



## **Influence of Date of Sowing and Number of Cuttings on Leaf Yield and Quality of Seed in Palak (*Beta vulgaris* var. *bangalensis*)**

**Sumati Narayan<sup>1</sup>, Ajaz Malik<sup>1\*</sup>, M. I. Makhdoomi<sup>1</sup>, Ambreen Nabi<sup>1</sup>, K. Hussain<sup>1</sup> and F. A. Khan<sup>2</sup>**

<sup>1</sup>*Division of Vegetable Science, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Shalimar, Srinagar – 190 025 (J&K), India.*

<sup>2</sup>*Division of Basic Science and Humanities, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Shalimar, Srinagar – 190 025 (J&K), India.*

### **Authors' contributions**

*This work was carried out in collaboration between all authors. Authors SN and AM designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors MIM, AN and KH managed the analyses of the study. Author FAK managed the literature searches. All authors read and approved the final manuscript.*

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### **ABSTRACT**

A field experiment was conducted to ascertain the Influence of Date of sowing and number of cuttings on leaf yield and quality of seed in Palak (*Beta vulgaris* var. *bangalensis*) in Experimental Field, Division of Vegetable Science, SKUAST-K Shalimar during three consecutive rabi seasons of 2013-14, 2014-15 and 2015-16. The experiment comprised of three sowing dates viz first fortnight of October, 2<sup>nd</sup> fortnight of October and 1<sup>st</sup> fortnight of November and four levels of cutting i.e no cutting, one cutting, two cutting and three cutting. The observations were recorded on Green leaf weight (q/ha), 100 seed weight (g), seed yield (q/ha), Germination %, Vigour Index I & II and Economics of Production. The date pooled over three years reveals a significant effect of sowing dates and number of cuttings on leaf and seed yield. Results obtained indicated that highest green

\*Corresponding author: E-mail: [geemalik06@gmail.com](mailto:geemalik06@gmail.com);

leaf yield can be obtained by sowing in the first fortnight of October and three cuttings, however highest seed yield can be obtained by sowing in the second fortnight of October with two cuttings. Benefit-cost ratio for various treatments was also worked out. D<sub>2</sub>C<sub>1</sub> treatment i.e sowing in 2<sup>nd</sup> fortnight of October and one cutting gave a highest benefit cost ratio of 3.66:1.

**Keywords:** Date of sowing; spinach; seed yield; vigour index.

## 1. INTRODUCTION

Palak or Spinach beet (*Beta vulgaris* var. *bangalensis*) is one of the most common leafy vegetable grown and consumed in India. It is primarily used as pot herb. Spinach beet is most probably a native of Indo-Chinese region. Spinach beet, Swiss chard and garden beet has a chromosome number  $2n=2x=18$ , indicates their close relationship. Leaves of this crop might have been first used in Bengal and hence it is known as *Beta vulgaris* var. *bangalensis*. Being a leafy vegetable, it is very rich in minerals and vitamin A and C and also contains appreciable amounts of protein, calcium, Iron and Roughages. Thus, making it indispensable in human diet. 100 g leaves contains 86.6% moisture, 3.4 g protein, 0.8 g fat, 6.6 g carbohydrate, 5862 IU vitamin A, 0.26 mg thiamine, 0.56 mg Riboflavin, 3.3 mg Niacin, 70 mg Ascorbic Acid, 380 mg Calcium, 30 mg phosphorus and 16 mg Iron.

In spite of the importance of this vegetable, little attention has been paid to evolve suitable package of practice for remunerative cultivation since temperature plays a major role in germination, vegetative growth, flowering and fruiting, so the appropriate sowing time is to be ascertained to get highest leaf and seed yield. The yield of Indian spinach depends on vegetative growth it may be expressed in terms of number of leaves per plant, size of leaf and plant height etc. For obtaining more vegetative growth cutting of crop is important due to cutting of crop side shoots are arises which increases the number of leaves per plant and ultimately increased the yield [1]. Cutting of leaves affects the vegetative growth of plant causing delay in flowering and seed setting. Keeping in view the above points, a research experiment was framed to standardise the sowing date and number of cuttings in palak under temperate conditions of Kashmir.

