Assessment of Yield and quality attributes of Garden pea (*Pisum sativum.* L) Varieties under Shade House Condition

ABSTRACT: The present study investigated the yield potential of fifteen varieties of Garden pea from various sources across the country. The varieties were evaluated for yield and quality attributes at Department of Horticulture, College of Agriculture, UAS, GKVK, Bengaluru, India between Rabi 2019-20 and 2020-21. Most of the major yield and quality contributing characters were significantly differed in the experiment. Out of the fifteen varieties tested, highest pod length (10.98 cm), pod weight (9.38 g), higher pod width (2.87 cm), number of pod per plant (19.35), yield of pods per plant (92.62 g), per plot (3.15 kg), per hectare (157.50 q ha-1 tonnes) were registered in T_{10} (Arka Apoorva), and number of green peas per pod (9.87), were registered in T_9 (Arka Karthik). Whereas T_3 (Kashi Nandini) produced the days to first flower (41.56), and days to fifty percent flowering (52.08) were observed in T_7 (PSM-4). Garden Pea being one of the most suitable vegetable crops for Rabi cultivation, the identified varieties could be raised by the farming community of the region for enhanced yield and economic benefits.

Keywords: Garden pea, Varieties, performance, yield, quality, Shade house condition.

Introduction

Garden Pea (*Pisum sativum* L.) is an essential cool-season legume vegetable crop (Rabbi *et al*., 2011). Relatively high or low temperatures are the primary variables restricting garden pea growing, widely disseminated in regions with a mild and warm climate (Ambrose, 2008). The five species of the genus Pisum, which are primarily found in the Mediterranean region are and West Asia P. fulvum, P. abyssinicum, P. sativum L., P. humile, and P. elatius (Verhinin *et al*., 2003) and of which only P. sativum is cultivated, having a chromosome number 2n=14, plant is short lived, herbaceous annual

which climbs by leaflets tendrils. It is a nutritious vegetable and rich source of protein, and essential amino acid particularly lysine (Nawab *et al*, 2008) carbohydrate, Vit-A, Vit-C, potassium, phosphorous, minerals, dietary fibers and antioxidant compounds. Each 100 g edible portion of the green pea contains moisture 78 g, protein 6.3 g, carbohydrates 14.4 g, energy 84 K cal, calcium 26 mg, phosphorus 116 mg, iron 1.9 mg and vitamin A 640 IU (Urbano *et al*., 2003) (Kichi *et al.*, 2003) .

On the basis of seed pea cultivars are divided into two classes, i.e., smooth or wrinkle seeded types; on the basis of height cultivars are classified into three classes, i.e., bush, medium tall and tall types and according to maturity three classes are early, midseason and late cultivars (Datta and Das, 2018). Garden pea is consumed as fresh or cooked vegetable, it is also consumed as processed products like canned, dehydrated and frozen for consumption in off season. In India garden pea occupies about 2.5% of total vegetable production with 9.8 t ha^{-1} of average national productivity (Anonymous, 2018). India is the largest producer of garden pea next to China (Anonymous, 2011).

Due to the enormous number of garden pea varieties that are currently available on the market and the aforementioned problems, it is necessary to compare some of the variations and choose high yielding, more adaptable variants for commercial production in any given region. Present investigation was focused on identifying superior and promising garden pea varieties in respect to yield and other quality contributing characters under southern region of Karnataka. In this context the current investigation assumes relevance.

Material and methods

The field study was carried out at the Horticulture Research Station, Department of Horticulture, College of Agriculture, UAS, GKVK, Bengaluru, during the academic years 2019–20 and 2020–21 from October to January. Material comprised fifteen different types of garden peas choosen from across the nation. The experiment was triple-replicated using a Randomized complete block design.

Each replication maintained a plot size of (2.1 m x 0.9 m) for each treatment. Vermicompost and fertilizer doses were applied as a result, during the preparation of the experimental plot land, 10 tonnes of FYM, 12.5 kg of Nitrogen, 75 kg of Phosphorus, and

50 kg of potash were applied per hectare, and 12.5 kg of Nitrogen was applied at 30 days after sowing.

The seeds were sown on beds at a depth of 4 to 5 cm using the dibbling method, with a spacing of 30 cm x 10. The cultural practices as recommended were uniformly followed. Observations were recorded on five plants from each replication in each Variety for various Yield and yield contributing characters as suggested by Mahajan *et al*., (2000). The mean data were subjected to statistical analysis as suggested by Panse and Sukhatme (1978).

