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Effect of fertigation on growth and physiology in coriander

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ABSTRACT

The effect of fertigation on growth and physiology in coriander was carried out in two coriander genotypes Co CR-4 and CS 11 for two seasons. Drip fertigation with water soluble fertilizer at 125 %,100 %,75 % RDF along with recommended normal fertilizer was carried out in the year 2007. Dry matter production was favourably influenced by different levels of fertigation. Among the fertigation levels, fertigation with 125 per cent water soluble fertilizers had registered increased leaf area index and higher dry matter production in both the genotypes. The maximum fresh leaf weight and leaf dry weight was recorded in Co CR-4 with 125 per cent of fertigation (T_1V_1) in all the stages of the crop growth

Key words : Coriander, Fertigation, Growth, Physiology

Coriander (*Coriandrum sativum* L.) is a annual herb with several branches and lacy leaves with jagged edges belonging to the family Apiaceae. It is native of Mediterranean region. This aromatic herb is found in many parts of the world.In India, coriander is mainly cultivated in Rajasthan and Gujarat with a sizeable acreage in Madhya Pradesh, Haryana, Punjab, Uttar Pradesh, Andhra Pradesh, Tamil Nadu and Bihar. It is cultivated in an area of 3,40,400 ha with the production of 2,23,400 tonnes (Anon., 2006). Rajasthan alone shares 40-45 per cent of the area and production. To produce a high yield of best quality coriander leaves, timely application of nutrients is a pre-requisite.Among the sophisticated hi-tech methods practiced, drip irrigation has proved its superiority due to direct application of water in the vicinity of root zone.Fertigation technology remarkably increases the efficiency of the applied fertilizers thus economizes the quantity of fertilizers and water, and the cost of labour and energy resulting in reduced cost of cultivation. Adoption of advanced and efficient methods of application of water and fertilizers will have saving upto 50 per cent fertilizer usage (Shiva shankar,1999).

Hence, the present investigation was taken up, to find out the influence of fertigation on growth and physiology of coriander Co CR-4, CS 11.

MATERIALS AND METHODS

Out of 27 genotypes (leafy types) maintained in the Department of Spices and Plantation Crops, Horticultural College and Research Institute, Coimbatore, two genotypes (Co CR-4, CS 11) were selected for this study, as the genotypes proved well for use as leafy type.

The experiment was conducted at the University orchard of Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore

The experiment was laid out in FRBD design with 4 treatments replicated thrice. The following treatments were employed for the study.

T_1 - Drip fertigation with water soluble fertilizer at 125 % RDF

T_2 - Drip fertigation with water soluble fertilizer at 100 % RDF

T_3 - Drip fertigation with water soluble fertilizer at 75 % RDF

T_4 - Recommended normal fertilizer applied to soil with furrow irrigation

RESULTS AND DISCUSSION

The plant which received water soluble fertilizers through fertigation significantly influenced the growth and physiology in coriander especially leaf area index and leaf area ratio at 35 DAS (Table 1). Application of 125 per cent RDF (T_1) recorded the maximum leaf area index during first and second season, respectively at 45 days. The lowest leaf area index was recorded in the treatment applied with recommended NPK applied to soil with furrow irrigation (T_4). The variety Co CR-4 combined with 125 per cent of fertigation (T_1V_1) showed maximum leaf area index in all the stages of the crop growth in both two seasons.

The treatments had a significant influence on fresh leaf weight and leaf dry weight at all stages of observation (Table 2 and 3). At 35 DAS, application of nutrients through fertigation significantly influenced the fresh leaf weight. Application of 125% RDF (T_1) recorded 6.45 and 6.24 g in first and second season, respectively.

Table 1 : Effect of fertigation on leaf area index (LAI) at different growth stages in coriander

Treatments	35 DAS						45 DAS					
	Season I			Season II			Season I			Season II		
	V_1	V_2	Mean	V_1	V_2	Mean	V_1	V_2	Mean	V_1	V_2	Mean
T_1	0.15	0.12	0.14	0.15	0.11	0.13	0.31	0.21	0.26	0.29	0.19	0.24
T_2	0.13	0.09	0.11	0.12	0.07	0.10	0.10	0.15	0.17	0.23	0.16	0.19
T_3	0.11	0.06	0.08	0.10	0.05	0.07	0.16	0.12	0.14	0.17	0.14	0.15
T_4	0.04	0.03	0.03	0.04	0.02	0.03	0.08	0.06	0.07	0.13	0.09	0.11
Mean	0.11	0.07		0.10	0.06		0.19	0.13		0.20	0.14	
	S.E. ±	C.D. (P=0.05)		S.E. ±	C.D. (P=0.05)		S.E. ±	C.D. (P=0.05)		S.E. ±	C.D. (P=0.05)	
V	0.00109	0.00233		0.00133	0.00285		0.00139	0.00298		0.00125	0.00269	
T	0.00154	0.00330		0.00188	0.00403		0.00197	0.00422		0.00177	0.00381	
V x T	0.00218	0.00467		0.00266	0.00570		0.00278	0.00597		0.00251	0.00538	

