

# Evaluation of Pea (*Pisum sativum* L.) Varieties for Growth, Yield and Quality of Seed Under Malwa Region of Madhya Pradesh

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**ABSTRACT:** Twelve pea varieties V<sub>1</sub>- Arka Kartik, V<sub>2</sub>-Azad Pea-3, V<sub>3</sub>- Pusa Pragati, V<sub>4</sub>- Kashi Shakti, V<sub>5</sub>- Kashi Samarth, V<sub>6</sub>- Arkel, V<sub>7</sub>- Kashi Mukti, V<sub>8</sub>- Kashi Uday, V<sub>9</sub>- Kashi Nandini, V<sub>10</sub>- Matar Ageta-6, V<sub>11</sub>- Arka Ajit and V<sub>12</sub>- Bonneville were evaluated for growth, yield and seed quality in randomized block design with four replications. Findings revealed that maximum plant height, number of leaves per plant, number of branches per plant, fresh weight of plant and dry weight of plant were recorded in Kashi Shakti. Highest number of root nodules was observed with Kashi Shakti under the study. Matar Ageta-6 recorded minimum days taken to 50% flowering. Maximum number of pod per plant was found with variety Kashi Shakti. Maximum number of seeds per pod and length of pod were recorded in variety Pusa Pragati. Highest shelling percentage was observed in case of variety Matar Ageta-6 which was followed by Kashi Shakti, Kashi Samarth and Arka Kartik with non significant difference. Maximum seed yield per hectare was found in variety Kashi Shakti which was followed by Kashi Samarth, Pusa Pragati and Kashi Uday with non significant differences. Rest of the varieties differed significantly from Kashi Shakti. Maximum germination percentage was recorded in Kashi Mukti which was at par to Arkel, Kashi Shakti, Kashi Uday, Azad Pea-3, Arka Ajit. Kashi Nandini, Kashi Samarth, Pusa Pragati, Matar Ageta-6 and Bonneville. Maximum 100 seed weight (20.88g) was observed in Matar Ageta-6, followed by Kashi Samarth, Pusa Pragati, Bonneville, Arka Kartik and Arka Ajit with non significant differences. Seed vigour index was highest with Arkel (3662.25) which was at par with Matar Ageta-6, Kashi Shakti, Kashi Mukti, Azad Pea-3, Arka Ajit. Kashi Uday and Arka Kartik.

**Keywords:** Pea, *Pisum sativum*, varieties, growth, yield, seed quality

## INTRODUCTION

Pea is a popular and economically important vegetable. It is highly nutritive and a rich source of protein and carbohydrate along with minerals, vitamin A, B and C. Each 100 g edible portion of the green pea contains moisture 72.9 g, protein 7.2 g, fiber 4.0 g, carbohydrates 15.9 g, energy 93 K cal, calcium 20 mg, phosphorus 139 mg, iron 1.5 mg, carotene 83 µg. Whereas the dry pea contains moisture 16.0 g, protein 19.7 g, fiber 4.5 g, carbohydrates 56.5 g, energy 315 K cal, calcium 75 mg, phosphorus 298 mg, iron 7.05 mg and carotene 39 µg. (1). Large proportion of peas is processed in the form of canned, frozen or dehydrated pea for consumption in the period of scarcity.

Pea is grown mainly as a winter vegetable in plains of north India and as a summer vegetable in the hills. Being a cool season crop, it is most extensively grown in the temperate regions throughout the world. In tropics and

subtropics, its cultivation is restricted to cooler altitude and winter season. In India, the main pea growing states are Uttar Pradesh, Bihar, Haryana, Punjab, Himachal Pradesh, Orissa and Karnataka. It ranks among the top 10 vegetable crops and is exported from India to other countries like Saudi Arabia, Nepal, United Arab Emirates, Bahrain, Bangladesh, Australia, Maldives, Oman, Guinea-Bissau etc. To fulfill the local demand and enhance the export, there is a need of increasing production which is possible by both increasing area as well as introducing high yielding varieties. But both require quality seed of improved varieties available locally at a affordable prices. The availability of good seed in sufficient quantity is very important for its successful production. Malwa region of Madhya Pradesh is not a traditional pea growing region. Whatever pea is grown that is for consumption purpose. But increase in area is possible through providing good quality seed at cheaper rates.

