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# Evaluation of different varieties/hybrids of okra (*Abelmoschus esculentus* (L.) Moench.): A review

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**Abstract**
Okra cultivated in tropical, subtropical and warm temperate regions around the world. Okra is a warm-season crop that is considered to have originated from India (Rao, 1989), and it is a traditional vegetable crop commercially cultivated in West Africa, India, Southeast Asia, Southern United States, Brazil, Turkey and Northern Australia (Duzyaman, 1997). Okra has a high nutritional value and grows very quickly with high temperatures, which lends its production to more tropical parts of the world. Okra seeds are a source of oil, protein and are also used as a coffee substitute, while ground-up okra seeds have been used as a substitute for aluminum salts in water purification (Camciuc *et al*, 1998). 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. 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. The reduction in the productivity and yield in okra is mainly due to lack of location specific varieties or hybrids tolerant to pests and diseases such as fruit and shoot borer and yellow vein mosaic virus disease.

**Keywords:** Varieties/hybrids, okra, *Abelmoschus esculentus* (L.) Moench.

## Introduction
Okra [*Abelmoschus esculentus* (L.) *Moench*] Okra is a polyploid, belonging to the family Malvaceae with 2n = 8x =72 or 144 chromosome. According to Vavilov (1951), it was probably domesticated in the Ethopian 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.

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 (Neeraja *et al.*, 2004) [36]. 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 (Chauhan, 1972) [9]. Its ripe seeds are roasted, ground and used as a substitute for coffee in Turkey (Mehta, 1959) [30]. The fruits are a green capsule containing numerous white seeds when immature (Jesus *et al.*, 2008) and the flowers and upright plants give okra an ornamental value (Duzyaman, 1997). The okra fruit can be classified based on the shape, angular or circular (Mota *et al.*, 2005) [32].

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 (Chadha, 2001) [5]. It is also very useful against genito-urinary disorders, spermatorrhoea and chronic dysentery (Nandkarni, 1927) [35].

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 per cent of the export of fresh vegetables. At present, it is being exported to the neighbouring countries in the Gulf

and South- East Asia, particularrly 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. its annual production is 6346.0 thousand MT. (Anonymous: 2015) [3]. In Madhya Pradesh okra is grown in 26.51 thousand ha area and 305.91 thousand MT. (Anonymous: 2015) [3].

It is a very wide range of adoptable 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 fiber 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.

## Review of Literature

### Morphological parameters

Gondane and Bhatia (1995) [17] found that Panjabrao Krishi Vidyapeeth Maharsatra all the okra genotypes responded differently to the environments. Significant and marked variation was noted in the plant height. Gill *et al.* (1997) [16] found that University of Agricultural Science Bengaluru developed a key for varietal identification on the basis of morphological characters, 10 varieties of okra (G-2, Parbhani Kranti, Pusa Makhmali, Punjab-7, Punjab Padmani, Pusa Sawani, IIHR-4, IIHR-10, HRB9-2 and EMS-B) were subjected to morphological characterization over 2 years. Considerable variation with respect to vegetative, floral and fruit characters and reaction to diseases and pests was recorded. Hazra and Basu (2000) [19] found that School of Agriculture and Rural Development Open University Gazipur Bangladesh reported that a wide range of variations for plant height (general mean=80.8 cm), leaves per plant (28.9), nodes per plant (14.9), days to first flower (49.9), fruit weight (15 g), number of fruits per plant (10), seeds per fruit (53.3), fruit yield per plant (155.7g), moderate variations for primary branches per plant (2.9) and fruit length (12.9 cm) and lesser variations for node at first flower (4.8), ridges per fruit (5.1) and dry weight of fruit (1.5 g). Primary branches per plant, which showed a moderate range of variation. Prakash *et al.* (2001) reported that Arka Abhay was best for high seed yield per plant (62.89g), fruit length (12.64cm), fruit weight (15.66g) and seed yield per fruit (3.71g). Raji (2002) [46] studied that Institute of Agriculture Ibaban Nigeria the growth, yield, and yield components of okra conducted at Moor Plantation, Ibadan, Nigeria, in 1995 and. 1996. Increase in plant height, leaf stalk, internode length, pod length, and pod diameter were largely determined by cultivar characteristics. Fruiting peduncle, leaf nodes, were significantly different among cultivars. Bendale *et al.* (2003) [4] recorded that Dr.Y.S. Paramar University Solan showed a wide range of genetic variability for yield and yield-contributing characters fruit length, weight, plant height, nodes per plant, internodal length, number of branches per plant Duzyaman *et al.* (2003) [12] recorded that University of Gazipur Bangladesh the numerous okra genotypes of American, African, Indian, European and Turkish origin were examined for their pod properties and nutritive values. Pod thickness was considerably high in the genetic material from Africa with up to 2.84cm in diameter in the case of line 1051 from Togo. However, pods of the improved cultivars from the USA and India had a more attractive appearance with diameters varying between 1.15 and 1.50 cm. Kuwar *et al.* (2003) [29] recorded that Agriculture College Trupati (A.P.) the cv. Parbhani Kranti had the highest leaf area per plant (18.92 dm2/m), plant height (18.22cm), dry matter per plant (60.62g), number of fruits per plant (16.59), fruit diameter (1.47cm), fruit weight per plant (95.48g), the yield per plant (6.16kg), and yield/ha (38.04q). Singh *et al.* (2003a) [58] reported that plant height, stem diameter, dry weight of shoots, and fresh and dry weight of roots per plant, were observed superior characters. Tiwari and Singh (2003) [65] reported that Tarai region of Uttaranchal Plant height was highest in SPHB-316 (189.7 cm), and lowest in MBORH-913 (124.1 cm). The number of primary branches per plant ranged from 5.0 (in NOH-101) to 7.6 (in HOE-301). The number of leaves per plant was highest in SPHB-316 (26.6).

