



Agronomic traits of Okra cultivars under agro-climatic conditions of Baffa (KPK), Pakistan

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Abstract

The place under experiment is very ideal for all type of crops specially for vegetables. In district Mansehra (Baffa) is famous for growing of organic vegetables and tobacco (Gold-Leaf brand a super brand internationally) production due non pollutants and climatic condition therefore the present study was planed on this back ground. Experiment was conducted at Agricultural Research Station, Baffa, Mansehra-Pakistan during June, 2011 to August, 2011 with the objectives to screen out the high yielding cultivar of Okra and to select the cultivar that is best adoptable to the soil and climatic conditions of Mansehra area. Five different Okra cultivars i.e., Sabz Pari, Sarhad Green, Green Star, Pusa Green and Pusa Sawani were evaluated for their comparative performance under the agro-climatic conditions Mansehra, Pakistan. Maximum days (14) to germination were recorded in Okra cultivars viz , Sarhad Green and Pusa Sawani, whereas, minimum days to emergence (12) were recorded in cultivars Sabz Pari, Green Star and Pusa Green without any variation among these three. Maximum pod diameter (1.653cm) was recorded in Pusa Green and minimum pod diameter (1.530 cm) was recorded in Green Star. Maximum plant height (116.4cm) was recorded in Sarhad Green and minimum height (112.3cm) was recorded in cultivar Green Star. Maximum numbers of seed per pod (68.50) were found in Green Star whereas minimum numbers of seed per pod (59.27) were found in cultivar Pusa Sawani. Highest 1000 seed weight (82.23gm) was also recorded in cultivar Sarhad Green. Yield among different Okra cultivars were non-significant but highest yield was recorded in cultivar Sarhad Green. Different parameters viz a viz days to flowering, length of green pod, green pod yield per treatment and yield per hectare remained non-significant for the Okra cultivars. However finding were much correlated both for climatic, soil and varietal interaction.

Keywords: *Abelmoschus esculentus*. Agro-climatic. Cultivar. KPK. Pakistan.

Introduction

Okra (*Abelmoschus esculentus* L.) known as lady's finger world-wide belongs to the family *malvaceae* or *mallo*. It is a popular home garden vegetable and is commercially grown in many parts of the world specially in Indo-Pak sub continent, kept the place among other vegetables as fresh as well as in dried form in bulk. Probably originated in Ethiopian region of Africa, but is now spread and widely grown in Africa, especially in Sudan, Egypt and Nigeria. It is also important in the other tropical areas including Asia, Central and South America [1]. Okra has fulfilled the demand of vegetables besides nutritional requirements. According to Hudsini *et.al*, [2] 10 pods having weight of 106 g of Okra contains 91% water calories food energy, 2 g protein, 6 g carbohydrates, 98 mg calcium, 43 mg phosphorus, 0.5 mg iron, 184 mg potash and various vitamins. In Pakistan, it is sown/grown throughout the country from mid March to mid of May depends upon region to region. Having favourable climatic condition in many parts of the KPK, Pakistan it grown very well, while the average yield per unit area is low as compared to other countries probably due to low nutrients or climatic conditions. Nitrogen, phosphorus and potassium is the basic requirement for a good/healthy crop @ 120, 90, and 60 kg/ha respectively [3]. The

major factors, which contributed to the green pod yield include: genetic, nutritional factors and space availability to the plants for nourishment /proper utilization of day length, utilized full day for photosynthetic activities. Different genotypes differ significantly among each-other for most of the traits like population of green pods, length, weight and number of viable and healthy seeds per pods etc. Rather determine overall green pods and seeds yield of the cultivar, but also has respond differently to the varying environmental condition with respect to their physiological characteristics and yield components [4-5].

District Mansehra is located at the eastern border of Khyber Pakhtunkhwa (KPK). At 34° - 12' and 35° - 50' and 47° - 07' longitude. While “Baffa” is located 21 km north of Mansehra city on the Karakoram Highway silk route to China, it is located at 34°28'0N, 73°16'60E at an altitude of 1019 meters (3346 feet). Climate of Baffa is very ideal /suitable for Okra due to aforementioned possibilities [6]. Keeping in view of its economic importance & nutritional value and to find-out best time/climatic under local conditions, the present experiment on five local cultivated Okra cultivars i.e Sabz Pari, Sarhad reen, Green Star, Pusa Green and Pusa Sawani were investigated to screen out the high yielding with best adaptable to the soil and agro-climatic conditions of northern parts of KPK (Mansehra) Pakistan. The research finding would provide information regarding effect of agro-climatic condition of district Mansehra on different agronomic traits on Okra.

