International Journal of Horticulture and Food Science

E-ISSN: 2663-1067
P-ISSN: 2663-1075
NAAS Rating (2025): 4.74
www.hortijournal.com
IJHFS 2025; 7(7): 96-100
Received: 13-05-2025
Accepted: 16-06-2025

Pruthvishree C
University of Agricultural Sciences, GKVK, Bangalore, Karnataka, India

Paramesh R
University of Agricultural Sciences, GKVK, Bangalore, Karnataka, India

Siddarudh Singadi
Assistant Professor, Department of Seed Science and Technology, College of Forestry, Ponnampet, Karnataka, India

Arvind Kumar PR
Assistant Professor, Department of Seed Science and Technology, CoH, UHS, Bagalkote, Karnataka, India

Harish MS
Assistant Professor, Department of Seed Science and Technology, CCS HAU, CoA, Bawal, Haryana, India

Corresponding Author:
Pruthvishree C
University of Agricultural Sciences, GKVK, Bangalore, Karnataka, India

Study of planting geometry and Plant nutrition on seed quality parameters of okra cv. Arka Anamika

Pruthvishree C, Paramesh R, Siddarudh Singadi, Arvind Kumar PR and Harish MS

DOI: https://www.doi.org/10.33545/26631067.2025.v7.i7b.341

Abstract
The field and laboratory experiments were conducted to study the effect of planting geometry and nutrition on quality of okra at NSP, UAS, Bangalore. The experiment was laid out in FRCBD design with 12 treatment combinations replicated thrice which includes three different planting geometry S_0 (60 × 45 cm), S_1 (60 × 30 cm) and S_2 (60 × 60 cm), four levels of nutrients N_0 (100% RDF), N_1 (125 % RDF), N_2 (150% RDF) and N_3 (200% RDF) (RDF: 156.25: 93.75: 78.75 kg NPK ha^{-1}). Results revealed that S_2 and N_1 are highest seed quality parameters documented under S_2N_1 such as germination (89.50%), mean seedling length (35.65 cm), mean seedling dry weight (57.22 mg), seedling vigour index-I (3190) and II (5121) and 100-seed weight (8.60 g).

Keywords: Planting geometry, plant nutrition, seed quality, okra

Introduction

Okra (*Abelmoschus esculentus* (L.) Moench) known in many English-speaking countries as ladies finger, bhindi, bamila, ochro or gumbo, is a flowering plant in the *Malvaceae* family and it is valued for its edible green pods. It is widely cultivated in tropics, sub-tropics and warm temperate regions around the world. Okra originated near the equator in Africa. It is an important pan-tropical vegetable, particularly in West Africa, India, Brazil and Southern USA (Gruben, 1989) [6]. In Karnataka this crop is extensively grown in the Indian states of Uttar Pradesh, Assam, Bihar, Odisha, Maharashtra, West Bengal, and Karnataka. India is second largest producer of okra after China. In India, okra is grown primarily during two seasons: the pre-kharif (March to June) and kharif (July to October) seasons. The crop is cultivated across 511 thousand hectares, yielding an annual production of 5,849 thousand tones, with an average productivity of 11.5 tones per hectare. In Karnataka, okra occupies an area of 9.66 thousand hectares with an annual production of 79.61 thousand tonnes and productivity of 8.24 t/ha^{-1}. (Horti. Statistics at glance, 2015).

Okra plays a significant role in human nutrition by providing carbohydrates, protein, fat, minerals and vitamins that are generally deficient in basic foods. Okra is a vegetable valued for many of its properties. The fruits are used in making soup, salad and for flavoring when dried and powdered. Sometime, the seeds are roasted and used as a substitute for coffee. Its ripe fruit and stems contain crude fiber, which is used in the paper industry. The tender fruits contain minerals especially calcium, magnesium, iron, phosphorus, protein, vitamin A and C including riboflavin as well as high mucilage (Ndaeyo *et al*., 2005) [11]. Its every 100 g green pod contains among others, protein 1.8g, carbohydrate 6.4g, fiber 1.2g, vitamin C 18 mg and Ca 90 mg (Rashid, 1999) [12]. Mature okra seeds are good source of protein and oil and it has been known to be very important in nutritional quality. Okra accounts for 60 percent of export of fresh vegetables excluding potato, onion and garlic (Sharma and Arora, 1993) [14].

