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Integrated crop management practices in watermelon in Tiruvallur district of Tamil Nadu

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Abstract
The present investigation was conducted in different villages under Krishi Vigyan Kendra, Tiruvallur operational areas during 2018-2019. Total 10 front line demonstrations were laid out on farmers' fields in Tiruvallur district. The result of present study revealed that average highest yield 38.5 t/ha was noted in demonstration plot over control (25.0 t/ha) and 41 per cent of average yield increase was recorded over control plot. The extension gap (12.0 t/ha), technology gap (11.5 t/ha) with the technology index of 23 per cent during the demonstration year. Besides this, the demonstrated plots gave higher gross returns, net returns with higher benefit cost ratio when compared to farmer's practice. In present study efforts were also made to study the impact of FLD on horizontal spread which has increased by 120%, if appropriate package and practices were followed. Further, the study was undertaken to do a formative and summative (outcome and impact) evaluation of the frontline demonstration on integrated crop management in watermelon under Tituvallur district of Tamilnadu.

Keywords: watermelon, ICM, growth, yield

Introduction
Watermelon *Citrullus lanatus* (Thunb.) is one of the important fruit cultivated in the tropics and is consumed throughout the world. Watermelon [*Citrullus vulgaris* L. sin *C. lanatus* (Thlumb) Mansf. is also known as tarbuj, tarmuj, kalingad and kalindi in different parts of India. It belongs to Cucurbitaceae family (Panigrahi and Sharma, 2017) [13]. Melons, as a general term are sweet, juicy and tasty fruits being consumed mainly in the hot season. The crop is native of Africa. In India area under watermelon was 95,520 hectares with a production of 23, 62,160 tonnes. 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 (Edwards *et al.*, 2003) [7]. 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 (Adojutelegan *et al*., 2015) [1]. Watermelon with red flesh is a significant source of lycopene. Preliminary research indicates the consumption of watermelon may have antihypertensive effects Lilly, 2013 and Makaepea *et al.*, 2019 [10].

In Tiruvallur district, Watermelon crop was raised in the month of January to May. Generally seeds were sowed on the beds without mulching and drip irrigation. During summer, when the rise in temperature leads to increase of staminate flowers, high incidence of sucking pest and viral diseases was increased in watermelon. Plant growth became stunted and blossom end rot was observed. Finally, these may leads to reduction in fruit quality, yield and increasing in cost of production. In order to overcome these problems, a technology integrated crop management in watermelon was introduced and conducted front line demonstration with an objective to disseminate the technology to farmers and to identify the technology gap, extension gap and technology index.

Materials and Methods
ICAR -Krishi Vigyan Kendra, Tiruvallur, Taminadu carried out front line demonstrations (10) during 2018-2019 to spread the technology to farmers. Each frontline demonstration was laid out on 0.4 ha area which was taken as demo while adjacent 0.4 ha was taken as control for comparison of farmer's practice.

The farmers were selected randomly on the basis of surveys, diagnostic visits and farmer meetings conducted by KVK, Tiruvallur and trainings imparted on integrated crop management in watermelon. The factors that contribute to low productivity like unavailability of quality seed, gaps in cultivation practices and plant protection measures were identified. Improved method of crop production technology with recommended management practices were applied as an intervention to manage these problems. The differences in the packages were in line with the findings of Dilip Singh (2017) [6], Morwal *et al.* (2018) [12] and Babu and Rao (2018) [3].

The traditional practices were taken as a control. Field days were also conducted in each cluster to show the results of front line demonstration to the farmers of the same village and neighboring villages.

Data on yield and yield attributing characters, expenditure incurred by the farmer (Farmer's practice) and expenditure of demonstration plots were collected and analyzed. Gross income was calculated based on local market prices of water melon and net income by subtracting the total cost of cultivation from gross income. B: C ratio was computed by dividing gross returns with cost of cultivation.

