# Evaluation of okra varieties under Sub-Humid plains of South-East Rajasthan for morphological and phenological traits


## ABSTRACT

Vegetable crop okra is well known for its Indian vegetable export and household consumption, contributionand thus should be explored for cultivation under various agro climatic zones. Enhanced production of this crop is only possible via improved and high yielding cultivars in comparison to other cultivars grown at same time or under same condition.Hadoti region of South-East Rajasthan, can serve a okra production in better way if the productive varieties can be screened for thisregion, which is lacking till date.Hence an experiment is made to recommend a variety, which performs better under South-East climatic conditions of Rajasthan. The present study was conducted in the summer season during 2022 and 2023 attheInstructionalFarm, Department of Horticulture, School of Agricultural Sciences, Career Point University, Kota, Rajasthan.12 varieties of okra *viz.* Parbhani Kranti, Parbhani Bhindi, Arka Anamika, Shahiba, Shan, No. 55, Harita, Jhilmil, No. 64, Sonal, Shakti, and Punjab Selection were evaluated in Randomized Block Design,with three replication.Analysis of variance revealed that all varieties differed significantly for all the traits. The results concluded that, variationfor earliness, growth, yield and quality parameters as well. These results showed presence of significant varietaleffect. However, the present study demonstrated the superiority of Arka Anamika over other varieties in terms of maximum mean plant height (89.07 cm), number of leaves per plant (25.64), number of branches per plant (13.88), leaf length (19.03 cm), leaf width (25.32 cm) and leaf area (250.04 $cm^2$) while minimum mean days taken to flowering opening to fruit picking (5.51 DAS) and days taken to first picking (47.16 DAS) was recorded in variety Punjab Selection under soil and climatic condition of Hadoti region of Rajasthan.



***KEYWORDS: Evaluation, Flowering, Growth, Varieties***


## INTRODUCTION

Okra[*Abelmoschusesculentus*(L.)Moench]aprominent position among vegetables. Okra is known by many local names in differentparts of the world. It is called lady's finger in

England, Gumbo in U.S.A. and Bhindi inIndia. InIndia, it is one of the most important vegetable crop grown for its tender green fruitsduring summer andrainy seasons.It is a short duration crop propagated through seeds, cherished for its tender andscrumptiousgreen fruitsusedincurries,soups orincanned, dehydrated or frozenformsforoff-seasonconsumption(Neeraja*etal.*,2004).Okraismoreremunerativeas compared totheleafyvegetables.The roots and stems are useful for clearing cane juice from which guror jaggery is prepared (Chauhan, 1972). Its ripe seeds are roasted, ground and used asasubstituteforcoffeeinTurkey(Mehta,1959).

The foremost challenges faced by okra crop isdamage 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 factors in okra cultivation. The challenge to the existence of mankind has always been to produce adequate quantity of food form the available acreage to meet the requirements of ever expending world population. The rate of yield gain in crop improvement programme must match the rate of population growth so, as to avoid malnutrition and hunger. A lot of okra hybrids/varieties are being grown by the farmers, but best performing hybrids/varieties of okra having desirable quantitative and qualitative characters such as adoptability to adverse environments and resistance to biotic and a biotic stresses resulting 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 could be obtained. This is common fact that the varieties showing better performance under one locality may not be suitable for another locality or region. So that the main aim of experiment is to find out the better performance of a particular okra variety in Hadoti region of Rajasthan and screen out to which variety well adopted and produced maximum yield to another variety under South-East region of Rajasthan.

## Materials and Methods

### *Location*

Kota district is located at 25.18° N to 75.83° E Latitude in South Eastern Rajasthan. It covers an area of 221.36 $km^2$. Agro-climatically, the district falls in Zone V, known as Humid South Eastern Plain. The average rainfall in the region is 660.6. mm. Maximum temperature range in the summer is 40 to 48°C and minimum 1.0- 2.6°C during winter. Major *kharif* crops of the district are soybean, maize and pulses. While in *rabi*, wheat, mustard, coriander and garlic are main crops.

***Experimental Details***

The present study was carried out at the Department of Horticulture, School of Agricultural Sciences, Career Point University, Kota (Rajasthan) during the year 2022 and 2023. Twelve varieties of okra *viz.* Parbhani Kranti, Parbhani Bhindi, Arka Anamika, Shahiba, Shan, No. 55, Harita, Jhilmil, No. 64, Sonal, Shakti, and Punjab Selection were evaluated in randomized block design, replicated thrice.Raised bed planting system at 60 x 30 cm spacing was adapted to grow the crop. The FYM 20 tonnes and RDF 150:100:100 NPK applied per hectare respectively, as basal dose.

***Measurement of the morphological parameters***

The morphological data such as, plant height was taken from the tagged plant in each replication with the help of a meter scale, total number of leaves were counted from tagged plants in each replication after completion of harvesting period and expressed as average number of leaves per plant, number of branches of selected plants was counted and average was worked out, length of leaf and width was measured from randomly selected five leaves from every genotype with the help of scale and then average was recorded, leaf area of random five plants from each treatment was recorded by using electronic leaf area meter. The all plant morphological parameters was recorded at 30,60 and 90 days after sowing the crop.

***Measurement of the phenological parameters***

Days taken to 50% flowering was recorded after sowing the crop when 5-6 plants in each replication started to flower and average number of days from sowing date was calculated to make the observation.The number of days taken to first picking was recorded from sowing date was calculated to make the observation.Number of days required from the date of sowing to first picking of fruits was recorded.

## RESULTS

### *Morphological parameters*

Data observed on morphological parameters showed that there was considerable variation among the all varieties during all the stage of plant growth. Among the different varieties the maximum mean plant height (89.07 cm), number of leaves per plant (25.64), number of branches per plant (13.88), leaf length (19.03 cm), leaf width (25.32 cm) and leaf area (250.04 $cm^2$) was found superior in varietyArka Anamika. However, lowest plant height (64.39cm), number of leaves per plant (18.24) and number of branches per plant (10.22) was recorded in Shan variety. Theleaf length (13.97 cm), leaf width (19.54 cm) and leaf area (204.89 $cm^2$) was found lowest inPunjab Selection variety 90 days after sowing (Table 1 to 6).

### *Phenological parameters*

Data observed on phenological parameters showed that there was considerable variation in different varieties. Theminimum meandays taken to 50% flowering was recordedinShakti (43.15 DAS) whereasthemaximumdays taken to 50% flowering wasfoundinShan(47.28 DAS). Similarly, minimum meandays taken to flowering opening to fruit picking was recordedinPunjab Selection (5.51 days) whereasthemaximumdays taken to flowering opening to fruit picking wasfoundinShan(9.51 days). However,minimum meandays taken to first picking was recordedinPunjab Selection (47.76 days) whereasthemaximumdays (54.02 days)taken to first picking wasfoundinvariety Shan(Table 7).

