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Maximization of seed yield in transplanted fennel (*Foeniculum vulgare* Mill.)

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Abstract

A field experiment was conducted at Udaipur (Rajasthan) to study the effect of three plant densities, four fertilizer treatments and two growth regulators on yield maximization of transplanted fennel (*Foeniculum vulgare*). Planting of fennel at a density of 27,770 plants ha⁻¹ recorded significantly higher yield attributes (umbels plant⁻¹, seed yield plant⁻¹ and test weight), while seed yield ha⁻¹ was higher with a density of 55,550 plants ha⁻¹ (20.89 q ha⁻¹). Application of 90 kg N + 40 kg P₂O₅ + 20 kg K₂O + 20 kg S + 5 kg Zn ha⁻¹ recorded significantly higher yield attributes and yield of fennel during both the years. Application of naphthalene acetic acid 100 ppm recorded significantly higher yield attributes and seed yield.

Keywords: fennel, fertilization, *Foeniculum vulgare*, growth regulator, plant density, yield.

Growing transplanted fennel (*Foeniculum vulgare* Mill.) is a common commercial practice in Gujarat and Rajasthan under irrigated agro-ecosystems having medium to medium-heavy soils. The yield potential of transplanted fennel (2.5 t ha⁻¹) is always higher than the direct seeded crop, while the realized average productivity of this crop is 1.2 to 1.5 t ha⁻¹ in this region. Thus, there is a wide gap between its inherent genetic potential and attained productivity. This is because of lack of appropriate agro-techniques available for raising this crop. Little research work has been carried out on development of suitable agro-techniques which are important production factors for realizing higher crop productivity and hence,

this experiment was conducted.

The field experiment was conducted at Instructional Farm, Department of Agronomy, Rajasthan College of Agriculture, Udaipur (Rajasthan) during 2002–03 and 2003–04. The experiment was laid out in a split plot design comprising of three plant densities [27,770 (60 cm x 60 cm), 55,550 (60 cm x 30 cm) and 83,330 (60 cm x 20 cm) plants ha⁻¹], four fertilizer treatments (90 kg N + 40 kg P₂O₅ + 20 kg K₂O, 90 kg N + 40 kg P₂O₅ + 20 kg K₂O + 20 kg S, 90 kg N + 40 kg P₂O₅ + 20 kg K₂O + 5 kg Zn and 90 kg N + 40 kg P₂O₅ + 20 kg K₂O + 20 kg S + 5 kg Zn ha⁻¹) and two growth regulators [benzyl adenine (BA) 10 ppm, naphthalene acetic acid (NAA) 100 ppm

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Table 1. Effect of plant densities, fertilizers and growth regulators on yield attributes of transplanted fennel

Treatment	Umbels plant ⁻¹			Seed yield plant ⁻¹ (g)			1000 seed weight (g)		
	2002-03	2003-04	Mean	2002-03	2003-04	Mean	2002-03	2003-04	Mean
Plant density (ha⁻¹)									
27,770 (60 cm x 60 cm)	30.84	31.85	31.34	74.78	84.15	79.46	7.08	7.09	7.09
55,550 (60 cm x 30 cm)	25.71	26.47	26.09	39.24	44.92	42.08	6.80	6.91	6.85
83,330 (60 cm x 20 cm)	21.03	21.96	21.49	24.85	29.18	27.01	6.77	6.87	6.82
SEm ±	0.39	0.35	-	1.11	1.37	-	0.05	0.04	-
CD (P=0.05)	0.92	0.83	-	2.62	3.25	-	0.11	0.10	-
Fertilizer (kg ha⁻¹)									
90 kg N + 40 kg P ₂ O ₅ + 20 kg K ₂ O	23.60	24.45	23.02	39.55	45.45	42.50	6.78	6.87	6.82
90 kg N + 40 kg P ₂ O ₅ + 20 kg K ₂ O + 20 kg S	26.65	27.57	27.16	47.83	55.00	51.41	6.89	6.95	6.92
90 kg N + 40 kg P ₂ O ₅ + 20 kg K ₂ O + 5 kg Zn	25.70	26.46	26.08	45.67	51.40	48.54	6.87	6.95	6.91
90 kg N + 40 kg P ₂ O ₅ + 20 kg K ₂ O + 20 kg S + 5 kg Zn	27.49	28.55	27.97	52.11	59.15	55.63	7.00	7.06	7.03
SEm ±	0.45	0.41	-	1.28	1.59	-	0.05	0.05	-
CD (P=0.05)	1.06	0.96	-	3.03	3.75	-	NS	NS	-
Growth regulator									
Water spray (Control)	24.44	25.22	24.83	42.13	48.61	45.37	6.80	6.87	6.83
BA 10 ppm	26.13	27.15	26.64	46.83	52.60	49.72	6.90	6.98	6.94
NAA 100 ppm	27.00	27.91	27.46	49.91	57.04	53.47	6.95	7.03	6.99
SEm ±	0.28	0.33	-	0.88	0.86	-	0.04	0.04	-
CD (P=0.05)	0.65	0.75	-	2.01	1.97	-	0.09	0.10	-

