

# IMPACT OF DIFFERENT LEVELS OF CUTTING AND DATES OF SOWING ON GROWTH OF CORIANDER UNDER OPEN AND PROTECTED CULTIVATION

S. GUHA<sup>1\*</sup>, S. DEBNATH<sup>2</sup>, AND A. B. SHARANGI<sup>1</sup>

<sup>1</sup>Department of Spices and Plantation Crops,  
Faculty of Horticulture, Nadia - 741 252, West Bengal, INDIA

<sup>2</sup>Department of Crop Improvement, Horticulture And Agricultural Botany,  
Institute of Agriculture, Visva-Bharati University, Sriniketan - 731 236, West Bengal, INDIA  
e-mail:g.sagarika1@gmail.com

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\*Corresponding  
author

## ABSTRACT

The experiment was conducted to assess the change in growth of coriander influenced by different sowing dates and cutting levels. This study was laid out at Factorial RBD replicated thrice with 3 cutting treatments for 7 months (September-March) in open and 5 months (April-August) in protected condition. At 15 DAS and just before one cut, highest plant height of 5.38 cm and 15.77cm was recorded respectively in October sown crop. In the first and second year of experiment, highest plant height of 32.33cm and 32.91 cm respectively were observed in November and December sown seeds after one cutting. Although after second cutting, October and November sown seeds were recorded for the highest plant height (86.20cm). Highest leaf number was recorded for October sown seed as 13 with no cut and it was recorded as 23.38 after cutting. In protected condition, highest plant height at 15 DAS and just before cutting were recorded as 4.14 cm and 14.07 cm respectively in June sown seeds. June sown seeds were also observed to produce highest leaf number of 4.11 in no cut treatment. In conclusion, farmers may have an opportunity to cultivate coriander in the hot seasons by adopting protected cultivation technique.

## INTRODUCTION

Coriander is one of the few plants which can be termed both as an herb and spice. The seeds are being used as spices and leaves as herbs. It is one of the earliest seed spices known to us (Meena *et al.*, 2014). Coriander leaves are the rich source of vitamin A and C also. In West Bengal, coriander is very popular for its scented leaves, which are preferred for its flavour and seed as a spice for seasoning of food items. The demand for green leaf prevails throughout the year. So, protected cultivation in summer days may be assumed as a possible alternative for farmers to control external climatic factors which affect germination of coriander seeds as well as production of green leaf. In mild climate, coriander can be grown round the year for leaf purpose provided moisture is made available.

Green leaf production of coriander is affected by extreme weather especially high temperature. It causes bolting which results in less number of cuttings and ultimately lesser green yields (Moniruzzaman *et al.*, 2013). Number of leaves is an indicator of leaf yield. It is the most important economic character from producer point of view. Several researches have been done and documented regarding the protected cultivation during summer situations as to make the circumstances congenial. Some low cost shade net structure (50% agro shade net) may be used especially during off season (Guha *et al.*, 2013). However, sowing of coriander in varying dates creates a changing microclimate condition during the entire period of its growth and development. The shade net

houses during off season also reduce the temperature up to 5°C and increase the relative humidity, thus offering optimum environmental conditions for the growth of coriander (Shoba and Rajamani, 2009). Vegetables under protected cultivation are a right choice both for domestic and export purposes and an efficient substitute for land use and other resources (Sanwal *et al.*, 2004). Several attempts have been made by a number of researchers on the response of coriander to dates of sowing as well as to cutting management (Sharangi *et al.*, 2011; Datta *et al.*, 2008). This crop has regenerative capacity and hence 2-3 cuttings can be undertaken very easily. Menon *et al.*, (1997) and Thapa (1999) suggested that leaf plucking of coriander seed crop at early stages can provide an additional income to the growers.

The information available so far on leaf production of coriander with differential sowing dates in multi-cut system both under open and protected cultivation is very much scarce especially for Gangetic alluvial situation of West Bengal. Besides, recommendations may be furnished to the farmers regarding the year round cultivation and production of green leaf by the application of proper shade net structure. The experiment was done to investigate the feasibility of growing coriander in different sowing dates for year round foliage production. So, it has been found worthwhile to execute the experiment by focusing the effect of different levels of cutting and dates of sowing on growth of coriander under open and protected cultivation of coriander in this situation.

