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RESEARCH ARTICLE

Evaluation of varietal performance of okra under subtropical conditions of Nepal

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Abstract

The experiment was aimed at evaluating the yield and yield attributes of okra (*Abelmoschus esculentus* L.). The experiment was conducted on the horticulture research farm of Gokuleshwor Agriculture and Animal Science College, Dilasaini, Baitadi, Nepal, from June 2023 to August 2023. It was laid out in a randomized complete block design (RCBD) with five treatments (Arka Anamika, Liza 151, Bhindi F_1, Kamala, and Glory) and four replications. Results showed that Arka Anamika (179.32 cm) exhibited the highest plant height while Liza-151 (142.9 cm) showed the lowest. Bhindi F_1 (24.55) had the highest numbers of leaves, while Liza-151 (20.05) had the lowest at 60 DAS. The highest pod length and pod diameter were obtained in Arka Anamika (16.48 cm) and Kamala (2.78 cm) respectively. Arka Anamika (45.5) took the highest number of days to reach 50% flowering, whereas Glory (42.75) reached 50% flowering earlier. The highest numer of branches per plant (5.1) and yield per plot (1.57 kg) were obtained in Arka Anamika. Arka Anamika performed better than the other evaluated varieties making it more economical for framers to grow in the subtropical region of the country.

Keywords: Okra, evaluation, subtropical, variety, yield

Introduction

Okra (*Abelmoschus esculentus* L.) is a popular vegetable crop grown in tropical, subtropical, and warm temperate regions all over the world. This crop is appropriate for growing as a garden crop as well as on large industrial farms (Puri *et al.,* 2022). Okra is a member of the Malvaceae family. Nationally, 112,260 metric tons of okra were produced over an area of 9,397 hectares with a productivity of 11.95 tons per hectare (MoALD, 2023). Its green, soft fruits are eaten as vegetables in a variety of ways (Regmi *et al.,* 2020). Dash et al., (2013) and Saha *et al.,* (2016) reported that the fruits of okra are a useful source of additional nourishment for humans since they are rich in carbohydrates, protein, lipids, and calcium, as well as vitamins A, B, C. Several abiotic and biotic factors limit okra production in tropical climates. Temperature, relative humidity, rainfall, and soil are examples of abiotic parameters. Pathogens like bacteria, fungi, viruses, mycoplasma, and nematodes, insect pests, and weeds are examples of biotic influences (Poudel *et al.,* 2018). Depending on the variety, there is variation in plant height, flowering and fruiting period, pod size, pod length, and so on; this variation is driven by the impacts of polygenes (Binalfew and Alemu, 2016). Okra is utilized for a variety of applications, including biomass production from the leaf and paper production from the dry stems.

In various regions of the world, fibres derived from okra stems are used to make strings and nets (Kumar *et al.,* 2023). Ibitoye and Kolawole (2022) reported that the lack of improved varieties was ranked as one of the most significant constraints affecting okra productivity, along with diseases, pests, and drought. Okra production, like other annual crops, can have a considerable impact on national economies. As a result, this study was conducted to analyze varietal performance to assist farmers in okra production.

