

Fertilizer Prescription Based on Specific Yield of Fennel in Chandauli District of Uttar Pradesh

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Abstract

The present study was conducted in five locations of Naugarh block in Chandauli district during the year 2018-19, to study the fertilizer prescription based on specific yield of fennel crop. The fertilizer adjustment equations are derived by the Council of Science and Technology, Project, Institute of Agricultural Science, B.H.U., Varanasi centre. Results revealed that targeted yield of fennel (15 q ha^{-1}) and (20 q ha^{-1}) have been achieved by using the plant nutrients on the basis of targeted yield concept (soil test crop response technology). The maximum net returns of coriander first location (Rs.36934 and Rs.66534), second location (Rs.38853 and Rs.68754), third location (Rs.34954 and Rs.64554), fourth location (Rs.39453 and Rs.69054), fifth location (40174 and 70374) were obtained. This technology also maintained the soil available plant nutrients. Thus, for obtaining maximum gain and sustain the soil fertility, application of plant nutrients as per soil test value (STCR technology) is essential.

Key words: Fennel, target yield, soil test crop response and fertility and yield etc.

Introduction

In an intensively cultivated areas of India, a high annual productivity of fennel results in removal of nutrients in substantial amounts that after exceed replenishment through fertilizers and manures ultimately leading to deterioration of soil health. Yields decline and decreasing total factor productivity have been reported. Farmers are using excess chemical fertilizers to achieve higher yield but the decision on fertilizer use requires knowledge of the expected crop yield and response to nutrient application. It is a function of crop nutrient needs, supply of nutrients from indigenous sources and the short and long-term fate of the applied fertilizer nutrients. One of the reasons for lower production is imbalanced use of fertilizers by the farmers without knowing soil fertility status and nutrient requirement of crops causes adverse effects on soil and crop both in terms of nutrient toxicity and deficiency. Micro situation level specific fertilizer

recommendations are possible for soils of varying fertility resource conditions of farmers and levels of targeted yield and for similar soil classes and environment. Field specific balanced amounts of primary nutrients (N, P and K) were prescribed based on crop based estimates of the supply of N, P and K and by modelling the expected yield response as a function of nutrient interaction.

The objective of this study was to evolve the sound basis of fertilizer prescriptions for fennel crop in alluvial soil (Inceptisol) at different soil fertility levels under the conditions of fertilizer scarcity and to ensure maximum fertilizer use efficiency. The study also intended to find the relationship between the nutrients supplied by the soil and added by inorganic sources, their uptake and to develop a guideline for judicious application of fertilizer for desired yield target of coriander by using STCR model. This will ensure efficient utilization and

profitable fertilizer application rates for
Materials and Methods

The on farm testing trials were conducted in village – Dhobai, block - Naugarh of Chandauli district, Uttar Pradesh, India during year *rabi*- 2018-19 on alluvial soil (Inceptisol). Initial soil samples (0-15 cm in depth) were collected, dried and passed through 2 mm sieve and analyzed for physico chemical properties. Available nitrogen, by the alkaline permanganate method; available phosphorus, by Olsen method and available potassium, by the ammonium acetate method were estimated. Five fertilizers treatments viz., Control, Farmers

higher and profitable crop production.

practice, General recommendation dose of fertilizer, soil test crop response (STCR) for 15 q ha⁻¹ target yield and soil test crop response (STCR) for 20 q ha⁻¹ target yield were taken. The targeted yield of crop was decided as per yield potential of varieties. Pre sowing soil samples were analyzed according to the standard procedures [Table 1]. Soil resource inventory of the study area in given in the table 1. Quantities of nitrogen, phosphorus and potassium were calculated with the help of fertilizer adjustment equations as follows:-

$$FN = 8.68 T - 0.28 SN - 0.21 NFYM$$

$$FP_2O_5 = 2.08 T - 1.16 SP - 0.06 PFYM$$

$$FK_2O = 2.32 T - 0.08 SK - 0.07 KFYM$$

Where - T = Yield target (t ha⁻¹)

- F.N. = Fertilizer N (kg ha⁻¹)
- F.P₂O₅ = Fertilizer P (kg ha⁻¹)
- F.K₂O = Fertilizer K (kg ha⁻¹)
- SN = Soil available nitrogen (kg ha⁻¹)
- SP = Soil available phosphorus (kg ha⁻¹)
- SK = Soil available potassium (kg ha⁻¹)

The crop received one third N and full dose of P₂O₅ and K₂O as basal application and remaining half N were applied and 27 days after sowing in funnel crop. Remaining nitrogen was applied at panicle initiation stage.

