Journal of Tropical Agriculture 55 (2): 189-194, 2017

Short communication

Evaluation of *Piper longum* L. hybrids under different shade levels

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Received 09 September 2017; received in revised form 7 December 2017; accepted 26 December 2017

Abstract

Four promising hybrids along with female parent and Viswam variety were evaluated for growth and yield under open, twenty five percent and fifty percent shade levels. Among the hybrids, PI 9, PI 63 and PI 140 recorded higher plant height, number of laterals, number of spikes, fresh and dry spike yield per plant which were on par but significantly higher than the present popular variety "Viswam" released by the Kerala Agricultural University. The hybrid PI 63 was found to be the most promising hybrid followed by PI 9 under open condition. At 25 per cent shade, hybrid PI 140 produced higher fresh and dry spike yield per plant. However, at 50 per cent shade, Pl 9 produced maximum spike yield. Yield was higher at lower shade level (zero per cent) compared to higher (25 per cent and 50 per cent).

Keywords: *Piper longum*, Promising hybrids, Shade level, Yield.

Piper longum L., commonly known as long pepper, belongs to family Piperaceae. The species has originated in South Asia. *Piper longum* is an important medicinal plant used in more than 320 ayurvedic preparations. Inspite of the importance of the species, 'Viswam' is the only variety released so far. As a part of a KSCSTE funded project, hybrids of *Piper longum* were developed and in the preliminary evaluation trials, four hybrids were found promising. In the present study an attempt was made to evaluate these hybrids under different shade levels for growth and yield.

The experimental material included four promising hybrids of *Piper longum* viz., Pl 9, Pl 63, Pl 140, Pl 141, female parent and released variety 'Viswam'. This experiment was conducted at Vellanikkara during 2015-2017. Four promising hybrids along with female parent and Viswam were evaluated for growth and yield under three different shade levels such as zero per cent, twenty five per cent and fifty per cent. The experiment was laid out in CRD with 18 treatments and four replications. Rooted cuttings were transplanted into pots at three to four leaf stage in June. Observations were recorded on plant height, number of primary branches per plant, time taken for production of first lateral, number of laterals per plant, season of flowering and fruit set, number of spikes per plant, fresh and dry spike yield. Observations were recorded since from the time of planting and continued for a period of one year.

The four promising hybrids of long pepper were catalogued based on the descriptor developed for *Piper nigrum* by IPGRI (1995) with suitable modifications. Observations on morphological characters like leaf shape, leaf color, spike orientation, spike shape, immature spike color and color change while fruit ripening were considered for cataloguing.

All the accessions studied had leaves with elliptic-lanceolate shape on their plagiotropic shoots. Leaf lamina was mostly cordate on their orthotropic shoots and only Pl 141 was ovate-lanceolate. Leaf color was varying from light green to dark green.

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Table 1. Leaf and spike characters of *Piper longum* hybrids

Hybrid	Leaf shape		Leaf colour				Immature	Colour change
	Plagiotropic Shoot	Orthotropic Shoot	Plagiotropic Shoot	Orthotropic Shoot	Spike orientation	Spike shape	Spike colour	while fruit ripening
Pl 9	Elliptic-Lanceolate	Cordate	Light green	Light green	Erect	Cylindrical	Light yellow	Black
Pl 63	Elliptic-lanceolate	Cordate	Light green	Light green	Erect	Cylindrical-Conical	Light yellow	Black
Pl 140	Elliptic-lanceolate	Cordate	Dark green	Dark green	Erect	Cylindrical	Light yellow	Black
Pl 141	Elliptic-lanceolate	Ovate lanceolate	Light green	Light green	Erect	Cylindrical	Greenish yellow	Black
Female	Elliptic-lanceolate	Cordate	Green	Green	Erect	Cylindrical-Conical	Light yellow	Black
Viswam	Elliptic-lanceolate	Cordate	Dark green	Dark green	Erect	Cylindrical	Greenish yellow	Black

Spike orientation was erect in all the genotypes of *Piper longum* studied. Shape of spike varied from cylindrical to conical. All the genotypes except Pl 63 and female had developed cylindrical spikes. Spikes were cylindrical-conical shaped in Pl 63 and female. Variation was also seen in color of immature spikes among genotypes. It was varying from light yellow to greenish yellow. However there was no variation in spike color on ripening. It was black in all the genotypes of *Piper longum* studied (table 1). Earlier reports says that spikes of long pepper were cylindrical, oblong, berries red or black when ripe, globose with aromatic odour and pungent taste (Viswanathan, 1995; Banerjee et al., 1999).

