

Original Research Article

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Yield, Quality and Economics of Coriander (*Coriandrum sativum* L.) As Influenced by Weed Management Practices and Nitrogen Levels

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An experiment was conducted at Agronomy Instructional Farm, C. P. College of Agriculture, S. D. Agricultural University, Sardarkrushinagar during rabi season of 2016 – 17 to evaluate the effect of weed and nitrogen management in coriander (*Coriandrum sativum* L.). Results show that the significantly higher plant height (66.6 cm), test weight (13.54 g), seed yield (8.86 g) per plant, seed (1055 kg ha⁻¹) and straw (1688 kg ha⁻¹) yield, volatile oil content (0.42%) in seed, protein content (10.90%), productivity (8.72 kg ha⁻¹) per day, gross (95040 ₹ ha⁻¹) and net (64374 ₹ ha⁻¹) realization, net income (532 ₹ ha⁻¹) per day and BCR (3.09) were recorded under weed free (W₂) and was at par with pre emergence application of pendimethalin 1 kg ha⁻¹ + interculturing followed by HW at 30 days after sowing (W₆). Whereas, application of 60 kg N ha⁻¹ recorded significantly the higher plant height (61.8 cm), test weight (12.06 g), seed yield (7.69 g) per plant, seed (849 kg ha⁻¹) and straw (1373 kg ha⁻¹) yield, volatile oil content (0.42%) in seed, protein content (10.90%), productivity (7.02 kg ha⁻¹) per day, gross (76410 ₹ ha⁻¹) and net (48654 ₹ ha⁻¹) realization, net income (402 ha⁻¹) per day and BCR (2.75) and was at par with 40 kg N ha⁻¹. This study revealed that higher growth, yield, quality attributing characters and economics can be achieved by application of pendimethalin 1 kg ha⁻¹ as pre emergence + interculturing followed by hand weeding at 30 DAS along with application of 40 kg N ha⁻¹ under North Gujarat Agro - climatic condition.

Introduction

Coriander (*Coriandrum sativum* L.) is an annual herb from umbelliferae family with 90 to 120 days growth period. Coriander leaves are being used in cooking, flavouring,

beverages etc., and seeds are being used for preparing value added products such as coriander powder, chana dal, curry powder, oleoresin and essential oil. So, it is known as low volume but high value crop of arid and semi-arid regions. Among all the states of

India, Gujarat and Rajasthan together contribute more than 80 per cent of the total seed spices production in the country and thus, both the states together are known as “Seed Spices Bowl” of India. In Gujarat coriander is cultivated in area of 553 thousand hectares and produced 462 thousand tonnes with averages productivity of 835 kg ha⁻¹ during 2015 (Anon. 2015).

Coriander leaves are also rich source of vitamin C (125-250 mg/100 g) and vitamin A (5200 IU/100 g). Leaves are used for flavouring curries, sauces and soups. The dry seeds of coriander contain 19.6 per cent non-volatile oil, 24 per cent carbohydrates, 5.3 per cent mineral matter and 175 IU/100 g vitamin A (Chaudhary, 2011).

Delay in germination, initial slow growth rate and application of one more irrigation for better establishment of crop may increase severe weed problem during early stage growth which is responsible for yield loss up to 72-75 per cent which is depending upon the intensity and types of weed flora. Weed management is important not only to check yield losses but also to increased fertilizer use efficiency. Nutrient status of soil is another important factor deciding the productivity of the crop.

Most of the Indian soils, particularly light texture ones are deficient in nitrogen. Nitrogen is an expensive major plant nutrient. It plays a key role in the synthesis of chlorophyll and amino acid which contribute to the building of proteins. It imparts dark green colour to the plant and promotes growth of leaves, stems and finally governs the yields.

Therefore, an application of optimum quantity of nitrogen at right time has prime importance to enhance the productivity of coriander. So, the present study was conducted to study the

weed management practices and nitrogen levels on yield, quality and economics of coriander.

