

Growth Performance of Garden Pea (*Pisum sativum* L.) Varieties Grown Under Shade House Condition

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ABSTRACT

An experiment was conducted at Department of Horticulture, University of Agricultural Sciences, GKVK, Bengaluru during *rabi* seasons of 2019-20 and 2020-21, with fifteen varieties of garden pea (*Pisum sativum* L.) to study their growth characters, by adopting Randomized Complete Block Design with three replications under shade house conditions. As there is no specific high yielding genotype of garden pea recommended for cultivation in Bangalore region. The study was taken up on growth and physiological attributes in different varieties revealed significant differences observed in all traits. Pooled data of two consecutive years revealed that the variety T₁₀ (Arka Apoorva) registered the highest plant height (108.37 cm), number of branches per plant (18.80), where as longer Internodal length (7.95 cm) and number of leaves per plant (72.90) at 90 DAS was registered with T₉ (Arka Karthik) while the minimum plant height (71.35 cm), number of branches per plant (11.10), number of leaves per plant (45.16), Internodal length (4.82 cm), was associated with T₁₅

(Magadi Local), similarly maximum leaf chlorophyll content, (54.54 m mol/cm²), and leaf area (1358.10 cm²) at 90 DAS were observed with T₁₀ (Arka Apoorva) and maximum relative water content (46.89 %) observed with T₉ (Arka Karthik) minimum relative water content (31.46), total leaf chlorophyll content (36.30 m mol/cm²) and leaf area (772.16 cm²) were noticed in the variety T₁₅ (Magadi local). garden pea being one of the most suitable vegetable crops for *rabi* cultivation hence there is a need to evaluate a variety recommended for Bangalore region.

Keywords Garden pea, Varieties, Growth, Shade House Condition.

INTRODUCTION

Garden peas (*Pisum sativum* L.) is one of the most versatile leguminous vegetable crop, containing more protein than other vegetables and has acquired a place of prominence in diet of all sections of the society. it belongs to the family Fabaceae (Leguminosae) having chromosome No. 2n=14. It is native to Mediterranean region. Among various vegetables grown in India, it is grown as both garden and field crops throughout the temperate regions of the world. Green peas is consumed as a raw or cooked vegetable, separate or mixed with potato, cheese, cauliflower and many other vegetables or as a conserved frozen product, hay feed for animals, green fertilizer and dry seeds as food (Bozoglu *et al.* 2007).

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The crop is a native to Mediterranean or South West Asia and is widely grown in temperate countries. Garden peas thrive well in a relatively cool weather; and withstands relatively low temperatures, especially during the seedling stage. The optimum temperature for seed germination is about 22°C. In India, it is grown as a winter vegetable in the plains of North India and as a summer vegetable in the hills. Planting can take place from winter to early summer, depending on locations grown in many parts of the world. It is grown in almost all types of soil with adequate drainage. Silt loam and clay loam soils having pH range of 5.5 to 6.5 are best for growing peas.

There are several garden pea varieties released by different State Agricultural Universities and ICAR institutes, but there is need for suitable varieties for southern region of Karnataka. So, there is need to evaluate different varieties of garden peas released from different parts of India and select high yielding varieties having high protein content and resistance to biotic and abiotic stresses coupled with suitability for southern region of Karnataka. It is also necessary to study their suitability under different cropping systems with their performance with respect to growth, yield and quality.

MATERIALS AND METHODS

The present investigation, comprising fifteen varieties of garden peas was conducted under shade house condition during 2019-20 and 2020-21 from October to January at, Department of Horticulture, College of Agriculture, UAS, GKVK, Bengaluru. The experiment was conducted using Randomized Complete Block Design (RCBD) with three replications in shade house conditions following 30 cm × 10 cm spacing with the individual gross plot size of 2.1m × 0.9 m.

The required area for experiment was marked prior to layout under shade house conditions for both the consecutive years of 2019-20 and 2020-21 and was ploughed with tractor followed by leveling, double disking and planking with a view to have a fine tilth of the land. Weeds were removed so as to obtain clean and leveled deep bed and fine texture.