RESULTS AND DISCUSSION

Yield attributes

The results indicated the existence of significant differences among the Garden Pea Varieties for all the yield traits observed (Table 1, 2 ,3 & 4). From two years average, significantly lesser number of days taken to first flowering (41.56) was recorded in T_3 (Kashi Nandini) which was followed by T_7 (PSM-4) (42.51) and T_1 (Kashi Mukti) (42.61) while the most days taken to first flowering (55.08) was observed in T_{15} (Magadi Local) and lesser number of days taken to 50 per cent flowering (52.08) was recorded in T_7 (PSM-4) which was followed by T_5 (PSM-2) (53.31) and T_8 (PSM-6) (53.69), while most days taken to 50 per cent flowering (68.81) was observed in T_{15} (Magadi Local). Differences in flowering period may be attributed to genetic differences among the cultivars. These results are in conformity with Sharma and Rajesh Kumar (2017), in chilli. Longer length of green pod (10.98), was observed in T_{10} (Arka Apoorva) which was at par with T_9 (Arka Karthik) (10.70 cm) and T_8 (PSM-6) (10.55 cm), while the lowest length of green pod (7.65) was recorded in T_{15} (Magadi Local) .The difference in average length of pod of different Varieties due to their genetic make-up had already been observed and reported by Bhushan *et al*. (2013), Sharma *et al.* (2013). From two years average, significantly wider green pods (2.69), was observed in T_{10} (Arka Apoorva) which was followed with with T_9 (Arka Karthik) (2.68 cm), T_{13} (Kashi Shakti) (2.30 cm) and T_{11} (Arka Uttam) (2.25 cm), while, the lowest width (1.46 cm) of green pod was recorded in T_{15} (Magadi Local). Such variation for width of pod has been reported by Kumar and Kohali (2001) More weight of green pod was (9.38 g), was recorded in T_{10} (Arka Apoorva) which was followed by T_9

(Arka Karthik) (9.35 g) and T_{13} (Kashi Shakti) (9.24 g), while the least weight of green pod (7.19 g) was recorded in T_{15} (Magadi Local) (C). Variations in the weight of green pods might be due to genetic charecteristics of each variety of Garden Peas. Kumar and Kohali (2001) also reported similar findings from their experiment on Garden Pea. In the present study, higher number of green peas per pod (9.87) was recorded in T_9 (Arka Karthik) which was at par with T_{10} (Arka Apoorva) (9.47), T_{14} (Pant Uphar) (9.16) and T_8 (PSM-6) (9.04). While, the lowest number of green peas per pod (6.17) was recorded in T_{15} (Magadi Local). Among the garden pea varieties evaluated, higher numbers of pods per plant (19.35), was obtained in T_{10} (Arka Apoorva) which was followed with T_9 (Arka Karthik) (17.32) and T_8 (PSM-6) (15.35), while the lowest number of pods per plant (8.33) was recorded in T_{15} (Magadi Local) (C). Variation in number of Green Peas per pod and number of pods per plant may be due to their genetical characteristics which might have been influenced by high relative humidity inside the Shade house triggering the vegetative growth resulting in improved fruit production. Highest number of pods per plant was produced by plants receiving optimal dose of nutrition coupled with factors like light, water etc. These conditions might have favoured for lateral growth of the plants as well as higher number of pods per plant. Similar variations in number of green pods per plant among different varieties were reported by Naik (2005) and Dubey *et al.* (2017), in capsicum. Higher hundred pod weight (970.48 g) was obtained in T_9 (Arka Karthik) which was followed with T_4 (Kashi Uday) (951.39 g) and T_8 (PSM-6) (946.50 g), while the lowest number of pods per plant (546.92 g), was recorded in T_{15} (Magadi Local). The difference in hundred pod weight of different Varieties due to their genetic make-up had already been observed and reported by Ankur *et al.* (2006), Khan *et al.* (2013). Higher hundred seed weight (42.89 g), was obtained in T_{10} (Arka Apoorva) which was followed by T_9 (Arka Karthik) (42.24 g) and T_8 (PSM-6) (42.01 g), while the lowest of hundred seed weight (29.53) was recorded in T_{15} (Magadi Local). Similar variations were observed in Chadha *et al.* (2013) in Garden pea**.** Lesser days taken for commencement of first pod (41.51) after sowing was recorded in T_8 (PSM-6) which was significantly followed with T_4 (Kashi Uday) (42.03) and T_6 (PSM-3) (42.87), while more days taken for commencement of first pod (56.99) was observed in T_{15} (Magadi Local). Similar findings were observed in Amin *et al.* (2014), and Patel *et al*

