

**NUTRITIVE VALUE AND YIELD POTENTIAL OF OKRA  
(*Abelmoschus esculentus* L. Moench) GENOTYPES**

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**Abstract**

Two experiments were conducted at the research field and laboratory of the Department of Horticulture, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Salna, Gazipur, during April 2012 to September 2013 to find out the yield performance and nutritional quality of seven genotypes of okra in Bangladesh. The results revealed that the highest yield of okra obtained from BARI Dherosh1 (14.9 t/ha) and the lowest yield was obtained from Hybrid Raja (5.76 t/ha). The highest fruits per plant were recorded from BARI Dherosh1 (24.27 fruits/plant). The genotype Green Hybrid produced the lowest edible fruit per plant (10.27). Maximum virus infestation was recorded in genotype Hybrid Raja (100%) and the lowest in Arka Anamika (76.67%) as well as Arka Anamika performed well in many aspect such as yield (12.95 t/ha), fruits per plant (19.83), number of branches per plant (6). The highest content of free ascorbic acid was recorded in Nabik (3.35 mg/100gm) and the minimum ascorbic acid content was observed in Green Hybrid (1.987 mg/100g). Hybrid Moti had the maximum amount of  $\beta$ -carotene (0.15 IU/100 g), while minimum amount of  $\beta$ -carotene was found in IPSA Okra (0.09IU/100 g). The highest K content was observed in IPSA Okra (1.091%) and the lowest in Hybrid Raja (1.06%). The highest amount of Fe was observed in Hybrid Moti (139.60 ppm) and the lowest amount of Fe was observed in Green Hybrid (111.80 ppm). The present results revealed that the yield was maximum in BARI Dherosh1 while Hybrid Moti was superior in nutritive value.

Keywords: Okra genotype(s), nutritive value, yield potentiality.

**Introduction**

Okra (*Abelmoschus esculentus* L. Moench) is a popular green fruit vegetable in Bangladesh. It is commonly known as bhendi or lady's finger in Bangladesh (Rashid, 1999). It is the choicest fruit vegetable grown extensively in tropical, subtropical and warm area of the temperate zones of the world (Tindall, 1983; Siemonsma and Kouame, 2004). Being native of tropical Africa, it is widely cultivated as an important vegetable crop in Bangladesh. Okra is very popular for

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its delicious, tasty, gelatinous, tender, fruits as vegetable. 3-5 days old tender green pods are used as a vegetable, generally marketed in the fresh state. It is the best source of iodine and calcium. Consumption of 100 g of fresh okra fruit provides 20, 15 and 50% of the daily requirement of calcium, iron and ascorbic acid, respectively (Schipper, 2002). Okra is a popular health food due to its high fiber, and vitamin C content. It is also known for being high in antioxidants. It is also a good source of calcium and potassium (Duvauchelle, 2011). Greenish-yellow edible okra oil is pressed from okra seeds; it has a pleasant taste and odor, and is high in unsaturated fats such as oleic acid and linoleic acid (Franklin, 1982).

Average yield of okra in this country is quite low because of the commercially cultivated low yielding varieties. High yield potential genotype with good characteristics is the basis of successful crop production and is important for increasing the productivity. So, in case of genotypes yield potential must be considered for commercial production. Different okra genotypes differ significantly for most of the traits like number of fruits, fruit length, fruit weight and fruit yield per plant, those ultimately determine overall yield of the variety or cultivar. A number of okra varieties are under cultivation in Bangladesh. Besides the improved cultural practices, there is a need to grow high yielding cultivars to increase the green fruit yield per plant and per unit area. In the present study seven okra genotype from local and exotic sources were evaluated for their yield potentiality and determined the nutritional quality of okra genotypes.

### **Materials and Method**

The experiment was conducted at the Horticultural Research Farm, BSMRAU, Gazipur during the period from April 2012 to September 2013. Seven genotypes of okra viz. BARI Dherosh1, IPSA Okra 1, Green Hybrid, Nabik, Hybrid Raja, Arka Anamika and Hybrid Moti were used in this experiment. The field experiment was laid out in a Randomized Complete Block Design with three replications and the lab experiment was laid out in completely randomized design with three replications. The unit plot size was 4m x 1.5m. The genotypes of okra were collected from the respective organizations and the market of Siddique bazaar of Dhaka. The land was manured and fertilized with Cowdung, Urea, TSP, MoP and Molybdenum @ 1000, 150, 100, 150 and 1kg/ha, respectively. The entire amount of Cow dung,  $\frac{1}{2}$  Urea, TSP,  $\frac{1}{2}$  MoP and Molybdenum were applied at the time of final land preparation and the rest of urea and MoP were applied as top dressing in three equal split at 20, 40 and 60 days after germination. The seeds of seven genotypes were sown on 11 April 2012 in the plots. The row spacing was 60 cm having plant spacing of 40 cm within the row. Weeding, irrigation and other cultural practices were done as and when necessary. The collected data on various parameters were statistically analyzed

using MSTAT-C program and the significance was tested by ANOVA. The means of different parameters were compared by Duncan's Multiple Range Test (DMRT) at 5% level of probability (Gomez and Gomez, 1984).