Kumar and Kuwar (2005) [25] reported that Indian Institute of Horticulture Research Bangaluru the genotype Punjab-8 had the tallest plant (89.8cm) and produced significantly high number of primary branches (2.53) as compared to other genotypes. Sachan (2006) [50] Parbhani Kranti recorded the second highest plant height (89.79 cm), number of nodes per plant (17.00) and number of fruits per plant (13.16), Internode length was highest in Pusa Sawaney (8.11 cm) as compared to other genotype of okra. Chaudhary *et al.* (2006) [6]. The results indicated that the growth parameters differed within different hybrids and check variety. The differences in genetic makeup caused this difference. The vegetative characters viz., plant height and internodal length showed positive effect on yield of okra. Somashekhar and Salimath (2011) [62] reported that Kerala Agriculture University Thiruvananthapuram the wider range of variation as evidenced for number of branches per plant, number of fruits per plant, average fruit weight (g), fruit lengthwas recorded in different characters of okra. Kumar *et al.* (2011) [45] found that Dr.Y.S. Paramar Universities Solan (H.P.) the analysis of variance (mean square) revealed significant differences among genotypes for all the characters under study. The results indicated considerable genetic variability among the genotypes for plant height, number of nodes per plant, number of fruits per plant. Nagre *et al.* (2011) [33] reported that Jawaharlal Nehru Krishi Vishwa Vidyalaya Jabalpur Mdhya Pradesh the highest genotypic coefficient of variation as well as phenotypic coefficient of variation was recorded for leaf area followed by number of nodes per plant, length of fruit, number of leaves per plant, yield per plant, internodal length and chlorophyll content of leaves in different genotypes of okra Nwangburuka *et al.* (2012) [37] There was high genotypic coefficient of variability in traits such as plant height (26.2), fresh fruit length (23.9), fresh fruit width (23.9), mature fruit length (28.6), branching per plant (29.3) and fruit weight per plant (33.9). Singh and Jain (2012) [57] The plant height was ranged between 90.9-134.0 cm. It was highest in SOHO-2 and lowest in HIHBO-90. The no. of pods/plant was ranged from 9.2 (Arka Anamika) to 22.2. (SOH-5). Reddy *et al.* (2013) [48] evaluated that one hundred germplasm lines of okra (*Abelmoschus esculentus* (L.) *Moench*) at the Vegetable Research Station, Rajendranagar, Hyderabad, Andhra Pradesh, India. Plant height had significant positive correlation, while number of branches per plant, internodal

length and first fruiting node had significant negative correlation with marketable yield per plant. Swamy *et al.* (2014) [64] Genotypic and phenotypic correlation coefficient studies revealed that fruit yield per plant exhibited positive and significant correlation with number of pods per plant, number of nodes per plant, average pod weight, pod width, plant height and pod length. Thus pod yield in okra can be improved by selection of traits with higher number of pods per plant, number of nodes per plant, average pod weight and pod length.