## 2. MATERIALS AND METHODS

The present research was conducted to study the effect of date of sowing and number of

cuttings on leaf and seed yield in Spinach beet at experimental farm, division of vegetable science, SKUAST-K, Shalimar, Srinagar during three consecutive Rabi seasons of 2013-14, 2014-15 and 2015-16. The experiment was based on 3 dates of sowing i.e. (1<sup>st</sup> Fortnight of October (D<sub>1</sub>), 2<sup>nd</sup> Fortnight of October (D<sub>2</sub>) and 1<sup>st</sup> fortnight of November (D<sub>3</sub>) and four levels of cutting No cutting (C<sub>0</sub>), one cutting (C<sub>1</sub>), Two cutting (C<sub>2</sub>) and three cutting (C<sub>3</sub>) making a total of 12 combinations. The experiment was laid in RBD with 3 replications. Seeds of variety Shalimar Green were sown in rows 30 cm apart and plot size of 3x3 m. The observations were recorded on Green leaf weight (q/ha), 100 seed weight (g), seed yield (q/ha), Germination %, Vigour Index I & II and Economics of Production. The date was pooled over three years.

## 3. RESULTS AND DISCUSSION

Perusal of the data in Table 1 reveals significant differences among various treatments. As per green leaf weight, sowing at different dates gave different yields. Highest leaf yield of 115.68 q/ha was recorded in sowing during 1<sup>st</sup> fortnight of October (113.70 q/ha) which were significantly higher than sowing during 1<sup>st</sup> week of November (107.69). The results are also in agreement with the findings of [2] who reported that the sowing dates didn't show any significant effect on leaf yield/plant.

With regards to leaf cutting, significantly higher leaf yield was obtained in C<sub>3</sub> (167.52 q/ha) followed by C<sub>2</sub> (113.38) and C<sub>1</sub> (56.20 q/ha). However in no cutting, no leaf was harvested. The findings are in agreement with the findings of [3] and [4] who reported that total green leaf yield was highest with a combination of 150 kg N/ha and 3 cuttings. [5] also revealed that three cuttings at 35, 50 and 65 DAS independently gave the highest green leaf yield of 6.2 t/ha.

Interaction with both the treatment reveals that maximum green leaf yield was recorded in D<sub>1</sub>C<sub>3</sub> (55.59 q/ha) followed by D<sub>2</sub>C<sub>3</sub> (53.23 q/ha), D<sub>3</sub>C<sub>3</sub> (50.15 q/ha) as compared to other treatments.

**Table 1. Effect of different sowing time and cutting on yield and seed characters in spinach beet**

	<b>Green leaf weight (q/ha)</b>	<b>100 Seed weight</b>	<b>Seed yield</b>	<b>Germination %</b>	<b>Vigour index mass</b>	<b>Vigour index length</b>	
<b>Date of sowing</b>							
D1	115.68	1.38	25.28	78.33	1136.28	1.24	
D2	113.70	1.40	24.90	77.58	1079.63	1.26	
D3	107.69	1.31	21.86	75.67	1101.39	1.13	
CD at 5%	4.99	0.09	2.18	1.90	40.26	0.13	
<b>No. of cuttings</b>							
C0	0	1.37	22.62	77.16	1064.17	1.21	
C1	56.20	1.37	26.67	77.04	1145.16	1.33	
C2	113.38	1.37	25.23	78.33	1135.63	1.23	
C3	167.52	1.37	21.54	75.68	1078.11	1.07	
CD at 5%	5.89	0.10	2.52	2.19	46.39	0.15	
<b>Interaction</b>							<b>B:C ratio</b>
D1xC0	0.00	1.34	22.42	78.02	1087.07	1.25	2.69
D1xC1	18.42	1.37	27.91	78.00	1160.15	1.30	3.62
D1xC2	38.67	1.41	27.80	80.44	1183.68	1.34	3.64
D1xC3	58.59	1.41	23.02	76.87	1114.23	1.09	3.50
D2xC0	0.00	1.41	23.07	77.22	1060.82	1.23	2.77
D2xC1	19.08	1.41	28.13	78.13	1102.47	1.47	3.66
D2xC2	38.98	1.39	25.87	79.58	1113.02	1.30	3.45
D2xC3	55.64	1.40	22.53	75.41	1042.22	1.07	3.39
D3xC0	0.00	1.38	22.37	76.24	1044.63	1.17	2.68
D3xC1	18.70	1.33	23.98	76.68	1172.86	1.24	3.17
D3xC2	35.73	1.32	22.02	74.99	1110.19	1.07	2.99
D3xC3	53.29	1.21	19.08	74.77	1077.90	1.07	3.00
<b>C.D.</b>	9.14	0.24	0.73	0.58	5.74	0.13	

