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Evaluation of garden pea (*Pisum sativum* L.) varieties for yield and quality attributes under Malwa region of Madhya Pradesh

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Abstract

An experiment was conducted to see the evaluation of garden pea (*Pisum sativum* L.) varieties for yield and quality attributes under Malwa region of Madhya Pradesh. Result revealed that in the present investigation, the genotypes differed significantly with respect to different yield and quality parameters. A comparison of pea varieties indicated that they differed significantly for yield parameters viz., number of pods per plant, pod length, number of seed per pod, pods weight, pod yield per plant as well as green pod yield per hectare (q/ha) and shelling percentage. Variety Kashi Shakti was recorded highest number of pods per plant (12.59), pod length (10.50 cm), highest number of seeds per pod (9.53), highest average pod weight (4.74 g), highest pod yield per plant (59.68 g/plant), maximum pod yield per hectare (198.92q/ha), highest proportion of shelling (58.80%). Quality parameters viz., TSS and protein content of green pea. The variety Palam Priya has noticed the highest TSS (17.87 °Brix) and highest protein content (16.90g/100g) was observed in variety Kashi Shakti.

Keywords: Pea (*Pisum sativum* L.), varieties, yield parameters, quality parameters

Introduction

Garden pea (*Pisum sativum* L. var. *hortense*) belongs to the family Fabaceae (Leguminosae) is also called sweet pea is a choice vegetable grown for its fresh shelled green seeds rich in protein (7.2%), vitamins and minerals. Peas are grown for their soft immature and mature dry pods. Immature pods are used as fresh vegetables and mature dried pods are used as pulses. In both situations, the pea seeds are separated from the pod and used as a vegetable or pulses and as well as in making soup (Kumari and Deka, 2021) [13]. The pea cultivars, cultivated by the vegetable growers in Madhya Pradesh particularly are very low in yield and their quality. Indian pea varieties do not compete with the varieties grown in the many other countries. The productivity of pea in India is less than many other pea growing countries. This could be attributed to the lack of suitable cultivars for different pea growing regions in the country. Though, many new varieties have been developed in India through varietal development programme under different SAU's and ICAR institutes. Varieties either introduced or developed during very early continue to dominate its cultivation. Therefore, evaluation of varieties for higher yield, suitable for different agro-climatic conditions is necessary to enhance production and productivity of vegetable pea. India is the world's second-largest producer of garden pea, after China and tenth ranks among vegetable crops in terms of productivity. Pea is grown on around 568.00 thousand hectares in India, with a total yield of 5791 thousand MT (Anonymous, 2020) [2]. In India, Peas are grown in Uttar Pradesh, Madhya Pradesh, Assam, Jharkhand, Himachal Pradesh, West Bengal, Punjab, Rajasthan, Haryana, Uttarakhand and Bihar. In Madhya Pradesh, total production is 961.55 thousand MT with 94.99-thousand-hectare area and productivity 10.12 MT per hectare (Anonymous, 2018) [3]. Important pea growing districts of Madhya Pradesh are Jabalpur, Ratlam, Chhindwara, Ujjain, Narsinghpur, Dewas, Tikamgarh, Gwalior, Datia and Seoni etc.

To eradicate the malnutrition problem and improve the protein deficient diet and low yield of pea, it is necessary to increase pea production per unit area to meet out the requirement of increasing population of the nation. Besides, good agronomic practices like growing high yielding varieties, providing proper spacing, irrigation, use of fertilizers, optimum sowing time and appropriate plant protection measures to be essentially followed in order to increase the productivity. Among all these factors, identification of high yielding varieties for certain region is most important.

Cultivar performs differently under various agro-climatic conditions and various cultivars of same species grown even in same environment often have yield differences. Yield and quality of crop are very complex characteristics depending on certain biological alignments between environment and heredity. The characteristics of a cultivar as well as combination of traits differ according to the climatic conditions of the localities (Damor *et al.*, 2017)^[7].

