



## Research Article

# PERFORMANCE OF ALL INDIA CO-ORDINATED VEGETABLE IMPROVEMENT PROJECT (AICVIP) HYBRID TRIALS (IET, AVT-I and AVT-II) ON GROWTH, YIELD AND QUALITY OF BHENDI (*Abelmoschus esculentus* L. Moench)

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**Abstract:** A field experiment was carried out to study the performance of All India Co-Ordinated Vegetable Improvement Project (AICVIP) hybrid trials (IET, AVT-I and AVT-II) on growth, yield and quality of Bhendi (*Abelmoschus esculentus* L. Moench) from 2012 to 2014 at the Department of Vegetable Crops, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore. The seeds of the okra hybrid (IET, AVT-I and AVT-II) entries were chosen for this study. The results based on Bhendi hybrids trials mean revealed that different hybrid entries were applied in three replications. Among the entries tested (IET), the highest fruit yield (226.5 q/ha) was recorded in 2014/OKHYB-4 followed by 2014/OKHYB-6 (200.4 q/ha), the results revealed that (AVT-I) the highest fruit yield (243.5 q/ha) was recorded in 2013/OKHYB-9 followed by 2013/OKHYB-10 (224.6 q/ha). Among the entries tested (AVT-II), the highest fruit yield (238.7 q/ha) was recorded in 2012/OKHYB-13 followed by 2012/OKHYB-15 (225.4 q/ha).

**Keywords:** ICAR-ICRP-VC Bhendi hybrid entries (IET, AVT-I and AVT-II), growth, Yield

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## Introduction

Okra [*Abelmoschus esculentus* (L.) Moench] has occupied a prominent position among vegetables. Okra is known by many local names in different parts of the world. It is called lady's finger in England, Gumbo in U.S.A. and Bhindi in India. Okra is a polyploid, belonging to the family Malvaceae with  $2n = 8x = 72$  or 144 chromosome<sup>1</sup>, it was probably domesticated in the Ethiopian region. Okra is a often cross pollinated crop, occurrence of out crossing to an extent of 4 – 19 % pollination. Okra is cultivated comprehensively in the tropical, subtropical and warm areas of the world like India, Africa, Turkey and other neighbouring countries. In India, okra is one of the most important vegetable crops grown for its tender green fruits during summer and rainy seasons. It is a short duration crop propagated through seeds, cherished for its tender and scrumptious green fruits used in curries, soups or in canned, dehydrated or frozen forms for off-season consumption<sup>2</sup>. Okra is more remunerative than the leafy vegetables, while crop has not adapted in India as leafy vegetable as in for East countries. The roots and stems are useful for clearing cane juice from which gur or jaggery is prepared [3]. Its ripe seeds are roasted, ground and used as a substitute for coffee in Turkey [4]. The fruits are a green capsule containing numerous white seeds when immature and the flowers and upright plants give okra an ornamental value<sup>5</sup>. The okra fruit can be classified based on the shape, angular or circular<sup>6</sup>. Edible fresh and mature fruits contain 88% moisture and large number of chemical components including Vit. A 88 IU, Vit. B 63 IU and Vit. C 13 mg/100 gm. unripe okra fruits contain 3100 calorie energy, 1.8gm Protein, 90 mg Calcium and 1.0 mg iron. Seeds of okra had the oil content 17.3% It strike out the nutritious ingredient of cattle feed. It has Ayurvedic medicinal properties. Its leaves are used for preparing a medicament to reduce inflammation. It is an excellent source of Iodine for control of goiter [7]. It is also very useful against genitor-urinary disorders, spermatorrhoea and chronic dysentery [8]. In India, Okra has occupied a prominent position among the export oriented vegetables because of its high