(2006). From pooled data of combined analysis, significantly more days taken for last picking after sowing (112.87) was observed in T_{10} (Arka Apoorva) which was statistically at par with T_{11} (Arka Uttam) (111.24) and T_9 (Arka Karthik) (111.17), while the least days taken for last picking after sowing (97.80) was observed in T_4 (Kashi Uday). Similar findings were reported in Amin *et al.* (2014), and Patel *et al* (2006). Higher yield of pods per plant (92.62 g) was recorded in T_{10} (Arka Apoorva) which was followed by T_9 (Arka Karthik) (85.29 g) and T_{13} (Kashi Shakti) (84.17), while the lowest yield of pods per plant (45.76 g), was recorded in T_{15} (Magadi Local). Such type of varietal differences was also reported by Jakhar *et al.* (2017), and Singh *et al.* (2017), in capsicum.

The pod yield plot^{-1} ranged from 1.22 to 3.25 kg^{-1} higher green pod yield per plot (3.15 kg/plot) was recorded in variety T_{10} (Arka Apoorva) which was followed with T_9 (Arka Karthik) (2.80 kg/ plot) and T_{13} (Kashi Shakti) (2.69 kg/ plot) while the lowest green pod yield per plot (1.22 kg/ plot) was recorded in T_{15} (Magadi Local). Higher green pod yield per hectare (157.50 q/ ha) was recorded in T_{10} (Arka Apoorva) which was significantly superior over rest of varieties, followed by T_9 (Arka Karthik) (139.75 q/ ha) and T_{13} (Kashi Shakti) (134.25 q/ ha) whereas the lowest green pod yield per hectare (60.75 q/ha) was recorded in T_{15} (Magadi Local). The differences in yield could be attributed to the differential genetic make-up and adaptability for the given agro climatic conditions by the hybrids as reported by Thorat *et al.* (2009) in cluster bean.

Variations in green pod yield per plant among different Garden Peas varieties might be due to the varietal differences along with climatic factor. The varieties that have demonstrated superior yield performance have a significantly greater number of primary branches and leaves on them, as well as greater number of nodes. This could have resulted in more food material being synthesized and supplied to the pods, increasing the weight of the pod and the number of seeds, and ultimately resulting in higher pod yield. Similar variations in yield parameters among different varieties were reported by Amjad and Anjum (2002), Ankur *et al.* (2006), Khan *et al.* (2013),

Table: 1 Days to first flowering and days to fifty per cent flowering in Garden Pea varieties grown under shade house condition

Treatments (Varieties)	Days to first flowering			Days to 50 % flowering		
	2019-20	2020-2021	Pooled average	2019-20	2020-2021	Pooled Average
T_1 (Kashi Mukti)	43.80	41.55	42.61	54.67	53.20	54.14
T_2 (Kashi Ageti)	43.00	46.12	44.09	55.69	58.00	57.33
T_3 (Kashi Nandini)	42.73	41.53	41.56	55.25	52.68	53.79
T_4 (Kashi Uday)	44.57	42.07	43.03	54.69	53.28	53.73
T_5 (PSM-2)	50.94	51.27	51.05	52.16	54.60	53.31
T_6 (PSM-3)	52.27	53.66	52.95	57.38	53.67	55.26
T_7 (PSM-4)	41.67	43.00	42.51	50.62	53.73	52.08
T_8 (PSM-6)	42.27	50.33	45.78	52.91	54.27	53.69
T_9 (Arka Karthik)	42.67	44.58	43.70	62.33	61.80	62.25
T_{10} (Arka Apoorva)	42.00	43.87	43.23	61.88	61.93	61.56
T_{11} (ArkaUttam)	43.57	47.53	45.35	61.20	58.13	59.57
T_{12} (Kashi Samriddhi)	52.73	44.93	48.76	63.42	59.79	62.19
T_{13} (Kashi Shakti)	53.13	51.60	52.42	58.82	57.62	58.19
T_{14} (PantUphar)	52.47	53.20	53.01	58.25	57.92	58.02
T_{15} (Magadi Local)	56.13	54.78	55.08	69.27	67.73	68.81
S.Em (±)	**1.01**	**0.77**	**0.54**	**1.21**	**0.90**	**0.70**
C.D.@ 0.5%	**2.92**	**2.24**	**1.56**	**3.49**	**2.62**	**2.02**

