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Article

The growth and leaf yield performance of several coriander varieties as influenced by organic nutrient sources during summer

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Abstract: Coriander (*Coriandrum sativum* L.) has wide reputation as spice and culinary herb. An experiment was carried out to promote off-season organic coriander leaf cultivation in Bangladesh. The study was conducted at the horticulture farm of Sher-e-Bangla Agricultural University, Dhaka, replicated thrice with two factors; variety (V_1⇒Green aroma, V_2⇒ Green giant and V_3⇒ Indian variety) and organic nutrient source (T_0 ⇒ Control, T_1 ⇒ Cowdung @ 10 t ha^{-1}, T_2 ⇒Vermicompost @ 3 t ha^{-1}), repeated over five months (March, April, May, June and July) in Randomized Block Design. Data were recorded on several growth and yield parameters. March sown seeds were recorded for highest plant height (19.0 cm), fresh weight of plants per m^2 (1359.67 g) and leaf yield (13.6 t ha^{-1}). Results revealed that treatment combination, V_2T_1 performed better in terms of foliage yield with its best performance (12.17 t ha^{-1}) in March. It was also the best performer for sowing time April (5.14 tha^{-1}), May (3.92 t ha^{-1}) and July (3.16 t ha^{-1}).

Keywords: coriander; organic farming; sowing date; leaf yield performance

1. Introduction

Coriander (*Coriandrum sativum* L.) is one of the rare herbs which is simultaneously used as an important spice and culinary herb throughout the world. This is the most widely used plant in both forms. It has found to be a remunerative crop. While the seeds are used in medicine as a carminative, refrigerant, diuretic and aphrodisiac, Coriander leaves are valued as food mainly for its high vitamin A and vitamin C. The green herbs contain vitamin C upto 160 mg and vitamin-A upto 12 mg (Girenko, 1982) alone with 88% water, 6.0 g CHO, 2.7 protein and 32 kcal per 100 g fresh weight of leave (Rubatzky *et al*., 1999).

The cultivation of coriander has increased in Bangladesh for the leaves as well as seeds (Islam *et al*., 2004), particularly for leaf production. Among the various factors responsible for high yield, the variety itself plays a great role because even under stress condition they yield comparatively more than the traditional varieties. Although there are many imported high yielding (foliage/leaf) coriander varieties are available in the local market, but the only recognized commercial variety is BARI Dhonia-1 and this variety is popularly used for high seed production. To achieve higher leaf yield, an important component would be to introduce new high yielding varieties that can stealthily replace the existing varietal picture.

One of the important factors responsible for high yield of any crop is climatic condition which exerts a distinct effect on growth, severe competition of weeds and to some extent powdery mildew and aphid infestation. Temperature is the most important climatic factor which affects plant growth, development and yield and the determinant proper sowing time (Tiwari and Singh, 1993). Coriander is a temperature sensitive crop. Its optimum temperature for germination and early growth is 20-25°C (Singhania *et al*., 2006). 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. Even though

Coriander can be grown for foliage all the year round, the life cycle of the plants become shorter as the sowing is delayed that adversely affects yield of coriander (Ahmed and Haque, 1985).

For successful crop production, necessary nutrients must be supplied to the plants judiciously. Inorganic fertilizers are quick and convenient sources of nutrients but they do not retain in the soil for long period, particularly the nitrogen and provide more nutrient to the weeds, resulting in greater infestation of weeds (Jama *et al*., 1997). In addition, they have adverse effect on the environment. In contrast, organic fertilizers improve nutrient release with the advancement of time and decomposition in soil. It also improves the physical properties such as bulk density, aeration and porosity of soil (Frankenberger *et al*., 1985) and enhance the soil fertility as well as microbial activity (Agbede *et al*., 2008 and Muhammad *et al*., 2009). These are environment friendly compare to inorganic (Akande *et al*., 2004). Keeping the above facts in view, the present study was undertaken to investigate the off-season yield performances of coriander leaf of different cultivars by using organic fertilizer at various time of sowing.

2. Materials and Methods

2.1. Experimental design and treatments

The experiment was conducted at the horticulture farm of Sher-e-Bangla Agricultural University, Dhaka, Bangladesh. The experiment was laid out at Factorial Randomized Block Design replicated thrice with three varieties (V_1⇒Green aroma, V_2 ⇒ Green giant and V_3⇒ Indian variety) and three organic fertilizer treatments (T_0 ⇒ Control (no fertilizer), T_1 ⇒ Cowdung @ 10 t ha^{-1}, T_2 ⇒ Vermicompost @ 3 t ha^{-1}). The sowing of coriander seeds was done in rows 10cm apart on plots of dimension 2x1 m. The block to block distance was 1m and the plot to plot distance was 50 cm. the experiment was repeated five times and five months were March, April, May, June and July. Seeds were sown in the third week of the each month.

