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RESEARCH ARTICLE

Evaluation of Cucurbits under Rice Based Cropping Sequences in Tiruvallur District

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ABSTRACT

The field experiment conducted at Rice Research Station, Tirur, Tiruvallur District of Tamil Nadu Agricultural University aimed to evaluate the performance of rice-based cropping sequences of cucurbits in the district. Five cropping sequences were evaluated for Rice - Rice - Ashgourd, Rice - Rice - Muskmelon, Rice - Rice - Cucumber, Rice - Rice - Pumpkin and Rice - Rice - Watermelon. The study focused on the post samba season (December - March), when water scarcity results in low yields for rice cultivation. Instead of leaving the land as fallow during this season, cucurbits were raised to increase income. The results indicated that watermelon, cucumber and muskmelon were suitable for cultivation during the post samba season, with good economic returns. Rice – Rice - Watermelon recorded the highest yield of 26.10 t/ha with a BCR of 2.66 followed by Rice – Rice - Muskmelon (yield; 25.05 t/ha and BCR: 2.30) and Rice – Rice - Cucumber also showed good results with a yield of 20.4 t/ha and BCR of 2.19. Overall, the experiment's findings suggested that cultivating short duration cucurbits in the rice cropping sequence during the post samba season could help farmers to generate additional income instead of leaving the land as fallow. This information could be beneficial for farmers in Tiruvallur district, as it provides an alternative income source and maximizes the land's productivity during the low-yielding season.

Keywords: *Rice; Cucurbits; Cropping Sequence; Yield; Economics.*

INTRODUCTION

Rice is the major crop cultivated in Tamil Nadu which accounts for an area of 22.05 lakh hectares with a production of 122.22 lakh metric tonnes (GoTN, 2022). In Tiruvallur district, rice is cultivated in 96,348 ha, producing 4,26,203 metric tonnes. Rice based cropping sequence is a vital part of agriculture in Tamil Nadu. Intensive agriculture followed by the farmers involving exhaustive high yielding rice varieties has led to the heavy withdrawal of nutrients from the soil and imbalanced and discriminate use of chemical fertilizers, which has resulted in the deterioration of soil health (John *et al.,* 2001). Suitable rice based cropping sequence have to be evaluated to assess the stability in production. Rice - rice - pulses and rice - rice - fallow are the existing dominant cropping sequences of Tiruvallur district. This continuous cropping results in rapid decline in soil fertility and thus requires a special attention. Thus, the existing rice based cropping sequence has to be diversified with the inclusion of vegetables, pulses, maize and oilseed crops in kharif and summer seasons to overcome water and labour scarcity and to sustain soil health. Cucurbits include pumpkin, squash, cucumber and melon are commonly grown in many parts of the world including areas where rice is a major crop. Rice based cropping sequences involve growing rice as the main crop, followed by one or more crops in the same field. The evaluation of cucurbits under rice-based cropping sequences depends on various factors such as soil type, climate, irrigation, and management practices. In general, cucurbits can be successfully grown in rice-based cropping sequences and they can provide several benefits to the sequence. One of the main advantages of including cucurbits in rice-based cropping sequence

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which can help to break up soil sequences are that they can help to improve soil health. Cucurbits are known for their deep root compaction and improve soil structure. Additionally, cucurbits can help scavenge nutrients from the soil, reducing the risk of nutrient loss and improving nutrient availability for the subsequent crops. Another benefit of growing cucurbits in rice-based cropping sequences is that they can help to suppress weeds. Cucurbits exhibit vigorous growth habit and can quickly cover the soil surface and thus aids in reducing weed growth. Cucurbits are cultivated as short duration crops (3 to 4 months) with high profitability. Hence, choice of the component crops needs to be suitably planned to harvest the synergism among them towards efficient resource-based utilization and increase overall productivity (Anderson, 2005). Agricultural diversification towards high-value crops can potentially increase farm income. So, diversification has been envisaged as a new strategy for enhancing and stabilizing productivity toward achieving sustainable agricultural development. To strengthen economic security, there is a need to intensify and diversify the existing cropping sequence by other high-value or short duration crops of economic value. Hence, the present study was conducted to assess the feasibility of cultivation of cucurbits under rice based cropping sequences.