Table 2: Performance of Garden pea varieties for Yield traits

Treatments (Varieties)	Length of pod (cm)			Width of pod (cm)			Weight of pod (g)			Number of green peas per pod			Number of pods per plant		
	2019-20	2020-21	Pooled average	2019-20	2020-21	Pooled average	2019-20	2020-21	Pooled average	2019-20	2020-21	Pooled average	2019-20	2020-21	Pooled average
T_1 (Kashi Mukti)	9.15	9.08	9.12	1.73	1.67	1.66	6.00	6.16	6.08	8.51	8.46	8.49	9.40	8.49	8.95
T_2 (Kashi Ageti)	8.60	7.56	8.16	1.78	1.59	1.67	7.74	7.54	7.68	7.75	8.30	8.03	9.20	8.58	8.89
T_3 (Kashi Nandini)	8.83	8.37	8.58	1.86	1.85	1.86	6.81	6.74	6.71	7.07	8.00	7.54	10.04	9.49	9.77
T_4 (Kashi Uday)	9.37	9.25	9.34	1.94	1.87	1.88	8.31	7.67	7.95	8.80	8.33	8.57	10.92	11.18	11.05
T_5 (PSM-2)	9.41	9.36	9.44	1.62	1.55	1.60	9.31	8.11	8.73	9.00	8.27	8.64	10.20	9.63	9.91
T_6 (PSM-3)	6.43	6.75	6.60	1.82	1.67	1.73	7.58	7.31	7.40	8.40	7.80	8.10	11.33	9.51	10.42
T_7 (PSM-4)	9.61	8.47	9.13	1.72	1.50	1.64	6.16	6.43	6.35	8.73	8.13	8.43	12.31	10.43	11.37
T_8 (PSM-6)	10.15	10.95	10.55	2.13	1.86	1.98	6.46	6.32	6.45	9.47	8.60	9.04	16.48	15.32	15.35
T_9 (Arka Karthik)	10.49	11.10	10.70	2.87	2.46	2.68	9.61	9.10	9.35	10.53	9.20	9.87	17.75	16.88	17.32
T_{10} (Arka Apoorva)	10.75	11.25	10.98	2.75	2.62	2.69	9.48	9.35	9.38	9.42	9.53	9.47	19.73	18.97	19.35
T_{11} (Arka Uttam)	9.71	9.03	9.25	2.71	1.80	2.25	6.68	6.54	6.58	8.93	8.47	8.70	11.62	10.32	10.97
T_{12} (Kashi Samriddhi)	9.15	9.12	9.10	1.77	1.69	1.72	7.56	8.56	8.00	8.65	7.20	7.93	9.64	9.47	9.56
T_{13} (Kashi Shakti)	10.23	9.63	9.91	2.48	2.26	2.30	9.39	9.12	9.24	8.13	6.87	7.50	10.64	9.85	10.24
T_{14} (Pant Uphar)	9.58	8.96	9.32	1.83	2.52	2.18	7.29	7.49	7.40	8.84	9.47	9.16	8.66	9.08	8.87
T_{15} (Magadi Local)	7.59	7.63	7.65	1.54	1.37	1.46	6.93	7.46	7.19	6.60	5.73	6.17	8.17	8.49	8.33
S.Em (±)	**0.21**	**0.20**	**0.10**	**0.09**	**0.07**	**0.04**	**0.16**	**0.23**	**0.13**	**0.39**	**0.48**	**0.29**	**0.49**	**0.50**	**0.39**
C.D.@ 0.5%	**0.61**	**0.58**	**0.29**	**1.26**	**1.20**	**1.13**	**1.47**	**0.66**	**0.37**	**1.12**	**1.39**	**0.83**	**1.43**	**1.45**	**1.13**

Table 3: Performance of Garden pea varieties for Yield traits.