2. Materials and methods

2.1 Site selection

Agricultural Research Station, Baffa, (KPK) Pakistan was selected for experimentation.

2.2 Location:

The site of Baffa having 3500 ft elevation and following agro-climatic data presented for this vary crop [6].

-	Temperature:	Minimum (°C) -9 (January)	Maximum (°C) 34 (June)	Average 3
-	Rainfal l:	Minimum (mm) 1 (January)	Maximum (mm) 156 (March)	Average 76
-	Humidity:	Minimum (%) 47 (May)	Maximum (%) 70 (October)	Average 62

2.3 Locational detail of metrological observation.

Latitude	34.4667	Longitude	73.2833	Altitude (feet)	3346
Lat (DMS)	34° 28' 0N	Long (DMS)	73° 16' 60E	Altitude (meters)	1019
Approximate population for 1 km radius from this point: 40710					

Source: Waheed et. al., [6]

2.4 Experimental design:

The experiment was laid out in Randomized Complete Block Design (RCBD), five cultivated Okra cultivars i.e., Sabz Pari, Sarhad Green, Green Star, Pusa Green and Pusa Sawani, with five (5) treatments and each has replicated three times. The plot size was kept 4 m × 1.8 m (7.2 m²) for each variety of Okra respectively.

2.5 Experimental material:

The seeds of cultivated cultivars Sabz Pari, Pusa Green, Pusa Sawani, Sarhad Green and Green Star were collected from Gene-bank of Vegetable Program at National Agricultural Research Centre (PARC), Islamabad with standard pack in sealed envelopes.

2.6 Sowing preparation of plots/beds:

All materials were sown during June 2011. Prior to sowing 185 kg N/ha and 93 kg P₂O₅/ha was applied to the experimental field uniformly. Sowing was done during June 2011 ridges by putting 2 seeds per hill 20cm apart. At 6cm seedling stage, thinning have been practiced and retained only one plant required for plant population and data observance.

2.7 Cultural practices:

Maintained all plants in plots with complete cultural practices i.e weeding, hoeing, irrigation, earthing up. Earthing up done four times during study period. Showered/watered after every 5-6 days interval as and when required. Insects were controlled by insecticides available locally.

2.8 Data analysis:

The data recorded were analyzed statistically to record the level of significance ($P < 0.05$) for variation. L.S.D test were also employed to compare the Okra varieties under different treatments, while cost benefit ratio was analysed at ($P < 0.01$).Duncan's multiple range test (DMRT) was used to compare the means values among transform means and transferred to original mean values. However L.S.D was also used for comparison of means between cultivars [7].

3. Results and discussions

3.1 Days to emergence

The data in table-1 pertaining to days to emergence revealed that significant variations were observed among the different Okra cultivars for days to emergence. The cultivars Sarhad Green and Pusa Sawani showed maximum number of days (14) to emergence, while other three cultivars i.e. Sabz pari, Green Star and Pusa Green showed minimum number of 12 days to emergence, statistically behaved alike this was due to methods of storage or due to different seed viability and shelf life. While it may be noticed that each genotype have different characters which was directly affected on days to emergence. The results are also in agreement with Amjad *et al* [3].

3.2 Days to flowering

Days to initial flowering after sowing indicated the non-significant among all cultivars. As there were no significant variations among the treatment means, the variety Pusa Sawani took the maximum days (55) to flowering, closely followed by Green Star with (54.67) days. It indicates that the cultivars behaved statistically alike and stood at par each other, which was may be due to uniform fertilizer dose of 185kg N/ha and temperature "34°C" during July with all other cultural practices. Therefore, it revealed that both temperature and Nitrogen application enhanced flower buds quickly ultimately flower emergence leads to production of fruits/pods [3].