MATERIAL AND METHODS

Field experiments were conducted for two years at Rice Research Station, Tirur, during 2020-2022. The experiment is comprised of five treatments as cropping sequences *viz*., Rice - Rice - Ashgourd (T_1), Rice-Rice -Muskmelon (T_2), Rice - Rice - Cucumber (T_3), Rice - Rice - Pumpkin (T_4) and Rice - Rice- Watermelon (T_5). The treatments were laid out in Randomized Block Design with three replications. The cucurbits *viz*., ash gourd (Sungro No.700), musk melon (Kundan), cucumber (Gurka), pumpkin (Sunrise) and water melon (NS 295 Namdhari) were raised after the harvest of rice during the post samba season (Dec –March). Seeds were sown in pits at a spacing of 2 x 1.5 m during December and cultivation of the crop is done during post Samba (Dec -March). The recommended dose of fertilizers was given to each crop under the cropping sequences. The growth and yield parameters *viz.,* vine length, number of branches per vine, fruit length, fruit diameter, fruit weight, fruit yield per vine, TSS were recorded at the time of harvest and the flowering parameters *viz*., days to first appearance of male and female flowers, node number at which first male and female flowers appears at the time of flowering were also recorded to work out the feasibility and profitability of growing cucurbits in the rice cropping sequence. The data was recorded for two years and the pooled data was subjected to statistical analysis by the method suggested by Panse and Sukhatme (1985).

RESULTS AND DISCUSSION

Growth Parameters

The pooled mean data was interpreted for the growth parameters pertaining to post samba season for growing cucurbits under rice based cropping sequence. In muskmelon, earlier node number at which first male flower appears (2.6) and node number at which first female flower appears (4.5) was recorded. Similarly, earlier days to first appearance of male flower (28.3 days) and days to first appearance of female flower (32.2 days) with maximum crop duration (119 days) was observed in cucumber. Likewise, the growth parameters *viz*., number of branches per vine (8.7) and sex ratio (15.1) were found to be highest in pumpkin (Table 1). In muskmelon, earlier appearance of male and female flowers can lead to earlier fruit production, which can be advantageous for commercial growers. In cucumber, earlier appearance of male and female flowers, combined with a longer crop duration can result in a higher overall yield and also in pumpkin, more branches per vine and a higher sex ratio (which typically means more female flowers) can also lead to a higher yield.

Yield Parameters

In cucumber, the yield parameters *viz*., number of fruits per vine (13.4) and earlier days to first fruit harvest (48.7 days) were found to be highest when compared to the other cropping sequences. In ashgourd, fruit yield per vine (13.6 kg) was recorded to be highest during post samba season. Also, fruit diameter (48.8 cm) was found to be highest in pumpkin (Table 2). Similarly, fruit length (25.8 cm), fruit weight (3.15 kg), TSS (9.7° Brix) and yield (26.10 t/ha) was recorded to be the highest in watermelon during post samba season. Variations in the yield of crops may be due to the biological and environmental complexities and interactions in the cropping sequence (Kalpana *et al*., 2009). The incorporation of vegetables in the existing cropping sequences is an effective option for improving profitability. Becker *et al.* (1995); Yadav *et al*. (2000); Kumar *et al.* (2001); Sharma *et al.* (2004)

recorded maximum benefit cost ratio with rice based cropping sequences and with other vegetable crops combination. Arti *et al.* (2019) reported that the variation could be attributed due to differences in yield and selling prices of the vegetables and cropping sequence with sponge gourd-rice-broccoli proved superiority over rest of the sequences in rice based cropping sequence. This was mainly due to higher production potential associated with minimum cost of cultivation and higher selling price of the vegetables grown.

Economics of Cropping sequence

Gross return in different cropping sequences was comparatively higher in rice - rice - watermelon cropping sequence. Gross return (Rs/ha) in different cropping sequence differed significantly in both the years and also in pooled data. The pooled data recorded for 2020-21 & 2021-22 revealed that the maximum gross return (Rs.2,25,450/ha) was recorded in watermelon followed by gross return (Rs.2,08,800/ha) in muskmelon and gross return (Rs.1,83,600/ha) in cucumber was obtained during post samba season. Similarly, net return (Rs/ha) was calculated for both the years and the pooled analysis was presented (Table 3). Maximum net returns (Rs.1,40,700/ha) was recorded in watermelon followed by muskmelon (Rs.1,18,050/ha) and in cucumber (Rs.1,00,080/ha). Maximum benefit cost ratio was recorded in watermelon (2.66) followed by muskmelon (2.30) and cucumber (2.19). Kalpana et al. (2009) recorded that inclusion of more than two crops in a year particularly vegetables showed that the stability of the sequence in respect of yield and economics.