### Results and Discussions

The analysis of variance showed that the genotypes under study differed significantly among themselves for all characters which are presented below:

#### Plant height

Plant height varies significantly at 25DAS, 40DAS, 55DAS and 70DAS among the genotypes (Table 1). Plant height obtained from genotypes at 25 DAS ranged from 11.31 to 16.13cm, at 40 DAS ranged from 27.17 to 37.77cm, at 55 DAS ranged from 43.43 to 64.33 cm and at 70 DAS ranged from 78.67 to 108 cm. Highest plant height obtained from Hybrid Moti (16.13) which was statistically similar to Nabik (15.27 cm), Arka Anamika (14.27 cm) BARI Dherosh1 (14.1cm), IPSA Okra (14.1cm) while the lowest plant height obtained from Hybrid Raja (11.31 cm) which was statistically identical with Green hybrid (12.83 cm) at 25 DAS.

At 40 DAS Highest plant height obtained from Hybrid Moti (37.77 cm) which was statistically identical with Arka Anamika (35.59cm) and BARI Dherosh1 (35.17cm). The lowest plant height obtained from Hybrid Raja (27.17 cm) which was statistically identical with Nabik (29.47 cm).

**Table 1. Plant height of different genotypes of okra at different days after sowing**

Genotype	Plant height(cm)			
	25 DAS	40 DAS	55 DAS	70 DAS
BARI Dherosh1	14.10ab	35.17ab	64.33a	106.4a
IPSA Okra	14.10ab	33.43bc	60.93a	94.87b
Green Hybrid	12.83bc	31.97cd	54.50b	86.20bc
Nabik	15.27a	29.47de	52.47b	82.33c
Hybrid Raja	11.31c	27.17e	43.43c	70.07d
Arka Anamika	14.67ab	35.59ab	63.27a	108.0a
Hybrid Moti	16.13a	37.77a	63.13a	78.67cd
Level of significance	*	*	*	*
CV%	8.51	5.13	4.56	5.91

Means bearing same letter(s) in a column do not differ significantly at 5% level of probability by DMRT.

At 55 DAS after sowing highest plant height obtained from BARI Dherosh1 (64.33cm) which was statistically similar with Arka Anamika (63.27 cm), Hybrid Moti (63.13cm) and IPSA Okra (60.93 cm). Lowest plant height obtained from Hybrid Raja (43.43 cm).

At 70 DAS highest plant height obtained from Arka Anamika (108.00cm) which was statistically identical to BARI Dherosh1 (106.33 cm). Lowest plant height obtained from Hybrid Raja (70.07cm) which was statistically identical with Hybrid Moti (78.67cm). Plant height of different genotypes varied due to inherent characteristics of genotype. Karri and Pinaki (2012) reported that the highest plant height during summer season was 100.62cm. Rahman *et al.* (2012) found highest plant height 91.33cm under the evolutionary field trial of five okra genotype. Kuwar *et al.* (2001) reported highest plant height was 130.4 cm; the present result is within the range of reported result. Plant height varied probably due to genotypical variation.

### Number of leaves

Significant difference in number of leaves per plant was noticed among the genotypes (Table 2). The maximum number of leaves per plant obtained from IPSA Okra (8.83) which was statistically similar with BARI Dherosh1 (8.60), Arka Anamika (8.50) and Nabik (8.40) and minimum number of leaves obtained from Hybrid Raja (7.54) at 25DAS.

At 40 DAS maximum number of leaves obtained from Hybrid Moti (12.37) and minimum number of leaves obtained from Hybrid Raja (10.57) which was statistically similar with Arka Anamika (10.77) and IPSA Okra.

**Table 2. Number of leaves of different genotypes of okra at different days after sowing**

Genotype	Number of leaves			
	25DAS	40DAS	55DAS	70DAS
BARI Dherosh 1	8.60ab	11.10bc	23.93a	33.87a
IPSA Okra	8.83a	10.97cd	22.80ab	30.67b
Green Hybrid	8.23bc	11.27bc	19.93cd	24.20d
Nabik	8.40abc	11.53b	20.67bcd	27.73c
Hybrid Raja	7.54d	10.57d	18.93d	27.73c
Arka Anamika	8.50abc	10.77cd	21.90abc	33.47a
Hybrid Moti	8.03c	12.37a	20.90bcd	27.07c
Level of significance	*	*	*	*
CV%	3.20	7.57	5.89	3.71

Means bearing same letter(s) in a column do not differ significantly at 5% level of probability by DMRT.

