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Investigation on Effect of Sowing Dates and Cutting Management on Physiological Characteristics of Coriander (*Coriandrum sativum* L.) variety JD – 1

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ABSTRACT

Agronomic practices, genetics and environmental factors explicitly affect growth, development and yield of crop plant, so study of these factors is crucial. The present study was conducted at Vegetable Research Centre, College of Agriculture, JNKVV, Jabalpur, (M.P.) to study effect of sowing dates and cutting management on different parameters of coriander var. Jawahar Dhaniya - 1. The experiment was laid out on factorial randomized block design with 2 factors viz. Sowing date and cutting management. The investigation consisted of five level of sowing date (20 October, 30 October, 9 November, 19 November and 29 November) and four level of cutting management (0 cutting,1 cutting, 2 cutting and 3 cutting). Analysis of variance showed that effect of sowing dates and cutting management on physiological parameters i.e., Dry matter production, Light transmission ratio (LTR), Energy interception (EI), Total chlorophyll content, Leaf area index (LAI) and Crop growth rate (CGR) is significant.

***Key word**: Sowing date, Coriander, Foliage cutting, Energy interception, Light transmission ratio*

Introduction

Successful coriander production is profoundly affected by genetics, weather and agronomic factors (Nowak and Szemplinski, 2014). Coriander is tropical crop and it is cultivated in winter season for seed production. For vegetative growth it requires cool, dry and frost-free climate and for good quality and high yield it needs relatively warm weather during flowering and reproductive stage (Sharangi and Roychowdhary, 2014). Due to its regenerative capacity, 2 -3 cutting can be taken in coriander to earn extra income. Under irrigated condition, all around year production of coriander can be done for leaf production. Each phenophase has an optimum temperature for its initiation and development in specific crop, and change in this optimum temperature can affect a crop production primarily by changing

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plant physiological activities such as photosynthesis and respiration (Sharma, 2003). The following study was conducted with the objective to reveal effect of sowing dates and cutting management and their interaction on physiological parameters.

Material and Methods

The experiment was conducted at Vegetable Research Center, Department of Horticulture, College of Agriculture, JNKVV, Jabalpur in the year 2021-2022. Jabalpur is situated in the Kymore Plateau and Satpura Hills Agro climatic zone, at 23.10 North latitude and 79.58 East longitude in an altitude of 411.78 meters above mean sea level. The experiment was laid out on Factorial Randomized Block Design with three replications. The investigation consisted of two factors, first different date of sowing in five level (20th October, 30th October, 9th November, 19th November and 29th November) and cutting management in four level (0 cutting, 1 cutting, 2 cutting and 3 cutting). Jawahar Dhaniya – 1 variety was used in the experiment. Five plants were randomly selected from each plot for recording observations. The different physiological parameters studied were as follows:

Light transmission ratio: It was calculated as per formula given by Golingai and Mabbayad (1969).

$$LTR(\%)= \frac{I}{Io} \times 100$$

I = Light intensity at the base of the plant

Io= Total incoming solar radiation

Energy Interception (Cal cm^{-2} min^{-1}): The efficiency of crop canopy for solar energy interception (EI) was calculated as per formula given by Hayashi (1966):

Energy interception=Total incident energy-Transmitted energy

Total chlorophyll Content (mg/100g): The formula used to calculate Chlorophyll values (mg/100):

Total Chlorophyll Content =

$$20.2(A645)+8.02(A663)\times\frac{V}{1000\times W}$$

V =Volume of aliquot

W= Weight of sample

Leaf area index (LAI): This formula was given by Watson (1952).

LTR=X/Y

Where X represents the leaf area and Y represents the ground area

Crop growth rate (CGR): This concept was 1st described by Watson in 1956.

It is expressed in g/m^2/unit time (day)

$$CGR = \frac{(W_2 - W_1)}{(t_2 - t_1)} \times \frac{1}{P}$$

t_1 - time one (in days)

t_2 – time two (in days)

w_2- dry weight of plant at time one (g)

w_1- dry weight of plant at time two (g)

P- ground area

Results and Discussion

Dry Matter Production (g/plant)

Analysis of variance showed that effect of sowing date and cutting management on dry matter production was significant. The observation on dry matter production was taken at 30, 60 and 90 DAS. In case date of sowing, the highest value for dry matter production 0.24g, 7.03g and 9.18g were recorded in 19th November, 9thNovember and 20th October sowing at 30 DAS, 60 DAS and 90 DAS respectively (Table 1). The time of sowing is considerable to influence the phenological development of crop, as well as efficient conversion of biomass into yield (Khichar and Niwas, 2006).