2.2. Management practices

Standard management practices are followed throughout the growing period. Organic manures was incorporated in soil by disc plowing and cross plowing during land preparation followed by laddering and harrowing. Irrigation was provided as per evaporative demand of atmosphere. Hand weeding was done at 15 days interval. Since, there was no insect and pathogen attack to the crop, no measurement was taken for crop protection. Harvesting of young plants of the varieties was done before bolting from 1 m^2 area of the unit plot just beneath the soil with the help of khupri.

2.3. Statistical analysis

The mean values of the parameters in each replication were statistically analyzed following Factorial Randomized Block Design collected using the analysis of variance (ANOVA) technique with the help of a computer package program MSTAT-C and mean separation were done by Least Significance Difference (LSD) test at the probability of 0.05.

3. Results and Discussion

3.1. Growth parameters

3.1.1. Plant Height

Various cultivars of coriander had non-significant effect on plant height (Table 1, Table 2, Table 3, Table 4 and Table 5). In addition, influence of different organic manures was significant only during March sowing (Table 6) where the highest plant height (17.44 cm) resulted from T_1 (Cowdung) with statistically similarity to the result (16.72 cm) of T_2 (Vermicompost). Results revealed that plant height decreased steadily by the combined effect of variety and organic fertilizers with the advancement of sowing dates (Table 11, Table 12, Table 13, Table 14 and Table 15). The variation in plant height may be credited to the better availability of nitrogen for plants as suggested by Hnamte *et al.* (2013). In a field experiment conducted during 2008-09 and 2009-10, they studied the effect of different bio-fertilizers namely PSB, Nitrate fixers and KM along with Vermicompost (2 tha^{-1}), NPK (30:30:15 kg ha^{-1}) and organic manures (Cowdung @ 20t ha^{-1}) on growth behavior of coriander. Combined inoculation of biofertilizers along with vermicompost and NPK showed superiority with respect to plant height both at 45 DAS (40.80cm) and at maturity (63.96 cm), number of primary (7.42) and secondary branches (13.07), stem girth (3.37cm), root length (14.39 cm). The results were explained with increased nitrogen fixation due to microbial activities of bio-fertilizers in soils.

3.1.2. Number of leaves plant^{-1}

Number of leaves per plant was not significantly influenced by different variety of coriander (Table 1, Table 2, Table 3, Table 4 and Table 5). Different organic manure had non-significant effect on number of leaves plant^{-1} of coriander in all sowing except June sowing (Table 9). Results revealed that during June sowing the highest number of leaves plant^{-1} (7.04) was found from T_2 (Vermicompost) which was statistically identical with T_1 (Cowdung).Significant influence was found on number of leaves plant^{-1} due to combined effect of variety and organic manure only for the last two sowing (Table 14 and Table 15). In addition, V_3T_2 and V_1T_0 provided the highest (7.67 and 7.33) and the lowest number of leaves per plant (5.33 and 4.67) respectively for both sowing (Table 14 and Table 15) respectively. Ahmad *et al.* (2017) found similar results in an experiment entitled "Effect of organic fertilizer on growth and yield of Coriander" which was carried out with three organic fertilizers (FYM, Compost and Poultry). The findings revealed that organic fertilizer significantly affected all the studied attributes, - germination, number of leaves branch^{-1}, leaf area, days to harvest, chlorophyll content, weed flora and total soluble solids was subjected to all plots except control. The highest number of leaves branch^{-1} (6.24), highest leaf area (14.95 cm^2) and minimum days taken to harvest (40.75) was recorded in plants received poultry manure.

3.1.3. Fresh weight plant^{-1}

Significant influence was not found on fresh weight per plant due to effect different variety of coriander or, various organic manures or, the combined effect of variety and organic manure (Table 1 to Table 15). Meena *et al*. (2006) conducted a study to find out the response of Influence of sowing date, nitrogen and plant growth regulators on growth and yield of coriander (*Coriandrum sativum* L.) and found similar results. They found that higher levels of nitrogen fertilization had non-significant influence on growth parameters and yield however, foliar spray of naphthalene aceticacid (25ppm) at 30 days after sowing resulted in significantly higher growth and seed yield. This finding supports the results of the current experiment variation in fresh weight of a plant may not be directly influenced by nutrient sources.

