

Effect of Spacing on Seed Yield and Quality of Pea Varieties

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Abstract – The experiment was conducted in the horticulture research field of Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur during November 2017 to April 2018 to evaluate the effects of spacing on yield and quality of different pea varieties. The treatments consisted of two factors, which were six varieties and six spacing conditions. The experiment was laid out in randomized complete block design. Considering the varieties, numbers of branches per plant and seed yield were found the highest in BARI Motorshuti-1. The highest vitamin C content, total sugar content, reducing sugar and non-reducing sugar content were observed in BARI Motorshuti-3. Number of branches per plant, number of nodes per plant, 100 pod weight, pod yield, seed yield, vitamin C and sugar content were found the highest at 40×15 cm spacing. Due to interaction effect of variety and spacing, the highest seed yield was found at BARI Motorshuti-1 with 30×15 cm spacing. BARI Motorshuti-1 with 20×10 cm spacing produced the highest amount of protein. Vitamin C and total sugar content were found the highest at IPSA Motorshuti-1 with 40×15 cm and BARI Motorshuti-3 with 30×15 cm and 40×15 cm spacing, respectively.

Keywords – *Pisumsativum*, Variety, Spacing, Growth, Seed Yield.

I. INTRODUCTION

Pea (*Pisumsativum* L.) is well known as a vegetable and one of the important legume crops in Bangladesh. It is an annual herbaceous plant of family *leguminosae* having genus *Pisum* and mostly grown for green pods and seeds. In Bangladesh pea is grown in a very small area of 12,477 ha and annual production is about 9,410 metric tons ^[1]. The low yield is mainly due to the use of low yielding cultivars and lack of good quality seeds and improved cultural practice.

Planting spacing has significant effect on growth and development of pea. Closer spacing enhances the disease development and lower yield of pea. Optimum spacing ensures the proper growth and development of pea. Quality of seed also depends on proper spacing of crop.

Plant population density is a major determinant of crop yield and population density mostly depends on management of plant spacing. In fact, the yield of plant is the result of the competition within and outside of the plant on the environmental factors and the maximum yield will be obtained when, this competition has decreased and the plant has the maximum using of these environmental factors. Increasing the excessive density, prevent the light penetrating into the canopy and increase competition. Therefore, identifying the suitable planting density is the first and the most essential strategies considered for achieving high yield ^[2].

Variability in productivity and quality of residues can be of both genetic and non-genetic origin. Recommended agronomic practices vary according to crop and cultivar and can release the maximum genetic potential determining quantity and quality of residues. Planting method and planting rate recommendations should be followed to maximize productivity. Although low density planting improved fodder quality, fodder yield declined ^[3].

Agricultural practices, including mineral nutrition, bio fortification, the manipulation of the environment, and the use of biochemical and microbial elicitors allow substantial improvements in their nutritional and nutraceutical quality^[4].

Clarification of the effect of seeding density e.g. plant spacing on the yield and quality is especially needed. The impact of spacing on seed yield and quality of vegetable pea has not been studied adequately in Bangladesh. Therefore, the study was undertaken regarding following objectives:

1. To identify high yielding pea varieties in combination with optimum spacing for maximizing yield.
2. To find out the best seed quality of peavarieties on food value scale as influenced by different plant spacing.

II. MATERIALS AND METHODS

A field experiment was carried out at the research field of department of Horticulture of Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur during November 2017 to April 2018. The experimental site is located at the center of Modhupur Tract (24^o29 N latitude and 90^o26 E longitude) having an elevation of 8.2 m from the sea level (Anon., 1990). The climatic condition of the experimental plot was subtropical in nature characterized by heavy rainfall from June to September and scarcity in winter and mean rainfall is around 2200 mm per year. The experiment field belongs to Salna series representing the Shallow Red Brown Terrace soil within the AEZ number 28 in Bangladesh soil classification system which falls under Inceptisols in Soil Taxonomy. The soil was silty clay loam in texture and pH 6.5 in the surface.

