

Effect of weed management on yield-attributing characters of fennel (*Foeniculum vulgare*)

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ABSTRACT

The experiment was conducted to find out the effect of pendimethalin on growth and yield of fennel (*Foeniculum vulgare* Mill.) during 2018-19 and 2019-20 at Bharatpur, Rajasthan. The Pre-emergence application of Pendimethalin 30% EC @ 0.90 kg a.i./ha 2 days after sowing and one hand weeding 60 days after sowing recorded higher grain yield (20.15 q/ha) as compared to the control, i.e. one hand weeding 45 days after sowing (17.75 q/ha). There was 13.52% increase in yield over the control. The technology index value (19.4) was recorded, indicating the gap in potential and demonstration yield due to soil fertility and weather conditions. By conducting on- farm testing of proven technology of weed management, yield potential of fennel can be increased.

KEY WORDS: On-farm testing, Pendimethalin, Technology, Yield potential

Fennel (*Foeniculum vulgare* Mill.) is most important seed spice grown in India. Rajasthan is the second largest producer of fennel after Gujarat, producing 25,620 tonnes from 26,250 ha (2019-20). Of several constraints weeds often pose a serious problem. Wider spacing, frequent irrigation and liberal use of manures and fertilizers provide favourable conditions for weed seeds. Therefore, control of weeds in initial stages appears imperative. Hence, pre-emergence application of Pendimethalin 30% EC hold a promise in controlling weeds effectively. Hence, an experiment was conducted.

MATERIALS AND METHODS

An on-farm testing was conducted in Bharatpur district to find out the effect of weed management on yield of fennel during *rabi* 2018-19 and 2019-20 at farmers' fields under irrigated conditions. Soils were sandy loam, medium in nitrogen, phosphorus and potash with saline reaction. All farmers were trained on various aspects of production technologies. The field was prepared by deep ploughing and harrowing after *kharif* crops. Fennel R.F-125 was sown in last week of October. All the recommended practices, i.e. seed treatment with fungicide Carbendazim @ 1.5 g/kg seed, spacing, and plant protection chemicals were used to control the insect, pests and diseases.

Recommended dose of manure and fertilizers was applied as N:P:K @ 90:60:60 kg/ha.

Full amount of phosphorous and potash and one-third nitrogen each as basal, 45 days after sowing and at flowering were applied with irrigation. Seeds were sown by seed drill at a row - row spacing of 45 cm and plant - plant 20-25 cm. The two treatment consisted of control (farmers practice- one hand weeding 45 days after sowing) and application of Pendimethalin 30% EC @ 0.90 Kg a.i./ha was applied using 1000 liters of water as pre-emergence 2 days after sowing and one hand weeding 60 days after sowing. Weed count was made using quadrat having the size of 1m × 1m area in both treatments 45 days after sowing and total dry weight of weeds was measured. Crop was harvested in second week of April.

The data on cost of cultivation, production, productivity, total return and net return were collected in both treatments as per schedule. Average of cost of cultivation, yield and net returns were analyzed by formula.

$$\text{Average} = [F_1 + F_2 + F_3 + \dots + F_n] / N$$

where, F_1 = Farmer

N = Number of farmers

Technology index was operationally defined as the technical feasibility obtained due to implementation of demonstration (on-farm testing) in fennel. To estimate the technology gap, extension gap and

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technology index following formula used by Samui *et al.* (2000) have been used.

Technology gap = P_i (potential yield) – D_i (demonstration yield)

Extension gap = D_i (demonstration Yield) – F_i (farmers yield)

Technology index = $[(\text{potential yield} - \text{demonstration yield}) / \text{potential yield}] \times 100$

The relative weed density was defined as dominance of a particular weed species over other species in number in a mixture of weed population and expressed in percentage.

$RWD = NPW \times 100$

where, RWD = Relative weed density

NPTW NPW = Number of a particular species / unit area

NPTW = Number of total weed species / unit area

The weed control efficiency (WCE) was calculated to determine the variation in dry matter weight accumulated due to competition with fennel plants of treated plot or to estimate comparative ability of weeds at different stage as compared to farmers' practice (no use of weedicide) (Walia, 2013) and was computed as $WCE = \frac{DWC - DWT}{DWC} \times 100$ where, WCE = weed control efficiency

DWC = Dry weight of weeds in control plot

DWT = Dry weight of weeds in treated plot

RESULTS AND DISCUSSION

The pre-emergence application of Pendimethalin 30% EC @ 0.90 Kg a.i. / ha 2 days after sowing and one hand weeding 60 days after sowing recorded maximum weed control efficiency (100%), highest yield (20.15 q / ha) compared to farmers' practice (17.75 q / ha). The increase in yield (13.52 %) over farmers' was recorded. Pendimethalin was used as pre-emergence (before weed seedlings have emerged) to control annual grasses and certain broad leaved weeds. After application of Pendimethalin, a thin layer was formed at soil surface which prevents germination of weeds. It inhibited root and shoot growth, control weed population and their emergence, particularly during the crucial development

phase. The higher weed control efficiency in T_2 might be due to significant reduction in weed dry matter because effective weed control practices through application of pre-emergence herbicides. Significantly higher yield in demonstration as compared with farmers practice might be due to vigorous growth of crop due to availability of sufficient nutrient, moisture, light and space owing to absence of weed because of higher weed control efficiency. This enabled plants to efficiently utilize sunlight and water for photosynthesis leading higher plant height, increased number of leaves and yield.

