Original Research Article

Influence of Weed Control Measures and Nutrient Management on nutrient content, uptake and nutrient use efficiency of fennel crop (*Foeniculum vulgare* Mill.)

Abstract

An experiment was conducted during *Rabi,* 2021-22 at College of Agriculture, SKRAU, Bikaner where in sixteen treatment combinations having four nutrient management treatments-control (no fertilizer applied), 75 % RDF, 100 % RDF and 125 % RDFand four weed control measures- weed free, pendimethalin @ 0.75 kg ha^{-1} (PE), oxyfluorfen @ 50g ha^{-1} (POE at 25 DAS) and weedy checkwere replicated thrice in FRBD.The weed free treatment found significantly better treatments in increasing N, P and K content in seed and straw as well as their uptake by crop followed by pendimethalin @ 0.75 kg ha^{-1} (PE) over weedy check.Among the nutrient management treatments, application of 100 % RDF improved the nutrient content in seed and straw and their uptake by crop recorded the highest nutrient use efficiency which was at par with 125% RDF and significantly higher over remaining treatments.

Key words: Weed control measures, Nutrient management, Uptake, Content, Nutrient use efficiency, Fennel, RDF.

Introduction

Fennel is one of most important seed spice crop vernacularly it is called as *Saunf*belongs to the family Umbelliferae (Apiaceae).Fennel is said to be a Mediterranean and Southern European native. The fennel plant is pleasantly aromatic and each part of it (leaves, stalks, bulbs and seeds) is edible. Fennel seeds have afragrantodor and aromatic taste due to presence of volatile oils *viz.* Anethole and Fenchone and are commonly used in meals, meat and fish dishes, ice cream, alcoholic beverages, and herb blends.They're commonly utilized in candies, soups, sauces, pastries, pickles, liquors, and bakery dishes, among other things. The seeds contain about 9.5% protein, 10.0% fat, 42.3% carbohydrates, 18.5% fiber and

13.4% minerals and about 0.7% to 6.0% volatile oil depending on genotypes or botanical types.

In India, fennel is mostly produced in Gujarat, Rajasthan, Madhya Pradesh, Maharashtra, Haryana, Uttar Pradesh, and Punjab. In Rajasthan fennel cultivated on 26.25 thousand hectare area and produces 25.62 thousand tones with an average yield of 976 kg ha^{-1} (Spice Board, India, 2019-20). It is primarily grown in the districts of Tonk, Pali, Sirohi and Jodhpur and to a limited extent in Bharatpur, Bikaner, Kota, Jaipur and Ajmer.

Fennel is a valuable commercial cash crop traditionally grown as *rabi* season crop in dry and semi-arid areas. It is a slow growing plant that takes longer time to germinate and leads heavy weed infestation in the initial days of growth. Looking to the importance of the crop the average productivity is low, so the efforts have made to enhance the productivity of the fennel by the management of agronomic practices and fertilizer. Macro nutrients such as N, P and K are essential to all crops. Nitrogen is the most important element that limits crop growth and yield. Most of the nitrogen in plants is present in organic form: nucleic acid, hormones, membrane component, coenzymes and pigment. Phosphorus is an essential component of the genetic information system, the energy transfer compounds (ATP and other nuclei-proteins), cell membranes and phospho-proteins. Potassium improves droughttolerance and water uptake in plants. Hence, balanced crop nutrition and good weed control practices is a key factor to achieving higher crop yields.Keeping theabove facts in view, the study was conductedfor knowing the suitable weed control measure and best nutrient management for maximizing nutrient content, uptake and nutrient use efficiency of fennel.

Materials and Methods

A field experiment was conducted at Instructional farm, College of Agriculture, Swami Keshwanand Rajasthan Agricultural University, Bikaner during *Rabi* season 2021-22 which is situated at 28.01^0 N latitude and 73.22^0 E longitude and altitude of 234.70 meters above mean sea level. The region falls in Agro-climatic zone IC (Hyper Arid Partially Irrigated North Western Plain Zone) of Rajasthan. The soil of experimental site was loamy sand having pH 8.5, low organic carbon (0.18%), low available N (121.4 kg ha^{-1}), medium P (19.08 kg ha^{-1}) and low K (191.42 kg ha^{-1}).The experiment was laid out in factorial randomized block design with three replications.The treatments comprising combinations of

