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Seed production potentialities of sprouting broccoli (*Brassica oleracea* var. Italica) varieties to different date of planting in plains of West Bengal

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Abstract
The present experiment was carried out at Horticultural Research Station, Mondouri, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal, to study the seed production potentialities of sprouting broccoli varieties planted at different dates. The experiment was laid out in Factorial Randomized Block Design, with three replication, during 2016-2017. The treatments composed of three different dates of planting (viz.15th September, 15th October and 15th November) with four numbers of varieties (viz. Palam Samridhi, Green Head, Pusa KTS-1 and Palam Kanchan). In respect to planting dates the findings in the present study revealed that highest seed yield were obtained when the plants were transplanted on 15th September. Amongst the varieties seed yield and seed yield attributing characters were found best from the varieties Palam Samridhi followed byGreen Head, Pusa KTS-1and Palam Kanchan. The highest seed yield of 437.61 kg/hectare was obtained with Palam Samridhiwhen transplanted on 15th September.from the present investigation it may be concluded that the variety Palam Samridhi has been found superior for seed production potentialities in the plains of West Bengal with September planting date.

Keywords: Planting date, seed, sprouting broccoli, varieties

Introduction
Broccoli (*Brassica oleracea*var. italica) is an important exotic vegetable from the family Brassicaceae. Broccoli is high in antioxidant and anticancer compounds. It has been shown to be effective in protecting against some cancers (Anonymous, 2002 [1]. and Yoldas, 2004) [16]. World statistics on broccoli production are incomplete and often mixed with cauliflower data. Important broccoli producing areas are: North America 56,000 ha, Europe 45,000 ha, Latin America 8000 ha and Asia 17,000 ha. In tropical Africa cauliflower and broccoli are minor crops; statistical data are very incomplete. In 2001, Broccoli production was about 6,745,000 tonnes in India and its share in the production of broccoli in the world is 32.31 percent (FAO.2014) [4]. In Himachal Pradesh, the crop has received growers attention and according to rough estimates, it occupies an area of 50 hectares with an annual production of 600 to 750 tonnes (Sharma *et al*. 2002). In the recent years broccoli is gaining popularity among the growers of West Bengal due to its palatability and high nutritive value as well as good market potential. But for commercial cultivation it is still on infancy stage and need to be exploited fully at different vegetable growing belts. Realizing the tremendous potential of sprouting broccoli in domestic and foreign market, the cauliflowers growers of terrain zone of West Bengal are gradually adopting the broccoli cultivation (Saha *et al*. 2006) [10]. But its Cultivation could not be promoted commercially due to non-availability of seed of the open

pollinated varieties of this crop. No doubt farmers are getting hybrid varieties of broccoli in the market from different private company but due to higher price the farmers are not able to cultivate commercially. As sprouting broccoli is a new crop Available information on seed production technology as well as not much work has been done on its seed production. Information is lacking on this aspects in the present condition of West Bengal. Keeping this view in perspectives, the present investigations have been taken with the objectives to find out the superior varieties and optimum time of planting for the seed production potentialities of broccoli. Suitableopen pollinated varieties of this crop are however, very much limited under West Bengal situation. A complete package on this line will help the growers to promote its cultivation commercially.

Materials and Methods

The present research work was conducted at Horticultural Research Station of Bidhan Chandra Krishi Viswavidyalaya, Mondouri, Nadia, West Bengal. The experiment was laid out Factorial Randomized Block Design with three replications. 12 treatment combinations with three replications arranged in 36 plots, during 2016-2017. The treatments composed of three different dates of planting 15th September, 15thOctober and15th November with different four numbers of varieties, namely Palam Samridhi, Green Head, Pusa KTS-1 and Palam Kanchan. The treatments are presented in Table 1. The soil of the experiment site was sandy loam and slightly acidic in nature with pH 6.5. The soil had total organic carbon of 0.57%, total Nitrogen of0.06%, available Phosphorus of 30.1kg/ha and available Potassium of 115.7kg/ha. The experimental site is under subtropical humid region with range of average temperature of 25^0 and 12^0 during experimental period of September to March. The twenty eight days old seedlings were transplanted at a spacing of 60cm x 45cm. Intercultural operations were followed according to the necessity. Observations on growth parameters were recorded from 60 days after transplanting of the crop.