Nitrogen was applied through urea and phosphorus through single super phosphate and potassium through muriate of potash. The funnel variety of test crop was RF-125. The same variety was used in STCR treatment and other treatments.

Table 1 Physico-chemical properties of the experimental area

Locations	Physico chemical properties			Fertility status		
	pH	EC (dSm ⁻¹)	OC (%)	Av-N (kg ha ⁻¹)	Av-P (kg ha ⁻¹)	Av-K (kg ha ⁻¹)
Location-I	7.0-8.1	0.32-0.39	0.45-0.71	186.45	10.50	146.00
Location-II	6.8-8.0	0.37-0.60	0.36-0.72	181.10	10.50	141.20
Location-III	7.0-7.8	0.28-0.58	0.42-0.82	185.30	10.80	145.60
Location-IV	7.0-7.8	0.31-0.39	0.30-0.44	183.00	11.30	143.60
Location-V	7.2-8.0	0.30-0.50	0.34-0.45	184.00	11.80	144.50

Table 2 Economics of Verification Trails for fennel crop

Fertilizer dose N, P ₂ O ₅ , K ₂ O (kg ha ⁻¹) & FYM (t ha ⁻¹) Treatments	Actual mean grain yield (kg ha ⁻¹)	Actual mean straw yield (kg ha ⁻¹)	Additional yield (kg ha ⁻¹)	Value of additional yield (Rs.)	Cost of fertilizer (Rs.)	Net Benefit (Rs.) Over T ₁	B/C ratio
Location - I: Name – Sri. , Shanker, Village-Dhobai							
T ₁ -0-0-0	852	1278	-	-	-	-	-
T ₂ -50-30-20	1060	1590	208	12480	3082	9398	3.05
T ₃ -80 - 40 – 30	1240	2083	388	23280	4429	18851	4.26
T ₄ - 80 - 20- 24	1520	2554	668	40080	3146	36934	11.74
T ₅ -123 - 30 - 35	2040	3488	1188	71280	4746	66534	14.02
Location - II: Name – Mahabir, Village-Dhobai							
T ₁ -0-0-0	845	1394	-	-	-	-	-
T ₂ -50-30-20	1080	1782	235	14100	3082	11018	3.57
T ₃ -80 - 40 – 30	1210	2057	365	21900	4429	17471	3.94
T ₄ - 80 - 20- 24	1545	2626	700	42000	3146	38853	12.35
T ₅ -123 - 30 - 35	2070	3519	1225	73500	4746	68754	14.49
Location - III: Name – Amarnath. , Village-Dhobai							
T ₁ -0-0-0	875	1312	-	-	-	-	-
T ₂ -50-30-20	1072	1608	197	11820	3082	8738	2.83
T ₃ -80 - 40 – 30	1265	2150	390	23400	4429	18971	4.28
T ₄ - 80 - 20- 24	1510	2567	635	38100	3146	34954	11.11
T ₅ -123 - 30 - 35	2030	3451	1155	69300	4746	64554	13.60
Location - IV: Name – Sri –Jokhan , Village-Dhobai							
T ₁ -0-0-0	825	1320	-	-	-	-	-
T ₂ -50-30-20	1060	1696	235	14100	3082	11018	3.57
T ₃ -80 - 40 – 30	1215	1944	390	23400	4429	18971	4.28
T ₄ - 80 - 20- 24	1535	2763	710	42600	3146	39453	12.54
T ₅ -123 - 30 - 35	2055	3699	1230	73800	4746	69054	14.55
Location - V: Name – Sri. Bhagwan Das, Village – Dhobai							
T ₁ -0-0-0	838	1240.24	-	-	-	-	-
T ₂ -50-30-20	1040	1539.20	202	12120	3082	9038	2.93
T ₃ -80 - 40 – 30	1235	2235.35	397	23820	4429	19391	4.38
T ₄ - 80 - 20- 24	1560	2823.60	722	43320	3146	40174	12.77
T ₅ -123 - 30 - 35	2090	3782.90	1252	75120	4745	70374	14.83