16 treatments comprising four nutrient management treatments, viz.control (no fertilizer applied), 75 % RDF, 100 % RDF and 125 % RDF and four weed control measures, viz. weed free, pendimethalin @ 0.75 kg ha^{-1} (PE), oxyfluorfen @ 50g ha^{-1} (POE at 25 DAS) and weedy check. Fennel crop variety RF-143was used as a test crop.Herbicides were sprayed by using knapsack sprayer at pre emergence (PE) and post emergence of both weed and crop. Urea, SSP and MOP was used as source of N, P and K, respectively. The nitrogen content was estimated by Nesssler's reagent colorimeter method (snell and snell, 1959), Phosphorus by Ammonium 'vanadomolybdatephosphate' yellow colormethod (richards, 1968) and potassium by Flame photometer method (Jackson, 1959). The nutrient uptake was calculated from N, P and K content in seed and straw at harvest using following equation.

$$\text{Nurient uptake (kg h}a^{-1}) = \frac{\text{Nutrient content in seed (\%) X Seed yield + Nutrient content in straw (\%) X Straw yield}}{100}$$

The nutrient use efficiency was computed by using the following formula:

$$\text{NUE (kg k}g^{-1}) = \frac{\text{Grain yield of fertilizer plot} - \text{Grain yield of unfertilized plot}}{\text{Quantity of applied nutrient}}$$

Result and Discussion

Effect of weed control measures

Nutrient content in seed and straw and their total uptake by crop were significantly influenced by different weed control measure. The lowest content of N, P and K in seed and straw was found in weedy check. Whereas, maximum content of N, P and K was obtained in weed free treatment followed by pendimethalin @ 0.75 kg ha^{-1} (PE). Higher content of nutrients in crop ascribed great availability of nutrients in soil, and less weed population. It is clear from the data (Table 1-3), that minimum uptake of N, P and K was observed under weedy check. Data further revealed that weed free recorded the significantly highest uptake of 40.50 kg N, 10.72 kg P and 58 kg K ha^{-1}. Pendimethalin @ 0.75 kg ha^{-1} (PE) and oxyfluorfen @ 50 g ha^{-1} (POE at 25 DAS) also recorded more N, P and K uptake compared to weedy check. These treatments provided weed free environment to crop at early growth stage, wherein the major portion of the basal dose of fertilizer was applied to soil was available to

crop in contrast to weedy check. Similarly, at later stages, the applied nutrients under weedy check were utilized by weeds due to their greater competition and better root system. More availability of nutrients to crop under weed free condition under superior treatments increased their content in the plants, which resulted in higher crop dry matter and yields. Similar findings have also reported by Yadav *et al*. (2016) in coriander and choudhary*et al.* (2022) in fennel.

Effect of nutrient management

A significant increase in N, P and K content in seed and straw and their total uptake by crop recorded with the application of 100 % RDF over control but was found at par with 125 % RDF (Table 1-3).Significant improvement in uptake of nitrogen, phosphorus and potassium might be attributed to their respective higher content in seed and straw. Data in table 4 indicated that increasing level of fertility affects the NUE. Significantly, highest N P K use efficiency was obtained with 100 % RDF 3.18, 7.90 and 15.81 kg kg^{-1}. Similar results have also been reported by Javiya*et al.* (2017) in coriander and Kalasare*et al.* (2021) in fennel.

Conclusion

It is concluded that in fennel crop the weed free treatment obtained maximum content of N, P and K and their uptake and followed by pendimethalin @ 0.75 kg ha^{-1} (PE) among the weed control measures. 100% RDF observed significantly highest nutrient content, uptake and nutrient use efficiency from all the nutrient management treatments.

