RESEARCH ARTICLE

VARIETAL PERFORMENCE OF BROCCOLI (*BRASSICA OLERACEA* VAR. *ITALICA*) UNDER NORTHERN HILL ZONE OF CHHATTISGARH

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Abstract: Broccoli (*Brassica oleracea* var. *italica*. L.) is one of the most prominent vegetable grown all over the world and is an important fancy and highly nutritive exotic vegetable. Vegetables play a very important role in our daily diet. As an unconventional vegetable "Broccoli" is yet to gain the desired popularity in our country. It is very rich source of various anti-cancer agents as well as Vitamin C and dietary fibre. However, considerable attention is being given on the production technology of Broccoli which is rich in nutrient content and greater yield potential. But yet, no systematic work has been done on evaluation and commercialization of high value nutrient rich this Cole crops. Therefore, the present study were carried out at Potato & Temperate Fruit Research Station, Mainpat, Surguja, Chhattisgarh under Indira Gandhi Krishi Vishwavidyalaya during the year 2017-2018 in *Rabi* season with objectives to varietal performance of Broccoli and to standardize the production technology of sprouting broccoli in northern hill zone of Chhattisgarh. Cultivation of these value added vegetables can boost the income of farmers due to very high market price and export demand. The investigations were followed in Randomized Block Design with three replications. Nine varieties of Broccoli *viz*. Palam Samridhi, Green Giant, Green Speed, KTS-1, Puspa, Palam Haritika, Priya, Aiswarya and Prema were evaluated for best performance. In general, the performances of this crop with different varieties proved that there is good scope to grow broccoli vegetable due to prevailing suitable agro-climatic condition as well as the gaining importance as potential vegetable for export. Among all the varieties of Broccoli Palam Samridhi was found superior, which gave higher yield (184.5q/ha) followed by Green Speed (173.74q/ha), Green Giant (156.23q/ha) and Palam Haritika (144.84q/ha) respectively in combination with best head formation.

Keywords: Performance, Broccoli, Varieties, Quality and yield

INTRODUCTION

Broccoli is an important vegetable among the Cole crops. It is a rich source of Vitamins and minerals. In fact, it contains more vitamin A than cabbage and cauliflower and the highest amount of proteins among the Cole crops. It also contains anti-cancerous compounds and antioxidants. India is endowed with a wide range of tropical, sub-tropical and temperate vegetable crops. But still there are some vegetables which are lesser known or rare to most of our growers and con- summers. Our farmers can earn a lot of profit by growing this rare or unusual high value Cole vegetables nearby big cities (periurban areas) and towns as they attract very high prices in cosmopolitan markets, star hotels and places of tourists' interest. They can also be exported to foreign especially European countries where their cultivation is not possible throughout the year in open field conditions. But due to lack of information about their cultural practices for our conditions the production or availability of these vegetables is still meager. Chinese cabbage, Sprouting broccoli, Red cabbage and Brussels sprouts, etc. have opened up new opportunities for vegetable growers of our country for diversification and off-season production for high market in metropolis. But due to lack of preference in food among Indians some of the introduced vegetables could not get popularity though they are rich in protein, carbohydrates, minerals, vitamins and fibers etc. However, with the growing tourist industry and nutritional awareness among people, these vegetables are gaining popular. Among the Cole crops broccoli is more nutritious than other Cole crops, such as cabbage, cauliflower and kohlrabi. It is fairly rich in carotene and ascorbic acid and contains appreciate quantities of thiamin, riboflavin, niacin and iron. Realizing the tremendous potential of sprouting broccoli in domestic and foreign market, the Kharif season potato growers of Northern Hill Zone of Chhattisgarh are gradually adopting the broccoli cultivation. To popularize this high value Cole crops and its variety among the marginal and small farmers, proper demonstration should be adopted through personal contact approach, monitoring, motivation and awareness creation about benefits. However, State is facilitated with good and congenial agro-climatic condition for cultivation of these crops. Therefore, present studies were aimed at promotion of high value Cole vegetables by identifying new promising varieties with high productivity under wide range of environmental conditions, better horticultural characteristics and market opportunities.

MATERIALS AND METHODS

The present studies were carried out at Potato & Temperate Fruit Research Station, Mainpat, Surguja, Chhattisgarh under Indira Gandhi Krishi Vishwavidyalaya during *Rabi* season (2017-2018) with the principle objective to standardize the

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production technology of sprouting broccoli. The investigation details are as follows: Broccoli seed were sown in nursery beds. At four leaf stage the seedlings were transplanted in the main field in a plot size 2.5 x 4m. The design of experimental site was Randomized Block Design replicated thrice utilizing nine genotypes showing diverse features. Genotypes taken under observations were Palam Samridhi, Green Giant, Green Speed, KTS-1, Puspa, Palam Haritika, Priya, Aiswarya and Prema. The transplanting of seedlings was accomplished on first week of November with the spacing of 60cm x 45cm. Applied fertilizer doses are in NPK ratio of [120:80:100] kg per hectare. Nitrogen was applied in the form of urea in two split doses. The half dose of nitrogen was applied along with full dose of phosphate and potassium. P and K were applied in the form of diammonium phosphate and muriate of potash respectively at the time of transplanting. The remaining dose of nitrogen was applied 30 days after transplanting Regular cultural practices, crop protection measures were adopted as per the requirements of crop. Observations were taken under physical, yield and quality attributing parameters. Mean value of randomized data were analysed by following standard statistical technique (Panse and Sukhatme 1985).

