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Studies on Growth and Quality of Coriander (*Coriandrum sativum* l.) Grown Under Shade Net and Open Field Conditions

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ABSTRACT

The coriander (*Coriandrum sativum* L.) is a cool season crop and can be successfully cultivated in *rabi* season on black cotton or other type of heavy soils. The study was conducted in the Department of Spices and Plantation Crops, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore to study the effect of season of sowing on foliage yield and quality of coriander under two different growing condition *viz.,* open field and shade net (50%) with the variety CO (CR) 4. The experiment was laid out in a Randomized Block Design (RBD) with eighteen treatments replicated thrice. Under Shade net grown coriander yielded well compared to open field condition. In open field condition there was no germination observed during summer months (March, April and May) while in shade net condition slight reduction of yield was observed compared to other months. In case of quality, no significance was observed between open field and shade net condition. In case of effect on month of sowing, October month recorded higher yield and quality for both the condition.

Key Words: Coriander, Shade net, Yield, Quality, Year, Production.

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INTRODUCTION

Coriander (*Coriandrum sativum* L.) is an important spice crop which belongs to the family Apiaceae originated from Mediterranean Region. Coriander is valued for its tender leaves and grains. The coriander is a cool season crop and can be successfully cultivated in *rabi* season on black cotton or other type of heavy soils which have better water retention capacity. Coriander plants are highly sensitive to the abrupt variations in climatic parameters as it is delicate in nature. The soil temperature especially in the afternoon (28.0^0 C to 32.5^0 C) is the most crucial factor in summer production of coriander leaf (Sarada *et al*, 2011). For leaf purpose, coriander is grown all-round the year. The plant has to be harvested for foliage before bolting as late harvest produces bitter leaves.

Temperature between 10^0 to 30^0 C provides optimum growing conditions for foliage production of coriander (Anonymous, 2000) .Therefore, during off season (summer) high temperature negatively affects the quantity as well as quality of this valuable crop. Protected cultivation thus facilitate continuous production of leafy coriander throughout the year and off-season crop to fetch higher market rates due to high demand. Raising coriander under protection of shade net is beneficial, as the shade nets provide partial shade to the crop with reduction of temperature inside resulting into better plant growth and development, which consequently increased the foliage yield during off- season. There is a continuous demand for fresh coriander leaves all-round the year. Hence, the experiment was conducted to assess the performance of coriander var.CO (CR) 4 under shade net and open field condition for yield contributing characters and quality characters.

MATERIALS AND METHODS

The study was undertaken in the Department of Spices and Plantation Crops, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore. The experimental location is situated at 110 N latitude, 770 E longitude and at an altitude of 426.26 m above MSL. The field experiment was conducted from September to May to study the effect of season of sowing on foliage yield and quality of coriander under two different growing condition *viz.,* open field and shade net (50%) with the variety CO (CR) 4. The experiment was laid out in a Randomized Block Design (RBD) with eighteen treatments replicated thrice. The treatment details were under

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Treatment combinations

Treatment	Details
G1 S1	Open field condition + Time of sowing (September)
G2 S1	Shade net (50%) + Time of sowing (September)
G1 S2	Open field condition + Time of sowing (October)
G2 S2	Shade net (50%) + Time of sowing (October)
G1 S3	Open field condition + Time of sowing (November)
G2 S3	Shade net (50%) + Time of sowing (November)
G1 S4	Open field condition + Time of sowing (December)
G2 S4	Shade net (50%) + Time of sowing (December)
G1 S5	Open field condition + Time of sowing (January)
G2 S5	Shade net (50%) + Time of sowing (January)
G1 S6	Open field condition + Time of sowing (February)
G2 S6	Shade net (50%) + Time of sowing (February)
G1 S7	Open field condition + Time of sowing (March)
G2 S7	Shade net (50%) + Time of sowing (March)
G1 S8	Open field condition + Time of sowing (April)
G2 S8	Shade net (50%) + Time of sowing (April)
G1 S9	Open field condition + Time of sowing (May)
G2 S9	Shade net (50%) + Time of sowing (May)

