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Effect of Different Sowing Times and Cutting Management on Phenology and Yield of off Season Coriander under Protected Cultivation

[1]S. Guha, [1]A.B. Sharangi and [2]S. Debnath
[1]Department of Spices and Plantation Crops, Faculty of Horticulture, [2]Department of Genetics, Faculty of Agriculture, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur-741252, Nadia, West Bengal, India

Corresponding Author: A.B. Sharangi, Department of Plant, Environmental and Soil Sciences, 133, J.C. Miller Hall, Baton Rouge, LA 70803, USA

ABSTRACT

Coriander is one of the few plants which can be termed both as a herb and a spice, the seeds being used as spices and leaves are widely used as herbs. The experiment has been carried out to popularize coriander cultivation in West Bengal commercially to optimize the sowing time and cutting management for production of coriander leaf and seed in protected situation. Observations on phonological [e.g., time taken for germination (DAS), time taken for emergence of 1st leaf 2nd leaf and 3rd leaf (DAS), time taken for initiation of serrated leaf (DAS), time taken for flowering (DAS), time taken for seed setting (DAS), time taken for physiological maturity (DAS)] yield components [e.g., yield of green leaves/plot (g/3 m^2) yield of seeds/plot (g/3 m^2) were recorded. The results revealed protected cultivation in the summer days was a possible alternative for farmers to control external climatic factors which may affect germination of coriander seeds and leaf yield. June sown seeds recorded the highest leaf number and were found to produce the highest leaf yield and seed yield. Highest leaf yield was found in two cutting and highest seed yield was observed in one cutting.

Key words: Coriander, protected cultivation, dates of sowing, level of cutting, phenology, green leaf yield, seed yield

INTRODUCTION

Coriander is one of the few plants which can be termed both as herb and spice, the seeds being used as spices and leaves are widely used as herbs. This is the most widely used plant in both forms. Coriander leaves are the rich source of vitamin A and C. The green herbs contain vitamin C upto 160 mg/100 g and vitamin A upto 12 mg/100 g (Girenko, 1982). Coriander plant has regenerative capacity and hence 2-3 cuttings can be undertaken very easily. Menon and Khader (1997) and Thapa (1999) suggested that leaf plucking of coriander seed crop at early stages can provide an extra income to the growers. Sharangi *et al.* (2011) showed that, a foliar spray of nitrogen (2.5%urea) may be beneficial for coriander leaf production under multicut system and the crop is sensitive to rainfall, photo temperature, and morning humidity. Sarada *et al.* (2011) suggested that the soil temperature, especially the afternoon soil temperature (maintained between 28.0 to 32.5°C is the most crucial factor in summer production of coriander leaf. For leaf purpose, coriander is grown all the year round. Harvesting at leafy stage has been found to improve seed yields in coriander. It can fairly tolerate light frost and high temperature. In hot weather, the crop for leaves, can be grown under ensured irrigation facilities.

Summer months are not ideal for early germination of coriander. It may be due to high temperature and other climatic factors not suitable to speed up coriander seeds to germinate. Hence, protected cultivation in the summer days may be a possible alternative for farmers to control external climatic factors which may affect germination of coriander seeds and leaf yield. That is why the further studies and validation in protected conditions with amiable agronomic packages is necessary. Singh *et al.* (2007) reported that protected cultivation of vegetables in peri-urban areas of Northern India provides the best way to increase the productivity and quality of vegetables as well as biotic and abiotic stress situation compared to open field condition. A substantial increase in yield alongwith enhancement in yield attributing characters has been found in protected cultivation compared to that of open (Dixit, 2007). With the above in view the experiment has been carried out commercially and to optimize the sowing time and cutting management for production of coriander leaf and seed in protected situation.

MATERIALS AND METHODS

Experimental design and treatments: The experiment was conducted during 2009-10 at the Horticultural Research Station, Mondouri, Bidhan Chandra Krishi Viswavidyalaya, West Bengal (India). The experiment was laid out at Factorial Randomized Block Design replicated thrice with three cutting treatments (no cutting, one cut and two cuts) and 5 months (April- August). The sowing of coriander seeds [Local Variety-X-47 (Leafy type)] was done on plots of dimension 2×1.5 m at 30×15 cm spacing. Five sowing dates were April = D_1, May = D_2, June = D_3, July = D_4, August = D_5 and three cutting treatments are No cut-C_o, One Cut-C_1 and Two Cut-C_2. Seeds were sown in the third week of the each month.