3.3 First picking (days)

First picking was showed significant difference among the treatment (table-1). Maximum days to first picking were taken by Okra cultivar Pusa Sawani and Sarhad Green with 60.33 and 60.00 respectively. Whereas minimum days to first picking were taken by Sabz Pari and Green Star with 58 days for both the cultivars and statistically behaved alike. Very minute differences were found for days to first picking of various Okra Cv. The differences are due to genetic behaviour of different cultivars or due to environmental conditions because all other cultural practices were the same for all five cultivars. Early flowering resulted reduced the days to first picking. It also observed that this habitat of all cultivars improved the yield as early maturity to late picking period of 60 days.

3.4 Green pod size (cm)

Edible pod length revealed the non-significant variation among the different Okra cultivars. Although, there were not significant maximum and minimum pod length were showed Pusa Green (11.16 cm) and Pusa Sawani (10.72 cm). Very minute differences were checked among the different Okra cultivars. Same genotype belonging to the local cultivars and due to uniform cultural practices and fertilizers doses, the green pod were remained non-significant amongst each other.

3.5 Green pod diameter (cm)

Table 1 indicating edible pod diameter (cm) showed the significant variation among the different Okra cultivars for pod diameter. The Cv. Pusa Green showed maximum pod (1.653 cm) diameter over other cultivars while cultivar Green Star showed the lowest pod diameter (1.530 cm). The differences in pod diameter are due to difference in genetic make of the cultivars and their response to prevailing environmental condition with reference to Waheed *et al* [6].

3.6 Average weight of green pod (g)

The results for average weight per green pod were significantly differ among cultivars as shown in Table-1. Maximum pod weight (22.80 g) was observed in Pusa Green; whereas the lowest (16.37 g) was observed in Green Star while Sabz Pari, Sarhad Green and Pusa Sawani gave the same statistical results without any variation among themselves. The variation among the Okra cultivars are due to genetic makeup. Similarly differences in pod weight have also reported among different Okra cultivars [3-8]. It has been observed that maximum weight of green pod fruits were found in thin skin fruits covers as compared to thick one. The thick one have < wt comparatively. Pusa Green Cv were also found more juicy as compared to others.

3.7 Branches per plant

Data in table-1 regarding number of branches per plant gave significant differences among cultivars. The cultivar Sarhad Green showed maximum number of branches (19.80) per plant and minimum number of branches (13.23) was shown by cultivar Sabz Pari which is closely followed by Pusa Sawani with 14.23 branches per plant. May be this is due to their naturally happen. On the other hand during experiment 185Kg N/ha was applied which was also responsible for the vegetative growth, it has induced more number of branches/plant.

3.8 Number of green pods/plant

The results in table-1 obtained for number of pod per plant showed the significant differences among cultivars. The cultivar Sarhad Green showed maximum number of pod per plant (14.77) while the cultivar Green Star showed minimum number of pods per plant (12.37). While the other three cultivars Sabz Pari, Pusa Green and Pusa Sawani showed the non- significant variation. Perhaps this was due to temperature during the formation of green pod & may be nutrient uptake among Okra cultivar. Amjad *et al* (2001) [3] evaluated fifty genotypes and already reported significant and marked variation in yield components among the cultivars. In separate studies, similar results have been reported by [9, 10, 11, 12 & 13].

3.9 Plant height (cm)

Plant height revealed clearly significant variation among Okra cultivars. Maximum plant height (116.4 cm) was found in Okra cultivar Sarhad Green where as the minimum plant height (112.3 cm) was found in Green Star. The variation were may be of different genotypes having different characters. During the study period the temperature was retained up to 34 °C and rainfall was up to 171 mm average (August, 2011) [6]. This probably intake, uptake equivalence to output of growth of the plants. Photosynthetic activity increased during August with the application of Nitrogen were responsible for inducing more branches may be.

3.10 Seed/pod

Data in table 1 showed highly significant differences were observed regarding seed per pod. Maximum numbers of seed per pod (68.50) were shown by Green Star and minimum numbers of seed per pod (59.27) were given by Okra cultivar Pusa Sawani (table 4). Due to micro-nutrients in soil + agro-climatic condition and cultural practices differ Okra cultivars produce difference in seed/pod among all Cv. The difference were found that where the size of pods recorded small, the number of seed/pod increased whereas the size of pod increased with thickness, decreased the number of pods.