In case of cutting management, scrutiny of data depicted in Table 1 revealed that at 30 DAS highest dry matter production recorded was 0.194g in 2 cutting, at 60 DAS it was recorded in 1 cutting and at 90 DAS highest dry matter production recorded in 0 cutting (Table 1). During vegetative and reproductive phases, more and photosynthetically should have space between them active leaf area for longer period, results in higher absorption and better utilization of light energy which led to a higher dry matter production. The results are in close proximity with results reported by Balai (2005) in coriander. Highest dry matter production per plant recorded in treatment combination 19 November sowing with 3 cutting (D19C4), 30 October sowing with 2 cutting (D30C3) and 9 November sowing coupled with 0 cutting (D9C1) at 30 DAS, 60 DAS and 90 DAS respectively which is 0.298 g, 7.59 g and 11.66g (Table 2). Meteorological factors as temperature, humidity, rainfall have a significant effect on coriander growth, biomass partitioning and ultimately yield. It can limit plant development and production individually or collectively. It indicated that during normal sown crop, crop plants have capability to produce more dry weight as compared to late sown crop (Kuri *et al.*, 2015). Early planting beneficially influence plant growth has been reported by Qaryouti and Kasrawi (1995).

Light Transmission Ratio and Energy Interception

Light transmission ratio (LTR) and Energy Interception (EI) for coriander under different sowing dates and cutting management are found significant. Effect on light transmission ratio and energy interception by both factors is presented in Table 1 and interaction effect of both factors in Table 2 and illustrated through Fig. 1.

Among the factors LTR was maximum in 20 October sowing (57.05) and 1 cutting (56.35). In case of treatment combination 20 October sowing coupled with 1 cutting (D20C2) outperformed (59.68) others. The High absorption and utilization of light indicated by lower LTR value; it was due to better spatial use of light by canopy of plant.

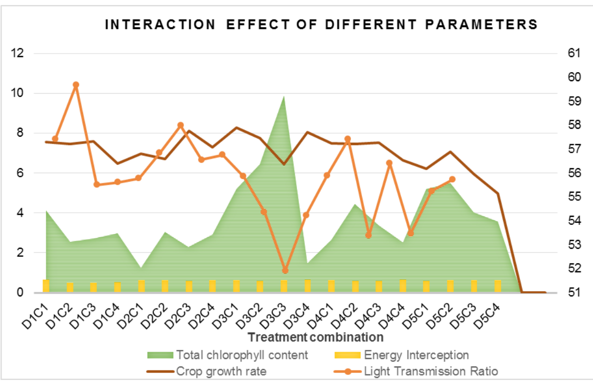

Fig. 1. Interaction effect of sowing dates cutting management on total chlorophyll content, Light transmission ratio, energy interception and crop growth rate

From the data it was interpreted that highest value for EI was recorded in 29th November sowing (0.622 cal cm^{-2} min^{-1}), while in case of cutting, it is obtained from 0 Cutting (0.622 cal $cm^{-2}min^{-1}$) EI. 9 November sowing with 3 cutting observed maximum (0.668 cal cm^{-2} min^{-1}) EI value in case of factor combination. The higher light interception was due to quick growth of vegetative cover. The amount of light intercepted by a crop canopy is highly proportional to total leaf area and orientation. If a crop develops more leaf area, it will intercept more PAR and grow quickly. As per the reports of Kuri *et al.*, 2015, when coriander is sown at the right time, plants take best advantage of environment hence, the influences of sowing date on yield is quite imperative. These results are in conformity with the findings reported by Balai (2005) in coriander.

Total Chlorophyll (mg/100g)

Maximum total chlorophyll found in 9th November sowing and 2 cutting which is 5.77 mg/100g and 4.47 mg/100g respectively (Table 3). Kuri *et al.* (2015) reported that normal sowing (first week of November) recorded high Chlorophyll content, which leads to high photosynthesis. Chlorophyll

Table 1. Effect of sowing date and cutting management on Dry matter production at 30,60 and 90 DAS, Light transmission ratio (LTR) and Energy Interaction (EI)