Materials and methods

The experiment was laid out on the horticulture research farm of Gokuleshwor Agriculture and Animal Science College, Dilasaini, Baitadi, Nepal. Geographically, the experimental field is situated at 29º 58′ 25" N latitude, 80º 31′ 43" E longitude, and an elevation of 700 masl. The duration of the experiment was from June 2023 to August 2023. With average summer and winter temperatures of 21.1°C and 7.7°C, respectively, it is located in a subtropical and moderate climate zone. This experiment was laid out in a randomized complete block design (RCBD) with five varieties (Arka Anamika, Liza 151, Bhindi F_1, Kamala, and Glory) and four replications. All the varieties were randomized separately in each replication. Altogether, there were 20 plots. The net area of the experimental field was 119.7 m^2 (12.6 m × 9.5 m), while the individual plot measured 3.6 m2 (2.4 m × 1.5 m). The gap between the two replications was maintained at 1 m, and between the two treatments, it was 0.5 m. 16 plants per plot were kept with a spacing of 0.6 m between rows and 0.4 m between plants. All the cultural practices were performed as per the recommendations. Seed sowing was done by line sowing at a depth of 3 cm. Plants from the same treatment as filler plants were used for gap filling, which conducted 16 days after seeding. Intercultural operations, crucial for optimal okra development and yield, were performed 15, 30, and 45 days after sowing (DAS). Once the fruits reached maturity and attained marketable size, they were hand-selected, immediately weighed, and subjected to various observations. Five randomly selected plants from each plot were used to collect various types of growth and yield contributing data for okra, and their average value was considered as one plot for each parameter. Plant height, branches per plant, number of leaves per plant, leaf length, and days to first flowering were measured at different intervals after sowing. Pods were collected every seven-day interval after the first harvest, up to four times. Pod length, pod diameter, and whole plot weight were determined at each harvest. Data were entered in MS Excel 2019, and analysis was conducted using the open-source software package R-Studio v. 4.3.2. Analysis of variance was computed, and least significant difference (LSD) was set at 0.05 level of significance (LOS). Duncan's multiple range test (DNMRT) was performed to compare the means between treatments that were found to be significantly different.

Results and discussion

The plant height showed significant variation among different varieties. The highest plant height was observed in Arka Anamika (21.19 cm), and the lowest was observed in Glory (13.52 cm) at 20 DAS. The plant height increased up to 60 DAS. On that day, Arka Anamika (179.32 cm) showed the highest plant height, while Liza-151 (142.9 cm) showed the lowest. At 60 DAS (159.29 cm), the total mean was the highest and at 20 DAS, the lowest (16.66 cm) (Table 2). The variations in plant height can be caused by plant density, environmental conditions, fertilizer application, and nutrient uptake (Dahal *et al.,* 2021).

Moreover, the results showed that Bhindi F_1 (10.75) had the highest number of leaves at 20 DAS, whereas Glory (8.53) had the fewest. The leaf number progressively increased to 60 DAS. Bhindi F_1 (24.55) had the most leaf number, while Liza-151 (20.05) had the lowest at 60 DAS. At 60 DAS, the highest observed overall mean was 22.67, while at 20 DAS, the lowest was 9.25 (Table 2). Increased photosynthesis and supply of photosynthates may lead to more leaves, promoting growth and apical dominance. The outcomes are consistent with the findings of Obumneke *et al.,* (2019).

Table 2: Evaluation of okra varieties for the plant height and the leaf number

Variety	Plant height (cm)			Leaf Number		
	20DAS	40DAS	60DAS	20DAS	40DAS	60DAS
Arka Anamika	21.19^{a}	132.12^{a}	179.32^{a}	8.75^{b}	15.95^{c}	22.15^{ab}
Liza-151	13.83^{c}	98.07^{c}	142.90^{b}	8.85^{b}	18.45^{bc}	20.05^{c}
Bhindi F_1	17.99^{ab}	118.28^{b}	170.84^{a}	10.75^{a}	21.45^{a}	24.55^{a}
Kamala	16.76b^{c}	89.73^{c}	149.34^{b}	9.35^{b}	20.10^{ab}	23.70^{ab}
Glory	13.52^{c}	97.84^{c}	154.07^{b}	8.53^{b}	20.65^{ab}	22.90^{ab}
Mean	16.66	107.21	159.29	9.25	19.32	22.67
SEM	0.60	1.59	1.66	0.19	0.39	0.31
CV (%)	16.14	6.63	4.67	8.99	9.12	6.20
LSD	4.14	10.95	11.46	1.28	2.72	2.17
F-Test	**	***	***	*	**	**

*Significant at 5% level of significance, **Significant at 1% level of significance, ***Significant at 0.1% level of significance