Treatments (Varieties)	Hundred Pod weight (g)			Hundred seed weight (g)			Days to first pod Picking			Days to last pod picking			Days to marketable maturity		
	2019-20	2020-21	Pooled average	2019-20	2020-21	Pooled average	2019-20	2020-21	Pooled average	2019-20	2020-21	Pooled average	2019-20	2020-21	Pooled average
T_1 (Kashi Mukti)	753.87	773.87	768.44	36.87	32.47	34.72	51.71	52.40	52.30	92.20	105.47	99.00	63.00	67.18	64.84
T_2 (Kashi Ageti)	674.13	680.80	673.36	41.41	39.22	40.43	55.07	52.91	53.86	93.13	104.80	98.69	61.27	62.64	61.93
T_3 (Kashi Nandini)	767.33	794.00	787.69	40.80	41.35	41.16	57.80	55.71	56.59	94.53	101.67	98.32	55.07	62.73	59.81
T_4 (Kashi Uday)	962.92	931.07	951.39	42.31	40.36	41.67	41.00	42.60	42.03	95.60	100.73	97.80	56.40	59.33	57.87
T_5 (PSM-2)	731.40	758.07	742.50	39.01	32.27	35.64	48.77	45.87	47.14	94.53	106.20	100.72	70.02	64.09	67.02
T_6 (PSM-3)	642.93	616.27	642.32	42.67	40.70	41.74	44.51	40.91	42.87	95.67	104.47	100.14	62.31	65.60	63.93
T_7 (PSM-4)	632.40	645.73	646.60	36.16	32.00	33.66	46.52	44.47	44.99	93.53	108.73	101.59	69.75	66.53	67.89
T_8 (PSM-6)	935.00	958.33	946.50	42.73	41.24	42.01	42.11	41.06	41.51	97.67	104.07	101.01	60.53	64.33	61.29
T_9 (Arka Karthik)	973.87	960.93	970.48	41.36	42.75	42.24	55.64	54.07	54.92	108.60	115.07	111.17	72.81	72.14	72.04
T_{10} (Arka Apoorva)	912.00	931.28	922.84	45.52	40.26	42.89	54.86	51.50	53.41	108.20	116.73	112.87	72.24	70.58	71.58
T_{11} (Arka Uttam)	855.67	755.67	810.11	38.48	37.07	37.78	52.86	53.07	52.47	110.07	112.60	111.24	72.80	67.30	70.10
T_{12} (Kashi Samriddhi)	654.47	667.80	655.38	38.13	36.66	36.72	51.00	47.93	49.53	97.27	106.53	102.14	71.80	64.30	65.10
T_{13} (Kashi Shakti)	749.07	729.07	737.08	36.13	35.00	35.29	50.60	46.67	48.43	96.40	106.67	101.40	55.40	58.33	55.67
T_{14} (Pant Uphar)	746.20	692.87	720.77	33.80	32.82	32.98	53.28	47.60	50.28	97.33	115.00	106.46	61.27	62.64	61.93
T_{15} (Magadi Local)	555.93	542.60	546.92	30.20	28.87	29.53	57.33	55.60	56.99	109.13	117.27	112.92	76.43	73.45	74.60
S.Em (±)	**16.43**	**17.51**	**8.40**	**1.20**	**1.06**	**0.75**	**2.15**	**1.11**	**1.03**	**1.53**	**4.39**	**3.23**	**1.84**	**2.25**	**0.98**
C.D.@ 0.5%	**47.58**	**50.72**	**24.33**	**3.48**	**3.08**	**2.18**	**6.22**	**3.23**	**2.99**	**4.44**	**12.73**	**9.34**	**5.33**	**6.52**	**2.85**

Table 4: Performance of Garden pea varieties for Yield characters

Treatments (Varieties)	Yield of pods per plant (g)			Yield of pods per plot (kg)			Yield of pods (q/ha)		
	2019-20	2020-21	Pooled average	2019-20	2020-21	Pooled average	2019-20	2020-21	Pooled average
T_1 (Kashi Mukti)	68.99	73.46	71.23	1.87	1.48	1.68	93.50	74.00	83.75
T_2 (Kashi Ageti)	81.74	84.05	82.90	2.14	1.63	1.89	107.00	81.50	94.25
T_3 (Kashi Nandini)	82.14	85.10	83.62	1.92	1.36	1.64	96.00	68.00	82.00
T_4 (Kashi Uday)	83.12	84.30	83.71	2.45	1.29	1.87	122.50	64.50	93.50
T_5 (PSM-2)	64.45	66.67	65.56	2.11	1.08	1.60	105.50	54.00	79.75
T_6 (PSM-3)	52.75	56.35	54.55	2.08	1.24	1.66	104.00	62.00	83.00
T_7 (PSM-4)	50.71	48.74	49.73	2.19	1.62	1.91	109.50	81.00	95.25
T_8 (PSM-6)	52.07	58.53	55.30	2.04	1.43	1.74	102.00	71.50	86.75
T_9 (Arka Karthik)	82.48	88.10	85.29	2.58	3.01	2.80	129.00	150.50	139.75
T_{10} (Arka Apoorva)	91.39	93.85	92.62	3.18	3.12	3.15	159.00	156.00	157.50
T_{11} (ArkaUttam)	81.81	85.71	83.76	2.28	1.65	1.97	114.00	82.50	98.25
T_{12} (Kashi Samriddhi)	82.87	82.18	82.53	2.36	1.46	1.91	118.00	73.00	95.50
T_{13} (Kashi Shakti)	82.93	85.41	84.17	2.14	3.23	2.69	107.00	161.50	134.25
T_{14} (PantUphar)	63.47	64.30	63.89	2.04	1.19	1.62	102.00	59.50	80.75
T_{15} (Magadi Local)	46.13	45.38	45.76	1.20	1.23	1.22	60.00	61.50	60.75
S.Em (±)	**2.40**	**2.77**	**2.06**	**0.07**	**0.04**	**0.06**	**4.23**	**2.78**	**3.21**
C.D.@ 0.5%	**6.92**	**8.00**	**5.95**	**0.20**	**0.13**	**0.18**	**12.21**	**8.04**	**9.27**

