Effect of Sowing Dates and Row Spacing on the Yield of Spinach (Spinacia oleracea L.)

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Abstract: The differences in sowing dates and row spacing were highly significant for plant stand. Maximum plant stand (53.77 plants/m²) was recorded in the plots sown on 20th October and the wider row spacing of 45 cm produced the maximum plant stand of 53.88 plants/m². Significantly, 20th October crop gave the maximum plant height of 24.58 cm but row spacing did not effect statistically on the plant height. Sowing dates and row spacing did not show any significant effect on the number of leaves per plant. However, maximum number of leaves 10.98/plant was obtained in the plots sown on 20th October, broadcast produced the maximum 11.02 number of leaves per plant. Fresh and dried foliage yield was significantly affected by the varioust row spacing but was not affected by different sowing dates and their interaction. However, plots sown on 20th October gave the highest fresh yield of 1753.33 Kg/ha while broadcast led by obtaining the maximum fresh foliage yield of 1962.78 Kg/ha. Almost the similar trend was observed in the dried foliage yield. The differences among sowing dates were not whereas row spacing were highly significant in terms of total fresh yield. Plots sown on 20th October produced significantly the highest yield of 6249 Kg/ha as compared to other sowing dates while broadcast again gained the maximum total fresh yield of 6474 Kg/ha.

Key words: Spinacia oleracea, Sowing dates, Row spacing, Yield.

Introduction
Spinach (Spinacia oleracea L.) locally known as Palak is an annual dioecious plant and belongs to Chenopodiaceae family. It is one of the most important winter leafy vegetable commercially grown in Pakistan. Spinach is one of the most common herbage vegetable grown for its greens or leaves. It is consumed in fresh form as salad as well as in dishes as a cooked pot herb. Hartmann et al. (1988) reported that long-day plant that produces its best vegetative growth under cool 15-18°C temperatures than short day length. Long days especially coupled with higher temperatures above 25°C cause the plant to bolt and flower, which is detrimental to production of spinach crop. Many factors are responsible for spinach production i.e. sowing time, seed rate, planting methods etc. Among these, sowing time and row spacing are important factors which affect the production of this crop. In Pakistan, it is generally sown by broadcast method on the flat beds. Close plant spacing do not form a rossette of leaves and are apt to develope elongated shoots even in seedling stages. Planting in row eases the manual weeding in the earlier stages of growth. Plants within the rows are relatively close (5-10 cm) (Hartmann et al., 1988; Baloch, 1994). Aria and Okayama (1982) investigated the effects of growing spinach seedlings at 2, 3, 4 or 5 per soil block of 10 x 20 cm² on the growth, quality and yield. The best quality and high yielding crops were obtained with 3 seedlings/block. Also the sowing of spinach seed in rows is better than broadcast method in terms of yield (Baloch, 1994). Khan et al. (1994) observed that spinach cultivar Kandiari was sown at monthly intervals from 1st October to 1st January and leaves harvested once, twice or three times. Although, it is a very important, valuable and nutritious leafy vegetable but a very little work has been reported regarding its time of sowing and planting methods in the country in general and N.W.F.P. in particular.

Materials and Methods
The experiment was laid out in Split-Plot arrangement with sowing dates as main plots and row spacings as sub-plots. Each sub-plot was 2x3 m². The experiment was replicated thrice. The different sowing dates were allotted the main plots i.e., S1 = Sowing done on 20th September, S2 = Sowing done on 20th October and S3 = Sowing done on 20th November. Whereas the various row spacing were kept under sub-plots i.e., Broad Casting, 15 cm apart with 12 rows, 30 cm apart with 6 rows and 45 cm apart with 4 rows. The experimental area was throughly prepared by ploughing the land thrice with a local scarrifer to a depth of 10-15 cm followed by planking. The seed beds were well prepared. The seed of local spinach variety at the rate of 25 kg/ha was sown on respective dates with specified methods. Soon after the sowing, the experimental trail was irrigated. Culting was taken after 60 days from date of sowing. All cultural practices were maintained uniformly throughout the growing period for all treatments. Plantstand/m², Number of leaves/plant, Plant height (cm), Fresh foliage yield (kg/ha), Dry foliage yield (kg/ha) and Total yield (kg/ha) at the end of the season was studied. The data collected on various parameters were analyzed statistically using Analysis of Variance Technique for the interpretation by the method as described by Steel and Torrie (1980).

Results and Discussion
It is clear from the results that differences among sowing dates and row spacing were significant (Table 1). The maximum plant stand was recorded in 20th October sowing, while the minimum plant stand was observed in 20th September sowing. This result obtained, may be due to the favourable temperature existing during the mid of October. Maximum plant stand was obtained at 45 cm row spacing, while the minimum plant stand was observed in case of broadcasting due to the less competition between the seeds as the lines were 45 cm apart from each other. Plant height (cm) was highly significantly affected by different sowing dates (Table 1). Maximum plant height was recorded in the plots sown on 20th October which was at par with 20th November. The row spacing did not show significant effect. However, the maximum plant height was obtained in broadcast method, whereas the minimum plant height was recorded in 30 cm row spacing. Interaction between different sowing dates and various row spacing was also non-significant. Encouraging results were obtained by 20th October sowing and similarly by broadcast method. This could have been due to the favourable conditions throughout this growth period.

Data pertaining to the number of leaves per plant (Table 1) revealed that the number of leaves per plant was not significantly affected by different sowing dates, row spacing as well as their interaction. Maximum number of leaves were recorded in the crop sown on 20th October whereas the minimum number of leaves was observed in the crop sown on 20th November. Table 2 indicates the results of fresh foliage yield (kg/ha). The analysis shows that the different sowing dates and the interaction had a non-significant effect on the fresh foliage yield (Kg/ha) of spinach. However, 20th October sowing crop gave maximum fresh foliage yield of 1753 Kg/ha. Whereas, row spacing had statistically significant effect on the fresh foliage yield (Kg/ha) of
Spincchia. The maximum fresh foliage yield of 1963 Kg/ha was recorded in broadcast method and it was significant from the yield of other row spacings. The interaction between different sowing dates and various row spacing had a non significant effect on fresh foliage yield of spinach. The foliage production is a function of the combined row spacing had a non significant effect on fresh foliage yield of spinach. The maximum fresh foliage yield of 1963 Kg/ha was recorded in broadcast method and it was significant from the yield of other row spacings. The maximum total yield 6474 kg/ha in case of row spacing was obtained in the crop sown on 20th October. However, the rest of the spacing remained non-significant. This may be due to the favourable temperature during October as compared to September and November. Hartmann et al. (1988) also mentioned that 15-18°C is the optimum temperature for spinach production. For getting higher yield, the best time of spinach sowing is the 20th October followed by 20th November. Broadcast proved better than other row spacings in terms of foliage, fresh and dry yield. The findings of this research would be very helpful for the ordinary farmer in deciding the particular time and relative method of spinach sowing in the agro-limactic conditions of Der ismail Khan.

References