Table 2 : Effect of fertigation on fresh leaf weight (g) at different growth stages in coriander

Treatments	35 DAS						45 DAS					
	Season I			Season II			Season I			Season II		
	V_1	V_2	Mean	V_1	V_2	Mean	V_1	V_2	Mean	V_1	V_2	Mean
T_1	7.58	5.32	6.45	7.15	5.33	6.24	10.30	8.28	9.29	10.22	8.15	9.19
T_2	5.59	4.49	5.04	5.45	3.19	4.32	8.30	6.76	7.53	7.16	5.14	6.15
T_3	4.63	3.80	4.21	5.14	2.74	3.94	7.61	5.28	6.45	6.13	4.73	5.43
T_4	2.65	2.06	2.36	2.26	1.25	1.75	3.61	2.78	3.19	3.23	2.53	2.88
Mean	5.11	3.92		5.00	3.13		7.45	5.77		6.69	5.14	
	S.E.±	C.D. (P=0.05)		S.E.±	C.D. (P=0.05)		S.E.±	C.D. (P=0.05)		S.E.±	C.D. (P=0.05)	
V	0.09573	0.20535		0.01487	0.03189		0.09364	0.20085		0.01552	0.03329	
T	0.13539	0.29041		0.02103	0.04510		0.13242	0.28405		0.02195	0.04708	
V x T	0.19146	0.41070		0.02973	0.06378		0.18727	0.40171		0.03104	0.06658	

Table 3 : Effect of fertigation on leaf dry weight (g) at different growth stages in coriander

Treatments	35 DAS						45 DAS					
	Season I			Season II			Season I			Season II		
	V_1	V_2	Mean	V_1	V_2	Mean	V_1	V_2	Mean	V_1	V_2	Mean
T_1	0.74	0.49	0.61	0.83	0.66	0.74	1.08	0.98	1.03	1.03	0.93	0.98
T_2	0.63	0.47	0.55	0.71	0.47	0.59	0.92	0.85	0.88	0.85	0.64	0.74
T_3	0.54	0.38	0.46	0.56	0.38	0.47	0.83	0.73	0.78	0.74	0.51	0.62
T_4	0.32	0.24	0.28	0.24	0.11	0.17	0.37	0.28	0.33	0.45	0.25	0.35
Mean	0.56	0.39		0.58	0.40		0.80	0.71		0.77	0.58	
	S.E.±	C.D. (P=0.05)		S.E.±	C.D. (P=0.05)		S.E.±	C.D. (P=0.05)		S.E.±	C.D. (P=0.05)	
V	0.01074	0.02304		0.00966	0.02071		0.01130	0.02424		0.01652	0.03544	
T	0.01519	0.03258		0.01366	0.02929		0.01598	0.03428		0.02336	0.05011	
V x T	0.02148	0.04608		0.01931	0.04143		0.02260	0.04848		0.03304	0.07087	

Maximum fresh leaf weight was recorded in Co CR-4 (V_1). At 45 DAS, application 125 per cent RDF (T_1) recorded the maximum leaf dry weight of 1.03 and 0.98 g during first and second season, respectively

With 125 per cent RDF (T_1) plants recorded the maximum fresh leaf weight of 9.29 and 9.19 g during first and second season, respectively at 45 days. The lowest fresh leaf weight was registered in the treatment applied with recommended NPK applied to soil with furrow irrigation (T_4) with values of 3.19 and 2.88 g during first and second season, respectively. Both the varieties exhibited similar trend.

Regarding interaction effect, the maximum fresh leaf weight and leaf dry weight were recorded in

Co CR-4 with 125 per cent of fertigation (T_1V_1) in all the stages of the crop growth followed by T_1V_2 in both seasons. The leaf area per plant was highest in the variety Co CR-4 with 125 per cent water soluble fertilizer applied through the fertigation. The leaf area per plant increased steadily from all the stages. Fertigation gives flexibility of fertilization, which enables the specific nutritional requirements of the crop to be met at different stages of its growth. The effect of nitrogen in enhancing the leaf area is well established and increased levels usually had positive relationship with growth (Sarro *et al.,* 1989). There was increase in leaf area with increment in nitrogen dose. Greater leaf area would help the plant to synthesize more metabolites exhibiting high photosynthetic rate during the growth and development (Mahadevan, 1988).

The effect of fertigation on total dry matter at different growth stages of coriander in two different varieties are furnished in the Table 4. The treatments had a significant influence on total dry matter at all stages of observation. At 35 DAS, application of nutrients through fertigation significantly influenced the total dry matter. Application of 125% RDF (T_1) recorded 2.91 and 3.16 g plant^{-1} in first and second season, respectively. With regard to variety Co CR-4 (V_1) had maximum total dry matter than CS 11(V_2).