**Phenological parameters**

Sood (1999) reported that Days to 50% flowering varied from 44.33 to 71.00 days and IC -45791 was the earliest to flower among the genotypes. IC-14026 and IC-45796 had the highest duration of availability of edible pods (66 days). Prakash *et al.* (2001) reported that Parbhani Kranti registered as a superior parent for number of fruit per plant (16.60) and days to first flowers occurred (44.90). Bendale *et al.* (2003) [4] reported that Dr. Y.S. Parmar University of Horticulture and Forestry Himanchal Pradesh showed a wide range of genetic variability for first flowering node, and days to first harvest. Hamed *et al.* (2003) [18] reported that Balady green recorded the highest number of days to first flower (71.78) and number of nodes of first flower (11.31).

Alam *et al. (2006)* [1] reported in Federal College of Agriculture Badinkowa Gombe State Nigeria assessed the variabilities reported wide range of variation was recorded for days to first flowering (40-52 days) reported that differed genotypes okra. Oppong-Sekyere *et al.* (2011) [38] observed that Deptament of Genetic and Biotechnology Colabar Nigeria the variation in petal colour, pubescence of the leaf and stem, fruit shape, anthocyanin pigmentation and variation in number of days to 50% flowering reported that differed genotypes okra. Reddy *et al.* (2013) [48] evaluated at the Vegetable Research Station, Rajendranagar, Hyderabad, Andhra Pradesh, India. one hundred germplasm lines of okra (*Abelmoschus esculentus (L.) Moench)* Reported days to 50% flowering, first flowering node and first fruiting node had significantly negative correlation with marketable yield per plant. Swamy *et al.* (2014) [64] evaluated that Agriculture University Hydrabad 14 different yield attributing traits in 32 advanced breeding lines of okra during summer season, 2012-13. Genotypic and phenotypic correlation coefficient studies revealed that days to 1st flowering and day to 50% flowering recorded significant negative correlation with pod yield per plant. Amoatey *et al.* (2015) [2]. The highest correlation (r=0.95) was between number of days to 50% flowering (NDFl) and number of days to 50% fruiting (NDFr). The pattern of clustering showed some degree of association between quantitative characters and geographic origin of the collections.

**Yield parameters**

Hussein *et al.* (1994) [21] reported that School of Agriculture and Rural Development Gaipur Bangladesh in six local ecotypes and 6 exotic cultivars of okra. Significant differences were recorded among the accessions for the measured traits. The high yielding ecotype was found in Balady Green and Clemson Spineless. Pandey *et al.* (1994) [39] reported that Increasing rate of nitrogen significantly increased the plant growth, LAI, yield attributing characters and seed yield. Fruit diameter, 100 seed weight and shelling percentage were unaffected due to different varieties, plant spacing and nitrogen levels. Gondane and Bhatia (1995) [17] found that in Krishi Vidyapeeth Maharashtra India all the okra genotypes responded differently to the environments. Significant and marked variation was noted in the yield components, particularly in yield per plant, number of fruit per plant. Patil *et al*. (1996b) [41] recorded that UAS Dharwad Agriculture University India ten genotypes of okra were recorded no infestation of insects and minimum weight loss, noted among these PI 82009 and PI 378630 had high marketable yields (1095 and 1037 g/plant, respectively), followed by PI 489817 (745 g/plant) and PI 21729 (634 g/plant). Patil and Ranpise (1998) [40] found that Poona Condition the highest marketable fruits per plot (kg/plot) and per hectare (q/ha) were noted in Parbhani Kranti during all the three years and it was significantly superior to all other varieties. It was also found tolerant to yellow vein mosaic virus disease as compared to other cultivars. Hamed *et al.* (2003) [18] reported that Himalayan Foothills of Uttaranchal Gold coast had the highest number of pods per main stem (8.41), plant height (131.95cm) and yield per plant (90.50g). Bendale *et al.* (2003) [4] reported that Dr. Y.S. Parmar University of Horticulture and Forestry Himanchal Pradesh showed a wide range of genetic variability for yield and yield-contributing characters yield per plant and number of fruits per plant showed high GCV and PCV estimates. Singh *et al.* (2003a) [58] DVR-2 recorded the longest fruits and highest number of fruits, whereas DVR-1 recorded the highest fruit weight per plant and total fruit yield/ha. Zulfeghar and Patil (2004) [67] reported that University of Agriculture Science Dharwad the Arka Anamika recorded the lowest disease incidence (0.80%) and the highest yield (23.00t/ha), while the susceptible control Pusa Sawani recorded the highest disease incidence 3 (74.99%) and the lowest yield (7.90t/ha).