nutritive value, palatability and good post-harvest life. It has an enormous potential as one of the foreign exchange earner crops and accounts for 60 percent of the export of fresh vegetables. At present, it is being exported to the neighbouring countries in the Gulf and South-East Asia, particularly Singapore, Mauritius, Malaysia, Sri Lanka and Bangladesh. Okra is widely cultivated in plains of India mostly in Uttar Pradesh, Bihar, Orissa, West Bengal, Andhra Pradesh Karnataka and Assam. In India it is being cultivated in 5.33 lakh ha and its annual production is 6346.0 thousand MT [9]. In Madhya Pradesh okra is grown in 26.51 thousand ha area and 305.91 thousand mt<sup>9</sup>. It is a hardy crop and can be grown with considerable success on a wide range of soils and under variable environmental conditions. In India, it is grown twice in a year for getting regular supply. In the country, a large number of okra varieties are grown, the variation occurs with regards to quantitative and qualitative traits. The plant height, number of primary branches per plant, number of fruits per plant, size of fruit i.e. length as well as weight of fruits are the yield contributing characters while, colour of fruit and fibre content determine the quality of fruit. The foremost challenges faced by okra crop is that it is ravaged by many species of insect-pests and diseases throughout its growth period. Among these, jassid, fruit and shoot borer, powdery mildew and yellow vein mosaic are quite serious and major restraining factors in okra cultivation. Another challenge faced by mankind has been to produce adequate quantity of food from the available acreage to meet the requirements of ever expanding world population. The rate of yield gain in crop improvement programme must be in proportion to the rate of population growth so, as to avoid malnutrition and hunger. A lot of okra hybrids/varieties are being grown by the farmer's, but best performing hybrids/varieties of okra having desirable quantitative and qualitative characters such as adaptability to adverse environments and resistance to biotic and abiotic stresses result into better monetary return to the vegetable growers.

Tables-1 Performance of (IET) entries on growth and yield quality of Bhendi hybrids

Name of the entry	Plant height (cm)	No. of ridges / fruit	Average fruit weight (g)	Marketable yield / plot (kg)	Days to first harvest	Fruit length (cm)
2014/OKHYB-1	120.0	5.0	16.1	13.2	44	11.2
2014/OKHYB-2	105.5	5.0	17.1	13.9	42	15.3
2014/OKHYB-3	98.4	5.0	15.0	13.7	41	12.9
2014/OKHYB-4	105.5	5.0	19.3	18.4	39	16.5
2014/OKHYB-5	62.5	5.0	10.7	14.5	43	11.8
2014/OKHYB-6	109.5	5.0	17.1	16.3	41	15.2
2014/OKHYB-7	82.5	5.0	9.2	14.1	46	10.9
2014/OKHYB-8	105.5	5.0	17.1	14.7	44	16.4
HOK 152 (C)	131.9	5.0	14.6	14.3	40	12.7
NHB 180 (C)	102.5	5.0	13.2	13.0	42	14.2
ARKA ANAMIKA (C)	123.2	5.0	17.0	11.5	45	13.5
PUSA SAWANI (C)	109.5	5.0	18.5	10.9	53	12.5
CD (p=0.05)	13.13	NS	2.694	1.265	2.697	1.695
CV %	7.41	-	8.36	4.75	7.36	6.96

Name of the entry	Fruit girth (cm)	Number of fruits / plant	Marketable yield (q/ha)	Duration of the crop
2014/OKHYB-1	4.9	18.2	162.5	126.0
2014/OKHYB-2	5.8	18.0	170.9	121.0
2014/OKHYB-3	5.2	20.2	168.4	124.0
2014/OKHYB-4	7.1	21.2	226.5	122.0
2014/OKHYB-5	4.7	29.9	178.6	127.0
2014/OKHYB-6	6.4	21.0	200.4	125.0
2014/OKHYB-7	5.1	34.0	174.0	123.0
2014/OKHYB-8	6.1	19.0	180.7	122.0
HOK152 (C)	5.4	21.6	175.5	125.0
NHB 180 (C)	5.3	21.8	160.5	124.0
ARKA ANAMIKA (C)	5.7	15.0	141.3	121.0
PUSA SAWANI (C)	5.5	13.0	133.8	127.0
CD (p=0.05)	1.032	4.639	13.784	NS
CV %	6.52	7.38	4.75	

Table-2 Performance of (AVT-I) entries on growth and yield quality of Bhendi hybrids