## DISCUSSION

Itisclearfromtheexperimentalresultsthatsignificantvariationswererecorded amongst the different varieties of okra for the studied on growth parameters*viz.* plant height, number ofleavesperplant, number of branches per plant, leaf length, leaf width and leafarea.

Themaximum meanplantheight was recordedin "Arka Anamika" (89.07cm)while thelowestplantheightwasfoundin"Shan"(64.39cm).The significant differences amongst the varieties for plant height could be attributed to their genetic constitution and inheritance of thecharacter as well as differences in apical dominance controlled by the endogenousauxin level of the genotypes. The obtained results are in accordance with earlierfindingofSharma *et al*. (2016), Singh *et al*. (2017) for plantheight; Kandasamy*etal.*(2015),Darshan*etal.*(2016)andDeepanshuandShamad(2017).

The maximum mean numbers of branches per plant(13.88) and leaves per plant(25.64) were found in ‘Arka Anamika’ while the minimum numbers of branches perplant (10.22) and leaves per plant (18.24) were found in ‘Shan’. Thedifferencesamongstthevarietiesandhybridsfornumber of branches per plant could be attributed to their differentialendogenousauxin and cytokinin contents which regulate the lateral growth and bud development,as low auxin and higher cytokinin levels promote lateral growth and bud developmentor vice-versa. The variation in number of leaves per plant may be due to varyingbranching in plants. The findings are in agreement with the results of Deepanshu andShamad (2017), Simon *et al.* (2013), Muluken *et al.* (2016)and Kumar *et al.* (2019) for number of branches per plant and Kumar*etal*. (2016)fornumberofleavesper plant.

The maximum mean leaf length(19.03 cm) leaf width(25.32 cm) were found in ‘Arka Anamika’ while the minimum mean leaf length (10.22) and leaf width (19.54) were found in ‘Punjab Selection’. Thedifferencesamongstthe different varietiesforleaf length and leaf width could be attributed to their differentialendogenousauxin and cytokinin contents which regulate the lateral growth and bud development,as low auxin and higher cytokinin levels promote lateral growth and bud developmentor vice-versa. The variation in length and leaf width may be due to varyingbranching in plants. The findings are in agreement with the results of Deepanshu andShamad (2017) and Kumar *et al.* (2019) and Das *et al.* (2012) for number of branches per plant and Kumar*etal*. (2016) and Singh*et al.* (2017) fornumberofleavesper plant.

The largestleaves(250.04cm$^2$area)were recordedin‘Arka Anamika’while the smallest leaves (204.89 cm$^2$ area) in ‘Punjab Selection’. The variation in leafarea amongst the different varieties of okra might be due to their genetic makeupgoverningthenutrientuptakebehaviour,photosyntheticefficiencyandtheirenvironmental interactions.TheobservedresultsareinaccordancetoChandramouli*et al.* (2016) and Bendale *et al*. (2003).

The flowering parameters *viz.* days taken to50% flowering, days taken to flowering opening to fruit picking and days taken to first picking were significantly influenced by the different varieties of okra.

Theminimum meandays taken to 50% flowering wererecordedin‘Shakti’(43.15DAS),whilethemostlate50% flowering were recorded in ‘Shan’

(47.28 DAS). Similarly minimum meandays taken to flowering opening to fruit picking was recordedin "Punjab Selection" (5.51 days)whereasthemaximum mean days taken to flowering opening to fruit picking wasfoundin"Shan"(9.51 days). On the other hand minimum meandays taken to first picking was recordedin "Punjab Selection" (47.76 days), whereasthemaximumdays taken to first picking wasfoundin"Shan"(54.02 days). The early or late production of flowers by different varieties andhybridsofokramighthavebeengeneticallycontrolledandbetteradaptabilityto particularenvironmentalconditionsassupportedbytheearlierfindingsofKandasamy*etal.* (2015), Kumar*et al.* (2017), Duggi *et al.* (2013), Chandra *et al*. (2014), Kumar *et al*. (2013) and Bagwale *et al.*(2016) for daystakento50 per cent flowering andAdeoluwa and Kehinde (2011) for early flowering.

## CONCLUSION

Based on the overall effects, the variety Arka Anamika was highest in terms of all growth characteristics but Punjab Selection was found earliness in flowering and fruiting. Hence, variety Punjab Selection may be considered worth for better harvest of the crop under Hadoti region of South-East Rajasthan.

## REFERENCES


Adeoluwa, O.O. and Kehinde, O.B. (2011). Genetic variability studies in West Africanokra(*Abelmoschuscaillei*).*AgricultureandBiologicalJournalofNorthAmerica*,**2** (10): 1326-1335.

Bagwale,S.B.,Jawale,L.N.,Deosarkar,D.B.andJadhav,R.A. (2016).Genetic variabilitystudiesforyield,yieldcontributingandqualitytraits inokra[*Abelmoschusesculentus*(L.)Moench.].*IndianJournalofAgriculturalResearch*,**50** (6): 614-618.

Bendale, V.W., Kadam, S.R., Bhave, S.G., Mehta, J.L. and Pethe, U.B. (2003). Geneticvariabilityandcorrelationstudiesinokra[*Abelmoschusesculentus*(L.)Moench].*O rissa Journal of Horticulture*, **3l**(2): 1-4.

Chandra, S., Bhardwaj, M., Kumar, R., Kumar, D., Kumar, S., Gautam, N., Dogra, B.and Sharma, S. (2014). Estimation of parameters of variability for

differentquantitativetraitsinokra[*Abelmoschusesculentus*(L.)Moench].*InternationalJournal of Farm Sciences*,**4**(3): 33-41.

Chandramouli,B.,Shrihari,D.,Rao,A.V.D.D.andRao,M.P. (2016).Studiesongeneticvariability,heritability andgeneticadvanceinokra [*Abelmoschusesculentus*(L.)Monech] genotypes.*PlantArchives,* **16**(2):679-682.

Chauhan,D.V. S.(1972).VegetableCrops. NayaPrakash,Calcutta-6.pp.711.

Darshan S. Nikitha J. and Arya K. (2016). Genetic variability studies for yield and yieldparameters in okra [*Abelmoschus esculentus* (L.) Moench]. *Advances in lifesciences*,**5**(17): 6539-6541.

Das,S.,Chattopadhyay,A.,Chattopadhyay,S.B.,Dutta,S.andHazra,P. (2012).Genetic parameters and path analysis of yield and its components in okra[*Abelmoschusesculentus*(L.)Moench]atdifferentsowingdatesintheGangetic plains of eastern India. *African Journal of Biotechnology*, **11**(95):16132-16141.