Verma *et al.* (2004) [66] Maximum range of mean value was recorded for yield per plant and minimum for branches per plant. High degree of variability was recorded for branches per plant and yield per plant. Kumar and Kuwar (2005) [25] reported that Dr. Panjabrao Deshmunkh Krishi Vidyapeeth Akola Maharashtra Punjab Padmini reported that the highes seed number per fruit (46.5), seed weight per fruit (2.6g) and seed yield (30.7g/plant and 14.5q/ha). Maximum number of fruits per plant (11.6) was recorded in Arka Abhay and Punjab Padmini. Alam *et al. (2006)* [1] reported in Mymensingh, Bangladesh, to assess the variability of 10 yield contributing characters of 50 okra accessions and their interrelation effects on green pod yield. A wide range of variation was recorded for weight of green pod per plant (105-281 g), days to first flowering (40-52 days) and weight of individual green pods (14-26 g). Moderate variation for length of green pod (12-19 cm), number of green pods per plant (6-11) and yield of green pods (4-13 t/ha). Sachan (2006) [50] reported that Mid Hills of Sikkim okra variety Saatdhari recorded the highest fruit weight (13.1 g) and green fruit yield (119.17 q/ha). Chaudhary *et al.* (2006) [6] found that North Konkan Coastal Zone of Maharashtra the five okra hybrids were grown with the okra variety Antara as a check. The results indicated that the growth parameters differed within different hybrids and check variety. The differences in genetic makeup caused this difference. The number of fruits per plant and weight of fruits per plant significantly increased the yield of okra hybrids. Singh *et al.* (2006) [59] recorded that Indian Institute of Vegetable Research, Varanasi Uttar Prades, the performance of 3 improved open-pollinated cultivars of okra, namely Kashi Vibhuti (VRO-5), Kashi Pragati (VRO-6) and Kashi Satdhari (IIVR-10), along with 2 hybrids, namely Kashi Bhairav (DVR-3) and Kashi Mahima (DVR-4), were

evaluated in frontline demonstration trials in 580 farmers' field of Varanasi, Mirzapur, Chandauli, Sonbhara and Ghazipur districts of eastern Uttar Pradesh during 2003-06, and compared with some existing cultivars, such as Parbhani Kranti and Pusa Sawani. All the improved cultivars/hybrids had higher yield than the existing cultivars in all the districts.
Naidu *et al*. (2007) [34] reported that Maximum range of mean value was recorded for yield per plant and minimum for number of ridges per fruit. High degree of variability was recorded for plant height and fruit yield per plant. Phad *et al.* (2008) [43] reported that Parbhani condition Marthwada Region Maharashtra performance of ten hybrids of okra was studied along with two checks i.e. Parbhani Kranti and Pusa Swani in order to evaluate the promising elite okra hybrids suitable for cultivation under Parbhani conditions (Marathwada region of Maharashtra State). The highest yield of 166.83 q/ha was obtained from hybrid NBH-225 which was at par with Mahabeej-333 and NBH-180 (160.49 and 153.74 q/ha, respectively). Senapati *et al.* (2011) reported that Jawaharlal Nehru Krishi Vishwa Vidyalaya Jabalpur Mdhya Pradesh the analysis of variance exhibits a wide spectrum of variability among the characters of the hybrids. The largest variability was recorded in fruit yield (58.16-125.07 q/ha) followed by plant height (138.80-182.26cm). Reddy *et al.* (2013) [48] evaluated that at the Vegetable Research Station, Rajendranagar, Hyderabad, Andhra Pradesh, India. one hundred germplasm lines of okra (*Abelmoschus esculentus (L.) Moench*) fruit length, fruit width, fruit weight, total number of fruits per plant, number of marketable fruits per plant and total yield per plant had significant positive correlation.