Significant difference in vine length was observed among hybrids at different shade levels. Vegetative growth was found to be better in the genotypes at zero and 25 per cent shade compared to 50 per cent shade. Among genotypes, female parent showed maximum vine length. Results of the study indicated that maximum plant height was in female parent at 25 per cent shade level (table 2). Variability in the length of longest stem was studied by Manuel (1994), Jaleel (2006) and Joseph (2008) in *Piper longum*. Long pepper produced fruits on plagiotropic shoots or laterals. Therefore production of laterals can influence yield in *Piper longum*. Time taken for production of first lateral was varying among hybrids. It was also depended on the shade

Table 2. Plant height/vine length of *Piper longum* hybrids at different shade levels

Hybrids	Plant height/ Vine length (cm)			Mean
	0% shade	25% shade	50% shade	
Pl 9	94.75 (9.49)	178.75 (13.28)	138.00 (11.38)	137.17 (11.38)
Pl 63	153.50 (12.14)	175.50 (12.95)	112.00 (10.51)	147.00 (11.87)
Pl 140	128.50 (10.95)	273.50 (16.31)	88.50 (9.36)	163.50 (12.21)
Pl 141	238.00 (15.44)	198.50 (13.92)	83.00 (9.11)	173.17 (12.82)
Female	446.00 (20.21)	460.00 (21.38)	116.00 (10.78)	340.67 (17.46)
Viswam	97.50 (9.80)	70.25 (8.35)	122.50 (10.00)	96.75 (9.38)
Mean	193.04 (13.00)	226.08 (14.37)	110.00 (10.19)	
C.D(0.05)	5.654	3.981	NS	
C.D(0.05)				
Shade		1.837		
Hybrid		2.598		
Shade × Hybrid		4.501		

Table 3. Time taken for production of first lateral in hybrids at different shade levels

Hybrids	Number of days from planting to first lateral production			Mean
	0% shade	25% shade	50% shade	
Pl 9	60	60	61.4	60.47
Pl 63	55	54.4	55	54.8
Pl 140	44.8	44.6	45	44.8
Pl 141	46.8	44	41.2	44.0
Female	60	59.4	62	60.47
Viswam	60	57.8	60.8	59.53
Mean	54.43	53.37	54.23	
C.D (0.05)	1.599	1.324	1.438	
C.D (0.05)				
Shade		0.573		
Hybrid		0.810		
Shade × Hybrid		1.403		

level at which the plants were grown. i.e, the performance of different hybrids at different shade levels were significantly different. As can be seen from table 3, Pl 140 took less number of days to produce first lateral at zero per cent and 25 per cent shade levels. Pl 141 took lesser number of days to produce first lateral at 50 per cent shade level. Time taken for production of first lateral varied from 41.2 (Pl 141) to 62 (female parent) days among the accessions studied. Chandran (2012) in an initial evaluation of seedling progenies reported that time taken for lateral branch production varied from 109 to 260 days. Mean number of laterals was higher in Pl 9 (39.83) followed by Pl 63 (37). At zero per cent shade, Pl 9, Pl 63 and Pl 140 were on par with respect to number of laterals per plant whereas at 25 per cent shade, Pl 9 was significantly superior to all other hybrids studied. Even though the hybrids did not show significant difference in number of laterals at 50 per cent shade, maximum number of laterals was produced by Pl 140 (table 4).

Hybrids differed significantly in producing primary branches per plant. Number of primary branches went on increasing throughout the growing season. As can be seen from table 5, mean number of primary branches showed variation among hybrids from 6.2 to 25.3 after one year of growth. Variability in this character was reported by Manuel (1994), Jaleel (2006), Joseph (2008) and Chandran (2012).

Table 4. Number of laterals per plant in hybrids of *Piper longum* at different shade levels

Hybrids	Laterals			Mean
	0 % shade	25 % shade	50 % shade	
Pl 9	58.25(7.61)	53.50(7.33)	7.75(2.75)	39.83(5.90)
Pl 63	65.75(8.07)	40.75(6.46)	4.50(2.32)	37.00(5.61)
Pl 140	46.00(6.78)	38.50(6.28)	10.25(3.24)	31.58(5.43)
Pl 141	28.25(5.40)	19.75(4.55)	9.75(3.12)	19.25(4.36)
Female	32.00(5.72)	15.00(3.98)	3.00(2.00)	16.67(3.90)
Viswam	29.00(5.46)	6.75(2.77)	2.25(1.75)	12.67(3.33)
Mean	43.21	29.04	6.25	
C.D(0.05)	1.538	0.775	NS	
C.D(0.05)				
Shade		0.479		
Hybrid		0.678		
Shade × Hybrid		1.174		

Table 5. Number of primary branches per plant in hybrids at different shade levels

Hybrids	Number of primary branches per plant			Mean
	0% shade	25% shade	50% shade	
Pl 9	24(4.8)	23.25(4.9)	6.0(2.6)	17.8(4.1)
Pl 63	33.75(5.9)	36(6.1)	6.0(2.6)	25.3(4.8)
Pl 140	7.0(2.8)	7.0(2.8)	4.5(2.3)	6.2(2.6)
Pl 141	11.0(3.4)	5.0(2.4)	4.0(2.2)	6.7(2.7)
Female	12.25(3.6)	8.5(3.0)	4.5(2.3)	8.4(3.0)
Viswam	14(3.8)	22.5(4.8)	9.25(3.1)	15.3(3.9)
Mean	17.0(4.1)	17.0(4.0)	5.7(2.5)	
C.D (0.05)	1.236	0.851	NS	
C.D (0.05)				
Shade		0.37		
Hybrid		0.52		
Shade × Hybrid		0.91		

