



Factors Influencing Adoption of Precision Farming Technologies in Watermelon Cultivation

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Watermelon (*Citrullus lanatus*) is one of the important fruit crops cultivating in India. Adoption improved production technologies in watermelon cultivation is not followed by majority of the farmers. Tamil Nadu Irrigated Agriculture Modernization and Water Bodies Restoration and Management (TN IAMWARM) is a unique World Bank funded project implemented with the prime motive of increasing the productivity of irrigated agriculture in the state of Tamil Nadu. Accordingly the TNIAMWARM project was implemented in Villupuram district through Krishi Vigyan Kendra, Tindivanam with one of the interventions that dissemination of precision farming technologies in watermelon cultivation to improve its productivity. The present study analysed the factors influencing adoption of Precision farming technologies in Watermelon cultivation. Most of the respondents gave first preference to the higher yield (Mean score - 72.2) as their reason of adoption of precision farming technologies in tomato cultivation followed by yield increase, provision of subsidy. Under external factors, the respondents gave first rank to TNAU scientists (Mean score - 79.42) as the influencer to adopt the precision farming technologies in watermelon cultivation.

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Further, the respondents expressed that the influence of executing TNIAMWARM project (79.25) exerted some compulsion on them which was deemed as a social factor in the adoption of Precision Farming technologies.

Keywords: Watermelon; precision farming; IAMWARM; Nallavur sub basin.

1. INTRODUCTION

Watermelon (*Citrullus lanatus*) is a notable horticultural crop belonging to the Cucurbitaceae family cultivated widely for its delicious fruits and it is thought to have originated in Southern Arica. Asian countries contribute approximately 81% of total production of watermelon worldwide [1]. According to the Food and Agricultural Organization of the United Nations, a cultivation area of 3.2 million hectares was employed for the production of 103 million tons of watermelon worldwide in 2018 [1]. Today, watermelon is cultivated all over the world cultivated in tropical and sub-tropical climates [2,3]. It is an important cucurbitaceous crops grown extensively in India, tropical and sub tropical countries. In developed countries, they are exclusively grown in monoculture systems [4]. In developing countries, they are mostly cultivated in small traditional gardens with low or no external inputs like fertilizers, pesticides, herbicides, and chemicals for disease control [4]. It is a warm season crop and requires relatively high temperature for quality fruit production. In some areas it is cultivated throughout the year. Demand for this fruit is mainly in summer. A watermelon fruit contain 95 per cent water, 0.2 percent protein, 0.3 percent minerals and 3.3 percent carbohydrates per 100g fresh weight [5]. The fruits of watermelon are good source of sugar, vitamin A, C, B1, B2 and B6. Watermelon is relished by many people across the world as a fresh fruit. Among all members of cucurbitaceous crops, watermelon is rich in iron content [6].

The total water potential of the State including ground water is 47,125 MCM (1664 TMC ft.). The total surface water potential of the State is 24,160 M cum (853 TMC ft) including the contribution (7391 MCM or 261 TMC ft.) from the neighboring States, viz., Kerala, Karnataka and Andhra Pradesh [7]. The State's irrigation potential in per capita terms is 0.08 ha when compared to the all-India average of 0.15 ha. The three main sources of irrigation in the State are rivers, tanks and wells [8].

Improved performance in Agriculture and related fields is the key to unlock the tremendous

potential of the rural areas of Tamil Nadu. In this direction, the Tamil Nadu Irrigated Agriculture Modernization and Water Bodies Restoration and Management (TN IAMWARM) is a unique World Bank funded project implemented with the prime motive of increasing the productivity of irrigated agriculture in the state of Tamil Nadu within an integrated water resources management framework. Under this project, 63 sub basins covered with Water Resources Organization (WRO), PWD, Government of Tamil Nadu as the Nodal Agency. Tamil Nadu Agricultural University (TNAU), one among the line departments implemented TNIAMWARM project, mainly concentrated on the transfer of water saving and improved production technologies of major crops of the respective sub basins.

Based on the major crops of each sub basin, activities were formulated in convergence with line departments as project mode and mission mode. Accordingly, the TN-IAMWARM project was implemented through Krishi Vigyan Kendra, Tindivanam in Nallavur sub basin at Villupuram district. Villupuram district situated in the North Eastern Agroclimatic Zone of Tamil Nadu and it is one of the predominant agricultural district in which more than sixty percent population is engaged in agriculture and allied activities for their livelihood. Krishi Vigyan Kendra for Villupuram district is located in Tindivanam. The main role of this KVK is testing and transfer of agricultural technologies to bridge the yield gap between the production and productivity and to increase self-employment opportunities among the rural communities. The overall mandate of the KVK is to develop and disseminate location specific technological modules at district level through Technology Assessment and Demonstration and to act as knowledge resource centre for agriculture and its allied activities. Dissemination of precision farming technologies is one of the intervention in TNIAMWARM project implemented through KVK. Although a lot of researchers have worked on socio economic analysis of watermelon production [9], the profitability and adoption of watermelon technologies [10]. However, very little research has been done to investigate the factors affecting watermelon farmers. Hence, an effort has been

made to study the factors affecting adoption of precision farming technologies among Watermelon famers in Villupuram district of Tamil Nadu.

2. METHODOLOGY

North eastern zone of Tamil Nadu was selected for the study. This is one of the seven agro-climatic zones of Tamil Nadu. The North eastern zone comprises of Thiruvallur, Vellore, Kancheepuram, Thiruvannamalai, Villupuram, part of Cuddalore, Perambalur and Ariyalur. The general criterion of maximum area under Tamil Nadu Irrigated Agriculture Modernization and Water Bodies Restoration and Management project and water melon cultivation by adopting Precision Farming was considered to select the locale of the study. TN IAMWARM is a turnkey project implemented by Tamil Nadu Agricultural University (TNAU) through Krishi Vigyan Kendra, Tindivanam in Villupuram district at Nallavur sub basin.