**Quality Parameters**
Iremiren *et al*. (1991) [23] evaluated that Agriculture Institute Benincity Nigeria the age at which okra pods were harvested (4, 7, 10 or 13 days after pod set) had no effect on vegetative growth or pod yield/ha, but pods harvested more than 7 days after pod set were of poorer quality due mainly to an increase in crude fibre and a reduction in the moisture, crude protein and ash contents of older pods. Farghali *et al.* (1994) [14] reported that Balady Green and Clemson Spineless had the highest dry matter contents. White Velvet fruits had the highest fiber content and Green Velvet the lowest. Hazarika *et al.* (1997) [20] evaluated that sub tropical high humid climate Assam in okra (cv. Pusa Sawani) pod size, weight, moisture content and colour were made in the morning (06.00 h) and afternoon (18.00 h) from the second day of flowering until maturity during summer [year not given] in Assam, India. Ekka and Chakrabati (2003) [13] conducted an experiment in IARI New Delhi with two cultivars of okra viz. Pusa A-4 and Prabhani Kranti during summer, 1997, in New Delhi, India to study the storage behaviour of okra under different temperature (storage) conditions. The pods of the cultivars were harvested at maximum edible stage of maturity i.e. on 7th day of anthesis. The pods kept in cool store required least force 9.28 N, 9.29 N and 9.72 N to puncture the pericarp on 2nd, 8th and 12th, respectively. Pusa A-4 had significantly less dry matter content than Prabhani Kranti on day 2nd, 8th and 12th. On day 12, packaged pods had significantly lower matter than unpacked ones. The pods kept in cool store showed significantly less crude fibre content (10.82%). Singh *et al.* (2003) found that Pantnagar, Uttaranchal, India the quick fruit development takes place between 4 to 6 DAF, where in fruits are most tender and suitable for better marketable. The fruit length increased rapidly up to 8 DAF and was found maximum between 4 and 6 DAF while the fruit diameter was highest during 6 to 8 DAF. Similarly, fruit fresh weight increased significantly between 4 and 8 DAF and the 100 seed weight was maximum at 22 to 24 DAF in VRO-6 (5.52g), VRO-5 (5.27g), and 30 DAF in IIVR-10 (5.51g). Patro and Ravisankar (2004) reported that Tropical Agriculture Research Hydrabad Agriculture Univesities the significant negative correlation of fruit yield per plant was recorded with plant height, number of days taken for first fruit setting, fruit volume, shape index, longevity of tenderness in okra.
Patro and Ravisankar (2006) [42] recorded that Yield per plant was positively and directly affected at both phenotypic and genotypic levels by germination percentage, number of branches per plant, number of fruits per plant, fruit weight, number of seeds per fruit, 100 seed weight and ascorbic acid content, at the genotypic level by plant weight, fruit volume and longevity of tenderness, and at the phenotypic level by number of nodes per plant. Hussaini and Babu (2007) [22] reported that College of Agriculture Orissa effect of harvest at different days after fruit set on the fruit quality and shelf life of bhendi [okra] cultivars Parbhani Kranti and Arka Abhay. The fruits were harvested on 3, 5, 7, 9 and 11th day after fruit set. Fresh and dry weight of fruits, fruit length and diameter, fibre content, visual spoilage and shelf life of fruits were recorded. It was recorded that maximum fresh fruit weight was accumulated from 9 to 11 days of harvest after fruit set in both cultivars. Fruits of Parbhani kranti and Arka Abhay accumulated maximum dry weight of fruits from 9 to 11 days and 7 to 9 days, respectively. Solankey *et al.* (2013) [61] reported in Banaras Hindu University, Varanasi. The colour pigment expressed that the reddish green pod colour was dominant over green and purple green pod colour in F1's crosses due to additive gene effects. The high fruit yield potential and quality attributing traits recorded in the F1 hybrid Arka Abhay x Arka Anamika has been directly attributed to increased number of fruits/plant during both climatic changes years.

