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Flora Veilalkim Baite
Department of Agronomy, College of Agriculture, CAU, Imphal, Manipur, India

Kshetrimayum Manishwari Devi
Ph.D., Scholar, Department of Agronomy, College of Agriculture, CAU, Imphal, Manipur, India

Tabuiliu Abonmai
Ph.D., Scholar, Department of Agronomy, College of Agriculture, CAU, Imphal, Manipur, India

MS Singh
Professor, Department of Agronomy, College of Agriculture, CAU, Imphal, Manipur, India

Corresponding Author:
Kshetrimayum Manishwari Devi
Ph.D., Scholar, Department of Agronomy, College of Agriculture, CAU, Imphal, Manipur, India

Effect of spacing and nipping on growth parameters of pea (*Pisum sativum* subsp. *hortense*) local cultivar Makhyatmubi

Flora Veilalkim Baite, Kshetrimayum Manishwari Devi, Tabuiliu Abonmai and MS Singh

Abstract

Nipping of young tender top shoots though traditionally practiced by the farmer but its associated beneficial effects are not scientifically documented. Apical bud nipping is known to alter the source- sink relationship by arresting the vegetative growth and hastening the reproductive phase. It also helps in production of more pod bearing branches with luxuriant foliage thus, enhances the photosynthetic activity, accumulation of more photosynthates, ultimately resulting in better plant growth. A field experiment was conducted during the *rabi* season of 2013-2014 and 2014-2015 and the treatments consisted of two factors i.e four spacing S_1 (20 X 15 cm), S_2 (20 X 20 cm), S_3 (30 X 10 cm) and S_4 (30 X 20 cm). The eight treatment combinations were laid out in FRBD with three replications. S_1N_1 recorded the highest plant height of 76.72 cm (1st year), 76.95 cm (2nd year) and 76.83 cm (Pooled data) at harvest and the same trend was recorded at 60 and 90 DAS. S_4N_2 gave the highest number of leaves with 46.83 (1st year), 84.13 (2nd year) and 47.48 (Pooled data). Maximum days of 86.41 days (1st year), 86.33 days (2nd year) and 86.37 (Pooled data) was recorded in S_1N_1. The number of branches at harvest was significantly affected by both spacing and nipping with maximum branches in treatment combination S_4N_2 3.20 (1st year), 3.30 (2nd year) and 3.27 (Pooled data). From the present investigation it was observed that pea growth was found to perform better in combination with spacing and nipping.

Keywords: Pea, spacing, nipping and growth

Introduction

Pea (*Pisum sativum* L.), the famous plant in which Mendel worked out his Laws and Genetic Principles, is a noble and aristocratic vegetable. The pea is a member of the Leguminosae (legume family). Peas are highly nutritive and contain high content of digestible protein (7.2g/100g), Carbohydrate (15.8g), Vitamin-C (9 mg), Phosphorus (139 mg) and minerals. Pulses occupy a unique position in the agricultural economy of the country by virtue of their ability to fix nitrogen in symbiotic association with *Rhizobium.* A few traditional pea varieties of the state Manipur are Makhyatmubi (Field pea), *Makuchabi*, *Ningtekpi* etc. (Garden pea). These varieties are grown mainly during winter. Farmers sell the green pods at high rate (Rs 50-60 / kg) during the off season which earns them a good income. In addition, it is also grown both in hills and parts of the valley throughout the year for its young shoot which is mainly used as vegetable in curry and fresh chutney.

Plants grown under normal spacing will have optimum population density per unit area which provides optimum conditions for luxuriant crop growth and better plant canopy area due to maximum light interception, photosynthetic activity, assimilation and accumulation of more photosynthates into plant system and hence they produce more seed yield with best quality traits (Mazumder *et al*., 2007) [2].

Among several seed production approaches, apical bud nipping is being commonly practiced in several crops to increase the seed yield and quality. Nipping of young tender top shoots though traditionally practiced by the farmer but its associated beneficial effects are not scientifically documented. Apical bud nipping is known to alter the source-sink relationship by arresting the vegetative growth and hastening the reproductive phase. It also helps in production of more pod bearing branches with luxuriant foliage thus, enhances the photosynthetic activity, accumulation of more photosynthates, ultimately resulting in better seed quality with higher seed yield (Thakral *et al*., 1991) [9].