Name of the entry	Plant height (cm)	No. of ridges / fruit	Average fruit weight (g)	Marketable yield / plot (kg)	Days to first harvest	Fruit length (cm)
2013/OKHYB-1	78.5	5.0	15.9	17.6	48	12.8
2013/OKHYB-2	124.5	5.0	15.5	18.6	43	15.2
2013/OKHYB-3	113.5	5.0	17.6	18.2	49	15.5
2013/OKHYB-4	143.5	5.0	16.4	19.9	47	14.4
2013/OKHYB-5	102.5	5.0	17.2	19.4	43	12.3
2013/OKHYB-6	142.5	5.0	18.7	21.1	45	13.2
2013/OKHYB-7	91.5	5.0	22.5	17.4	49	14.2
2013/OKHYB-8	92.5	5.0	17.9	20.1	44	15.1
2013/OKHYB-9	102.5	5.0	19.3	24.4	38	16.6
2013/OKHYB-10	105.5	5.0	18.5	22.5	40	16.5
HOK-152 (C)	133.5	5.0	14.3	18.1	42	12.5
NHB-180 (C)	108.5	5.0	14.3	16.3	44	14.6
ARKA ANAMIKA (C)	124.3	5.0	17.1	14.5	46	13.5
PUSA SAWANI (C)	106.4	5.0	12.4	13.8	45	12.3
CD (p=0.05)	12.5	NS	2.639	1.639	3.58	1.478
CV %	6.46		6.69	7.96	8.22	9.45

Name of the entry	Fruit girth (cm)	Number of fruits / plant	Marketable yield (q/ha)	Duration of the crop
2013/OKHYB-1	6.2	20.5	176.2	126.0
2013/OKHYB-2	6.1	22.7	186.4	130.0
2013/OKHYB-3	6.8	14.8	181.7	126.0
2013/OKHYB-4	5.8	22.9	198.7	124.0
2013/OKHYB-5	6.1	21.3	194.3	129.0
2013/OKHYB-6	6.2	21.0	210.7	125.0
2013/OKHYB-7	8.5	15.6	174.4	128.0
2013/OKHYB-8	6.8	16.8	200.5	126.0
2013/OKHYB-9	6.5	23.7	243.5	121.0
2013/OKHYB-10	6.3	20.9	224.6	124.0
HOK-152 (C)	5.3	23.7	180.6	126.0
NHB-180 (C)	5.6	21.4	162.7	125.0
ARKA ANAMIKA (C)	5.6	16.3	145.3	124.0
PUSA SAWANI (C)	5.4	18.6	137.6	128.0
CD (p=0.05)	0.654	1.235	10.38	NS
CV %	4.65	6.98	7.96	

Table-3 Performance of (AVT- II) entries on growth and yield quality of Bhendi hybrids

Name of the entry	Plant height (cm)	No. of ridges / fruit	Average fruit weight (g)	Marketable yield / plot (kg)	Days to first harvest	Fruit length (cm)
2012/OKHYB-1	140.5	5.0	13.9	18.1	48	13.6
2012/OKHYB-2	127.8	5.0	22.10	20.8	44	16.4
2012/OKHYB-4	125.4	5.0	11.2	17.5	46	10.2
2012/OKHYB-5	108.5	5.0	16.60	19.7	44	14.8
2012/OKHYB-6	112.5	5.0	17.30	21.3	41	13.1
2012/OKHYB-7	97.5	5.0	15.30	20.0	43	12.7
2012/OKHYB-8	145.5	5.0	15.90	17.1	50	13.2
2012/OKHYB-10	117.5	5.0	12.80	18.6	44	12.2
2012/OKHYB-12	105.5	5.0	14.10	16.1	47	11.6
2012/OKHYB-13	115.5	5.0	19.00	23.9	39	15.2
2012/OKHYB-15	138.5	5.0	27.10	22.5	41	17.7
HOK-152 (C)	131.5	5.0	14.00	17.3	44	12.6
NHB-180 (C)	110.2	5.0	13.8	16.3	44	11.5
ARKA ANAMIKA (C)	121.7	5.0	17.50	14.4	48	13.8
PUSA SAWANI (C)	105.5	5.0	18.90	13.7	43	12.3
CD (p=0.05)	10.90	NS	2.467	2.698	2.11	2.344
CV %	5.42		6.98	6.78	7.57	9.63

