Enhancing Watermelon Yield and Economic Returns through Integrated Crop Management in Prakasam District, Andhra Pradesh

Abstract:

Watermelon, being a crucial fruit crop, plays a vital role in the well-being and livelihood security of farmers. In the Prakasam district of Andhra Pradesh, where many farmers cultivate various watermelon varieties, limited awareness exists regarding research findings on integrated crop management for watermelon. To assess the yield potential and economic impact of integrated crop management, an evaluation was conducted in Thimmayapalem and Bodhanampadu villages. The adopted package of practices for integrated crop management included a seed rate of 5 kg/ha, spacing of 3m x 2m, application of 15 tons/ha of farmyard manure (FYM), and the use of Urea, single superphosphate, and murate of potash at rates of 100:100:62 kg/ha, respectively. Significant differences were observed between integrated crop management and traditional farmers' practices in terms of fruit yield and economic returns. The results demonstrated that integrated crop management outperformed farmers' practices, yielding 5.6 fruits per plant and a total yield of 55.3 t/ha, with a thrips incidence of 10.3%. In contrast, farmers' practices resulted in 4 fruits per plant, a yield of 46.67 t/ha, and a higher thrips incidence of 11.97%. Economic returns were also superior for integrated crop management, with a net income of Rs 245,667/- and a benefit-to-cost (B:C) ratio of 3.19, compared to Rs 176,467/- and a B:C ratio of 2.01 for farmers' practices. The integrated crop management approach exhibited an 18.5% increase in yield compared to farmers' practices. In conclusion, the study suggests that adopting integrated crop management practices for watermelon could significantly contribute to improving economic outcomes for farmers in the region.

Keywords: Andra Pradesh, Yield potential, integrated crop management, thrips, economic returns

INTRODUCTION

Watermelon (*Citrullus lanatus*), a member of the Cucurbitaceae family, is cultivated extensively across various tropical, subtropical, and arid regions worldwide. Notably, China holds the position of the largest global producer of watermelon. In the state of Andhra Pradesh, watermelon cultivation spans a vast area of 17.6 lakh hectares, contributing to a substantial production of 566.1 lakh tonnes (as per GOI, 2021).

This fruit is renowned for being fat-free, low in calories, and an excellent dietary choice. It stands out as a high-energy food and serves as an effective energy booster (Altuntas, 2008). The nutritional profile per 100 grams of the edible portion includes 90 grams of moisture, 7.0 grams of carbohydrates, 7.0 mg of phosphorus, 0.05 mg of thiamine, 6.0 mg of ascorbic acid, 1.0 gram of protein, 7.0 mg of calcium, 599 IU of vitamin A, and 0.05 grams of riboflavin (Sahu et al., 2011). The fruit is esteemed for its cooling properties, acting as a purgative, antihelminthic, antipyretic, and carminative agent. It is believed to purify the blood, alleviate thirst, remedy biliousness, and demonstrate effectiveness against sore eyes, scabies, and itching.

Genetic diversity plays a pivotal role in the success of genetic improvement initiatives. Selecting superior genotypes is crucial to achieve high yields, superior quality, uniform produce, resistance to diseases, and tolerance to abiotic stress. Specifically, improved genotypes of watermelon designed for vegetable purposes can be directly employed as varieties, providing farmers with optimal market benefits. Furthermore, integrating good agricultural practices holds the potential to enhance both yield and quality, particularly for dessert-type watermelons. Madidi and Hakimi (2019) emphasized that watermelon landraces exhibit high heat and drought tolerance compared to modern varieties, making them valuable for bolstering food security in arid and desert regions. The primary objective of this study is to assess integrated crop management practices for watermelon, focusing on parameters such as growth, yield, and quality. Given the significant impact of global production and demand on market prices, the volatility in watermelon prices is noteworthy and can potentially affect farmers' income. Therefore, understanding the economic benefits and improving farmers' income through watermelon cultivation are key aspects of this research endeavor.