Management practices: Standard management practices are followed throughout the growing period. In addition to organic manuring inorganic fertilizer was also applied. Nitrogen, Phosphorus and Potassium at the rate 60:40:20 kg ha^{-1} (Irrigated condition). With one third of nitrogen along with full doses of phosphorus and potassium were applied as basal and rest nitrogen was top dressed twice after each cutting for boosting further vegetative growth. Irrigation was provided as per evaporative demand of atmosphere.

Agro shade net: For weather modification in summer months 50% agro shade net was used. A low cost temporary bamboo made covering structure was made all the four sides and the roof with 50% agro shade net. In rainy season, however, the agro shade net was covered with further protective measures and for this a replaceable transparent polythin sheet (of 200 gauge thickness) was used.

Cutting management: As the coriander variety used for the experiment was responsive to cut, the same was undergone with cutting treatment up to two cuts (Table 1). The first and second cut were taken during times when the leaves were in ideal marketable condition without any signs of serration and preferred by the consumers at the market. This was found to be varied with the time of sowing irrespective of growing condition.

Statistical analysis: Mean values 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 Table formulated by Fisher and Yates (1975) were consulted for the purpose of comparison of F values and for determination of critical differences (C.D. values) at the probability of 0.05. The mean comparisons were made by following the

methods of Duncuns Multiple Range Analysis. The statistical softwares used, were MS Excel (Daniel's XL Toolbox Version 4.01) and SPSS 16.

RESULTS AND DISCUSSION

Time taken for germination: In the year 2009-10, it was found that among different dates of sowing July sown seeds were germinated as the earliest ones (at 11.78 DAS) and August sown seeds were noticed to avail the longest time period (13.56 DAS) for emergence (Table 2). No significant effect of cutting was found in germination on coriander (Table 3). Late sown seeds were

Table 1: Month of cutting, number of cuts and time of cutting (days after sowing, DAS)

Month	Treatment	Time of cutting (DAS)
April	One cut	35
	Two cut	42
May	One cut	35
	Two cut	42
June	One cut	35
	Two cut	49
July	One cut	35
	Two cut	49
August	One cut	30
	Two cut	45

Table 2: Mean comparison of effects of different sowing time on phenological variables under study

	Time taken for							
Month	Germination	Emergence of first leaf	Emergence of second leaf	Emergence of third leaf	Flowering	Initiation of serrated leaf	Seed setting	Physiological maturity
April	12.56^{b}	14.33^{b}	14.56^{bc}	16.22^{c}	66.00^{b}	75.56^{a}	76.78^{c}	101.78^{ab}
May	12.22^{b}	13.67^{c}	15.00^{b}	17.56^{b}	67.00^{b}	78.11^{a}	76.78^{c}	104.78^{bc}
June	12.44^{b}	13.33^{c}	13.78^{c}	14.78^{b}	72.33^{a}	77.56^{a}	81.22^{a}	110.22^{a}
July	11.78^{b}	13.22^{c}	15.44^{b}	16.78^{bc}	71.56^{a}	74.78^{a}	80.22^{ab}	107.22^{c}
August	13.56^{a}	15.44^{a}	17.22^{a}	19.11^{a}	68.00^{ab}	70.11^{b}	77.33^{bc}	104.44^{bc}
S.Em(±)	0.31	0.23	0.32	0.36	1.39	1.41	1.04	1.44
CD (0.05)	0.89	0.68	0.92	1.04	4.01	4.08	3.01	4.16

Means within a column followed by the same letter are not significantly different at the $p \leq 0.05$ probability level. Means within a column followed by a different letter denotes significant differences ($p \leq 0.05$) as determined by Fisher's protected least significant differences

Table 3: Mean comparisons of effects of cutting management on phenological variables under study