Material and Methods

The present field experiment entitled “Evaluation of garden pea (*Pisum sativum L.*) varieties for growth, yield and quality attributes under Malwa region of Madhya Pradesh” was carried out at the vegetable Research Farm, Department of Vegetable Science, College of Horticulture (M.P.) during the Rabi season of 2020-21. Experiment was conducted at Bahadari Farm, College of Horticulture, Mandsaur (MP). The experiment was laid out in the randomized block design with three replications. Pure, healthy and good quality seed of pea varieties *viz.* V₁ –(Arka Ajit), V₂ (Arka Apoorva), V₃ (Arka Kartik), V₄ (Arka Priya), V₅ (Arkel), V₆ (Azad Pea-3), V₇ (Kashi Ageti), V₈ (Kashi Mukti), V₉ (Kashi Nandini), V₁₀ (Kashi Samarth), V₁₁ (Kashi Samridhi), V₁₂ (Kashi Shakti), V₁₃ (Kashi Uday), V₁₄ (Matar Ageta-6), V₁₅ (Matar Ageta- 7), V₁₆ (Palam Priya), V₁₇ (Palam Sumool), V₁₈ (Palam Triloki), V₁₉ (PSM-3), V₂₀ (Punjab-89), V₂₁ (Pusa Pragati), V₂₂ (Pusa Shree) with 22 different varieties was obtained from Department of Vegetable Science, College of Horticulture, Mandsaur (M.P.). Five plants were randomly selected and tagged from each treatment under each replication excluding the border plants. Observation data were recorded of the tagged plants for the yield and quality attributes

Yield attributes

- Number of pods per plant:** The number of pods was counted in 5 randomly selected plants in each picking and average was worked out for each treatment.
- Pod length (cm):** Length of 10 randomly selected pods was measured after each harvesting and mean was calculated for each treatment. The pod length was measured with the help of scale and average values were worked out.
- Average pod weight (g):** Ten green pods were taken randomly during second picking from each plot and their weight was worked out on digital balance and average value work out.
- Number of seeds per pod:** Ten pods were taken out randomly at the time of picking. The pods were shelled for counting the seeds per pod. Thereafter, average values were worked out.
- Pod yield (g/plant):** The weight of total pod produced from tagged plants was recorded in gram with the help of electronic balance and average was worked out.
- Pod yield (q/ha):** Green pod obtained in each plot was recorded with help of digital weighing balance and converted into green pod yield (q/ha) from each treatment.
- Shelling per cent:** Shelling percentage was calculated with taking total weight of 10 green pods per plant and total weight of fresh green seed from these pods by following formula:

$$\text{Shelling percentage \%} = \frac{\text{Weight of green seed}}{\text{Total weight of green pod}} \times 100$$

Quality attributes

- T.S.S. (°Brix):** The total soluble solid was determined by hand refractometer, which was recorded in °Brix.
- Protein content (g/ 100 g):** Procedure for protein content analysis: - Weight 0.5 g of green seed sample in to 500 ml dry distillation tube. Add 25 ml of H₂SO₄ and add 5 g Digestion mixture and digested the content on Kel plus-12 digestion. The digested sample was distilled off on kel-plus automatic nitrogen analyzer. Distill the sample by adding concentrate NaOH and steam for 3 minutes. Absorb the ammonia gas in 0.5 N standard H₂SO₄ added with drops of methyl red indicator. After distillation, sulfuric acid solutions titrated against 0.5 N NaOH blank is also run, and titration is carried out to the same end point as that of the sample. The nitrogen content in plant samples is calculated and then calculated the protein content in pod as follows:

$$\text{Protein content} = \text{Nitrogen content} \times 6.25$$

Results and Discussion

Yield attributes

A comparison of pea varieties indicated that they differed significantly for number of pods per plant, pod length, number of seed per pod, pods weight, pod yield per plant as well as green pod yield per hectare (q/ha) and shelling percentage.

The variety Kashi Shakti ranked first for number of pods per plant. Varieties Kashi Samarth, Kashi Samridhi, Kashi Nandini, Pusa Pragati, PSM-3 and Punjab-89 were next in order to merit. On the other hand, variety Palam Priya was observed lowest number of pods per plant; it was followed by Pusa Shree, Palam Sumool, Palam Triloki, Arka Apoorva, Arka Ajit and Arka Priya. The differences in number of pods per plant may be due to its inherent genetic setup and suitability of climate and soil conditions of this region (Damor *et al.*, 2017)^[7] as similarly reported by Bhusashan *et al.* (2013)^[5], Kanchan *et al.* (2017)^[10], Sirwaiya and Kushwah (2018)^[20] and Kanwar *et al.* (2020)^[11].

The longest pod was found in variety Kashi Shakti. It was followed by Kashi Samarth, Kashi Samridhi, Kashi Nandini, Pusa Pragati, PSM-3 and Punjab-89, all of which are comparable to each other. Variety Palam Priya and Pusa Shree both have the shortest pod length. Variation in pod length could be assigned to their genetic characters (Damor *et al.*, 2017)^[7]. Such type of varietal differences for pod length was also reported by Mukherjee *et al.* (2013)^[14], Datta and Das (2018)^[8], Sirwaiya and Kushwah (2018)^[20] and Devi *et al.* (2021)^[9].

