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Original Research Article

Growth and Yield Performance of Okra [*Abelmoschus esculentus* (L.) Moench] Varieties on Farmer's Field

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A B S T R A C T

The major constraint on of low productivity of okra in the Kishanganj district of Bihar is lack of awareness for okra cultivars along with non adoption of recommended package of practices. To replace this old age technology Krishi Vigyan Kendra, Kishanganj conducted On Farm Testing trail with four okra cultivars and one local cultivar. In the present investigation the trail was laid out in Complete Randomized Block Design with ten replications on different farmer's fields in Kishanganj district of Bihar during summer season, 2015 & 2016. Characters studied regarding growth attributes were plant height (cm) while regarding to yield attributes, days to 50% flowering, fruit length (cm), days to first fruit harvest, numbers of fruit per plant and average fruit weight (g). Among the four varieties *viz.*, Kashi Kranti, Kashi Pragati, Arka Anamika and Parbhani Kranti, variety Kashi Kranti proved its dominance over other varieties regarding to both attributes (yield and growth) while among agronomical practices was found best and optimum for okra crop. Maximum fruit yield 136.7 q/ha was recorded in Kashi Kranti (VRO-22), which was also earliest to flower in 52.30 days. Plant height at flowering was not affected significantly among the cultivars. Green pod length was the maximum in VRO-22 (14.81cm) with numbers of fruit /plant 15.50 followed by Arka Anamika (13.84 cm) with number of fruit/plant 14.20 but Kashi Pragati (VRO-6) maximum number of fruit/plant 14.30 comparison to Arka Anamika and analysed data of BC ratio is high for cultivar Kashi Kranti (4.25) followed by Kashi Pragati, Arka Anamika, Prabhani Kranti and local cultivar.

Keywords

Yield attributes, Cultivar, Fruit yield and OFT

Introduction

Okra, ladies' fingers or bhendi, *Abelmoschus esculentus* (L.) Moench is 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 (Costa *et al*., 1981). 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). The nutritional value of 100 g of edible portion of okra contains 1.9 g of protein, 0.2 g fat, 6.4 g carbohydrate, 0.7 g minerals and 1.2 g fiber (Tiwari *et al*, 1998).The immature pods are

used as vegetable and its dried form is often used as soup thickener. It is an important vegetable in India that can be gauged from the fact that India accounts for 41% of world acreage and 69% of world production in okra. (FAO 2010) World area: 1101631 ha, world production: 69,17,062 MT India area: 4,52,000 ha, India production: 4803000 MT. Among the states, West Bengal is the leading okra producing state which has production of around 718.9 thousand tones followed by Bihar (714.1 thousand tonnes) and Orissa (618.8 thousand tonnes) (NHB, 2015).It is grown mostly in Hoogly, Mursidabad, Nadia, 24 Parganas, Bankur and Midnapur districts. Okra is attacked by a number of insect pests, of which shoot and fruit borer, *Earias spp*. is one of the major constraints in achieving potential yield. The infested fruits become unfit for human consumption, thus resulting in 30.81 % decrease in yield (Ghosh *et al*., 1999). The farmers of Bihar mostly save their own seed for cultivation of okra. However, old traditional cultivars and poor seed quality often result poor yield and ultimately lower productivity (Meher *et al*., 2016).Application of pesticides as the plant protection measures to overcome the pest problem causes the pesticide residues problem in harvested product and hazardous to consumers. Considering the limitations of chemical control, use of natural plant resistance to their pest attack can overcome the problem. In Northern region of Bihar, okra is cultivated in almost all the districts. However, the productivity of these areas is not upto the mark comparing to some other okra growing regions. There is a considerable gap between the yield at farmers and experimental field. A good number of improved cultivars of private seed companies are now available locally in the market as well as farmers of the Kishanganj district are also taking interest for these new cultivars but they don't know the best one. Considering the importance of okra in the terms of national and international markets, On Farm Testing demonstrations of four high yielding varieties/hybrids of okra developed by public sector were given in the farmer's field of Kishanganj district of Bihar. Therefore, keeping the above points in mind, a research work has been formulated with an objective to evaluate their yield performance in comparison to the existing cultivars of this district to support the farmers in okra cultivation.