The studies on influence of nipping on growth parameters in pea. In this experiment, different spacing and nipping level to enhance the pea productivity without much increase in input cost.

Materials and Methods

The experiment was conducted during the *rabi* seasons of 2013-2014 and 2014-2015 at the Research farm of Agronomy, College of Agriculture, Central Agricultural University, Imphal situated at about $24^0 46'$ N latitude and $93^0 54'$ E longitude and an altitude of about 790 metre above Mean Sea Level. The soil was clay in texture. The soil pH was acidic in reaction, medium in organic carbon (0.58%), medium in available nitrogen (280.53 kg/ha), medium in available P_2O_5 (18.45 kg/ha) and medium in K_2O. The experiment was laid out in FRBD with three replications. The treatment combinations involving two factors were S_1N_1, S_1N_2, S_2N_1, S_2N_2, S_3N_1, S_3N_2, S_4N_1 and S_4N_2. Factor-1: Spacing (S) i.e S_1- 20X15 cm, S_2 -20X15 cm, S_3 - 20X15 cm and S_4- 20X15 cm and factor-2: Nipping (N) i.e N_1- No nipping and N_2-Nipping. The selected seed for the experiment was Pea (*Pisum sativum* L. subsp. *hortense*, local cultivar - Makhyatmubi. During the period of sowing season of 2013-2014, minimum temperature was found to be 6.2 °C in the month of January and maximum temperature 28.5 °C in the month of March. In the following year i.e 2014-2015, during the crop season, minimum temperature was found to be 4.6 °C in the month of January and maximum temperature of 30.5 °C was recorded in the month of April. Ten plants from each plot were selected randomly excluding border rows plants and are tagged properly for taking biometric observations.

Results and Discussion

Effect of spacing and nipping on plant height (cm) at different growth stages

Data on plant height (cm) at 30 DAS, 60 DAS, 90 DAS and at harvest are presented in table 1. Plant height was significantly influenced by spacing throughout the growing period. There was no significant influence of spacing on plant height at 30 DAS. At harvest, maximum plant height were obtained at the spacing of 20X15 cm with the height of 76.72 cm (1st year), 76.96 cm (2nd year) and 76.83 cm (Pooled data) followed by the spacing 20X20 cm (S_2). While the minimum plant height at the spacing of 30X15 cm (S_4) with plant height of 66 cm (1st year), 66.66 cm (2ndyear) and 66.33 cm (Pooled data) followed by the spacing 30X10 cm. Significant difference were observed with interaction between spacing (S) and nipping (N) on plant height at 30 DAS, 60 DAS, 90 DAS and at harvest. At harvest, the maximum plant height of 85.63 cm (1st year), 88.21 cm (2nd year) and 76.83 cm (Pooled data) were recorded at the treatment combination of the spacing 20X15 cm without nipping (S_1N_1) followed by the treatment combination of spacing 20X20 cm without nipping (S_2N_1). The minimum plant height of 59.86 cm (1st year), 62.08 cm (2nd year) and 60.97 cm (Pooled data) were recorded at the treatment combination with the spacing of 30X15 cm with nipping. Similar trend were recorded at 60 DAS at 90 DAS as compared to all other treatment combinations. The marked increases in plant height noticed in narrow spacing may be attributed to higher in plant population density which might have resulted in less plant canopy area and exhibited more vertical growth by producing weak, lanky and taller plants due to stiff competition for space, light nutrients and moisture in the narrow spacing compared to those in wider spacing. Similar results were also obtained by Singh *et al.* (2001) [8] in field pea. The higher plant height noticed with no nipping (N_1) treatment was mainly due to the fact that plants were not nipped and as such plants grew to their original height without reduction. In plants, the developments of auxiliary buds are inhibited normally by Indole Acetic Acid (IAA) produced in the apical meristem.