Deepanshuand Shamad, A. (2017). Genetic variability, heritability andcorrelationcoefficientinokra[*Abelmoschusesculentus*(L.)Moench]inAllahabadagro climaticconditions.*Plant Archives*, **17**(2):1597-1602.

Duggi, S., Magadum, S.K., Srinivasraghavan, A., Kishor, D.S. and Oommen, S.K. (2013).Geneticanalysisofyieldandyield-attributingcharactersinokra [*Abelmoschus esculentus* (L.) Moench]. *International Journal of AgricultureEnvironmentand Biotechnology*,**6**(1): 45-50.

Kandasamy,R. (2015).Geneticdivergenceinokra[*Abelmoschusesculentus*(L.)Moench]*InternationalJournal ofAgricultural Sciences*,**11**(1):158-160.

Kumar, A., Kumar, S. and Maji, S. (2016). Genetic variability, heritability and geneticadvance studies in okra [*Abelmoschus esculentus* (L.) Moench]. *InternationalJournalof Agriculture Sciences*, **8**(57): 3122-3124.

Kumar, A., Kumar, M., Sharma, V.R., Singh, M.K., Singh, B. and Chand, P. (2019).Genetic variability, heritability and genetic advance studies in genotypes ofokra

[(*Abelmoschus esculentus* (L.) Moench]. *Journal of Pharmacognosy andPhytochemistry*,**8**(1): 1285-1290.

Kumar, K.V.V., Venkatesha, K.T., Asif, M., Gangappa E. and Pitchaimuthu M. (2013).Genetic variability studies in okra [*Abelmoschus esculentus* (L.) Moench].*InternationalJournal of Plant Sciences*, **8**(1): 187-192.

Mehta, Y. R. (1959).Vegetable Crops. NayaPrakash, Calcutta-6.pp.711.

Muluken, D., Wassu, M. and Endale, G. (2016). Variability, heritability and geneticadvance in ethiopian okra [*Abelmoschus esculentus* (L.) Moench] collectionsfor tender fruit yield and other agro-morphological traits. *Journal of AppliedLifeSciences International***4**(1): 1-12.

Neeraja, G.Vijaya, M.Chiranjeevi, C.Gautham, B. (2004) Screening of okrahybridsagainstpestanddiseases.IndianJournalofPlant Protection;2004.**32(1):**129-131.

Sharma, P.K., Mishra, D.P. and Pandey, A. (2016). Genetic variability studies for yieldand its contributing traits in okra [*Abelmoschus esculentus*(L.) Moench].*Journalof Applied and Natural Science,* **8**(3): 1634-1637.

Simon, S.Y., Gashua I.B., and Musa, I. (2013). Genetic variability and trait correlationstudiesinokra[*Abelmoschusesculentus*(L.)Moench].*AgricultureandBiologyJ ournal of NorthAmerica*, **4**(5): 532-538.

Singh, A.P., Kumar, P.P., Kumar, B.A. and Bahadur, V. (2017). Studies on geneticvariability,heritabilityandcharacterassociationinokra[*Abelmoschusesculentus* (L.) Moench.]. *International Journal of Bio-resource and StressManagement*,**8**(3): 457-462.

Singh, N., Singh, D.K., Sati, U.C., Rawat, M. andPandey, P. (2017). Genetic analysisstudies in Okra [*Abelmoschus esculentus* (L.) Moench]. *Indian Journal ofPureand Applied Bioscience*,**5**(4): 361-367.

**Table 4.1 Performance of different varieties of okra with respect toplant height**

| Treatment | Varieties | Plant height (cm) 30 DAS | | | Plant height (cm) 60 DAS | | | Plant height (cm) 90 DAS | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | **2022** | **2023** | **Pooled** | **2022** | **2023** | **Pooled** | **2022** | **2023** | **Pooled** |
| $T_1$ | Parbhani Kranti | 16.68 | 18.36 | 17.52 | 29.97 | 32.11 | 31.04 | 71.97 | 73.48 | 72.72 |
| $T_2$ | Parbhani Bhindi | 16.35 | 19.03 | 17.69 | 28.88 | 31.02 | 29.95 | 74.53 | 76.04 | 75.28 |
| $T_3$ | Arka Anamika | 19.43 | 22.11 | 20.77 | 38.17 | 40.31 | 39.24 | 88.32 | 89.83 | 89.07 |
| $T_4$ | Shahiba | 17.43 | 20.11 | 18.77 | 30.63 | 32.77 | 31.70 | 76.55 | 78.06 | 77.3 |
| $T_5$ | Shan | 16.03 | 18.71 | 17.37 | 27.03 | 29.17 | 28.10 | 63.64 | 65.15 | 64.39 |
| $T_6$ | No. 55 | 16.46 | 19.21 | 17.83 | 28.41 | 30.55 | 29.48 | 68.30 | 69.81 | 69.05 |
| $T_7$ | Harita | 16.99 | 19.67 | 18.33 | 30.05 | 32.19 | 31.12 | 69.18 | 70.69 | 69.93 |
| $T_8$ | Jhilmil | 16.16 | 18.84 | 17.50 | 29.47 | 31.61 | 30.54 | 70.45 | 71.96 | 71.2 |
| $T_9$ | No. 64 | 17.52 | 19.20 | 18.36 | 32.68 | 34.82 | 33.75 | 79.33 | 80.84 | 80.08 |
| $T_{10}$ | Sonal | 18.03 | 20.71 | 19.37 | 34.9 | 37.04 | 35.97 | 82.93 | 84.44 | 83.68 |
| $T_{11}$ | Shakti | 17.19 | 19.87 | 18.53 | 30.69 | 32.83 | 31.76 | 67.99 | 69.50 | 68.74 |
| $T_{12}$ | Punjab Selection | 15.90 | 18.58 | 17.24 | 29.03 | 31.17 | 30.10 | 71.01 | 72.52 | 71.76 |
| | **SEm±** | **1.63** | **1.71** | **0.82** | **1.66** | **1.68** | **1.65** | **2.24** | **2.02** | **1.78** |
| | **C.D.($p_{=}$0.05)** | **2.31** | **5.02** | **2.40** | **4.88** | **4.94** | **4.86** | **6.59** | **5.92** | **5.22** |