Materials and Methods

The field experiment was conducted at Agronomy Instructional Farm, C. P. College of Agriculture, S. D. Agricultural University, Sardarkrushinagar (North Gujarat), during *rabi* 2016 - 17. The soil of experimental field was loamy sand in texture, low in organic carbon and available nitrogen, medium in available phosphorus and rich in available potassium.

Eighteen treatment combinations consisting of six treatments of weed management *i.e.*, weedy check (W_1), weed free (W_2), IC + HW at 30 and 45 DAS (W_3), pendimethalin 1 kg ha⁻¹ as pre emergence (W_4), pendimethalin 1 kg ha⁻¹ as pre emergence + imazethapyr 75 g ha⁻¹ as post emergence at 20 - 25 DAS (W_5), pendimethalin 1 kg ha⁻¹ as pre emergence + interculturing followed by HW at 30 DAS (W_6) and three levels of nitrogen *i.e.*, 20, 40 and 60 kg ha⁻¹ were evaluated in Randomized Block Design with Factorial Concept and replicated three times.

Half nitrogen was applied as basal dose whereas, remaining half nitrogen applied as top dressing at 30 DAS. A common dose of 10 kg P ha⁻¹ was applied through diaammonium phosphate as basal dose. The statistical analysis of data for each characters studied in the experiment was carried out as per design of the experiment.

Estimation of quality attributes

Protein content (%)

The estimation of nitrogen in seed was done by adopting the micro Kjeldahl's method as described by Jackson (1967). Protein content

calculated by using following formula (Bhuiya and Chaudhary, 1974).

$$\text{Protein content (\%)} = \text{Nitrogen content (\%)} \times 6.25$$

Volatile oil content (%)

The volatile oil content was determined in percentage by steam distillation method (AOAC, 1970). The volume of oil so obtained was converted into percentage by using following formula.

$$\text{Volatile oil (\% (v/w))} = \frac{\text{Vol. of oil (ml)}}{\text{Wt. of sample}} \times 100$$

Results and Discussion

Effect of weed management

The data presented in Table 1 and 2 revealed that the significantly higher plant height (66.6 cm), test weight (13.54 g), seed yield (8.86 g) per plant, seed (1055 kg ha⁻¹) and straw (1688 kg ha⁻¹) yield, volatile oil content (0.42%) in seed, protein content (10.90%), productivity (8.72 kg ha⁻¹) per day, gross (95040 ₹ ha⁻¹) and net (64374 ₹ ha⁻¹) realization, net income (532 ₹ ha⁻¹) per day and BCR (3.09) were recorded under weed free (W₂) and was at par with pre emergence application of pendimethalin 1 kg/ha + interculturing followed by HW at 30 days after sowing (W₆) (Fig. 1). Effective removal of weeds throughout crop growth period by physical and integrated weed management practices provide better space and resource *i.e.*, moisture, nutrient and solar radiation *etc.* for crop which might be improved plant growth and seed yield per plant consequently higher seed and straw yield as result higher net return. Per cent increase in seed yield of coriander due to weed free condition (W₂)

were 8.31, 13.56, 19.34, 74.09 and 336 over treatments W₆, W₃, W₄, W₅ and W₁, respectively. Similarly, seed yield increased in per cent by treatment W₆ were 4.84, 10.18, 60.72, and 302.47 over treatments W₃, W₄, W₅, and W₁, respectively. However, removal of weeds through various weeds management practices cause beneficial effect on volatile oil and protein content in seeds. Lower seed yield of coriander under treatment W₅ was observed might be due to phytotoxic effect of post emergence herbicide *i.e.*, imazethapyr on crop and weeds was not controlled effectively at later stage. These finding corroborate the results reported by Gohil *et al.*, (2014), Meena *et al.*, (2015) and Mehariya *et al.*, (2007).