At 55 DAS after sowing maximum number of leaves obtained from BARI Dherosh 1(23.93) which was statistically similar with IPSA Okra (22.80) and Arka Anamika (21.90). Minimum number of leaves obtained from Hybrid Raja (18.93) which was statistically similar with Green Hybrid (19.93), Nabik (20.67) and Hybrid Moti (20.90).

At 70 DAS maximum number of leaves obtained from BARI Dherosh1 (33.87) which was statistically similar with Arka Anamika (33.47) and minimum number of leaves obtained from Green Hybrid (24.20). Falusi *et al.* (2012) reported that average number of leaves at the time of maturity were 12.40. The present result is higher than the reported result because of different genotype.

#### Number of branches per plant

The number of branches per plant showed significant variation (Fig.1) and Green Hybrid (6.27) was highest in this respect followed by Arka Anamika (6.00), BARI Dherosh1 (5.93). The lowest number of branches obtained from IPSA Okra (3.47) which was identical with Hybrid Moti (4.13) and Hybrid Raja (4.60). Number of branches per plant in this study varied from 3.47 to 6.27. Similar result was also reported by Kuwar *et al.* (2001).

#### Days to anthesis

As regards to days to anthesis, it was observed that it varied significantly among the genotypes and ranges from 41.33 to 46.67 days (Fig. 2). Earliest first opening of flower was recorded in BARI Dherosh1 (41.33 days) which was at par with Hybrid Moti (42.33 days), Arka Anamika (42.33 days) and IPSA Okra (43 day) while late first opening of flower was observed in Hybrid Raja (46.67 days) which was identical with Green Hybrid (46 days). Muhammad *et al.* (2001) reported the earliest flowering in 45 days in four high yielding okra genotypes.

#### Days to 50% flowering

Seven genotypes showed significant variation in respect of 50% flowering. All the genotypes required 44.33 days to 49.67 days for 50% flowering (Fig. 3). The earliest 50% flowering was recorded from BARI Dherosh1 (44.33 day) which was at par with IPSA Okra (45.33 day), Arka Anamika (45.33 days) and Hybrid Moti (45.33 days) while late 50% flowering were observed in Green Hybrid (49.67 days) and Hybrid Raja (49.67 days). The present result is in agreement with the findings of Reddy *et al.* (2012)

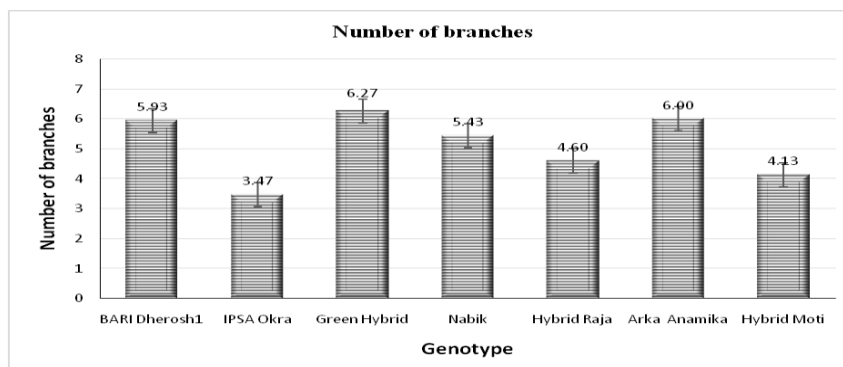
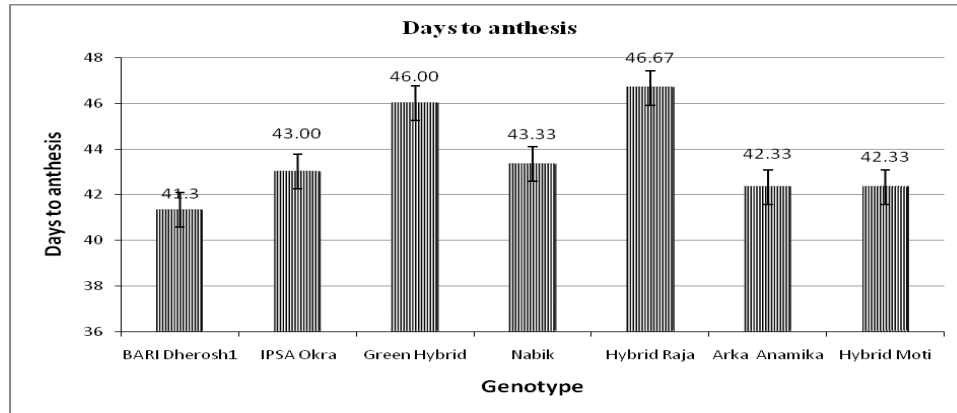
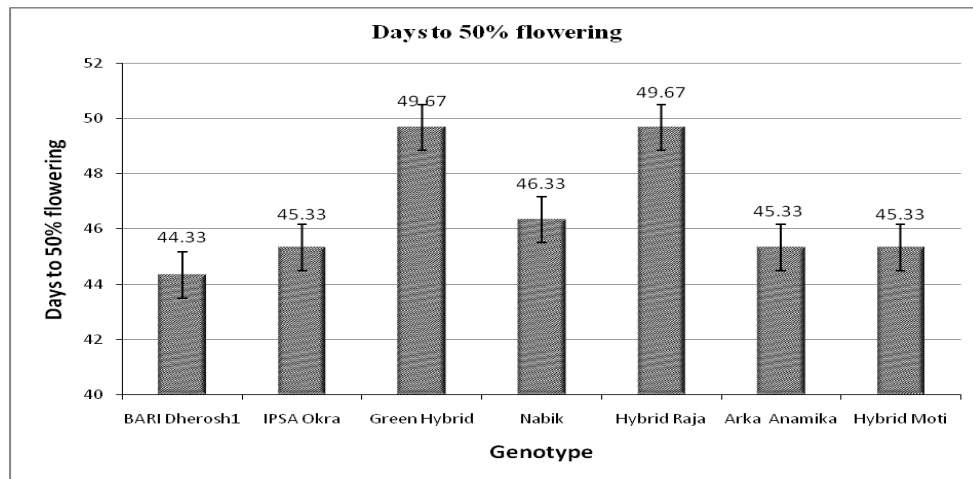