## MATERIALS AND METHODS

The experiment was conducted during 2008-10 at the Horticultural Research Station, Mondouri, Bidhan Chandra Krishi Viswa vidyalaya, India. Geographical Location of the experimental site is 23.5°N latitude and 80°E Longitude with average altitude of 9.75m above the mean sea level. The experimental site comes under *Gangetic* new alluvial plains of West Bengal with sandy loam soil and assured irrigation facilities. At the experimental site, the average precipitation was about 56.50 mm per month. Maximum temperature varied from 24.82°C to 35.52°C and minimum temperature varied between 9.50°C and 26.18°C. The experiment was laid out at Factorial Randomized Block Design, replicated thrice with three cutting treatments (no cutting, one cut and two cuts) for 7 months (September March) in open and 5 months (April-August) in protected situation. Seeds of Local Variety of coriander X-47 (Leafy type) were sown in the third week of the each month as stated above. For weather modification in summer months agro- shade net was used where a low cost temporary bamboo made structure was made with four sides and the roof of the structure covered with 50% agro shade net (Guha et al., 2013). In rainy season, however, the agro shade net was covered with further protective measures and for this a replaceable transparent normal polythene sheet (of 200 gauge thickness) was used. Standard management practices were followed throughout the growing period. As the coriander variety used for the experiment is responsive to cut, the same was undergone cutting treatment up to two cuts. The first and second cut were taken during times when the leaves were in ideal marketable condition without any signs of serration as it is performed by growers and preferred by the consumers at the market.

Mean value of the parameters in each replication were statistically analyzed following Factorial Randomized Block Design as suggested by Panse and Sukhatme (1985) and Gomez and Gomez (1984). The mean comparisons were made by following the methods of Duncan's Multiple Range Test (DMRT). The statistical software used were MS Excel (Daniel's XL Toolbox Version 4.01) and SPSS 16.0.

## RESULTS AND DISCUSSION

### Open condition

#### Plant height at 15 DAS and just before one cut

Different sowing dates showed significant effect on plant height (Table 1 and Table 3). In the first year of experiment (2008-09) at 15 DAS highest plant height (5.38cm) was observed in October sown seeds. The perusal of data just before one cut (at 42 DAS) in 2008-09 showed the highest plant height (15.77cm) in October sown seed. In 2009-10, the same trend was observed as in the previous year. The highest plant height (5.38cm) was recorded in October sown seeds and the lowest plant height was observed in March sown seeds (1.78cm). These results are similar to of the findings of Meena et al. (2006). Later sowing dates offers insufficient time for vegetative growth as the plants enter the reproductive phase at a faster rate (Sharangi and Roychowdhury, 2014). So, this might be possible reason behind the lowest plant height observed in

**Table 1 : Mean Comparison study of effect of different dates of sowing on plant height of coriander (open and protected condition)**

Open condition Months	Plant height at 15 das (cm)		Plant height after one cut (cm)		Plant height after two cut (cm)		Protected condition Plant height at 15 das (cm)		Plant height after one cut (cm)		Plant height after two cut (cm)						
	2008-09	2009-10	2008-09	2009-10	2008-09	2009-10	2008-09	2009-10	2008-09	2009-10	2008-09	2009-10					
September	2.59d	2.98d	13.57b	13.72b	28.42c	28.56c	84.84ab	84.42ab	April	2.06d	2.06d	11.08c	10.08c	21.87b	21.49b	74.98a	75.20a
October	5.38a	5.38a	15.77a	15.72a	32.24a	32.56a	86.20a	86.36a	May	2.81c	2.92c	12.92b	11.92b	24.37a	24.70a	72.42b	72.64b
November	4.19b	4.08b	15.73a	15.67a	32.33a	32.56a	86.20a	85.37a	June	4.14a	4.22a	14.07a	14.18a	25.92a	25.48a	72.42b	72.73b
December	3.63c	3.86b	15.50a	15.63a	32.13a	32.91a	83.69b	84.31ab	July	3.72b	3.68b	13.89a	13.78a	25.26a	25.13a	72.28b	72.61b
January	2.76d	3.14c	13.79b	14.11b	30.91ab	31.24b	82.87bc	82.54bc	August	3.50b	3.61b	13.74a	13.52a	24.48a	25.13a	71.67b	71.02b
February	2.08e	2.19c	13.14c	12.98c	30.07b	30.40b	81.31c	80.81c									
March	1.56f	1.78d	11.94d	11.83d	28.14c	28.03c	77.53d	78.42d									
S.Em( + )	0.11	0.17	0.09	0.17	0.49	0.57	0.74	0.66		0.11	0.1	0.19	0.23	0.74	0.84	0.36	0.57
CD (0.05)	0.33	0.47	0.26	0.5	1.4	1.63	2.11	1.88		0.31	0.3	0.56	0.65	2.15	2.44	1.05	1.64