  

Name of the entry	Fruit girth (cm)	Number of fruits / plant	Marketable yield (q/ha)	Duration of the crop
2012/OKHYB-1	5.5	24.8	181.2	126.0
2012/OKHYB-2	6.5	18.3	208.3	124.0
2012/OKHYB-4	4.9	29.0	174.7	128.0
2012/OKHYB-5	6.1	22.7	197.4	130.0
2012/OKHYB-6	6.2	24.0	212.6	125.0
2012/OKHYB-7	5.8	23.5	200.4	127.0
2012/OKHYB-8	6.1	20.5	171.1	124.0
2012/OKHYB-10	5.5	26.8	185.8	128.0
2012/OKHYB-12	5.9	22.5	160.9	124.0
2012/OKHYB-13	6.0	23.8	238.7	121.0
2012/OKHYB-15	7.1	16.0	225.4	123.0
HOK-152 (C)	5.4	22.8	173.3	124.0
NHB-180 (C)	5.8	22.3	163.4	125.0
ARKA ANAMIKA (C)	5.6	15.7	143.5	126.0
PUSA SAWANI (C)	5.4	15.9	136.5	128.0
CD (p=0.05)	1.93	8.05	11.48	NS
CV %	8.96	8.32	6.78	

Keeping in view, it is essential to work out on the appropriate quantitative and qualitative characters of okra crop so that maximum yield and high quality produce can be obtained. It is a common fact that the genotypes performing better under one locality may not be suitable for another locality or region. Hence, the present investigation is proposed to screen out best hybrid of okra for AICRP Trials (IET, AVT-I and AVT-II).

#### Materials and Methods

The present investigation was carried out at All India Co-Ordinated Vegetable Improvement Project (AICVIP) at the Department of Vegetable Crops, Horticultural College and Research Institute, Coimbatore from 2012 to 2014. Field trials were laid out in randomized block design with replicated thrice. Bhendi hybrids entries viz., (IET, AVT-I and AVT-II) were taken for this study. The seeds of the okra hybrid IET entries viz. 2014/OKHYB-1, 2014/OKHYB-2, 2014/OKHYB-3, 2014/OKHYB-4, 2014/OKHYB-5, 2014/OKHYB-6, 2014/OKHYB-7, 2014/OKHYB-8, HOK-152 (C), NHB 180 (C), Arka Anamika (C) and PusaSawani (C), The seeds of the okra hybrid AVT-I entries viz. 2013/OKHYB-1, 2013/OKHYB-2, 2013/OKHYB-3, 2013/OKHYB-4, 2013/OKHYB-5, 2013/OKHYB-6, 2013/OKHYB-7, 2013/OKHYB-8, 2013/OKHYB-9, 2013/OKHYB-10, HOK-152 (C), NHB 180 (C), Arka Anamika (C) and PusaSawani (C) and The seeds of the okra hybrid AVT II entries viz. 2012/OKHYB-1, 2012/OKHYB-2, 2012/OKHYB-4, 2012/OKHYB-5, 2012/OKHYB-6, 2012/OKHYB-7, 2012/OKHYB-8, 2012/OKHYB-10, 2012/OKHYB-12, 2012/OKHYB-13, 2012/OKHYB-15, HOK-152 (C), NHB 180 (C), Arka Anamika (C) and PusaSawani (C) were chosen for this study. The seeds of the Okra entries were sown at a spacing of 60 x 30 cm with the plot size of 3.0 x 2.7m. The results of the Okra hybrid entries (IET, AVT-I and AVT-II) were presented in the Table 1, 2 and 3.

