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(RESEARCH ARTICLE)



Performance assessment of Bhendi hybrid Co 4 cultivation over local check variety under Front Line Demonstration

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Abstract

A field investigation on productivity augmentation of bhendi [*Abelmoschus esculentus* L. Moench] was carried out at Melanagai village, Mannargudi block of Thiruvavur district. The study was conducted by ICAR-Krishi Vigyan Kendra, Needamangalam [Tamil Nadu], during 2016-17 to assess the bhendi/okra hybrid Co 4 performance along with local check variety. The per cent yield improvement, technology gap, extension gap, technology index were calculated based on the observation recorded on growth, yield and economical attributes of both demonstration and local adopted check variety. The recorded data showed that the average yield of demonstration plots was 20.35 tha⁻¹ whereas the local check recorded an average yield of 12.80 tha⁻¹ and there is an amplified average yield by 37.21 per cent. The gross returns and benefit cost ratios from the demonstration plot were higher [Rs. 121020/ha and 2.80 respectively] as compared to farmer's practices [Rs. 76800/ha and 1.90]. The demonstrated improved variety i.e. okra hybrid Co 4 recorded superior growth, yield and economical parameters of the local adopted check variety. The enhancement in growth, yield and economic parameters under okra hybrid Co4 than the farmers' practice [local check] signifying the technical and economic viability of improved variety / hybrid over farmers practices.

Keywords: Bhendi Hybrid Co4; Local Check Variety; improved cultivation practices; Field Performance; Growth Parameters; Yield Parameters; Cost Economics

1. Introduction

The main occupation of Thiruvavur district is primarily "Farming". This area depends mostly on Cauvery river water for irrigation purpose. Although, this district is called as rice bowl of Tamil Nadu because of paddy cultivation in larger area and for all the three seasons, horticulture crops are also being cultivated in an area of 1534 ha. Among the vegetables cultivated in this district, okra plays a significant role for periodical income of small and marginal farm holdings. *Abelmoschus esculentus* L. Moench is also called as Okra/Bhendi or lady's finger in India, which is one of the most

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fashionable vegetables grown through out of the tropical, sub-tropical and warm temperature regions of the world. The origin of bhendi is considered as South Asia, Ethiopian and West African origins [1]. Bhendi is gaining importance with regard to its nutritional, medicinal and industrial value. It is rich in various nutrients and average nutritive value of okra is 3.21 per cent. It is a good source of folic acid, vitamin B, vitamin C providing 21.1 per cent of daily value for a 2000 calorie and has high dietary fibre content. Bhendi has anti-diabetic property which helps in reducing blood sugar levels, while in Turkey roasted okra seeds have been used as a traditional diabetes medicine for generations. Bhendi has highest amount of iodine which prevents from goitre disease. Bhendi also helps in preventing constipation, lowering cholesterol, aids in treating sore throat, irritable bowel, ulcers and lung inflammation. Bhendi has various industrial uses and young immature pods of okra can be consumed in different forms [2]. The fruits are harvested when immature and eaten as vegetable. The tender leaves of bhendi often used as a vegetable in areas where a wide variety of leaves are used as greens [West Africa, South East Asia]. Mature fruits containing crude fibre are used in the paper industry. Its ripe seeds can be dried, roasted and ground to be used as a coffee substitute [3]. Between these schemes, Frontline Demonstration [FLD] is one, which highlights to escalate productivity by contributing critical inputs along with amended cultivation of practices established by scientists of research Institutes and State Agricultural Universities [SAUs]. Using improved seed, adoption of seed rate, seed treatment, sowing time, recommended dose of fertilizer, weed control and plant protection measure generate higher yield of okra as compared to farmer's practices. Extending cultivation of improved varieties, getting feedback from farmers about constraints in adoption of recommended improved technologies for further research and to maximize the technology dissemination process among the farmers are some of the other important features of this programme [4]. Keeping these in mind, the present study was conducted to assess the impact of frontline demonstration on yield and economics of okra production.

2. Material and methods

The field experiments i.e. Front Line Demonstrations [FLD] on bhendi hybrid Co 4 were conducted in ten farmers field. The investigation was carried out by the ICAR-Krishi Vigyan Kendra, Needamangalam, to study the production and financial viability of scientific farming methods on Bhendi at Thiruvavur district during June to September and October to December season [two successive seasons] of 2016-17 in the farmer field at Mannargudi, Needamangalam and Nannilam blocks. The study was implemented in an area of 10 hectares with acreage of 1 hectare per farmer under front line demonstration with dynamic involvement of farmers in particular village. Before initiation of FLDs, the group meetings and skillfulness trainings were conducted for the selected farmers with reference to various aspect of Bhendi cultivation. To demonstrate the scientific bhendi production technology, constraints in bhendi production were categorized through participatory approach preferential ranking technique.