The pea cultivars, cultivated by the vegetable growers in this region are very low in yield. However, many new varieties have been developed in India through varietal development programme under different SAU's and ICAR institutes. Therefore, evaluation of varieties for higher yield, suitable for different agro-climatic conditions is necessary to further enhance production and productivity of vegetable pea. Keeping these points in view the present experiment was carried out with objectives to evaluate the performance of different pea varieties for growth attributes, seed yield and seed quality in Malwa region of Madhya Pradesh.

## MATERIAL AND METHODS

A field experiment was conducted at vegetable research field, College of Horticulture, Mandsaur. Twelve pea varieties V<sub>1</sub> - Arka Kartik, V<sub>2</sub>-Azad Pea-3, V<sub>3</sub> - Pusa Pragati, V<sub>4</sub> - Kashi Shakti, V<sub>5</sub> - Kashi Samarth, V<sub>6</sub>- Arkel, V<sub>7</sub>- Kashi Mukti, V<sub>8</sub>- Kashi Uday, V<sub>9</sub>- Kashi Nandini, V<sub>10</sub>- Matar Ageta-6, V<sub>11</sub>-Arka Ajit and V<sub>12</sub>-Bonneville were tested in randomized block design with four replications. The soil of the experimental field was sandy clay loam in texture with soil pH 7.86, Electrical conductivity 1.12 dS m<sup>-1</sup>, available nitrogen 203kg/ha, available phosphorus 17.95kg/ha, available potash 392kg/ha. Pure, healthy and good quality seed of pea varieties was sown on 12<sup>th</sup> December in lines at a spacing of 30 x 10 cm and covered with soil. Seeds were sown at a depth of 3-4 cm. Nitrogen, phosphorus and potash were applied at the rate of 50 kg/ha, 90 kg/ha and 50 kg/ha, respectively. According to the treatment the full quantity of the nitrogen, phosphorus and potash were applied as basal at the time of sowing. Other intercultural operations and crop management practices were carried out in accordance with the recommended package of practices. Observations were recorded on plant height at 60 days after sowing (DAS), number of leaves per plant at 60 DAS, number of branches per plant at 60 DAS, fresh weight of plant (g) at harvesting stage, dry weight of plant (g) at harvesting stage, number of root nodules per plant at 30, 45 and 60 DAS, number of node of 1<sup>st</sup> flowering, days taken to 50 percent flowering, number of pods per plant, number of seeds per pod, pod length, shelling percentage, average seed yield per plant, average seed yield per hectare. Pea seed quality was assessed in terms of weight of 100 seed, germination (%) as per ISTA (2) and seed vigour index. The vigour index was calculated adopting the method of Abdul-Baki and Anderson (3).

Vigour Index = Germination % × average seedling length (mm)

The data recorded during the investigation were analyzed statistically as per standard procedure.

## RESULT AND DISCUSSION

### Growth parameters

Observations on plant height, number of leaves per plant, number of branches per plant were recorded at 60 DAS. Fresh weight and dry weight of plant were noted at harvesting stage. The findings pertaining to growth parameters viz., plant height, number of leaves per plant, number of branches per plant, fresh weight of plant, dry weight of plant indicated significant influence of varieties of pea (Table 1).

Kashi Shakti recorded maximum plant height, number of leaves per plant, number of branches per plant, fresh weight of plant and dry weight of plant under study. Minimum plant height, number of leaves per plant, number of branches per plant, fresh weight of plant and dry weight of plant was observed in case of variety Bonneville. Higher plant growth in terms of plant height and number of leaves might have enhanced photosynthesis resulted in more accumulation of food material which was reflected as higher dry weight per plant. These finding were corroborated with those reported by Gupta and Singh (4), Singh and Singh (5).