RESULTS AND DISCUSSION

The nine different varieties of Broccoli were varied significantly. The days taken for germination was varied from 4.2 (Palam Samridhi) to 5.79 (Green Giant). The minimum germination days taken by variety Palam Samridhi (4.2) followed by KTS-1 (4.41), Palam Haritika (4.60) and Puspa (4.96) while, variety Green Giant (5.79) have taken maximum days for germination of seed. The yield and yield attributing characters due to different varieties showed a significant differences effect. In respect of earliness of head initiation and days required to harvesting, the cultivars under study were found significant. The average number of days to head initiation varied from (55.50 to 63.50). The cultivar Palam Samridhi (55.50), Prema (57.50), Puspa (58.48) and (60.97) found earlier and KTS-1 and Priya was found very late in respect of head initiation. The average period required days to harvesting varied from (72.67 to 93.74). The cultivar Palam Samridhi (72.67), Puspa (78.07), Prema (80.13) and Palam Haritika (82.23) found earlier and Green Giant found very late (93.74). The height of the plants varied from (33.07 to 56.95 cm). From the data it revealed that the variety, Palam Samridhi recorded significantly maximum plant height (56.95 cm) while Puspa variety recorded the minimum (30.78 cm). The lowest plant height observed in some other varieties might be due to its inherent genotypic characteristics or for the variations in agro-climatic condition. The number of leaves per plant is an important character that might influence the yield. The cultivars included in the study produced an average variation of (13. 22 to 16.53) leaves per plant. The maximum number of leaves per plant was recorded as (16.53) in variety Palam Samridhi, followed by Green Speed (16.50), Palam Haritika (16.25), and KTS-1 (15.56). The lowest number of leaves was noticed in the variety Puspa (13.22), Prema (14.30), Green Giant (15.06) and Aiswarya (15.13). Lower number of leaves in some cultivars was probably due to slow rate in leaf initiation which would be an inherent character of the cultivars. This wide variation in vegetative growth of the different varieties was also recorded by earlier investigators (Abou El-Magd *et al.* 2005, 2006; El-Helaly 2006). Similar results were also recorded by Damato (2000), Damato and Trotta (2000), Sharma (2003), Siomos *et al*. (2004) and Singh *et al.* (2014) and Renbomo and Biswas (2014). More number of leaves might have reduced the head size and total head weight due to more nutrient absorption by the leaves. This is in agreement with previous investigation in which some of the cultivars were included. In this investigation, plant spread in each cultivar were recorded and found significant differences. The range of head diameter was (13.10 to 20.5cm). It has been found from the experiment results, the maximum head diameter (20.57cm) was obtained with variety Prema followed by Puspa (20.17cm), Priya (20.14cm) and Palam Haritika (16.17cm). The minimum head diameter of (13.10cm), with variety Green Speed was recorded. It has been found from the experimental results that the highest stem diameter was measured in variety Palam Samridhi (4.52 cm) followed by Green Giant (4.24 cm). Similarly the higher site in diameter of stem was observed with variety Green Speed (3.79 cm), Palam Haritika (3.75 cm), and Prema (3.70 cm). From the [Table-1] it is clear that among the above mentioned varieties there were significant differences among themselves. Rest of the other varieties different significantly from the above mentioned one. However, the lowest diameter of stem was obtained with variety KTS-1 (3.39cm). This similarity and dissimilarity among the varieties in stem diameter may be attributed to the variability in their genetic configuration. The maximum head weight of (410.23gm) was found with Palam Samridhi, variety. The varieties which produced comparatively more head weight are namely Green Speed (372.43g), Aishwarya (366.83g) and Palam Haritika (309.07g). The highest head weight might be due to resulted from the highest head diameter and number of sub sprout in the respective varieties. The minimum head weight of (260.20.g) was obtained with Priya variety. In respect of the stem length, statistically parity was observed. Among the nine varieties the minimum stem length (21.77 cm) was observed in variety Puspa and maximum stem length observed in variety of Palam Samridhi (28.43cm). This showed that the cultivars represent a good range