The Recommended Dose of FYM (10 tonnes /

ha) and fertilizers (12.5 kg N, The following doses of Vermicompost and fertilizers and accordingly 10 tones of FYM, 12.5 kg, Nitrogen, 75 kg P, and 50 kg of K per hectare) were applied at the time of preparation of land and 12.5 kg Nitrogen per hectare were applied at 30 days after sowing. Irrigation was provided as and when necessary. Seeds were sown to a depth of 4 to 5 cm by dibbling method as per recommended plant placing. Standard agronomic practices and plant protection measures were adopted as per schedule. Five plants from each plot were randomly selected and tagged in order to record observations.

The observations on various growth parameters, such as plant height, number of branches, were recorded at different growth stages of 30, 60, and 90 DAS and number of leaves, length of internode and leaf area were recorded at 90 DAS. For statistical analysis, replicated mean data was analyzed applying the Randomize Complete Block Design and significance was tested at the level of 5% significance (Panse and Sukhatme 1957).

RESULTS AND DISCUSSION

Growth parameters: The data recorded at different stages of growth parameters at 30, 60, and 90 days after sowing are presented and discussed as follows.

Data recorded on days taken for germination are presented in Table 1. Lesser days taken for germination (7.50) among varieties of garden pea from the pooled averages, was recorded in T₅ (PSM-2) which was found to be significantly on par with T₇ (PSM-4) (7.84), whereas, more days taken for germination (10.00) was recorded in T₁₅ (Magadi Local) and higher percentage of germination (96.00) was registered in T₃ (Kashi Nandini) which was found to be significantly on par with T₆ (PSM-3) (95.31) and T₁₀ (Arka Apoorva) (95.22), while the lowest germination percentage (84.00) was recorded in T₁₅ (Magadi Local). Significant differences obtained for days taken for germination and germination percentage among different varieties of garden peas might be due to differences in their inherent capacity to germinate and it is possible that the varieties might not have expressed their genetic potential to the fullest extent and also it could be mainly due to the differences

Table 1. Days taken for germination and germination percentage in garden pea varieties grown under shade house condition.

Treatments (Varieties)	Days to germination			Germination percentage		
	2019-20	2020-21	Pooled average	2019-20	2020-21	Pooled average
T ₁ (Kashi Mukti)	9.00	7.00	8.00	90.11	92.02	93.49
T ₂ (Kashi Ageti)	7.00	9.67	8.34	91.68	92.44	92.30
T ₃ (Kashi Nandini)	8.00	9.52	8.76	97.00	95.33	96.00
T ₄ (Kashi Uday)	9.33	8.00	8.67	93.60	93.02	93.15
T ₅ (PSM-2)	8.00	7.00	7.50	95.00	93.67	94.17
T ₆ (PSM-3)	9.00	10.00	9.50	96.67	94.85	95.31
T ₇ (PSM-4)	8.67	7.00	7.84	94.35	93.75	94.35
T ₈ (PSM-6)	9.00	7.00	8.00	94.33	93.29	94.20
T ₉ (Arka Karthik)	10.33	9.00	9.67	96.33	93.67	94.72
T ₁₀ (Arka Apoorva)	8.00	8.67	8.34	96.33	94.00	95.22
T ₁₁ (Arka Uttam)	9.00	7.67	8.34	95.33	94.00	95.11
T ₁₂ (Kashi Samridhhi)	9.33	8.00	8.67	94.00	93.75	93.54
T ₁₃ (Kashi Shakti)	10.33	6.00	8.17	85.17	85.92	85.82
T ₁₄ (Pant Uphar)	8.67	7.33	8.00	95.00	93.75	94.21
T ₁₅ (Magadi Local)	9.40	11.00	10.00	82.44	85.16	84.00
SEm (±)	0.85	0.64	0.76	0.94	1.23	0.65
CD @ 0.5%	2.15	2.59	2.70	2.74	3.55	1.87

in the genotypic variation and early germination could be due to genetic characteristic nature of the variety. Seed germination depends on both internal and external conditions mainly oxygen, and proper temperature to germinate. When a seed is exposed to the proper conditions, water and oxygen are taken in through the seed coat resulting in better germination of seed. These findings are in accordance with the findings of Singh and Singh (2011) and Sharma and

Bora (2013), in garden pea.

Plant height is considered as an important trait in garden pea cultivation from management aspect. In this study, garden pea varieties differed significantly for this trait at all growth stages of 30, 60, 90 days of sowing and analyzed mean data and its range for the fifteen genotypes with respect to height of plant are presented in Table 2. From pooled mean analysis

Table 2. Plant height (cm) and number of branches per plant at different stages of growth under shade house condition.