3.1.4. Number of plants m^{-2}

Number of plants m^{-2} was significantly influenced by different varieties of coriander (Table 1 to Table 5). It was found that V_1 (Green aroma) produced the highest number of plants m^{-2} for all sowing except June sowing (Table 4) where highest number of plants m^{-2} (271.78) was recorded for V_2 (Green giant). Different organic manure had significant effect on number of plants m-^{2} of coriander various organic fertilizers (Table 6 to Table 10). Outcomes revealed that the highest number of plants m^{-2} was found from T_1 (Cowdung) on every occasion but April sowing (Table7) in which the top result (331.55) was found from T_2.Similarly, significant influence was found on number of plants m^{-2} due to combined effect of variety and organic manure (Table 11 to Table 15). Moniruzzaman *et al.* (2013) conducted a study to find out the suitable coriander genotypes for foliage yield and its attributes. They reported that number of plants m^{-2}, the highest plant height, leaves/plant and single plant weight varied among the various coriander genotypes. In addition, significant variation of foliage yield of coriander among various genotypes was also observed in the findings of the current study.

3.1.5. Fresh weight of plants m^{-2}

Fresh weight of plants m^{-2} was significantly influenced by different variety of coriander (Table 1 to Table 5) and various organic fertilizers (Table 6 to Table 10). Similarly, significant influence was found on number of plants m^{-2} due to combined effect of variety and organic manure (Table 11 to Table 15). It was found that the highest fresh weight of plants m^{-2} was found from V_2T_1 for every sowing excepting March sowing (Table 11) .Results revealed that the highest fresh weight of plants m^{-2} (1359.67 g) was found from V_1T_1 in March sowing. Rahman (2000) conducted a study to assess the morphological characters and yield potential of different coriander genotypes. He reported that weight of plants varied significantly among coriander genotypes. This result reinforces the findings of the current study.

3.1.6. Brix index

Brix index was significantly influenced by different variety of coriander, using March and July sowing (Table 1 and Table 5). It was found that the highest brix index (11.41 and 10.72) was found from V_2 (Green gaint), whereas the lowest brix index (10.74 and 9.02) was obtained from V_3 (Indian variety) for both sowing respectively. Different organic manure had significant effect on brix index of coriander only for March and July sowing (Table 6 and Table 10). Results revealed that, while T0 (Control) provided the highest brix index (12.02) for March sowing (Table 6), it gave the lowest brix index (8.99) for July sowing. Significant influence was

found on brix index due to combined effect of variety and organic manure in all sowing excluding April (Table 12).

Table 1. Effect of different growth and leaf yield parameters of coriander affected by different cultivars using sowing time of March, 2017.

Treatments	Growth and leaf yield parameters					
	Plant height (cm)	Number of leaves plant^{-1}	Fresh weight plant^{-1} (g)	Number of plants m^{-2}	Fresh weight of plants m^{-2} (g)	Brix index (leaf)
V_1	16.00 a	5.89 a	1.78 a	1016.2 a	1126.11 b	10.98 b
V_2	16.67 a	6.22 a	1.63 a	885.33 b	1146.67 a	11.41 a
V_3	15.50 a	5.33 a	1.60 a	824.11 c	997.78 c	10.74 b
$LSD_{0.05}$	1.026	0.527	0.342	5.263	8.319	0.126
CV (%)	4.153	5.029	3.117	10.268	12.314	6.034

$V_1 \Rightarrow$ Green aroma, $V_2 \Rightarrow$ Green giant, $V_3 \Rightarrow$Indian variety
(Means with different letter denotes significant variation)

Table 2. Effect of different growth and leaf yield parameters of coriander affected by different cultivars using sowing time of April, 2017.

Treatments	Growth and leaf yield parameters					
	Plant height (cm)	Number of leaves plant^{-1}	Fresh weight plant^{-1} (g)	Number of plants m^{-2}	Fresh weight of plants m^{-2} (g)	Brix index (leaf)
V_1	11.67 a	6.78 a	1.42 a	371.33 a	417.55 a	11.42 a
V_2	10.89 a	6.22 a	1.40 a	332.11 b	381.89 b	11.28 a
V_3	11.45 a	7.34 a	1.23 a	220.89 c	293.56 c	11.41 a
$LSD_{0.05}$	1.104	1.026	0.512	3.147	5.289	1.204
CV (%)	4.864	4.389	3.122	10.677	12.084	4.056

$V_1 \Rightarrow$ Green aroma, $V_2 \Rightarrow$ Green giant, $V_3 \Rightarrow$Indian variety
(Means with different letter denotes significant variation)

Table 3. Effect of different growth and leaf yield parameters of coriander affected by different cultivars using sowing time of May, 2017.

