

## Production of Spinach (*Spinacia oleracea*) as Affected by Different Row Spacings and Frequency of Cuttings

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**Abstract:** A trial was conducted to see the effect of different row spacing and cutting on the growth and yield of Spinach. The results showed that the differences in row spacing were non-significant for Plant height (cm), number of leaves, fresh foliage yield (kg ha<sup>-1</sup>) and dried foliage yield (kg ha<sup>-1</sup>). Broadcast method of sowing produced the most prominent results in all the parameters studied, giving the maximum plant height of 25.58 cm, maximum number of leaves (11.61), maximum fresh foliage yield of 2255 kg ha<sup>-1</sup> and maximum dried foliage yield of 218.7 kg ha<sup>-1</sup>. The cuttings showed significant differences for plant height (cm), fresh and dried foliage yield (kg ha<sup>-1</sup>), whereas the cuttings showed a non-significant behavior for number of leaves. First cutting showed maximum plant height of 26.66 cm, whereas the second cutting gave the maximum number of leaves (11.17), fresh foliage yield of 2329 kg ha<sup>-1</sup> and dried foliage yield of 222.7 kg ha<sup>-1</sup>.

**Key words:** Spinach, cuttings, row spacing, yield

### Introduction

There is a need to manipulate the row spacing competition and to increase the plant productivity. In recent years, there has been a growing interest in the use of row spacing for the Spinach production. Shuja and Waheed Ullah (1977) recommended that in Pakistan the spinach is grown by the broadcast method, but in advanced countries, however, line sowing is a general practice with a plant to plant distance of 5-10 cm. Plants within the rows are relatively close 5-10 cm (2-4 in). Singh and Gill (1983) stated that the highest seed yields (7.26-10.08) gha<sup>-1</sup> and total return (value of seed and cut leaves) were obtained from plants spaced at 45 and 30 cm and cut once. Baloch (1994) stated that the spinach seed by planting method is better than broadcast method in terms of yield. Seeds should be grown in rows about 15-20 cm apart, which facilitates weeding in the earlier stages of growth. At some places it is grown on the ridges 30-45 cm apart. Waseem *et al.* (2000) stated that maximum Spinach yield was gained in Broadcast method of sowing as compared to any other method. Although, it is a very important, valuable and nutritious leafy winter vegetable, but our farmers really don't know the different planting densities and their effect on the production and yield of the Spinach. Although, no research has yet been done on the various sowing methods in the country, therefore this experiment was conducted to sort out the best sowing method for the better yield of Spinach.

### Materials and Methods

This particular experiment was carried out at the Horticultural Research Area, Faculty of Agriculture, Gomal University, Dera Ismail Khan, during the winter season 1998-99. It was laid out in Split-Plot arrangement with row spacing as main and the cuttings as sub-plots. The experiment was replicated thrice. The plot size was kept 12 x 30 m<sup>2</sup> and that of the sub-plot was 2 x 3 m<sup>2</sup>. Different row spacing were allocated the main plots i.e. Broadcasting, 15 cm apart with 12 rows, 30 cm apart with 6 rows and 45 cm apart with 4 rows. Whereas, two cuttings i.e. first Cutting and 2nd Cutting were kept under the sub-plots. The seeds of spinach local variety were spread at the rate of 25 kg ha<sup>-1</sup>. The seeds were sown at 15th October, on the flat beds with respective methods. First cuttings were taken at 60 days interval from dates of sowing and the second cuts were taken at 30 days interval from first cuttings. All the required cultural practices were maintained

uniformly throughout the growing period for all treatments. Number of leaves per plant, Plant height (cm), fresh foliage yield (kg ha<sup>-1</sup>) and dried foliage yield (kg ha<sup>-1</sup>) was studied. The data on various parameters were collected and analyzed statistically using Analysis of Variance Technique (Steel and Torrie, 1980).

### Results and Discussion

**Plant height (cm):** The results for the different row spacing on the plant height (cm) was non-significant. The maximum plant height of 25.58 cm was recorded in broadcast method while the plant heights in 15, 30 and 45 cm were at par with each other with 24.14, 24.13 and 24.01 cm respectively. Same results were obtained by Waseem *et al.* (2000). As far as, the cuttings were concerned the results were significant. First cutting had the maximum plant height of 26.66 cm as compared to the second cutting with 22.27 cm plant height. This might be due to the favourable temperature available at that particular time.

**Number of leaves:** The different row spacing and cuttings were non-significant for number of leaves. However, the maximum number of leaves were obtained in broadcast method, while the other treatments were at par with each other with 11.32, 11.07 and 10.68 number of leaves, respectively. Whereas the cuttings are concerned, second cutting gave rather higher number of leaves as compared to the first cutting. Waseem *et al.* (2000) also found that the broadcast and 15 cm row spacing crop sown in October showed little role in stimulating vegetative growth and contribute mainly to leaf development.