Materials and Methods

The present experiment was laid out in Complete Randomized Block Design during the summer season (2015 & 2016) with ten replications under supervision of Farm Science Centre, Kishanganj, on different farmer's fields in Kishanganj district of Bihar, India. These farmers were selected for the On Farm Testing of improved okra varieties based on their area and production. At sowing two seeds (seed treatments with systemic fungicide) were dropped per hole at a spacing of 0.6 m x 0.3 m giving a projected population of 55,555 plants /ha with plot size 4.5 m^2. The sowing was done in second week of February, 2015 and 2016. Thinning was done to one plant per stand at 2 week after sowing. The compost treatments were uniformly applied and worked onto the soil by light hoeing a week before sowing. Nitrogen was split applied at 2 and 5 week after sowing while weed free plots were achieved by applying pre emergence at the rate of 1.5 and 2.5 kg a.i. /ha a within 24 hour after sowing. The plants were sprayed with Imidacloprid 17.8 % SL 1ml /2 liter of water against flea beetles fortnightly, starting from 2 weeks after seedling emergence till on set of fruiting. The reactions of four commercial varieties of okra *viz*., Kashi Kranti, Kashi Pragati,

Arka Anamika, Parbhani Kranti and existing cultivars were evaluated under farmer's field condition (Table 1). During the initial survey it has been found that majority of the growers are not satisfied with the existing cultivars due to their low yield and high infestation of pests and diseases. The yield data of demonstrated okra varieties/hybrids were collected along with the yield of practicing varieties/hybrids by the farmers in a particular district for two years, which was further analyzed and district wise mean yield value was calculated. The demonstrations of above okra varieties were regularly monitored and desired data were collected with the help of a questionnaire developed for the purpose (Thakral and Bhatnagar 2002), which was further analyzed for drawing the inferences. These improved varieties were demonstrated at 10 farmer's field of different villages. Five competitive plants of each variety and replications were selected for taking observations. Observations were recorded on 07 economically important traits *viz*., days to 50 % flowering, Plant height (m), fruit length (cm), average fruit weight (g), days to 1st fruit harvest, number of fruits/ plant and average fruit yield (q/ ha).The soil of the plot was sandy loam in texture having good fertility properly leveled and well drained Analysis of soil sampled from the experimental land of farmer's field showed $_{p}$H, E.C. (Desi/m), organic carbon (%), total N, available P_2O_5 (kg/ha) and total K_2O (kg/ha), (Table 2). The area has bimodal rainfall with total annual rainfall ranges from 1150 mm to 1250 mm, temperature and RH spanning six months (first week of Feb to first week of july) Figure 1 and Figure .2

Results and Discussion

The mean weekly weather observations recorded second week of February to first week of July (Fig 1 & Fig 2) shows that higher rainfall was recorded in the summer season (38.33 mm) and (17.59 mm) in 2015 and 2016 respectively. Maximum temperature was higher in the summer season (40.61 and 37.27 ^{o}C in 2015 and 2016, respectively), However, the minimum temperature received in the summer season (13.03 and 14.50 ^{o}C in 2015 and 2016, respectively). The summer season crops in general, experienced relatively higher minimum temperatures during the vegetative phase (Feb to March) than during the reproductive phase (April to June).

A better performance of okra in terms of plant height, number of fruits/plant, fruit weight and fruit yield was observed during the summer season of both years (Table 3), which may be attributed to the more favorable environmental conditions experienced during the summer season 2015 and 2016 as compared with that of the wet season. Changes in environmental conditions have been reported to influence growth and development of okra. Thamburaj (1972) recorded taller plants, early flower production and higher fruit yield at a maximum temperature of 34.4-35.0 ^{o}C and minimum temperature of 22.5-23.5 ^{o}C. He further reported that temperature range between 28.4-29.2^{o}C (maximum) and 18.9 to 19.6 ^{o}C (minimum) resulted in less vigorous growth and yield of okra. Welby and Mc Gregor (1977) estimated optimum relative humidity of 90-95% for improved performance of okra. Therefore, the higher maximum temperature (29.3 and 28.1^{o}C) experienced during the vegetative phase of the crop in the summer season (Feb to March) may have led to more vegetative growth and consequently, more assimilation of production that induced better yield in the summer season crop and similar findings by Randhawa (1967). A considerable change in various growth characters and yield parameters was noticed due to effect of different okra cultivars.

Table.1 Varieties of okra employed in the investigation on farmer's field

Sl.No.	Varieties	Specific traits	Source
1.	Kashi Kranti (VRO-22)	Resistant to YVMV, high yielding and better for kharif season & summer season.	IIVR, Varanasi, Uttar Pradesh
2.	Kashi Pragati (VRO-6)	Resistant to YVMV, high yielding and better for kharif season & summer season.	IIVR, Varanasi, Uttar Pradesh
3.	Arka Anamika	Moderately resistant to YVMV, high yielding variety.	IIHR, Banglore, Karnataka
4.	Parbhani Kranti	YVMV resistant variety with good fruit quality.	MPKV, Rahuri, Maharashtra
5.	Local Cultivar	Low yielding and susceptible of YVMV	Traditional variety of farmer's, kishanganj, Bihar