**Table 4.2 Performance of different varieties of okra with respect tonumber of leaves per plant**

| Treatment | Varieties | Number of Leaves 30 DAS | | | Number of Leaves 60 DAS | | | Number of Leaves 90 DAS | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2022 | 2023 | Pooled | 2022 | 2023 | Pooled | 2022 | 2023 | Pooled |
| $T_1$ | Parbhani Kranti | 6.78 | 8.01 | 7.39 | 14.02 | 15.38 | 14.70 | 21.14 | 22.53 | 21.84 |
| $T_2$ | Parbhani Bhindi | 7.31 | 8.54 | 7.92 | 13.27 | 14.63 | 13.95 | 20.42 | 21.79 | 21.10 |
| $T_3$ | Arka Anamika | 8.84 | 10.07 | 9.45 | 17.38 | 16.06 | 18.06 | 24.94 | 26.33 | 25.64 |
| $T_4$ | Shahiba | 7.41 | 8.64 | 8.02 | 14.62 | 15.98 | 15.30 | 22.74 | 24.13 | 23.44 |
| $T_5$ | Shan | 6.84 | 8.07 | 7.45 | 12.40 | 13.76 | 13.08 | 17.54 | 18.93 | 18.24 |
| $T_6$ | No. 55 | 7.18 | 8.41 | 7.79 | 13.39 | 14.75 | 14.07 | 21.10 | 22.49 | 21.80 |
| $T_7$ | Harita | 6.44 | 7.67 | 7.05 | 14.14 | 15.5 | 14.82 | 22.54 | 23.93 | 23.24 |
| $T_8$ | Jhilmil | 7.04 | 8.27 | 7.65 | 14.00 | 15.36 | 14.68 | 20.67 | 22.06 | 21.37 |
| $T_9$ | No. 64 | 7.71 | 8.94 | 8.32 | 14.70 | 18.74 | 15.38 | 23.25 | 24.64 | 23.95 |
| $T_{10}$ | Sonal | 8.41 | 9.64 | 8.69 | 15.70 | 17.06 | 16.38 | 23.44 | 24.83 | 24.14 |
| $T_{11}$ | Shakti | 7.32 | 8.55 | 7.93 | 14.14 | 15.5 | 14.82 | 22.48 | 23.87 | 23.18 |
| $T_{12}$ | Punjab Selection | 6.58 | 7.81 | 7.19 | 14.92 | 16.28 | 15.60 | 20.3 | 21.69 | 21.00 |
| | **SEm±** | **0.43** | **0.47** | **0.38** | **0.79** | **0.66** | **0.69** | **1.00** | **1.01** | **1.06** |
| | **C.D.($p=0.05$)** | **1.28** | **1.38** | **1.13** | **2.33** | **1.95** | **2.04** | **2.93** | **2.96** | **3.12** |

**Table 4.3 Performance of different varieties of okra with respect tonumber of branches per plant**

| Treatment | Varieties | Number of Branches 30 DAS | | | Number of Branches 60 DAS | | | Number of Branches 90 DAS | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2022 | 2023 | Pooled | 2022 | 2023 | Pooled | 2022 | 2023 | Pooled |
| $T_1$ | Parbhani Kranti | 3.12 | 3.44 | 3.28 | 8.18 | 8.41 | 8.30 | 10.47 | 10.66 | 10.57 |
| $T_2$ | Parbhani Bhindi | 2.85 | 3.17 | 3.01 | 7.78 | 8.01 | 7.90 | 10.83 | 11.02 | 10.93 |
| $T_3$ | Arka Anamika | 3.85 | 4.17 | 4.01 | 8.68 | 8.91 | 8.80 | 13.78 | 13.97 | 13.88 |
| $T_4$ | Shahiba | 2.92 | 3.24 | 3.08 | 8.15 | 8.38 | 8.27 | 11.05 | 11.24 | 11.15 |
| $T_5$ | Shan | 3.25 | 3.57 | 3.41 | 6.98 | 7.21 | 7.10 | 10.12 | 10.31 | 10.22 |
| $T_6$ | No. 55 | 3.38 | 3.70 | 3.54 | 7.84 | 8.07 | 7.96 | 10.88 | 11.07 | 10.98 |
| $T_7$ | Harita | 3.18 | 3.50 | 3.34 | 8.12 | 8.35 | 8.24 | 12.72 | 12.91 | 12.82 |
| $T_8$ | Jhilmil | 3.12 | 3.44 | 3.28 | 8.11 | 8.34 | 8.23 | 10.66 | 10.85 | 10.76 |
| $T_9$ | No. 64 | 3.38 | 3.70 | 3.54 | 9.38 | 9.61 | 9.50 | 11.75 | 11.94 | 11.85 |
| $T_{10}$ | Sonal | 3.45 | 3.77 | 3.61 | 8.28 | 8.51 | 8.40 | 12.44 | 12.63 | 12.54 |
| $T_{11}$ | Shakti | 3.25 | 3.57 | 3.41 | 8.52 | 8.75 | 8.64 | 13.49 | 13.68 | 13.59 |
| $T_{12}$ | Punjab Selection | 3.32 | 3.64 | 3.48 | 8.65 | 8.88 | 8.77 | 13.12 | 13.31 | 13.22 |
| | **SEm±** | **0.16** | **0.24** | **0.22** | **0.35** | **0.33** | **0.45** | **0.83** | **0.35** | **0.46** |
| | **C.D.($p=0.05$)** | **0.49** | **0.72** | **0.65** | **1.05** | **0.97** | **1.34** | **2.44** | **1.05** | **1.35** |

**Table 4.4 Performance of different varieties of okra with respect toleaf length (cm) per plant**

| Treatment | Varieties | leaf length (cm) 30 DAS | | | leaf length (cm) 60 DAS | | | leaf length (cm) 90 DAS | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2022 | 2023 | Pooled | 2022 | 2023 | Pooled | 2022 | 2023 | Pooled |
| $T_1$ | Parbhani Kranti | 8.13 | 8.45 | 8.29 | 14.80 | 15.05 | 14.92 | 16.19 | 16.49 | 16.34 |
| $T_2$ | Parbhani Bhindi | 8.33 | 8.65 | 8.49 | 14.00 | 14.25 | 14.12 | 16.30 | 16.60 | 16.45 |
| $T_3$ | Arka Anamika | 10.09 | 10.41 | 10.25 | 17.09 | 17.34 | 17.21 | 18.87 | 19.17 | 19.03 |
| $T_4$ | Shahiba | 9.14 | 9.46 | 9.30 | 14.94 | 15.19 | 15.06 | 16.61 | 16.91 | 16.76 |
| $T_5$ | Shan | 7.53 | 7.85 | 7.69 | 12.53 | 12.78 | 12.65 | 14.99 | 15.29 | 15.14 |
| $T_6$ | No. 55 | 8.16 | 8.48 | 8.32 | 14.12 | 14.37 | 14.24 | 15.53 | 15.83 | 15.68 |
| $T_7$ | Harita | 8.99 | 9.31 | 9.15 | 13.80 | 14.05 | 13.92 | 16.28 | 16.58 | 16.44 |
| $T_8$ | Jhilmil | 8.82 | 9.14 | 8.98 | 12.94 | 13.19 | 13.06 | 15.83 | 16.13 | 15.98 |
| $T_9$ | No. 64 | 9.40 | 9.72 | 9.56 | 15.26 | 15.51 | 15.38 | 16.91 | 17.21 | 17.06 |
| $T_{10}$ | Sonal | 9.81 | 10.13 | 9.97 | 16.08 | 16.33 | 16.20 | 17.47 | 17.77 | 17.62 |
| $T_{11}$ | Shakti | 8.48 | 8.80 | 8.64 | 12.70 | 12.95 | 12.82 | 15.02 | 15.32 | 15.17 |
| $T_{12}$ | Punjab Selection | 7.88 | 8.20 | 8.04 | 11.68 | 11.93 | 11.80 | 13.82 | 14.12 | 13.97 |
| | **SEm±** | **0.50** | **0.44** | **0.50** | **0.71** | **0.47** | **0.59** | **0.83** | **0.45** | **0.58** |
| | **C.D.($p_{=}$0.05)** | **1.46** | **1.31** | **1.44** | **2.10** | **1.39** | **1.72** | **2.44** | **1.32** | **1.69** |