Effect of nitrogen levels

A perusal of data in Table 1 and 2 revealed that the application of 60 kg N ha⁻¹ recorded significantly the higher plant height (61.8 cm), test weight (12.06 g), seed yield (7.69 g) per plant, seed (849 kg ha⁻¹) and straw (1373 kg ha⁻¹) yield, volatile oil content (0.42%) in seed, protein content (11.13%), productivity (7.02 kg ha⁻¹) per day, gross (76410 ₹ ha⁻¹) and net (48654 ₹ ha⁻¹) realization, net income (402 ₹ ha⁻¹) per day and BCR (2.75) and was at par with 40 kg N ha⁻¹ (Fig. 1). Application of nitrogen increased with increase in seed and straw yields. It might be due to due to overall improvement in vegetative stage at higher levels of nitrogen, which positively influenced on yield contributing characters *viz.*, 1000 - seed weight and seed yield per plant. Moreover, adequate supply of nitrogen improved growth and yield attributes consequently seed yield and higher net return. Better effect of higher levels of nitrogen might be attributed to rapid expansion of dark green foliage, which could intercept and utilize more light energy in the production of food through the process of photosynthesis.

Table.1 Growth and yield of coriander as influenced by different weed management practices and nitrogen levels

Treatments	Plant height (cm)	1000-seed weight (g)	Seed yield per plant (g)	Seed yield (kg ha^{-1})	Straw yield (kg ha^{-1})
Weed management (W)					
W₁: Weedy check	56.1	8.12	3.53	242	493
W₂: Weed free	66.6	13.54	8.86	1055	1688
W₃: IC + HW at 30 and 45 DAS	60.5	12.06	7.97	929	1481
W₄: Pendimethalin 1 kg ha^{-1} as PE	60.2	11.59	7.96	884	1470
W₅: Pendimethalin 1 kg ha^{-1} as PE + Imazethapyr 75 g ha^{-1} as PoE at 20-25 DAS	57.2	10.35	6.73	606	1027
W₆: Pendimethalin 1 kg ha^{-1} as PE + IC followed by HW at 30 DAS	62.3	12.86	8.40	974	1664
S.Em. \pm	1.57	0.49	0.27	32	68.02
C.D. at 5%	4.50	1.40	0.78	93	195.49
Levels of nitrogen (N)					
N₁: 20 kg ha^{-1}	58.1	10.42	6.46	711	1196
N₂: 40 kg ha^{-1}	61.5	11.77	7.58	786	1342
N₃: 60 kg ha^{-1}	61.8	12.06	7.69	849	1373
S.Em. \pm	1.11	0.35	0.19	23	48
C.D. at 5%	3.18	0.99	0.55	66	138
C.V. %	7.76	12.86	11.34	12.41	15.64

Table.2 Quality and economics of coriander as influenced by different weed management practices and nitrogen levels

Treatments	Volatile oil content (%)	Protein content (%)	Productive per day (kg ha ⁻¹)	Gross realization (₹ ha ⁻¹)	Total cost of cultivation (kg ha ⁻¹)	Net realization (₹ ha ⁻¹)	Net income per day (₹ ha ⁻¹)	BCR
Weed management (W)								
W₁: Weedy check	0.39	9.40	2.00	21780	24426	-2646	-22	0.89
W₂: Weed free	0.42	10.90	8.72	95040	30666	64374	532	3.09
W₃: IC + HW at 30 and 45 DAS	0.41	10.70	7.68	83610	28446	55164	456	2.93
W₄: Pendimethalin 1 kg ha⁻¹ as pre emergence	0.40	10.89	7.31	79560	26017	53542	442	3.05
W₅: Pendimethalin 1 kg/ha as pre emergence + Imazethapyr 75 g ha⁻¹ as post emergence at 20-25 DAS	0.40	9.58	5.01	54540	27328	27242	225	1.99
W₆: Pendimethalin 1kg ha⁻¹ as pre emergence + interculturing followed by HW at 30 DAS	0.41	10.85	8.05	87660	28027	59632	493	3.12
S.Em. ±	0.01	0.49	-	-	-	-	-	-
C.D. at 5%	NS	NS	-	-	-	-	-	-
Levels of nitrogen (N)								
N₁: 20 kg ha⁻¹	0.38	9.29	5.88	63990	27214	36776	304	2.35
N₂: 40 kg ha⁻¹	0.41	10.73	6.50	70740	27485	43255	357	2.57
N₃: 60 kg ha⁻¹	0.42	11.13	7.02	76410	27756	48654	402	2.75
S.Em. ±	0.01	0.35	-	-	-	-	-	-
C.D. at 5%	0.02	0.99	-	-	-	-	-	-
C.V. %	7.30	14.21	-	-	-	-	-	-

