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Short Communication

Effect of farming practices and varieties on growth, phenology and yield of okra (*Abelmoschus esculentus* (L.) Moench)

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Abstract

A field experiment was carried out with four farming practices and three varieties at Palampur (H.P) during *kharif* 2021, to assess the effect of different farming practices on growth, phenological stages and yield of okra. The results revealed that integrated nutrient management (INM) resulted in significantly higher plant height, number of nodes per plant, dry matter accumulation, harvest duration and fruit yield. The minimum number of days to complete emergence were recorded in natural farming practice whereas the minimum number of days to first picking were recorded in organic farming. Palam Komal came out to be best performing among the three varieties which remained statistically at par with P-8 in growth attributes, phenological stages and total fruit yield.

Key words: Okra, farming practices, yield, varieties

In India, okra is one of the major summer and rainy season vegetable. India ranks first in the world in okra production and it occupied an area of 513 thousand hectare with 6,466 thousand metric tonnes production during 2020-21 (Anonymous 2022). In Himachal Pradesh, it occupied 3.92 thousand ha area with 60.95 thousand metric tonnes production during 2020-21 (Anonymous 2022). It is necessary to compare and analyze different farming practices and varieties to increase the productivity in order to meet out the increasing demands vis a vis sustaining agroecological health. Increasing energy crises, rapid depletion of non-renewable sources and release of pollutants during fertilizers production has necessitated the development of alternate or supplemental technologies (Sharma *et al*. 2015). To overcome the problem of injudicious and imbalanced use of chemical fertilizers and to reduce the dependence on synthetic agrochemicals in agriculture various farming practices such as organic farming, natural farming and integrated nutrient management in crops are advocated.

To meet out the increasing demand due to ever growing population of our country and enhanced purchasing capacity of the consumers for quality vegetables, vegetable breeders are striving hard to come up with more and more high yielding varieties suiting to different agri-situations. Furthermore, different varieties certainly respond differentially to varying management practices. Higher production of this crop is possible by the cultivation of varieties which give higher returns compared to other cultivars grown at same climatic conditions and inputs applied (Meena *et al*. 2021). Keeping these points in view, the present investigation was carried out to study the comparative performance of new varieties under different farming practices.

The experiment was carried out during *kharif* 2021 (June to September) in Integrated Research Farm Holta of the Department of Organic Agriculture and Natural Farming, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur (H.P). The experimental farm was located at 32°4'N latitude, and 76°3'E

longitude at an elevation of 1290.8 m above mean sea level in the mid hill zone (Zone II) of Himachal Pradesh. The experimental site was characterized by humid sub- temperate climate with mild summers and cool winters. The soil of the experimental site was silty clay loam in texture and acidic in reaction. The soil was rated as medium in organic carbon, low in available nitrogen, medium in available phosphorus and available potassium. The field experiment was conducted in split plot design and consisted of three blocks of twelve plots each. Details of the experiment are as following:

A. Main Plot Treatments: Farming Practices (4)

Farming Practice	Treatment Detail
1. Organic Farming	Seed treatment with bio fertilizers (Azotobacter and PSB) at sowing + application of 10 t vermicompost (VC) ha^{-1} followed by 3 sprays of organic liquid manure (Vermiwash 10%) at 15 days interval (As per recommendations of organic farming in vegetable crops).
2. Natural Farming	Seed treatment with *Beejamrit* + application of *Ghanjeevamrit* @ 500 kg ha^{-1} followed by sprays of different bioformulations at 10 days interval i.e *Jeevamrit* (5%, 7.5% & 10%) at first, fourth, seventh sprays respectively. Drekastra at second spray, fermented buttermilk at third (2.5%) and sixth spray (3.5%), B*rahmastra* at fifth spray, *Agniastra* at eight spray and *Saptdhaanankur* at ninth and tenth spray. Sowing on ridges and application of mulch @10t/ha on dry weight basis (As per SPNF recommendations).
3. Inorganic farming	100% Recommended NPK fertilizer 75:50:55 kg $N:P_2O_5:K_2O$ ha^{-1}
4. INM	Vermicompost@ 5t/ha + 50% recommended NPK fertilizer 37.5:25:27.5 kg $N:P_2O_5:K_2O$ ha^{-1}

B. Sub plot treatments: Okra varieties (3) - Palam Komal, P-8 and Punjab Suhawani

Observations were recorded for growth characters viz. plant height (cm), number of nodes/plant, dry matter accumulation (g/m^2), phenological stages *viz*. days to compelete emergence, days to first picking, harvest duration and total fruit yield. The data obtained on various aspects in the present study were subjected to the statistical analysis using split plot design of experimentation as per procedures suggested by Gomez and Gomez (1984).

