



Influence of sowing time and leaf cuttings on the seed yield and quality components of palak (*Beta vulgaris* var *bengalensis*)

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ABSTRACT

A field study to assess the effects of sowing time and leaf cuttings on the yield and quality of palak (*Beta vulgaris* L. var *bengalensis*) seed was carried out at Vegetable Research Farm of Punjab Agricultural University, Ludhiana during 2009–10 and 2010–11. The experiment was laid out in a split plot design with sowing time as main plot and cuttings as sub-plot treatment. The results revealed that crop sown in October with one cutting had maximum seed yield (27.83 q/ha), 100 seed weight (1.4 g), germination (80.33%), seed vigour index-I and vigour index-II, which was statistically at par with two cuttings but significantly higher than the November sown crop. Late sown crop coupled with more cuttings though increased the number of branches/plant and total green leaf yield but the seed yield and quality in terms of germination, seedling dry weight and vigour indices I and II was considerably reduced due to less absorption and storage of photosynthates. Thus, the crop sown in October cut once or twice besides giving more green leaf yield produced maximum seed yield and better quality seed in palak.

Key words: Cuttings, Germination, Palak, Seed vigour, Seed yield

Green leafy vegetables constitute an essential component of balanced human diet. They play an important role in overcoming both micro and macro nutrient deficiencies, fight degenerative diseases and cancer (Grubben 1977). Palak (*Beta vulgaris* L. var *bengalensis*) is highly nutritious leafy vegetable in India preferred for its succulent leaves. It is a good source of iron, protein, vitamin A and chlorophyll. Fresh leaves forms an important ingredient in “Saag”- a culinary Asian speciality particularly in India and Pakistan (Muendel 1990). Though it is an integral part of home gardens (Spore 2005) across the world, the requirement of commercial fresh leaf and seed production is totally different. Also, non availability of quality seed is a major constraint in cultivation. Several factors like sowing period and leaf cuttings have direct influence on seed yield and quality. Singh and Gill (1983) obtained highest palak seed yield when the crop was cut once. Whereas, Phor and Mangal (1991) stated that one cutting at 40 days after sowing gave better quality and higher seed yield and Lal *et al.* (1979) found cuttings to be profitable for seed yield in palak. Similarly, *gobhi sarson* gave better

seed yield when cut once than uncut (Gupta and Saini 1986). Lal *et al.* (2003) obtained significantly high seed yield in November sown crop with one cutting in fenugreek. Khan *et al.* (2003) reported the influence of cutting levels on plant growth parameters which reflected in final seed yield and quality in gram. Due to absence of any comprehensive study to overcome the hindrance in quality seed production, there is an urgent need for the standardisation of sowing time and cutting frequency. This can accrue windfall profits for the growers both in terms of fresh leaf and seed yield in palak. Therefore, the research gap on these attributes lead to the present investigation to find out the optimum sowing time and number of leaf cuttings on the seed yield and quality in palak.

MATERIALS AND METHODS

The experiment was conducted at the Vegetable Research Farm and Seed Technology Centre, Punjab Agricultural University, Ludhiana during the winter season of 2009–10 and 2010–11. The climate of Ludhiana is subtropical with extreme hot during the summer and freezing temperature during winter. The experiment was laid out in a split-plot design replicated thrice with sowing time as main and the leaf cuttings as sub plot treatments. Plot size was kept at 3 m × 3 m. Seeds of cv. Punjab Green were sown at within row spacing of 50 cm and within plant spacing of 30 cm. Different