**Fresh foliage yield (kg ha<sup>-1</sup>):** The different row spacing had a non-significant effect on the fresh foliage yield of spinach. However, the maximum fresh foliage yield of 2255 kg ha<sup>-1</sup> was recorded in broadcast method, followed by 30 cm row spacing with a fresh foliage yield of 2232 kg ha<sup>-1</sup>, while the minimum fresh foliage yield of 2153 kg ha<sup>-1</sup> was obtained in 15 cm row spacing. Same results were obtained by Waseem *et al.* (2000) who also found that the maximum fresh foliage yield was obtained in Broadcast method of sowing. Whereas the second cutting produced the maximum fresh foliage yield of 2329 kg ha<sup>-1</sup> as compared to that of the first cutting

Waseem *et al.*: Effect of different row spacing and cuttings on the Spinach Yield

Table 1: Effect of different row spacing and cuttings on the growth and yield of Spinach.

Planting Methods	Cuttings		Means
	1st Cutting	2nd Cutting	
<b>PLANT HEIGHT (cm)</b>			
Broadcast	28.77 A	22.39 B	25.58 NS
15 cm	25.77 A	22.52 B	24.14
30 cm	26.07 A	22.19 B	24.13
45 cm	26.07 A	21.98 B	24.01
MEANS	26.66 A	22.27 B	
<b>NUMBER OF LEAVES</b>			
Broadcast	12.12 A	11.10 AB	11.61 NS
15 cm	10.95 AB	11.67 A	11.32
30 cm	11.24 AB	10.88 AB	11.07
45 cm	10.29 B	11.06 AB	10.68
MEANS	11.15 N.S	11.17	
<b>FRESH FOLIAGE YEILD (kg ha<sup>-1</sup>)</b>			
Broadcast	2243 A	2267 A	2255 NS
15 cm	2037 B	2270 A	2153
30 cm	2051 B	2413 A	2232
45 cm	2067 B	2368 A	2217
MEANS	2099 B	2329 A	
<b>DRIED FOILAGE YEILD (kg ha<sup>-1</sup>)</b>			
Broadcast	218.0 A	219.3 A	218.7 NS
15 cm	205.0 B	220.3 A	212.7
30 cm	206.3 B	227.7 A	217.0
45 cm	207.3 B	223.3 A	215.3
MEANS	209.2 B	222.7 A	

NS = Non-significant

producing a yield of 2099 kg ha<sup>-1</sup>. The rates of most biological processes are affected by climate and especially by temperature (Beinhauer, 1980). In particular, the rate of crop development is closely related to the sum of effective temperature over the growing season (Davidson and Campbell, 1983).

**Dried foliage yield (kg ha<sup>-1</sup>):** The data recorded on the dried foliage yield of spinach showed the same trend as that of fresh foliage yield and revealed the non-significant differences among different row spacing. However, the maximum dried foliage yield of 218.7kg ha<sup>-1</sup> was once again recorded in broadcast, closely followed by 30 cm row spacing with dried

foliage yield of 217 kg ha<sup>-1</sup>. The minimum dried foliage yield of 212.7kg ha<sup>-1</sup> was recorded in 15 cm row spacing. Waseem *et al.* (2000) also found the similar results stating that the maximum dried foliage yield was observed in broadcast method. Almost the similar trend was also observed in case of dried foliage yield as was in fresh foliage yield. The second cutting produced the maximum dried foliage yield of 222.7 kg ha<sup>-1</sup> as compared to that of the first cutting producing a yield of 209.2 kg ha<sup>-1</sup>. These results are in support of Gonzalez and Marx, 1982.

It can be concluded from the results that Broadcast method of sowing proved to be the best as compared to the other different row spacing. It was also concluded usually the second cuts gave higher yield as compared to the first cuts.

#### References

- Baloch, A.F., 1994. Vegetable crops. Horticulture. pp.489-538. National Book Foundation, Islamabad.
- Beinhauer, R., 1980. Beginn und End der ureutzbutler imm norddeut-schen Flachland. J. Agron. Crop Sci., 149: 167-171.
- Davidson, H.R. and C.A. Campbell, 1983. The effect of temperature, moisture and nitrogen on the rate of development of spring wheat measured by degree days. Can. J. Plant Sci., 63: 833-846.
- Gonzalez, A.R. and D.B. Marx, 1982. Study of early and late fall plantings of spinach. Arkansas Farm Research, 31: 8.
- Shuja, M.A. and A. Waheedullah, 1977. Methods of sowing cum fertilizer trail on two varieties of spinach. Front. J. Agric., 4: 101.
- Singh, H. and S.S. Gill, 1983. Effect of spacing and leaf cutting on the seed yield of spinach. Hort. Absts., 55: 222, 1985.
- Steel, R.G.D. and J.H. Torrie, 1980. Principals and Procedures of Statistics. Mc-Graw Hill Book Co. Inc. New York.
- Waseem, K., A. Ghaffoor, R.U. Khan and M.A. Nadeem, 2000. Effect of sowing dates and row spacing on the yield of Spinach (*Spinacia oleracea* L.). Pak. J. Bio. Sci., 3: 822-823.