**Table 2 : Mean Comparison study of effect of different dates of sowing on leaf number of coriander (open and protected condition)**

Open condition Months	Leaf number at 15 das		Leaf number at one cut		Leaf number after two cut		Protected condition Leaf number at 15 das		Leaf number at one cut		Leaf number after two cut	
	2008-09	2009-10	2008-09	2009-10	2008-09	2009-10	2008-09	2009-10	2008-09	2009-10	2008-09	2009-10
September	2.00d	11.22c	14.67bc	14.89bc	23.44d	23.00c	April	2.33c	11.89a	12.00ab	13.11a	23.11 b
October	5.11a	13.22a	16.44a	16.44a	28.00a	28.00a	May	2.56bc	10.78b	11.00bc	13.67a	23.11b
November	4.11b	12.33b	13.00b	16.11ab	27.89a	27.78a	June	4.11a	12.44a	13.00a	14.67a	25.56 a
December	3.11c	11.89b	12.00c	16.00ab	26.11b	25.33b	July	3.44ab	11.89a	12.67a	14.56ab	23.89ab
January	3.00c	11.89b	12.00c	15.33abc	25.44bc	25.44bc	August	3.33ab	10.00c	10.44c	14.44b	24.33ab
February	2.00d	10.89c	11.00d	14.00cd	24.78bcd	24.56bc						
March	1.11e	10.11d	10.22e	12.89d	24.11cd	23.67bc						
S.Em( + )	0.22	0.18	0.36	0.35	0.54	0.56		0.3	0.21	0.37	0.3	0.6
CD (0.05)	0.62	0.5	1.02	1.01	1.55	1.59		0.87	0.61	1.08	0.87	1.75

**Table 3 : Mean comparison study of different levels of cutting on plant height of coriander (open and protected condition)**

Open condition Level of cutting	Plant height at 15 das (cm)		Plant height after two cut (cm)		Protected condition Level of cutting		Plant height at 15 das (cm)		Plant height after two cut (cm)	
	2008-09	2009-10	2008-09	2009-10	2008-09	2009-10	2008-09	2009-10	2008-09	2009-10
No cut	3.14p	14.23p	14.22p	55.73p	93.13p	No cut	3.35p	13.15p	13.02p	49.63p
One cut	3.24p	14.12p	14.17p	17.84q	83.88q	One cut	3.19p	13.03p	12.43q	49.81p
Two cut	3.12p	14.27p	14.32p	18.25q	72.52r	Two cut	3.21p	13.23p	12.63pq	11.65q
S.Em( + )	0.07	0.06	0.11	0.32	0.43	S.Em( + )	0.08	0.15	0.18	0.57
CD (0.05)	NS	NS	NS	0.92	1.06	CD (0.05)	NS	NS	NS	1.66

Table 4: Mean comparison study of different levels of cutting on leaf number of coriander (open and protected condition)