Table 6. Flowering and fruiting season of *Piper longum* hybrids at different shade levels

Hybrid	Season of flowering			Season of fruit set		
	0% Shade	25% hade	50% shade	0% Shade	25% Shade	50% Shade
Pl 9	MayJune-July	June-July	July	September-May	September-May	September-February
Pl 63	July	June-July	July	October-May	September-May	September-March
Pl 140	June-July	July	August	September-May	October-May	September-May
Pl 141	August	August	August	December-April	November-May	February-May
Female	June-July	June-July	August	August-April	September-May	October-April
Viswam	September	June-July	July	December-May	October-May	October

Table 7. Number of spikes per plant in *Piper longum* hybrids at different shade levels

Hybrids	No. of spikes per plant			Mean
	0% shade	25% shade	50% shade	
Pl 9	44.00	6.00	6.00	18.67
Pl 63	47.50	7.75	1.50	18.92
Pl 140	40.50	14.50	2.00	19.00
Pl 141	1.00	1.00	0.75	0.92
Female	1.25	1.25	2.50	1.67
Viswam	1.25	1.75	0.50	1.17
Mean	22.58	5.38	2.21	
C.D (0.05)	20.38	7.33	3.31	
C.D (0.05)				
Shade	4.90			
Hybrid	6.93			
Shade × Hybrid	12.01			

Flowering was observed throughout the year in *Piper longum* accessions studied. Hybrid Pl 9 started flowering earlier (May-June) than other accessions. Viswam started flowering only during September at zero per cent shade (table 6). Nair (2015) reported that, maximum inflorescence was produced during June, July and August. Less than five per cent flowering reported during December and January during her study.

Table 8. Fresh spike yield per plant in *Piper longum* hybrids at different shade levels

Hybrids	Fresh spike yield (g)			Mean
	0% shade	25% shade	50% shade	
Pl 9	39.25	5.79	5.52	16.85
Pl 63	44.23	4.88	1.28	16.79
Pl 140	25.48	12.06	1.48	13.00
Pl 141	0.85	0.85	0.56	0.75
Female	0.77	0.91	2.28	1.32
Viswam	0.83	0.90	0.40	0.71
Mean	18.57	4.23	1.92	
C.D (0.05)	19.56	7.01	2.98	
C.D (0.05)				
Shade		4.70		
Hybrid		6.65		
Shade × Hybrid		11.51		

Table 9. Dry spike yield per plant in *Piper longum* hybrids at different shade levels

Hybrids	Dry spike yield (g)			Mean
	0% shade	25% shade	50% shade	
Pl 9	7.37	0.95	1.10	3.14
Pl 63	8.14	1.05	0.26	3.15
Pl 140	4.45	2.01	0.30	2.25
Pl 141	0.16	0.16	0.11	0.14
Female	0.14	0.16	0.46	0.25
Viswam	0.14	0.14	0.08	0.12
Mean	3.40	0.74	0.38	
C.D (0.05)	3.57	1.10	0.60	
C.D (0.05)				
Shade		0.85		
Hybrid		1.2		
Shade × Hybrid		2.08		

Significant difference was observed among hybrids in number of spikes per plant, fresh yield and dry spike yield per plant. Hybrids Pl 9, Pl 63 and Pl 140 were on par and significantly superior to all other accessions for number of spikes per plant, fresh and dry spike yield per plant. At zero per cent shade, Pl 63 was found to be the most promising in yield including number of spikes per plant, fresh weight of spikes (g) per plant and dry weight of spikes (g) per plant. Pl 63 was followed by Pl 9 at zero per cent shade for these characters. At 25 per cent shade Pl 140 yielded more than other genotypes studied. At 50 per cent shade, Pl 9 produced maximum fresh and dry spike yield than other accessions studied. Mean fresh and dry spike yield was found to be decreasing with increasing shade levels from zero per cent to 50 per cent shade. Number of primary branches and laterals significantly influenced yield. This was in agreement with the findings of Manuel (1994), Jaleel (2006) and Joseph (2008).

Among shade levels, zero and 25 per cent shade were more suitable for genotypes to develop good vegetative growth. However, the yield of hybrids was better under open condition. Mean value for yield was found to be decreasing with increasing shade levels from zero per cent to 50 per cent shade.

At zero per cent shade, Pl 63 was found to be the most promising in yield including number of spikes per plant, fresh spike yield (g) per plant and dry spike yield (g) per plant. Pl 63 was followed by Pl 9 at zero per cent shade for these characters. At 25 per cent shade Pl 140 yielded more than other genotypes studied. At 50 per cent shade, Pl 9 produced higher yield than other accessions studied. Pl 9 and Pl 63 were promising in open condition whereas Pl 140 was the most promising at 25 per cent shade. However, the result is based on observations for one year and more trials are needed to confirm the results before recommendation.

Acknowledgements

This paper forms a part of the M.Sc. (Hort.) thesis of the first author submitted to the Kerala Agricultural University, 2017.

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