Quality Attributes

The results indicated the existence of significant differences among the Garden Pea Varieties for all the Qualitative traits observed (Table 5). From the pooled mean, T_{15} (Magadi Local) was found to have the least firmness (15.73 N), While more firmness was noticed in T_4 (Kashi Uday) (26.16 N), followed by T_8 (PSM-6) (25.25 N) and T_3 (Kashi Nandini) (24.22 N). Similar results in Garden pea have been reported earlier by Phom *et al.* (2014) in vegetable pea. Higher moisture content (74.43 %) was recorded in T_9 (Arka Karthik) which was followed with T_6 (PSM-3) (72.94 %) and T_1 (Kashi Mukti) (72.03 %), while the lowest moisture content (52.05 %) was recorded in T_{15} (Magadi Local). Differences in moisture content might be due to the genetic constitution of the genotypes. Moisture content affects physical, and chemical aspects of quality which relates to freshness and stability for the storage of the Garden Peas for a long period of time as such the moisture content determines the shelf life of storage period.

Higher shelling percentage (55.31 %) was recorded in T_{13} (Kashi Shakti) which was followed by T_9 (Arka Karthik) (55.01 %), T_{11} (Arka Uttam) (53.90) and T_{14} (Pant Uphar) (52.21 %), while the lowest shelling percentage (32.49 %) was recorded in T_{15} (Magadi Local). Differences in shelling Percentage might be due to genotypic variation. These findings are in accordance with the findings of Singh (2000) in cluster bean, Pooled data results have shown higher T.S.S (17.29 ^{0}Brix) was recorded in T_{14} (Pant Uphar) which was followed by T_3 (Kashi Nandini) (16.10^{0}Brix) and T_7 (PSM-4) (16.05^{0}Brix), while the lowest T.S.S (13.01^{0}Brix) was recorded in T_{15} (Magadi Local). Increase in TSS content might be due to conversion of complex starch or carbohydrate into simple compounds. Similar results were obtained by Khichi *et al.* (2016) in garden pea. Greater Protein content (23.92 %) was recorded in T_7 (PSM-4) which was followed by T_9 (Arka Karthik) (23.85 %) and T_8 (PSM-6) (23.38 %) while the lowest Protein content (11.01 %) was recorded in T_{15} (Magadi Local). The difference in protein content may be due to variation in genotypes. However, factors such as pH, ionic strength, or the presence of other ingredients will affect the functional properties of garden pea protein. These findings are in accordance with the findings of Singh (2000), in cluster bean, Kalloo *et al.* (2005), in vegetable pea, Amin *et al.* (2014) and Patel (2015), in cowpea.