Due to this high prominence, okra has been a beneficiary of worldwide research over many years resulting in many varieties currently been planted in different parts of the world. Seed is very important input on which the ultimate yield of the crop depends. To obtain maximum seed yield with superior quality, the proper growth of the plant and its fruits are desired. Most of the studies are concerned with the development of varieties adopted to specific other needs while seed quality has been neglected. Hence, there is need to give utmost attention to both monetary (fertilizers) and non-monetary (spacing and fruit position) inputs for improvement of seed yield and quality. Optimum plant population provides conditions for maximum light interception right from early period of crop growth and it ensures the plants to grow uniformly and properly through efficient utilization of moisture, nutrients and lack of it thus eases to produce maximum yield in okra. The yield and quality of commercial vegetables are directly related to plant population (Samlind and Sam Ruban, 2007) [13]. By changing planting geometry, it is possible to achieve better plant growth which in turn contributes to a higher yield. Further, it has been reported that optimum plant population is the key element for better yields of okra, as plant growth and yield are affected by intra and inter row spacing (Amjad *et al.,* 2002) [1].

Nutrient is one of the most important inputs contributing to production of crop because it increases productivity and improves seed yield and quality (Shiyab *et al*., 2014) [15]. Among the nutrient, nitrogen (N) exhibits a high positive response in okra. Nitrogen (N) is crucial for synthesizing chlorophyll, proteins, nucleic acids, hormones, and vitamins, while also supporting cell division and elongation. Phosphorus (P) plays a key role in photosynthesis and respiration, promoting root development, root nodule formation, and faster crop maturity. Potassium (K) plays a unique role in osmotic regulation, opening and closing of stomata and also improves the color, flavors and size of fruits. (Bhende *et al*., 2015) [3]. Present nutritional rates are insufficient to sustain higher yields and to replenish nutrient removal by the crop due to continuous cropping and use of high yielding varieties, there is depletion of nutrients from soil. Hence, to meet the crop demand in long run, there is a need to apply NPK nutrients based on soil fertility status. So, present investigation will helpful to standardize the nutrition level which influence on seed yield and quality in okra. (Naveen Kumar *et al*., 2017) [10]. Various factors influence the seed quality in okra among which position of fruit is of great significance. Ability of seeds to produce a greater number of normal and vigorous seedlings depends on fruit position which affects proper seed filling and maturation due to the competition for assimilates between fruits and within fruit distresses seed set and development (Bertin, 1998) [4]. Fruits produced at the base; middle and apex positions of the stem would have a variation in seed quality due to the varied flow of nutrients (source-sink relationship) and micro-environment experienced by the seed due to its position on the parent plant. (Kortse P. Alohoand Oketa Anita, 2016) [9].

Materials and Methods

The field and laboratory experiments were conducted to study the effect of planting geometry and nutrition on plant growth, seed yield and quality of okra at NSP, UAS, Bangalore. The experiment was laid out in FRCBD design with 12 treatment combinations replicated thrice which includes three different planting geometry S_0 (60 × 45 cm), S_1 (60 × 30 cm) and S_2 (60 × 60 cm), four levels of nutrients N_0 (100% RDF), N_1 (125 % RDF), N_2 (150% RDF) and N_3 (200% RDF) (RDF: 156.25: 93.75: 78.75 kg NPK ha^{-1}). After harvested seeds from plants seeds were analyzed the quality parameters.