Experimental Layout

The experiment was laid out in a Randomized Complete Block Design (RCBD) having two factors with three replications. The unit plot size was 1.5×1.2 m. The experimental plot was separated by 0.6 m. The plots were raised by 10 cm for proper irrigation. The treatments included Factor A: Spacing; S₁ = 20×10 cm, S₂ = 30×10 cm, S₃ = 40×10 cm, S₄ = 20×15 cm, S₅ = 30×15 cm and S₆ = 40×15 cm Factor B: Variety; V₁ = BARI Motorshuti-1, V₂ = BARI Motorshuti-3, V₃ = IPSA Motorshuti-1, V₄ = IPSA Motorshuti-3, V₅ = Jashore local and V₆ = Natore local.

Land Preparation

The experimental soil was well prepared by deep ploughing with tractor followed by harrowing and laddering up to a good tilth. The experimental plots were uniformly fertilized with cowdung, urea, TSP and MP. The total cowdung, TSP, MP and ½ urea were applied during the final land preparation and rest of the urea were top dressed in the plot in two installments. The first installment was top dressed at 21 days after sowing and the second at 45 days after sowing. Boric acid @ of 4 kg/ha was applied as foliar spray before flowering of pea. Seeds were sown @ 2-3 seeds/hill on November 11 in furrows maintaining the different row to row spacing and plant to plant spacing as per treatment. Thinning was done after 7 and 15 days of emergence for keeping desired plant density. Three weeding were done by hand to avoid competition between the plants and weeds. Ten plants were randomly selected from each plot for data collection on growth and yield characteristics viz. days to flowering, number of branch/plant, position of first bearing node, pod length, number of pod/plant, number of seed/pod, weight of 100 dry seed and dry seed yield.

After harvesting the pod, seeds were separated by hands. After proper drying the seeds were stored for seed q-

-uality tests.

Reducing Sugar

Reducing sugar was determined by Benedict test.

Total Sugar

Sugar contents (total reducing) were estimated according to Somogyi using Bertrand A, Bertrand B and Bertrand C solutions.

Total Nitrogen and Protein Estimation

The oven dried seeds were ground and total nitrogen content was determined by modified Kjeldahl digestion colorimetric method by using CuSO_4 and K_2SO_4 mixture (1:9) as catalyst. The total nitrogen was calculated by the following formula: % N = $14.007 \times Fx (T - B) \times 100\text{ml}/10\text{ml} \times 100/1000$ w (g)

Protein content in green pod and mature seed was estimated by multiplying 6.25 to the value of total nitrogen (%).

Ascorbic Acid Determination

The ascorbic acid content was determined as per the procedure described by Pleshkov. Free ascorbic acid was quantified by using the formula: Ascorbic acid content (mg/100g) = T.F. V/v W $\times 100$

Statistical Analysis

All the recorded data were subjected to analysis of variance following the procedure using MSTAT-C statistical software. Duncan's Multiple Range Test (DMRT) was used to separate means ^[5].

III. RESULTS AND DISCUSSION

Effect of Pea Varieties

Significant variation was observed among different pea varieties in respect to yield and yield contributing characters (Table 1 and 2). BARI Motorshuti-1 showed significantly the highest number of days (50.61 days) required for first flowering compared to all other varieties and the lowest number of days (24.88 days) required at BARI Motorshuti-3 (Table 1). Similar trend was observed in case of 50% maturity of pea varieties. BARI Motorshuti-1 showed significantly the highest number of branches per plant (3.08/plant) compared to all other varieties and the lowest (2.33/plant) was observed at Jashore local variety of pea (Table 1). Position of first bearing node was found at the 10.55 cm above the ground level at BARI Motorshuti-1 variety and IPSA Motorshuti-1 showed it at 6.29 cm from the ground level (Table 1). BARI Motorshuti-1 showed the longest pod (69.87 mm) among all the varieties. Significantly the maximum number of pods per plant (20.77/plant) was found in IPSA Motor shuti-1 which was statistically identical with BARI Motorshuti-1 (20.16). Natore local exhibited the minimum number of pods per plant (16.55/plant) (Table 2). Significantly the maximum number of seeds per pod was found in BARI Motorshuti-3 which was statistically similar to BARI Motorshuti-1, Jashore local and Natore local (About 5 seeds/pod). The minimum number of seeds per pod was observed in IPSA Motorshuti-1. Dry seed yield also varied significantly among different varieties (Table1). BARI Motorshuti-1 significantly produced the highest seed yield (3.25 t/ha) and the lowest seed yield (2.70 t/ ha) was observed from

IPSA Motorshuti-3 (2.70t/ha) which was identical with Jashore local (2.79 t/ha) variety of pea.