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sowing dates (D₁, First fortnight of October, D₂, second fortnight of October D₃, first fortnight of November) were allotted main plot treatments, and number of green leaf cuttings (C₀, no green leaf cutting, C₁, one cutting, C₂, two cuttings and C₃, three cuttings) as sub-plot treatments. First leaf cutting was done 40 days after sowing and subsequent cuttings were done after 20 days after first and second cutting. Other agronomic practices and plant protection measures were followed as per Punjab Agricultural University's package of practice (Anonymous 2011). Data were recorded on plant height (cm), green leaf yield (q/ha), number of branches, number of days to 50% flowering, 100 seed weight (g), seed yield (q/ha), germination (%), seedling length (cm), seedling dry weight (g), vigour index-I and vigour index-II. The data were analysed using Steel and Torrie (1980). Number of days to 50% flowering and green leaf yield (q/ha) and seed yield (q/ha) was estimated from the entire plot for each treatment. For 100 seed weight, 100 seeds were selected from each plot at random and weighed on electronic balance. The germination was tested as per ISTA seed testing rules (ISTA 1999) in quadruplicate of 100 seeds each at 25±1°C in a germinator. For determining seedling dry weight ten randomly selected normal seedlings were dried at 110°C for 17 hours and weighed. Vigour index was calculated using the formula given by Abdul-Baki and Anderson (1973). The treatment means were separated by DMRT at 5% level of significance for interpretation of the results.

RESULTS AND DISCUSSION

Since there were no significant differences between the results of the year 2009–10 and 2010–11 in respect of different parameters, pooled analyses were done and discussed accordingly.

Growth attributes

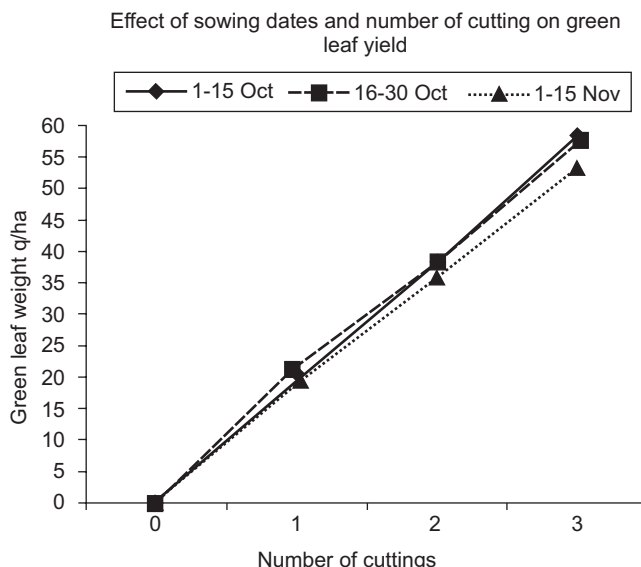
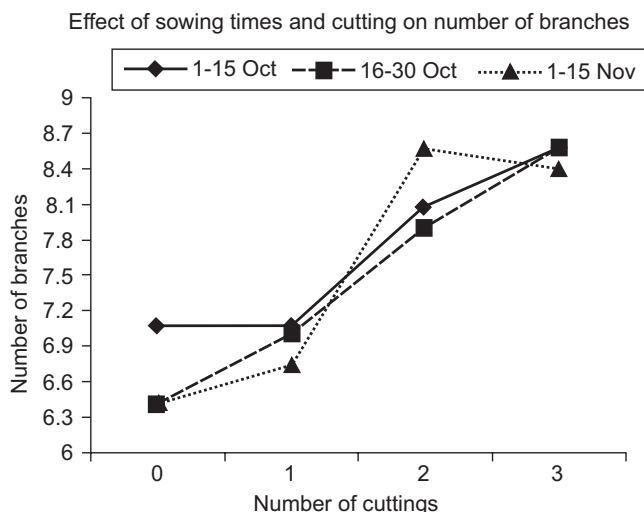
Maximum plant height was obtained when the crop was sown during first fortnight of October (173.9 cm) without

any leaf cutting which was significantly higher than other treatments and was least in the November sown crop with three cuttings. This can be explained by way of favourable environment available over a longer period of time for its vegetative growth before entering the reproductive phase (Waseem *et al.* 2001). The results also showed that the delay in sowing and increase in cutting frequency adversely affected the plant height. This reduction in plant height may be due to less number of days available for the crop for vegetative growth before entering reproductive phase (Korla and Saini 2003). Sowing time had no effect on number of branches/plant though it was maximum in D₁. However, number of branches increased with the increase in number of cuttings and it was highest when crop was cut thrice. This is due to the fact that cutting enhances the tillering and leading to more number of branches.