Table 1: Effect of spacing and nipping on plant height (cm) at different growth stages

Treatment	At 30 DAS			At 60 DAS			At 90 DAS			At harvest		
	2013-2014	2014-2015	Pooled	2013-2014	2014-2015	Pooled	2013-2014	2014-2015	Pooled	2013-2014	2014-2015	Pooled
Spacing												
S_1(20X15 cm)	10.45	10.78	10.62	45.50	46.12	45.94	71.50	71.85	76.83	76.72	76.95	76.83
S_2(20X20 cm)	10.62	10.27	10.44	44.43	43.55	44.72	68.70	67.78	71.65	71.41	71.89	71.65
S_3(30X10 cm)	10.58	10.63	10.61	42.03	41.08	42.18	64.73	63.85	70.60	70.00	71.21	70.60
S_4(30X15 cm)	10.72	10.58	10.65	37.02	38.43	37.17	59.93	60.80	66.33	66.00	66.66	66.33
S.E(d)(±) S	0.12	0.12	0.10	0.26	0.30	0.25	0.32	1.26	0.44	0.66	0.87	0.44
CD (5%) S	NS	NS	NS	0.79	0.91	0.77	0.96	3.64	1.34	1.99	2.63	1.34
Nipping												
N_1(Non-nipped)	10.63	10.46	10.54	45.37	44.83	45.10	72.82	72.18	72.50	77.53	78.67	78.10
N_2(Nipped)	10.56	10.68	10.62	39.13	39.76	39.44	59.62	59.97	59.79	64.53	64.69	64.61
S.E(d)(±) N	0.08	0.08	0.18	0.18	0.21	0.18	0.22	0.28	0.31	0.46	0.61	0.31
CD (5%) N	NS	NS	NS	0.56	0.64	0.55	0.68	0.84	0.95	1.41	1.86	0.95
Treatment Combinations												
S_1N_1	10.53	10.67	10.60	49.23	49.33	49.72	78.73	79.07	78.90	85.63	88.21	86.92
S_1N_2	10.37	10.90	10.63	41.77	42.90	42.16	64.27	64.63	64.45	67.80	65.69	66.75
S_2N_1	10.83	10.43	10.63	47.53	46.43	47.77	76.03	74.87	75.45	77.69	79.21	78.45
S_2N_2	10.40	10.10	10.25	41.33	40.67	41.67	61.37	60.70	61.03	65.13	64.56	64.85
S_3N_1	10.57	10.30	10.43	45.17	43.20	44.86	70.30	68.70	69.50	74.67	76.01	75.34
S_3N_2	10.60	10.97	10.78	38.90	38.97	39.51	59.17	59.00	59.08	65.32	66.41	65.87
S_4N_1	10.57	10.43	10.50	39.53	40.37	39.04	66.20	66.07	66.13	72.13	71.23	71.68
S_4N_2	10.87	10.73	10.80	34.50	36.50	35.31	53.67	55.53	54.60	59.86	62.08	60.97
S.E(d)(±) N	0.17	0.17	0.10	0.37	0.42	0.36	0.45	0.39	0.63	0.93	1.23	0.63
CD (5%) N	NS	NS	NS	1.11	1.29	1.09	1.35	1.18	1.90	2.81	3.72	1.90