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The height of the plant from cotyledonary node to the tip was measured at final harvest stage and expressed in centimeter. The branches that arose from the main stem were considered as primary branches and was counted at final harvest stage and expressed in numbers. Plants were selected randomly in each treatment and the fresh weight of the herbage was calculated at the time of harvest and the mean value was expressed as gram per plant. The fresh weight of herbage per plot was recorded immediately after harvest by cleaning the adhering soil on the roots and expressed in kg per plot. The yield of herbage per hectare was estimated for the cropped area based on the yield per plot and expressed in kg per ha. The ascorbic acid content in coriander leaves was estimated at 35 days after sowing by using the procedure given in Association of Analytical Communities (Anonymous, 1975) The crude fiber content of leaves was analyzed as per the method described by (Chopra and Kanwar, 1976) and expressed in per cent. Leaf iron was estimated at 35 days after sowing as per the method described by (Ranganna, 1986) and expressed in mg/100 g on fresh weight basis. Leaf calcium was analyzed at 35 days after sowing from the triple acid extract by Versanate method (Jackson, 1973) and expressed in mg/100g of leaf sample. Essential oil of the total fresh herb was estimated using Clevenger apparatus by hydro distillation. 100g of the herb was hydro distilled for six hours and the oil content V/W was expressed in per cent (%). The data were analyzed adopting the standard procedure (Panse and Sukhatme, 1985).

RESULTS AND DISCUSSION

The highest plant height (29.88 cm) and number of primary branches per plant (5.50) was observed in October month under shade net and open field condition. Date of sowing was an important management factor for almost all seed spices including coriander

Table 1. Effect of time of sowing and growing condition on yield and quality characters

Sr. No	Time of sowing	Growing Condition (G)		Growing Condition (G)		Growing Condition(G)	
		Open (G1)	Shade (G2)	Open (G1)	Shade (G2)	Open (G1)	Shade (G2)
		Plant height (cm)		Yield (kg/plot)		Ascorbic acid (mg/100g)	
1	September	24.43	28.81	2.32	5.21	97.65	97.23
2	October	26.59	29.88	2.52	5.69	98.69	97.22
3	November	24.31	27.90	2.26	5.14	98.29	97.22
4	December	24.28	27.26	2.21	5.09	98.31	97.24
5	January	22.59	27.04	2.10	4.67	95.98	95.19
6	February	22.77	24.44	1.67	4.29	95.66	95.07
7	March	NA	24.07	NA	4.08	NA	97.42
8	April	NA	23.54	NA	3.89	NA	97.45
9	May	NA	27.39	NA	4.39	NA	96.17
Mean		24.16	27.94	2.18	4.71	97.43	96.69
SE(d)		0.563	0.68	0.028	0.069	1.27	1.59
CD (P=0.05)		1.254 **	1.45**	0.062 **	0.147**	NS	NS
NS – Non Significant and ** Highly significant							

Table 2. Effect of different months of sowing and growing condition on quality parameters

Sr. No	Time of sowing	Condition(G)		Condition(G)		Condition(G)	
		Open (G1)	Shade (G2)	Open (G1)	Shade (G2)	Open (G1)	Shade (G2)
		Iron content(mg/100g)		Crude fiber content (%)		calcium (mg/100g)	
1	September	1.14	1.19	8.86	10.65	135.11	135.61
2	October	1.19	1.21	8.97	10.87	135.13	135.71
3	November	1.16	1.20	8.86	10.76	135.09	135.63
4	December	1.16	1.19	9.18	10.27	134.89	135.12
5	January	1.13	1.18	8.64	10.22	131.21	132.06
6	February	1.11	1.16	8.26	9.89	131.09	132.11
7	March	NA	1.17	NA	9.73	NA	133.42
8	April	NA	1.16	NA	9.29	NA	134.89
9	May	NA	1.19	NA	10.19	NA	135.09
Mean		1.15	1.18	8.80	10.21	133.7	134.40
SE(d)		0.027	0.021	0.106	0.182	3.2765	3.4970
CD (P=0.05)		0.060NS	0.044	0.237**	0.383**	7.3006 NS	7.4134 NS
NS – Non Significant and ** - Highly significant							

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Table 3: Effect of different months of sowing and growing condition on quality characters