#### Results and Discussion

Performance of All India Co-Ordinated Vegetable Improvement Project (AICVIP) hybrid trials on growth, yield and quality of bhendi (*Abelmoschus esculentus* L. Moench) during (2012-2014). The results revealed that (IET), the highest fruit yield (226.5 q/ha) was recorded in 2014/OKHYB-4 followed by 2014/OKHYB-6 (200.4 q/ha). Whereas the checks, HOK 152, NHB 180, Arka Anamika and PusaSawani recorded the yield of 175.5, 160.5, 141.3 and 133.8 q/ha respectively. Among the entries tested (AVT-I), the highest fruit yield (243.5 q/ha) was recorded in 2013/OKHYB-9 followed by 2013/OKHYB-10 (224.6 q/ha). Whereas the checks, HOK 152, NHB 180, Arka Anamika and PusaSawani recorded the yield of 180.6, 162.7, 145.3 and 137.6 q/ha respectively. Among the entries tested (AVT-II), the highest fruit yield (238.7 q/ha) was recorded in 2012/OKHYB-13 followed by 2012/OKHYB-15 (225.4 q/ha). Whereas the checks, HOK 152, NHB 180, Arka Anamika and PusaSawani recorded the yield of 173.3, 163.4, 143.5 and 136.5 q/ha respectively. It was also observed higher number of pods per plant, pod length, pod girth and pod weight with application of 100 % NPK fertigation through water soluble fertilizers in okra. All the fertigation treatments recorded higher marketable okra pod yield over the conventional soil application of fertilizers (T1) to the tune of 12.5 to 46.0 percent. Most of the fertigation treatments with water soluble fertilizers remained on par except T10, and among those T3 recorded the highest (21.65 t/ha) and T10 lowest (17.35 t/ha) pod yield [10]. It was identified that highest yield in okra with 100 percent fertigation of the recommended dose. These higher yields were due to better growth and yield parameters like days to flowering, plant height, number of fruits per plant and fruit length. It was also reported significant positive correlation of okra fruit yield with above mentioned parameters. There were very marginal differences between the yields of 100 or 75 percent recommended dose of NPK fertigation given weekly or bi-weekly.

Similarly, application of 50% NK through fertigation of 100 percent recommended dose shows no difference when applied weekly or bi-weekly, however with reduced dose of fertilizers the same treatment produced marginally higher yield when applied weekly than bi-weekly. It showed that application of water soluble fertilizers through fertigation at recommended or reduced rate will not affect the yield by weekly or bi-weekly fertigation interval. Difference between 100 or 75 percent of NPK or NK fertigation was less when applied weekly interval as compared to biweekly application with same treatment [11].

### Conclusion

From the above study, it could be concluded, among the entries tested (IET), the highest fruit yield (226.5 q/ha) was recorded in 2014/OKHYB-4 followed by 2014/OKHYB-6 (200.4 q/ha). Whereas the checks, HOK 152, NHB 180, Arka Anamika and PusaSawani recorded the yield of 175.5, 160.5, 141.3 and 133.8 q/ha respectively. Among the entries tested (AVT-I), the highest fruit yield (243.5 q/ha) was recorded in 2013/OKHYB-9 followed by 2013/OKHYB-10 (224.6 q/ha). Whereas the checks, HOK 152, NHB 180, Arka Anamika and PusaSawani recorded the yield of 180.6, 162.7, 145.3 and 137.6 q/ha respectively. Among the entries tested (AVT-II), the highest fruit yield (238.7 q/ha) was recorded in 2012/OKHYB-13 followed by 2012/OKHYB-15 (225.4 q/ha). Whereas the checks, HOK 152, NHB 180, Arka Anamika and PusaSawani recorded the yield of 173.3, 163.4, 143.5 and 136.5 q/ha respectively.

**Application of research:** Among the Twelve entries tested (IET), the highest fruit yield (226.5 q/ha) was recorded in 2014/OKHYB-4. Among the fourteen entries tested (AVT-I), the highest fruit yield (243.5 q/ha) was recorded in 2013/OKHYB-9. Among the fifteen entries tested (AVT-II), the highest fruit yield (238.7 q/ha) was recorded in 2012/OKHYB- 13.

**Research Category:** Vegetable science

### Abbreviations:

1. ICAR- Indian Council of Agricultural Research
2. AICRP-VC - All India Coordinated Research Project on Vegetable Crops
3. IET- Initial Evaluated Trial
4. AVT- Advanced Varietal trial
5. OKHYB- Okra Hybrid
6. NPK- Nitrogen, Phosphorus and Potash
7. T- Treatment
8. C- Check (Variety)
9. Vit- Vitamin

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