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Effect of sowing dates on biochemical parameters of edible pod pea genotypes

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Edible pod pea which includes snow pea (*Pisum sativum* var. *saccharatum*) and sugar snap pea (*Pisum sativum* var. *macrocarpon*) is one of the popular cool season oriental vegetable which shares the cultivation pattern with the garden pea. The pods are mildly flavoured, lack pod parchment or fibre and can be eaten together as plump pods along with partially developed seeds usually by removing the tough strings along the edges of pods as salad, lightly boiled, steamed or used in 'stir-fry' and other dishes. At the global level, garden pea covers an area of about 2.67 million hectares with a production of 20.70 million metric tonnes and productivity of 7.75 metric tonnes/ha (Anonymous 2017). In India, it occupies an area of 540 thousand hectares with the production of 5422 thousand tonnes (Anonymous 2018). Recently in India, popularity of edible pod pea is increasing and has tremendous scope for its spread particularly in the niche and up market in the urban areas besides has great potential as export and processed vegetable. Presently, corporate houses of India are interested in farming of such exotic crops though there are no final figures available for snow pea cultivation in India. Snap pea can be grown in varied agro climatic conditions, but optimum yield and quality of produce can be obtained in cool and moist growing conditions. The choice of sowing date is an important management option to optimize pod yield (Sharma et al. 2014). For the purpose, the varieties suitable to a specific climatic condition are needed. Therefore, the optimum sowing date and a suitable variety is of primary importance for harnessing potential yield (Sharma et al. 2014). Keeping this in view, mid-season edible pod pea genotypes have been developed recently through hybridization between snow pea and garden pea genotypes followed by selection in segregating generations. Therefore, it would be imperative to study the effect of different sowing dates on the performance of different genotypes of snow pea to harness better growth and potential pod yield thereby also analyse biochemical traits.

The present investigation was carried out at the Experimental Farm of the Department of Vegetable Science and Floriculture, College of Agriculture, Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Palampur during winters 2018-19 and 2019-20, respectively to evaluate the response of 4 edible pod pea genotypes namely, DPEPP-10-1, DPEPP-15-1, Mithi Phali and Arka Apoorva to different sowing dates (21st October, 5th November and 20th November). Thus, a total of 12 treatments were evaluated in split plot design with three replications in the respective years in a plot size of 2.7 m × 1.8 m at spacing of 45 cm between rows and 7.5 cm within row. The dates of sowings were placed in main plots and four varieties in the sub plots. The standard plant protection and other cultural practices were followed to maintain uniform experimental conditions. The observations were recorded on randomly taken ten plants for quality traits namely, total soluble solids (seeds and whole pod), protein content, ascorbic acid content, reducing sugar, non-reducing sugar and total sugar content. The analysis of variance was done for all the quality characters as per the method given by Gomez and Gomez. 5-10 whole pods containing seeds and seeds alone of fresh pods from second picking randomly were crushed in pestle-mortar from the each treatment and the liquid extract obtained was used to record the total soluble solids of whole pods containing seeds and fresh seeds respectively with the help of a digital refractometer in °Brix. Ascorbic acid content was estimated from the marketable green pod harvest stage by '2, 6 dichlorophenol-indophenol Visual Titration Method' as described by Ranganna. Dry pea pods along

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with seeds were grounded to a fine powder and protein was estimated with the help of Perten Inframatic Analysis System machine. The Inframatic Analyzer is a Near Infrared Reflectance (NIR) spectrometer specifically designed and optimized for the analysis of powdered food products. The sugar content of the marketable green pod was estimated by 'Shaffer-Somogyi Micro Method' as described by Ranganna.

Effect on total soluble solids (seeds and whole pod): The data presented in Table 1 revealed that different sowing dates had no influence on total soluble solids (seeds) during 2018-19 and on pooled basis. In contrary, sowing dates influenced significantly total soluble solids (whole pod) during 2018-19 and on pooled basis. During 2019-20, sowing dates had significant influence on total soluble solids (seeds) with significantly more content in crop sown on 21st October and 5th November as compared to 20th November. Similarly, maximum total soluble solids content in whole pod was recorded in early sown crop that was significantly more than 5th November and 20th November sown crop. Amongst the varieties, significant differences were recorded for total soluble solids in both seeds and whole pod, in both the years as well as on pooled basis. DPEPP-10-1 showed higher total soluble solids in both seeds and whole pod over other varieties though it was at par with DPEPP-15-1. Kumar et al. (2015) had also observed wide variation in the performance of different genotypes of garden pea for total soluble solids (seed).