Effect of spacing and nipping on number of leaves per plant

Number of leaves at 30 DAS, 60 DAS, 90 DAS are presented in table 2. At 60 DAS, number of leaves per plant differed significantly due to spacing in both the experimental years. Among the treatments, spacing of 30X15 cm (S_4) was found with significantly maximum number of leaves per plant with 26.57 (1st year), 26.98 (2nd year) and 26.78 (Pooled data) followed by the spacing 30X10 cm (S_2). While, minimum number of leaves per plant i.e. 20.95 (1styear), 21.07 (2ndyear) and 21.01 (Pooled data) were recorded at the spacing of 20X 15 cm (S_1) which was statistically at par with the spacing 20X20 cm (S_2). At 90 DAS, among the treatments, maximum number of leaves per plant with 42.68 (1st year), 42.02 (2nd year) and 43.35 (Pooled data) were recorded in the spacing of 30X15 cm (S_4) followed by spacing 30X10 cm (S_3). However, minimum number of leaves per plant with 33.92 (1st year), 33.02 (2ndyear) and 33.47 (Pooled data) were recorded with the spacing of 20X15 cm (S_1) followed by the spacing 20X20 cm (S_2).Significant influence of interaction between spacing and nipping at 60 and 90 DAS for both the experimental years were recorded (table 2). At 60 DAS, maximum number of leaves 28.77 (1st year), which was statistically at par with 30X10 cm with nipping (S_3 N_2), 29.17 (2nd year) and 28.97 (Pooled data) were observed in the spacing 30X15 cm with nipping (S_4N_2). The minimum number of leaves i.e.19.23 (1st year), 19.50 (2nd year) and 19.27 (pooled data) were observed in the spacing of 20X15 cm under no nipping treatment (S_1N_1). For the 1st year and pooled data, the number of leaves in the spacing 20X15 cm without nipping (S_1N_1) and 20X20 cm without nipping (S_2N_1) were statistically at par. At 90 DAS, maximum number of leaves i.e 46.83 (1st year), 48.13 (2nd year) and 47.48 (Pooled data) were observed with the spacing 30X15 cm under nipping (S_4N_2) and the minimum number of leaves with 31.10 (1st year), 30.10 (2nd year) and 30.60 (Pooled data) were observed with the spacing 20X15 cm without nipping (S_1N_1) which was followed by S_2N_1. Leaf number decreases with narrow inter and intra row spacing as this causes more competition among the neighbouring plants for light. This result was similar with the findings of Woldesenbet (2014) [10] and Malami and Samaila (2012) [1] in cowpea.

Table 2: Effect of spacing and nipping on number of leaves per plant

Treatment	At 30 DAS			At 60 DAS			At 90 DAS		
	2013-2014	2014-2015	Pooled	2013-2014	2014-2015	Pooled	2013-2014	2014-2015	Pooled
Spacing									
S_1 (20X15 cm)	3.17	3.23	3.27	20.95	21.07	21.01	33.92	33.02	33.47
S_2 (20X20 cm)	3.38	3.43	3.43	21.77	22.52	22.14	37.47	38.48	37.98
S_3 (30X10 cm)	3.40	3.33	3.33	25.52	25.82	25.67	40.13	41.03	40.58
S_4 (30X15 cm)	3.38	3.25	3.27	26.57	26.98	26.78	42.68	44.02	43.35
S.E(d) (±) S	0.13	0.06	0.05	0.44	0.36	0.32	0.98	0.34	0.31
CD (5%) S	NS	NS	NS	0.95	0.78	0.68	0.98	0.72	0.93
Nipping									
N_1(Non-nipped)	3.26	3.26	3.28	21.71	22.22	21.96	69.95	35.17	35.07
N_2(Nipped)	3.41	3.37	3.38	25.69	25.98	25.83	84.25	43.11	42.62
S.E(d)(±) N	0.09	0.04	0.04	0.31	0.27	0.32	0.32	0.28	0.32
CD (5%) N	NS	NS	NS	0.67	0.55	0.66	0.69	0.51	0.66
Treatment Combinations									
S_1N_1	2.87	3.03	3.10	19.13	19.40	19.27	31.10	30.10	30.60
S_1N_2	3.47	3.43	3.43	22.77	22.73	22.75	36.73	35.93	36.33
S_2N_1	3.33	3.40	3.40	20.00	20.97	20.48	34.40	34.13	34.27
S_2N_2	3.43	3.47	3.47	23.53	24.07	23.80	40.53	42.83	41.68
S_3N_1	3.37	3.30	3.30	23.33	23.70	23.52	35.87	36.53	36.20
S_3N_2	3.43	3.37	3.37	27.70	27.93	27.82	44.40	45.53	44.97
S_4N_1	3.47	3.30	3.30	24.37	24.80	24.58	38.53	39.90	39.22
S_4N_2	3.30	3.20	3.23	28.77	29.17	28.97	46.83	48.13	47.48
S.E(d)(±) N	0.19	0.08	0.07	0.62	0.51	0.45	0.45	0.48	0.30
CD (5%) N	NS	NS	NS	1.33	1.10	0.92	0.98	1.02	0.61

