Eco. Env. & Cons. 29 (April Suppl. Issue) : 2023; pp. (S104-S108)
Copyright@ EM International
ISSN 0971–765X

DOI No.: http://doi.org/10.53550/EEC.2023.v29i02s.020

Influence of crop geometry and spacing of Long pepper (*Piper longum*) under the agro-ecological condition of Upper Brahmaputra Valley Zone of Assam, India

Bijit Kr. Saud[1] and Pranjal Kr. Kaman[2]

[1]Citrus Research Station, Department of Horticulture, Assam Agricultural University, Jorhat, India
[2]AICRP on Medicinal and Aromatic and Betelvine, Department of Plant Pathology, Assam Agricultural University, Jorhat, India

(Received 23 August, 2022; Accepted 3 November, 2022)

ABSTRACT

An experiment was conducted in the Experimental Farm Garden, at Assam Agricultural University, Jorhat to see the influence of crop geometry and spacing of Long pepper (*Piper longum*). Result showed that the plants grown with support crop geometry of 60 x 40 cm yielded maximum (516.59 kg/ha Dry), which was significantly higher than the crop grown without support. The other yield attributing parameters also found superior in the above method growing with support and plant geometry. But the B.C ratio is better in the case of without support method in crop geometry 60x40cm (1.89) compared to with support, i.e. 1.84.

Key words : *Piper longum, Upper Brahmaputra valley, Crop geometry*

Introduction

Pippali is a under-shrub with erect and slender branches belonging to the family piperaceace. Pippali commonly known as Indian long pipper, pipli or pippali, a flowering plant which grow throughout the year (Dorman and Deans, 2000 and Hamss *et al.*, 2003). Leaves are simple, alternate, stipulate and petiolate or nearly sessile. Flowering is nearly through out the year; inflorescence is spike; fruit greyish green or darker grey berries. It is believed to be originated from North east India especially in hotter parts of India ranging from central Himalayas to Assam (Oommen *et al.*, 2000). Pippali is normally cultivated for its medicinal property which are being largely exploited in the ayurvedic industry for different diseases in humans. Diseases like respiratory tract, cough, bronchitis, asthma, etc.; as counterirritant, analgesic can be cured from the Pippali plant. The main ingredient or constituent of the Pippali is the Piperine found in the catkin which is termed as fruit. In pharmacological studies the piperine is used as antibacterial (Reddy *et al*., 2001), antiallergic activity (Chatterjee, 1999; Dahanukar *et al.*, 1984), antitumour activity (Bai and Xu, 2000), Intestinal disorders (Ghoshal *et al.*, 1996), Hepatitis (Koul and Kapil, 1993) and respiratory disorder (Dahanukar *et al.*, 1984; Anshuman *et al.*, 1984).

Considering the importance of the crop in North East India and its application in the medicinal indus-

([1]Principal Scientist, [2]Junior Scientist)

try the above experiment was conducted with the following objective:

a) Standardization of planting methods and spacing of Long pepper (*Piper longum*)
b) To determine its effect on various plant growth parameter

Materials and Methods

Geographical location of the experimental site

The experiment was carried out at the Experimental Farm Garden, Deptt. of Horticulture at Assam Agricultural University, Jorhat. The experimental site is situated at an elevation of 172m above mean sea level, latitude of 26.7886° N and longitude of 94.2140° E. The mean maximum temperature during the period of experiment ranged from 21.55 °C to 26.48 °C while, the mean minimum temperature ranged between 17.7°C to 18.52°C. Similarly, the relative humidity, rainfall and sun shine hours ranged from 86.92-90.33 per cent, 2134.67-2324.65 mm and 6.8-9.5 hr, respectively.

Source of Planting Material

Elite planting materials of Pippali (JPL-19) from Bokakhat district of Assam was collected from the crop cafetaria maintained at AICRP on MAP and Betelvine.

Lay out field and field preparation

The experiment was lay out in randomized block design with a plot size of 3 cm x 2 cm For field preparation 2-3 times ploughing was done. After ploughing farm yard manure was applied at each plot as basal dose

Treatment combination

The experiment was carried out at experimental farm, Department of horticulture, AAU, Jorhat, Assam with seven treatments:

S_1 : 40 x 40 cm
S_2 : 60 x 40 cm
S_3 : 60 x 60 cm
S_4 : 90 x 60 cm
P_1 : With support
P_2 : Without support
Observation recorded

Morphological features

Morphological features like leaf size (cm), leaf length and breadth (cm) and stem diameter of base (cm) after 280 days of planting was recorded for both with support and without support.