Open condition Level of cutting	Leaf number at 15 das		Leaf number after one cut		Leaf number after two cut		Leaf number at one cut		Leaf number after one cut		Leaf number after two cut	
	2008-09	2009-10	2008-09	2009-10	2008-09	2009-10	2008-09	2009-10	2008-09	2009-10	2008-09	2009-10
No cut	2.90p	3.10p	11.62p	11.81p	23.38p	23.33p	34.05p	33.57p	11.27p	11.53p	23.20p	23.53p
One cut	2.86p	3.24p	11.52p	12.10p	11.10q	10.95q	24.67q	24.38q	11.47p	12.20p	9.20q	9.20q
Two cut	3.00p	2.95p	11.81p	11.90p	10.86q	10.95q	18.33r	18.24r	11.47p	11.73p	9.60q	9.53q
S.E.m(+ )	0.14	0.11	0.12	0.12	0.23	0.23	0.36	0.37	0.11	0.29	0.23	0.24
CD (0.05)	NS	NS	NS	NS	0.67	0.66	1.02	1.04	NS	NS	0.68	0.70
Protected condition Level of cutting	Leaf number at 15 das		Leaf number after one cut		Leaf number after two cut		Leaf number at one cut		Leaf number after one cut		Leaf number after two cut	
	2008-09		2009-10		2008-09		2009-10		2008-09		2009-10	
No cut	3.13p		2.93p		34.05p		33.57p		11.27p		11.53p	
One cut	3.20p		3.00p		24.67q		24.38q		11.47p		12.20p	
Two cut	3.13p		2.73p		18.33r		18.24r		11.47p		11.73p	
S.E.m(+ )	0.23		0.16		0.36		0.37		0.11		0.24	
CD (0.05)	NS		NS		1.02		1.04		NS		0.70	

case of March sown seeds. Shadap *et al.* (2013) also advised in an analogous way with differential sowing time in ginger.

#### Plant height after one and two cut

Different sowing dates showed significant effect on plant height (Table 1 and Table 3). In the first year of experiment (2008-09), after one cutting (63 DAS), highest plant height (32.33cm) was observed in November sown seeds. In 2009-10, the highest plant height (32.91cm) was recorded in December sown seeds. After second cutting (117 DAS and 116 DAS) in 2008-09, October and November sown seeds showed the highest plant height (86.20cm). In 2009-10 the same trend was observed as in the previous year. Different levels of cutting showed significant effect on plant height. According to Tehlan and Thakral (2008) single leaf cutting at initial vegetative growth stage did not affect the later vegetative and reproductive growth substantially. After one cutting, the highest plant height was 55.73 and 56.26 cm (no cut treatment) in 2008-09 and 2009-10. After second cutting the highest plant height was 92.13 and 93.87 cm (no cut treatment) in 2008-09 and 2009-10. Better vegetative growth was observed in October sown crop due to more favorable temperature during its growth period. From another experiment it was noticed that, optimum date of sowing was 5th November for having best results regarding important growth parameters (Sharangi and Roychowdhury, 2014).

#### Leaf number before cutting

Different dates of sowing have significant effects on number of leaves (when no cutting was done). October sown seeds showed highest leaf number in the year 2008-09 and 2009-10. Leaf number before cutting varies according to different dates of sowing (Table 2 and Table 4). The highest leaf number (13.0) was observed in October sown seeds and the lowest (10.0) was observed in March sown seeds in the year 2008-09. In the second year of experiment 2009-10 similar kind of result was observed. Levels of cutting and interaction between the dates of sowing and levels of cutting showed no significant interaction on leaf number of coriander plant. Our results are in corroboration with Meena *et al.* (2006). Higher foliage yield in winter months and lower yield in summer months was an important finding from a recent study at Bangladesh (Moniruzzaman *et al.*, 2013).