MATERIALS AND METHODS

The conducted experiment spanned four Rabi seasons, covering the years 2021 to 2024, and took place at five farmers' fields located in Thimmayapalem and Bodhanampadu villages of Darsi mandal. Watermelon seeds of the US-777 variety were sourced from Myhico Seed Company in Guntur. The cultivation process involved thorough ploughing of the field, incorporation of well-decomposed farmyard manure at a rate of 25t/ha, and the formation of ridges and furrows. Sowing of seeds occurred in pots during the third week of December for the years 2021 to 2023. The study adopted integrated crop management practices recommended by Krishi Vigyan Kendra, Darsi, and incorporated local farmers' practices. The watermelon seeds, treated with imidacloprid (5g/kg), were sown with a spacing of 3m x 2m on one side of the ridges. Each demonstration plot covered an area of 50 cents, with a total of 1 acre cultivated for each demonstration. The recommended cultivation practices included the application of 25 t/ha of farmyard manure, 500 kg of neem cake during the last ploughing, and the basal application of NPK (100:100:62 kg/ha). Nitrogen (N), potassium (K), and phosphorous (P) top dressing were carried out in four equal splits on days 25, 50, 75, and 90 after planting. Additionally, boron was sprayed at a rate of 3g/l of water at the 2-4 leaf stage, and Formula-4 was applied as a foliar treatment on the 35th, 60th, and 80th days after sowing. Pest monitoring involved the placement of yellow and blue sticky traps (30 numbers per acre) in different directions of the plot, and neem oil was distributed to farmers for insect pest control. Before initiating the experiment, farmers underwent training on integrated crop management, covering topics such as main field preparation, the application of growth regulators, and harvesting methods. Various parameters, including vine length, branches per plant, node at which the first male flower appeared, node at which the first female flower appeared, days to the first male and female flowers, fruit weight, fruits per plant, yield per plant, yield per hectare, and thrips incidence, were observed and recorded. The collected data underwent statistical analysis using methods recommended by Panse and Sukhatme (1967).

RESULTS AND DISCUSSION

The results from the study, as presented in Table 1, clearly indicate that integrated crop management for watermelon cultivation exhibited superior performance in terms of growth, yield, and cost economics when compared to farmers' practices. In terms of growth, the vine length in integrated crop management reached 4.42 meters, and the number of branches per plant was 10.17, surpassing the growth observed in farmers' practices with 9.13 branches per plant and 3.67 meters. These findings are consistent with previous studies on watermelon by Alimari et al. (2017) and Anumala et al. (2020). The increased number of branches in integrated crop management is reported to enhance potential fruiting sites, contributing to increased yield, as noted by Gichimu et al. (2010).

Integrated crop management also demonstrated an advantage in terms of early growth stages. The days to first seed germination were significantly lower (7.90) in integrated crop management, along with earlier days observed for the appearance of the first male flower (36.67), first female flower (43), node at which the male flower appeared (9.33), and node at which the first female flower appeared (13). In contrast, farmers' practices showed longer durations for these events. Similar variations in days to female flower opening were reported in a study by Mohanta and Mandal (2016), and positive correlations between fruit yield per plant and the node at which the first female flower appeared were found by Choudhary et al. (2012). Integrated crop management outperformed in key yield-related parameters. The number of fruits per plant was the highest (5.67) compared to farmers' practices (4), and similar trends were observed for fruit length and fruit weight, with integrated crop management recording the highest values (10.37 cm and 6.27 g, respectively), while farmers' practices had the lowest values (9.22 cm and 4.77 g). These results align with previous findings that the number of fruits can significantly differ among different cultivars, as reported by Reddy et al. (2012) in muskmelon.

The most significant advantage of integrated crop management was evident in fruit yield, with 25.3 kg per plant and 55.3 t/ha, surpassing other crop management practices. In contrast, farmers' practices registered the lowest fruit yield per plant (12.53 kg) and yield per hectare (46.67 t/ha). The superiority of integrated crop management in overall yield is consistent with previous studies by Rolania et al. (2004), and Vashistha et al. (1983) in watermelon. The observed variations in yield emphasize the multifactorial nature of field conditions, genetic factors, and cultivation practices, as reported by Mishra et al. (2017). Overall, the study suggests that adopting integrated crop management practices for watermelon cultivation can lead to significantly enhanced growth, yield, and economic outcomes compared to traditional farmers' practices.