Treatment	Dry matter production			LTR (%)	EI
	30 DAS	60 DAS	90 DAS		
Date of sowing					
D20 (20 October)	0.143	6.69	9.18	57.05	0.541
D30 (30 October)	0.144	6.58	8.21	56.79	0.621
D9 (9 November)	0.177	7.03	8.88	54.73	0.612
D19 (19 November)	0.241	6.59	6.70	55.23	0.614
D29 (29 November)	0.235	5.52	5.58	55.22	0.622
S. Em ±	0.003	0.12	0.11	0.51	0.003
C.D.5% level	0.008	0.35	0.31	1.46	0.009
Cutting management					
C1 0 cutting	0.183	6.37	9.12	56.12	0.622
C2 1 cutting	0.184	6.74	7.90	56.35	0.583
C3 2 cutting	0.194	6.63	7.48	56.10	0.587
C4 3 cutting	0.191	6.19	6.32	54.64	0.618
S. Em ±	0.003	0.11	0.10	0.46	0.003
C.D.5% level	0.007	0.32	0.28	1.31	0.008

content of leaves are directly related with leaf nitrogen status and photosynthesis capacity (Evans, 1983). Treatment combination 9 November sowing with 2 cutting (D9C3) obtained highest value (9.89 mg) of total chlorophyll (Fig.1 and Table 3).

Leaf Area Index (LAI)

Leaf area index (LAI) significantly varied relative to sowing time and cutting management at 30,60 and 90 DAS (Table 3). Highest LAI (0.61, 5.59 and 4.90) at 30 DAS, 60 DAS and 90 DAS respectively was obtained in 19th November sowing. Even in the lack of enough development, the Vegetative phase of coriander is shifted to the reproductive phase as the day length increases. The findings are consistent with those reported in coriander by Carrubba *et al.* (2006) and Ghobadi and Ghobadi (2010). Among cutting management ,0 cutting reported Highest value of LAI 0.56, 5.11 and 5.13 at 30 DAS,60 DAS and 90 DAS. Treatment combination 19 November sowing with 0 cutting (D19C1) had highest LAI of 0.66, 7.37 and 6.61 at 30, 60 and 90 DAS respectively (Table 3). The more leaf area could leads to improved vegetative development of aerial portions of plant. The total leaf area affects the amount of photosynthesis. LAI represents leaf photon interception, which stimulates how much light passes through a canopy and effects the microclimate; consequently, it can be used as a measure of canopy health or development. The findings are consistent with those reported in coriander by Nandal *et al.* (2007), Dixit (2007), and Prabhu *et al.* (2009). Karetha *et al.* (2014) reported maximum number of leaves per plant in 25th May sowing due to the fact that, this treatment was encountered by favourable meteorological conditions, for vegetative growth over late sowing date.

Crop Growth Rate (CGR)

CGR values are also significantly affected by sowing dates and cutting management. 9th November sown crop (7.63 $g/m^2/day$) and 0 cutting (7.30 $g/m^2/day$) recorded highest CGR (Table 3). The normal sown crop showed a significantly high photosynthetic ability of leaf, leads to more concentration of photosynthates. The results are in confirmatory to the finding of Meena *et al.*, (2006) and Kuri *et al.* (2015). In case of treatment combination 9th November sowing coupled with 0 cutting recorded prominent

Table 2. Effect of interaction of sowing date and cutting management on Dry matter production at 30, 60 and 90 DAS, Light transmission ratio (LTR) and Energy Interaction (EI)

Treatment Combination	Dry Matter Production			Light Transmission Ratio	Energy Interception
	30 DAS	60 DAS	90 DAS		
D20C1(20 October sowing with 0 cutting)	0.150	6.96	9.19	57.41	0.643
D20C2 (20 October sowing with 1 cutting)	0.104	6.81	9.71	59.68	0.491
D20C3(20 October sowing with 2 cutting)	0.141	6.98	9.25	55.50	0.503
D20C4(20 October sowing with 3 cutting)	0.178	6.00	8.56	55.62	0.529
D30C1(30 October sowing with 0 cutting)	0.124	5.89	10.65	55.78	0.631
D30C2(30 October sowing with 1 cutting)	0.132	6.18	9.29	56.84	0.615
D30C3(30 October sowing with 2 cutting)	0.208	7.59	6.03	57.98	0.605
D30C4(30 October sowing with 3 cutting)	0.112	6.66	6.89	56.56	0.635
D9C1(9 November sowing with 0 cutting)	0.196	7.58	11.66	56.76	0.608
D9C2(9 November sowing with 1 cutting)	0.205	7.18	8.67	55.86	0.580
D9C3(9 November sowing with 2 cutting)	0.173	5.98	8.51	54.38	0.633
D9C4(9 November sowing with 3 cutting)	0.135	7.39	6.55	51.93	0.668
D19C1(19 November sowing with 0 cutting)	0.223	6.25	6.59	54.24	0.630
D19C2(19 November sowing with 1 cutting)	0.207	6.91	6.07	55.89	0.600
D19C3(19 November sowing with 2 cutting)	0.235	7.00	8.93	57.41	0.581
D19C4(19 November sowing with 3 cutting)	0.298	6.19	5.21	53.39	0.645
D29C1(29 November sowing with 0 cutting)	0.221	5.15	7.52	56.41	0.595
D29C2(29 November sowing with 1 cutting)	0.272	6.63	5.75	53.48	0.629
D29C3(29 November sowing with 2 cutting)	0.213	5.58	4.66	55.25	0.612
D29C4(29 November sowing with 3 cutting)	0.234	4.73	4.38	55.72	0.611
S. Em ±	0.006	0.25	0.22	1.02	0.006
C.D.5% level	0.017	0.71	0.62	2.93	0.017