Fig. 1. Number of branches of seven genotypes of okra.



**Fig. 2.** Days to anthesis of different genotypes of okra.



**Fig. 3.** Days to 50% flowering of seven genotype of okra.

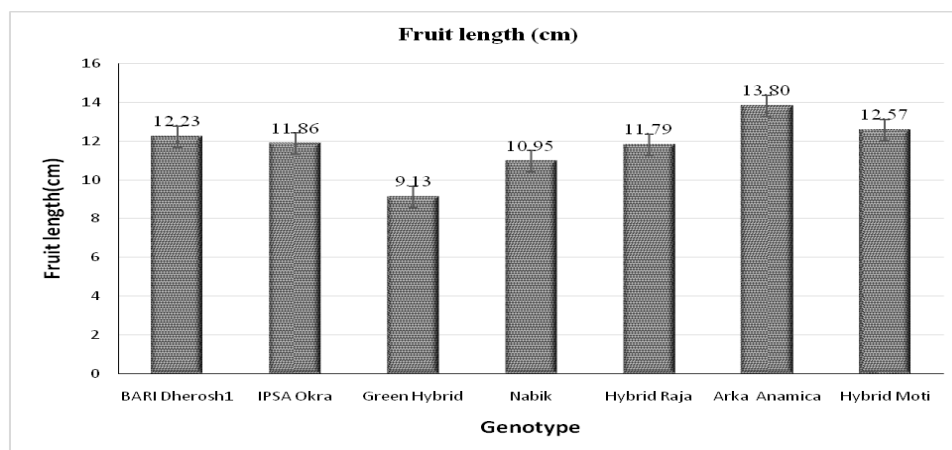
#### **Fruit length (cm)**

Seven genotypes showed significant variation in respect of fruit length (Fig.4). The longest fruit length was observed in Arka Anamika (13.80 cm) followed by Hybrid Moti (12.57cm), BARI Dherosh1 (12.23 cm). The fruit length of Green Hybrid (9.13 cm) was found to be shortest. This result was in agreement with the result obtained by Kuwar *et al.* (2001) who found that maximum fruit length were 13.86 cm