Combined effects also showed similar pattern that crop sown in first fortnight of October and cut three times gave maximum number of branches. Korla and Saini (2003) observed similar interaction between cuttings and different genotypes in fenugreek. Likewise, Thakral *et al.* (1991) reported that pinching of apical bud while checking the vertical growth encouraged more productive axillary branching contributing towards overall seed yield in coriander. Significant effect of cuttings was observed among treatments in days to 50% flowering. Days to flowering were least in uncut crop but were statistically at par with one cutting and were least when the crop was cut thrice. The earliness in flowering may be due to the change in the source sink relationship thereby advancing the reproductive phase of the crop (Vasudevan *et al.* 2008).

Green leaf yield

Sowing time had no significant effect on total green leaf yield though it was highest when the crop was sown in the

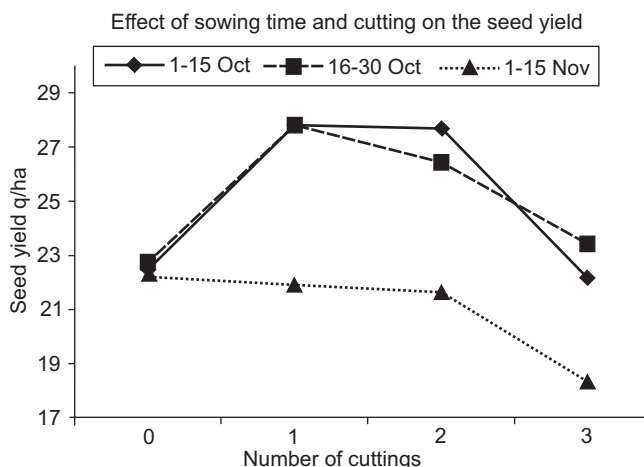


second fortnight of October. Rate of plant biological processes impacting the crop growth and development are affected by climatic conditions like temperature during the growing period of the crop (Beinhauer 1980). Cuttings had pronounced and significant effect on the total green leaf yield. Maximum green leaf yield was obtained with three cuttings (56.51 q/ha) and least in one cutting (19.94 q/ha). The results corroborate the findings of Waseem *et al.* (2000) who found increase in fresh foliage yield with the increase in number of cuttings in spinach.

Combined effects of sowing time and cuttings also depicted that irrespective of sowing time it was cutting frequency which impacted the green leaf yield. This is reflected in the statistically non-significant differences among combinations of $D_1 \times C_3$ (58.63 q/ha), $D_2 \times C_3$ (57.37 q/ha) and $D_3 \times C_3$ (53.53 q/ha). Moniruzzaman and Quamruzzaman (2009) obtained higher green pod yield with more number of pickings in okra.

Seed yield and test weight

Crop sown in first fortnight of October (D_1) gave highest seed yield at par with D_2 but significantly higher than November sown (D_3) crop with other treatments. Contrarily, Korla and Saini (2003) revealed that seed yield in fenugreek is not influenced by sowing date. Effect of cuttings and interaction between cuttings and sowing time was highly significant on the overall seed yield. Irrespective of sowing time in October (D_1 and D_2) maximum seed yield was obtained with one cutting (C_1) which however was at par with two cuttings (C_2) but significantly higher than three cuttings (C_3). Seed yield was considerably and significantly reduced in the November sown crop (D_3). The results also showed that seed yield is considerably reduced and adversely affected with the increase in cutting level (Lal *et al.* 2003 and Lal *et al.* 1979). Rahim (1986) found that cutting before bud formation in rapeseed gave better seed yield. As the cuttings are increased the apical growth is arrested which though resulted in production of more number of productive branches