Yield attributing parameters

Yield attributing characters like catkin length and breadth (cm), catkin colour and number of catkin per plant was recorded after 280 days of planting for both with support and without support.

Yield and yield attributing parameters

Yield and yield attributing parameters or characters like fresh yield per plant (g), fresh yield per plot (g), fresh yield/ha (g) and dry yield/ha (g) was recorded at the time of harvesting.

Experimental Findings

Morphological features

Data presented in Table 1 revealed that all the morphological features like leaf size (130.32 cm), leaf length (10.64 cm), leaf breadth (9.55 cm) and stem diameter of base (1.45 cm) was found to be highest when Pipali was planted at spacing of 90 x 60cm without support. This was followed by the spacing of 60 x 60 cm where leaf size (128.65 cm), leaf length (10.51 cm), leaf breadth (10.34 cm) and stem diameter of base (1.40 cm) was recorded (Table 1).

Similarly yield attributing parameters like catkin

Table 1. Morphological features of Pipali as influenced by crop geometry and method of planting

Treatment	P1 (With Support)				P2 (Without Support)			
	Leaf Size (cm)	Leaf Length (cm)	Leaf breadth (cm)	Stem dia at base (cm)	Leaf Size (cm)	Leaf Length (cm)	Leaf breadth (cm)	Stem dia at base (cm)
S1 (40 × 40 cm) (Plant population - 60000)	110.32	6.58	7.15	1.06	120.32	9.58	9.15	1.09
S2 (60 × 40 cm) (Plant population – 41000)	115.54	7.35	9.11	1.08	127.54	10.35	10.11	1.38
S3 (60 × 60 cm) (Plant population - 27000)	120.65	8.51	9.34	1.10	128.65	10.51	10.34	1.40
S4 (90 × 60 cm) (Plant population -18000)	126.32	9.64	9.55	1.25	130.32	10.64	10.55	1.45
CD at 5%	0.58	0.67	1.32	0.23	1.54	NS	0.56	NS

length (3.23 cm), catkin breadth (1.18 cm), catkin colour black and number of catkin per plant 63.21 cm was found to be highest when Pipali was planted at spacing of 90 x 60 cm with support.This was followed by a spcing of 60 x 60 cm catkin length (3.20 cm), catkin breadth (1.17 cm), catkin colour black and number of catkin per plant 60.21 cm was recorded respectively (Table 2).

Yield and yield attributing parameters like yield per plant (34.67g), fresh yield per plot (568.98g), fresh yield/ha (3100.54g) and dry yield/ha (520.30g) was recorded highest with a spacing of 60 x 40 cm with support. This was followed by spacing of 90 x 60 cm with support. (Table 3).

Piper longum plants in this study behaved differently in the growth and fruiting attributes based on the plant densities. Plant population has been considered a major factor that determines the degree of competition between plants based on the observations on maize (Abuzar *et al*., 2011). So the observed variations in the growth and yield characteristics of *Piperlongum* could be attributed to the agronomic practice adopted which in this case are the plant population densities in the different plots. Nasto *et al*. (2009) also noted that modern vegetable production practices emphasize the need to use optimum plant population attained with appropriate spacing and plant arrangements. Adequate plant spacing could help farmers in maximizing yield (Ahmed, 1983; Stofella and Bryan, 1988; Adams *et al*., 2001). The observed large canopy diameter in low population density could be an indication of numerous branches and leaves. It is a pointer that the wider the spacing, the higher the canopy diameter. This could equally be translated to higher yield if plant population is adequate. Plants with larger canopy diameter may also be pertinent in the metabolic activities of the plant by providing numerous leaves for photosynthetic activity as also was suggested by Alabi *et al*. (2014). It was observed that higher plant densities had lower number of leaves, branches and less canopy diameter, which was similar to the reports of Johnson and William (1997) and Islam *et al*. (2011). This may be due to competition among plants. Plants under high population compete for space, assimilates and sunshine. At the fruiting stage, plants with lower population densities were still more vigorous than those of higher population densities which may be, due to availability of space, assimilates and other micro-environmental components like air movements. Higher number of leaves/plant is an indication of higher photosynthetic efficiency since the leaves are the major sites of photosynthesis in green plants. Therefore, it is expected that the high number of leaves/plant recorded will enhance high assimilate production which will promote growth, development and yield in that population. The tallest and most profusely branched plants and those with the highest number of leaves were recorded in 60 x 40 cm plant spacing. This may be attributed to wider spacing between plants. This was also reported by Nagdy *et al*. (1979) who ob-

Table 2. Yield attributing parameters of Pipali as influenced by crop geometry and method of planting