To estimate the technology gap, extension gap and technology index the following formula as mentioned below were used as suggested by Samui *et al*. (2000) [15], Sagar and Chandra (2004) [14] and Dayanand *et al*. (2012) [4].

Per cent increase in yield = Demonstration yield – Farmers yield X 100 / Farmers yield

Technology Gap = Pi (Potential yield) – Di (Demonstration yield)

Extension Gap = Di (Demonstration yield) – Fi (Farmers yield)

Technology index = [(Potential yield – Demonstration yield/ Potential yield) X 100].

The data on adoption and horizontal spread of technologies were collected from selected farmers with the help of schedule. Data were subjected to suitable statistical methods. The following formulae were used to assess the impact on different parameters of water melon crop.

Impact of yield = Yield of demonstration plot- yield of control plot/Yield of control plot X 100

Impact on adoption (% change) = No. of adopters after demonstration - No. of adopters before demonstration /No. of adopters before demonstration X 100

Impact on horizontal Spread (% change) = After area (ha) - Before area (ha)/ Before area ×100

Table 1: Difference between demonstrated package of practices and farmers' practice of Watermelon cultivation

S.no.	Particulars	Demonstrated packages of Watermelon	Farmers practice of Watermelon
1	Sowing time	November-December	December- January
2	Seed rate	3.5 kg per ha	5 kg per ha
3	Preparation of raised beds along with drip and mulching	Preparation of raised beds size of 1.2 m width & 30 cm height along with drip and mulching- Practiced	Not practiced
4	Spraying of Ethrel at 2-4 leaf stage	Foliar spraying of Ethrel @ 2.5 ml/10 litre of water once at 2-4 leaf stage	Not practiced
5	Thinning of plants at 10-15 days after sowing	Thin the seedling 2/hill at 10-15 days after sowing - Practiced	Not practiced
6	Application of Recommended Dose of Fertilizers	55:55:55 kg per ha NPK fertilizers were applied along with Azospirillum (2 kg/hac) ,Phosphobacteria (2 kg/hac), *Pseudomonas fluorescens* (2.5 kg/hac), neem cake(100 kg/ha) & FYM (50 kg) half of the fertilizer as basal dose and remaining half of N& K 25 days after planting fertilizers	Not practiced
7	Fertigation	200: 200: 100 kg per ha NPK soluble fertilizers were applied Application of soluble fertilizers along with drip irrigation	Furrow method of irrigation -Not practiced
8	Spraying of need based pesticides	Need based spray of insecticides and fungicides	Indiscriminative dose of insecticides & pesticides used- Not practiced
9	Weed management	3 times proper hand weeding -Practiced	4-5 times hand weeding - Not practiced
10	Harvesting at proper stage	Fruits are harvested on withering of tendril, change in belly colour or ground spot to yellow and the mature fruit gives dull sound while thumbing	Premature harvesting without any thumbing test and ground spot to yellow- Not practiced

Results and Discussion

The data were pooled on different parameters and the results obtained were discussed accordingly. The demonstrated package and farmers practices details were given in Table1.

Table 1 show that all the FLD farmers fully adopted the recommended package of practices with slight modifications where as non-FLD farmers were unable to adopt the practices.

Yield and yield attributing characters

Integrated Crop Management practices in watermelon lead to marked effect on Water melon fruit yield. The yield performance indicators are presented in Table 2.

The effect of demonstrated package revealed an average fruit weight of 3.3kg compared to farmers practice 2.5 kg. The number of fruits per plant under demo recorded was 5.0 as compared to control 4.0 during 2018-2019. The cumulative effect of demonstrated package over three years, revealed an average number of fruits per plant as 5.33, whereas in control it was 3.66 fruits per plant. The fruit yield per plant under demonstrated package was 16.5 kg compared to 10.4 kg in

control plots during 2018-2019.