of genetic diversity in response of stem length. The tabulated data (Table-1. showed clearly that the best quality of more number of sprout (spears) was recorded from the variety Palam Samridhi (6.87) followed by Priya (6.60) and Green Giant (5.59). The lowest numbers of sprout were observed from Prema (4.30) variety. The differences in number of sprout among these varieties may be due to their own genetic characters. Results obtained in (Table-1) reflect significant differences in the sprout weight of the different varieties. The highest sprout weight was obtained from Palam Samridhi (40.73g) followed by Palam Haritika (37.70g) and KTS-1 (36.03g) while, minimum sprout weight found in Prema (28.17g). The highest sprout yield per plot was obtained from Palam Samridhi (6.5kg) followed by Green Giant (5.26kg) and Aiswarya (4.7kg) while, minimum yield per plant was observed in Prema (2.40kg). The highest yield per plant was obtained from Palam Samridhi (323.33g) followed by Green Giant (318.00g) and KTS-1 (300.00g) while, minimum head yield per plant found in Puspa (253.48g). The highest yield per plot was obtained from Palam Samridhi (14.34kg) followed by Green Giant (12.8kg) and Palam Haritika (12.2kg) while, minimum head yield per plant found in Prema (9.50kg). There was a significant and positive effect of different varieties on head yield (q/ha) Palam Samridhi performed the highest results in head yield (184.0q/ha) and the other two varieties showed statistically similar results Green Speed (173.7q/ha), Green Giant (156.2q/ha) and Palam Haritika (144.8q/ha) Table 2. This wide variation in yield of the different varieties was also recorded by earlier investigators (Abou El-Magd *et al.* 2005, 2006; El-Helaly 2006). Similar results were also recorded by Damato (2000), Damato and Trotta (2000), Sharma (2003), Siomos *et al*. (2004), Singh *et al.* (2014) and Renbomo and Biswas (2014). It indicates that next to Palam Samridhi, there three varieties, Green Speed, Green Giant and Palam Haritika have ability to produced good head yield. The present experiment revealed that the yield and yield attributing characters significantly differed within the different varieties. On the basis of performance of varieties related to head yield and concerning yield attributing characters, Palam Samridhi performed the highest head yield and other two varieties Green Speed and Palam Haritika are also considered suitable for positive response for boosting higher yield. The variety of Broccoli Palam Samridhi was very significantly quantitative character and this was good for cultivation northern hill zone of Chhattisgarh.

Table 1. Performance of Broccoli in northern hill zone of Chhattisgarh

S. No	Varieties	Days taken for germination	Days to Head Initiation (Days)	Days to Harvest (Days)	Plant height (cm)	No of Leaves/ plant	Head diameter (cm)	Head weight (g)	Stem diameter (cm)
1.	**Palam Samridhi**	4.28	55.50	72.67	56.95	16.53	16.67	410.23	4.52
2.	**Green giant**	5.79	62.50	93.74	48.21	15.06	14.60	293.67	4.24
3.	**Green speed**	5.00	62.20	84.48	47.79	16.50	13.10	372.43	3.79
4.	**KTS-1**	4.41	63.60	85.22	48.53	15.56	14.51	285.00	3.39
5.	**Puspa**	4.96	58.48	78.07	43.07	13.22	20.17	290.5	3.50
6	**Palam Haritika**	4.60	60.97	82.23	46.33	16.25	15.13	309.07	3.75
7.	**Priya**	5.61	63.05	82.41	46.61	15.28	20.14	260.2	3.61
8.	**Aishwarya**	4.66	61.92	83.67	51.67	15.13	13.88	366.83	3.46
9.	**Prema**	5.45	57.50	80.13	45.20	14.30	20.57	270.2	3.70
S. Em		0.38	1.35	1.54	1.28	0.41	0.66	6.20	0.10
CD 5%		**1.14**	**4.06**	**4.63**	**4.04**	**1.24**	**2.10**	**12.55**	**0.30**

Photographs: Research work done at IGKV-Potato & Temperate Fruit Research Station, Mainpat, Surguja (C.G.)

Table 2. Performance of Broccoli in northern hill zone of Chhattisgarh

S. No	Varieties	Stem length (cm)	Yield/ plant (g)	Yield (kg/plot)	No of Sprout	Sprout weight (g)	Sprout yield /plot (kg)	Yield (q/ha)
1.	**Palam Samridhi**	28.43	323.33	14.34	6.87	40.73	6.50	184.00
2.	**Green giant**	27.70	318.00	12.80	5.59	35.26	5.26	156.23
3.	**Green speed**	27.12	276.49	8.96	5.36	34.12	4.48	173.74
4.	**KTS-1**	28.05	300.00	10.72	4.51	36.03	3.73	134.36
5.	**Puspa**	21.77	253.48	11.30	4.62	32.34	2.52	107.92
6	**Palam Haritika**	26.38	283.40	12.20	4.31	37.70	3.88	144.84
7.	**Priya**	26.03	269.67	9.50	6.60	35.17	3.60	120.17
8.	**Aishwarya**	26.33	290.00	9.61	4.57	33.59	4.70	137.71
9.	**Prema**	23.31	285.10	12.8	4.30	28.17	2.40	140.50
S. Em		0.73	6.93	0.38	0.13	1.08	0.14	4.42
CD 5%		**2.20**	**10.77**	**1.22**	**0.39**	**3.26**	**0.42**	**11.27**

CONCLUSIONS

The present study revealed that the growth, yield and yield attributing characters significantly differed within the different varieties. On the basis of performance of varieties related to head yield and other yield attributing characters Palam Samridhi proved to be the best suited and other three varieties namely Green Speed, Green Giant and Palam Haritika are also suitable for growing by the farmers in the region.

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