The highest number of seeds per pod was recorded in variety Kashi Shakti, which was followed by Kashi Samarth, Kashi Samridhi, Kashi Nandini, Pusa Pragati, PSM-3 and Punjab-89. The least number of seed per pod was observed with Palam Priya. Variation in number of seeds may be due to their genetical characters and environmental condition (Damor *et al.*, 2017)^[7]. Difference in number of seed per pod in garden pea varieties was also reported by Chadha *et al.* (2013)^[6], Datta and Das (2018)^[8], Sirwaiya and Kushwah (2018)^[20],

Kanwar *et al.* (2020)^[11] and Raj *et al.* (2020)^[16] and Devi *et al.* (2021)^[9].

Variety Kashi Shakti received the highest average pod weight which was followed by Kashi Samarth, Kashi Samridhi, Kashi Nandini and Pusa Pragati. The order of the remaining variations differed significantly. The smallest average pod weight had recorded in variety Palam Priya. It may be due to inherent genetic constitution (Damor *et al.*, 2017)^[7]. Similar results were also reported by Bhushan *et al.* (2014)^[5], Sharma *et al.* (2016)^[17] and Kanwar *et al.* (2020)^[11].

The highest pod yield per plant was recorded in variety Kashi Shakti it was followed by variety Kashi Samarth, Kashi Samridhi, Kashi Nandini, Pusa Pragati, PSM-3, Punjab-89, Matar Ageta-6 and Kashi Mukti. Variety Palam Priya had recorded the lowest pod yield per plant. Among the yield determinate parameters such as number of pods per plant, pod length, average pod weight, only one parameter was not found as the determinate character for yield estimation. However, combination of number of pods and average pod weight directly influenced the green pod yield per plant. Similar result has been reported by Chadha *et al.* (2013)^[6], Afreen *et al.* (2017)^[1], Khichi *et al.* (2017)^[12] and Kanwar *et al.* (2020)^[11]. Variety Kashi Shakti had recorded the maximum pod yield per hectare it was followed by Kashi Samarth,

Kashi Samridhi, Kashi Nandini, Pusa Pragati and PSM-3. In variety Palam Priya had the minimum pod yield per hectare. This might be due to congenial climatic condition like cool relative humidity, low temperature and optimum photoperiod for luxuriant vegetative growth and flowering which favors better pods production. This may possibly be due to its good plant growth and comparatively a greater number of primary branches causing greater assimilation of the photosynthates which ultimately resulted into higher yield (Bairwa *et al.*, 2018)^[4]. The difference in green pod yield may be attributed mainly to the difference in number of pods per plant, average pod weight and pod yield per plant. These results were in supported by Chadha *et al.* (2013)^[6] and Kanwar *et al.* (2020)^[11].

The highest proportion of shelling was observed by variety Kashi Shakti it was followed by Kashi Samarth, Kashi Samridhi, Kashi Nandini, Pusa Pragati, PSM-3 and Punjab-89. The variety Palam Priya had the lowest shelling percentage. Variation in shelling percentage may be due inherent characters of different variety and its genetic setup (Damor *et al.*, 2017)^[7]. Such type of varietal differences was also reported by Mukherjee *et al.* (2013)^[14], Phomet *et al.* (2014)^[15], Datta and Das (2018)^[8], Sirwaiya and Kushwah (2018)^[20] and Devi *et al.* (2021)^[9].

Table 1: Performance of different pea varieties for Yield attributes

T/t	Varieties	Number of pods per plant	Pod length (cm)	Number of seeds per pod	Average pod weight (g)	Pod yield (g/plant)	Pod yield (q/ha)	Shelling percent (%)
V ₁	Arka Ajit	9.97	7.87	7.00	3.62	35.89	119.64	44.00
V ₂	Arka Apoorva	9.75	7.87	6.79	3.60	35.00	116.67	43.84
V ₃	Arka Kartik	10.35	7.95	7.13	3.70	37.88	126.27	44.67
V ₄	Arka Priya	10.15	7.93	7.13	3.66	36.74	122.48	44.67
V ₅	Arkel	10.50	8.53	7.27	3.84	39.90	133.00	45.93
V ₆	Azad Pea-3	10.48	8.26	7.19	3.80	39.30	131.01	45.60
V ₇	Kashi Ageti	10.43	8.24	7.18	3.79	38.88	129.60	45.57
V ₈	Kashi Mukti	11.06	8.65	7.40	4.01	44.35	147.84	46.65
V ₉	Kashi Nandini	12.01	9.57	8.72	4.46	53.56	178.55	49.53
V ₁₀	Kashi Samarth	12.37	9.73	8.87	4.62	57.15	190.50	53.80
V ₁₁	Kashi Samridhi	12.27	9.66	8.73	4.47	54.85	182.82	50.80
V ₁₂	Kashi Shakti	12.59	10.50	9.53	4.74	59.68	198.92	58.80
V ₁₃	Kashi Uday	10.89	8.63	7.40	3.94	41.82	139.39	46.07
V ₁₄	Matar Ageta-6	11.19	8.78	7.47	4.18	46.77	155.91	46.93
V ₁₅	Matar Ageta-7	10.37	8.08	7.17	3.71	38.59	128.64	44.92
V ₁₆	Palam Priya	8.58	7.00	6.04	3.33	28.97	96.57	39.12
V ₁₇	Palam Sumool	8.80	7.15	6.40	3.59	33.81	112.68	42.27
V ₁₈	Palam Triloki	9.50	7.47	6.60	3.61	34.11	113.68	43.30
V ₁₉	PSM-3	11.39	9.33	8.27	4.29	48.86	162.88	47.47
V ₂₀	Punjab-89	11.33	9.07	8.01	4.26	48.27	160.89	47.00
V ₂₁	Pusa Pragati	11.59	9.37	8.47	4.31	49.95	166.51	48.00
V ₂₂	Pusa Shree	8.70	7.00	6.08	3.43	30.18	100.61	40.33
	S.Em (±)	0.17	0.14	0.12	0.11	0.93	4.31	0.84
	CD 5%	0.49	0.40	0.35	0.30	2.65	12.30	2.40