The total fruit yield per hectare under demonstrated package recorded was 38.5 t compared to 25 t in control plots during 2018-19. The total yield per ha of watermelon is increased by 41.8 per cent over the yield obtained under farmer's practice. The year-to-year fluctuations in yield and cost of cultivation can be explained on the basis of variations in prevailing social, economic and microclimatic condition of that particular location. The above findings are in similarity with the findings of Yusuf *et al*. (2013) in water melon.

Table 2: Effect of Integrated Crop Management on Yield attributing characters of Water melon

S.no.	Average fruit wt (kg)		No. of fruits		Fruits yield per plants		Total yield per ha (t/ha)		Percentage increase in yield
	Demo	Check	Demo	Check	Demo	Check	Demo	Check	
1	3.3	2.5	5	4	16.5	10.4	38.5	25	41.0

Economic parameters

Economic indicators *i.e.* gross expenditure; gross returns, net returns and BC ratio of Front Line Demonstration are presented in Table 3. The data clearly revealed that net returns from the demonstration plot were substantially higher than control plot, *i.e.* farmers practice during the year 2018-2019 of demonstration. Average net returns from demonstration plot were Rs. 1,68,000/ha compared to Rs 1,19,000/ha in control.

The average gross expenditure from the demonstration plot was recorded as Rs.1, 63,000 per ha compared to Rs. 1, 35,000 per ha in control.

The average gross returns from the demonstration plot were Rs. 3,31,000/ha compared to Rs. 2,54,000/ha in control plots.

Economic analysis of the yield performance revealed that benefit cost ratio of demonstration plots was observed to be significantly higher than control plot i.e., farmer practice. The benefit cost ratio of demonstrated and control plots was recorded 2.03 and 1.88 during 2018-2019.

Table 3: Cost of Economics of FLD on ICM in Watermelon

S.no	Total yield per ha. (t/ha)		Gross expenditure per ha. (Rs.)		Gross returns per ha. (Rs.)		Net returns (Rs.)		B:C Ratio	
	Demo	Check	Demo	Check	Demo	Check	Demo	Check	Demo	Check
1	38.5	25	1,63,000	1,35,000	3,31,000	2,54,000	1,68,000	1,19,000	2.03	1.88

Technology gap

The technology gap, the difference between potential yield and yield of demonstration plots was 11.5 t /ha during 2018-19 (Table 4). This may be due to the soil fertility, managerial skills of individual farmer's and climatic conditions of the selected area. Hence, location specific recommendations are necessary to bridge these gaps. These findings are similar to Mishra *et al*. (2009) [11], Kansara and Sabalpara (2015) [8] and Babu and Rao (2018) [3].

Extension gap

Extension gap of 12.5 t/ha was observed during 2018-19. This emphasized the need to educate the farmers through various techniques for the adoption of improved agricultural production technologies to reverse this trend of wide extension gap. More and more use of latest production technologies along with high yielding variety/hybrid will subsequently change this alarming trend of galloping extension gap. (Table 4).

Technology Index

The technology index shows the feasibility of the demonstrated technology at the farmer's field. The technology index of 23 per cent (Table 4) was observed during 2018-2019 which shows the effectiveness of technical interventions. This accelerates the adoption of demonstrated technical interventions to increase the yield performance of watermelon.

Table 4: Fruit yield, extension gap, technology gap and technology index in integrated crop management in Watermelon under FLD

S.no	Fruits yield per ha. (t/ha)		Technology gap (t/ha)	Extension gap(t/ha)	Technology index
	Demo	Check			
1	38.5	25	11.5	12.5	23

Horizontal Spread

Data in Table 5 showed that FLD organized on watermelon crop helped to increase area under integrated crop management of watermelon. There was significant increase in area under horizontal spread of the technology from 15 ha to 33 ha, an increase of 120 per cent under integrated crop management in watermelon.

Table 5: Impact of Front Line Demonstration (FLDs) on Horizontal Spread of Integrated Crop Management in Watermelon

Name of the technology	Area (ha)		Change in area	Impact (% change)
	Before demo	After demo		
ICM in Watermelon	15	33	18	120

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