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

J. K. Patil¹, A. U. Amin², Y. A. Tamboli²* and U. V. Patel¹

¹Department of Agronomy, Chimanbhai Patel College of Agriculture, S. D. Agricultural University, Sardarkrushinagar, Gujarat-385 506, India
²Department of Agronomy, Seed Spices Research Station, Jagudan, S. D. Agricultural University, Sardarkrushinagar, Gujarat-385 506, India
³Department of Agronomy, Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana-125 004, India

*Corresponding author

A B S T R A C T

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.

Key words: Coriander, Economics, Nitrogen, Quality, Weed, Yield

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 syntheses 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 diammonium 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).

Protein content (%) = Nitrogen content (%) × 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.

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

**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 \(\equiv\) ha\(^{-1}\)) and net (64374 \(\equiv\) ha\(^{-1}\)) realization, net income (532\(\equiv\) ha\(^{-1}\)) per day and BCR (3.09) were recorded under weed free (W\(_2\)) and was at par with pre emergence application of pendimethalin 1 kg/ha + interculturing followed by HW at 30 days after sowing (W\(_6\)) (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 yields as result higher net return. Per cent increase in seed yield of coriander due to weed free condition (W\(_2\)) were 8.31, 13.56, 19.34, 74.09 and 336 over treatments W\(_6\), W\(_3\), W\(_4\), W\(_5\) and W\(_1\), respectively. Similarly, seed yield increased in per cent by treatment W\(_6\) were 4.84, 10.18, 60.72, and 302.47 over treatments W\(_3\), W\(_4\), W\(_5\), and W\(_1\), 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 W\(_5\) 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 \(\equiv\) ha\(^{-1}\)) and net (48654 \(\equiv\) ha\(^{-1}\)) realization, net income (402 \(\equiv\) 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 1kg ha\(^{-1}\) as PE + IC followed by HW at 30 DAS | 62.3             | 12.86                | 8.40                   | 974                         | 1664                       |
| S.Em. ±                              | 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. ±                | 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) | BC R |
|--------------------------------------------------------------------------------|--------------------------|---------------------|-------------------------------|-----------------------------|-------------------------------------|--------------------------|-----------------------------|------|
| 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               | -                            | -                           | -                                   | -                        | -                           |      |
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.

References

A.O.A.C. 1970 Official methods of Analysis. Association of official Agriculture Chemists, Washington.

Anonymous, 2015. State of Indian Agriculture 2014-15. Department of Agriculture and Co-operation, Ministry of Agriculture, Government of India, New Delhi. pp. 202-205.

Bhuiya, Z.H. and Chaudhary, S.V. 1974. Effect of NPK and S on quality of groundnut. Asian Journal of Agricultural Science. 44 (1) : 751-754.

Chaudhary, I. 2011. Weed management in coriander (Coriandrum sativum L.) under varying levels of nitrogen. Ph.D Thesis, Submitted to S.K.N College of Agriculture, Jobner.

Datta, S., Alam, K. and Chatterjee, R. 2008.
Effect of different levels of nitrogen and leaf cutting on growth, leaf and seed yield of coriander (*Coriandrum sativum* L.). *Indian Journal of Horticulture*. 65(2):201-203.

Gohil, B. S, Mathukia, R. K., Dobaria, V. K. and Chhodavodia, S. K. 2014. Weed management and dynamics of weed seed bank in fennel (*Foeniculum vulgare* Mill.). *Indian Journal of Agricultural Science*. 46(4): 399-401.

Jackson, M. L. 1973. Soil chemical analysis. Prentice Hall of India Pvt. Ltd., New Delhi. pp. 183-192.

Lokhande, S. N., Jogdande, N. D and Thakare, S. S. 2015. Effect of varying levels of nitrogen and phosphorus on growth and seed yield of coriander (*Coriandrum sativum* L.). *Plant Archives*. 15(1): 57-59.

Meena, R. L., Meena, S. S., Mehta, R. S and Meena, R. D. 2015. Weed management in ajwain (*Trachyspermum ammi* L.). *Journal of Spices and Aromatic Crop*. 24(2): 124-128.

Mehriya, M. L., Yadav, R. S., Jangir, R. P. and Poonia, B. L. 2007. Nutrient utilization by cumin (*Cuminum cyminum* L.) and weed influenced by different weed control methods. *Indian Journal of Agronomy*. 52(2): 176-179.

Patel, C. B., Amin, A. U. and Patel, A. L. 2013. Effect of varying levels of nitrogen and sulphur on growth and yield of coriander (*Coriandrum sativum* L.). *The bioscan*. 8(4): 1285-1289.

---

**How to cite this article:**

Patil, J. K., A. U. Amin, Y. A. Tamboli and Patel, U. V. 2020. Yield, Quality and Economics of Coriander (*Coriandrum sativum* L.) As Influenced by Weed Management Practices and Nitrogen Levels. *Int.J.Curr.Microbiol.App.Sci*. 9(04): 2351-2357.

doi: [https://doi.org/10.20546/ijcmas.2020.904.282](https://doi.org/10.20546/ijcmas.2020.904.282)