Table.2 Soil test results of experimental plot on farmer's field

Sl. No	Content	Farmer's field-1	Farmer's field-2	Farmer's field-3	Farmer's field-4	Farmer's field-5	Farmer's field-6	Farmer's field-7	Farmer's field-8	Farmer's field-9	Farmer's field-10
1.	pH	5.85	6.30	5.90	5.85	5.90	5.80	6.30	6.10	6.15	6.40
2.	E.C. (Desi/m)	0.21	0.08	0.12	0.13	0.17	0.56	0.18	0.24	0.12	0.13
3.	Organic Carbon (%)	0.67	0.45	0.54	0.59	0.44	0.67	0.30	0.40	0.74	0.51
4.	Available N (kg/ha)	376.32	263.42	303.06	225.79	163.07	213.25	200.70	301.06	288.51	301.06
5.	Available P_2O_5 (kg/ha)	25.68	24.78	31.96	32.94	32.83	34.83	35.02	33.76	34.73	34.92
6.	Potash K_2O (kg/ha)	136.64	202.72	160.16	216.16	146.72	109.76	180.32	128.80	159.04	100.80

Table.3 Performance of okra cultivars in summer season (2015 & 2016

Cultivars	50% of Flowering (days)	Plant Height (m)	Fruit Length (cm)	Ag. Fruit Wt. (g)	First Fruit Harvest (days)	No. of fruits / plant	Ag. Fruit Yield (q/ha)	Cost of cultivation (Rs./ha)	Gross return (Rs./ha)	Net return (Rs./ha)	BC ratio
Local Cultivar	61.50	1.06	11.94	11.68	52.50	11.90	81.8	36800	98160	61360	2.67
Kashi Kranti	52.30	1.02	14.81	14.09	46.40	15.50	136.7	38500	163920	125420	4.25
Kashi Pragati	56.30	1.01	13.68	13.20	52.00	14.30	118.6	38200	142320	104120	3.72
Arka Anamika	60.00	1.03	13.84	13.24	49.20	14.20	99.4	38400	119280	80880	3.10
Parbhani Kranti	62.20	1.03	13.33	12.70	50.40	14.00	94.5	38300	113400	75100	2.96
CV at 5%	3.29	2.50	3.78	5.29	4.34	7.57	9.33	--	--	--	--
CD at 5%	2.21	0.03	0.56	0.81	2.41	1.17	5.24	--	--	--	--