Treatment	P1 (With Support)					P2 (Without Support)				
	Catkin length (cm)	Catkin breadth (cm)	Catkin length/ Breadth ratio	Catkin colour at maturity	No of catkin/ plant	Catkin length (cm)	Catkin breadth (cm)	Catkin length/ Breadth ratio	Catkin colour at maturity	No of catkin/ plant
S1(40x40cm) (Plant population - 60000)	3.12	1.06	2.90	Black	46.35	3.05	1.02	2.87	Black	44.35
S2(60x40cm) (Plant population – 41000)	3.15	1.16	2.58	Black	55.05	3.10	1.12	2.65	Black	50.05
S3(60x60cm) (Plant population - 27000)	3.20	1.17	2.69	Black	54.91	3.17	1.14	2.54	Black	51.91
S4(90x60cm) (Plant population - 18000)	3.23	1.18	2.79	Black	**63.21**	3.20	1.17	2.34	Black	**60.21**
CD at 5%	0.58	0.67	1.32	NS	0.23	1.54	NS	0.56	NS	NS

Table 3. Yield and yield attributing parameters of Pipali as influenced by crop geometry and method of planting

Treatment	P1 (With Support)				P2 (Without Support)			
	Yield/ plant (g) (Fresh)	Yield/ plot (g) (Fresh)	Yield/ha (Fresh) Kg	Yield/ ha (Dry) Kg	Yield/ plant (g) (Fresh)	Yield/ plot (g) (Fresh)	Yield/ ha (Fresh) Kg	Yield/ ha (Dry) Kg
S1(40x40cm) (Plant population - 60000)	32.65	456.98	2350.6	394.29	30.98	435.89	2150.16	356.06
S2(60x40cm) (Plant population – 41000)	43.66	568.98	3100.54	520.30	40.66	505.87	2850.76	474.26
S3(60x60cm) (Plant population - 27000)	35.67	510.76	2950.87	485.75	36.89	487.98	2720.52	452.66
S4(90x60cm) (Plant population -18000)	34.67	523.87	2719.89	400.42	32.87	510.87	2200.78	367.14
CD at 5% (Dry yield)	CD (P) = 3.124 CD (S) = 4.418 CD (P XS) = 6.248							

served that varying plant spacing and rates of nitrogen application increased plant height, number of branches and leaves on pepper plants. Increase in plant height may enhance the emergence of more branches, leaves and consequently increase the canopy diameter; it equally, could contribute in exposing the plants to higher sun intensity. The dry yield per plant was highest at wider spacing with low plant population. This may suggest that there were less competition for nutrient and space among plants. Similar observation was made among Okra cultivars by Ekwu and Nwokwu (2012). Even though plants in low population densities, had higher values in most vegetative characters, which had been reported to have higher correlation with number of fruits and fruit yield (Ngozi, 2013), their cumulative yield were low based on lower plant population. The higher population densities due to competition for space and assimilate could not produce fruits as those with low population in both number and weight on single plant stand basis but on cumulative basis higher populations produced more number of fruits. This result contradicts the report on Okra, where widest plant spacing consistently gave least values in all vegetative parameters (Amjad *et al*., 2001). Number of fruits/plant and fruit weight per plant were more at the widest spacing. This also agrees with the reports of Ekwu and Nwokwu (2012). Russo (2003), Nasto *et al*. (2009) and Khasmakhi Sabet *et al*. (2009) had observed that the highest fruit yield of pepper was obtained when grown at the higher population densities.

Conclusion

From this experiment we can conclude that Pipali can be cultivated at a spacing of 60 x 40 cm with higher dry yield of 520.30 g for Assam conditions as compared to other treatments. However the cost benefit ratio was found to be better in the case of without support method in crop geometry 60x40cm (1.89) as compared to with support, i.e. 1.84.

Acknowledgement

The authors like to acknowledge All India Coordinated Research Project on Medicinal and Aromatic Plants and Betelvine, Borivari, Annand, Gujurat and Director of Research (Agri.), Assam Agricultural Universirty, Jorhat.

References

Abuzar, M. R., Sadozai, G. U.; Baloch, M. S., Baloch, A. A., Shah, I. H., Javaid, T. and Hussain, N. 2011. Effect of plant population densities on yield of maize. *The Journal of Animal & Plant Sciences*. 21(4) : 692-695.

Adams, H.V., Lauckner, F.B. and Sisnett, D.D. 2001. *Effects of high plant population densities on yields, plant and fruit characters of the hot pepper cultivar, West Indies Red* (No. 1883-2017-555).