Table 1: Treatment Details

Planting dates		
D1	:	15thSeptember
D2	:	15th October
D3	:	15th November
Variety		
V1	:	Palam Samridhi
V2	:	Green Head
V3	:	Pusa KTS-1
V4	:	Palam Kanchan

Statistical Analysis

Mean values of the parameters in each replication were statistically analyzed following the Factorial Randomized Block Design as suggested by Panse and Sukhatme (1985) [9]. and Gomez and Gomez (1984) [6]. The tables formulated by Fisher and Yates (1974). Were consulted for the purpose of comparison of F-values and for determination of critical differences (CD) at the probability level of 0.05 (5%).

Results and Discussion

Effect of planting dates and varieties on different growth and head yield attributing characters of sprouting broccoli

The representation of mean data of various effect of planting dates and varieties on different growth and head yield attributing characters of all sprouting broccoli presented in Table-2 has shown significant variations at 5% critical difference. The maximum plant height of (58.74cm) was obtained when the plants were transplanted on 15th September. The last date of transplanted plant produces only (49.90 cm) plant height which was the lowest among the three dates of planting. The maximum (60.16 cm) plant height was obtained from the variety Palam Samridhi and on the other hand Palam Kanchan had shown the lowest (46.79 cm) plant height. The differences in the varietal performance may be due to the inherent genetic configuration, asusual the variation in plant height may be due to environment effects like temperature, light intensity etc. The plant height with first date of planting might be due to the reason that earlier sown crop got favourable environment condition to complete the vegetable growth specially the temperature than delayed date of planting. When total number of leaves per plant is taken in account for statistical analysis, it has been noticed that the highest number of leaves per plant (21.52) was obtained from plants which were transplanted on 15th September and the lowest (19.06) number of leaves per plant was obtained when plant transplanted on 15thNovember. Then reasons behind obtaining maximum number of leaves might be the effects of environmental factors. However, highest (21.74) and lowest (18.35) was obtained from the variety Palam Samridhiand Palam Kanchan respectively. The maximum days required to head initiation of 102.91 days was obtained when the plants were transplanted on 15th September. The last dates of transplanted plants take only 89.81days to head initiation. Similarly delay in head maturity of cauliflower from early planted plant was reported earlier by Pandey *et al*. (1991) [8] and Gautam *et al*. (1998) [5] in India. The maximum (99.07days) days required to head initiation was obtained with Green Head. Palam Samridhi had showed the lowest (92.46days) days required to head initiation. The differences in the performance may be due to the inherent genetic configuration responsible for variation in days required to head initiation. This result is conformity with the finding of Booij (1990) [3]. Regarding the parameter days to head maturity, it was found to be maximum 118.49 days with early planting on 15th September and there was decreasing trend with delayed planting dates. Among the variety Palam Kanchan required the highest 111.85 days for head maturity. The lowest of 100.11 days to head maturity was observed with variety Palam Samridhi. Among the various planting dates maximum head size of (18.55cm^2**)** was obtained from first transplanted plant (15th September). The highest head size of (18.74 cm^2) was observed in variety Palam Samridhi and the result was statistically *at par* with result of Green Head (17.50 cm^2) but significantly (CD at 5%) superior to Palam Kanchan, as it produce the lowest (17.08cm^2) head size. The decreased head size with late planting might be due to the poor vegetative growth and fall in average temperature below the requirement of early season varieties, resulted to the production of poor head size. Saikia *et al*. (2010) [11]. confirmed the result and reported that sowing on 15th October recorded the highest total yield of 46.83 q/ha followed by sowing on 30th September (41.83 q/ha). In case of head weight, same trend of result has been noticed like the parameter head size where September date of planting has been found best over other dates of planting. Among the four varieties of this present investigation, the performances of Green Head with Pusa KTS-1 were found statistically *at par* on head weight. Palam Samridhi as because of promising cultivar amongst all varieties studied which adapted well to all agro- climatic regions might be a possible reason for

producing highest head weight 399.05 gm. The decreased trend in head weight in the late-planted crop might be due to the transition in weather towards lowering down the average maximum and minimum temperature and rainfall. This shift in weather condition caused adverse effect on plant by initiating more percentage of abnormal heads.