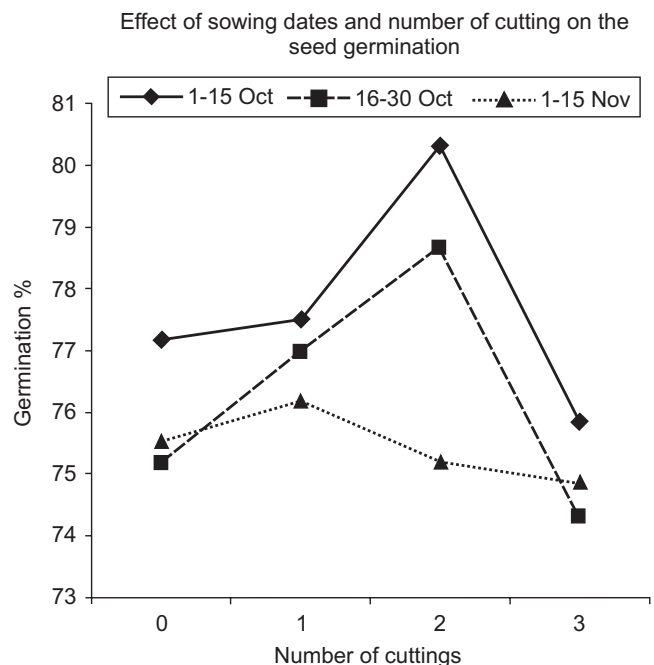
but its contribution towards overall seed yield decreases with higher frequency of cutting. Similar results were reported by Thakral *et al.* (1991) in coriander and Gill *et al.* (2001) in fenugreek. The 100 seed weight was at par on D_1 and D_2 but significantly higher than D_3 . Uncut (control) plants and one cutting gave highest 100 seed weight (1.37 g) followed by two cuttings (1.34 g), Phor and Mangal (1991).