Economics:

Table 2 clearly demonstrates that the Integrated Crop Management of watermelon has proven to be economically superior compared to farmers' practices. The Integrated Crop Management approach achieved a substantial net return of Rs. 245,667/-, accompanied by an impressive benefit-cost ratio of 3.19. In contrast, the farmers' practice resulted in a lower net income of Rs. 176,467/-, with a less favorable benefit-cost ratio of 2.01. This considerable difference in net return and benefit-cost ratio can be directly attributed to the variations in yield between the two cultivation approaches. The results underscore that not only does the Integrated Crop Management strategy excel in terms of yield, but it also translates into significantly higher economic returns and a more favorable benefit-cost ratio when compared to traditional farmers' practices. This economic advantage further highlights the overall efficacy and economic viability of adopting Integrated Crop Management practices for watermelon cultivation.

Conclusion:

The Watermelon Integrated Crop Management has clearly demonstrated superior performance when compared to traditional farmers' practices. Several key indicators, including days taken for the first male flower (36.67), days taken for the first female flower (43), node at which the female flower appeared (13), number of fruits per plant (5.67), yield per plant (25.33), yield per hectare (55.33 t/ha), and a low incidence of thrips (10.3%), all showed significant improvement in the Integrated Crop Management approach. In contrast, farmers' practices exhibited longer durations for these events and lower yields, with days taken for the first male flower (42.67), days taken for the first female flower (54.38), node at which the female flower appeared (14.67), number of fruits per plant (4), yield per plant (12.53), yield per hectare (46.67 t/ha), and a slightly higher incidence of thrips (11.97%). The impressive 18.5% increase in yield and the demonstration of good market preference over farmers' practices strongly suggest that adopting Watermelon Integrated Crop Management can significantly contribute to the economic upliftment of farmers in the Prakasam district of Andhra Pradesh. Therefore, it is highly recommended for mass communication and popularization at farmers' fields to encourage widespread adoption, ultimately helping farmers achieve higher returns.

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Table1. Performance and Integrated crop management and farmers practice in watermelon during *Rabi* season

Particulars	Integrated crop management							Farmers practice						
	2021-22	2022-23	2023-24	Mean	SD	t-value	p-value	2021-22	2022-23	2023-24	Mean	SD	t-value	p-value
Day to germination	8.5	7.2	8.1	7.93	0.67	2.82	0.001	9.3	8.7	9.4	9.13	0.38	1.70	0.0120
vine length(m)	3.87	4.08	5.32	4.42	0.78	1.77	0.001	2.98	3.68	4.35	3.67	0.69	2.46	0.0340
Number of primary branches per plant	9.3	12.3	8.9	10.17	1.86	4.03	0.002	7.6	11.9	6.9	8.80	2.71	4.29	0.0010
Day to female flower appearance	39	47	43	43.00	4.00	3.35	0.140	53	61	49	54.33	6.11	2.65	0.0010
Days to first male flowr appeared	31	38	41	36.67	5.13	7.14	0.200	42	39	47	42.67	4.04	7.17	0.0010
Node atwhich first male flower	9	11	8	9.33	1.53	5.46	0.102	11	9	12	10.67	1.53	3.15	0.0100
Node at which first female flower	13	15	11	13.00	2.00	1.85	0.001	17	15	12	14.67	2.52	2.20	0.3000
fruit weight (kg)	4.5	6.2	5.8	5.50	0.89	1.37	0.030	3.5	4.2	3.4	3.70	0.44	1.09	0.1480
Number of fruits per plant	5	4	8	5.67	2.08	2.71	0.020	3	5	4	4.00	1.00	0.86	0.0250
fruit yield per plant	16	23	37	25.33	10.69	1.06	0.030	8.6	19	10	12.53	5.64	2.82	0.0300
Average fruit yield per hactare(t/ha)	48	53	65	55.33	8.74	6.96	0.001	43	51	46	46.67	4.04	4.50	0.1500
Thrips incidence(%)	12.1	9.4	8.9	10.13	1.72	3.68	0.020	15.9	10.9	9.1	11.97	3.52	3.07	0.0220

Table.2 Cost of cultivation and economics in integrated crop management and farmers practice in watermelon.

Particulars	Integrated crop management				Farmers practice			
	2021-22	2022-23	2023-24	Mean	2021-22	2022-23	2023-24	Mean
Yield per hectare	48	53	65	55.33	43	51	46	46.67
Cost of cultivation	97000	132000	127000	118667	150000	163000	159000	157333
Gross Returns	345600	360400	416000	374000	309600	346800	345000	333800
Net returns	248600	228400	260000	245667	159600	183800	186000	176467
B:C Ratio	3.56289	2.7303	3.27559	3.19	2.064	2.12761	1.85484	2.015482