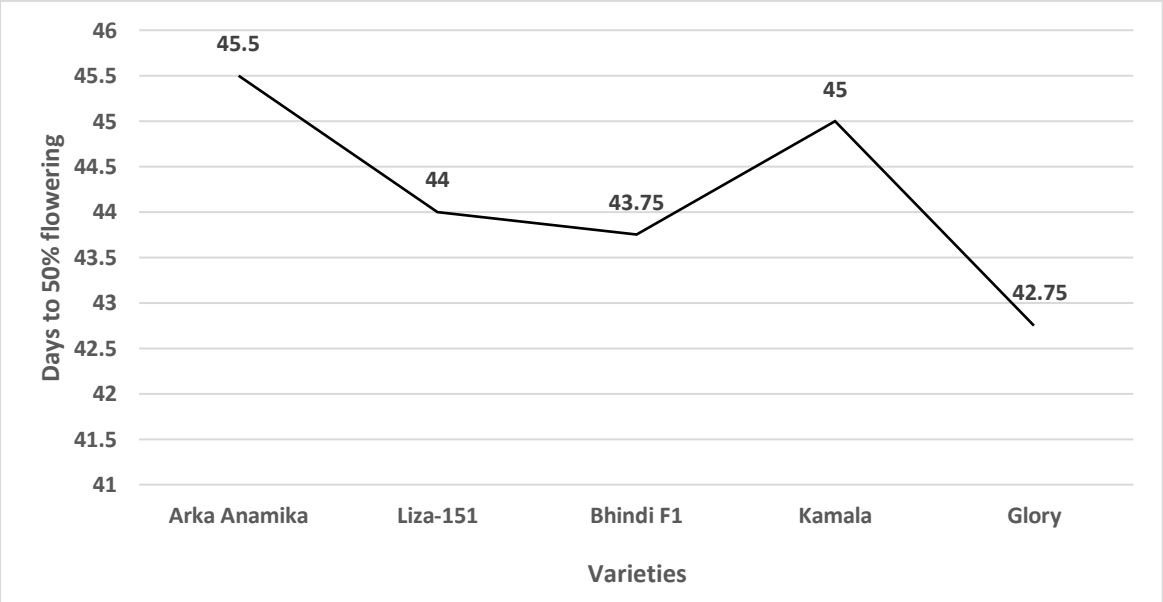
The pod length showed significant variation among the different varieties. Arka Anamika showed the highest pod length at 40 DAS (12.24 cm), followed by Bhindi F*1* (9.48 cm), and Kamala showed the lowest (7.72 cm). Similarly, at 60 DAS highest pod length was obtained in Arka Anamika (16.48 cm), and the lowest pod length was obtained in Bhindi F_1 (12.61 cm) (Table 3). The current study's findings show align with those of Kenaw *et al.,* (2023) and Aminu et al., (2016). There was significant difference among different varieties at 60 DAS. Bhindi F_1 had the largest pod diameter (1.76 cm) at 40 DAS, while Glory had the lowest (0.87 cm). At 50 DAS, Kamala had the largest pod diameter (2.36 cm). Similarly, Kamala (2.78 cm) had the largest pod diameter at 60 DAS, while Glory (1.98 cm) had the lowest (Table 3). Yadav *et al.,* (2023) reported that the pod's mean diameter lies between 2.43 and 6.31. The effect of okra varieties was non-significant on days to 50% flowering, which ranges from 42.75 to 45.5. Arka Anamika (45.5) took the highest number of days to reach 50% flowering, whereas Glory (42.75) reached 50% flowering earlier (Fig. 1). He *et al.,* (2020) reported that variation could be caused by differences in gibberellin levels in the plant. Higher gibberellin levels have been linked to earlier flowering in crop plants in agrrement with of Hamid and Waheed, (2013) and Maheshwari *et al.,* (2016).