Quality attributes

TSS and protein content are desirable character in green pea. In the present investigation varieties differed significantly with regard to TSS and protein content of green pea. Quality parameters studied in pea were TSS and protein content, which were significantly influenced by the varieties.

The variety Palam Priya has noticed the highest TSS which was followed by Arka Ajit, Punjab-89, Kashi Nandini, and Arkel. The lowest TSS was recorded in variety Pusa Shree. The difference in TSS content could be attributed to inherent

Similar results were reported by Khichi *et al.* (2017)^[12], Sharma *et al.* (2020)^[18] and Devi *et al.* (2021)^[9].

The highest protein content was observed in variety Kashi Shakti which was followed by Kashi Samarth, Kashi Samridhi and Kashi Nandini, all of which were comparable. Variety Palam Priya was observed the lowest protein content in green seeds of pea. These differences in protein content in different varieties occurred due to their varying genetic makeup (Damor *et al.*, 2017)^[7]. Such type of varietal differences was also reported by Singh *et al.* (2015)^[19].

Table 2: Performance of different pea varieties for Quality attributes

T/t	Varieties	T.S.S. (°Brix)	Protein content (g/100 g)
V ₁	Arka Ajit	17.66	6.10
V ₂	Arka Apoorva	15.67	6.00
V ₃	Arka Kartik	16.94	6.17
V ₄	Arka Priya	16.68	6.16
V ₅	Arkel	17.23	6.53
V ₆	Azad Pea-3	14.83	6.45
V ₇	Kashi Ageti	16.23	6.43
V ₈	Kashi Mukti	16.03	6.61
V ₉	Kashi Nandini	17.32	7.08
V ₁₀	Kashi Samarth	15.40	7.14
V ₁₁	Kashi Samridhi	15.27	7.12
V ₁₂	Kashi Shakti	16.90	7.32
V ₁₃	Kashi Uday	15.47	6.57
V ₁₄	Matar Ageta-6	16.79	6.71
V ₁₅	Matar Ageta-7	15.53	6.22
V ₁₆	Palam Priya	17.87	5.09
V ₁₇	Palam Sumool	16.32	5.21
V ₁₈	Palam Triloki	17.03	5.23
V ₁₉	PSM-3	16.59	6.82
V ₂₀	Punjab-89	17.40	6.72
V ₂₁	Pusa Pragati	17.09	6.88
V ₂₂	Pusa Shree	14.20	5.15
	S.Em (±)	0.30	0.30
	CD 5%	0.86	0.86

Conclusion

On the basis of present experiment, it may be concluded that variety Kashi Shakti was superior in yield attributes as number of pods per plant, pod length, number of seed per pod, pods weight, pod yield per plant as well as green pod yield per hectare followed by Kashi Samarth, Kashi Samridhi, Kashi Nandini and Pusa Pragati. Variety Palam Priya was best in T.S.S. followed by Arka Ajit, Punjab-89, Kashi Nandini and Arkel. Kashi Shakti was substantially better than other varieties in terms of protein content. Based on the result obtained from evaluation of pea varieties, Kashi Shakti, Kashi Samarth, Kashi Samridhi, Kashi Nandini, Pusa Pragati, Palam Priya and PSM-3 are the best for yield and quality parameters. Hence, it can be concluded these varieties may be adopted for commercial cultivation in Malwa region of Madhya Pradesh.

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