Treatments (Varieties)	30 th DAS			Height of plant (cm) 60 th DAS			90 th DAS		
	2019-20	2020-21	Pooled average	2019-20	2020-21	Pooled average	2019-20	2020-21	Pooled average
T ₁ (Kashi Mukti)	22.29	23.50	22.90	56.73	52.13	54.43	73.21	76.02	74.62
T ₂ (Kashi Ageti)	25.26	20.44	22.85	53.23	51.50	52.37	84.84	80.71	82.78
T ₃ (Kashi Nandini)	26.64	27.41	27.02	62.91	61.82	62.36	88.15	81.22	84.69
T ₄ (Kashi Uday)	26.01	21.44	23.72	57.02	53.35	55.19	102.30	100.56	101.43
T ₅ (PSM-2)	29.57	22.09	25.83	54.33	51.26	52.80	92.65	83.05	87.85
T ₆ (PSM-3)	29.60	21.34	25.47	54.12	51.27	52.69	80.38	78.64	79.51
T ₇ (PSM-4)	22.40	23.16	22.78	54.94	47.86	51.40	77.56	74.89	76.23
T ₈ (PSM-6)	24.20	24.73	24.47	59.39	55.57	57.48	73.63	69.50	71.57
T ₉ (Arka Karthik)	26.46	22.43	24.45	64.91	62.29	63.60	108.02	100.62	103.57
T ₁₀ (Arka Apoorva)	29.52	24.78	27.15	68.21	61.14	64.68	111.12	105.62	108.37
T ₁₁ (Arka Uttam)	24.51	23.34	23.93	60.56	61.57	61.07	80.53	77.40	78.97
T ₁₂ (Kashi Samridhhi)	23.29	21.64	22.46	55.16	51.56	53.36	80.14	78.34	79.24
T ₁₃ (Kashi Shakti)	23.05	22.16	22.60	67.27	63.01	65.14	1107.80	102.37	105.09
T ₁₄ (Pant Uphar)	24.63	27.56	26.10	64.44	60.17	62.31	87.18	80.87	84.03
T ₁₅ (Magadi Local)	17.74	12.52	15.13	48.27	41.42	44.85	72.22	70.48	71.35
SEm (±)	1.23	1.17	0.75	3.45	0.86	0.86	2.42	1.41	1.00
CD @ 0.5%	2.71	3.41	2.19	4.21	2.51	2.56	3.66	5.53	2.92

Table 2. Continued.

Treatments (Varieties)	Number of eranches per plant								
	2019-20	30 th DAS			60 th DAS			90 th DAS	
		2020-21	Pooled	2019 -20	2020-21	Pooled	2019-20	2020-21	Pooled
T ₁ (Kashi Mukti)	3.87	3.20	3.53	10.09	9.94	9.95	12.13	11.32	11.84
T ₂ (Kashi Ageti)	2.03	3.67	2.85	7.84	6.52	6.95	12.91	11.44	12.23
T ₃ (Kashi Nandini)	2.80	2.66	2.73	9.23	7.17	8.36	13.61	11.38	12.39
T ₄ (Kashi Uday)	4.46	3.35	3.91	10.16	7.55	8.65	14.25	12.05	13.08
T ₅ (PSM-2)	3.96	3.50	3.73	10.03	7.03	8.47	14.88	12.56	13.72
T ₆ (PSM-3)	3.19	3.53	3.36	9.48	10.71	6.67	12.62	11.73	11.86
T ₇ (PSM-4)	3.73	2.87	3.30	8.70	6.74	7.73	13.76	12.31	13.05
T ₈ (PSM-6)	5.43	4.46	4.94	10.07	10.19	10.24	12.85	11.93	12.38
T ₉ (Arka Karthik)	3.30	2.96	3.13	11.04	11.19	11.15	16.12	15.87	15.93
T ₁₀ (Arka Apoorva)	3.61	3.36	3.49	13.89	12.58	13.23	19.50	17.81	18.80
T ₁₁ (Arka Uttam)	3.67	3.35	3.51	6.87	6.46	6.77	11.59	10.06	11.11
T ₁₂ (Kashi Samriddhi)	3.73	3.13	3.43	5.98	5.85	5.86	12.68	11.25	11.70
T ₁₃ (Kashi Shakti)	4.86	3.22	4.04	7.23	5.99	10.08	16.53	15.71	16.07
T ₁₄ (Pant Uphar)	3.59	2.17	2.88	6.99	6.51	6.81	12.06	12.31	12.22
T ₁₅ (Magadi Local)	2.09	2.67	2.38	6.03	5.95	5.90	11.36	10.93	11.10
SEm (±)	0.31	0.16	0.18	0.77	0.44	0.32	0.66	0.47	0.32
CD @ 0.5%	0.91	0.48	0.51	1.62	1.28	0.93	1.92	1.35	0.91