Yield attributes were significantly superior by pre-emergence application of Oxadiargyl @ 75g / ha + one hand weeding at 45 days after sowing or Pendimethaline @ 1.0kg / ha + one hand weeding at 45 days after sowing in fennel (Meena and Mehta 2009). Pre-emergence application of Pendimethaline @ 0.75 kg a.i. / ha and one hand weeding 40 days after sowing recorded highest yield (Mehta *et al.*, 2010), Pre-emergence application of Pendimethaline @ 1.0kg / ha + one hand weeding at 45 days after sowing in coriander (Nagar *et al.*, 2009).

Similarly, Patel *et al.* (2016), Meena and Mehta (2010), Patel *et al.* (2007), Meena *et al.* (2013). Nagar and Jain (2017), also supported these things. The farmers were motivated by seeing the results in term of productivity.

The technology gap showed the difference between potential yields over demonstration (on-farm testing) yield. The potential yield was 25 q / ha with Technology gap 4.85 q / ha. There exist a gap between the potential yield and demonstration yield. This may be due to soil, fertility and weather condition. Hence, location-specific recommendations are necessary to bridge the gap. Comparative high extension gap (2.40 q / ha) indicates that there is a need to educate farmers and help them for optimizing the yield by adopting improved practices. The technology index value was 19.4 (Table 1). It means the technology is suitable for Bharatpur district of eastern Rajasthan. The result consonance with Paghadal *et al.* (2022).

Table 1. Yield, technology gap, extension gap and technology index

Variable	No. of trials	Yield (q/ha)	Increase over farmers' practice(%)	Extension gap (q/ha)	Techno-logy gap (q/ha)	Technology index (%)
T_1 Control (one hand weeding 45 days after sowing)	10	17.75	-	-	-	-
T_2 Pre-emergence application of Pendimethalin 30% EC @ 0.90 Kg a.i./ha 2 days after sowing and one hand weeding 60 days after sowing	10	20.15	13.52	2.4	4.85	19.4
Additional in T_2 treatments application		2.4				

Table 2. Economics (average of 2 years) of fennel production under on-farm testing

Technology option	Yield q/ha	Cost /ha (₹)	Gross return ₹/ha	Net return ₹/ha	Benefit : cost ratio
T ₁ - control (one hand weeding 45 days after sowing)	17.75	31350	118750	102233	1:3.79
T ₂ - pre-emergence application of Pendimethalin 30 % EC @ 0.90 Kg a.i./ha 2 days after sowing and one hand weeding 60 days after sowing	20.15	32900	134925	123500	1:4.10
Additional in T ₂ treatment application	2.4	1550	16175	21267	* 13.72

* incremental benefit : cost ratio.

The economic analysis of fennel production revealed that treatment T₂- pre-emergence application of Pendimethalin 30% EC @ 0.90 kg a.i./ha 2 days after sowing and one hand weeding 60 days after sowing recorded higher gross return (₹ 1,34,925/ha) and net return (₹ 1,23,500/ha) with higher benefit: cost ratio (4:10) as compared to farmers' practice. These results are in accordance with findings of by Patel *et al.* (2016), Mehta *et al.* (2010), Paghadal *et al.* (2022). An additional cost of ₹ 1,550/ha has increased additional net return ₹ 16,175/ha with incremental benefit:cost ratio 13.72 suggesting higher profitability and economic viability of pre-emergence application of Pendimethalin 30% EC @ 0.90 Kg a.i./ha at 2 days after sowing and one hand weeding at 60 days after sowing. Mamatha *et al.* (2021), also reported similarly as pre-emergence application of Pendimethalin 30% EC @ 1.0 kg a.i./ha at and one hand weeding at 40 days after sowing is found to be beneficial for maximizing grain yield of coriander with high benefit:cost ratio. Pre-emergence application of pendimethalin at 1.00 kg/ha supplemented with one hand-weeding in onion gave the higher net return of ₹ 51,296/ha with maximum benefit:cost ratio of 8.77 (pre-emergence application of pendimethalin at 1.00 kg/ha supplemented with one hand-weeding in onion gave higher net return with maximum benefit cost ratio (Kumar and Gupta, 2021) (Table 2).

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