**(p<- 0.05)**

[6] reported that the maximum fresh foliage was obtained from October sowing (20.82 q/ha). [7] reported that the crop sown in October cut once or twice give more green leafy yield.

Data on spinach seed yield per ha as presented in Table 1 revealed that max seed yield of 25.28 (q/ha) was recorded under sowing in D<sub>1</sub> (1<sup>st</sup> fortnight of October) followed by D<sub>2</sub> (2<sup>nd</sup> fortnight of October). The results are in agreement with [8] who reported that the significant highest seed yield (8.67 q/ha) was recorded when seeds were sown on 10<sup>th</sup> October in combination with the application of 100 kg N/ha.

In case of leaf cuttings, maximum seed yield of 26.67 q/ha was recorded in C<sub>1</sub> followed by C<sub>2</sub> (25.23 q/ha). The findings are in conformity with the earlier work of [9].

An interaction effect of Date of sowing and of cuttings on seed yield reveals that sowing during

2<sup>nd</sup> fortnight of October with single cutting gave highest seed yield of 28.13 q/ha followed by D<sub>1</sub>C<sub>1</sub>. The results are in agreement with the earlier results obtained by [7]. More number of cuttings resulted in a reduction of seed yield due to delay in flowering and seed setting.

Maximum 100 seed weight was recorded in treatment D<sub>2</sub> i.e. sowing during 2<sup>nd</sup> fortnight of October followed by D<sub>1</sub> (sowing during 1<sup>st</sup> fortnight of October). Different cutting levels had no significant effect on 100 seed weight.

An interaction effect of both the treatments register more or less similar 100 seed weight for all the treatments.

Perusal of data on the seed quality parameter i.e. germination %, vigour index mass & Vigour Index length revealed that date of sowing had a significant effect on these parameters. Sowing during the month of October gave the highest

germination per cent, vigour index mass and Vigour Index length.

Maximum and at par results for these seed quality parameters were obtained with 1<sup>st</sup> and 2<sup>nd</sup> cuttings, however, C<sub>3</sub> drastically reduce the seed quality in terms of these parameters.

Interaction of both these factors suggested that sowing during 1<sup>st</sup> fortnight with two cuttings gave maximum seed germination (80.44%) and Vigour Index mass (1183.68), however maximum Vigour index length (1.47) was recorded in D<sub>2</sub>C<sub>1</sub> (sowing during // fortnight & one cutting).

Benefit-cost ratio for various treatments was worked out. D<sub>2</sub>C<sub>1</sub> treatment i.e sowing in 2nd fortnight of October and one cutting gave highest benefit-cost ratio of 3.66:1. Similar results were also obtained by Gill et al. [10] who reported that the benefit cost ratio was higher in earlier sowing dates (1<sup>st</sup> and 15<sup>th</sup> October).

#### 4. CONCLUSION

It can be concluded from the results obtained that highest green leaf yield can be obtained by sowing in the first fortnight of October and three cuttings, however highest seed yield can be obtained by sowing in the second fortnight of October with two cuttings.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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