Effect on protein content and ascorbic acid: The scrutiny of the data presented in Table 1 revealed that sowing dates had pronounced influence on protein content during 2018-19 and on pooled basis but it could not influence ascorbic acid during both the years as well as on pooled basis. Significantly highest protein content was found in 5th November sown crop over 21st October and 20th November sown crop which were at par with each other during 2018-19. On pooled basis, significantly higher protein content was found in 5th November sown crop though it was at par with and 21st October sown crop and significantly higher than 20th November sown crop. Kaur (2018) recorded maximum protein content in early sown crop. Maximum ascorbic acid content was recorded in early sown crop on 21st October followed by 5th November and 20th November sown crop during both the years. However, Chandel (2019) had observed higher ascorbic acid content in late sown crop. Amongst the varieties, significant differences were recorded for protein content in both the years and on pooled basis while differences for ascorbic acid content were recorded during 2019-20 and on pooled basis. On pooled basis, significantly higher protein content was recorded in Arka Apoorva and DPEPP-15-1 which were significantly better than other genotypes. Lowest protein content was recorded in variety DPEPP-10-1 in both the years and on pooled basis. On the other hand, DPEPP-10-1 showed significantly maximum ascorbic acid content over other varieties during 2019-20 and on pooled basis followed by Mithi Phali. Al-Aysh et al. (2015) and Katoch et al. (2016) had observed significant differences in the performance of different genotypes of garden pea for protein content and ascorbic acid content.

Effect on sugar content: Data presented in Table 1 revealed that different sowing dates had no influence on reducing sugar, non-reducing sugar and total sugar content during both the years as well as on pooled basis except non-reducing sugar during 2019-20 which was significantly influenced by sowing dates. During this year, significantly higher non-reducing sugar content was recorded in late sown crop on 20th November as compared to other dates of sowing. Amongst the varieties, significant differences were recorded over the years and on pooled basis for these traits. The maximum reducing sugar content was recorded in DPEPP-15-1 which was at par with DPEPP-10-1 during 2018-19, but it had significantly outperformed all varieties during 2019-20 and on pooled basis. The maximum non-

Table 1: Effect of dates of sowing on biochemical parameters of different edible pod pea genotypes

Treatment	TSS (°B) (seeds)			TSS (°B) (whole pod)			Protein content (%)			Ascorbic acid (mg/100g)			Reducing sugar (%)			Non-reducing sugar (%)			Total sugar (%)		
Year	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled
Date of sowing																					
21st October	14.79	15.68	15.24	9.29	8.96	9.13	22.13	18.86	20.50	31.05	35.00	33.03	0.59	0.58	0.58	0.29	0.24	0.27	0.88	0.82	0.85
5th November	15.46	14.98	15.22	7.78	8.13	7.95	23.20	18.42	20.81	30.50	33.01	31.76	0.58	0.60	0.59	0.28	0.25	0.27	0.86	0.85	0.86
20th November	15.21	14.32	14.76	7.70	7.78	7.74	21.66	17.65	19.65	28.51	29.66	29.09	0.56	0.60	0.58	0.28	0.28	0.28	0.84	0.88	0.86
CD (P=0.05)	NS	0.85	NS	0.64	NS	0.48	0.66	NS	0.68	NS	NS	NS	NS	NS	NS	NS	0.02	NS	NS	NS	NS
Variety																					
DPEPP-15-1	15.44	15.30	15.37	8.47	8.80	8.63	23.50	18.29	20.89	29.81	29.55	29.68	0.64	0.66	0.65	0.29	0.28	0.28	0.93	0.94	0.93
DPEPP-10-1	16.78	15.62	16.20	8.82	8.89	8.86	21.23	17.27	19.25	30.68	36.87	33.78	0.60	0.61	0.61	0.34	0.31	0.32	0.94	0.92	0.93
Mithi Phali	14.23	14.39	14.31	7.63	7.37	7.50	22.03	18.38	20.21	30.30	33.45	31.87	0.51	0.51	0.51	0.24	0.20	0.22	0.75	0.72	0.73
Arka Apoorva	14.16	14.67	14.41	8.11	8.11	8.10	22.56	19.30	20.93	29.30	30.37	29.83	0.57	0.58	0.57	0.27	0.24	0.25	0.83	0.82	0.83
CD (P=0.05)	1.08	0.74	0.63	0.61	0.72	0.45	0.67	0.60	0.44	NS	2.00	1.51	0.05	0.04	0.03	0.03	0.03	0.02	0.05	0.06	0.04
D x V	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

reducing sugar content was recorded in DPEPP-10-1 which was significantly more than DPEPP-15-1, Arka Apoorva and Mithi Phali in that order, each variety differing significantly from one another. The maximum total sugar content was recorded in DPEPP-10-1 and DPEPP-15-1 which were significantly better than Arka Apoorva and Mithi Phali during both the years and on pooled basis. Interaction effects between sowing dates and varieties were non-significant for all the biochemical parameters.

In conclusion, early sown edible pod pea crop (21st October) resulted in more total soluble solids (seeds and whole pod) and ascorbic acid content. Amongst the varieties, DPEPP-10-1 showed significantly superior performance for more total soluble solids (seeds and whole pod), ascorbic acid content and non-reducing sugar content followed by DPEPP-15-1. On the other hand, DPEPP-15-1 showed more reducing sugar content followed by DPEPP-10-1 while both were at par with each other for total sugar content.

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