Effect of spacing and nipping on number of branches per plant at harvest

The data on number of branches per plant at harvest is shown in the table 3. There were significant differences in the number of branches per plant at harvest due to spacing. The maximum number of branches i.e. 2.8 (1st year), 2.8 (2nd year) and 2.8 (Pooled data) were obtained with the spacing 30X15 cm (S_4) and the same trend was obtained in the 2nd year as well. However, the pooled data shows that maximum number of branches 2.8 per plant with spacing 30X15 cm was statistically at par with spacing 30X10 cm (S_3) and 20X20 cm (S_2). There were significant differences in the number of branches per plant at harvest due to nipping. The maximum number of branches per plant at harvest i.e. 2.78 (1st year), 2.71 (2nd year) and 2.75 (Pooled data) were observed with the nipping (N_1) treatment and the minimum number of branches i.e. 1.83 (1st year), 1.73 (2nd year) and1.78 (Pooled data) were observed under no nipping (N_1) treatment. Significant differences in the number of branches per plant at harvest due to interaction of spacing and nipping. The maximum number of branches 3.20 (1st year), 3.30 (2nd year) and 3.27 (Pooled data) were observed with the spacing 30X15 under nipping (S_4N_2) while the minimum number of branches 1.17 (1st year), 1.20 (2nd year) and 1.20 (Pooled data) were observed with the spacing 20X15 cm without nipping (S_1N_1). The increase in number of branches per plant in wider row spacing may be due to more space availability for plants to spread rather than to grow straight. These findings are in intune with the findings of Sajid *et al.* (2012) [5], Sharma *et al.* (2003) [6] in pigeon pea and Shaukat *et al.* (2012) [7].

Table 3: Effect of spacing and nipping on number of branches per plant at harvest

Number of branches per plant at harvest			
Treatment	**2013-2014**	**2014-2015**	**Pooled**
Spacing			
S_1 (20X15 cm)	1.80	1.77	1.78
S_2 (20X20 cm)	2.17	2.03	2.10
S_3 (30X10 cm)	2.45	2.32	2.38
S_4 (30X15 cm)	2.80	2.77	2.78
S.E(d)(±) S	0.08	0.05	0.03
CD (5%) S	0.17	0.12	0.08
Nipping			
N_1(Non-nipped)	1.83	1.73	1.78
N_2(Nipped)	2.78	2.71	2.75
S.E(d)(±) N	0.04	0.03	0.02
CD (5%) N	0.12	0.08	0.05
Treatment Combinations			
S_1N_1	1.17	1.20	1.18
S_1N_2	2.43	2.33	2.38
S_2N_1	1.60	1.60	1.60
S_2N_2	2.73	2.47	2.67
S_3N_1	2.13	1.90	2.03
S_3N_2	2.77	2.73	2.77
S_4N_1	2.40	2.23	2.40
S_4N_2	3.20	3.30	3.27
S.E(d)(±) N	0.08	0.05	0.04
CD (5%) N	0.17	0.12	0.09

Effect of spacing and nipping on number of days to 100 percent flowering

There were no significant differences in the number of days to 100% flowering due to spacing for both the experimental years (table 4). Nipping had significant influence on the number of days to 100% flowering in pea. The early 100% flowering i.e. 78.67 (1st year), 78.33 (2nd year) and 78.50 (Pooled data) were observed under no nipping treatment (N_1) and the delayed 100% flowering i.e. 82.92 (1st year), 84.67 (2nd year) and 83.79 (Pooled data) were observed with nipping treatment (N_2). This may be related to the fact that , the reduced competition at wider spacing made plants to have optimum growth rate than narrow planted plants which has fastened growth rate due to increase in competition for available resources. These results are in accordance with the earlier reports of Woldesenbet (2014) [10], Mazumder (2007) [2] and Mohmmed and Sahid (2012) [3] in pea.