**Table 4.5 Performance of different varieties of okra with respect toleaf width (cm) per plant**

| Treatment | Varieties | leaf width (cm) 30 DAS | | | leaf width (cm) 60 DAS | | | leaf width (cm) 90 DAS | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2022 | 2023 | Pooled | 2022 | 2023 | Pooled | 2022 | 2023 | Pooled |
| $T_1$ | Parbhani Kranti | 9.64 | 9.96 | 9.80 | 19.67 | 19.92 | 19.79 | 21.51 | 21.66 | 21.51 |
| $T_2$ | Parbhani Bhindi | 9.45 | 9.77 | 9.61 | 18.65 | 18.90 | 18.77 | 20.97 | 21.12 | 20.97 |
| $T_3$ | Arka Anamika | 12.10 | 12.42 | 12.26 | 22.59 | 22.84 | 22.71 | 25.32 | 25.47 | 25.32 |
| $T_4$ | Shahiba | 10.08 | 10.40 | 10.24 | 20.31 | 20.56 | 20.43 | 22.27 | 22.42 | 22.27 |
| $T_5$ | Shan | 8.51 | 8.83 | 8.67 | 16.97 | 17.22 | 17.09 | 18.75 | 18.9 | 18.75 |
| $T_6$ | No. 55 | 9.01 | 9.33 | 9.17 | 18.52 | 18.77 | 18.64 | 20.14 | 20.29 | 20.14 |
| $T_7$ | Harita | 9.74 | 10.06 | 9.90 | 18.87 | 19.12 | 18.99 | 21.38 | 21.53 | 21.38 |
| $T_8$ | Jhilmil | 9.53 | 9.85 | 9.69 | 17.76 | 18.01 | 17.88 | 21.81 | 21.96 | 21.81 |
| $T_9$ | No. 64 | 10.34 | 10.66 | 10.50 | 20.84 | 21.09 | 20.96 | 23.41 | 23.56 | 23.41 |
| $T_{10}$ | Sonal | 10.93 | 11.25 | 11.09 | 21.53 | 21.78 | 21.65 | 23.98 | 24.13 | 23.98 |
| $T_{11}$ | Shakti | 9.04 | 9.36 | 9.20 | 19.28 | 19.53 | 19.40 | 22.04 | 22.19 | 22.04 |
| $T_{12}$ | Punjab Selection | 8.11 | 8.43 | 8.27 | 16.84 | 17.09 | 16.96 | 19.54 | 19.69 | 19.54 |
| | **SEm±** | **0.50** | **0.51** | **0.68** | **1.04** | **0.57** | **0.62** | **0.67** | **0.83** | **0.70** |
| | **C.D.($p=0.05$)** | **1.46** | **1.50** | **1.98** | **3.06** | **1.68** | **1.83** | **1.95** | **2.44** | **2.00** |

**Table 4.6 Performance of different varieties of okra with respect toLeaf Area ($cm^2$) per plant**

| Treatment | Varieties | Leaf Area ($cm^2$) 30 DAS | | | Leaf Area ($cm^2$) 60 DAS | | | Leaf Area ($cm^2$) 90 DAS | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2022 | 2023 | Pooled | 2022 | 2023 | Pooled | 2022 | 2023 | Pooled |
| $T_1$ | Parbhani Kranti | 149.14 | 150.46 | 149.80 | 184.37 | 186.29 | 185.33 | 220.96 | 223.92 | 222.44 |
| $T_2$ | Parbhani Bhindi | 156.27 | 157.59 | 156.93 | 191.39 | 193.31 | 192.35 | 226.05 | 229.01 | 227.53 |
| $T_3$ | Arka Anamika | 172.06 | 173.38 | 172.72 | 223.53 | 225.45 | 224.49 | 248.56 | 251.52 | 250.04 |
| $T_4$ | Shahiba | 161.96 | 163.28 | 162.62 | 199.28 | 201.20 | 200.24 | 230.63 | 233.59 | 232.11 |
| $T_5$ | Shan | 118.32 | 119.64 | 118.98 | 167.54 | 169.46 | 168.50 | 198.49 | 201.45 | 199.97 |
| $T_6$ | No. 55 | 123.39 | 124.71 | 124.05 | 173.14 | 175.06 | 174.10 | 205.73 | 208.69 | 207.21 |
| $T_7$ | Harita | 134.60 | 135.92 | 135.26 | 177.46 | 179.38 | 178.42 | 211.61 | 214.57 | 213.09 |
| $T_8$ | Jhilmil | 144.10 | 145.42 | 144.76 | 179.65 | 181.57 | 180.61 | 216.07 | 219.03 | 217.55 |
| $T_9$ | No. 64 | 164.57 | 165.89 | 165.23 | 208.69 | 210.61 | 209.65 | 235.07 | 238.03 | 236.55 |
| $T_{10}$ | Sonal | 168.72 | 170.04 | 169.38 | 217.32 | 219.24 | 218.28 | 240.18 | 243.14 | 241.66 |
| $T_{11}$ | Shakti | 137.38 | 138.70 | 138.04 | 191.26 | 193.18 | 192.22 | 204.56 | 207.52 | 206.04 |
| $T_{12}$ | Punjab Selection | 127.13 | 128.62 | 127.96 | 182.08 | 184.00 | 183.04 | 203.41 | 206.37 | 204.89 |
| | **SEm±** | **2.21** | **2.24** | **2.55** | **2.41** | **2.47** | **2.55** | **1.66** | **2.41** | **1.90** |
| | **C.D.($p=0.05$)** | **6.51** | **6.60** | **7.49** | **7.06** | **7.21** | **7.50** | **4.88** | **7.06** | **5.50** |