Results and Discussion

Seed Germination (%)

The results pertaining seed germination as influenced by planting geometry, nutrition and interaction are presented in Table 1. There was significant difference among the plant geometry with respect to seed germination. Highest germination was observed in S_2 (84.25 %) followed by S_0 (82.25 %) and least was in S_1 (81.06 %). Seed Germination percent was markedly influenced by nutrient levels. Maximum germination was obtained in N_1 (88.00%), while minimum was in N_0 (74.50%). Seed germination percent showed significant differences due to interaction effects of planting geometry and nutrition. Highest germination was registered in S_2N_1 (89.50%) and lower was in S_1N_0 (71.50%). Highest seed germination obtained under wider spacing with 125 percent RDF might be due to the production of healthy and bold seeds with more reserve food material as synthesized photosynthates might have translocated to seeds under wider spacing with less competition for resources. These findings are agreement with Vikash Kumar *et al.* (2015) [17] and Ghadir Mohammadi *et al.* (2016) in okra.

Mean seedling length (cm)

The mean seedling length (cm) influenced by planting geometry, nutrition and interactions were presented in Table 1. Significant results were obtained for mean seedling length due to influence of planting geometry. Highest mean seedling length was measured in S_2 (30.97 cm). While, least was in S_1 (28.76 cm). Mean seedling length was significantly influenced by nutrition. Maximum mean seedling length was recorded in N_1 (34.56 cm) and minimum was in N_0 (26.14 cm). The results revealed significant differences on seedling length due to interaction effect of planting geometry and nutrition. Highest mean seedling length was measured in S_2N_1 (35.65 cm) followed by S_0N_1 (33.68 cm). Whereas, least was in S_1N_0 (24.78 cm). The better development of seed owing to greater accumulation of storage reserves, which inturn have utilized for seed germination and seedling growth resulted in maximum seedling length under wider spacing and 125 percent RDF. Similar result indicated by Vikash Kumar *et al.* (2015) [17] in okra.

Mean seedling dry weight (mg)

The data on mean seedling dry weight as influenced by planting geometry, nutrition and their interactions are presented in the Table 1. Mean seedling dry weight differed significantly among the plant spacings. S_2 (50.05 mg) recorded highest seedling dry weight, while lowest was in S_1 (47.44 mg). Among the different nutrient levels, the mean seedling dry weight differed significantly. The highest mean seedling dry weight (53.04 mg) was recorded in N_1, while, the lowest seedling dry weight was found in control (N_0) (45.60 mg). The interaction of planting geometry and nutrition for mean seedling dry weight was found to be significant. The maximum mean seedling dry weight was cataloged in S_2N_1 (57.22 mg), and the minimum was recorded in S_1N_0 (44.70 mg). Accumulation of more food reserves in the seed due to wider spacing and more NPK nutrient application might have increased the dry weight of the seedling reported by Vikash kumar *et al.* (2015) [17] in okra and Gangaraju *et al*., (2023) [5] in Maize.

Seedling vigour index-I (SVI-I)

The results on seedling vigour index-I as influenced by plant geometry, nutrition and interaction are presented in Table 1.

The influence of planting geometry on seedling vigour index-I was differed significantly. Highest seedling vigour index-I was documented in S_2 (2628). However, least was in S_1 (2349). Seedling vigour index-I showed significant differences due to influence of different nutrient levels. Maximum seedling vigour index-I was measured in N_1 (3042) and minimum was in N_0 (1948). Significant differences were observed for seedling vigour index-I due to interaction effect of planting geometry and nutrition. S_2N_1 (3190) reported highest seedling vigour index-I and least was recorded in S_1N_0 (1772). Higher seedling vigour Index-I obtained due to higher seed germination percent and seedling length stated by Vikash Kumar *et al.* (2015) [17] in okra, Hai Chun Jing *et al*. (2000) [7] in cucumber and Gangaraju *et al*., (2023) [5] in Maize.