Tallest plants of okra (120.3 cm) were observed with integrated nutrient management (INM) practice followed by organic farming, which was found statistically at par with inorganic farming and the dwarfest plants of okra (100.8 cm) were observed in natural farming practice (Table 1). Better plant height of okra in integrated nutrient management may be

Table 1. Effect of different farming practices and varieties on plant height, number of nodes and dry matter accumulation in okra

Treatment	Plant height (cm)	Number of nodes/plant	Dry matter accumulation (g/m^2)
Farming Practices			
F_1 – Organic farming	113.3	12.7	457.4
F_2 – Natural farming	100.8	10.6	406.9
F_3 – Inorganic farming	112.0	12.1	436.3
F_4 – INM	120.3	14.2	482.9
SEm±	1.9	0.4	7.5
CD (P=0.05)	6.7	1.4	25.9
Varieties			
V_1 – Palam Komal	114.5	12.9	454.8
V_2 – P-8	113.2	12.6	447.9
V_3 – Punjab Suhawani	107.1	11.6	427.4
SEm±	1.7	0.3	4.8
CD (P = 0.05)	5.1	0.9	14.4

*INM = Integrated nutrient management

attributed to steady and controlled release of nutrients from organic sources of nutrients and early availability of nutrients especially N from inorganic fertilizers which altogether might have created favourable conditions for proper growth and development. These findings are in line with the results obtained by Das *et al*. (2014) in okra. Among the varieties, tallest plants of okra (114.5 cm) were recorded in Palam Komal variety which remained statistically at par with P-8 variety and significantly taller than Punjab Suhawani variety (Table 1).The significant difference in plant height among varieties might be attributed to genetic constitution and inheritance of the character in different varieties. Similar results were recorded by Meena *et al*. (2021) in okra.

Significantly higher number of nodes per plant (14.2) was recorded under integrated nutrient management practice followed by organic farming practice which remained at par with inorganic farming practice. However, the least number of nodes (10.6) were observed under natural farming practice. The better availability and uptake of nutrients more specifically N, P, K might have resulted in better photosynthesis and protein synthesis leading to greater availability of photosynthates from source to sink which might have resulted in higher number of nodes per plant under Integrated Nutrient Management (INM) compared with other farming practices. These results are in consonance with Mal *et al*. (2013). Among the varieties, the highest number of nodes (12.9 cm) were recorded in Palam Komal which was at par with P-8 and the least number of nodes (11.6) were recorded in Punjab Suhawani variety (Table 1). The variation in number of nodes per plant among the varieties may be due to their genetic makeup governing varietal characters. Meena *et al*. (2021) also recorded maximum number of nodes in Palam Komal variety.

The dry matter accumulation per square metre increased significantly (454.8 g/m^2) in integrated nutrient management practice followed by organic farming which was found to be statistically at par with inorganic farming. The lowest dry matter accumulation per sqaure metre was registered under natural farming practice (Table 1). The larger photosynthetic area in terms of growth attributes *viz*., plant height and number of nodes per plant might have intercepted more solar radiation and have resulted in increased photosynthesis rate which was reflected in significant increase in dry matter accumulation of okra under integrated nutrient management. The results are in accordance with the findings of Anburani and Manivannan (2002) in brinjal. The highest dry matter accumulation (454.8 g/m^2) was recorded in Palam Komal which was statistically at par with P-8 variety. The lowest dry matter accumulation was recorded in Punjab Suhawani variety of okra (Table 1). The variation among the varieties may be due to the genetic makeup governing nutrient uptake behaviour, phtotosynthetic efficiency and environmental interactions.

