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Evaluation of different varieties of okra [*Abelmoschus esculentus* (L.) Moench] under organic farming conditions in mid hills of Himachal Pradesh

Sanjay Chadha, Sonia Sood, Rameshwar and J.P. Saini
Department of Organic Agriculture
CSK, Himachal Pradesh Krishi Vishvavidyalaya, Palampur – 176 062, India

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Abstract

An experiment was conducted during the two consecutive summer-rainy seasons of 2010 and 2011, at Model Organic Farm, CSKHPKV, Palampur to identify the okra [*Abelmoschus esculentus* (Linn.) Moench.] varieties suitable for cultivation under organic farming conditions. The results revealed that amongst eithteen tested varieties/entries of okra, Nazuk was found to be the highest yielding (126.95 q/ha) variety which gave net profit of Rs. 1 20 918 and with a benefit: cost ratio of 1.74 in pooled data. The other promising varieties of okra suitable for cultivation under organic farming conditions in mid hill of Himalayas were S-51, VRO-4 and Arka Anamika with a yield potential of 116.52, 113.51 and 112.71 q/ha respectively and net profit and benefit: cost ratio of these varieties were Rs. 1 05 280, 1 00 765 & 99 565 and 1.52, 1.45 & 1.44, respectively.

Key words: Okra, *Abelmoschus esculentus,* organic farming, varietal performance.

Introduction

Okra is one of the most important offseason vegetable crops of low and mid hills of Himachal Pradesh and is being cultivated on an area of 2400 ha with production of 28100 MT (Anonymous, 2010-11). In the recent past, consumers' awareness toward concern of growing pesticides' residues in vegetables has attracted the attention of farmers, scientists, environmentalists, policymakers and governments for organic farming. With adoption of organic farming practices despite the low productivity during initial years of adoption, the income of the farmers is expected to increase (Sivaharsh *et al.*, 2010). At the same time, the demand of organic vegetables and especially okra is increasing day by day in the domestic and international markets. For organic farming to be profitable there is an urgent need to identify suitable varieties adapted to organic conditions for their increased sustainability of performance (Wolfe *et al*., 2008). Therefore, in the present study, an attempt has been made to evaluate and identify varieties/entries of okra suitable for cultivation under organic farming conditions.

Materials and Methods

The present investigation was carried out for two years at Model Organic Farm, Department of Organic Agriculture, CSKHPKV, Palampur which has been maintained under complete organic farming conditions since April 2006. Eighteen

varieties/entries of okra *viz.*, Kanchan, VRO-3, VRO-4, P-8, Arka Anamika, VRO-6, Tulsi, Varsha Uphar, Prabhni Kranti, Nazuk, S-51, Hisar Unnat, VRO-5, Nitya, 9801, Komal, P-20 and Harsa were evaluated in Randomized Block Design with 3 replications during Summer-Rainy seasons of 2010 and 2011. The seeds were sown at a spacing of 45×10cm in plots of 4.5 m^2 size on April 16th 2010 and April 18th 2011. Prior to sowing, the seeds were treated with *Azotobactor* and *Beejamrit* (organic preparation made of cow dung, cow urine, cow milk and slaked lime in 5:5:1:¼ proportion dissolved in 100 litre of water and kept overnight with 2-3 times stirring). Vermicompost (VC) @10t + Enriched Compost (EC) @2t /ha was applied in the field at the time of sowing. EC was prepared by enriching compost with oilseed cake, cow urine, rock phosphate and gypsum @ 1% of the total organic material used for the preparation of composting. In addition to this, for meeting out the nutritional requirement of standing crop, two sprays of *Panchgavya* (10%) and two sprays of *vermiwash* (10%) were given alternatively at fortnightly interval starting from one month after sowing. The observations recorded on 10 randomly marked plants in each plot on plant height (cm), total number of leaves per plant, inter nodal length (cm), total fruits per plant, average fruit weight (g), whereas, fruit yield (q/ha) from the net plot area was recorded for comparison. Standard statistical procedure (Panse and Sukhatme, 1976) was used to analyze the data and economics of the different entries was calculated.