Seedling vigour index-II (SVI-II)

The results pertaining to seedling vigour index-II as influenced by planting geometry, nutrition and interaction are depicted in Table1. The influence of plant geometry on seedling vigour index-II was differed significantly. seedling vigour index-II was more in S_2 (4233). Whereas less was in S_1 (3857). Seedling vigour index-II showed statistically significant differences due to influence of nutrient levels. Maximum seedling vigour index-II was recorded in N_1 (4670) while, minimum was in N_0 (3399). Significant differences were observed for on seedling vigour index-II due to interaction effect of planting geometry and nutrition. S_2N_1 (5121) recorded highest seedling vigour index-II and least was in S_1N_0 (3196). Higher Seedling vigour index-I obtained due to higher seed germination % and more seedling dry weight. Similar results obtained by Bhende *et al*. (2015) [3], and Vikash Kumar *et al.* (2015) [17] in okra.

Hundred seed weight (g)

Hundred seed weight varied significantly due to planting geometry, nutrition and interaction is depicted in Table 2. The observations showed that planting geometry had statistically significant effect on seed weight. More hundred seed weight was obtained in S_2 (7.47 g) followed by S_0 (7.22 g). Whereas, less was found in S_1 (6.98 g). Nutrient levels influenced significantly on hundred seed weight. The maximum hundred seed weight was reported in N_1 (8.51 g) followed by N_2 (7.29 g) and minimum was in N_0 (6.37 g). The interaction effect of planting geometry and nutrition found to be significant for 100-seed weight. Highest hundred seed weight was noted in S_2N_1 (8.60 g) followed by S_0N_1 (8.47 g). While, least was in S_1N_0 (6.34 g). Increased in hundred seed weight might be due to more mobilization of the metabolites, resulted in improved seed filling under wider spacing with 125 % of RDF. Similar results noticed by Bhende *et al.* (2015) [3] in okra.

Seed moisture content (%)

Moisture content of resultant seeds as influenced by planting geometry, nutrition and interaction are presented in Table 2. There was no significant difference among treatments for seed moisture content. This might be due to seed moisture content depends upon the physiological maturity of the seed (time of harvesting) and weather conditions at the time of harvesting. Therefore, the plant spacing and nutrition did not have any significant effect on moisture contents of the seeds. The results are in same line with studies made by Amjad *et al*. (2002) [1] in okra and Siddarudh *et al*., (2013) [16] in maize.

Electrical conductivity of seed leachates (μScm^{-1})

The data pertaining to electrical conductivity of seed leachate as influenced by planting geometry, nutrition and interaction are furnished in Table 2. Stastically non-significant difference found for the electrical conductivity of seed leachate among the treatments. This might be due to neither spacing nor nutrition affect the EC of seed leachates as electrical conductivity depend on membrane integrity of seeds. These findings are in agreement with the results of Bhende *et al*. (2015) [3], Vikash Kumar *et al.* (2015) [17] in okra, Siddarudh *et al*., (2013) [16] in maize and Ashok Sajjan *et al*. (2004) [2] in okra.

Total dehydrogenase activity (OD value at A_{480nm})

The observation regarding to total dehydrogenase activity as influenced by planting geometry, nutrition and their interaction are furnished in Table 2. There was no significant difference for TDH activity of seeds among treatments. This might be due to neither spacing nor nutrition affect the viability of seeds as it was influenced by duration of maturity and environmental condition prevailed during crop growth and supremacy of genetic constitution of seed embryo. The present results are in line with studies conducted by Vikash Kumar *et al.* (2015) [17] in okra.