of two year's data revealed that significantly at 30 DAS, greater plant height (27.15 cm) was noticed in T₁₀ (Arka Apoorva) which was followed by T₃ (Kashi Nandini) (27.02 cm) and T₁₄ (Pant Uphar) (26.10 cm), while the least height of plant (15.13 cm) was noticed in T₁₅ (Magadi Local) and greater plant height g (65.14 cm), at 60 DAS, was observed in T₁₃ (Kashi Shakti) which was followed by T₁₀ (Arka Apoorva) (64.68 cm) and T₉ (Arka Karthik) (63.60 cm), while the least height of plant (44.85 cm) was recorded in T₁₅ (Magadi Local). At 90 DAS greater plant height among the varieties of garden pea, from the pooled average, was found in T₁₀ (Arka Apoorva) (108.37 cm) which was followed by T₁₃ (Kashi Shakti) (105.09 cm) and T₉ (Arka Karthik) (103.57 cm) while the least height of plant (71.35 cm) was recorded in T₁₅ (Magadi Local).

Height of the plant influences its growth behavior and, in turn, its performance. Variation in plant growth stages among these different garden pea varieties might be due to their genetic heritability, coupled with variation in soil and climatic conditions, in addition to nutrition management. The results so obtained might be due to the favorable micro-climatic conditions under shade house condition and these results are in conformity with the findings of Padma *et al.* (2020), in french bean, and Jamir *et al.* (2017), in sweet pepper.

Analyzed mean data and its range for the fifteen

genotypes with respect to number of branches per plant are presented in Table 2. More number of branches per plant (4.94) from the pooled average from two consecutive years at 30 DAS was recorded in T₈ (PSM-6) followed by T₁₃ (Kashi Shakti) (4.04) and T₄ (Kashi Uday) (3.91), while the least number of branches per plant (2.38) was noticed in T₁₅ (Magadi Local). More number of branches per plant (13.23), at 60 DAS, was observed in T₁₀ (Arka Apoorva) which was followed by T₉ (Arka Karthik) (11.15), T₈ (PSM-6) (10.24) and T₁₃ (Kashi Shakti) (10.08), while the least number of branches per plant (5.90) was noticed in T₁₅ (Magadi Local) and similarly, at 90 DAS, more number of branches per plant (18.80) was noticed in T₁₀ (Arka Apoorva), which was followed by T₁₃ (Kashi Shakti) (16.07) and T₉ (Arka Karthik) (15.93), while the least number of branches per plant (11.10) was noticed in T₁₅ (Magadi Local). Greatest number of branches per plant could be attributed to increased cell division, resulting in increasing the number of vegetative buds on the main stem. Variation in the number of branches per plant between varieties was also due to the favorable microclimatic conditions under the shade house. Similar results were also reported by Padma *et al.* (2020), in french bean, and Jamir *et al.* (2017), in sweet pepper, which support the results of the present findings.

Analyzed mean data and its range for the fifteen genotypes with respect to number of leaves per plant

Table 3. Number of leaves per plant and internodal length (cm) in different varieties of garden peas grown under shade house condition at 90th DAS.