NS = Not significant

Table 2. Effect of plant densities, fertilizers and growth regulators on yields and harvest index of transplanted fennel

Treatment	Yield (q ha ⁻¹)						Harvest index		
	Seed yield			Biological yield					
	2002-03	2003-04	Mean	2002-03	2003-04	Mean	2002-03	2003-04	Mean
Plant density (ha⁻¹)									
27,770 (60 cm x 60 cm)	17.69	17.99	17.84	100.49	103.61	102.05	0.176	0.174	0.175
55,550 (60 cm x 30 cm)	20.46	21.32	20.89	110.51	116.24	113.37	0.185	0.184	0.185
83,330 (60 cm x 20 cm)	19.10	20.29	19.70	117.61	122.24	119.92	0.164	0.167	0.166
SEm ±	0.40	0.33	-	2.06	2.08	-	0.004	0.004	-
CD (P=0.05)	0.96	0.79	-	4.87	4.91	-	0.010	0.010	-
Fertilizer (kg ha⁻¹)									
90 kg N + 40 kg P ₂ O ₅ + 20 kg K ₂ O	16.69	18.09	17.39	98.98	102.99	100.99	0.168	0.176	0.172
90 kg N + 40 kg P ₂ O ₅ + 20 kg K ₂ O + 20 kg S	19.49	20.29	19.89	112.02	117.07	114.54	0.176	0.175	0.175
90 kg N + 40 kg P ₂ O ₅ + 20 kg K ₂ O + 5 kg Zn	18.96	19.70	19.33	109.26	113.44	111.35	0.174	0.174	0.174
90 kg N + 40 kg P ₂ O ₅ + 20 kg K ₂ O + 20 kg S + 5 kg Zn	21.18	21.39	21.28	117.88	122.62	120.25	0.182	0.176	0.179
SEm ±	0.47	0.39	-	2.38	2.40	-	0.005	0.005	-
CD (P=0.05)	1.10	0.91	-	5.63	5.67	-	NS	NS	-
Growth regulator									
Water spray (Control)	17.68	18.39	18.04	103.75	107.87	105.81	0.171	0.172	0.172
BA 10 ppm	19.25	19.84	19.54	110.53	115.77	113.15	0.175	0.172	0.174
NAA 100 ppm	20.32	21.37	20.85	114.34	118.45	116.39	0.179	0.182	0.180
SEm ±	0.33	0.32	-	1.81	2.02	-	0.004	0.003	-
CD (P=0.05)	0.74	0.73	-	4.15	4.62	-	NS	NS	-

NS=Not significant

and water spray as control]. These 36 treatment combinations were replicated thrice. Seeds of GF-2 variety of fennel (4 kg ha⁻¹) were sown in the nursery during the last week of June and the seedlings transplanted during the first fortnight of August.

Plant density

Planting of fennel at a density of 27,770 plants ha⁻¹ recorded maximum number of umbels plant⁻¹ (25.71 and 26.47), seed yield plant⁻¹ (39.24 and 44.92 g) and test weight (6.80 and 6.91 g) during 2002–03 and 2003–04, respectively (Tables 1 and 2). However, maximum seed yield was recorded with the density of 55,550 plants ha⁻¹ during both the years of experimentation (20.46 and 21.32 q ha⁻¹), which was significantly higher than other densities. The mean increase in seed yield due to planting of fennel at a density of 55,550 plants ha⁻¹ was 14.60% and 5.69% higher over 27,770 and 83,330 plants ha⁻¹, respectively. The higher level of yield attributes under low population might be due to availability of more inputs to the plants; however, its effect on yield is population dependent. These results are in accordance with Rinaldi (2003).

Fertilization

Application of 90 kg N + 40 kg P₂O₅ + 20 kg K₂O + 20 kg S + 5 kg Zn ha⁻¹ recorded

maximum number of umbels plant⁻¹, seed yield plant⁻¹ and test weight (Table 1) and produced 21.18 q and 21.39 q ha⁻¹ seed yield during 2002–03 and 2003–04, respectively, which was significantly higher than rest of the treatments (Table 2). The marked increase in seed yield with the treatments applied might be due to optimum nutritional environment, which was reflected in higher magnitude to yield attributed and ultimately the yield. These results are in conformity with Afaq (2000).

Plant growth regulators

Foliar spray of NAA 100 ppm recorded significantly higher number of umbels plant⁻¹ (27.00 and 27.91), seed yield plant⁻¹ (49.91 and 57.04 g), and test weight (6.95 and 7.03 g) during 2002–03 and 2003–04, respectively. The mean increase of seed yield was 6.28% and 13.47% over BA 10 ppm and control, respectively. The increase in yield attributes and yield might be due to cellular level effect of growth regulators. The interaction effects were not significant.

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