Table 1: Influence of planting geometry and nutrition on seed germination per cent, mean seedling length, mean seedling dry weight, SVI-I and II of okra cv. Arka Anamika

Treatments	Seed germination (%)	Mean seedling length (cm)	Mean seedling dry weight (mg)	Seedling vigour index I (SVI-I)	Seedling vigour index II (SVI-II)
Spacing (S)					
S_0: 60 × 45 cm	82.25	29.82	48.07	2459	3964
S_1: 60 × 30 cm	81.06	28.76	47.44	2349	3857
S_2: 60 × 60 cm	84.25	30.97	50.05	2628	4233
S.Em±	0.45	0.27	0.29	23.23	35.74
C.D (P= 0.05)	1.28	0.78	0.84	66.63	102.52
Nutrition Levels (N)					
N_0: 100% RDF	74.50	26.14	45.60	1948	3399
N_1: 125 % RDF	88.00	34.56	53.04	3042	4670
N_2: 150% RDF	86.00	30.32	48.50	2607	4171
N_3: 200% RDF	81.58	28.38	46.95	2316	3831
S.Em±	0.52	0.31	0.34	26.83	41.27
C.D (P= 0.05)	1.48	0.90	0.97	76.94	118.37

Interaction (S × N)					
S_0N_0	75.50	28.83	45.48	2176	3434
S_0N_1	87.25	33.68	51.62	2938	4504
S_0N_2	86.00	28.50	48.21	2452	4147
S_0N_3	80.25	28.28	46.96	2269	3769
S_1N_0	71.50	24.78	44.70	1772	3196
S_1N_1	87.25	34.35	50.27	2998	4385
S_1N_2	85.75	28.25	48.09	2421	4123
S_1N_3	79.75	27.65	46.69	2205	3723
S_2N_0	76.50	24.83	46.60	1896	3567
S_2N_1	89.50	35.65	57.22	3190	5121
S_2N_2	86.25	34.20	49.19	2949	4244
S_2N_3	84.75	29.20	47.19	2475	4000
S.Em±	1.03	0.63	0.68	53.65	82.54
C.D (P= 0.05)	2.96	1.79	1.94	153.88	236.75
C.V (%)	2.24	3.68	2.45	3.71	3.63

(RDF: Recommended Dose of Fertilizer- 125: 75: 63 kg of N: P_2O_5: K_2O ha^{-1})

Table 2: Influence of planting geometry and nutrition on hundred seed weight, seed moisture percent, total dehydrogenase activity and electrical conductivity of seed leachate of okra cv. Arka Anamika

Treatments	Hundred Seed Weight (g)	Seed moisture (%)	Total dehydrogenase activity (A_{480} nm)	Electrical conductivity (µScm^{-1})
Spacing (S)				
S_0: 60 × 45 cm	7.22	7.99	2.17	737
S_1: 60 × 30 cm	6.98	8.15	2.14	718
S_2: 60 × 60 cm	7.47	7.92	2.17	726
S.Em±	0.13	0.09	0.01	7.30
C.D (P= 0.05)	0.37	NS	NS	NS
Nutrition Levels (N)				
N_0: 100% RDF	6.37	8.07	2.15	730
N_1: 125 % RDF	8.51	7.92	2.18	732
N_2: 150% RDF	7.29	7.91	2.17	735
N_3: 200% RDF	6.74	8.17	2.13	711
S.Em±	0.15	0.10	0.02	8.43
C.D (P= 0.05)	0.42	NS	NS	NS
Interaction (S × N)				
S_0N_0	6.36	8.32	2.17	726
S_0N_1	8.47	7.82	2.18	748
S_0N_2	6.94	7.75	2.21	758
S_0N_3	7.13	8.06	2.14	715
S_1N_0	6.34	8.31	2.14	740
S_1N_1	8.45	8.01	2.17	731
S_1N_2	6.72	8.12	2.11	697
S_1N_3	6.42	8.17	2.13	704
S_2N_0	6.41	7.59	2.15	723
S_2N_1	8.60	7.94	2.18	718
S_2N_2	8.20	7.87	2.20	751
S_2N_3	6.67	8.27	2.14	713
S.Em±	0.30	0.20	0.03	16.86
C.D (P= 0.05)	0.85	NS	NS	NS
C.V (%)	7.10	4.45	2.59	4.02