Treatments	Growth and leaf yield parameters					
	Plant height (cm)	Number of leaves plant^{-1}	Fresh weight plant^{-1} (g)	Number of plants m^{-2}	Fresh weight of plants m^{-2} (g)	Brix index (leaf)
V_1	9.00 a	6.11 a	1.59 a	272.45 a	317.11 b	11.02 a
V_2	8.66 a	6.10 a	1.42 a	263.78 b	346.44 a	11.08 a
V_3	9.33 a	6.22 a	1.19 a	224.00 c	281.44 c	10.72 a
$LSD_{0.05}$	1.147	0.367	0.142	4.289	5.364	1.056
CV (%)	6.527	4.732	3.856	11.389	10.524	5.706

$V_1 \Rightarrow$ Green aroma, $V_2 \Rightarrow$ Green giant, $V_3 \Rightarrow$Indian variety
(Means with different letter denotes significant variation)

Table 4. Effect of different growth and leaf yield parameters of coriander affected by different cultivars using sowing time of June, 2017.

Treatments	Growth and leaf yield parameters					
	Plant height (cm)	Number of leaves plant^{-1}	Fresh weight plant^{-1} (g)	Number of plants m^{-2}	Fresh weight of plants m^{-2} (g)	Brix index (leaf)
V_1	7.89 a	6.33 a	1.57 a	244.78 c	276.78 b	10.28 a
V_2	8.45 a	6.89 a	1.40 a	271.78 a	296.67 a	10.36 a
V_3	8.22 a	6.56 a	1.51 a	253.56 b	290.78 a	10.91 a
$LSD_{0.05}$	1.153	0.126	0.104	3.529	6.754	1.056
CV (%)	5.289	6.376	3.871	10.244	12.389	4.375

$V_1 \Rightarrow$ Green aroma, $V_2 \Rightarrow$ Green giant, $V_3 \Rightarrow$ Indian variety
(Means with different letter denotes significant variation)

Table 5. Effect of different growth and leaf yield parameters of coriander affected by different cultivars using sowing time of July, 2017.

Treatments	Growth and leaf yield parameters					
	Plant height (cm)	Number of leaves plant^{-1}	Fresh weight plant^{-1} (g)	Number of plants m^{-2}	Fresh weight of plants m^{-2} (g)	Brix index (leaf)
V_1	8.55 a	5.89 a	1.29 a	161.44 a	210.45 b	10.10 a
V_2	8.67 a	5.90 a	1.34 a	201.22 b	234.11 a	10.72 a
V_3	9.11 a	6.22 a	1.38 a	206.44 b	231.22 a	9.02 b
$LSD_{0.05}$	1.117	1.086	0.214	4.287	5.264	0.861
CV (%)	5.217	5.388	3.129	8.376	1.578	6.514

$V_1 \Rightarrow$ Green aroma, $V_2 \Rightarrow$ Green giant, $V_3 \Rightarrow$Indian variety
(Means with different letter denotes significant variation)

Table 6. Effect of different growth and leaf yield parameters of coriander affected by different organic fertilizer using sowing time of March, 2017.

Treatments	Growth and leaf yield parameters					
	Plant height (cm)	Number of leaves plant^{-1}	Fresh weight plant^{-1} (g)	Number of plants m^{-2}	Fresh weight of plants m^{-2} (g)	Brix index (leaf)
T_0	14.00 b	5.89 a	1.53 a	840.11 c	849.89 c	12.02 a
T_1	17.44 a	5.67 a	1.80 a	1015.89 a	1222.56 a	10.39 b
T_2	16.72 a	5.90 a	1.71 a	869.67 b	1198.11 b	10.72 b
$LSD_{0.05}$	1.014	0.526	0.312	5.289	7.341	0.236
CV (%)	4.153	5.029	3.117	10.268	12.314	6.034

$T_0 \Rightarrow$ Control, $T_1 \Rightarrow$ Cowdung, $T_2 \Rightarrow$ Vermicompost
(Means with different letter denotes significant variation)

Table 7. Effect of different growth and leaf yield parameters of coriander affected by different organic fertilizer using sowing time of April, 2017.