### Nodulation in pea varieties

There was decrease in number of root nodules with the advancement of growth stage (Table 2). Highest number of root nodules were counted at 30 DAS and lowest at 60 DAS. Kashi Shakti recorded maximum number of root nodules at all the stages under study. Minimum number of root nodules was observed in case of Kashi Uday at 30 and 45 DAS under the investigation. However, at 60 DAS, minimum number of root nodules was observed in case of Kashi Nandini. Contrary to the present findings, Singh *et al.* (6) reported non significant difference among varieties with respect to number of root nodules per plant.

### Phenological parameters

There were significant differences among varieties for number of node of first flower appearance (Table 2). Lowest number of node of first flower appearance was observed in case of Matar Ageta-6 under the study. Kashi Mukti recorded maximum number of node of first flowering

**Table 1.** Growth attributes as influenced with different varieties of pea

Varieties	Plant height (cm)	Number of leaves per plant	Number of branches per plant	Fresh weight of plant (g)	Dry weight of plant (g)
V <sub>1</sub> - Arka Kartik	11.58	11.58	11.58	21.98	9.73
V <sub>2</sub> - Azad Pea-3	12.58	12.58	12.58	23.14	10.32
V <sub>3</sub> - Pusa Pragati	13.17	13.17	13.17	24.47	10.89
V <sub>4</sub> - Kashi Shakti	14.00	14.00	14.00	27.56	11.36
V <sub>5</sub> - Kashi Samarth	13.50	13.50	13.50	26.45	11.33
V <sub>6</sub> - Arkel	11.83	11.83	11.83	21.99	9.78
V <sub>7</sub> - Kashi Mukti	13.08	13.08	13.08	24.08	10.85
V <sub>8</sub> - Kashi Uday	13.00	13.00	13.00	23.18	10.63
V <sub>9</sub> - Kashi Nandini	12.42	12.42	12.42	22.78	10.24
V <sub>10</sub> - Matar Ageta-6	12.33	12.33	12.33	22.36	10.18
V <sub>11</sub> - Arka Ajit	11.42	11.42	11.42	21.17	9.28
V <sub>12</sub> - Bonneville	11.33	11.33	11.33	20.93	8.97
S.Em±	0.61	0.61	0.61	1.56	0.58
CD at 5%	1.76	1.76	1.76	4.50	1.69

**Table 2.** Number of root nodules and phenological parameters as influenced with different varieties of pea

Varieties	Number of root nodules			Number of node of 1 <sup>st</sup> flowering	Days taken to 50% flowering
	30 DAS	45 DAS	60 DAS		
V <sub>1</sub> - Arka Kartik	28.67	18.08	10.58	10.20	57.50
V <sub>2</sub> - Azad Pea-3	30.25	19.00	11.17	10.20	51.75
V <sub>3</sub> - Pusa Pragati	31.25	20.00	11.75	9.60	52.75
V <sub>4</sub> - Kashi Shakti	33.00	22.17	12.00	9.95	55.00
V <sub>5</sub> - Kashi Samarth	32.08	21.08	11.50	9.75	55.50
V <sub>6</sub> - Arkel	30.92	19.08	10.00	9.00	50.50
V <sub>7</sub> - Kashi Mukti	31.08	19.25	11.25	10.55	54.00
V <sub>8</sub> - Kashi Uday	28.67	17.17	10.75	10.10	54.50
V <sub>9</sub> - Kashi Nandini	31.92	20.08	9.83	9.35	51.25
V <sub>10</sub> - Matar Ageta-6	31.58	20.08	10.00	7.95	48.50
V <sub>11</sub> - Arka Ajit	29.00	18.67	10.75	9.90	54.25
V <sub>12</sub> - Bonneville	30.17	18.92	11.08	9.65	55.50
S.Em±	0.87	0.73	0.46	0.40	1.88
CD at 5%	2.50	2.12	1.32	1.16	5.42

under the study. Non significant differences were observed in Arka Kartik, Azad Pea-3, Kashi Uday, Kashi Shakti, Arka Ajit, Kashi Samarth, Bonneville and Pusa Pragati. Genetic makeup of the varieties might be responsible for differences in number of node of first flowering. Similar results have been observed by Gupta and Singh (4), Kumar *et al.* (7) and Hussain *et al.* (8).