Table 1. Effect of varieties on growth, yield and yield contributing characters of pea.

Varieties	Days to 1 st flowering	Days to 50% flowering	Number of Branch plant ⁻¹	Position of 1 st bearing node	Pod length (mm)	Number of pod plant ⁻¹	Number of Seed Pod ⁻¹	Weight of 100 dry seed (g)	Dry seed yield (t/ha)
BARI Motorshuti-1	50.61a	59.22a	3.08a	10.55a	69.87a	20.16a	5.39a	12.77	3.25a
BARI Motorshuti-3	24.88d	38.44d	2.69b	6.47e	57.24c	18.00b	5.45a	11.42	2.87b
IPSA Motorshuti-1	24.94d	36.11e	2.37c	6.29f	53.91d	20.77a	4.44c	11.29	2.91b
IPSA Motorshuti-3	42.77b	45.88c	2.62b	10.17b	54.68d	18.00b	4.85b	16.80	2.70c
Jashore local	41.44c	46.38c	2.33c	9.28c	48.89e	16.72c	5.39a	14.92	2.79bc
Natore local	43.33b	53.88b	2.58b	7.24d	59.64b	16.55c	5.38a	12.64	2.89b
Level of Sig.	**	**	**	**	**	**	**	NS	**
CV(%)	4.46	2.58	8.51	2.36	2.77	6.48	4.58	35.53	7.63

Means bearing same letter (s) do not differ significantly at 1% level of probability by DMRT.

Effect of Spacing

Different spacing of pea crop varieties exhibited different planting density and that's why different crop physical and yield parameters responded to variation. From Table 2, it can be observed that, wider spacing provides comparatively early flower induction but delayed 50% flowering. It can be observed that 40×15cm spacing condition required minimum number of days (35.88 days) for first flowering of pea but the maximum number of days (48.44 days) 50% flowering at 40×15cm spacing. Although, 30×15cm spacing had demonstrated comparatively higher days to first flowering but lower days to 50% flowering (Table 2). Wider spacing (40×15cm, 40×10cm, 30×15cm) provides adequate space and less biotic and abiotic stresses rendering higher trend of branching. Likewise other attributes, wider spacing (40×15cm spacing, 64.00 mm) demonstrated the longest pod size (Table 2). Number of seeds per pod showed significant variation and the plants at 40×10cm spacing showed the highest number of seeds per pod (5.52). The lowest seeds per pod (4.91) were observed in 20×10cm spacing (Table 2). The plants grown with 40×15cm spacing produced the highest seed yield (3.13 t/ha) which was statistically similar to 30×15cm spacing. The lowest seed yield (2.75 t/ha) was observed at 20×10cm spacing which was identical to 30×10cm, 40×10cm and 20×15cm spacing (Table). This result is in agreement with Ali *et al.* (2012).

Table 2. Effect of spacing on growth, yield and yield contributing characters of different pea varieties.

Spacing	Days of 1 st Flowering	Days of 50% Flowering	Number of Branch Plant ⁻¹	Position of 1 st Bearing Node	Pod Length (mm)	Number of pod plant ⁻¹	Number of seed pod ⁻¹	Weight of 100 dry seed (g)	Dry Seed yield (t/ha)
20 cm × 10 cm	38.38a	44.44d	2.46cd	8.91a	50.05f	18.00	4.91c	12.80	2.75b
30 cm × 10 cm	38.66a	46.55c	2.56c	8.77b	52.22e	18.22	4.99c	13.18	2.79b