Treatments	Growth and leaf yield parameters					
	Plant height (cm)	Number of leaves plant^{-1}	Fresh weight plant^{-1} (g)	Number of plants m^{-2}	Fresh weight of plants m^{-2} (g)	Brix index (leaf)
T_0	10.67 a	6.45 a	1.22 a	301.89 b	340.56 b	11.87 a
T_1	11.89 a	7.00 a	1.35 a	290.89 c	373.33 a	11.43 a
T_2	11.45 a	6.89 a	1.48 a	331.55 a	379.11 a	10.81 a
$LSD_{0.05}$	1.036	1.149	0.329	5.812	7.389	1.044
CV (%)	4.864	4.389	3.122	10.677	12.084	4.056

$T_0 \Rightarrow$ Control, $T_1 \Rightarrow$ Cowdung, $T_2 \Rightarrow$ Vermicompost
(Means with different letter denotes significant variation)

Table 8. Effect of different growth and leaf yield parameters of coriander affected by different organic fertilizer using sowing time of May, 2017.

Treatments	Growth and leaf yield parameters					
	Plant height (cm)	Number of leaves plant^{-1}	Fresh weight plant^{-1} (g)	Number of plants m^{-2}	Fresh weight of plants m^{-2} (g)	Brix index (leaf)
T_0	8.22 a	5.56 a	1.44 a	239.67 c	294.66 c	11.39 a
T_1	8.89 a	6.55 a	1.37 a	269.56 a	338.33 a	10.54 a
T_2	9.89 a	6.33 a	1.39 a	251.00 b	312.00 b	10.89 a
$LSD_{0.05}$	1.322	0.589	0.107	4.506	4.036	1.056
CV (%)	6.527	4.732	3.856	11.389	10.524	5.706

$T_0 \Rightarrow$ Control, $T_1 \Rightarrow$ Cowdung, $T_2 \Rightarrow$ Vermicompost
(Means with different letter denotes significant variation)

Table 9. Effect of different growth and leaf yield parameters of coriander affected by different organic fertilizer using sowing time of June, 2017.

Treatments	Growth and leaf yield parameters					
	Plant height (cm)	Number of leaves plant^{-1}	Fresh weight plant^{-1} (g)	Number of plants m^{-2}	Fresh weight of plants m^{-2} (g)	Brix index (leaf)
T_0	7.78 a	5.78 b	1.37 a	206.78 b	252.78 c	10.66 a
T_1	8.22 a	7.00 a	1.72 a	280.78 a	297.11 b	9.99 a
T_2	8.56 a	7.04 a	1.39 a	282.56 a	314.33 a	10.90 a
$LSD_{0.05}$	1.147	1.376	0.381	5.637	6.281	1.322
CV (%)	5.289	6.376	3.871	10.244	12.389	4.375

$T_0 \Rightarrow$ Control, $T_1 \Rightarrow$ Cowdung, $T_2 \Rightarrow$ Vermicompost
(Means with different letter denotes significant variation)

Table 10. Effect of different growth and leaf yield parameters of coriander affected by different organic fertilizer using sowing time of July, 2017.

Treatments	Growth and leaf yield parameters					
	Plant height (cm)	Number of leaves plant^{-1}	Fresh weight plant^{-1} (g)	Number of plants m^{-2}	Fresh weight of plants m^{-2} (g)	Brix index (leaf)
T_0	8.67 a	5.11 a	1.24 a	132.00 c	172.00 c	8.99 c
T_1	8.89 a	6.67 a	1.33 a	236.22 a	260.55 a	9.92 b
T_2	8.78 a	6.22 a	1.43 a	200.89 b	243.22 b	10.93 a
$LSD_{0.05}$	1.033	1.012	0.214	5.385	6.124	0.614
CV (%)	5.217	5.388	3.129	8.376	1.578	6.514

$T_0 \Rightarrow$ Control, $T_1 \Rightarrow$ Cowdung, $T_2 \Rightarrow$ Vermicompost
(Means with different letter denotes significant variation)

Table 11. Effect of different growth and leaf yield parameters of coriander affected by different cultivars and organic fertilizer using sowing time of March, 2017.