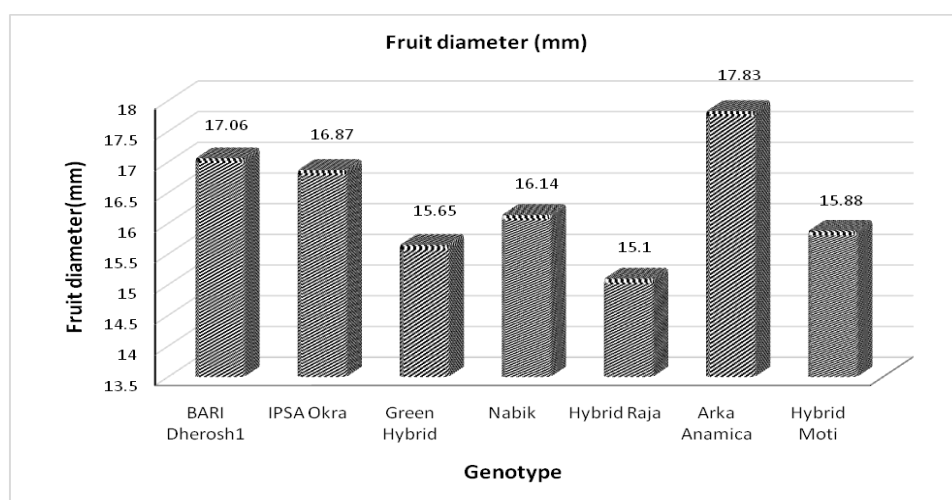
#### **Fruit diameter (mm)**

Fruit diameter varied significantly among the genotypes (Fig.5). The widest fruit diameter found in genotype Arka Anamika (17.83 mm) which was at par with BARI Dherosh1 (17.06 mm.) and IPSA Okra (16.87 mm.) while Hybrid Raja

(15.1 mm.) had the shortest fruit diameter and similar with genotypes Green Hybrid (15.65 mm.) and Nabik (16.14 mm.). Kuwar *et al.* (2001) reported that maximum fruit diameter were 14.7 cm.



**Fig. 4.** Fruit length of different genotypes of okra.



**Fig. 5.** Fruit diameter of seven genotypes of okra.

### Numbers of fruit per plant

Fruit per plant varied significantly among the genotypes (Fig. 6). Fruit per plant in this study varied from 10.27 to 24.27. The highest fruits per plant were recorded from BARI Dherosh1 (24.27). The genotype Green Hybrid (10.27) produced the lowest edible fruit per plant which was statistically identical with Hybrid Raja (11.27). The present result is within the range of the findings reported by Rahman *et al.* (2012).

**Fruit weight (g)**

Significant difference was observed among the okra genotypes in respect of fruit weight (Fig. 7). Fruit weight varied from 12.31 to 15.84 g. The highest fruit weight was observed in IPSA Okra (15.84 g) which was at par with Green Hybrid (15.44g), Nabik (15.45 g) and Arka Anamika (15.66 g). The lowest Fruit weight was observed in Hybrid Raja (12.31 g). This result was in agreement with the result obtained by Karri and Pinaki (2012).

**Picking duration (days)**

The seven genotypes showed significant variation in respect of picking duration (Fig. 8). Duration of picking in this study varied from days 36.33 to 43.33 days. Among all genotypes, fruit harvesting continued for the longest period in case of BARI Dherosh1 (43.33 days). The genotypes Green Hybrid (41.33 days) and Arka Anamika (42 days) carried out longer time while the Nabik (36.33 days) had shortest duration.

**Yield per plant**

Fruit yield per plant differed significantly among the tested genotype (Fig. 9). Yield per plant in this study varied from 138.30 to 357.70 g. The highest fruit yield per plant was observed in BARI Dherosh1 (357.70 g) which was at par with Arka Anamika (310.90 g) and Hybrid Moti (281.50 g). The lowest fruit yield per plant was observed in Hybrid Raja (138.30 g). Reddy *et al.* (2012) reported that yield per plant was 242.61 g. The present result is within the range of reported result. Yield per plant probably vary due to genotype, management practice, number of fruit per plant fruit length, fruit diameter etc.

**Yield (t/ha)**

The fruit yield significantly varied ranging from 5.76 t/ha to 14.90 t/ha among the genotypes (Fig. 10). The genotype BARI Dherosh1 (14.90 t/ha) produced the highest yield which was at par with Arka Anamika (12.95 t/ha) and Hybrid Moti (11.73 t/ha). The lowest yield was found in Hybrid Raja (5.76 t/ha). These results are in full conformity with Rahman *et al.* (2012), Firoz *et al.* (2011) and Amanullah *et al.* (1999) who found significant varietal differences in yield.

**Dry weight (%)**

Dry weight varied significantly among the genotypes (Fig. 11). Dry weight varied in this experiment 12.28 to 19.90 %. The highest dry weight was observed in IPSA Okra (19.9 %). While lowest dry weight was observed in Hybrid Raja (12.28 %) followed by Green Hybrid (13.13 %).