Spacing	Days of 1 st Flowering	Days of 50% Flowering	Number of Branch Plant ⁻¹	Position of 1 st Bearing Node	Pod Length (mm)	Number of pod plant ⁻¹	Number of seed pod ⁻¹	Weight of 100 dry seed (g)	Dry Seed yield (t/ha)
40 cm × 10 cm	38.50a	46.44c	2.75b	8.37c	55.49d	18.72	5.52a	13.70	2.82b
20 cm × 15 cm	37.94a	46.50c	2.40d	7.98e	59.91c	18.27	4.98c	13.80	2.84b
30 cm × 15 cm	38.61a	47.55b	2.60bc	7.80f	62.56b	18.55	5.23b	14.20	3.07a
40 cm × 15 cm	35.88b	48.44a	2.91a	8.18d	64.00a	18.44	5.26b	22.16	3.13a
Level of significance	**	**	**	**	**	NS	**	NS	**
CV (%)	4.46	2.58	8.51	2.36	2.77	6.48	4.58	35.53	7.63

Means bearing same letter (s) do not differ significantly at 1% level of probability by DMRT.

Interaction Effects

In respect of interaction effects of variety and spacing, BARI M otorshuti-1 being a long duration crop required the maximum number of days to reach first flowering stage (About 54 days) in all spacing combinations. Consequently, the variety also exhibited higher number of days to reach 50% flowering stage at 40×15 cm spacing (61 days). The minimum number of days required for first flowering showed by BARI Motorshuti-3 at 20×10 cm (23 days) and for 50% flowering IPSA Motorshuti-1 at 20×15 cm (35 days) spacing combinations. The similar results reported that wider spacing with a variety required more days to first flowering of garden pea [6]. The denser plant population hastened days to flowering in lentil [7].

BARI Motorshuti-1 with 40×15 cm spacing condition produced the highest number of branches per plant (3.33/plant). The lowest was observed at BARI Motorshuti-3 with 20 x 10 cm spacing (2.03/plant) (Table 3). Wider spacing enhanced the number of branch per plant due to availability of space to spread out of branch of garden pea [6]. In faba bean, soybean, garden pea and common vetch, respectively which indicated reduced number of branches with increased plant population [8], [9], [10]. Position of first bearing node was observed at 11.66 cm above from the ground level of BARI Motorshuti-1 with 20×10 cm spacing which was statistically similar to BARI Motorshuti-1 with 30×10 cm spacing condition. The plants of BARI Motorshuti-3 with 30×15 cm spacing showed the first bearing node at 5.80 cm above the ground level of pea crop (Table 3). BARI Motorshuti-1 with 40×15 cm spacing produced the longest pod (80.43 mm) compare to all other combinations. The shortest pod was observed at Jashore local with 20×10 cm spacing which was 41.57 mm (Table 3). Number of pods per plant for variety × spacing interaction did not differ significantly. Number of seeds per pod showed significant variation among the treatment combinations. The highest number of seeds per pod (6.13) was found in IPSA Motorshuti-3 with 40×10 cm spacing and Jashore local with 40×10 cm spacing and the lowest was in IPSA Motorshuti-3 with 20×15 cm spacing (4.16) (Table 3). In case of interaction effects of variety and spacing, BARI Motorshuti-1 with 30×15 cm spacing produced the highest seed yield (4.02 t/ha) which was statistically identical with BARI Motorshuti-1 with 40×15 cm spacing. The lowest seed yield (2.50 t/ha) was found at IPSA Motorshuti-3 with 20×10 cm spacing (Table 3). Wider spacing have the capability to enhance the seed yield of garden pea due to the higher photosynthesis rate of the crop [11].

Table 3. Interaction effect of variety and spacing on growth, yield and yield contributing characters of different pea varieties.