Table 3: Evaluation of okra varieties for the pod length and the pod diameter

Variety	Pod length (cm)			Pod diameter (cm)		
	20DAS	40DAS	60DAS	20DAS	40DAS	60DAS
Arka Anamika	12.24[a]	17.03[a]	16.48[a]	1.55[ab]	1.80[b]	2.50[a]
Liza-151	8.77[b]	12.63[b]	14.00[b]	1.08[ab]	1.78[b]	2.48[a]
Bhindi F_1	9.48[b]	12.43[b]	12.61[c]	1.76[a]	1.82[ab]	2.52[a]
Kamala	7.72[b]	12.29[b]	12.98[bc]	1.21[ab]	2.36[a]	2.78[a]
Glory	7.74[b]	11.88[b]	13.27[bc]	0.87[b]	1.59[b]	1.98[b]
Mean	9.19	13.25	13.87	1.30	1.87	2.45
SEM	0.30	0.34	0.17	0.10	0.08	0.05
CV (%)	14.37	11.57	5.48	35.39	18.86	9.73
LSD	2.03	2.36	1.17	0.71	0.54	0.37
F-Test	F-Test	**	**	***	NS	NS

*Significant at 5% level of significance, **Significant at 1% level of significance, ***Significant at 0.1% level of significance, NS Non-significant

Fig. 1: Number of days to 50% flowering by different okra varieties



Branch per plant varied significantly among different varieties of okra. Arka Anamika had the highest branch per plant (4) at 40 DAS followed by Bhindi F_1 (3.5), while Liza-151 had the lowest (2.5). On 50 DAS, Arka Anamika had the highest number of branches (4.5) and Liza-151 had the lowest (3.1). Similarly, Arka Anamika (5.1) had the highest branches at 60 DAS, while Liza-151 (3.8) had the lowest (Table 4). The results are consistent with the findings of Alam and Hossain,(2008).

The yield per plot varied significantly between okra varieties. The highest yield on 40 DAS was achieved by Arka Anamika (1.24 kg), followed by Liza-151 (1.01 kg), while Bhindi F1 (0.7 kg) produced the lowest yield. On 50 DAS, Bhindi F_1 (1.12 kg) had the lowest yield and Arka Anamika (1.46 kg) the highest. Similarly, Arka Anamika produced the maximum yield (1.93 kg) on 60 DAS. On day 70 of the experiment, the yield gradually falls. Arka Anamika had the highest yield that day (1.57 kg), followed by Kamala (1.31 kg), and Glory had the lowest (1.06 kg) (Table 4). An analogous outcome of yield from 6.11 ton/ha to 11.71 ton/ha is also attained by Dahal *et al.,* (2021) and Yadav *et al.,* (2023) reported that highest yield was obtained by Arka Anamika.

Table 4: Evaluation of okra varieties for the branch per plant and the yield per plot

Variety	Branch per plant			Yield per plot (kg)		
	20DAS	40DAS	60DAS	20DAS	40DAS	60DAS
Arka Anamika	4.00^{a}	4.50^{a}	5.10^{a}	1.24^{a}	1.46^{a}	1.93^{a}
Liza-151	2.50^{c}	3.10^{b}	3.80^{c}	1.01^{b}	1.25^{b}	1.61^{b}
Bhindi F_1	3.50^{ab}	4.10^{a}	4.70^{ab}	0.70^{c}	1.12^{b}	1.49^{bc}
Kamala	3.30^{b}	4.00^{a}	4.80^{ab}	0.75^{c}	1.11^{b}	1.61^{b}
Glory	3.20^{b}	4.00^{a}	4.40^{bc}	0.81^{c}	1.15^{b}	1.39^{c}
Mean	3.30	3.90	4.60	0.90	1.22	1.61
SEM	0.10	0.10	0.10	0.02	0.03	0.03
CV (%)	13.70	13.10	9.60	8.11	9.55	7.19
LSD	0.70	0.80	0.70	0.11	0.18	0.18
F-Test	**	*	*	***	**	***

Hence, in conclusion differences in yield and yield parameters were observed under the studied material which may be due to genetic differences and environmental factors. After evaluating the growth and yield of okra, it is concluded that the variety Arka Anamika performed better than the other evaluated varieties under current agro-climatic conditions and is suggested for further investigation and use.

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