Formerly the farmers were practiced to cultivate the traditional bhendi variety with low yield potential i.e. 10-12 tonnes per hectare which is highly susceptible to yellow vein mosaic virus disease due to the lack of awareness on latest high yielding bhendi hybrid Co 4. Primarily ICAR-KVK, Needamangalam has given technical knowledge on bhendi production and a few important significant inputs viz., seeds and nutrient formulations i.e., IIHR vegetable special etc., The cultivation practices demonstrated were using improved hybrids, seed treatment, maintenance of optimum plant population, application of recommended dose of fertilizer. The seed were sown at plant spacing of 0.45m x 0.30m with the seeds rate of 2.5 kg/ha. All participatory growers were educated on all aspects of bhendi production techniques. To study the viability and economic feasibility of the front line demonstration, 10 active farmers were selected from 50 respondent farmers through proportionate sampling method. Observation on Growth, yield characters and economics on FLDs and indigenous adopted practices were recorded. The recorded data were compared and statically analyzed. The extension gap, technology gap and technology index were calculated using the formula suggested by Samuiet *al.*, [5], Kadianet *al.*, [6], Sagar and Chandra [7] and Sivakumaret *al.*, [8]. Client Satisfaction Index [CSI] was calculated by using formula developed by Kumaran and Vijayragavan [9].

Particulars	Formula
Extension gap [qha ⁻¹] =	Demonstration yield [qha ⁻¹] – yield of local check [qha ⁻¹]
Technology gap [qha ⁻¹] =	Potential yield [qha ⁻¹] - Demonstration yield [qha ⁻¹]
Technology index [%] =	Technology gap / Potential yield x100
Client Satisfaction Index [CSI]	Individual obtained score/ Maximum score possible

3. Results and discussion

3.1. Constrains in bhendi cultivation

Field bottle necks on Bhendi growing locations were documented during field experimentation. Preferential ranking for scientific techniques were utilized to classify the troubles encountered by the respondent farmer in respective villages. The conditions explained by the various farmers is furnished in Table 1. On examination of the constrains, it was clearly indicated that lack of suitable high yielding hybrid [85.00%] was in the first position followed by lack of technical knowledge on cultivation [75.00%]. In respect of these ranks suggested by the farmer for the different constraint exposed that lack of suitable high yielding varieties, low technical knowledge, labour problem, low soil fertility status and other constraint such as marketing of the farm produce were the reason for reduction of bhendi cultivation area in Thiruvavur district. Among all these limitations, marketing of the farm produce and water scarcity got least concerns. Similar studies results were also reported by Dhaka *et al.*, [10], Ranawat *et al.*, [11], Sreelakshmi *et al.*, [12], Sivakumar *et al.*, [8] their varietal demonstration studies.

Table1 Ranking by farmers for various constraints [n=100]

S. No.	Constraints	Percentage	Ranks
1.	Lack of high yielding varieties	85.00	I
2.	Labor problem	55.00	III
3.	Low soil fertility	40.00	IV
4.	Marketing of the farm produce	35.00	V
5.	Low technical know how	75.00	II
6.	Water scarcity through canal	30.00	VI

3.2. Growth characters

Plant morphological, flowering, fruit and yield parameter were significantly influenced due to the usage of hybrid Co 4 seeds for cultivation and adopted improved production techniques over local practices. [Table 5]. Significantly, the higher values for plant height [125.3 cm], number of branches per plant [3.4], number of fruit per plant [20.4], individual fruit weight [15.6 g], fruit length [13.7 cm], fruit girth [7.1 cm], yield per plant [437.8 g] and yield per ha [203.5 q/ha] were recorded by the bhendi hybrid Co 4. The least values for the mentioned characters were observed under local check variety under farmers adopted cultural practice. Lesser days taken for 50 per cent flowering [51.0 days] and first fruit harvest [40.9 days] and least incidence of Yellow Vein Mosaic disease [3.8 %] were recorded by using bhendi hybrid Co 4.

3.3. Performance of FLD

Results of frontline demonstrations revealed that the improved hybrid i.e. TNAU bhendi hybrid Co4 along with precise cultivation techniques emphasized under demonstration produced on an average of 37.21 per cent more tender fruit yield of bhendi as compared to farmer's practices [Table 3]. The improved hybrid recorded a higher tender fruit yield 20.35 t ha⁻¹ whereas the local check variety produced only 12.80 tha⁻¹. The data on fruit yield clearly pointed out that the yield of bhendi could be augmented by 37.21 per cent over the yield obtained under farmer's practices due to utilizing high yielding hybrid and implementation of suitable package of practices technology to cultivate the same. Similar results of yield improvement in various crops under frontline demonstrations has also been reported by Jeenangar *et al.*, [13], Hiremath *et al.*, [14], Dhaka *et al.*, [10], Dudi and Meena [15], Patel *et al.*, [16], Singh and Sharma [17] Singh *et al.*, [18], Singh and Sharma, [19]. This positive impact resulted that, front line demonstration has given a confidence to the farming community as they were motivated to cultivate new bhendi hybrid Co 4 in larger extent.