3.11 Thousand seed weight (g)

1000 seed weight among the Okra cultivars were also remained significant. The highest 1000 seed weight (82.23gm) was recorded in cultivar Sarhad Green where as lowest (79.07gm) was recorded in cultivar Green Star. While the other three cultivars Sabz Pari, Pusa Green and Pusa Sawani gave no variation among each other statically. Perhaps due to their internal factors or due to their interaction with the environmental conditions of the study area. The results are in agreement with Amjad *et al* (2001) [3] who also reported significant variation among the 1000 seed weight of Okra cultivars.

3.12 Cultivars yield (kg)

Cultivars yield (kg) showed non-significant variation among the all Okra cultivars. Very less difference were found. Maximum yield (7.003 kg) per cultivar was observed in cultivar Sarhad Green, which was closely followed by cultivar Pusa Sawani with 6.997 kg. The minimum yield per cultivar was observed in cultivar Pusa Green with 6.090 kg.

3.13 Yield per hectare (kg)

The data in table-1 regarding yield per hectare (kg) showed non-significant variation among the different Okra cultivars for yield /ha (kg). As the data regarding yield per hectare was derived from yield per treatment, therefore, the data per hectare presented the same picture of results. The highest yield per hectare (14590.0 Kg/ha) was recorded in cultivar Sarhad Green which was closely followed by cultivar Pusa Sawani (14580.0 Kg/ha), while the minimum yield per hectare was recorded in cultivar Pusa Green 12690.0 kg/ha. Figure 1 to 5 presented all the agronomic traits of the Okra cultivars graphically. In all traits the cultivar Sarhad Green proven best among all of them. Although, changes in different agro-climatic factors affected the crop with-in the vicinity of district Mansehra. It was revealed highly productive cultivar can be adopted for good yield /good performer and have economically feasible for good net return to the local farmers. The study will be helpful to make it easy for cultivar selection either for the researchers or farmers for further improvement programme genetically or agronomically.

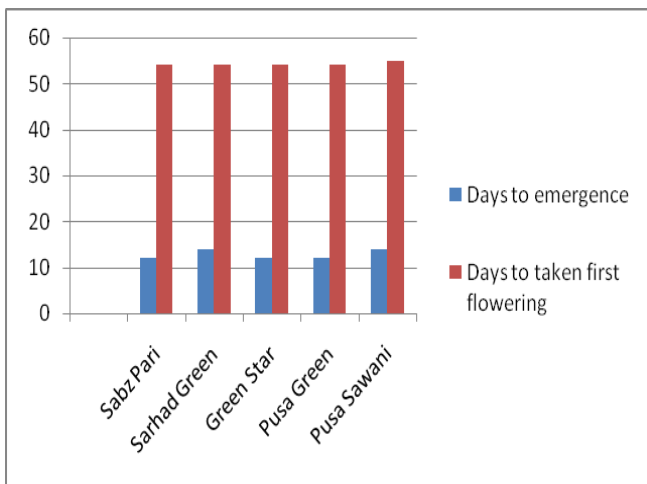


Figure 1: Days to emergence and days to first flowering.

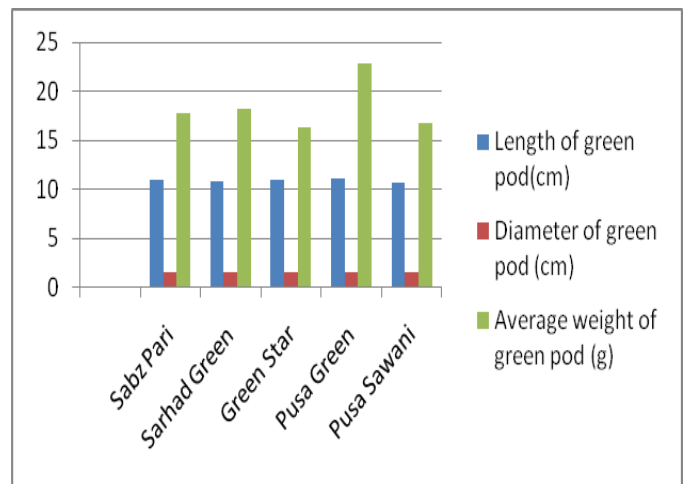


Figure 2: Length of green pod, diameter of green pods and average weight of green pods of cultivars.