Variety	Spacing	Days to 1 st Flowering	Days to 50% flowering	Number of Branch of Plant ⁻¹	Position of 1 st Bearing Node	Pod Length (mm)	Number of pod plant ⁻¹	Number of seed pod ⁻¹	Weight of 100 dry seed (g)	Dry seed yield (t/ha)
BARI Motorshuti-1	20 cm × 10 cm	53.00a	59.00bc	3.16ab	11.66a	58.45i-k	19.66	4.80i-l	12.11	2.70f-k
	30 cm × 10 cm	54.33a	59.00bc	3.13a-c	11.40a	61.35gh	19.33	5.30d-h	12.08	3.19b
	40 cm × 10 cm	53.00a	58.33bc	3.03a-e	10.63b	69.11d	22.00	5.70bc	12.83	2.82c-k
	20 cm × 15 cm	54.00a	57.66c	2.76d-h	9.73de	72.82c	21.33	5.1g-j	12.40	2.83c-k
	30 cm × 15 cm	54.33a	60.00ab	3.06a-d	9.36fg	77.09b	19.33	5.70bc	13.10	4.02a
	40 cm × 15 cm	35.00h	61.33a	3.33a	10.53b	80.43a	19.33	5.76a-c	14.09	3.94a
BARI Motorshuti-3	20 cm × 10 cm	23.33k	36.00lm	2.03mn	6.60k-m	50.42p-r	18.00	5.16e-i	11.12	2.70e-k
	30 cm × 10 cm	23.66jk	36.66l	2.66f-j	6.76k	53.51m-o	18.00	5.13e-j	11.05	2.53jk
	40 cm × 10 cm	26.33ij	37.33kl	3.03a-e	6.60k-m	56.28kl	18.33	5.70bc	10.56	2.76d-k
	20 cm × 15 cm	24.00jk	40.00ij	2.43h-l	6.73kl	60.97g-i	17.66	5.86ab	11.84	3.15bc
	30 cm × 15 cm	25.00i-k	39.00jk	3.06a-d	5.80n	62.74fg	18.00	5.53b-e	11.47	3.09bcd
	40 cm × 15 cm	27.00i	41.66i	2.93b-g	6.36m	59.54h-j	18.00	5.30d-h	12.51	2.99b-h
IPSA Motorshuti-1	20 cm × 10 cm	24.00jk	36.00lm	2.10l-n	6.83k	48.62q-s	21.33	4.30n-p	10.53	2.89b-i
	30 cm × 10 cm	25.33i-k	36.66l	2.13l-n	6.43lm	48.14q-s	20.66	4.36m-p	11.55	2.85b-k
	40 cm × 10 cm	26.00i-k	36.00lm	2.70e-j	6.40m	53.14no	20.66	4.33m-p	10.66	2.92b-i
	20 cm × 15 cm	24.33jk	34.66m	2.16lmn	5.83n	56.10k-m	20.66	4.50l-p	10.94	2.98b-h
	30 cm × 15 cm	26.33ij	36.33lm	2.13lmn	5.86n	56.45kl	21.33	4.63k-o	11.58	2.79c-k
	40 cm × 15 cm	23.66jk	37.00l	3.03a-e	6.40m	61.01g-i	20.00	4.53l-p	12.49	3.04b-g
IPSA Motorshuti-3	20 cm × 10 cm	41.33fg	37.33kl	3.00a-f	10.70b	47.81s	17.00	4.26op	15.37	2.50k
	30 cm × 10 cm	41.33fg	47.33fg	2.43h-l	10.60b	48.80p-r	19.00	5.13d-h	15.42	2.53jk
	40 cm × 10 cm	42.33d-g	48.00f	2.66f-j	10.06c	51.15o-q	18.33	6.13a	16.62	2.91b-i
	20 cm × 15 cm	42.00e-g	47.66f	2.40i-m	10.03cd	57.96j-l	17.66	4.16p	17.50	2.57i-k
	30 cm × 15 cm	45.00b-d	47.00fg	2.30k-n	9.83c-e	61.75gh	17.66	4.76j-l	17.94	2.71e-k
	40 cm × 15 cm	44.66b-e	48.00f	2.96b-f	9.80cde	60.61g-i	18.33	4.66k-n	17.99	2.99b-h
Jashore local	20 cm × 10 cm	42.66d-g	45.00h	2.36j-n	9.86c-e	41.57u	16.33	5.46c-g	14.12	2.65h-k
	30 cm × 10 cm	41.66fg	47.00fg	2.26k-n	9.63ef	44.76t	16.66	5.26d-h	14.77	2.78d-k
	40 cm × 10 cm	40.66fg	45.66gh	2.66f-j	9.16g	47.81s	16.33	6.13a	15.65	2.82c-k
	20 cm × 15 cm	41.66fg	45.00h	2.06mn	8.80h	50.49p-r	16.33	4.70k-m	14.25	2.86b-k
	30 cm × 15 cm	40.00g	48.66f	2.26k-n	9.10gh	52.48op	17.66	5.00h-k	15.37	2.88b-j
	40 cm × 15 cm	42.00e-g	47.00fg	2.40i-m	9.13g	56.23kl	17.00	5.80a-c	13.36	2.77d-k
Natore local	20 cm × 10 cm	46.00b	53.33e	2.13lmn	7.83i	53.43m-o	154.66	5.50b-f	13.57	3.05b-f