Table 2: Effect of planting dates and varieties on different growth and head yield attributing characters of sprouting broccoli

Treatments	Plant Height(cm)	Number of leaves per plant	Days required to head initiation	Days required to head maturity	Head size equatorial diameter) in (cm)	Head weight(g)
Planting dates						
D1	58.74	21.52	102.91	118.49	18.55	320.86
D2	53.68	20.51	94.31	107.37	17.85	293.62
D3	49.90	19.06	89.81	101.44	17.13	271.52
S. Em (±)	0.71	0.24	0.86	0.53	1.60	3.2
CD (5%)	2.10	0.72	2.54	1.56	4.70	9.41
Variety						
V1	60.16	21.74	92.46	108.10	18.74	399.05
V2	55.42	21.13	99.07	116.35	18.19	293.36
V3	54.02	20.23	95.38	100.11	17.36	262.49
V4	46.79	18.35	95.80	111.85	17.08	226.43
S. Em (±)	0.85	0.28	1.00	0.61	1.85	3.70
CD (5%)	2.43	0.83	2.93	1.81	5.43	10.86

Table 3: Effect of planting dates and varieties on flowering and seed yield attributes characters of sprouting broccoli

Treatments	Height of the inflorescence stalk (cm)	Days to 50% flowering	Siliqua per plant	Length of siliqua (cm)	Number of seeds per siliqua	1000 seed weight (g)	Seed yield (kg/ha)
Planting dates							
D1	75.09	151.76	291.46	4.50	11.12	4.03	353.62
D2	68.97	147.02	282.90	4.13	10.04	3.69	320.39
D3	63.97	141.64	269.96	3.97	8.67	3.48	299.94
S. Em (±)	1.21	0.88	6.39	0.05	0.56	0.07	4.20
CD (5%)	3.57	2.61	18.7	0.15	0.19	0.22	12.33
Variety							
V1	75.60	142.10	304.97	5.25	12.65	3.97	398.98
V2	66.43	142.93	287.19	4.20	10.86	3.83	344.39
V3	72.55	149.56	273.07	3.89	8.73	3.60	286.36
V4	62.80	152.65	260.54	3.45	7.54	3.52	268.81
S. Em (±)	01.40	1.08	18.75	0.17	0.22	0.09	14.24
CD (5%)	4.12	3.01	5.53	0.05	0.65	0.26	4.85

Effect of planting dates and varieties on flowering and seed yield characters of sprouting broccoli:

The maximum height of inflorescence stalk75.09cm was obtained when the plants were transplanted on 15th September followed by 15th October transplanted plant which produced 68.97 cm. The minimum of (63.97 cm) was observed when the plants were transplanted on 15th November. The longest inflorescence stalk was recorded from Palam Samridhi of 75.60 cm followed by Pusa KTS-1 of 72.55 cm. Genetically factors as well as the influence of temperature, relative humidity etc. might be the causes behind such result. Regarding days to 50% flowering maximum number days were taken by early planted crop and Palam Kanchan required the highest days of 152.65 days followed by Pusa KTS-1. The increase in crop duration in crop early planting dates might be due to the fact that late planting crop got the required temperature for flowering more quickly before full vegetative growth than early planted crop. Better performance regarding number of siliqua per plant was obtained when the plants were transplanted on 15th September and from the variety Palam Samridhiof 304.97 number of siliqua per plant. However, the response of the mentioned variety was statistically *at p*ar with Green Head, which produced 287.19 number of siliqua. The performance of genotype Palam Samridhi was found to be superior amongst all the genotypes on siliqua length and it was5.25 cm rom the data it revealed that highest number of seeds per siliqua (11.12) was observed with earlier transplanted plant. Delayed in transplanting number of seeds per siliqua was gradually decreased. The decreasing tendency in number of seeds per siliqua in delayed transplanted plant might be due to the stress of environment during that particular period which falls for proper development seeds in siliqua. The results are inconformity with the findings of Singh (1999) [14]. and Bhardwaz and Sharma (1996) [2].Variety Palam Samridhi produced the maximum number of seeds per siliqua amongst all the variety that is 12.65. The highest 1000 seed weight of (4.03g) was obtained from first transplanted plant. However, the data 1000 seed weight obtained from other two date of plantings, i.e. 15th October and 15th November were respectively statistically *at par*. This observation was collaborated to the findings of Bhardwaz and Sharma (1996) [2]. The highest 1000 seed weight (3.97g) was obtained from Palam Samridhi variety and the lowest 1000 seed weight of (3.52 g) was regarded from the variety Palam Kanchan. The above variation on 1000 seed weight among the varieties might be due to the randomly visit of pollinating agents or may be prevailing environment condition during the seed development stages which favour for individual genotype. It revealed from the result that maximum of (353.62 kg) per hectare of seed yield was obtained on 15th September transplanted plant followed by 15th October transplanted plant. The lowest seed yield per