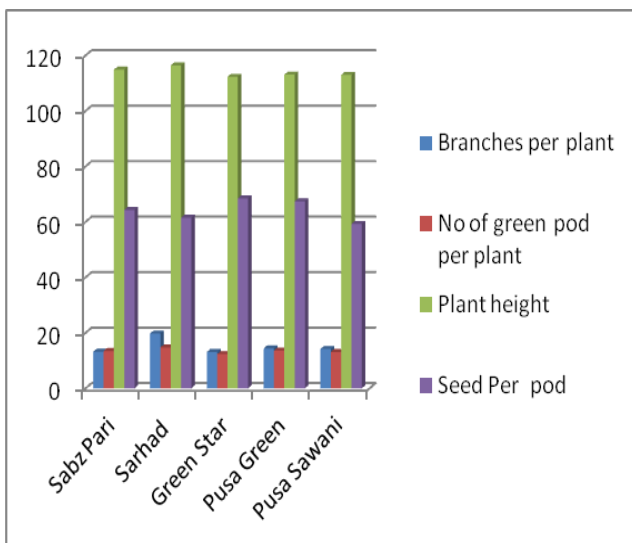


Figure 3: Number of branches/plant, no. of green pods/plant, plant height and seed/ pod.

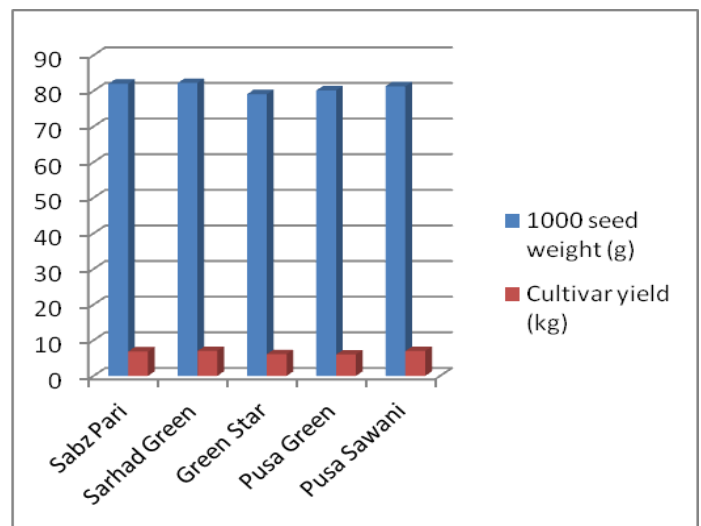


Figure 4: 1000 seed weight and cultivars yield.

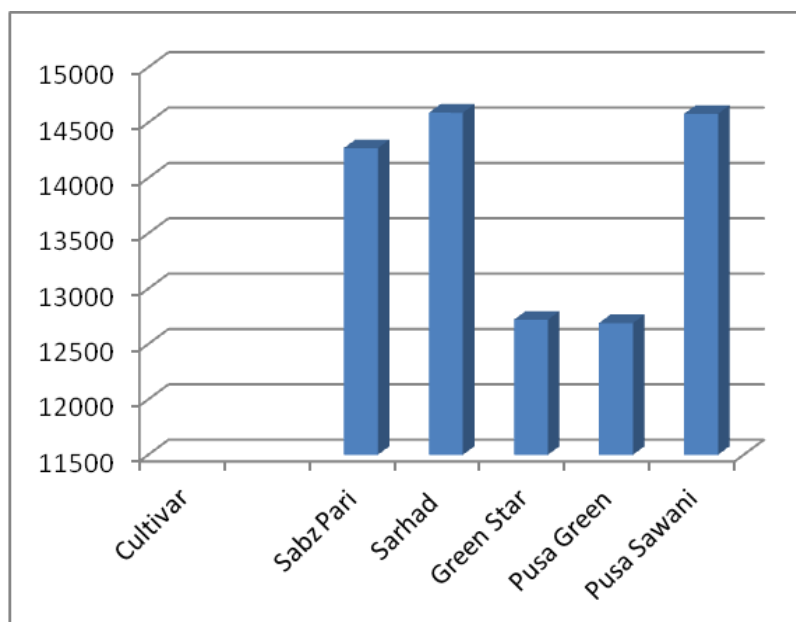


Figure 5: Green pod yield Kg/ hectare.