	Time taken for							
Cutting level	Germination	Emergence of first leaf	Emergence of second leaf	Emergence of third leaf	Flowering	Initiation of serrated leaf	Seed setting	Physiological maturity
No cut	12.47^{p}	13.80^{p}	15.07^{p}	16.80^{p}	62.40^{r}	69.53^{r}	72.60^{r}	92.40^{r}
One cut	12.47^{p}	14.07^{p}	15.47^{p}	16.93^{p}	69.20^{q}	76.00^{q}	77.47^{q}	109.93^{q}
Two cut	12.60^{p}	14.13^{p}	15.07^{p}	16.93^{p}	75.33^{p}	80.13^{p}	85.33^{p}	114.73^{p}
S.Em(±)	0.24	0.18	0.25	0.28	1.07	1.09	0.80	1.11
CD (0.05)	NS	NS	NS	NS	3.11	3.16	2.33	3.22

Means within a column followed by the same letter are not significantly different at the $p \leq 0.05$ probability level. Means within a column followed by a different letter denotes significant differences ($p \leq 0.05$) as determined by Fisher's protected least significant differences

found to take more time for germination in general. There may be some agro climatic factors responsible for early or delayed germination. High temperature was found to be the main limiting factor for the germination and growth of coriander (Sarada *et al*., 2011).

Time taken for emergence of first leaf: In the year 2009-10, June and July sown seeds were found to emerge first leaf at 13.22 DAS and August sown seeds were observed to take 15.44 DAS for emergence of 1st leaf (Table 2). No significant effect of cutting was found in emergence of first leaf (Table 3). It is interesting to note that June sown seeds took more time to emerge the first leaf compared to the later months upto July. There may be some specific micro-climatic factors responsible for earliness or delay in 1st leaf emergence.

Time taken for emergence of second leaf: Different time of sowing of coriander seeds had significant influence on the time taken for emergence of second leaf. Data of Table 1 disclosed that June sown seeds found to emerge second leaf at 14.56 DAS and August sown seeds observed to take about 17 DAS for emergence of second leaf in the same year. No significant effect of cutting was found in emergence of second leaf (Table 3). Late sown seeds were found to take more time for second leaf emergence. There may be some agro climatic factors responsible for early or delayed second leaf emergence.

Time taken for emergence of third leaf: In the year 2009-10, June sown seeds were found to emerge third leaf at 14.78 DAS and August sown seeds observed to take about 19 DAS for emergence of third leaf. No significant effect of cutting was found in emergence of third leaf. Most interestingly, emergence of third leaf had taken shorter time period where early sowing was done. On the other hand, late sown seeds were found to take more time for third leaf emergence. There may be some agro climatic factors responsible for early or delayed third leaf emergence. Temperature also played an important role during vegetative growth and grain formation in case of wheat (Marcellos and Single, 1972).

Time taken for flowering: Several dates of sowing and different levels of cutting had significant effect on time taken for flowering. Early flowering is not desirable for farmers as green leaf yield decreases. Flowering of coriander plants was found at about 72 DAS in June sown seeds and it was about 66 DAS for April sown seeds. Blooming of coriander plant had taken longer time period where early sowing was done but late sown seeds were found to take less time for blooming (Table 2). Two cut takes more time (75 DAS) for flowering in coriander (Table 3).

Time taken for initiation of serrated leaf: Different time of sowing of coriander seeds and different levels of cutting influenced significantly the time taken for initiation of serrated leaf. Early serration is not desirable for farmers as its marketability is lost. Early serration was best manipulated in two cuttings to make delay. Two cuttings (80.13 DAS) may be considered as crucial agronomic practice to delay the serration leading to better green leaf harvest (Table 3). From the data of Table 2 it is observed that in 2009-10, serration of coriander leaves was found at about 78 DAS in May sown seeds and it was about 70 DAS for August sown seeds. Initiation of serrated leaves had taken longer time period where early sowing was done. On the other hand, late sown seeds were found to take less time for initiation of serrated leaves.

