

Fennel yield and yield components as influenced by sowing methods and planting geometry

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Abstract

An experiment was conducted at the Agronomic Research Institute Faisalabad, Pakistan, during winter 2010-11 to find out the best suited planting geometry/method to obtain maximum yield of fennel (*Foeniculum vulgare* Mill.) crop. The sowing methods were; bed and ridge sowing by maintaining plant × plant distance 22.5 cm along with three line sowings with 12.5, 18.5 and 22.5 cm plant to plant distance. Seeds were sown in Randomized Complete Block Design with four repeats. According to the data, different geometry and sowing methods affected significantly the growth, yield and yield components. The ridge sowing method gave significantly higher yield than the other two methods mainly because of greater number of reproductive branches and umbels per plant, seeds per umbel and 1000-seeds weight. It was closely followed by bed sowing, whereas line sowing with 18.5 and 12.5 cm plant spacing treatments produced the lowest seed yield.

Key words: Fennel, medicinal plant, planting geometry, sowing methods, umbel yield.

Introduction

Foeniculum vulgare belongs to family Apiaceae or Umbelliferae is a strong aromatic perennial with feathery leaves and golden yellow flowers. It was originated from Mediterranean region, cultivated worldwide and extensively used as a traditional medicine since ancient times. It is also utilized for the flavouring of a number of food products and in cosmetics (Wicht and Bisset, 1994; Van Wyk and Wink, 2004). Fennel has antifungal and antibacterial activities against many pathogenic organisms (Aritomi and Kawasaki, 1984; Miura *et al.*, 1986). Fennel seeds contain valuable essential oil (Leung and Foster, 1996). The fruits and essential oil are being used as a flavour and also said to be carminative. The leaves are used as culinary purpose having diuretic properties. The juice made from roots is febrifuge, purgative and sudorific. Fennel cures asthma, windy colic useful in diseases of chest, spleen and kidney (Bhattacharjee, 2004). The fruits are used in flatulence, fever, intestinal colic, burning sensation and constipation. It is also used as toothpaste for the prevention of caries, periodontal diseases, and the hot infusion of fruit is useful in amenorrhea (Jarlad and Jarlad, 2006). Farmers from all over Pakistan are growing fennel crop mainly for their own domestic uses. The product obtained from such a lesser area is insufficient to

meet the commercial requirements of the country and unable to cover the gap between demand and production. So, there is dire need to increase the fennel production in Pakistan (Ayub *et al.*, 2008). Few reports are available on the fennel sowing methods and planting geometry in Pakistan. Therefore, trial was designed to find out the best suited sowing method and planting geometry affecting the growth, yield and yield components of fennel.

Materials and Methods

This experiment was carried out in winter 2010-11 at Plant Physiology Research Area, of Agronomic Research Institute Faisalabad, Pakistan. The planting geometries/methods of sowing i.e., bed sowing (B × B = 150 cm & P × P = 22.50 cm), ridge sowing (R × R = 75 cm & P × P 22.50 cm) and three drill sowings (each with R × R 75 cm & P × P 12.50 cm, 18.50 cm and 22.50 cm) were tested and the crop was sown on 22nd October 2010.

Design of the experiment was randomized complete block design (RCBD) with four repeats having plot size measuring 6 m × 3 m. In case of bed and ridge sowing methods, three seeds were sown manually on each single point and after successful germination thinning was done to only one plant per site. Whereas, single row hand drill

was utilized to sow fennel seeds by keeping 5 kg ha⁻¹ seed rate for line sowing method.

Phosphorus was applied @ 55 kg per hectare at sowing time. While nitrogen was given @ 55 kg per hectare in two split doses i.e., fifty percent at sowing time and remaining at the first irrigation, by keeping all practices same.

Ten plants were randomly selected from each plot and data regarding plant height, umbels and branches per plant, and seeds per umbel were recorded. Weight of 1000-seeds was recorded by taking three seed samples.

Data was analyzed by using Fishers analysis of variance technique and least significance test at $P \leq 0.05$ was used for comparison of various treatments means (Steel *et al.*, 1997).

Results and Discussion

Line sowing methods with 12.5 and 18.5 cm plant to plant distance produced fennel plants taller than all other sowing methods. This might have been resulted due to greater competition among plants for soil and environmental factors especially light because in both these methods number of plants per unit area was much higher as compared to rest of the methods which provided less plant spacing. Ayub *et al.* (2008) have also demonstrated significant effects of sowing methods on plant height.

Different planting geometry/sowing methods affected significantly the branches per plant. Ridge sowing produced maximum number of branches per plant which might be attributed to proper plant spacing and better agronomic practices in this method which resulted in better use of soil and environmental factors towards growth and development as compared to rest of sowing methods. Khorshidi *et al.* (2009) have also reported increase in branches per plant with proper plant spacing.

Umbels per plant in all the planting geometry/sowing methods was affected significantly with the maximum in ridge sowing and minimum in line sowing methods respectively. Again this might be due to better use of soil and environmental factors during early reproductive period of growth in ridge sowing than rest of sowing methods. These findings are in agreement with Yadav and Khurana (1999) and Khorshidi *et al.*

(2009) that sowing methods and plant spacing have significant effect on umbels per plant.