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Table 1: Effect of weed control measures and nutrient management on nitrogen content and uptake by crop

Treatment	Nitrogen content (%)		Total N uptake (Kg ha^{-1})
	Seed	Straw	
Nutrient management			
Control	1.19	0.562	21.79
75% RDF	1.31	0.611	29.19
100 % RDF	1.34	0.651	34.18
125 % RDF	1.35	0.653	35.56
SEm±	0.02	0.008	0.46
CD (p=0.05)	0.05	0.023	1.34
Weed control measures			
Weed free	1.39	0.672	40.50
Pendimethelin 750g ha^{-1}PE	1.33	0.630	32.57
Oxyfluorfan50g ha^{-1}PoE at 25 DAS	1.31	0.626	30.39
Weedy check	1.16	0.549	17.26
SEm±	0.02	0.008	0.46
CD (p=0.05)	0.05	0.023	1.34

Table 2: Effect of weed control measures and nutrient management on phosphorus content and uptake by crop

Treatment	Phosphorus content (%)		Total P uptake (Kg ha^{-1})
	Seed	Straw	
Nutrient management			
Control	0.404	0.157	5.60
75% RDF	0.440	0.177	7.63
100 % RDF	0.464	0.190	9.11
125 % RDF	0.469	0.192	9.52
SEm±	0.006	0.002	0.14
CD (p=0.05)	0.018	0.007	0.42
Weed control measures			
Weed free	0.472	0.193	10.72
Pendimethalin 750g ha^{-1}PE	0.468	0.191	8.60
Oxyfluorfan50g ha^{-1}PoE at 25 DAS	0.444	0.179	8.03
Weedy check	0.393	0.152	4.52
SEm±	0.006	0.002	0.14
CD (p=0.05)	0.018	0.007	0.42

Table 3: Effect of weed control measures and nutrient management on potassium content and uptake by crop

Treatment	Potassium content (%)		Total K uptake (kg ha^{-1})
	Seed	Straw	
Nutrient management			
Control	0.520	1.38	30.02
75% RDF	0.587	1.54	41.43
100 % RDF	0.602	1.64	49.04
125 % RDF	0.608	1.66	51.22
SEm±	0.009	0.02	1.03
CD (p=0.05)	0.026	0.06	2.99
Weed control measures			
Weed free	0.632	1.67	58.00
Pendimethalin 750g ha^{-1}PE	0.596	1.65	46.32
Oxyfluorfan50g ha^{-1}PoE at 25 DAS	0.588	1.55	43.45
Weedy check	0.502	1.34	23.93
SEm±	0.009	0.02	1.03
CD (p=0.05)	0.026	0.06	2.99

Table 4: Effect of weed control measures and nutrient management onNutrient use efficiency of crop

Treatment	Nitrogen use efficiency	Phosphorus use efficiency	Potassium use efficiency
Nutrient management			
Control	0.00	0.00	0.00
75% RDF	2.85	6.41	12.82
100 % RDF	3.51	7.90	15.81
125 % RDF	3.18	7.16	14.32
SEm±	-	-	-
CD (p=0.05)	-	-	-

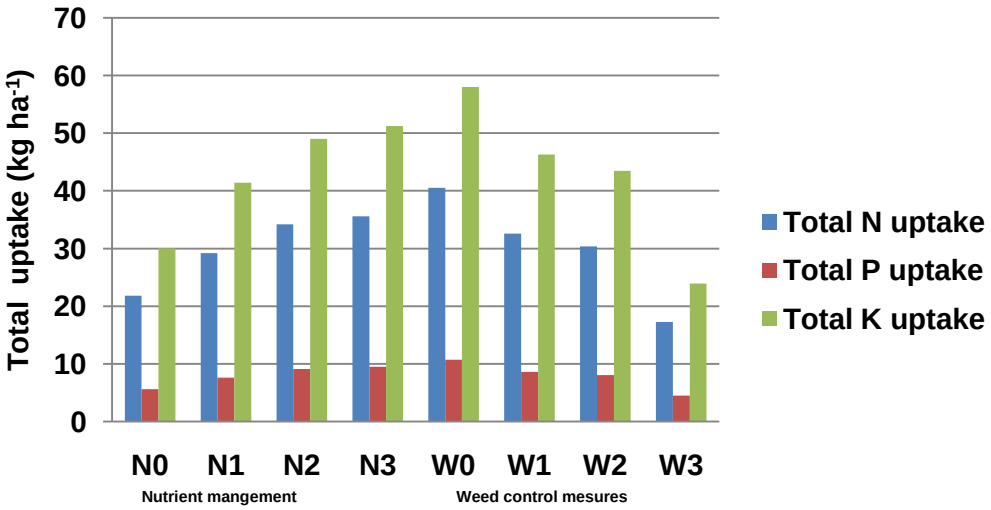

Fig. 1 Effect of nutrient management and weed control measures on total uptake