNAU scientists	78.41	I
Officials of agricultural and horticultural departments	65.06	II
Drip manufactures	59.45	IV
Officials of engineering department	50.15	VI

TABLE 5: Social factors influencing the adoption of precision farming technologies in tomato cultivation.

Social factors	Mean score	Rank
Influence by TNPFP	78.29	I
Urge to an innovator	64.91	II
Influence by successful drip users	58.49	III
Serve as a role model	51.30	IV
Prestige	43	V

than the normal fertilizers. Number of external factors motivated the farmers to adopt the precision farming technologies in crop cultivation. These factors were identified, analyzed and the results are presented in the following table.

It could be observed from the table that most of the respondents indicated that Tamil Nadu Agricultural University scientists were the major influences for the adoption of precision farming. Since TamilNadu Agricultural University was undertaking this precision Farming project, TNAU scientists highly motivated the farmers to adopt the precision farming technologies. The respondents gave first rank to TNAU scientists followed by second, third, fourth rank to officials of agricultural and horticultural departments department, drip manufactures respectively.

The data in use above table reveals that majority of the respondents were given first rank to TNPFP. Tamil Nadu Precision Farming Project highly influenced to adopt the precision farming technologies.

CONCLUSION

From this research study it is concluded that most 81.82 per cent of the respondents had medium to high level of adoption behaviour. About 18.18 per cent of the respondents had low level of adoption. Cent per cent of the respondents had fully adopted drip and fertigation system, more than ninety percent of the respondents adopted the following technologies such as optimum seed rate, use of portrays for nursery preparation, stacking practice, sorting and grading. The adoption level was found minimum for the practices like use of yellow sticky trap, micro nutrient application. There were various factors that favoured the adoption of precision farming technologies. Among these three major factors are economic, external and social factors. Most of the respondents gave first preference to the higher yield as their reason of adoption of precision farming technologies in tomato cultivation followed by yield increase, provision of subsidy. The respondents gave first rank to TNAU scientists. Since, Tamil Nadu Agricultural University was undertaking TNPF project. The respondents expressed that the influence of executing TNPFP exerted some compulsion on them which was deemed as a social factor in the adoption of precision farming technologies. By having this research finding it is suggested that slight modification of recommended spacing for tomato cultivation would give better convenience in intercultural operations and also gives better yield. Training programme shall be organized for drip system service and maintenance to facilitate farmers themselves repair and maintain the drip systems. These will enhance the adoption of precision farming technologies in tomato cultivation, further in the future.

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