hectare of 299.94 kg was found from late transplanted plant. Amongst the four varieties in this present experiment variety Palam Samridhi produced the highest seed yield of (398.98 kg) per hectare, which differ significantly (at 5% critical difference) from that of the variety Green Head which produced the second highest seed yield of (344.39 kg) per hectare. The lowest seed yield of (268.81 kg) per hectare was observed from the variety Palam Kanchan. The third highest seed yield of (286.36 kg) per hectare was obtained from Pusa KTS-1. The difference seed yield per hectare amongst the three varieties may be due to the difference inherent genetic constitution or may be due to the other factors. It is evident therefore early planting of broccoli had induced normal vegetative growth which might be conducive climatic condition which resulted better photosynthetic activities and higher mobilization of assimilates are responsible for highest seed yield beside this the highest seed yield may be due to the better growth, profuse branching, more number seeds per siliqua which in term contributed to more seed yield. The trend of present results is agreement with the finding of Thapa *et al.* (2002) [15].

Conclusion

Based on result obtained from the present investigation, it may be concluded that planting dates is one of the important factors for successful seed yield of broccoli. To get the quality seed and higher seed yield in broccoli the plants are planted in such a time so that favourable climatic conditions are very much required in both vegetative and reproductive phase. It indicates from the present investigation that planting dates are adjusted in such way that vegetative phase should be completed before the very prevailing cold as well as flowering should be completed within a appropriate time. It may be concluded from the investigation that optimum time of planting for higher seed yield of Sprouting Broccoli was 15thSeptember, so this planting date may be considered suitable to produce good broccoli seed in the plains of West Bengal. Similar to planting date different genotypes also plays a vital role for good bold and higher seed. In respect to genotypes Palam Samridhi may be the best performing variety amongst the rest of varieties.

References

1. Anonymous Food and agriculture development in Asia-Pacific region. (2002), FAO, Thailand. 2002; 19:186.
2. Bhardwaj ML and Sharma PP Studies on seed production in Indian cauliflower under sub-tropical regions of Himachal Pradesh. Indian J Hort. 1996; 53(3):206-209.
3. Booij R. Cauliflower curd initiation and maturity variability within a crop. J Hon. Sci. 1990; 65(2):89-99.
4. FAO, Org. Cauliflower and Broccoli. Data.fao.org/statistics, 2014,
5. Gautam BP, Shadeque A, Saikia L. Effect of sowing dates and varieties on growth and yield of early cauliflower. Veg. Sci. 1998; 25(1):1-4.
6. Gomez KA, Gomez AA. Statistical procedure for Agricultural research (2nd edition). A Wiley Intl. Sci. Pub., New York.1984; 20-30.
7. Kanwar JS. Effect of sowing date on seed yield of cauliflower. Seed Res. 1994; 22(1):69-70.
8. Pandey UC, Lai S, Mangal JL, Singh GP. Effect on date of transplanting on yield of cauliflower. Haryana Agric. Univ. J Res. 1991; 11(3):379-383.
9. Panse VG, Sukhatme PV. Statistical methods for Agricultural Workers 2nd Edn. ICAR, New Delhi.1985; 36.
10. Saha P, Chatterjee R, Mukhopadhyay D. Effect on boron and molybdenum on yield and quality of sprouting broccoli under teraiagroecological region of West Bengal. Crop Res. Hissar. 2006; 32(3):396-400.
11. Saikia BR, Phookan DB, Brahma S. Effect of time of planting and planting densities on growth, yield and economic production of broccoli [*Brassica oleracea* (L.) *var*. italica Plenck] cv. Pusa broccoli KTS-1. J Hill Agric. 2010; 1(2):135-139.
12. Sari N, Dasgan HY, Kazim A. Effects of sowing times on yield and head size of broccoli grown in the GAP Area, Turkey. Acta Hort. 2000; 533:299-305.
13. Sharma SK, Sharma R, Korla BN. Effect on nitrogen and phosphorus on the growth and seed yield of sprouting broccoli cv. Green Head. The Hort. J. 2000; 15(2):87-90.
14. Singh AK, Khan AR, Singh A. Influence of different dates of transplanting on head yield of broccoli. Crop res. 1999; 17(1):104-106.
15. Thapa U, Maity TK, Pandit MK. Effect of planting date and variety on seed production of early cauliflower. Veg. Sci. 2002; 229(2):189-190.
16. Yoldas F, Esiyok D. Effect of plant spacing, sowing and planting date on yield and some quality parameters of broccoli. Ege Univ. Ziraat Fakltesi Dergisi. 2004; 41(2):37-48.