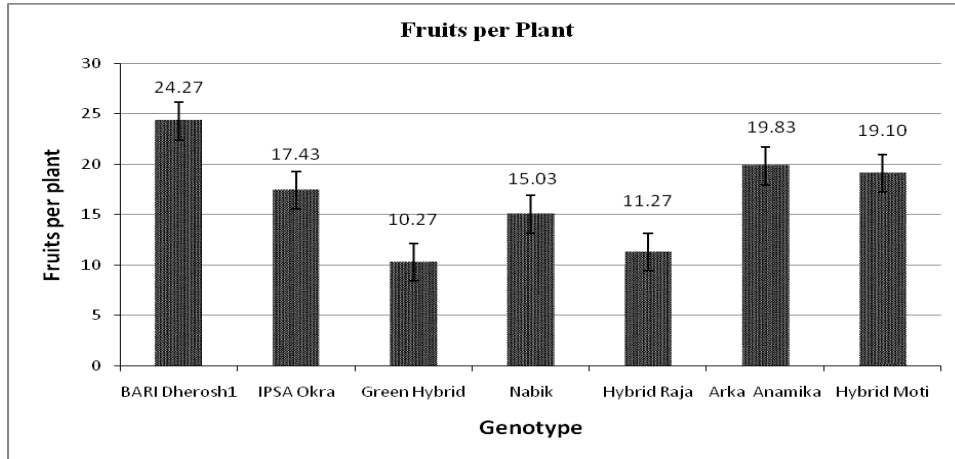


Fig. 6. Fruits per plant of seven genotypes of okra.

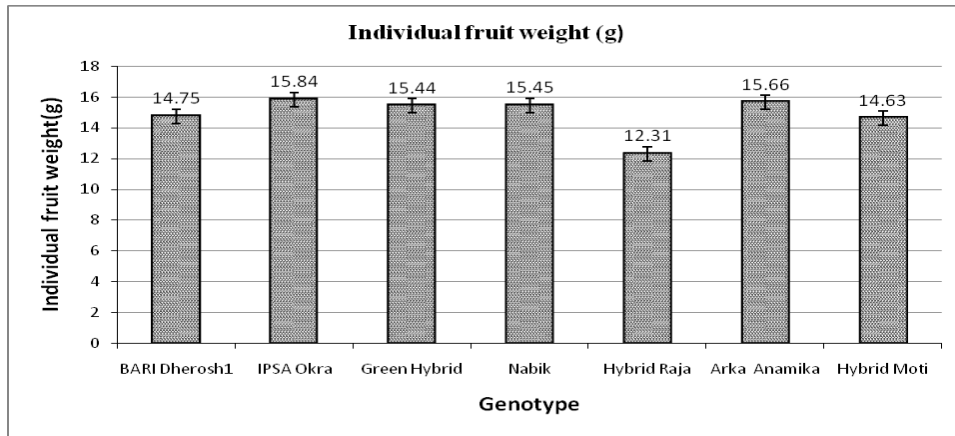


Fig. 7. Individual fruit weight of different genotypes of okra.

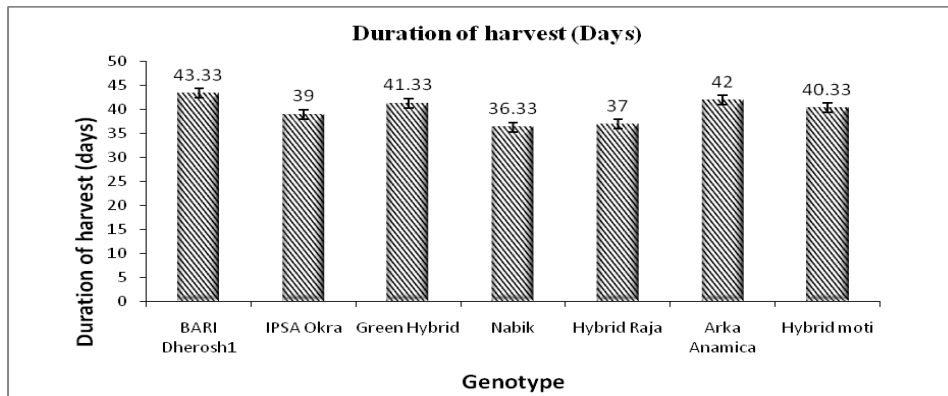
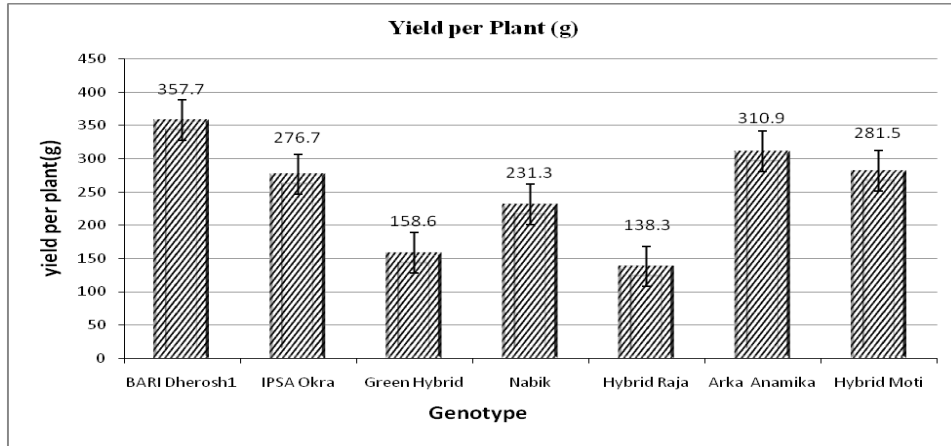
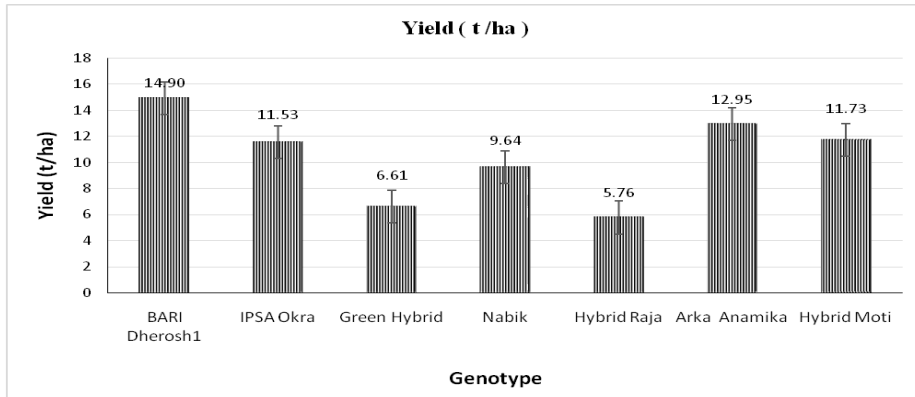