(RDF: Recommended Dose of Fertilizer- 125: 75: 63 kg of N: P_2O_5: K_2O ha^{-1})

References

1. Amjad M, Sultan M, Anjum MA, Ayyub CM. Response of okra (*Abelmoschus esculentus* L. Moench.) to various doses of N and P and different plant spacings. Pak J Res Sci. 2002;13(1):19-29.
2. Ashok Sajjan S, Shekhargouda M, Badanur VP. Influence of date of sowing, spacing, and levels of nitrogen on yield attributes and seed yield of okra. Karnataka J Agril Sci. 2004;15(2):267-274.
3. Bhende SK, Deshmukh HK, Nimbolkar PK, Dewangan RK, Nagone AH. Effect of phosphorous and potassium on quality attributes of okra cv Arka Anamika. Intl J Envl Sci. 2015;6(2):225-231.
4. Bertin N, Gary C, Tchamitchian M, Vaissiere BE. Influence of cultivar, fruit position and seed content on tomato fruit weight during a crop cycle under low and high competition for assimilates. J Hortil Sci Biotech. 1998;73(4):541-548.
5. Gangaraju N, Paramesh R, Siddaraju R, Harish MS. Effect of nutrient levels and split application of nitrogen on growth and seed yield of Maize hybrid Hema at various stages of plant growth. Madras J Agric. 2023;102:131-134.
6. Gruben GHT. The cultivation of Amaranth as a leafy vegetable with special reference to South Dahomey.

Communication of Department of Agriculture. Res Royal Trop Inst Amsterdam. 1989;1:99.
7. Hai Chun Jing, Jan HW Bergervoet, Henk Jalink, Meindert Klooster, Sheng Li Du, Bino Raoul JB, *et al*. Cucumber (*Cucumis sativus* L.) seed performance as influenced by ovary and ovule position. Seed Sci Res. 2000;10(4):435-445.
8. Horticultural Statistics at Glance. Horticultural Statistics Division, Dept. of Agriculture, GOI; 2015.
9. Kortse P Aloho, Oketa Anita. Effects of planting date and fruit position on mother plant on the quality of okra (*Abelmoschus esculentus* L. Moench) seeds. J Bio Agri Healthcare. 2016;6(2):1-6.
10. Naveen Kumar B, Padmaja G, Rao PC. Effect of different levels of nitrogen and potassium on ascorbic acid, crude protein and crude fibre content of okra (*Abelmoschus esculentus* L.). Int J Pure App Biosci. 2017;5(4):882-886.
11. Ndaeyo NU, Edu SU, John NM. Performance of okra as affected by organic and inorganic fertilizers on ultisol. In: Proc 39th Annual Con Agril Soc Nigeria. 2005. p. 206-209.
12. Rashid MM. Sabji Biggan (Vegetables Science). 2nd ed. Dhaka: Rashid Publishing House; 1999.
13. Samlind G, Sam Ruban J. Effect of different levels of nitrogen and spacings on crude protein of Amaranthus cv. CO.3. Asian J Horti. 2007;2(1):222-223.
14. Sharma DR, Arora SK. Improvement of okra. In: Adv Horti Veg Crops. 1993. p. 343-364.
15. Shiyab S, Bassam al Q, Mohanad A, Mohammed S, Jamal A, Khaldon al S. Response of okra (*Abelmoschus esculentus* (L.) to different levels of hoaglands solution. Life Sci J. 2014;11(10):1080.
16. Siddarudh KS, Eshanna MR, Harish MS. Effect of provenance and micronutrients on plant growth, seed yield and quality of maize hybrid (GH-0727). Green Farming. 2013;6(3):513-516.
17. Vikash Kumar, Saikia J, Barik N. Influence of organic, inorganic and biofertilizers on growth, yield, quality and economics of okra [*Abelmoschus esculentus* (L.) Moench] under Assam condition. Int J Curr Microbiol App Sci. 2017;6(12):2565-2569.