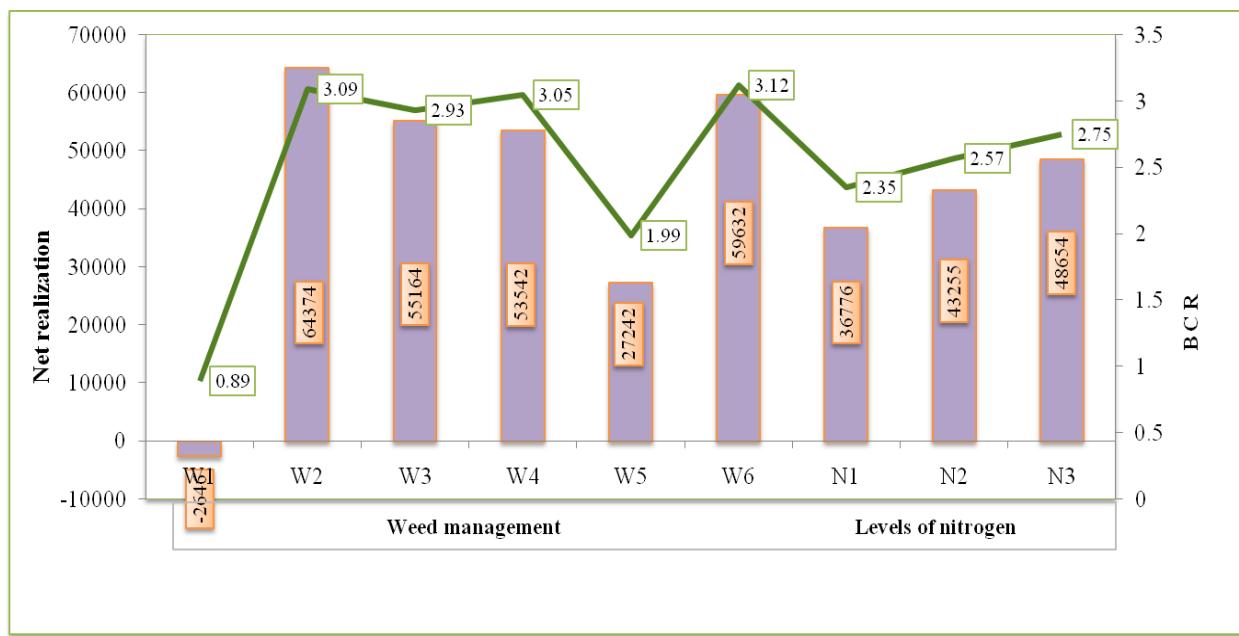


Fig.1 Economics of coriander as influenced by different weed management practices and nitrogen levels

On the contrast, application of inadequate dose of nitrogen adversely affect the plant growth might be reduce the production of photosynthates, which resulted in lower yield attributes consequently seed yield.

Nitrogen supply seems to be involved in an increased conversion of primary fatty acids metabolites end product of fatty acids, which resulted in increased volatile oil content in seed. In case of increased in protein content ascribed to increase in nitrogen uptake at higher levels of nitrogen and also nitrogen plays an important role in synthesis of different amino acid, which constitutes building blocks of protein and that might have resulted in higher protein content. Similar findings are also reported by Datta *et al.*, (2008), Lokhande *et al.*, (2015) and Patel *et al.*, (2013).

On the basis of experiment, it is concluded that efficient weed management and remunerative higher yield and net return of coriander can be obtained by adopting integrated weed management approach *i.e.*,

application of pendimethalin 1 kg/ha as pre emergence + interculturing followed by hand weeding at 30 DAS along with application of 40 kg N/ha under North Gujarat Agro - climatic condition.

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