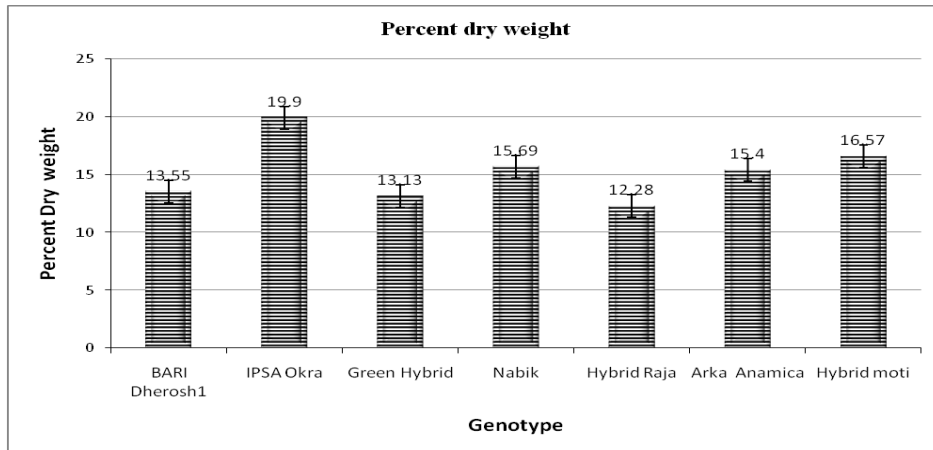
Fig. 8. Duration of harvest of seven genotype of okra.



**Fig. 9.** Yield per plant of seven genotypes of okra.



**Fig. 10.** Yield of seven genotypes of okra.



**Fig. 11.** Percent dry weight of seven genotypes of okra.

### Virus Infestation (%)

Significant variation was observed among the genotypes in respect of virus infestation (Table 3). After germination of seedling there was no virus infested plant in experimental plot. With the increases of days infestation of virus was higher. There was no significant variation of virus infestation among the genotypes at 45 DAS.

The highest virus infestation was observed in Hybrid Raja (50%) which was statistically identical with BARI Dherosh1 (43.33%) and Green Hybrid (40%). The lowest virus infestation was observed in Arka Anamika (23.33%) which was statistically identical with IPSA Okra (30%), Nabik (36.67%) and Hybrid Moti (36.67%) at 60 DAS. The Range of virus infestation was 50% to 23.33% at 60 DAS.

At 75 DAS highest virus infestation was observed in Hybrid Raja (76.67%) which was statistically identical with Green Hybrid (73.33%), Hybrid Moti (73.33%) and Nabik (70%). The lowest virus infestation was observed in Arka Anamika (53.33%) which was statistically identical with IPSA Okra (60%) and BARI Dherosh1. The range of virus infestation at 75 DAS was 76.67 % to 53.33%.

At 90 DAS highest virus infestation was observed in Hybrid Raja (100 %) which is statistically identical with Hybrid Moti (96.67 %), Green Hybrid (93.33 %) and BARI Dherosh 1 (90%). Lowest virus infestation was observed in ArkaAnamika (76.67%) which was statistically identical with IPSA Okra (83.33 %) and Nabik (83.33 %). Mathew *et. al.*, (2005) recorded in an investigation of six resistant variety of okra and infestation of virus varied from 2.31% to 54%. Reddy *et al.* (2012) reported that the highest incidence of yellow vein mosaic virus on plants was observed in genotype of IC043279-A and IC043751-B (60.00 %), while the lowest for the genotypes IC90210 and IC018530 (30.00 %). The present result is higher than reported result due to different genotype.