Becker *et al.* (1995); Yadav *et al.* (2000); Kumar *et al.* (2001) and Sharma *et al.* (2004) revealed that vegetable crops combination is more profitable in rice-based cropping sequences. One possible reason is that the cucurbits can utilize the nutrients left behind by the rice, reducing the need for additional fertilizers. In addition, the cucurbits can help suppress weeds, reducing the need for herbicides. Furthermore, relay cropping allows for better use of land and resources, as multiple crops can be grown in the same field, increasing the land's overall productivity and resulting in higher yields and profits for farmers. Additionally, the crops may have been managed well, with proper irrigation and pest control, which might have resulted in higher yield. Overall, relay cropping of cucurbits with rice can be a profitable and sustainable farming method if it is managed properly and adapted to local conditions. The relay cropping of cucurbits were profitable than the rice as sole crop and there was no adverse effect on yield attributes. Sharma *et al*. (2004); Saroch *et al.* (2005); Triparthi and Singh (2008) reported that diversification of rice cropping sequences particularly with vegetables gave more profit instead of rice cultivation as sole crop. Thus, small and marginal farmers can adopt this sequence to maximise their profit per unit time and space (Tripathi *et al.,* 2022).

Table 1. Mean performance on the growth parameters of cucurbits under rice based cropping sequence during post samba season (2020-21 & 2021-22)

S.No	Treatments	Vine length (cm)	Number of branches per vine	Days to first appearance of male flower (days)	Days to first appearance of female flower (days)	Node number at which first male flower appears	Node number at which first female flower appears	Sex ratio	Crop duration (days)
1.	T_1 - Rice - Rice - Ashgourd	679.5	6.2	68.0	77.0	39.0	44.0	5.2	104.0
2.	T_2 - Rice - Rice - Muskmelon	280.0	8.5	36.7	42.6	2.6	4.50	9.3	115.0
3.	T_3 - Rice - Rice - Cucumber	311.5	8.5	28.3	32.2	3.1	4.60	7.8	119.0
4.	T_4 - Rice - Rice - Pumpkin	419.5	8.7	53.2	62.1	16.1	26.10	15.1	102.0
5.	T_5 - Rice - Rice - Watermelon	280.5	7.1	33.5	41.7	6.9	13.20	8.1	113.0
	SEd	5.68	0.56	2.65	2.34	4.82	3.56	3.21	0.25
	CD (0.05)	13.2	1.65	6.89	5.91	12.3	7.92	7.24	0.638

Table 2. Mean performance on the yield parameters of cucurbits under rice based cropping sequence during post samba season (2020-21 & 2021-22)

S.No	Treatments	Number of fruits per vine	Fruit length (cm)	Fruit diameter (cm)	Fruit weight (kg)	Days to first fruit harvest (days)	Fruit yield per vine (kg)	TSS (°Brix)	Yield (t/ha)
1.	T_1 – Rice - Rice - Ashgourd	6.25	20.5	47.0	2.71	107.4	13.6	2.11	21.20
2.	T_2 – Rice - Rice - Muskmelon	9.3	17.4	36.6	0.515	77.61	5.89	8.95	25.05
3.	T_3 – Rice - Rice - Cucumber	13.4	13.2	16.1	0.163	48.7	2.14	4.60	20.40
4.	T_4 – Rice - Rice - Pumpkin	7.3	15.0	48.8	2.570	87.0	6.47	7.26	16.05
5.	T_5 – Rice - Rice - Watermelon	5.5	25.8	36.2	3.15	73.0	12.3	9.70	26.10
	SEd	0.98	0.23	1.85	1.15	4.32	3.85	2.16	1.75
	CD (0.05)	2.64	0.58	4.63	2.88	9.64	10.23	4.95	4.45

Table 3. Economics of cucurbits under rice based cropping sequence during post samba season (2020-21 & 2021-22)

S.No	Treatments	Cultivation cost	Gross returns	Net returns	BCR
1.	T_1 – Rice - Rice - Ashgourd	100100	148400	48300	1.49
2.	T_2 – Rice - Rice - Muskmelon	90750	208800	118050	2.30
3.	T_3 – Rice -Rice - Cucumber	83520	183600	100080	2.19
4.	T_4 – Rice - Rice - Pumpkin	74325	128400	54075	1.73
5.	T_5 – Rice - Rice - Watermelon	84750	225450	140700	2.66

Conclusion

Based on the experiment findings, it can be concluded that watermelon has the potential to grow well in Tiruvallur district during the post samba season (December to March) under rice-based cropping sequence. This cropping sequence has been found to be an alternate to the existing rice-based cropping sequences and with other vegetable crop combinations. Farmers in this area can benefit from this recommendation, as it offers them an opportunity to increase their income and improve their livelihoods during the fallow period, low-yielding season and when water for cultivating rice is scarce. Overall, the experiment's findings suggest that the rice-rice -watermelon cropping sequence is a promising option for farmers in Tiruvallur district. Additionally, watermelon cultivation during the post samba season can help farmers diversify their crops and reduce their dependency on a single crop.

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