Table 4: Effect of spacing and nipping on number of days to 100 percent flowering

Days to 100% flowering			
Treatment	**2013-2014**	**2014-2015**	**Pooled**
Spacing			
S_1 (20X15 cm)	81.33	81.00	81.17
S_2 (20X20 cm)	80.83	82.17	81.50
S_3 (30X10 cm)	81.67	81.83	81.75
S_4 (30X15 cm)	83.27	82.83	83.05
S.E(d)(±) S	0.72	0.75	0.51
CD (5%) S	NS	NS	NS
Nipping			
N_1(Non-nipped)	79.03	78.75	78.50
N_2(Nipped)	84.52	85.17	83.79
S.E(d)(±) N	0.51	0.53	0.36
CD (5%) N	1.09	1.14	1.06
Treatment Combinations			
S_1N_1	78.33	77.33	77.83
S_1N_2	84.33	84.67	84.50
S_2N_1	78.67	79.33	79.00
S_2N_2	83.00	85.00	84.00
S_3N_1	79.00	79.00	79.00
S_3N_2	84.33	84.67	84.50
S_4N_1	80.12	79.33	79.73
S_4N_2	86.41	86.33	86.37
S.E(d)(±) N	1.02	1.06	1.01
CD (5%) N	2.18	2.28	2.17

Effect of spacing and nipping on average weight of fresh nipped shoots

There was no significant influence of spacing on the fresh weight of shoots for both the years of experimentation (table 5). However, maximum fresh weight were recorded at the spacing 30X15 (S_4) followed by 30X10 cm spacing (S_3) while the minimum weight were recorded in the spacing 20X20 cm (S_2). The average weight of fresh nipped shoot recorded were 6.28 g (1st year), 6.27 g (2nd year) and 6.27 g (Pooled data). Significant differences were observed on the fresh weight of nipped shoots due to interaction effect of spacing and nipping. The maximum weight of 6.37 g (1st year), 6.40 g (2nd year) and 6.38 g (Pooled data) were recorded in the treatment combination of spacing 30X15 cm with nipping followed by the treatment combination 30X10 cm with nipping (S_4N_2). However minimum fresh weight of 6.20 g (1st year), 6.17 g (2nd year) and 6.18 g (Pooled data) were recorded in the treatment combination of spacing 20X20 cm with nipping (S_2N_2) and was statistically at par with the treatment combination of spacing 20X15 cm with nipping (S_1N_2). Though non- significant, the increase in fresh weight of nipped shoots with increase in spacing may be attributed to more photosynthetic activity and better light interception leading to more luxuriant growth of the plant.

Table 5: Effect of spacing and nipping on average weight of fresh nipped shoots

Average weight of fresh nipped shoots (g)			
Treatment	**2013-2014**	**2014-2015**	**Pooled**
Spacing			
S_1 (20X15 cm)	3.12	3.08	3.10
S_2 (20X20 cm)	3.10	3.08	3.09
S_3 (30X10 cm)	3.15	3.17	3.16
S_4 (30X15 cm)	3.18	3.20	3.19
S.E(d)(±) S	0.01	0.01	0.01
CD (5%) S	NS	NS	NS
Nipping			
N_1(Non-nipped)	-	-	-
N_2(Nipped)	6.28	6.27	6.27
S.E(d)(±) N	0.02	0.01	0.01
CD (5%) N	0.05	0.02	0.02
Treatment Combinations			
S_1N_1	-	-	-
S_1N_2	6.23	6.17	6.20
S_2N_1	-	-	-
S_2N_2	6.20	6.17	6.18
S_3N_1	-	-	-
S_3N_2	6.30	6.33	6.32
S_4N_1	-	-	-
S_4N_2	6.37	6.40	6.38
S.E(d)(±) N	0.02	0.01	0.03
CD (5%) N	0.04	0.02	0.06