**Table 4.7 Performance of different varieties of okra with respect tophonological characteristics**

| Treatment | Varieties | Days Taken to 50% Flowering | | | Days taken to flower opening to fruit picking | | | Days Taken to First Picking | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2022 | 2023 | Pooled | 2022 | 2023 | Pooled | 2022 | 2023 | Pooled |
| $T_1$ | Parbhani Kranti | 44.39 | 43.07 | 43.73 | 7.66 | 7.36 | 7.51 | 51.47 | 49.55 | 50.51 |
| $T_2$ | Parbhani Bhindi | 46.66 | 45.34 | 46.00 | 8.66 | 8.36 | 8.51 | 52.58 | 50.66 | 51.62 |
| $T_3$ | Arka Anamika | 43.99 | 42.67 | 43.33 | 6.66 | 6.36 | 6.51 | 50.22 | 48.30 | 49.26 |
| $T_4$ | Shahiba | 44.79 | 43.47 | 44.13 | 7.04 | 6.74 | 6.89 | 50.87 | 48.95 | 49.91 |
| $T_5$ | Shan | 47.94 | 46.62 | 47.28 | 9.66 | 9.36 | 9.51 | 54.98 | 53.06 | 54.02 |
| $T_6$ | No. 55 | 46.36 | 45.04 | 45.70 | 9.31 | 9.01 | 9.17 | 53.26 | 51.34 | 52.30 |
| $T_7$ | Harita | 44.97 | 43.65 | 44.31 | 7.93 | 7.63 | 7.78 | 51.45 | 49.53 | 50.49 |
| $T_8$ | Jhilmil | 45.42 | 44.10 | 44.76 | 7.33 | 7.03 | 7.19 | 51.52 | 49.60 | 50.56 |
| $T_9$ | No. 64 | 45.83 | 44.51 | 45.17 | 6.87 | 6.57 | 6.72 | 52.08 | 50.16 | 51.12 |
| $T_{10}$ | Sonal | 43.99 | 42.67 | 43.34 | 6.64 | 6.34 | 6.49 | 51.37 | 49.45 | 50.41 |
| $T_{11}$ | Shakti | 44.15 | 42.49 | 43.15 | 5.92 | 5.62 | 5.77 | 49.49 | 47.57 | 48.53 |
| $T_{12}$ | Punjab Selection | 42.93 | 41.61 | 42.27 | 5.66 | 5.36 | 5.51 | 48.72 | 46.80 | 47.76 |
| | **SEm±** | **0.80** | **0.83** | **0.67** | **0.61** | **0.33** | **0.62** | **1.09** | **1.67** | **0.62** |
| | **C.D.($p_{=}$0.05)** | **2.35** | **2.44** | **1.95** | **1.80** | **0.98** | **1.83** | **3.20** | **4.89** | **0.89** |