Table 5: Performance of Garden pea varieties for Quality characters

Treatments (Varieties)	Firmness			Shelling (%)			TSS (^{0}Brix)			Moisture content (%)			Protein content (%)		
	2019-20	2020-21	Pooled average	2019-20	2020-21	Pooled average	2019-20	2020-21	Pooled average	2019-20	2020-21	Pooled average	2019-20	2020-21	Pooled average
T_1 (Kashi Mukti)	20.08	22.90	21.49	49.46	47.18	48.25	14.45	14.80	14.43	71.79	72.45	72.03	15.42	16.17	15.80
T_2 (Kashi Ageti)	23.46	24.44	23.95	47.37	46.54	47.21	13.43	15.26	14.21	65.01	67.51	65.71	14.72	14.27	14.50
T_3 (Kashi Nandini)	24.72	23.71	24.22	45.59	47.91	47.47	17.61	14.87	16.10	61.29	64.01	62.60	16.35	15.82	16.09
T_4 (Kashi Uday)	25.39	26.92	26.16	53.23	51.25	51.91	14.38	15.21	14.65	64.59	66.74	65.99	15.89	17.58	16.74
T_5 (PSM-2)	22.89	23.78	23.34	37.89	40.42	38.93	15.37	16.06	15.56	71.31	74.67	72.94	17.68	15.47	16.58
T_6 (PSM-3)	21.49	22.34	21.92	40.94	41.48	41.33	16.09	15.10	15.55	72.26	71.61	71.60	16.73	16.32	16.53
T_7 (PSM-4)	23.88	22.75	23.32	45.85	42.49	43.50	16.64	15.97	16.05	63.22	62.84	63.36	24.53	23.31	23.92
T_8 (PSM-6)	24.78	25.72	25.25	38.61	35.89	37.16	15.48	14.94	15.24	64.87	63.59	63.67	23.88	22.88	23.38
T_9 (Arka Karthik)	21.66	20.79	21.23	53.87	55.98	55.01	16.64	14.47	15.52	76.51	73.47	74.43	22.80	24.90	23.85
T_{10} (Arka Apoorva)	20.73	22.37	21.55	54.22	50.90	53.06	16.24	15.29	15.54	71.76	70.11	71.19	21.18	24.55	22.87
T_{11} (Arka Uttam)	21.19	22.08	21.64	3.31	55.14	53.90	14.37	15.33	14.70	55.86	53.66	55.20	22.63	20.74	21.69
T_{12} (Kashi Samriddhi)	20.67	23.54	22.11	45.01	44.99	44.34	16.40	14.39	15.25	54.91	55.84	54.75	23.56	21.69	22.63
T_{13} (Kashi Shakti)	20.68	21.57	21.13	57.58	52.61	55.31	14.32	15.29	14.95	52.76	53.73	53.11	11.46	10.86	11.16
T_{14} (Pant Uphar)	22.69	21.62	22.16	52.61	51.66	52.21	18.71	15.87	17.29	67.61	62.55	64.89	23.49	20.64	22.07
T_{15} (Magadi Local)	15.11	16.34	15.73	34.05	32.40	32.49	13.36	12.28	13.01	52.84	51.14	52.05	11.44	10.57	11.01
S.Em(±)	**0.12**	**0.15**	**0.19**	**1.61**	**1.24**	**0.79**	**0.57**	**0.73**	**0.45**	**1.36**	**1.31**	**0.77**	**1.03**	**0.95**	**1.60**
C.D.@ 0.5%	**0.36**	**0.42**	**0.46**	**4.66**	**3.59**	**2.29**	**1.65**	**2.11**	**1.30**	**3.93**	**3.80**	**2.22**	**2.99**	**2.75**	**4.64**

CONCLUSION: Among the 15 varieties evaluated, Arka Apoorva was found to outperform with an yield of (157.50 q ha^{-1}), followed by Arka Karthik (139.75 ha^{-1}) and Kashi Shakti (134.25. ha^{-1}) and these Varieties could be commercially explored as being one of the most suitable vegetable crops for Rabi cultivation in this region.

Reference

Ambrose, L. (2008). Pea breeding: a review. *Hortic. Sci.*, 61:407.

Amin, A.U., Agalodia, A.V. and Prajapati, D. B. (2014). Performance of cowpea varieties on growth, yield and quality parameters. Proceedings of National Symposium on Centre for Research on Seed Spices, *Jagudan*, PP: 86.

Amjad, M., and Anjum, M.A. (2002). Performance of Nine Pea Cultivars under Faisalabad Conditions. Pakistan Journal of Agricultural Science, 39 (1): 6-19.

Anonymous, (2018). National horticulture database. National Horticulture Board, Govt. of India, Gurgaon, India. 20th March, 2018. www.nhb.gov.in

Anonymous. (2011). Indian institute of vegetable research database. Indian Institute of Vegetable Research, Govt. of India., Varanasi, India.www.iivr.org.in

Bhushan, A., Singh, B., Singh, A.K., and Singh, A. (2013). Evaluation of garden pea genotypes for yield and screening against downy mildew incidence under mid hill conditions of Jammu region. International Journal of Production Research, 26 (2): 171-172.

Chadha, S., Rameshwar, S.J. and Sharma, S. (2013). Performance of different varieties of pea (*Pisum sativum L.*) under organic farming conditions in mid Himalayas. *Int. J. Food Sci. Technol.* 4(7): 733-738.

Datta, S., Das, K. (2018). Varietal performance of garden pea (*Pisum sativum var. hortense*) under terai zone of West Bengal. *J. Nat. Appl. Sci.* **10**(3), 1032–1036

Kalloo, G., RAI, M., Singh, J., Verma, A. and Kumar, R. (2005). Morphological and biochemical variability in vegetable pea (*Pisum sativum* L.). *Veg. Sci,* **32** (1): 19-23

Khan T. N., Aasia R, Ghulam J. and Tariq M. (2013). Morphological performance of peas (*Pisum sativum.* L) genotypes under rainfed conditions of potowar region., *Indian J Agric Res*, **51**(1): 51-60.