The extension gap which recorded in this demonstration is 75.5 ha⁻¹ during the period of study call attention to educate the farmers through various means for implementing of superior horticultural techniques to overturn this tendency of broad extension gap. High yield performance of the non- descriptive varieties could be vanished due to uninterrupted cultivation of these varieties for years together. To improve the production and productivity any crop in particular regime, replacement of non-descriptive varieties seed by high yielding varieties is highly indispensable. Under these circumstances, Front Line Demonstration is acting an essential role in popularizing the improved variety of bhendi in the study area.

There was a wide difference in technology gap observed in the demonstration yield over the potential yield. The average technology gap estimated in the experiment was 120.5 kg ha⁻¹[Table2]. This could be because of the soil fertility and ecological status. Hence, location specific recommendations are obligatory to link the gap. These conclusion are comparable to the results of Mitra and Samajdar[20] and Katare *et al.* [21], Sharma and Sharma [22] and Patel *et al.*[16].The technology index recorded in the FLD was 37.19 per cent. The elevated range of technology index could be due to awareness and use of improved varieties and adoption of recommended scientific package of practices during the period of the study period. Importance of extension techniques for communicating to the farmers about the improved agro techniques for enhancing the productivity plays an essential role. The technology index showed the economic feasibility of the demonstrated technology at farmers field. Yadav *et al.*, [23] also enlighten the impact of FLD in convincing the farmers for adoption of improved techniques for enhancing the crop productivity. Kacha and Patel, [24] also reported similar findings in bhendi under agro ecological conditions of Gujarat. Therefore, it concluded that understanding and using improved varieties / hybrids with recommended scientific package of practices enhanced the yield during implementation of FLD study period. Results of the current field trial are in agreement with the results of Singh *et al.*, [25], Hiremath and Nagaraju[26], Dayanand *et al.*[27], Raj *et al.* [28], Meena and Singh [29], Bhargav *et al.*, [30], Singh and Sharma [17] and Singh *et al.*, [18].

3.4. Economic Impact, [30], Singh and Sharma [17] and Singh et al

The financial feasibility of superior technology over conventional farmer's practices was calculated based on the current prevailing market prices of inputs and output [tender vegetable] cost [Table 4]. The cost benefit analysis exposed that, cost of production of bhendi with improved technology reordered Rs. 43,000 ha⁻¹ where as it recorded only Rs. 40600 ha⁻¹ in farmers practice. The additional cost invested under improved technology was mainly due to additional cost for hybrid seed material. Front line demonstration with improved hybrid and systematic cultivation practices recorded higher net return of Rs. 78020 /ha] with higher benefit cost ratio [2.80] and local variety recorded least values for net return [Rs. 36200/ha] and benefit cost ratio [1.90]. The results are in accordance with the findings of Hiremath*etal.*,[14], Hiremath and Nagaraju[26] and Patel *et al.*[16].

Table 2 Comparison of package of practices demonstrated and farmers practices under FLD on Bhendi hybrid Co 4

Parameters	Package Demonstrated	Farmers practices
Hybrid / variety	TNAU-Bhendi hybrid Co 4	Traditional local variety
Seed rate	2.5 kg / ha	8-10 kg / ha
Seed treatment	Seed treatment with <i>Tricoderma viride</i> @ 4 g/kg or <i>Pseudomonas fluorescens</i> @ 10 g/ kg of seeds and again with 400 g of Azospirillum using starch as adhesive and dried in shade for 20 minutes.	Not following
Time of sowing	During June - August and February	Throughout the year
Method of sowing	Sow three seeds per hill at 30 cm apart and then thin to 2 plants per hill after 10 days.	Broad casting
Fertilizer dose	Basal dose FYM @ 40 t / ha, N @ 100 kg, P @ 100 kg and K @ 100 kg/ha as basal and 100 kg N / ha 30 at days after sowing.	No use of fertilizer
Foliar nutrition	1 % urea [10 g/l] + muriate of potash [10 g/l] on 30 and 45 days after planting. For hybrids, foliar application of water soluble fertilizer 19-19-19 three times @ 0.5% [5 g/l] at 10 days interval from 30 days after planting	Nil
Bio-fertilizers	Apply Azospirillum and Phosphobacteria each at 2 kg/ha mixed with 100 kg of FYM before sowing.	Not following
Plant protection measures	Need based application of neem oil to protect the crop against insect	Nil
Irrigation	Irrigation is done at weekly intervals	Irrigation at three days interval
Weed management	Spray Oxyflourfen at 0.15 kg a.i./ha or as pre emergence application on third day after sowing. Herbicide application should be integrated with one hand weeding on 30 days after sowing.	One hand weeding alone