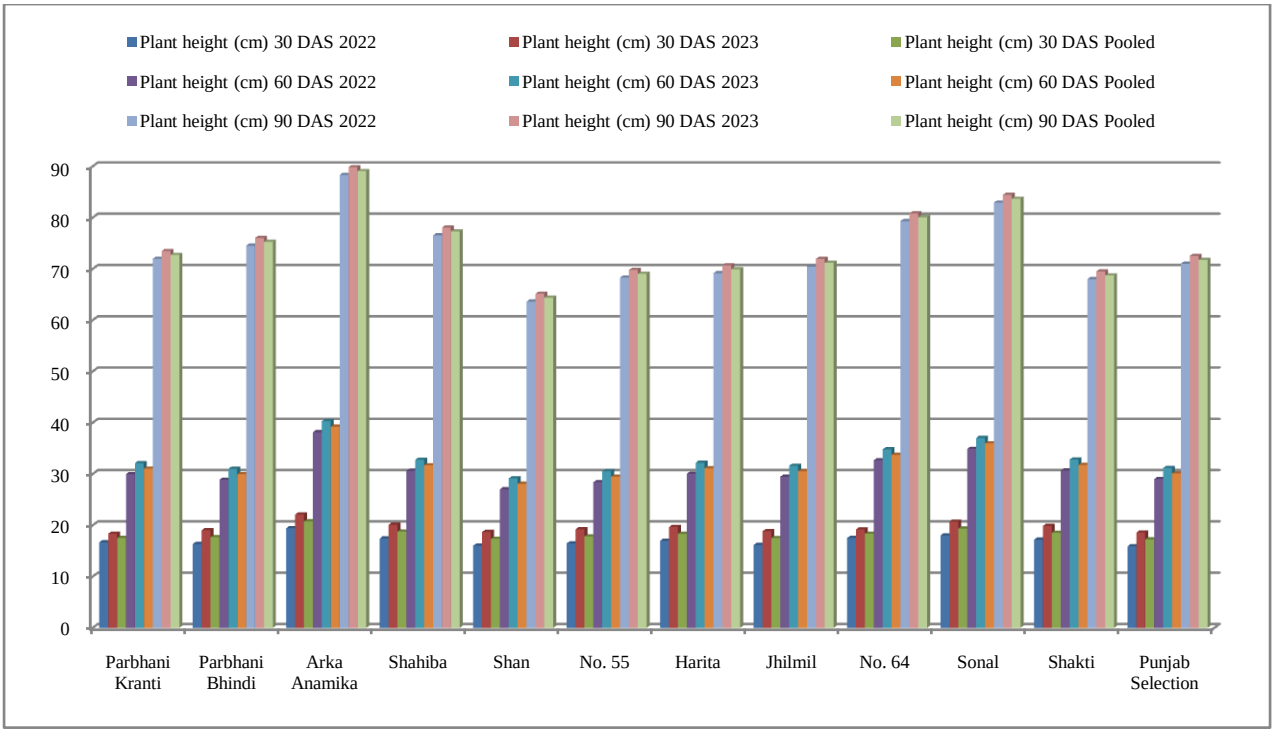


**Fig 1 Performance of different varieties of okra with respect toplant height**

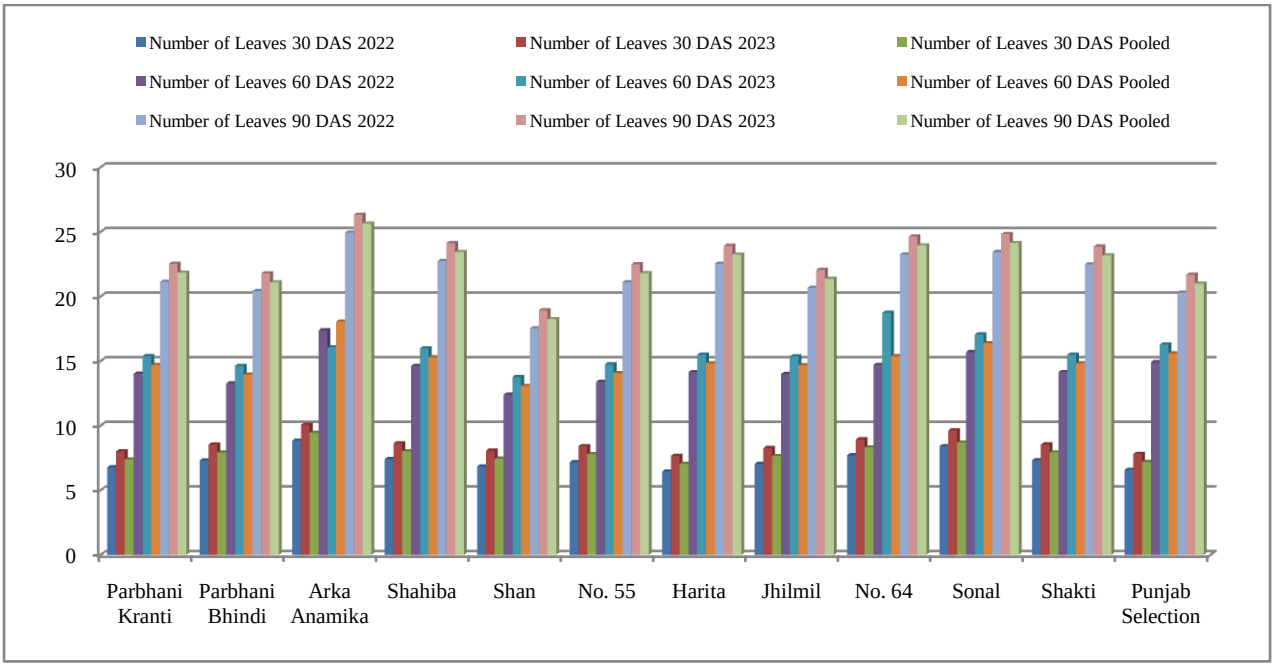


**Fig 2 Performance of different varieties of okra with respect tonumber of leaves per plant**

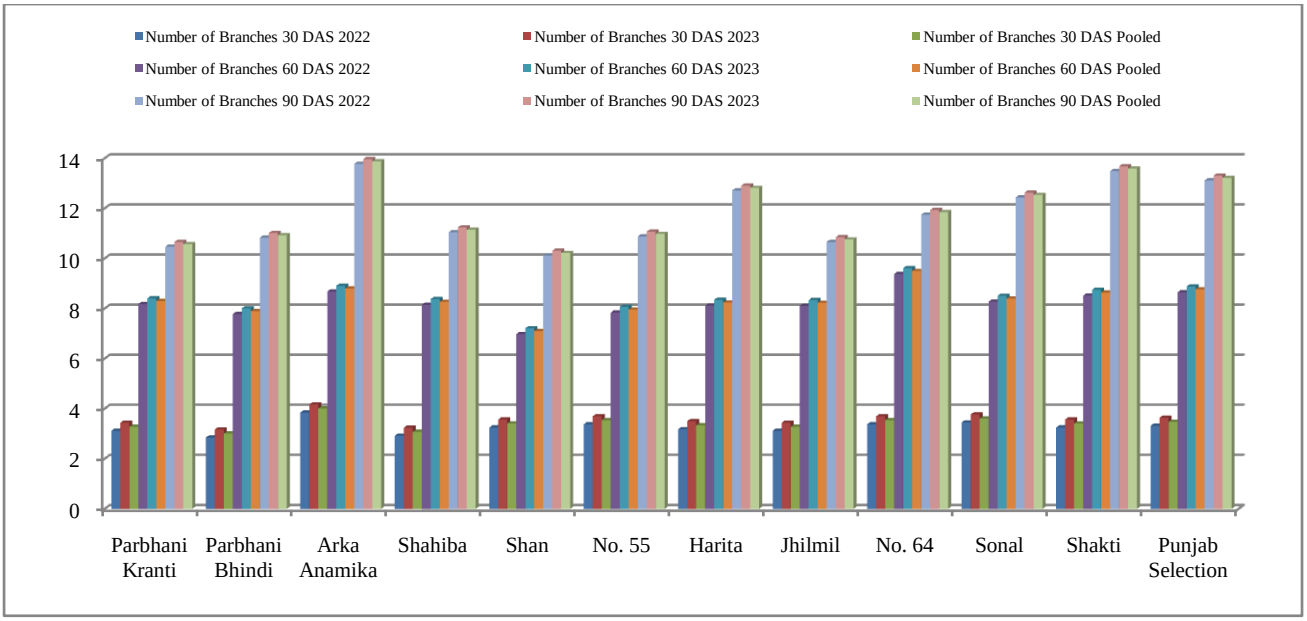


**Fig 3 Performance of different varieties of okra with respect tonumber of branches per plant**

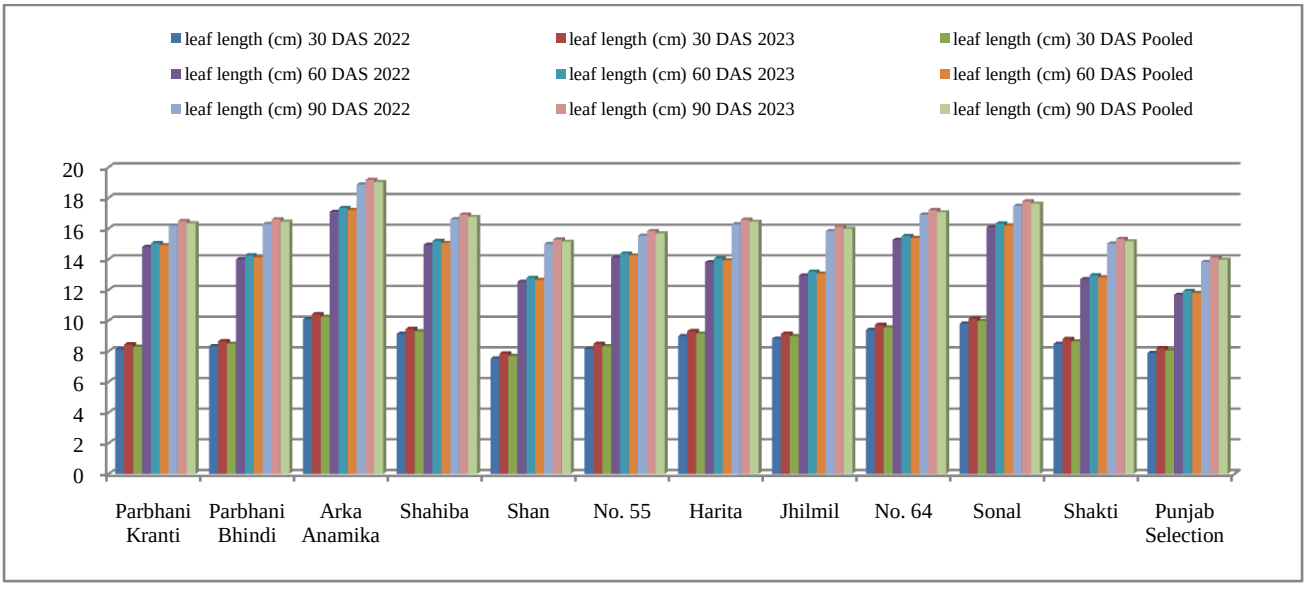