Treatment	Variety	Number of leaves/plant			Length of internode (cm)		
		2019	2020	Pooled data	2019	2020	Pooled data
T ₁	Kashi Mukti	54.67	51.07	53.01	5.78	5.54	5.66
T ₂	Kashi Ageti	48.27	43.87	46.04	6.69	6.36	6.53
T ₃	Kashi Nandini	56.13	53.07	54.19	6.87	6.45	6.66
T ₄	Kashi Uday	59.73	56.87	57.86	6.92	6.69	6.81
T ₅	PSM-2	51.27	44.07	47.64	6.95	5.92	6.44
T ₆	PSM-3	54.27	52.53	53.34	6.75	6.42	6.59
T ₇	PSM-4	54.00	53.33	53.27	5.96	5.82	5.89
T ₈	PSM-6	55.93	53.67	54.69	6.56	6.91	6.74
T ₉	Arka Karthik	73.40	71.40	72.90	7.96	7.89	7.95
T ₁₀	Arka Apoorva	68.93	72.20	70.92	7.47	7.85	7.66
T ₁₁	Arka Uttam	73.67	66.93	70.48	6.96	6.76	6.86
T ₁₂	Kashi Samriddhi	71.13	68.67	69.56	5.58	6.42	6.00
T ₁₃	Kashi Shakti	69.40	58.33	64.00	6.56	6.78	6.67
T ₁₄	Pant Uphar	73.07	66.40	69.64	6.72	6.24	6.48
T ₁₅	Magadi Local	46.62	43.42	45.16	4.68	4.96	4.82
SEm (±)		1.19	1.87	0.88	0.14	0.15	0.09
CD @ 0.5%		3.44	5.43	2.55	1.40	0.45	1.25

and Internodal length are presented in Table 3. At 90 DAS, more number of leaves per plant (72.90) was observed in T₉ (Arka Karthik) which was found to be at par with T₁₀ (Arka Apoorva) (70.92) and T₁₁ (Arka Uttam) (70.48), whereas, the least number of leaves per plant (45.16) was recorded in T₁₅ (Magadi Local) (C). Leaf is the primary photosynthetic organ in plants, expressing itself primarily through final dry matter production. Significant changes in leaf morphology occur under low light conditions, and leaf area increases significantly under shade house conditions. These findings are in confirmation with Akhter *et al.* (2009), in garden pea, Haque *et al.* (2009), in bottle gourd, Dhivya *et al.* (2014), in Dolichos bean and Kalloo *et al.* (2005), in vegetable pea,

Genetic characteristics and environmental factors under shade house conditions might have played significant role in the production of more leaves. Variation in number of leaves per plant, among different varieties was also reported by Biradar *et al.* (2017), in broccoli and red cabbage, and Singh *et al.* (2017), in capsicum.

From the pooled average, at 90 DAS, longer Internodal length (7.95 cm) was observed in T₉ (Arka Karthik) which was found to be on par with T₁₀ (Arka

Apoorva) (7.66 cm), T₁₁ (Arka Uttam) (6.86 cm) and T₄ (Kashi Uday) (6.81 cm), while the shortest Internodal length (4.82 cm) was observed in T₁₅ (Magadi Local) (C). The quantum of internodal elongation is influenced by the temperature. Gibberelic acids are the plant hormones responsible for internodal elongation, they cause a wide range of physiological

Table 4. Leaf area (cm²) in different varieties of garden peas grown under shade house condition.

Treatments (Varieties)	Total Leaf area (cm ²) at 90 th DAS		Pooled
	2019	2020	
T ₁ (Kashi Mukti)	1033.34	999.86	1016.52
T ₂ (Kashi Ageti)	834.33	846.00	842.53
T ₃ (Kashi Nandini)	897.04	855.84	877.77
T ₄ (Kashi Uday)	995.52	935.52	977.12
T ₅ (PSM-2)	963.35	870.01	894.52
T ₆ (PSM-3)	1077.70	951.04	1001.10
T ₇ (PSM-4)	830.33	750.33	794.77
T ₈ (PSM-6)	992.81	952.81	972.34
T ₉ (Arka Karthik)	1121.27	1136.05	1228.66
T ₁₀ (Arka Apoorva)	1442.56	1215.98	1358.10
T ₁₁ (Arka Uttam)	1001.80	948.47	963.32
T ₁₂ (Kashi Samriddhi)	959.07	899.07	921.48
T ₁₃ (Kashi Shakti)	1020.17	1076.83	1072.31
T ₁₄ (Pant Uphar)	975.52	938.86	980.10
T ₁₅ (Magadi Local)	808.82	735.49	772.16
SEm (±)	71.98	46.36	42.23
CD @ 0.5%	208.51	134.29	132.23

Table 5. Chlorophyll content and relative water content among varieties of garden peas grown under shade house condition.