Khichi, P., Chandan, P.M., Chauhan, J., Srinivas, J. and Bhagat, M. (2016). Varietal evaluation of garden pea under semi-arid conditions of Vidharba region. *Int. J. Farm Sci*, **6**(1), 20–24.

Kumar, A. and Kohali, U.K. (2001). Evaluation of garden pea genotypes for Horticulture traits and resistance against fusarium wilt. Haryana, *J. Hortic. Sci.* 30 (3): 217-219.

Mahajan, R. K., Sapra, R. L., Srivastava, U., Singh, M. and Sharma, G. D. (2000). Minimal descriptors of agri- hort. crops - part I. National Bureau of Plant Genetic Resources, New Delhi. Pp. 181-18.

Nawab, N.N., Subhani, G.M., Mahmood, K., Shakil, Q. and Saeed, A. (2008). Genetic variability, correlation and path analysis studies in garden pea (*Pisum sativum* L.). *Indian J. Agric. Res.*46 (4): 333-340.

Panse, V. G. and Sukhatme, P. V. (1978). Statistical Methods for Agricultural Workers. ICAR. New Delhi, India. Pp. 252-254

Patel, P.J., Patel, N.H., Prajapati, B.H., Tikka, S.B.S.and Patel, P.T. (2006). Correlation and path-analysis in field pea. *Indian J. Plant Sci*. 19 (1): 109-110.

Phom, C.A., Kanaujia, S.P. and Chaturvedi, H.P. (2014). Performance of various genotypes of pea under foothill condition of Nagaland. *Ann. plant soil res.,* 16 (4): 285-288.

Rabbi, A.K.M.Z., Paul, A.K., Sarker, J.R. (2011). Effect of nitrogen and molybdenum on the growth and yield of garden pea (*Pisum sativum* L.), *Int. j. bio-resour. stress manag.* **2**(2): 230–235

Sharma, V.K., and Bora, L. (2013). Studies on genetic variability and heterosis in vegetable pea (*Pisum sativum L.*) under high hills condition of Uttarakhand, India. *Afr. J. Agric. Res.., 8* (18): 1891-1895.

Singh, J., (2000). Response of cluster bean [*Cyamopsis tetragonoloba* (L.)Taub.] Varieties of different spacing during summer season. M.Sc. Thesis (unpub.), Gujarat Agriculture. University. Sardarkrushinagar.

Thorat, S. B., Gosavi, S. P. and Shedge M. S. (2009). Effect of agro-climatic conditions of Konkan region on growth, yield and chemical composition of different varieties of cluster bean. *Int. J. Pure App. Biosci*., **2** (9):606-608.

Urbano, G., Aranda, P., Ví lchez, A., Aranda, C., Cabrera, L., Porres, J.M. and López-Jurado, M. (2005). Effects of germination on the composition and nutritive value of proteins in (*Pisum sativum, L). Food Chemistry, 93*(4), pp.671-679.

Sharma, R. and Kumar, R., 2017. Growth, flowering and yield of chilli, (*Capsicum annuum L*.) as influenced by spacing and growing conditions. *Int. J. Pure App. Biosci*., **5**(5):524-527.

Singh, P., Singh, D., Jaiswal, D.K., Singh, D.K. and Singh, V., 2017. Impact of Naphthalene Acetic Acid and Gibberellic Acid on Growth and Yield of Capsicum, (*Capsicum annum*L.) cv. Indra under Shade Net Conditions. *Int.J.Curr.Microbiol. Appl. Sci*., **6**(6):2457-2462.

Jakhar, R.K., Singh, A.K. and Kumawat, N., 2017. Performance of Capsicum Cultivars (*Capsicum annum L.)* grown under shade net and open field in arid ecosystem of Rajasthan. *Ecol. Environ*., **35** (1):290-294

Ankur. A, Sunil. G and Ahmed, Z., 2006. Performance of garden pea (*Pisum sativum*) cultivars in high-altitude cold desert of Ladakh. *Indian J. Agric. Sci.*, 76 (12):713-715.

Patel, D.M. (2015). Varietal evaluation of vegetable cowpea [*Vigna unguiculata* (L.) Walp.] under North Gujarat condition. Unpublished M.Sc. (Veg.) Thesis submitted to S. D. Agricultural University, Sardarkrushinagar.

Verhinin, T., Noma, J. and Nisnitarumozu, J. (2003). Seed productivity and germiability of various garden pea genotypes collected in Medditerrian region. Memoirs of the Faculty of Agric. Magushima Univ. 34:12.