Different varieties showed significant difference with regard to days taken to 50% flowering. Variety Matar Ageta-6 recorded minimum days taken to 50% flowering under the study. It was at par with Arkel and Kashi Nandini. Rest of the varieties took significantly higher number of days to 50% flowering as compared to Matar Ageta-6. Maximum days to 50% flowering were taken in case of

Arka Kartik under the study. Number of node of first flowering has positive relation with number of days to 50 % flowering. Lower number of node of first flowering consequently resulted in lesser number of days to 50 % flowering. These results are supported with those of Kalloo *et al.* (9), Qasim *et al.* (10) and Agarwal *et al.* (11).

#### Yield attributes and yield

Number of pods per plant, pod length, number of seed per pod, shelling percentage, seed yield per plant as well as seed yield (q/ha) in different varieties differed significantly. Findings presented in Table 3 indicated that there was significant difference among varieties with respect to number of pods per plant. Maximum number

**Table 3.** Yield attributes and seed yield under different varieties of pea

Varieties	Number of pod per plant	Number of seed per pod	Pod length (cm)	Shelling percent	Seed yield per plant (g)	Seed yield per hectare (q)
V <sub>1</sub>	14.40	6.25	7.28	65.25	14.98	16.61
V <sub>2</sub>	15.70	6.15	7.05	63.25	15.37	17.91
V <sub>3</sub>	18.60	7.70	8.82	62.75	17.64	25.48
V <sub>4</sub>	19.10	6.05	7.01	68.00	19.30	28.01
V <sub>5</sub>	18.90	5.60	6.89	67.25	18.71	26.03
V <sub>6</sub>	14.80	5.40	6.78	61.00	15.24	17.47
V <sub>7</sub>	14.40	5.85	6.94	63.13	14.72	15.74
V <sub>8</sub>	18.50	5.20	6.73	63.00	17.20	24.02
V <sub>9</sub>	18.10	5.83	6.93	63.75	16.38	21.26
V <sub>10</sub>	18.05	5.05	6.30	69.25	16.05	20.18
V <sub>11</sub>	16.30	6.75	7.80	61.75	15.81	19.37
V <sub>12</sub>	13.60	5.55	6.80	63.50	14.58	15.28
S.Em±	1.06	0.49	0.30	1.87	0.93	1.59
CD at 5%	3.07	1.41	0.86	5.39	2.69	4.59

of pods per plant was found in variety Kashi Shakti, which was followed by Kashi Samarth, Pusa Pragati, Kashi Uday, Kashi Nandini and Matar Ageta-6. The lowest number of pods was observed under Bonneville. Differences in varieties for number of pod per plant were also observed by Singh and Singh (5), Kumar *et al.* (7), Ashraf *et al.* (12) and Chadha *et al.* (13).

Number of seeds per pod also showed significant varietal difference. Maximum number of seeds per pod was recorded in variety Pusa Pragati which was at par to Arka Ajit. Minimum number of seeds per pod was observed with Matar Ageta-6. Pod length has positive relationship with number of seeds per pod. These findings are in agreement with Gupta and Singh (4), Singh and Singh (5) and Kalloo *et al.* (9),

Different varieties exhibited significant differences in pod length. Longest pod was found in case of variety Pusa Pragati. It was followed by, Arka Ajit, Arka Kartik, Azad Pea-3, Kashi Shakti and Kashi Mukti with significant difference. Minimum pod length was recorded with Matar Ageta-6. These findings are in agreement with Gupta and Singh (4) and Ashraf *et al.* (12).

There were significant differences among varieties for shelling percentage. Highest shelling percentage was observed in case of variety Matar Ageta-6 which was followed by Kashi Shakti, Kashi Samarth and Arka Kartik with non significant difference. Minimum shelling percentage was recorded with Arkel. These findings are supported with Gupta and Singh (4), Kumar *et al.* (7) and Chadha *et al.* (13).