Results and Discussion

Plant height (cm)

The plant height was measured from the base of the plant to the top of the main axis at the time of final picking and mean values were computed. The data in Table 1 showed a similar trend in plant heights of different varieties during both the years of evaluation. The maximum plant height (181.44 &183.40 cm) was recorded in Nazuk, whereas, the minimum (111.10 & 111.33cm) values were recorded in VRO-3 during first and second year, respectively. The other varieties which were statistically *at par* with Nazuk in exhibiting the maximum plant height were S-51(180.24 & 182.4 cm), P-20 (178.1 &179.20 cm), Parbhani Kranti (172.40 &175.50 cm), Komal (175.1 & 173.20 cm) and Arka Anamika (173.84 & 170.52 cm) during 2010 and 2011, respectively.

Total number of leaves per plant

Significant differences for total number of leaves per plant were observed among different varieties. The range for this trait varied from 10.4 (VRO-3) to 22.8 (Varsha Uphar) in 2010 and 10.0 (VRO-3) to 23.4 (Parbhani Kranti) in 2011. The other varieties which had more number of leaves per plant were P-20(20.4), S-51 (19.3) and VRO-5 (19.1) in 2010 and S-51(19.2), Hisar Unnat (19.0), Nitya (19.0) and P-20(18.9) in 2011. In general, it was observed that the varieties with more number of leaves per plant produced higher fruit yield. These results are in accordance with Adeniji and Aremu (2007), who found that plants with larger leaf area achieved more photosynthesis and resulted in greater fruit yield.

Inter nodal length (cm)

Increased plant height coupled with more number of nodes and small inter-nodal length are the desirable traits leading to increased marketable fruit yield in okra (Hussain, 2005). The plant height was divided by the total number of nodes in order to get internodal length. The range for internodal length varied from 10.6 (VRO-4) to 14.1cm (Arka Anamika) in 2010 and 10.1 (VRO-4) to 14.2cm (Arka Anamika) in 2011. The other varieties which were found statistically *at par* with Arka Anamika in exhibiting the maximum internodal length were Tulsi (13.6 cm), Nazuk (13.3 cm), Versha Uphar (12.9 cm), S-51 (12.9 cm) and Komal (12.8 cm) in 2010 and Nazuk (13.5 cm), Tulsi (13.2 cm), P-20 (13.2 cm) and Hisar Unnat (13.1 cm) in 2011.

Number of fruits per plant

Increased number of fruits per plant is a direct component leading to higher yield. The data presented in the Table 1 indicated that there was significant variation in number of fruits per plant among the different varieties. During both the years

Table 1. Performance of different genotypes of okra under organic farming conditions

S. No.	Variety	Plant height (cm)		Number of leaves/plant		Internodal length(cm)		Number of fruits/plant		Average fruit weight (g)		Fruit yield (q/ha)			Net Profit (Pool)	B:C Ratio
		2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	Pooled	(Rs./ha)	(Pool)
1	Kanchan	139.44	123.40	15.0	13.0	12.2	12.0	5.82	6.82	9.59	8.56	69.03	68.00	68.52	33273	0.48
2	VRO-3	111.10	111.33	10.4	10.0	12.1	12.2	5.95	5.25	8.32	8.23	63.5	68.25	65.88	29313	0.43
3	VRO-4	130.80	129.47	13.3	12.3	10.6	10.1	8.35	6.35	10.75	10.45	114.01	113.01	113.51	100765	1.45
4	P-8	139.24	136.67	14.5	14.0	12.1	12.0	6.88	7.32	7.94	8.02	72.42	73.42	72.92	39880	0.58
5	A. Anamika	173.84	170.52	12.2	12.0	14.1	14.2	8.8	9.2	10.11	10.12	113.21	112.21	112.71	99565	1.44
6	VRO-6	135.67	132.67	12.4	12.3	11.6	11.5	6.47	5.42	8.35	8.23	68.77	65.72	67.25	31368	0.46
7	Tulsi	168.60	165.70	13.9	12.9	13.6	13.2	8.98	7.93	8.65	8.54	100.38	98.32	99.35	79525	1.15
8	V. Uphar	164.74	168.70	22.8	13.2	12.9	12.5	9.3	9.00	10.28	10.34	110.15	100.12	105.14	88203	1.27
9	P. Kranti	172.40	175.50	15.8	23.4	12.1	12.3	6.92	5.92	10.57	9.98	93.99	92.12	93.06	70083	1.01
10	Nazuk	181.44	183.40	18.7	16.8	13.3	13.5	9.53	8.53	10.43	10.32	127.49	126.40	126.95	120918	1.74
11	S-51	180.24	182.40	19.3	19.2	12.9	11.4	9.12	9.32	9.97	9.92	117.02	116.02	116.52	105280	1.52
12	Hisar Unnat	140.47	142.50	18.2	19.0	12.2	13.1	7.41	7.46	8.75	8.73	89.1	92.12	90.61	66415	0.96
13	VRO-5	164.34	163.25	19.1	17.2	11.6	11.8	7.67	8.68	9.33	9.23	92.11	123.42	107.77	92148	1.33
14	Nitya	149.57	145.57	13.0	19.0	11.8	11.9	7.95	7.91	10.14	10.12	103.23	115.03	109.13	94195	1.36
15	9801	144.67	147.60	16.1	12.0	12.3	10.6	9.78	9.23	8.46	8.43	106.39	89.20	97.80	77193	1.12
16	Komal	175.10	173.20	18.8	15.1	12.8	12.0	7.94	8.02	8.33	8.23	92.43	92.33	92.38	69070	1.00
17	P-20	178.10	179.20	20.4	18.9	11.84	13.2	7.94	7.82	9.96	9.67	101.72	106.34	104.03	86545	1.25
18	Harsa	122.60	123.60	15.4	16.2	10.77	12.4	6.13	7.12	9.42	9.45	74.08	101.23	87.66	61983	0.9
	CD(5%)	14.7	13.8	2.72	2.68	1.55	1.45	1.08	1.34	1.47	1.68	16.15	14.74	15.45	11470	0.06