Sr. No	Time of sowing	Condition(G)		Condition(G)	
		Open (G1)	Shade (G2)	Open (G1)	Shade (G2)
		Aroma		Essential oil content	
1	September	5.00	4.00	0.088	0.084
2	October	5.00	4.00	0.088	0.085
3	November	5.00	4.00	0.087	0.085
4	December	4.0	3.00	0.087	0.084
5	January	4.0	3.00	0.087	0.086
6	February	3.68	3.00	0.085	0.087
7	March	NA	4.00	NA	0.087
8	April	NA	4.00	NA	0.083
9	May	NA	300	NA	0.081
Mean		4.45	3.56	0.087	0.085
SE(d)		-	-	0.0035	0.0036
CD (P=0.05)		-	-	0.0079 NS	0.0075 NS

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Physical environment has profound influence on growth, biomass partitioning and ultimately the yield of coriander. Temperature, humidity, rainfall and other meteorological factors may individually or collectively limit the plant growth and production. Time of sowing controls the crop phenological development along with efficient conversion of biomass into economic yield (Khichar and Niwas, 2006). While comparing the growing conditions maximum mean plant height of 27.94 and 24.16 cm was recorded in shade net and open field condition respectively. October sown plants had optimum climate which delayed the reproductive stage and plants with prolonged vegetative phase gave higher fresh green leaf yield (Sagarika Guha *et al*, 2014). Better vegetative growth was observed in October sown crop due to more favourable temperature during its growth period (Guha *et al,* 2016). The maximum biological yield in October sown crop can be attributed to greater leaf area (Ayub *et al*, 2008).

The mean leaf yield/plot was higher under shade net condition (4.71 kg/plot) and was lower in the open field condition (2.18 kg/plot). During March, April and May there was no growth in open conditions. Even under shade net condition minimum growth and yield was observed.

Quality attributes

The Quality characters such as ascorbic acid content (mg/100g), iron content (mg/100 g), calcium content (mg/100 g), Aroma and essential oil content were found to be non-significant among different month of sowing and growing condition (Table 2). However, the highest ascorbic content (98.69 mg/100g), higher iron content (1.19 mg/100g), higher calcium content (135.13 mg/100g) and highest oil content (0.088%) during October under open condition. Crude fibre content showed a significant difference when grown at different months of sowing and growing condition (Table 2). Shade net condition recorded the higher crude fibre content of 10.87 % during October followed by November month (10.76 %). October month recorded more calcium content of 135.71 mg/100g under shade net and 135.13 mg/100g under open field condition. Similarly, the shade net condition had higher amount of calcium content (134.40 mg/100g) followed by open condition (133.70 mg/100g). Crude fibre content showed a significant difference when grown at different months of sowing and growing condition Calcium content during different months of sowing and growing condition found to be non significant.

The insignificant results in both the growing conditions and different months of sowing might be

due to the fact that agronomic practices like dates of sowing and growing conditions might not be able to manipulate the levels of quality parameters in coriander leaves, as these characters may be genetically controlled (Guha *et al*, 2016b) However, the ascorbic acid content was higher in the open field grown coriander leaves than the shade net grown coriander leaves (Anitha *et al*, 2016).

In general, shading resulted in reduction in the ascorbic acid content of leaves. Low light intensity might be responsible for reducing the ascorbic acid content (Padmapriya, 2015) in tomato.

Ascorbic acid is synthesized from photosynthesis-produced sugars (Lee and Kader, 2000) Thus, a lower ascorbic acid content of the fruits produced in a protected environment is probably caused by the lower luminosity in the environment, which may have reduced the production of sugar, a substrate that is used in the synthesis of ascorbic acid. Leaf calcium and ascorbic acid composition of spinach (*Spinacea oleracea* L.) and lettuce (*Lactuca sativa* L.) increases with minor reduction in temperature and high light intensities due to climatic or weather changes. Ascorbic acid concentration also generally increases with increased exposure to light, particularly in leafy greens.

The assessment on aroma of coriander grown during different months and growing condition were evaluated on the basis of scoring. The aroma was scored to be poor under shade net conditions during March, April and May with the score of 3.00. But the crop raised during winter months under open condition exhibited a good aroma score of 5.00 during September, October and November respectively.

There are also reports stating that the effect of sowing dates was insignificant on essential oil content (Kaya *et al*, 2000). Sowing dates had no significant effect on essential oil content rather it was more related to planting density (Ghobadi and Ghobadi, 2010).

CONCLUSION

The findings of the study revealed that coriander cultivation under shade net condition is a profitable venture to get yield of fresh coriander leaves and income throughout the year which is not possible under open field.

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