Fig.1 Meteorological observations during cropping period, 2015

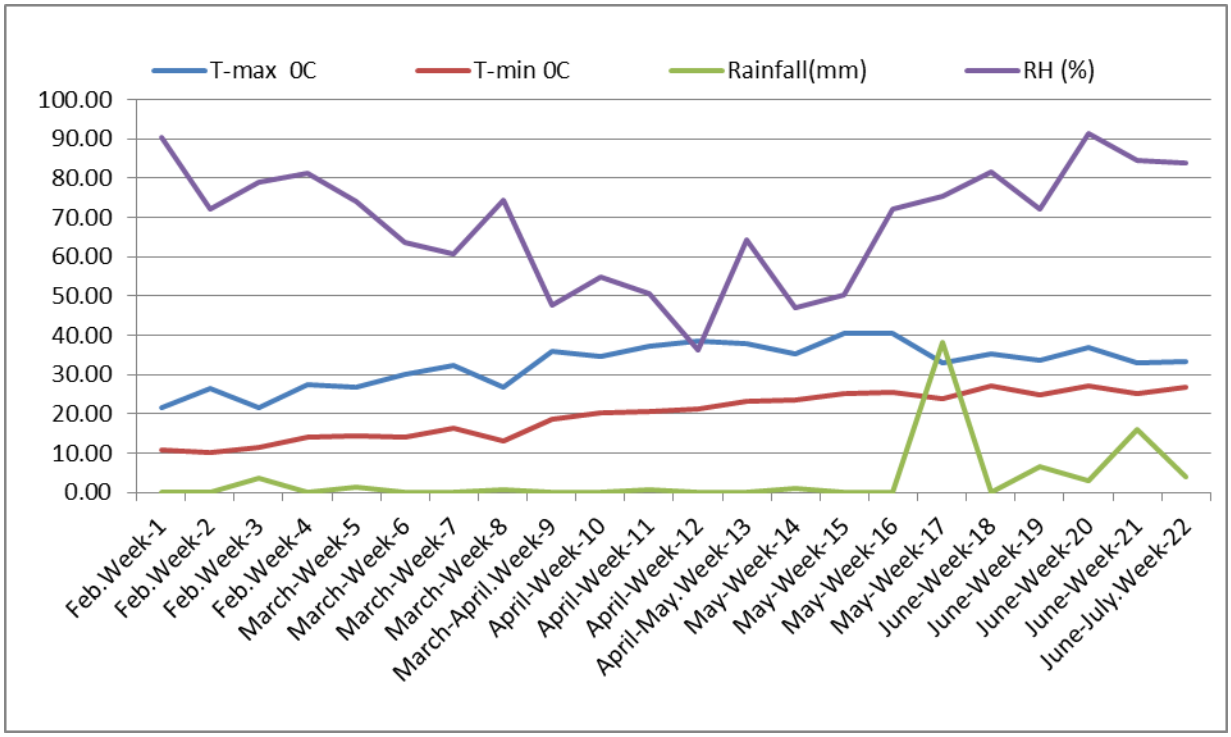
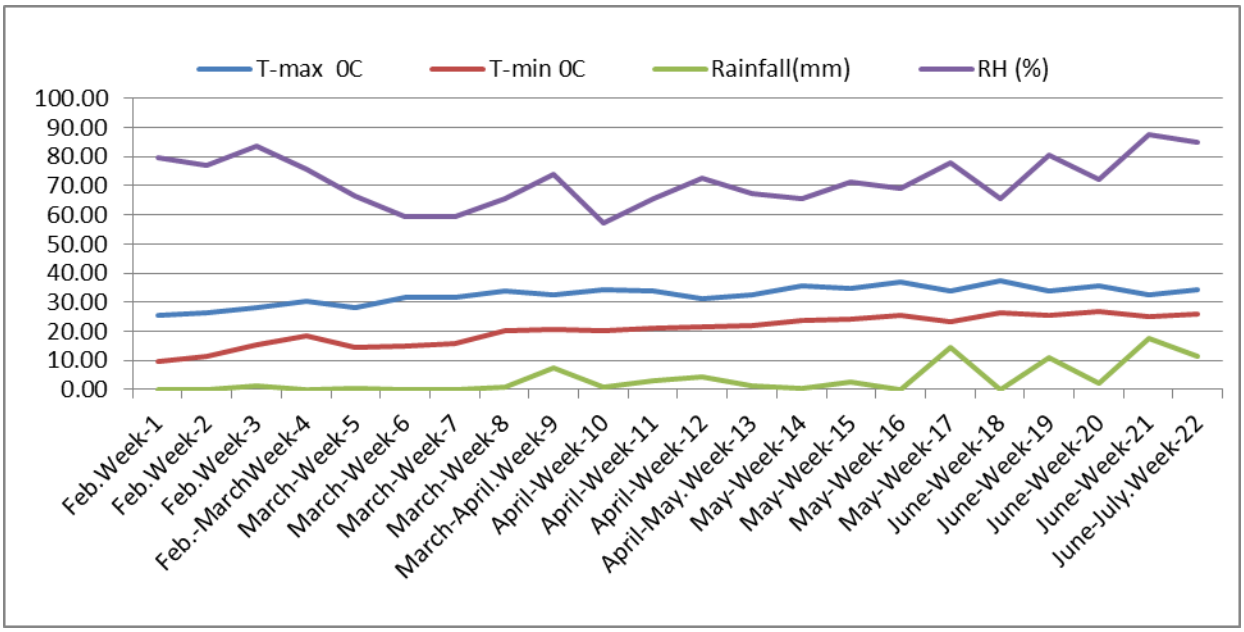


Fig.2 Meteorological observations during cropping period, 2016



The okra cultivar Kashi Kranti (VRO-22) and Kashi pragati (VRO-6) is a promising high yielding one released by IIVR, Varanasi. The third cultivar tested in this experiment was Arka Anamika is popular cultivar of South India released by IIHR,

Banglore. The fourth cultivar was Parbhani Kranti which is also a well known cultivar improved by Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra. The performance of Kashi Kranti proved superior in all the growth and yield attributes. Kashi Kranti has produced 136.7 q ha-1 fruit yield which was far superior to Kashi pragati (118.6 ha-1), Arka Anamika (99.4 ha-1) and Parbhani Kranti (94.5 ha-1) (Table 3). This finding has got support from other investigation also. Gautam *et al.* (2004) and Ram *et al***.** (2013) reported that average weight of pod, diameter of pod, yield of pods plant-1 were found highest with VRO-6 as compared to Arka Anamika, Varsha Uphar, Parbhani Kranti and NDO-10.The variety Kashi Kranti has earliest days to 50 per cent flowering (52.30 days) and days to first fruit harvest (46.40 days), are most important traits for exploiting earliness and which are significantly associated (Dakahe *et al.*, 2007). Early flowering behaviour might also be integrated to local okra due to the high market prices and demand in the early season (Duzyaman and Vural, 2003). The analysed data of BC ratio is high for cultivar Kashi Kranti (4.25) followed by Kashi Pragati, Arka Anamika, Prabhani Kranti and local cultivar.

Therefore, on the basis of above findings the okra cultivar Kashi Kranti is the most suitable for okra growers in Kishanganj district of Bihar for getting early fruits with higher yield and ultimately higher returns per unit area.

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