Cost of cultivation: Rs 69500/- per ha

of investigation, almost similar trend was observed for different varieties in exhibiting fruits no. per plant. In 2010, the maximum number of total fruits per plant were recorded in the entry 9801 (9.78), which were statistically *at par* with five other varieties *viz*., Nazuk (9.53), Versha Uphar (9.3), S-51 (9.12), Tulsi (8.98) and Arka Anamika (8.8). Whereas in 2011, S-51 gave maximum fruits per plant (9.32) and was statistically *at par* with five other varieties/entries *viz.*, 9801 (9.23), Arka Anamika (9.2), Versha Uphar (9.0), VRO-5(8.68) and Nazuk (8.53) in 2011.

Average fruit weight (g)

It is one of the most important character which accounts for yield of crops. Significant differences were noticed among the different varieties for average fruit weight over both the years of evaluation. The range for average fruit weight varied from 7.94 (P-8) to 10.75g (VRO-4) in 2010 and 8.02 (P-8) to 10.45 (VRO-4) in 2011. As many as thirteen varieties in first year and nine varieties in second year were statistically *at par* with VRO-4 in average fruit weight.

Fruit yield (q/ha)

Significant differences were observed among the eighteen genotypes of okra for fruit yield. Nazuk was found to be the highest yielding variety (127.49 and 126.4 q/ha in 2010 and 2011, respectively). In pooled yield of the two years, Nazuk yielded 126.95 q/ha followed by S-51 (116.52 q/ha), VRO-4 (113.51 q/ha) and Arka Anamika (112.71 q/ha). The use of vermicompost alongwith enriched compost at the time of sowing and the use of liquid manures *Panchgavya* and *Vermiwash* as spray proved effective in promotion of growth and fruiting, as these manures help in the quick build up of soil fertility through enhanced activity of soil micro-flora and fauna (Yadav and Mowade, 2004).

Net Profit (Rs. /ha)

The pooled values revealed that the variety Nazuk tended to fetch higher net returns (Rs. 1,20,918/ha) followed by S-51(Rs. 1,05,280 /ha) and VRO-4 (Rs. 1,00,765/ha). The lowest net returns were recorded in VRO-3 (Rs. 29,313/ha). The higher net returns were associated owing to higher yields

Benefit: Cost ratio

The highest benefit: cost ratio (1.74) was obtained with Nazuk variety followed by S-51 (1.52), VRO-4(1.45) and Arka Anamika (1.44). The benefit: cost ratio for cultivation of these varieties was higher due to their better cultivation under organic farming.

Based on two years evaluation of eithteen genotypes of okra under organic farming conditions, it is concluded that the varieties Nazuk, S-51, VRO-4 and Arka Anamika were found to be the best varieties of okra for getting higher and consistent yields and net returns in organic agriculture under mid hill conditions of Himalayas.

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