Variation in sowing methods for seeds per umbel were also significant with the highest number of seeds per umbel in ridge sowing and lowest in line sowing in which 12.5 cm plant to plant distance was maintained. Higher number of seeds in ridge sowing might be attributed to better availability, utility and distribution of growth and environmental factors towards reproductive phase of plants with good seed setting which resulted in maximum number of seeds per umbel as compared to rest of sowing methods. Our results are also supported by Yadav and Khurana (1999) and Khorshidi *et al.* (2009).

Different planting geometry and sowing methods also affected 1000- seed weight significantly. Maximum 1000-seed weight in ridge sowing again might be attributed to favorable distribution of yield contributing factors towards reproductive phase which ultimately resulted in better seed filling. These findings are in contrast to Ayub *et al.* (2008). This contradiction of results might be due to climatic change and genetic variation of the crop plants.

Seed yield of a crop is the result of all the genetic, soil and environmental factors towards growth and development and different planting geometry and sowing methods also have significant effect on seed yield. The ridge sowing produced significantly maximum seed yield per ha and it could be due to better growth and yield associated factors such as number of seeds per umbel, number of umbels per plant, and weight of 1000-seeds) which contributed materially towards more yield per hectare. These results are in line with findings of other researchers who reported that sowing methods have significant effect on seed yield of fennel crop (Ashiq and Shah, 1993; Ashiq, 1995). The present study concludes that in order to get maximum plant growth, yield and yield parameters fennel crop should be planted in ridge sowing method.

Conclusion

The present study concludes that in order to get the maximum plant growth, yield and yield parameters fennel crop should be planted in ridge sowing method.

Table 1: Effect of different planting geometry and sowing methods on the growth and yield of Fennel crop.

Treatments	Plant height at maturity (cm)	Branches per plant	Umbels per plant	Seeds per umbel	1000-seed weight. (g)	Seed yield (kg per ha)
Bed sowing B×B = 150 cm, P×P = 22.5	157 b	7.30 b	34.67 b	181.70 b	7.44 b	1692 b
Ridge sowing R×R = 75 cm, P×P = 22.5	158 b	7.90 a	39.67 a	200.30 a	7.77 a	1780 a
Line Sowing R×R = 75 cm, P×P = 12.5	167 a	6.10 c	25.0 e	151.70 d	6.91 d	1534 c
Line sowing R×R = 75cm, P×P = 18.5	165 a	6.43 c	29.0 d	155.70 cd	7.06 cd	1549 c
Line sowing R×R = 75 cm, P×P = 22.5	156 b	7.10 b	32.0 c	165.30 c	7.19 c	1637 b
LSD 5%	6.00	0.57	2.19	11.68	0.158	71.28

The means which are not sharing the same letter differ significantly at 5% probability level.

References

- Aritomi M, Kawaskaki T, 1984. Three highly oxygenated Flanone Glucuronides in leaves of *Spinacia oleracea*. *Phytochemistry*, **23**: 2043-2047.
- Ashiq M, 1995. Effect of sowing methods on the seed yield of fennel. Annual Report (Crop Physiology Section 1994-1995) Ayub Agric. Res. Inst. Faisalabad, Pakistan.
- Ashiq M, Shah ML, 1993. Study to determine the effect of different doses of NP fertilizer and sowing methods on seed yield of fennel. Annual Report (Crop Physiology Section) Ayub Agric. Res. Inst., Faisalabad, Pakistan.
- Ayub M, Nadeem MA, Tanveer A, Tahir M, Saqib MTY, Nawaz R, 2008. Effect of different sowing methods and times on the growth and yield of fennel (*Foeniculam vulgare*). *Pak. J. Bot.*, **40**: 259-264.
- Bhattacharjee SK, 2004. Handbook of Medicinal Plants. Aavishkar Publishers, Jaipur. India
- Farrell KT, 1985. Spices, condiments and seasonings. *AVI Publ.*, Westport, CT.
- Jarlad EE, Jarlad SE, 2006. Medicinal Plants. CBS Publishers and Distributers, New Delhi, India
- Khorshidi J, Tabatabaei MF, Omidbaigi R, Sefidkon F, 2009. The effect of different densities of planting on morphological characters, yield and yield components of fennel (*Foeniculum vulgare*). *J. Agric. Sci.*, **1**: 66-73.
- Leung AY, Foster S, 1996. Encyclopedia of common natural ingredients used in food, drugs and cosmetics. John Wiley, New York, NY.
- Miura YK, Ogawa K, Fukuir H, Tabata M, 1986. Changes in the essential oil components during the development of fennel plants from somatic embryokides. *Plant Med.*, **52**: 96-5.
- Steel RGD, Torrie JH, Dicky DA, 1997. Principles and procedures of statistics. A biometrical Approach. 3rd Ed. McGraw Hill Book Co. Inc. New York. pp. 400-408.
- Wicht M, Bisset NG, 1994. Herbal Drugs and Phytopharmaceuticals, Med. Pharm Scientific Publ. Stuttgart.
- Van Wyk BE, Wink M, 2004. Medicinal Plants of the World, Briza Publications, South Africa.
- Yadav BD, Khurana SC, 1999. Effect of planting methods and sowing dates on growth and yield of fennel. *Haryana Agric. J. Res.*, **29**: 81-87.