Ahmed, M.K. 1983. Optimum plant spacing and nitrogen fertilization of sweet pepper in the Sudan Gezira. In *VIII African Symposium on Horticultural Crops.* 143 : 305-310.

Alabi, E.O., Ayodele, O.J. and Aluko, M. 2014. Growth and yield responses of bell pepper (*Capsicum annuum*,

Rodo 'Variety) to in-row plant spacing. *ARPN Journal of Agriculture and Biology Science.* 9(11): 389-397.

Amjad, H.K., Foysal, H.R. and Hossain, G. 2001. Effect of plant spacing on growth and yield of okra production. *Pakistan Journal of Agriculture Science.* 12(1) : 59-89.

Anshuman, P.S., Singh, K.P. and Aasra, K.G. 1984. Effect of Vardhamanpippali (*Piperlongum*) on patients with respiratory disorders. *Sachitra Ayurveda.* 37 (1): 47-49

Bai, Y.F. and Xu, H. 2000. Protective action of Piperine against experimental gastric ulcer, *Acta Pharmacol Sin.* 21(4): 357-359.

Chatterjee, S. 1999. Bronchodilatory and anti-allergic effect of Pulmo Flex-A proprietary herbal formulation. *Indian Journal of Physiology and Pharmacology.* 43: 486-490

Dahanukar, S. A., Karandikar, S.M. and Desai, M. 1984. Efficacy of *Piper longum* in childhood asthma. *Indian Drugs.* 21(9): 84-388.

Dorman, H.J. and Deans, S.G. 2000. Antimicrobial agents from plants: antibacterial activity of plant volatile oils. *Journal of Application and Microbiology.* 88 : 308-316.

Ekwu, L.G. and Nwokwu, G.N. 2012. Effect of plant spacing and planting date on the growth and yield of Okra (*Abelmoschus esculentus* L.) in Abakaliki. *International Journal of Agriculture and Rural Development.* 15 (2) : 1041-1048

Ghoshal, S.; Prasad, B.N. and Lakshmi, V. 1996. Antiamoebic activity of *Piperlongum*fruits against *Entamoebahistolytica* in *in vitro* and *in vivo*. *Journal of Ethnopharmacology.* 50(3): 167-170.

Hamss , R.; Idaomar, M., Alonso-Moraga, A. and Muñoz Serrano, A. 2003. Antimutagenic properties of bell and black pepper. *Food Chemical Toxicology.* 41: 41-47.

Islam, M., Satyaranjan, S.A.H.A., Akand, H. and Rahim, A. 2011. Effect of spacing on the growth and yield of sweet pepper (*Capsicum annuum* L.). *Journal of Central European Agriculture*.

Johnson, G.A. and William, C.M. 1997. *Multiple Cropping in the Humid Tropics of Asia.* IDRC Publication, Canada. 176-248.

Khasmakhi-Sabet, A., Sedaghathoor, S., Mohammady, J. and Olfati, J.A. 2009. Effect of plant density on bell pepper yield and quality. *International Journal of Vegetable Science*. 15 (3): 264-271.

Koul, I. B. and Kapil, A. 1993. Evaluation of the liver protective potential of Piperine, an active principle of black pepper and long pepper, *Planta Medicine.* 59(5): 413-417.

Nagdy, G.A., Found, M.K. and Mahmound, W.S. 1979. Effect of Cycocel and Ethrel treatments on the anatomical structure of stems and leaves of pepper plant. *Research Bulletin.* 115 : 14.

Nasto, T., Balliu, A. and Zeka, N. 2009. The influence of planting density on growth characteristics and fruit yield of peppers (*Capsicum annuum* L.). *Acta Horticulturae*. 830 : 906-912.

Ngozi, E. 2013. Genotypic stability and correlation among quantitative characters in genotypes of aromatic pepper grown over years. *African Journal of Biotechnology.* 12(20) : 2792-2801.

Oommen, S., Ved, D.K. and Krishnan, R. 2000. *Tropical Indian Medicinal Plants: Propagation Methods*. FRLHT, Foundation for Revitalisation of Local Health Traditions.

Reddy, P., Kaiser, J., Madhusudhan, P., Anjali, G. and Das, B. 2001. Antibacterial activity of isolates from *Piper longum* and *Taxus baccata*, *Pharm acology Biology.* 39(3): 236-238.

Russo, V.M. 2003. Planting date and plant density affect the yield of pungent and non-pungent jalapeno peppers. *Journal of Horticultural Science.* 38: 520- 523

Stoffella, P.J. and Bryan, H.H. 1988. Plant population influences growth and yields of bell pepper. *Journal of American Society for Horticultural Science (USA).*