**Table 3. Virus infestation of seven okra genotypes at different days after sowing**

Genotype	Virus infestation (%)			
	45 DAS	60 DAS	75 DAS	90 DAS
BARIDherosh 1	10.00	43.33 ab	63.33 bc	90.00 ab
IPSA Okra	13.33	30.00 bc	60.00 bc	83.33 bc
Green Hybrid	16.67	40.00 ab	73.33 ab	93.33 ab
Nabik	13.33	36.67 bc	70.00 ab	83.33 bc
Hybrid Raja	16.67	50.00 a	76.67 a	100.0 a
ArkaAnamika	10.00	23.33 c	53.33 c	76.67 c
Hybrid Moti	10.00	36.67 bc	73.33 ab	96.67 ab
Level of significance	NS	*	*	*
CV%	34.64	22.88	11.41	8.72

Means bearing same letter(s) in a column do not differ significantly at 5% level of probability by DMRT.

### Nutritional effect among the okra genotypes

#### Ascorbic acid

Ascorbic acid content varied significantly among the genotype. Ascorbic acid content in this study varied from 3.35 to 1.99 mg/100 g (Table 4). The highest content of free ascorbic acid was recorded in Nabik (3.35 mg/100 g) which was statistically identical with Hybrid Moti (3.173 mg/100 g) while lowest ascorbic acid content was observed in Green Hybrid (1.987 mg/100 g). Kokare *et al.* (2006) reported that highest amount of ascorbic acid content was 17.35 mg/100 mg. The present result is quite lower than the reported result.

#### $\beta$ -carotene

Significant variations in the amount of  $\beta$ -carotene were found, when considered different genotype effect. It varied from 0.09 to 0.15 IU/100 g (Table 4). Hybrid Moti had the maximum amount of  $\beta$ -carotene (0.15 IU/100 g), while minimum amount of  $\beta$ -carotene was found in IPSA Okra (0.09 IU/100 g).

**Table 4. Vitamin and mineral content of seven genotypes of okra**

Genotype	Ascorbic Acid (mg/100g)	$\beta$ -carotene IU/100g	K (%)	Fe (ppm)
BARIDherosh 1	2.91 c	0.14 b	1.09 ab	111.80 c
IPSA Okra	2.93 c	0.09 e	1.09 a	132.60 ab
Green Hybrid	1.99 e	0.10 d	1.09 ab	111.80 c
Nabik	3.35 a	0.11 c	1.08 c	124.00 b
Hybrid Raja	2.64 d	0.10 d	1.07 d	132.60 ab
ArkaAnamika	3.08 bc	0.10 d	1.08 b	127.40 b
Hybrid Moti	3.17 ab	0.15 a	1.09 a	139.60 a
Level of significance	*	*	*	*
CV%	4.00	5.38	1.13	4.61

Means bearing same letter(s) in a column do not differ significantly at 5% level of probability by DMRT.

#### Potassium (K %)

Significant variation in the amount of K % was varied significantly among the genotypes. It varied from 1.066 % to 1.091 % (Table 4). The highest K % was observed in IPSA Okra (1.091 %) which was statistically identical with Hybrid Moti (1.09 %) and Green Hybrid (1.088 %). The lowest K % was observed in Hybrid Raja (1.07 %). Ubi and Osodeke (2006) reported that amount of potassium recorded as 302 mg/kg or 0.03 % which is much lower than the findings of present study.

### Iron (Fe)

Amount of iron varied significantly among the genotype. Amount of iron varied from 139.6 to 111.8 ppm (Table 4). The highest amount of Fe was observed in Hybrid Moti (139.6 ppm) which was statistically identical with IPSA Okra (132.6 ppm) and Hybrid Raja (132.6 ppm). The lowest amount of Fe was observed in Green Hybrid (111.8 ppm). Midrar *et al.* (2005) reported slightly higher amount (120.9 mg/ kg) of Fe in Okra.

### Conclusions

The result of present study generated some information which may help on efficient vegetable production. Among the seven genotypes, BARI Dherosh1 was the highest yielder, which had the maximum number of fruit per plant. Arka Anamika was second highest yielder and minimum virus infection. The highest percent of dry matter was obtained from IPSA Okra. None of the variety was found resistant against virus infestation. Nutritional status such as ascorbic acid,  $\beta$ -carotene, iron, and potassium of okra varied significantly among the genotypes. The present results revealed that the yield was maximum in BARI Dherosh1 while Hybrid Moti was superior in nutritive value.

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