Variety	Spacing	Days to 1 st Flowering	Days to 50% flowering	Number of Branch Plant ⁻¹	Position of 1 st Bearing Node	Pod Length (mm)	Number of pod plant ⁻¹	Number of seed pod ⁻¹	Weight of 100 dry seed (g)	Dry seed yield (t/ha)
	30 cm × 10 cm	45.66bc	52.66e	2.73d-i	7.80i	56.78kl	15.66	4.76j-l	14.23	2.88b-j
	40 cm × 10 cm	42.66d-g	53.33e	2.40i-m	7.36j	55.43l-n	16.66	5.13f-j	15.87	2.71e-k
	20 cm × 15 cm	41.66fg	54.00de	2.60g-k	6.76k	61.13gh	16.00	5.60b-d	15.90	2.68g-k
	30 cm × 15 cm	41.00fg	54.33de	2.80c-g	6.83k	64.88ef	17.33	5.76a-c	15.75	2.96b-h
	40 cm × 15 cm	43.00c-f	55.66d	2.83b-g	6.86k	66.21e	18.00	5.53b-e	18.65	3.06b-e
Level of sig.		**	**	**	**	**	NS	**	NS	**
CV %		4.28	2.58	8.51	2.36	2.77	6.48	4.58	35.53	7.63

Means bearing same letter (s) do not differ significantly at 1% level of probability by DMRT.

Qualitative Analysis of Pea:

In case of interaction effects of variety and spacing, BARI Motorshuti-1 with 20 × 10 cm spacing exhibited the highest amount of protein content (37.71%) which was statistically similar to BARI Motorshuti-1 with 20 × 15 cm, IPSA Motorshuti-1 with 40 × 10 cm and 20 × 15 cm spacing. The least amount of protein (23.40%) was found at Natore local variety with 20 × 10 cm spacing. Interactions of variety and spacing showed significant variation on Vitamin-C content (Table 4). The highest amount of vitamin C content (11.61 mg/100 g) was found in IPSA Motorshuti-1 with 40 × 15 cm spacing which was statistically similar to BARI Motorshuti-3 with 30 × 10 cm, 20 × 15 cm, 30 × 15 cm and 40 × 15 cm spacing. The least amount of vitamin C content (5.04 mg/100g) was found in Natore local variety with 20 × 10 cm spacing. BARI Motorshuti-3 with 40 × 15 cm spacing showed the highest amount of total sugar content (3.16%) which was statistically similar to BARI Motorshuti-3 with 30 × 15 cm spacing. The least amount of total sugar was observed at BARI Motorshuti-1 with 20 × 10 cm spacing condition which was statistically similar to BARI Motorshuti-1 with 30 × 10 cm (Table 4). Interaction effects of variety and spacing, showed non-significant variation between reducing and non-reducing sugar content of garden pea crop (Table 4).

Table 4. Interaction effect of variety and spacing on protein, vitamin C and sugar content of garden pea.

Variety	Spacing	Protein (%)	Vitamin C Content	Reducing Sugar (%)	Non Reducing Sugar (%)	Total Sugar (%)
BARI Motorshuti-1	20 cm × 10 cm	37.71a	8.90fg	1.53	0.54	2.08n
	30 cm × 10 cm	37.04ab	9.04fg	1.63	0.58	2.22mn
	40 cm × 10 cm	34.95c-f	9.53d-f	1.57	0.56	2.13n
	20 cm × 15 cm	35.40b-e	9.19e-g	1.56	0.56	2.13n
	30 cm × 15 cm	34.56d-g	10.14cd	1.74	0.61	2.36k-m
	40 cm × 15 cm	32.90gh	9.44d-f	1.81	0.64	2.45j-l
BARI Motorshuti-3	20 cm × 10 cm	30.94j	10.47c	1.87	0.67	2.54f-j
	30 cm × 10 cm	29.51jk	11.39ab	2.02	0.73	2.76b-e