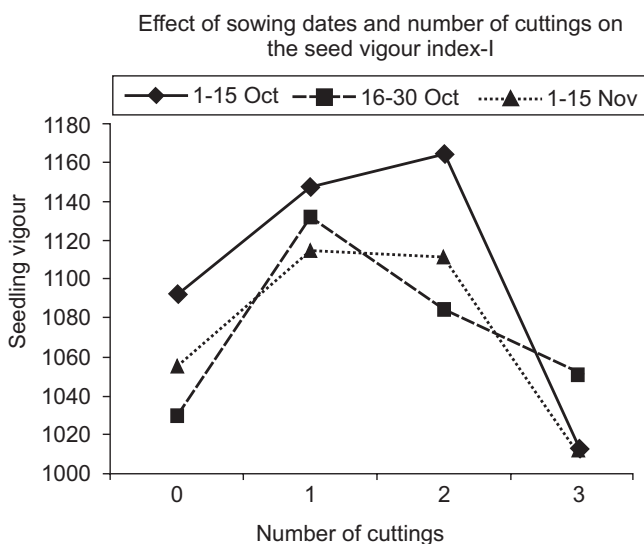
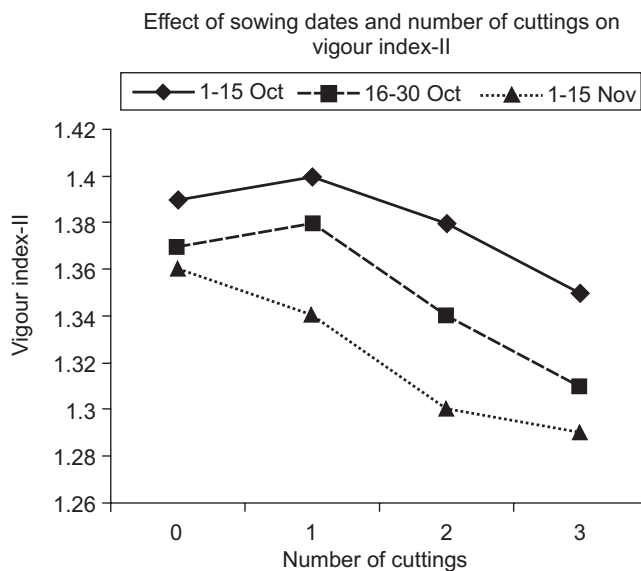
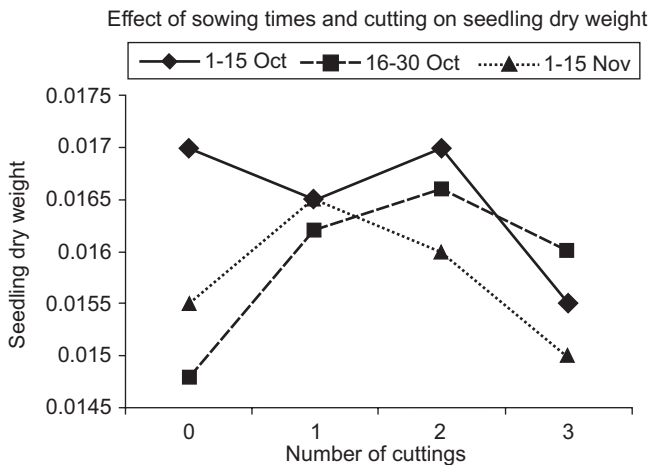
Reduction in seed weight with increasing levels of cuttings could be attributed to reduced plant height and leaf area resulting in less availability and translocation of photosynthates responsible for seed development (Baswana and Pandita 1989). Khan *et al.* (2003) reported that cutting top growth in gram resulted in decrease in plant growth attributes, seed yield and delayed crop maturity in gram. Interactive effects exhibited that irrespective of date of sowing, cutting once produced bolder seeds over other treatments.

Germination and seed quality parameters

Germination (%), seedling length, dry weight, and vigour indices I and II were significantly higher when the crop was sown in the first fortnight of October over other treatments. Cutting frequency exhibited significant beneficial effects on seed quality components. Germination (%) and seedling dry weight were found to be maximum with two cuttings (78.06%, 0.0166 g) which were statistically at par with one cutting (76.89%, 0.0164 g), respectively.

This is in accordance with results of Phor and Mangal (1991) who obtained highest germination with one cutting in palak. The beneficial effects of cuttings could be the product of effective synthesis and translocation of photosynthates from source to sink conferring higher seed weight leading to better seed germination, seedling length and vigour indices





(Vasudevan *et al.* 2008). The present study demonstrated significant differences with respect to vigour indices. Seed vigour index I (1 130.14) and seed vigour index II (1.30) were found to be maximum with C₁ treatment but at par with C₂. Moniruzzaman and Quamruzzaman (2009) in okra reported that green fruit picking significantly affected the seed germination and vigour. However, repeated cuttings can adversely affect the seed quality due to less time available for absorption and storage of photosynthates in the reproductive phase. It was found that three cuttings exhibited lowest germination (75%), seedling length (13.68 cm), seedling dry weight (0.0155 g), vigour index I (1 025.89) and vigour index II (1.10), over one or two cuttings. Kohli *et al.* (1985) reported similar effect of cuttings on lettuce.

Interaction of sowing time and number of cuttings had no substantial impact on seed quality parameters like germination, seedling length. Palak when cut twice during October gave better performance on seed quality attributes, viz. seedling dry weight, vigour indices I and II however

statistically at par with one cutting.

From the outcome of the study it can be concluded that sowing time and cutting frequency had significant effect on seed yield and quality. Number of cuttings had more pronounced effect on green leaf yield, seed yield and its quality components. Thus, for getting higher seed yield and better quality, the crop should be sown in the month of October and cut once or twice.

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