Though the seed yield per plant was generally low due to late sowing, maximum yield was obtained with Kashi Shakti followed by Kashi Samarth, Pusa Pragati, Kashi Uday, Kashi Nandani and Matar Ageta-6. Minimum seed yield per plant was observed in Bonneville. Maximum seed yield per hectare was found in variety Kashi Shakti which was followed by Kashi Samarth, Pusa Pragati and Kashi Uday with non significant differences. Rest of the varieties differed significantly from Kashi Shakti. Minimum seed yield per hectare was observed in Bonneville. Higher growth and yield attributes consequently resulted in higher seed yield (q/ha). Similar findings have been reported by Kalloo *et al.* (9), Hussain *et al.* (8) and Singh and Gautam (14).

#### Seed quality attributes

Quality of pea seed was studied with respect to germination percentage, 100 seed weight and seed vigour index. Results showed significant influence of varieties on seed germination percentage in pea. Maximum germination percentage was recorded in variety Kashi Mukti which was at par to Arkel, Kashi Shakti, Kashi Uday, Azad Pea-3, Arka Ajit. Kashi Nandini, Kashi Samarth, Pusa Pragati, Matar Ageta-6 and Bonneville. Minimum germination percentage was recorded with Arka Kartik. Similar findings have been reported by Ashraf *et al.* (12) and Singh and Singh (5).

Weight of 100 seed indicated significant difference in pea varieties. Among varieties, maximum 100 seed weight (20.88g) was observed in Matar Ageta-6, followed by Kashi Samarth, Pusa Pragati, Bonneville, Arka Kartik and

**Table 4.** Seed quality attributes under different varieties of pea

Varieties	Germination (%)	Weight of 100 seed (g)	Seed vigour index
V <sub>1</sub> - Arka Kartik	83.75	19.90	1676.00
V <sub>2</sub> - Azad Pea-3	95.00	19.29	2598.50
V <sub>3</sub> - Pusa Pragati	93.25	19.96	1876.75
V <sub>4</sub> - Kashi Shakti	97.00	18.94	2785.75
V <sub>5</sub> - Kashi Samarth	93.50	20.48	2385.00
V <sub>6</sub> - Arkel	97.25	16.78	3662.25
V <sub>7</sub> - Kashi Mukti	97.50	18.21	2749.00
V <sub>8</sub> - Kashi Uday	96.25	17.56	2424.75
V <sub>9</sub> - Kashi Nandini	93.75	16.35	1662.25
V <sub>10</sub> - Matar Ageta-6	92.50	20.88	3328.50
V <sub>11</sub> - Arka Ajit	94.75	19.85	2526.25
V <sub>12</sub> - Bonneville	91.25	19.95	1794.00
S.Em±	2.72	1.11	465.72
CD at 5%	7.84	3.19	1339.99

Arka Ajit with non significant differences. Remaining varieties viz., Azad Pea-3, Kashi Shakti and Kashi Mukti showed significantly low germination as compared to Matar Ageta-6 but all these three were at par with each other. Minimum weight of 100 seed (16.35g) was noted with Kashi Nandini. Similar findings are reported by earlier researchers (7 and 5).

Seed vigour index was highest with Arkel (3662.25) which was at par with Matar Ageta-6, Kashi Shakti, Kashi Mukti, Azad Pea-3, Arka Ajit. Kashi Uday and Arka Kartik. Minimum seed vigour index (1662.25) was determined with Kashi Nandini. Similar results were observed by Kumar *et al.* (7).

The findings of the present study showed that among the twelve improved varieties of pea, Kashi Shakti recorded highest growth and seed yield, which was followed by Kashi Samarth, Pusa Pragati and Kashi Uday with non-significant differences. Kashi Shakti also showed better performance with respect to seed quality, while variety Matar Ageta 6 was earliest, followed by Kashi Nandini and Arkel. Thus, seed production of pea cv. Kashi Shakti can be undertaken in Malwa region.

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