**Insect-pest and Disease incidence**
Devasthali and Saran (1997) [11] reported from Indore Madhya Pradesh that the sucking pests viz. *A. biguttula biguttula*, *A. gossypii* and *B. tabaci* were the first to appear on okra crop i.e. in 1st week of July. Sharma and Sharma, (1997) [52] reported that Haryana Agriculture University highest population of *A. biguttula biguttula* on okra plants was recorded during 1st week of August in Haryana and numbers were negatively correlated with maximum temperature but positively correlated with minimum temperature and average relative humidity. Shukla *et al.* (1997) [55] studied seasonal incidence of *E. vittella* in summer okra crop at Jawaharlal Nehru Krishi Vishwa Vidyalaya Jabalpur Madhya Pradesh and reported the peak shoot damage before fruiting (8.5 %) and peak fruit infestation (41.25 %) before harvesting in 1st fortnight of June. Kumawat *et al.* (2000) [24] reported from Jobner (Rajasthan) that the infestation of jassids and whiteflies started in 4th week of July and reached peaks in 2nd and 4th weeks of September, respectively, and maximum temperature was significantly and positively correlated with whitefly density. Neeraja *et al.* (2004) [36] reported in Rajendranagar, Andhra Pradesh, India, on okra cultivars Vijaya, Varsha, HYOH-1, AROH-47, MBORH-913, NOH-15, JNDOH-1, KOH-1, Arka Anamika and Arka Abhay to screen for resistance to yellow vein mosaic virus, powdery

mildew [*Erysiphe cichoracearum*] and fruit borer [*Earias vittella*] incidence.

**Economics**

Ganeshe *et al*. (2000) reported that Jawaharlal Nehru Krishi Vishwa Vidyalaya Jabalpur Mdhya Pradesh, India the effects of soil or seed inoculation of Azospirillum and Azotobacter with or without inorganic N application (0, 20, and 40 kg/ha) on the growth, yield, and quality of okra cv. Parbhani Kranti were studied in Azospirillum soil inoculation+40 kg N/ha gave the highest net return (Rs 16 293/ha) and cost: benefit ratio (2.37). Selvi and Perumal (2000) [51] reported that highest income (Rs. 20,912/ha) and benefit cost ratio (11.3) was recorded from the foliar application of SMF + CCP + Azospirillum followed by foliar applications of MNS + CCP + Azospirillum (Rs. 18,937/ha and 10.2, respectively). Prabu *et al*. (2003) [44] found that the effects of integrated nutrient management on the economics of okra cv. Parbhani Kranti were determined in a field experiment conducted in Parbhani, Maharashtra, India during the summer of 2001. Application of two-third of the full recommended rate of NPK, FYM at 10 t/ha and Azospirillum + VAM resulted in the highest marketable yield (14.17 t/ha), monetary returns (Rs. 1,41, 700/ha), net returns over the variable cost only (Rs. 1,38,600.50/ha) and net additional benefit over the control (Rs 43 900.50/ha).

Chaudhary *et al.* (2006) [6] reported that Nourth Konkan Maharastra the growing of all okra hybrids as well as Antara found profitable. The highest net returns (Rs. 85769 /ha) were obtained due to the cultivation of Rashmi hybrid. All hybrids except Tulsi were more profitable than Antara. Sharma *et al.* (2010) [54] revealed that the application of 80:60:60 kg NPK/ha fetched net return of Rs 46152/ha. And gave benefit cost ratio of 2.68, incorporation of vermicompost 5t/ha. also recorded significantly higher values of yield attributes and fruit yield (69.2q/ha.) as well as B:C ratio (2.11) with net return of Rs 35614/ha. Sharma *et al.* (2011) [53] found that Jawaharlal Nehru Krishi Vishwa Vidyalaya Jabalpur Madhya Pradesh the application of80:60:60 kg NPK per ha recorded the highest net return of Rs. 46,152 /ha and gave maximum benefit:cost ratio of Rs. 2.68. Chavan and Paqire (2013) [10] reported that ICAR Rrsearch Complex for Goa the maximum mean yield (84.80 q ha-1) of okra fruits and net monetary return of Rs. 26060.00 ha-1. The other promising treatments in checking the whitefly population and incidence of YVMV on okra included spray applications of acetamiprid and imidacloprid which recorded 80.62 and 75.60 q ha-1 yield of okra fruits and monetary returns of Rs 22200 and 16656 ha-1, respectively. The highest C:B ratio of 1:24.1 was obtained with treatment of acetamiprid followed by thiomethoxam (1:19.7).

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