Effect of spacing and nipping on average weight of oven dried nipped shoots

Data on oven dried weight of nipped shoots is presented in table 6. There were no significant differences among the different spacing on the average weight of oven dried nipped shoots. However, the maximum weight of 0.97 g were recorded at the spacing of 30X15 cm (S_4) for both the years of experimentation and followed by the spacing 30X10 cm (S_3) and 20X15 cm (S_1) while the minimum weight of 0.46 g (1st year), 0.47 g (2nd year) and 0.46 g (Pooled data) were recorded in the spacing of 20X20 cm (S_2). The average weight of oven dried nipped shoot recorded were 0.94 g (1st year), 0.95 g (2nd year) and 0.95 g (Pooled data). Significant influences were observed on the average weight of oven dried nipped shoots due to interaction between spacing and nipping. The maximum weight of 0.97 g each for both the years of experimentation and the pooled data were observed in the treatment combination of 30X10 cm spacing under nipping (S_4N_2) followed by (S_3N_2). However, minimum oven dried weight of 0.92 g (1st year), 0.93 g (2nd year) and 0.93 g (Pooled data) were recorded in the treatment combination of spacing 20X20 cm without nipping and was statistically at par with the treatment combinations (S_1N_2).Though non-significant, the increase in oven dried weight of nipped shoots with increase in spacing may be attributed to more photosynthetic activity and better light interception leading to more luxuriant growth of the plant.

Table 6: Effect of spacing and nipping on average weight of oven dried nipped shoots

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Average weight of oven dried nipped shoots (g)			
Treatment	**2013-2014**	**2014-2015**	**Pooled**
Spacing			
S_1 (20X15 cm)	0.47	0.47	0.47
S_2 (20X20 cm)	0.46	0.47	0.46
S_3 (30X10 cm)	0.47	0.48	0.48
S_4 (30X15 cm)	0.49	0.49	0.49
S.E(d)(±) S	0.004	0.002	0.002
CD (5%) S	NS	NS	NS
Nipping			
N_1(Non-nipped)	-	-	-
N_2(Nipped)	0.94	0.95	0.93
S.E(d)(±) N	0.01	0.02	0.03
CD (5%) N	0.02	0.05	0.08
Treatment Combinations			
S_1N_1	-	-	-
S_1N_2	0.93	0.93	0.93
S_2N_1	-	-	-
S_2N_2	0.92	0.93	0.93
S_3N_1	-	-	-
S_3N_2	0.95	0.96	0.95
S_4N_1	-	-	-
S_4N_2	0.97	0.97	0.97
S.E(d)(±) N	0.01	0.01	0.01
CD (5%) N	0.02	0.02	0.02

Conclusion

The result of this study revealed that plant height did not show significantly influence at 30 DAS. However, at 60 DAS, 90 DAS and at harvest, it was recorded significantly tallest in the treatment combination S_1N_1 (20X15cm spacing without nipping) among all the treatment combinations. Data on number of leaves per plant did not show significant difference at 30 DAS but significantly maximum number of leaves at 60 DAS and 90 DAS were recorded in the treatment combination of S_4N_2 (30X15 cm spacing with nipping). The number of branches per plant at harvest was significantly higher in the wider spacing with nipping treatment. The treatment combination S_4N_2 (30X15 cm spacing with nipping) recorded the maximum number of branches at harvest among all the treatment combinations. Days to 100 per cent flowering did not differ significantly with spacing however, the nipped plants showed delayed in 100 per cent flowering as compared to non-nipped plants. The maximum number of days taken to 100 per cent flowering was recorded in the treatment S_4N_2

(30X15 cm spacing with nipping). The average weight of fresh and oven dried nipped shoots were significantly more in the treatment combination S_3N_2 (30X15 cm spacing with nipping) which was at par with S_4N_2 (30X10 cm spacing with nipping) and the minimum weight was recorded at S_2N_2 (20X20 cm spacing with nipping) which was at par with the treatment combination S_1N_2 (20X15 cm spacing with nipping).

Conflict of Interests

The authors declare that there are no conflicts of interests within them.

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