Variety	Spacing	Protein (%)	Vitamin C Content	Reducing Sugar (%)	Non Reducing Sugar (%)	Total Sugar (%)
	40 cm × 10 cm	28.56k	10.64bc	2.10	0.77	2.87b
	20 cm × 15 cm	29.51jk	11.40ab	1.98	0.73	2.71b-e
	30 cm × 15 cm	27.65k	11.42ab	2.27	0.84	3.12a
	40 cm × 15 cm	27.79k	11.38ab	2.30	0.85	3.16a
IPSA Motorshuti-1	20 cm × 10 cm	36.87ab	9.16e-g	1.67	0.64	2.31lm
	30 cm × 10 cm	33.45f-h	10.10cd	1.78	0.68	2.46j-l
	40 cm × 10 cm	36.18a-d	9.99c-e	1.94	0.73	2.68d-h
	20 cm × 15 cm	36.57a-c	9.07fg	1.82	0.70	2.52h-j
	30 cm × 15 cm	35.26b-f	10.84a-c	1.94	0.74	2.69c-g
	40 cm × 15 cm	36.62d-g	11.61a	2.05	0.78	2.84bc
IPSA Motorshuti-3	20 cm × 10 cm	35.35b-e	8.41g	1.49	0.59	2.09n
	30 cm × 10 cm	34.60d-g	9.37d-f	1.57	0.63	2.20mn
	40 cm × 10 cm	33.68e-h	8.68fg	1.79	0.71	2.50i-k
	20 cm × 15 cm	33.57e-h	9.50d-f	1.74	0.67	2.42j-l
	30 cm × 15 cm	32.14hi	8.88fg	1.94	0.76	2.71c-e
	40 cm × 15 cm	33.75e-h	8.71fg	1.97	0.79	2.75b-e
Jashore local	20 cm × 10 cm	24.89 l	5.49kl	1.73	0.70	2.43j-l
	30 cm × 10 cm	25.18 l	6.25h-k	1.91	0.76	2.68d-h
	40 cm × 10 cm	24.72 l	5.41kl	1.87	0.76	2.63e-i
	20 cm × 15 cm	25.12 l	7.06h	1.79	0.74	2.54g-j
	30 cm × 15 cm	23.82 l	5.76kl	2.02	0.80	2.83b-d
	40 cm × 15 cm	24.46 l	6.76h-j	2.04	0.82	2.87b
Natore local	20 cm × 10 cm	23.40 l	5.04l	1.74	0.71	2.46j-l
	30 cm × 10 cm	24.99 l	5.71kl	1.81	0.72	2.54g-j
	40 cm × 10 cm	24.08 l	6.05jk	1.93	0.76	2.70c-f
	20 cm × 15 cm	25.26 l	5.91j-l	1.88	0.74	2.62e-i
	30 cm × 15 cm	23.81 l	6.12i-k	2.04	0.80	2.85bc
	40 cm × 15 cm	24.53 l	6.95hi	1.93	0.78	2.72b-e
Level of significance		**	**	NS	NS	**
CV %		3.76	6.35	4.68	9.41	3.83

Means bearing same letter (s) do not differ significantly at 1% level of probability by DMRT.

IV. CONCLUSION

According to the results of the experiment, the following conclusions can be made:

1. Among the varieties of pea, BARI Motorshuti-1 performed better in respect of number of seed per pod (5.39) and seed yield (3.25 t/ha) and protein content (35.43%) compared to all other varieties.
2. The highest number of branches per plant (2.91), number of nodes per plant (13.40), pod length (64.00 mm) and seed yield (3.13 t/ha), vitamin C content (9.14 mg/100 g), total sugar content (2.80%), reducing sugar content (2.02%) and non-reducing sugar content (0.78%) were found at 40×15cm spacing.
3. BARI Motorshuti-1 grown at 30×15cm spacing produced the highest seed yield (4.02 t/ha). BARI Motorshuti-1 at closer spacing had produced higher amount of protein (37%). IPSA Motorshuti-1 with 40×15cm spacing had produced higher amount of vitamin C (11.61 mg/100 g) and BARI Motorshuti-3 with 40×15cm spacing showed higher accumulation of total sugar (3.16%).

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