#### Leaf number after one cut and two cut

In the two years of experiment plants from October sown seeds showed the highest number of leaves (Table 2). The highest leaf number (23.38) was observed where no cutting was done compared to the one cut (11.10) and two cut (10.86) treatments respectively (year 2008-09). In 2009-10, however the values were 23.33, 10.95 and 10.95 in case of no cut, one cut and two cut respectively. After second cutting, in 2008-09 the highest leaf number (34.05) and in 2009-10 the highest leaf number (33.57) was observed where no cutting was done (Table 4). October sown seeds recorded the highest leaf number in both of the year. The greater leaf number on October sown crop might have helped in the production of more metabolites and consequent growth accumulation of total solids which ultimately resulted in the production of larger amount of green leaf yield. Better vegetative growth was observed in October sown crop due to more favorable

temperature during its growth period. Guha *et al.* (2014) reported that, sowing in October resulted in more leaf yield compared to other sowing dates.

### Protected condition

#### Plant height at 15 DAS and just before cutting

Different sowing dates showed significant effect on plant height (Table 1 and Table 3). In the first year of experiment (2008-09) at 15 DAS the highest plant height (4.14cm) was observed in June sown seeds. Similar trend was observed as 2009-10. The perusal of data just before one cutting in 2008-09 showed the highest plant height (14.07cm) for June sown seed. During 2009-10, the same trend was observed as in the previous year. The highest plant height (14.12cm) was recorded in June sown seeds. The reason may be the advantages of protected cultivation which provide congenial environmental conditions for the growth of coriander (Shoba and Rajamani, 2009). Besides, protected cultivation offers the paramount way to increase the productivity and quality of vegetables compared to open field condition (Singh *et al.*, 2007). Plant height was found to be highest under shade net house in a previous study (Rajasekar *et al.*, 2013). It may be due to the suitable micro-climatic conditions prevailed in the shade net house.

#### Plant height after one and two cuttings

It was observed that dates of sowing and levels of cutting had influential effect on plant height after one cutting and two cutting. In the two years of experiment, plants from June sown seeds showed the highest plant height (25.92 cm in 2008-09 and 25.48 cm in 2009-10). No cutting treatment recorded the highest plant height in both the year. Similarly, June sown seeds were found to produce the highest seed yield in protected condition (Guha *et al.*, 2013). It was reported earlier that, greenhouse cultivation showed superior yield and yield attributing characters as compared to open field condition (Dixit, 2007). The shade net houses during off season reduce the temperature up to 5°C and increase the relative humidity, thereby providing optimum environmental conditions for the growth of coriander (Shoba and Rajamani, 2009).

#### Leaf number before cutting

June sown seeds showed highest leaf number (4.11) in the year 2008-09 (Table 2). In 2009-10 a similar result was observed in June sown seeds (leaf number 3.44). Cutting has no significant effect on number of leaves in both the years (Table 4). Leaf number before one cutting varies according to the different dates of sowing. The highest leaf number (12.44) observed in June sown seeds. In the second year of experiment 2009-10 similar kind of result was observed. It is because the shade net houses during off season reduce the temperature considerably and increase the relative humidity, thereby providing favorable environmental conditions for the growth of coriander (Shoba and Rajamani, 2009). The protected cultivation was presumed to resolve the problem of low productivity during extreme weather conditions and numbers of leaves per plant was found to highest under shade net house in case of a number of vegetables including coriander by some earlier workers also (Rajasekar *et al.*, 2013).

#### Leaf number after one cutting and two cutting

It was observed that dates of sowing and levels of cutting had

influential effect on number of leaves (Table 2 and Table 4). In the two years of experiment plants from June sown seeds showed the highest number of leaves. The highest leaf number (23.20) was observed where no cutting was done compared to the one cut (9.20) and two cut (9.60) treatments, respectively (year 2008-09). Similar trend was observed in the second successive year. The decreased value in one and two cut treatments might be due to the exclusion of number of cut leaves before the subsequent calculations. As the benefit arises due to the opportunity of getting green leaf harvest for repeated times at least twice, so the cumulative effect of two cuttings exceeded total leaf number compared to no cutting. After two cutting the highest leaf number (34.27 in 2008-09 and 35.93 in 2009-10) was observed where no cutting was done. Similarly, June sown seeds were found to produce the highest green leaf yield and among different levels of cutting, the highest leaf yield was found in two cutting (Guha *et al.*, 2016). The reason may be best defined in the context of green leaf yield as number of leaves is an indicator of leaf yield.

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