Treatments (Varieties)	Chlorophyll content (m mol /cm ²)			Relative water content (%)		
	2019-20	2020-2021	Pooled average	2019-20	2020-2021	Pooled average
T ₁ (Kashi Mukti)	52.61	46.27	49.33	35.33	39.33	37.32
T ₂ (Kashi Ageti)	45.60	44.74	45.35	36.13	33.20	34.49
T ₃ (Kashi Nandini)	54.94	51.09	53.78	40.53	35.80	38.12
T ₄ (Kashi Uday)	53.83	44.60	49.19	43.27	38.87	41.21
T ₅ (PSM-2)	43.66	45.21	44.79	43.27	35.40	40.11
T ₆ (PSM-3)	48.00	47.23	48.29	42.93	37.16	40.97
T ₇ (PSM-4)	46.25	43.97	45.32	42.40	36.20	39.43
T ₈ (PSM-6)	41.07	42.83	42.33	36.93	32.93	34.96
T ₉ (Arka Karthik)	53.68	50.38	51.96	49.13	44.73	46.89
T ₁₀ (Arka Apoorva)	56.56	52.45	54.54	46.40	42.13	42.97
T ₁₁ (Arka Uttam)	47.05	43.20	45.11	41.20	44.87	44.26
T ₁₂ (Kashi Samridhhi)	46.08	45.21	45.19	46.87	33.73	40.54
T ₁₃ (Kashi Shakti)	50.86	46.96	49.21	39.93	36.60	37.86
T ₁₄ (Pant Uphar)	39.38	43.26	41.24	41.33	45.47	43.09
T ₁₅ (Magadi Local)	35.20	37.64	36.30	32.33	31.40	31.46
SEm (±)	1.59	1.69	1.00	1.43	1.84	2.67
CD @ 0.5%	4.61	4.88	2.90	4.15	5.32	5.32

responses in plants, including an increase in axis length, which causes an increase in internodal elongation. These findings are in consistency with Haque *et al.* (2009), in bottle gourd.

The observations on leaf area differed significantly among all the Garden pea varieties at different stages of growth. The data are presented in Table 4. At 90 DAS, higher leaf area (1358.10 cm²) was observed in T₁₀ (Arka Apoorva) (1358.10 cm²) which was followed by T₉ (Arka Karthik) (1228.66 cm²) and T₁₃ (Kashi Shakti) (1072.31 cm²), while the lowest leaf area (772.16 cm²) was recorded in T₁₅ (Magadi Local) which was treated as control. Changes in leaf area are mainly due to activation of cell proliferation, enhanced cell expansion which produces large leaves due to an increase in the cell number. Cell proliferation or cell expansion contribute to enlarged leaves, these findings are in confirmation with findings of Amjad and Anjum (2002), which confirms the results of the present investigation. Thorat *et al.* (2009) and Arora *et al.* (2011) also got similar results in cluster bean.

The data presented in Table 5 revealed that leaf chlorophyll content differed significantly among the garden pea varieties. From the two years average, higher chlorophyll content (54.54 m mol/ cm²) were

observed in T₁₀ (Arka Apoorva) which was found to be on par with T₃ (Kashi Nandini) (53.78 cm²) and T₉ (Arka Karthik) (51.96 m mol/cm²), whereas the lowest chlorophyll content (36.30 m.mol/cm²) was recorded in T₁₅ (Magadi Local). Chlorophyll is a major chloroplast component and has a positive relationship with photosynthetic rate. Nitrogen is a component of the chlorophyll structure in plant tissues. Under stress conditions, a decline in chlorophyll content was associated with changes in nitrogen metabolism as a result of proline synthesis to maintain osmotic adjustment reduction in total chlorophyll content leads to a reduction in photosynthesis. These findings are in consistent with findings of Dhivya *et al.* (2014) in Dolichos bean and Khan *et al.* (2013) and Pawar *et al.* (2007) in garden pea.

Data pertaining to relative water content as responded by different treatments are summarized in Table 5. From the two years average, maximum relative water content (46.89 %) was observed in T₉ (Arka Karthik) which was followed by T₁₁ (Arka Uttam) (44.26 %), and T₁₄ (Pant Uphar) (43.09 %), whereas, the lowest relative water content (31.46 %) was recorded in T₁₅ (Magadi local). These findings are in confirmation with Nagajothi *et al.* (2014), in pigeon pea. Relative water content (RWC) is probably the most appropriate measure of plant water

status in terms of the physiological consequence of cellular water deficit. Water potential as an estimate of the energy status of plant water is useful in dealing with water transport in the soil-plant-atmosphere continuum.

CONCLUSION

The present experimental findings, it can be concluded that Arka Apoorva was found to be the best for growth parameters under Shade House condition. Arka Karthik and Kashi shakti also showed good performance for growth parameters.

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