Note: Fennel@Rs.60.00/kg, N@Rs.17.39/kg, P₂O₅@Rs.56.25/kg, K₂O@Rs.26.66/kg.

A minor modification was made in the ready reckoner, FP: Farmers practice i.e. the fertilizer doses the farmers generally applied in the area, GRD: General recommendation of agricultural department of the district on the basis of soil test value, B: C ratio: benefit cost ratios

Results and Discussion

Soil characteristics

The soil was alluvial (Inceptisol) in reaction with pH varying from 7.00 –

8.00. The organic carbon content varied from 0.28 - 0.60 soils were medium in available nitrogen (ranging from 181.10-

186.45 kg ha⁻¹), low to medium in available phosphorus (ranging from 10.50-11.80 kg ha⁻¹) and medium to high in available potassium (ranging from 141.20-146.00 kg ha⁻¹) in table 1. Though these soils are considered to be most fertile, they are deficient in nitrogen and humus but moderately supplied with phosphorus and potassium.

Yield targeting of funnel based on soil test

Experimental data on follow up trails as frontline demonstration, for each location during the period 2018-19 were conducted in farmers field and are given in Table 2. From the field experiment the basic data on nutrient requirement for producing one quintal grain yield of fennel, percent contribution of nutrients from soil (%CS) and fertilizer (%CF) were evaluated. These basic parameters were used for developing the fertilizer prescription equations under NPK alone. The nutrient requirement of N, P₂O₅ and K₂O were 4.37, 1.13 and 3.91 kg q⁻¹ of grain yield, respectively. The percent contribution of nutrients from soil and fertilizers were found to be 14.05 and 50.30 for N, 62.65 and 54.08 for P₂O₅ and 13.24 and 169.63 for K₂O, respectively. It was noted that contribution of potassium from fertilizer for wheat was higher in comparison to soil. This high value of potassium could be to the interaction effect of higher doses of N, P coupled with priming effect of starter K doses in the treated plots, which might have caused the release of soil potassium form, resulting in the higher uptake from the native soil sources by the crop. Similar type of higher efficiency of potassic fertilizer was also reported earlier^[2] for rice in alluvial soils and for finger millet.

Target yield of 15 and 20 q ha⁻¹ has been achieved with comparatively lower

application of N and P₂O₅ fertilizers but higher application of K₂O, in comparison to doses applied in farmer's practice and soil based recommendations. As for example in the alluvial soil of West Bengal, In the winter season highest rice yield was 6.0 t/ha regardless of the N level used but could be raised to 7.4 t/ha with increased application of K fertilizers. This is probably due to the higher N use efficiency as well as increased N recovery by crop under increased K application. Yield targets of 15 and 20 q ha⁻¹ for fennel (GD 1240) were achieved in table 2 from the expected yield targets in all the cases. In all sites, grain yields of fennel through general recommendation (GRD) of fertilizers lagged behind the yield obtained at 15 and 20 q ha⁻¹ fixed target. These results accorded with the findings of other investigators^[1, 3]. Between the two targets tried, targeting for 15 q ha⁻¹ recorded relatively higher response ratio than with 20 q ha⁻¹ though it has also recorded higher yields. This might be due to the better use efficiency of applied NPK fertilizers at low yield target levels^[3].

However for efficient utilization of applied fertilizer some other parameters like soil pH, organic carbon status status etc. should also be considered, since these are the major determining factors of soil nutrient retention. This is for the development of an effective fertilizer schedule as well as nutrient supply source in view of the better nutrient absorption and assimilation by the plants.

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