Cost Benefit Ratio

It was observed from table-2 that highest net return from 1^{-a} of Rs.6669.00 were obtained from Sarhad Green among all, while Sabz Pari gave Rs.5300.00. Sabz Pari & Sarhad Green were remain significant with respect among each other statistically at < 0.1 LSD.

Table 2: Cost-Benefit Ratio of local Okra cultivars grown at ARS, Baffa (KPK).

Treatment combination (CV)	Cost of Production in Rs./acre	Net income Rs./acre	Cost/income difference (Rs.)
Sabz Pari	3100.0d	5300.0b	1643.00d
Pusa Green	5400.0c	5657.0b	3546.18b
Green Star	5438.0c	6100.0a	3317.18c
Sarhad Green	6200.0a	6669.0a	4134.78a
Pusa Sawani	3000.0d	5600.0b	1680.00d

Means followed by the same letter do not differ significantly at 1% level of probability.

It was noted that cost benefit ratio vs net income showed non-significant variation among each treatment, except Pusa Green & Sarhad Green. Sarhad Green costed Rs.6200.00, against net income of Rs.6669.00 obtained at highest, income difference of Rs.4134.78, against expenditure, followed by the Pusa Green. Difference between cost and income shows that the best variety was only Sarhad Green, may be due to a good market because of fruit size/colour & good shape. Lowest was recorded by Sabz Pari & Pusa Sawani, in both cost of production and income difference were remained significant. This difference was perhaps due to growing trend, cropping pattern, sowing and cultural practices, longevity of their fruits parsability & tenderness [14].

Conclusions

It was concluded on the basis of experimental results that maximum plant height (116.4), maximum 1000 seed weight (82.23) and highest yield were noted in Sarhad Green among the other cultivars. Cv Sarhad Green perform good hence recommended on the basis of their agronomic traits for high productivity and profitability. No lodging insect pest or diseases were observed, while proven as good character Cv, which is not only suitable to grow very well but also high yielder and good profitable.

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Table-1: Agronomic traits of different Okra cultivars grown in agro-climatic condition of Mansehra (KPK) Pakistan

S. #	Local cultivars <i>Abelmoschus esculentus</i> L	Days to emergence	Days to flowering	Days to first picking	Green pod size (cm)	Green pod diameter (cm)	Average weight of green pod (g)	Branches per plant	Number of green pods/plant	Plant height (cm)	Seed/pod	1000 seed weight (g)	Cultivars yield (kg)	Green pod yield/hectare (kg)
1	Sabz Pari	12.00b	54.00a	58.00b	11.00a	1.60ab	17.83ab	13.23b	13.47ab	114.9ab	64.33abc	82.00ab	6.85a	14270.0a
2	Sarhad Green	14.00a	54.00a	60.00a	10.89a	1.63ab	18.20ab	19.80a	14.77a	116.4a	61.50bc	82.23a	7.00a	14590.0a
3	Green Star	12.00b	54.67a	58.00b	10.93a	1.53b	16.37b	13.13ab	12.37b	112.3c	68.50a	79.07b	6.10a	12720.0a
4	Pusa Green	12.00b	54.00a	59.33ab	11.16a	1.65a	22.80a	14.37b	13.63ab	113.1bc	67.43ab	80.13ab	6.00a	12.690.0a
5	Pusa Sawani	14.00b	55.00a	60.33a	10.72a	1.62ab	16.80ab	14.23b	13.13ab	113.8bc	59.27c	81.30ab	6.99a	14580.0a
	Level of significance (P<0.05)	N.S	N.S	1.05	N.S	0.09	10.93	7.93	1.11	1.8	13.25	2.69	N.S	N.S