Alanguppam, Vadanerkunnam and Nolambur villages of Marakkanam block in Villupuram district were chosen to conduct this study. From these villages the respondents were randomly selected based on farmers benefited through TN IAMWARM scheme and cultivating Watermelon crop under Precision farming technology. A list of TN IAMWARM farmers of the Nallavur sub basin was obtained from the KVK, Tindivanam. A sample size of 120 farmers was fixed for conducting this study. The sample was proportionately allotted in each of all the selected villages of Nallavur Sub basin. The required number of respondents was selected by using the following formula.

$$n_i = \frac{N_i}{N} \times n$$

n_i -number of respondents to be selected from each village

N_i - number of respondents in the i^{th} village

N - Total number of respondents in all the 3 villages

n - Total number of respondents to be selected from all the 3 villages

The final sample from each selected villages was obtained by using random sampling technique.

The present research had no control over the independent variables prior to producing their effect, and hence the ex post –facto design was

used. According to Singh (1986) [11], the investigation draws the inference regarding the relationship between variables on the basis of such independent variables whose manifestations have already occurred.

By reviewing various relevant literature, discussion with scientists and progressive farmers, a list of factors which favour for adoption were collected. Since, this study is related to what are all the factors viz., economic, social and external influencing the watermelon farmers to adopt the precision farming technologies, the ranking was given for the various factors under each category. Each respondent was requested to indicate their preference towards the influenced factors for adoption of precision farming technology in watermelon cultivation. That was expressed in ranks.

Garette ranking technique was used for convert the rank into score. Garrette 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.

$$\text{Percentage Position} = \frac{100 \times (R - 0.5)}{N}$$

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
Respondent 1 st ranking score						
Respondents 2 nd ranking score						
Respondent 120 th ranking score						
Sum of scores mean						

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

3. RESULTS AND DISCUSSION

There are various factors which favour the adoption of Precision Farming technologies in watermelon cultivation. The three major factors viz, economic, extension and social were taken for this study.

3.1 Economic Factors

In this section an attempt was made to know the various economic factors favouring adoption of the Precision Farming technologies in Watermelon cultivation. Some economic factors were identified from the pre-test of the interview with the farmers and scientists and also by reviewing literatures. The results are presented in the following table.

The Table 1 reveals that most of the respondents gave first preference to the higher yield as their reason of adoption of precision farming technology in watermelon cultivation followed by yield increase, availability of subsidy, increased profit, 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 Tamil Nadu Agricultural University under TNIAMWARM project to implement the Precision Farming technologies in Watermelon cultivation. 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 than the normal fertilizers.

3.2 External Factors

There are number of external factors that motivated the farmers to adopt the Precision Farming technologies in crop cultivation. Some factors were identified, analyzed and the results are presented in the following Table 2.

Table 1. Economic factors influencing for adoption of Precision Farming technologies in Watermelon cultivation (n=120)

S.No	Factors	Mean score	Rank
1	Yield increase	72.2	I
2	Provision of subsidy	68.4	II
3	Higher profit	65.4	III
4	Time savings practice	45.0	IV
5	Minimum labour requirement	42.8	V
6	Savings in fertilizer usage	34.0	VI
7	Low cost of cultivation	25.4	VII

Table 2. External factors influencing for adoption of Precision Farming technologies in watermelon cultivation (n=120)

S.No	Factors	Mean Score	Rank
1	TNAU scientists	79.42	I
2	Officials of agricultural and horticultural departments	64.15	II
3	Drip manufactures	58.45	III
4	Officials of engineering department	51.05	IV

Table 3. Social factors influencing the adoption of Precision Farming technologies in tomato cultivation (n=120)

S.No	Factors	Mean score	Rank
1	Influence by IAMWARM project	79.25	I
2	Urge to an innovator	61.91	II
3	Influence by successful drip users	57.89	III
4	Serve as a role model	50.20	IV
5	Prestige	42.00	V

It could be observed from the Table 2 that most of the respondents indicated that TNAU scientists were the major influencing factor for the adoption of Precision Farming technology in watermelon cultivation. Tamil Nadu Irrigated Agriculture Modernization and Water Bodies Restoration and Management project is a world bank funded project implemented through TNAU and with the cooperation of other state departments of Horticulture, Agricultural Engineering, Agriculture, Agricultural Marketing and Agri-Business. Hence, TNAU scientists were 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, drip manufactures and agricultural engineering department respectively.

3.3 Social Factors

The Table 3 reveals that majority of the respondents were gave first rank to IAMWARM project. IAMWARM project highly influenced the farmer in the study area to adopt the Precision Farming technologies in watermelon cultivation. The respondents gave second, third, fourth, fifth rank to become an innovator, influenced by successful drip users, to be a role model and prestige respectively.

4. CONCLUSION

It is concluded from this study that the factors favouring adoption of Precision Farming would help the change agents of public and private sector to popularize the technology by focusing these factors. Most of the respondents gave first preference to the increased yield as their reason for adoption. It shows that cultivation of watermelon crop under Precision Farming increase the crop yield over conventional method of cultivation. So the Precision farmers got higher returns which lead to better livelihood. Since, the IAWARM project implemented through TNAU scientists, they were highly motivated the farmers

to adopt the Precision Farming technologies in the study area. The subsidy for adoption of Precision Farming was given under IAMWARM project hence, majority of the respondents felt that this project played a major role and highly influenced the farmer in the study area to adopt the Precision Farming technologies in watermelon cultivation. These findings on factors favouring adoption of Precision Farming in watermelon cultivation would help the change agents of public and private sector to popularize the technology by focusing these factors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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