Application of 125 per cent RDF (T_1) treatment recorded the maximum total dry matter of 4.99 and 4.81 g plant^{-1} during first and second season, respectively at 45 DAS. The lowest total dry matter was registered in the treatment applied with recommended NPK applied to soil with furrow irrigation (T_4) with values of 2.11 and 2.27 g plant^{-1} during first and second season, respectively. Variety Co CR-4 accumulated more dry matter than CS 11

Regarding the interaction effect, the maximum total dry matter was recorded in Co CR-4 with 125 per cent of fertigation (T_1V_1) in all the stages of the crop growth followed by T_1V_2 in both seasons.

The enhancement of growth parameters might be due to the restricted wetting area and root zone application of nutrients through drip system coupled with constant and continuous availability of optimum soil moisture, which provide the plants to absorb more nutrients (Patil, 1999). In the case of the soil application of fertilizers with furrow irrigation, fertilizers are applied on a wider area, which had resulted in faster depletion of nutrients from the rhizosphere. Further, the faster rate of infiltration in furrow irrigation has resulted in water deficit, which might have led to many changes in plant anatomy, such as decrease in cell size and intercellular spaces, limiting cell division and elongation that had reflected in restricted plant growth (Guinn *et al*., 1981).

The importance of leaf area index on crop growth is well recognized especially in leafy coriander. An increase in LAI results in better utilization of nutrients through fertigation. LAI was more in application of 125 per cent water soluble fertilizer through fertigation in the variety of Co CR-4 during the entire crop growth period. The results are in conformity with Prabhu (2007). This may be due to continuous and uninterrupted supply of water, nutrients and also due to easy availability of nutrients from water soluble fertilizers and better mobilization of nutrients in the plants as they were supplied through several splits (Singh *et al*., 2004).

Parthasarathi *et al*. (1999) stated that increase in leaf area, LAI were recorded in radish with increased fertilizer application. Similar results were reported in potato by Martinez Canades *et al*. (1985), Awari and Hiwase (1994) and Mahajan and Singh (2005). High LAI would have resulted in vigorous photosynthetic activity of leaf leading to higher carbohydrate accumulation in leaves.

Dry matter production was favourably influenced by different levels of fertigation. Among the fertigation levels, fertigation with 125 per cent water soluble fertilizers

Table 4 : Effect of fertigation on total dry matter (g/plant) at different growth stages in coriander

Treatments	35 DAS						45 DAS					
	Season I			Season II			Season I			Season II		
	V_1	V_2	Mean	V_1	V_2	Mean	V_1	V_2	Mean	V_1	V_2	Mean
T_1	3.24	2.58	2.91	3.24	3.07	3.16	5.23	4.75	4.99	4.86	4.76	4.81
T_2	2.94	2.16	2.55	2.94	2.73	2.83	4.57	3.77	4.17	4.60	4.51	4.56
T_3	2.72	1.93	2.33	2.63	2.47	2.55	4.23	3.46	3.84	4.16	4.06	4.11
T_4	1.74	1.41	1.57	1.84	1.64	1.74	2.25	1.97	2.11	2.33	2.22	2.27
Mean	2.66	2.02		3.66	2.47		4.07	3.49		3.99	3.89	
	S.E.±	C.D. (P=0.05)		S.E.±	C.D. (P=0.05)		S.E.±	C.D. (P=0.05)		S.E.±	C.D. (P=0.05)	
V	0.05169	0.11088		0.01458	0.03128		0.01403	0.03009		0.00994	0.02131	
T	0.07310	0.15681		0.02062	0.04423		0.01984	0.04255		0.01405	0.03014	
V x T	0.10338	0.22176		0.02916	0.06255		0.02805	0.06017		0.01987	0.04262	

had registered higher dry matter production. Prabhu (2007) reported similar results that application of 125 per cent water soluble fertilizer plus micronutrients produced highest dry matter production, the differential response may therefore, depend upon the levels of fertigation employed. Better availability of nitrogen would have helped better protein synthesis resulting in production of more branches thereby higher leaf dry weight (Neary *et al*., 1995). The favourable effect of nitrogen in promoting the growth of the plant could be explained due to the fact that nitrogen application improves the movement of metabolites from source to sink (Marschner, 1983).

Enhanced moisture and nutrient availability and effective absorption by plants under fertigation in tomato which was observed by Asokaraja (1998) are in accordance with the present study. This is in agreement with the earlier works of El-Sherif *et al*. (1993) in tomato, Thakur *et al*. (1991) in cauliflower.

All the growth attributes were found to be increased with increasing level of nutrients (N, P and K) application by fertigation. The results of the experiment clearly indicated that fertigation markedly increased the growth parameters of the crop compared to soil application with furrow irrigation. The interaction between higher doses of water soluble fertilizer (125 per cent) through fertigation in variety Co CR-4 resulted in better growth parameters than that of other levels of fertigation compared to CS 11. Rajasekaran (2006) also found tropical sugar beet responded well to higher fertilizer doses.

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