Table 3. Effect of sowing dates, cutting management and their interaction on total chlorophyll content, leaf area index and Crop growth rate

Treatment	Total Chlorophyll Content	Leaf Area Index 30 DAS	60 DAS	90 DAS	CGR ($g/m^2/day$) 30-60 DAS
Date of sowing					
D20 (20 October)	3.10	0.39	3.41	4.23	7.28
D30 (30 October)	2.39	0.43	3.64	4.66	7.26
D9 (9 November)	5.77	0.56	5.53	4.52	7.63
D19 (19 November)	3.26	0.61	5.59	4.90	7.27
D29 (29 November)	4.59	0.57	3.71	4.32	6.06
S. Em ±	0.20	0.01	0.19	0.12	0.13
C.D.5% level	0.58	0.04	0.54	0.33	0.37
Cutting management					
C1 0 cutting	3.70	0.56	5.11	5.13	7.30
C2 1 cutting	4.41	0.51	4.52	5.05	7.28
C3 2 cutting	4.47	0.50	4.18	4.26	7.13
C4 3 cutting	2.71	0.48	3.69	3.66	6.69
S. Em ±	0.18	0.01	0.17	0.10	0.11
C.D.5% level	0.52	0.04	0.48	0.30	0.33
Interaction					
D20C1(20 October sowing with 0 cutting)	4.12	0.44	3.96	4.69	7.57
D20C2 (20 October sowing with 1 cutting)	2.55	0.44	3.31	5.29	7.45
D20C3(20 October sowing with 2 cutting)	2.72	0.34	3.37	4.25	7.60
D20C4(20 October sowing with 3 cutting)	3.00	0.36	2.99	3.04	6.47
D30C1(30 October sowing with 0 cutting)	1.26	0.51	3.95	4.61	6.97
D30C2(30 October sowing with 1 cutting)	3.07	0.40	3.66	4.33	6.72
D30C3(30 October sowing with 2 cutting)	2.31	0.43	3.36	4.83	8.10
D30C4(30 October sowing with 3 cutting)	2.94	0.37	3.59	4.87	7.29
D9C1(9 November sowing with 0 cutting)	5.23	0.52	6.25	4.26	8.27
D9C2(9 November sowing with 1 cutting)	6.46	0.55	6.46	5.80	7.75
D9C3(9 November sowing with 2 cutting)	9.89	0.58	5.29	4.49	6.45
D9C4(9 November sowing with 3 cutting)	1.49	0.58	4.11	3.54	8.06
D19C1(19 November sowing with 0 cutting)	2.66	0.66	7.37	6.61	7.49
D19C2(19 November sowing with 1cutting)	4.46	0.62	5.35	5.33	7.45
D19C3(19 November sowing with 2 cutting)	3.38	0.61	5.11	4.23	7.52
D19C4(19 November sowing with 3 cutting)	2.53	0.56	4.54	3.41	6.64
D29C1(29 November sowing with 0 cutting)	5.21	0.65	4.00	5.47	6.21
D29C2(29 November sowing with 1 cutting)	5.51	0.52	3.83	4.48	7.07
D29C3(29 November sowing with 2 cutting)	4.03	0.57	3.81	3.51	5.96
D29C4(29 November sowing with 3 cutting)	3.59	0.56	3.23	3.45	4.99
S. Em ±	0.41	0.03	0.38	0.23	0.26
C.D.5% level	1.17	0.08	1.08	0.66	0.73

value of CGR $8.27 g/m^2/day$ (Fig. 1 and Table 3). Late sowing dates gives insufficient time for vegetative growth as the plants enter the reproductive phase at a faster rate (Sharangi and Roychowdhary, 2014).

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