Table 3 Effect on using bhendi hybrid Co-4 and adopting improved cultivation techniques over local practices on yield potential

Year	Variety	Area [ha]	Demo. [No.]	Potential Yield [qha ⁻¹]	Demonstration yield of improved technology [qha ⁻¹]				% Increase	Extension gap [qha ⁻¹]	Technology gap [qha ⁻¹]	Technology index [%]
					Max.	Min.	Avg.	Local				
2016-17 June-September	Bhendi Hybrid Co 4	10	10	324.0	221.0	186.0	203.5	128.0	37.21	75.5	120.5	37.19

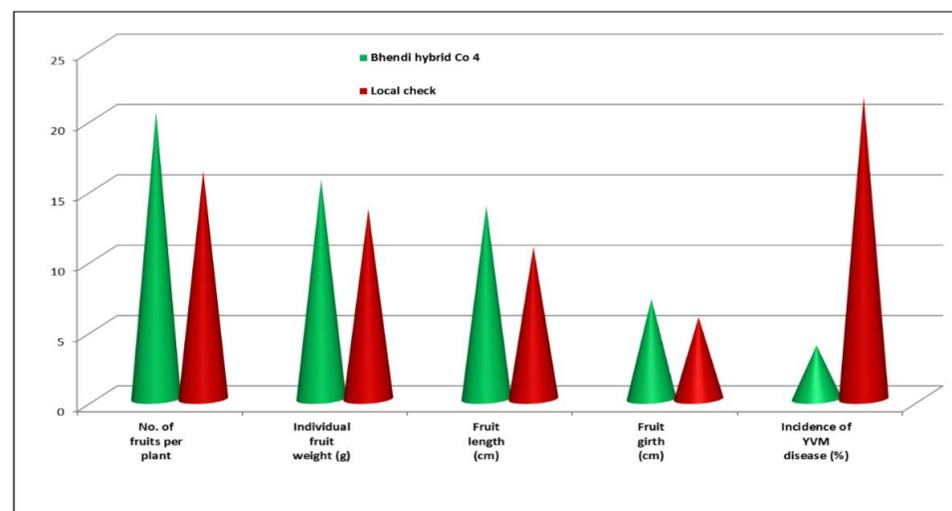
Table 4 Effect on using bhendi hybrid Co-4 and adopting improved cultivation techniques over local practices on economics

No. of Demo.	Area [ha]	Yield [t/ha]				% Increase in yield	*Economics of demonstration [Rs./ha]				*Economics of check [Rs./ha]			
		Demonstration			Check		Gross Cost	Gross Return	Net Return	** BCR	Gross Cost	Gross Return	Net Return	** BCR
10	10	H	L	A	12.80	37.21	43000	121020	78020	2.8	40600	76800	36200	1.9
		22.10	18.60	20.35										

* Economics to be worked out based total cost of production per unit area and not on critical inputs alone. ** BCR= Gross Return/Gross Cost:
H - Highest Yield, L - Lowest Yield A - Average Yield

Table 5 Effect on using bhendi hybrid Co-4 and adopting improved cultivation techniques over local practices on growth and yield characters

Treatment	Plant height [cm]	No. branches / plant	50% of Flowering [days]	First Fruit Harvest [days]	No. of fruits per plant	Individual fruit weight [g]	Fruit length [cm]	Fruit girth [cm]	Yield per plant [g]	Yield per ha [q/ha]	Incidence of YVM disease [%]
Hybrid Co 4	125.3	3.4	51.0	40.9	20.4	15.6	13.7	7.1	437.8	203.5	3.8
Check	116.2	3.2	62.0	56.8	16.2	13.5	10.8	5.8	378.5	128.0	21.5
Mean	120.75	3.30	56.50	48.85	18.30	14.55	12.25	6.45	408.15	165.75	16.00
SD	6.43	0.14	7.78	11.24	2.97	1.48	2.05	0.92	41.93	52.11	18.38
CV	5.33	4.29	13.77	23.02	16.23	10.21	16.74	14.25	10.27	31.61	114.90

**Figure 1** Effect on using bhendi hybrid Co-4 and adopting improved cultivation techniques over local practices on yield characters

4. Conclusion

The findings of this front line demonstration showed that the yield under cultivation of bhendi was amplified by 37.21 per cent due to technological interventions adopted during the study period. The findings noticeably recognized that the implementation of superior technology augmented the bhendi crop productivity and farmers economic profitability. Large number of farmers in the villages of Thiruvarur district adopted the recommended practices of demonstrations and got benefitted with higher bhendi production because of influence of Front Line Demonstration study which played a vital role and brought boon to the farming community.

Compliance with ethical standards

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Disclosure of conflict of interest

The author declares no conflict of interest.

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