**Fig.4 Performance of different varieties of okra with respect toleaf length (cm) per plant**

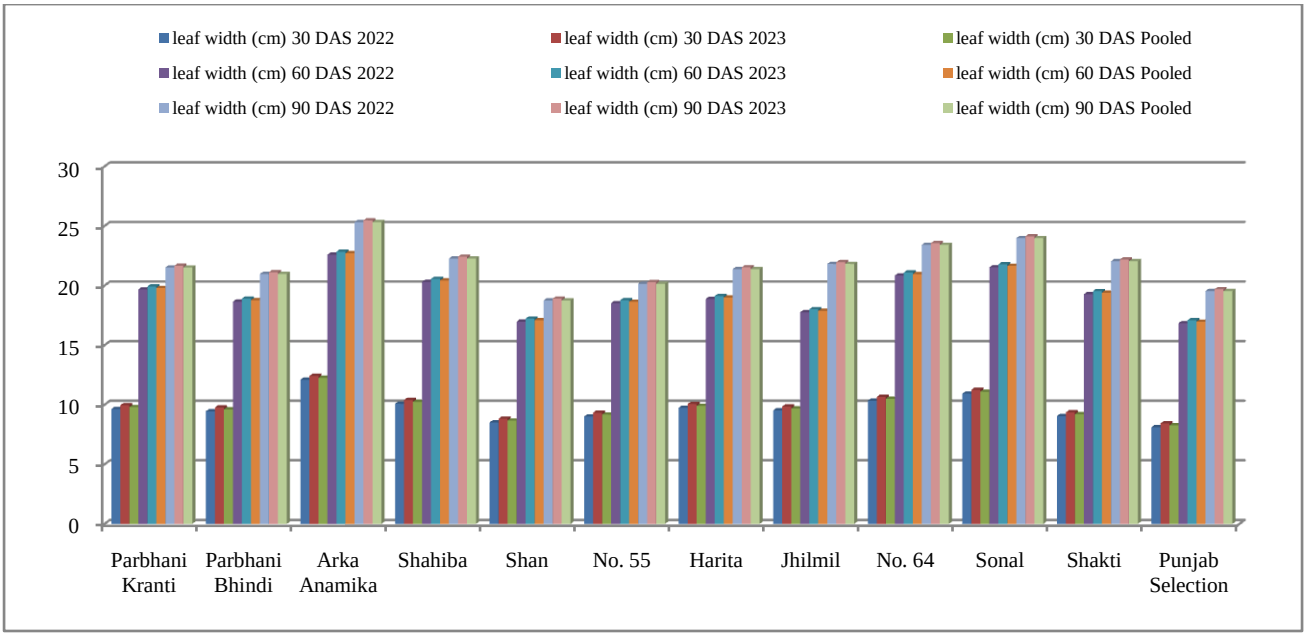


**Fig 5 Performance of different varieties of okra with respect toleaf width (cm) per plant**

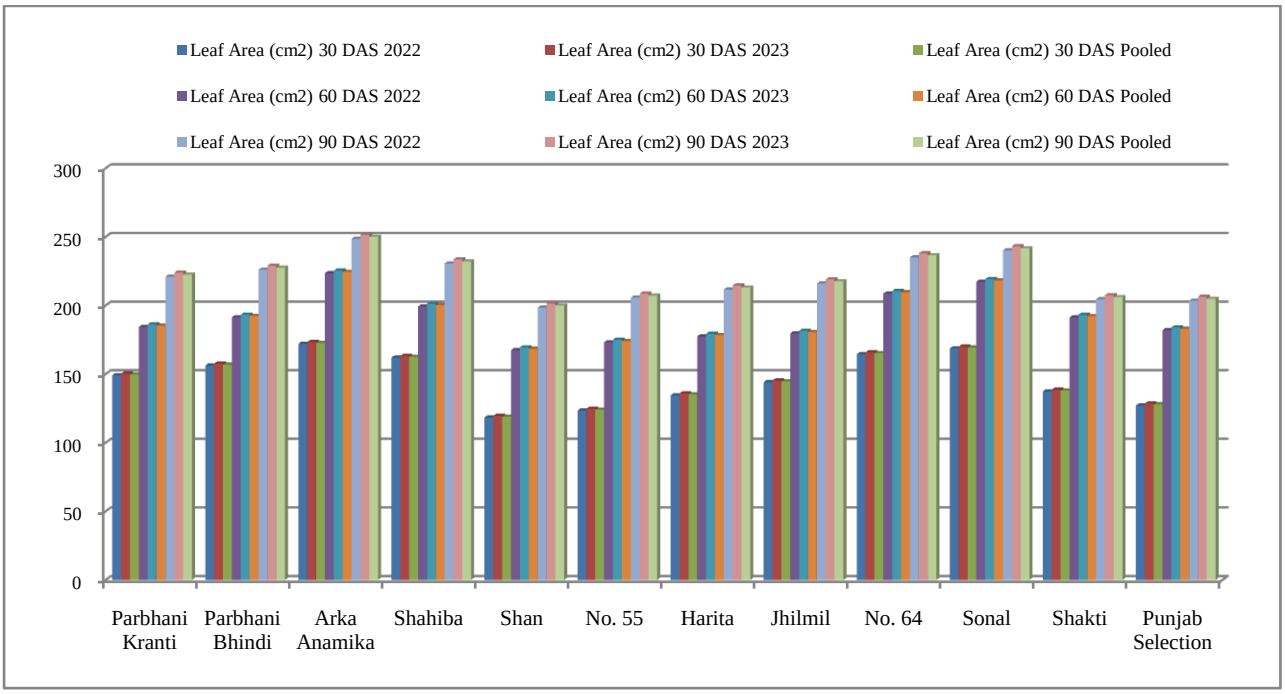


**Fig 6 Performance of different varieties of okra with respect toLeaf Area ($cm^2$) per plant**