Phenological stages *viz*., days to complete emergence, days to first picking and harvest duration in okra were significantly influenced by treatments (Table 2). Minimum number of days for complete emergence was recorded in natural farming practice followed by organic

Table 2. Effect of farming practices and varieties on phenological stages and fruit yield of okra

Treatment	Days to complete emergence	Days to first picking	Harvest duration	Fruit yield(t/ha)
Farming Practice				
F_1 – Organic farming	11.9	53.2	58.6	10.6
F_2 – Natural farming	11.7	53.7	56.7	8.7
F_3 – Inorganic farming	14.4	58.0	53.7	10.3
F_4 – INM	13.4	55.1	59.1	12.1
SEm±	0.2	0.7	0.5	2.1
CD (P=0.05)	0.7	2.4	1.8	7.2
Variety				
V_1 – Palam Komal	12.6	56.8	58.9	10.8
V_2 – P-8	12.8	55.5	57.8	10.6
V_3 – Punjab Suhawani	13.2	52.8	54.3	9.8
SEm±	0.3	0.5	0.9	1.8
CD (P = 0.05)	NS	1.6	2.6	5.5

*INM: Integrated Nutrient Management

farming practice which was statistically at par with former. It might be due to the seed treatment with beejamrit which might have resulted in improvement in seed germination due to the production of IAA and GA by beneficial microflora present in beejamrit. Similar results were reported by Sreenivasa *et al*.(2009) in soybean who reported that beejamrit contains not only general microflora, but also free living N_2 -fixers, P-solubilizers and bacteria producing plant growth promoting substances as well as bacteria having biological deterrent activities. There was no significant effect of varieties on number of days for complete emergence in okra.

The minimum number of days for first picking were recorded in organic farming practice which remained statistically at par with natural farming practice and maximum number of days for first picking were recorded under inorganic farming practice. Minimum number of days under organic farming might be due to the application of organic inputs like vermicompost, vermiwash and biofertilizers which might encouraged the differentiation of axillary buds resulting in early flowering and therefore early picking. Similar findings were reported by Dwivedi *et al*. (2018) in okra with the application of vermicompost @5t/ha + vermiwash (5 sprays). Among the varieties lesser number of days for first picking were recorded in Palam Komal variety which remained at par with P-8 variety. However, Punjab Suhawani variety took more number days for first picking. The variation among the varieties may be due to the genetic makeup and environmental interactions. Similar observations were recorded by Sharma (2011).

The maximum duration of fruit harvest (Harvest duration) was recorded under integrated nutrient management practice which remained statistically at par with organic farming. The lowest harvest duration was under inorganic farming. Higher harvest duration in integrated farming may be due to steady and balanced nutrient supply for longer duration of crop growth with the application of organic and inorganic nutrient sources. Among the varieties harvest duration was maximum in Palam Komal variety which remained at par with P-8 variety and the least harvest duration was observed in Punjab Suhawani variety. The variation among the varieties may be due to the genetic makeup governing nutrient uptake behaviour and phtotosynthetic efficiency. Sharma (2011) also reported similar results.

The fruit yield of okra was significantly influenced by various treatments. Highest fruit yield was recorded under INM while the lowest yield was recorded in natural farming practice (Table 2). The significant increase in yield in okra with the integration of organic and inorganic sources of nutrients was due to better yield contributing characters which might be due to vigorous vegetative growth and increased chlorophyll content, which together might have accelerated the photosynthetic rate and thereby increased the supply of carbohydrate to plants. These results are in the close conformity with the findings of Naik *et al*. (2012). Among varieties, Palam Komal was found to be the highest yielding variety and produced significantly higher fruit yield which remained statistically at par with P-8 while Punjab Suhawani variety produced the lowest fruit yield (Table 2). The observed variation in yield among the varieties might be due to genetic make up governing the yield contributing charatcters and source sink relationship. Similar results were reported by Chadha *et al*. (2014).The interaction between farming practices and varieties on yield was found to be non-significant.

On the basis of results emanated from present investigation it can be concluded that integrated nutrient management resulted in better growth attributes, maximum harvest duration and fruit yield as compared to other farming practices. Natural farming practice resulted in minimum number of days to complete emergence while organic farming practice resulted in early picking of fruits. Palam Komal variety came out to be best performing among the varieties.

Conflict of interest: There is no conflict of interest in this research paper.

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