

**Research Note :**

GROWTH AND SEED YIELD OF FENNEL AS INFLUENCED BY RHIZOBACTERIA

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Fennel (*Foeniculum vulgare*) is one of the most important seed spices grown in north India and widely cultivated mainly for its seeds. It grows well under dry and cold weather conditions and therefore its cultivation spread from Gujarat onwards to the northern parts of India. It is used for culinary preparations due to changed food habits and as a constituent in medicinal preparations of various systems of medicines. Fennel seeds are aromatic, stimulant and carminative, which are used in diseases like cholera, bile and nervous disorders. The productivity of a crop is controlled by many factors of which the mineral nutrition especially of nitrogen is by and large the most important factor but the heavy and imbalanced use of chemical fertilizers had led to deterioration in soil health to a great extent. No single source of nutrient is capable of supplying plant nutrients in adequate amount and balanced proportion. Therefore, to maintain soil fertility and to supply plant nutrients in balanced proportion for optimum growth and yield of fennel in an integrated manner in a specific agro-ecological situation is to practice integrated nutrient supply system through the combined use of organic, biological and chemical sources of plant nutrients. Keeping this in view, the present investigation was undertaken to evaluate the beneficial effect of two different strains of *Rhizobacteria* (FK 14 and FL 18) alone as well as their combinations by seed treatment and soil application along with *Trichoderma* (MTCC-5179) on growth and seed yield of fennel.

The experiment was carried out at Vegetable Research Farm of CCS Haryana Agricultural University, Hisar during the *rabi* season of 2008-09 and 2009-10. The soil of experimental plot was

sandy loam with pH 8.4, organic carbon 0.35%, available nitrogen 128 kg, available P₂O₅ 30 kg/ha and available K₂O₄ 94 kg/ha. The treatments consist of two different strains of *Rhizobacteria* (FK 14 and FL 18) alone as well as their combinations by seed treatment and soil application along with *Trichoderma* (MTCC 5179) in fennel cv. Hisar Swarup (HF-33). The experiment comprised of a set of eight treatments-T₁-*Rhizobacteria* FK 14 (Seed treatment), T₂-*Rhizobacteria* FK 14 (Seed treatment + Soil application), T₃-*Rhizobacteria* FL 18 (Seed treatment), T₄-*Rhizobacteria* FL 18 (Seed treatment + Soil application), T₅-*Rhizobacteria* FK 14+FL 18 (Seed treatment), T₆-*Rhizobacteria* FK 14+FL 18 (Seed + Soil treatment), T₇-*Trichoderma* MTCC 5179 (Recommended dose) and T₈-Control, was laid out in randomized block design with three replications. Irrigation and other intercultural practices were done as per general recommendation. The recommended dose of inorganic nitrogen @ 50kg/ha was applied. A uniform basal dose of 25 kg P₂O₅/ha along with one third quantity of nitrogen was given at sowing time and remaining two third of nitrogen was top dressed and incorporated in soil after 30 and 60 days after sowing. The fennel seeds were treated with *Rhizobacteria* strains @ 10g/kg of seed and soil application of *Rhizobacteria* and *Trichoderma* (MTCC 5179) @ 50g/sqm area was done as per treatment just before sowing. Seed of fennel cv. Hisar Swarup (HF-33) were sown at spacing of 20 cm in plant to plant and 30 cm row to row apart during last week of October. The experimental plot size was 4.0 x 2.4 m. All the recommended cultural practices and protection measures were followed throughout the experimentation.

Table 1: Effect of *Rhizobacteria* on growth and seed yield of fennel (Pooled data of 2008-09 and 2009-10).

S.No.	Treatments	Plant height (cm)	Branches per plant	Umbels per plant	Umbellets per umbel	Seeds per umbel	Seed yield (kg/ha)
1.	T ₁ - <i>Rhizobacteria</i> FK 14 (Seed treatment)	163.9	11.6	66.6	31.6	731.7	1952
2.	T ₂ - <i>Rhizobacteria</i> FK 14 (Seed treatment + Soil appl)	155.4	11.7	58.1	30.5	630.1	1513
3.	T ₃ - <i>Rhizobacteria</i> FL 18 (Seed treatment)	158.6	11.7	61.9	30.5	617.7	1562
4.	T ₄ - <i>Rhizobacteria</i> FL 18 (Seed treatment + Soil appl)	160.1	11.9	64.3	32.3	818.3	1914
5.	T ₅ - <i>Rhizobacteria</i> FK 14+FL 18 (Seed treatment)	154.7	11.7	67.0	30.2	597.6	1737
6.	T ₆ - <i>Rhizobacteria</i> FK 14+FL 18 (Seed + Soil treatment)	153.0	11.6	67.9	31.3	580.5	1637
7.	T ₇ - <i>Trichoderma</i> MTCC 5179 (Recommended dose)	159.7	11.3	72.0	30.5	626.4	1964
8.	T ₈ -Control	151.4	11.1	61.9	28.9	566.1	1466
	C.D. (P = 0.05)	11.2	0.5	6.7	1.7	43.1	115

Application of *Trichoderma* MTCC (5179), being at par with *Rhizobacteria* FK 14 (Seed treatment) and *Rhizobacteria* FL-18 (seed treatment + soil application) significantly increased the plant height, umbel per plant and seeds per umbel over the control. Maximum plant height (163.9) was recorded with the application of *Rhizobacteria* FK 14 (Seed treatment) followed by *Rhizobacteria* FL-18 (seed treatment + soil application). Maximum branches per plant (11.9) was recorded in *Rhizobacteria* FL-18 (seed treatment + soil application). However maximum umbellet per umbel (72) was recorded in *Trichoderma* MTCC (5179). Maximum seeds per umbel (818.3) recorded in *Rhizobacteria* FL-18 (seed treatment + soil application) followed by *Rhizobacteria* FK 14 (Seed treatment i.e.731.7. The results are in conformity with the findings of Vessey (3).

Data further showed that seed yield of fennel (Table 1) was significantly and favourably influenced with the use of *Trichoderma* (MTCC 5179) and different strains of *Rhizobacteria* (FK 14

and FL 18) alone as well as their combinations by seed treatment and soil application.

The maximum seed yield (1964 kg/ha) was recorded with the application of *Trichoderma* MTCC- 5179 remained at par with *Rhizobacteria* FL-14(seed treatment) and *Rhizobacteria* FL-18 (seed treatment + soil application) yielding 1952 kg/ha and 1914 Kg/ha, respectively. Fennel seed yield is an output of sequential metamorphosis from store to sink. Partitioning of photosynthates in vegetative and reproductive parts goes simultaneously in the later growth phases. The combined effect of inorganic N and *Rhizobacteria* played very important role due to their synergistic effect. Application of *Rhizobacteria* increased the supply of easily unavailable nutrients in to available form. Moreover, *Rhizobacteria* also perform better when soil is well supplied with nutrients particularly nitrogen. The results confirm the findings of Kachot *et.al.* (1), Ramesh *et.al.* (2) and Vessery (3).

Thus, by considering the favourable effect of *Rhizobacteria* on the succeeding crop as well as soil health, application of *Trichoderma* MTCC-5179 or *Rhizobacteria* FL-14 (seed treatment) could be recommended for cultivation of Fennel for obtaining higher seed yield.

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