Time taken for seed setting: Several dates of sowing and different levels of cuttings had significant effect on time taken for seed setting. For green leaf production purpose, early seed setting is not favorable for farmers as green leaf yield is hampered. Seed setting of coriander plants was found at about 81 DAS in June sown seeds and it was about 76 DAS for both April as well as May sown seeds (Table 2). In case of June sown seeds farmers get the benefit of extended vegetative period which promote better green leaf production. Then again two cuttings were found superior (85.33 DAS) to promote prolonged vegetative period for better green leaf harvest. In this year two cuttings also was given the better result in leaf yield duration (Table 3).

Time taken for physiological maturity: Time taken for physiological maturity, was significantly influenced by different dates of sowing and different levels of cutting. In case of June and July sown seeds, physiological maturity got delayed which might facilitate the farmers to have the benefit of a prolonged vegetative stage and sound seed yield. Then again two cuttings were superior for obtaining prolonged life span. Coriander plants were found to mature physiologically at about 110 DAS in June sown seeds and it was 101.78 DAS for April sown seeds (Table 2). In this year, two cuttings may also be considered as better (114.73 DAS) for achieving delayed physiological maturity (Table 3).

Green leaf yield: The data presented in Fig. 1 showed that different dates of sowing and levels of cutting influenced leaf yield of coriander significantly. Among the different dates of sowing, June sown seeds were found to produce the highest green leaf yield (771.70 g/3 m^2). Among different levels of cutting the highest leaf yield was found in two cutting. The lowest leaf yield was observed in April 553.13 g/3 m^2, respectively. One cutting recorded the lowest leaf yield (358.76 g/3 m^2) than two cutting in both the years. Interaction between cutting and dates of sowing showed no significant effect on yield of leaves. Singh *et al.* (2007) conducted an experiment in peri-urban areas of Northern India and reported that protected cultivation of vegetables can provide the best option to increase the productivity and quality of vegetables as well as biotic and abiotic stress condition compared to open field.

Yield of seeds: The data presented in Fig. 2 showed that different dates of sowing and levels of cutting influenced seed yield of coriander significantly. Among the different dates of sowing, June sown seeds were found to produce the highest seed yield (185.23 g/3 m^2). Among different levels of cutting, the highest seed yield was found in one cut treatment. The lowest seed yield was observed in April (172.60 g/3 m^2). Two cutting recorded the lowest seed yield (173.30 g/3 m).[2] Hundal (2004) observed that a 2°C increase in temperature resulted in 15 to 17% decrease in grain yield in rice under the low temperature condition.

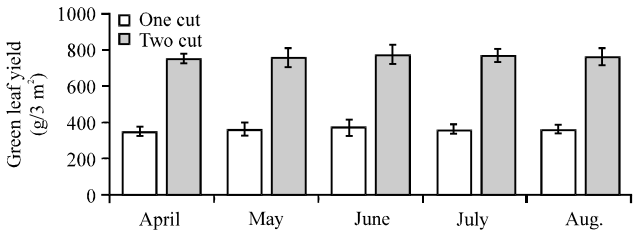

Fig. 1: Effect of different sowing times and cutting management on green leaf yield (g/3 m^2) of off season coriander under protected cultivation

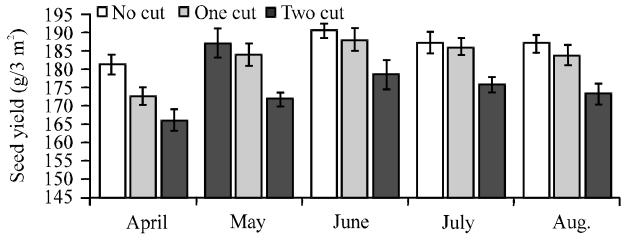

Fig. 2: Effect of different sowing times and cutting management on seed yield (g/3 m^2) of off season coriander under protected cultivation

CONCLUSION

The results revealed that protected cultivation in the summer days is a possible alternative for farmers to control external climatic factors which may affect germination of coriander seeds and leaf yield. June sown seeds were recorded the highest leaf number and were found to produce the highest leaf yield and seed yield. Highest leaf yield was found in two cutting and highest seed yield was observed in one cutting.

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