Treatments	Growth and leaf yield parameters					
	Plant height (cm)	Number of leaves plant^{-1}	Fresh weight plant^{-1} (g)	Number of plants m^{-2}	Fresh weight of plants m^{-2} (g)	Brix index (leaf)
V_1T_0	14.33 d	6.00 a	1.67 a	809.00 f	678.67 h	11.83 b
V_1T_1	17.00 b	5.67 a	1.82 a	1139.33 a	1359.67 a	9.77 f
V_1T_2	16.67 bc	6.00 a	1.85 a	1100.33 b	1340.00 b	11.33 c
V_2T_0	14.33 d	6.00 a	1.40 a	813.33 f	881.67 g	12.40 a
V_2T_1	19.00 a	6.00 a	2.00 a	1008.67 c	1216.67 c	11.33 c
V_2T_2	16.67 bc	6.33 a	1.45 a	834.00 e	1341.67 b	10.50 d
V_3T_0	13.33 e	5.67 a	1.47 a	898.00 d	989.33 e	11.83 b
V_3T_1	16.33 c	5.00 a	1.58 a	899.67 d	1091.33 d	10.07 de
V_3T_2	16.83 b	5.33 a	1.83 a	674.67 g	912.67 f	10.33 e
$LSD_{0.05}$	0.526	0.526	0.214	5.289	6.194	0.468
CV (%)	4.153	5.029	3.117	10.268	12.314	6.034

$V_1 \Rightarrow$ Green aroma, $V_2 \Rightarrow$ Green giant, $V_3 \Rightarrow$Indian variety
$T_0 \Rightarrow$ Control, $T_1 \Rightarrow$ Cowdung, $T_2 \Rightarrow$ Vermicompost
(Means with different letter denotes significant variation)

Table 12. Effect of different growth and leaf yield parameters of coriander affected by different cultivars and organic fertilizer using sowing time of April, 2017.

Treatments	Growth and leaf yield parameters					
	Plant height (cm)	Number of leaves plant^{-1}	Fresh weight plant^{-1} (g)	Number of plants m^{-2}	Fresh weight of plants m^{-2} (g)	Brix index (leaf)
V_1T_0	11.00 a	6.00 a	1.17 a	413.33 a	453.00 c	11.93 a
V_1T_1	11.33 a	6.67 a	1.60 a	286.33 d	319.33 e	10.90 a
V_1T_2	12.67 a	7.33 a	1.50 a	414.33 a	480.33 b	11.43 a
V_2T_0	10.33 a	5.67 a	1.33 a	263.67 c	287.67 g	12.17 a
V_2T_1	12.33 a	6.67 a	1.33 a	362.67 c	514.00 a	11.50 a
V_2T_2	10.00 a	6.33 a	1.53 a	370.00 b	344.00 d	10.17 a
V_3T_0	10.67 a	7.33 a	1.17 a	228.67 f	281.00 g	11.50 a
V_3T_1	12.00 a	7.67 a	1.13 a	223.67 e	286.67 g	11.90 a
V_3T_2	11.67 a	6.67 a	1.40 a	210.33 g	313.00 f	10.83 a
$LSD_{0.05}$	2.806	1.349	0.566	3.564	5.217	1.078
CV (%)	5.289	6.376	3.871	10.244	12.389	4.375

$V_1 \Rightarrow$ Green aroma, $V_2 \Rightarrow$ Green giant, $V_3 \Rightarrow$Indian variety
$T_0 \Rightarrow$ Control, $T_1 \Rightarrow$ Cowdung, $T_2 \Rightarrow$ Vermicompost
(Means with different letter denotes significant variation)

Table 13. Effect of different growth and leaf yield parameters of coriander affected by different cultivars and organic fertilizer using sowing time of May, 2017.

Treatments	Growth and leaf yield parameters					
	Plant height (cm)	Number of leaves plant^{-1}	Fresh weight plant^{-1} (g)	Number of plants m^{-2}	Fresh weight of plants m^{-2} (g)	Brix index (leaf)
V_1T_0	8.00 f	5.67 a	1.50 a	237.67 c	287.33 f	12.13 a
V_1T_1	8.67 d	6.33 a	1.43 a	289.00 b	302.33 e	9.83 e
V_1T_2	10.33 a	6.33 a	1.83 a	290.67 b	361.67 b	11.10 c
V_2T_0	8.33 de	5.67 a	1.33 a	242.00 c	330.33 c	10.27 d
V_2T_1	8.33 de	6.33 a	1.67 a	306.67 a	391.67 a	12.17 a
V_2T_2	9.33 bc	6.33 a	1.27 a	242.67 c	317.33 d	10.80 cd
V_3T_0	8.33 de	5.33 a	1.50 a	239.33 c	266.33 b	11.77 b
V_3T_1	9.67 ab	7.00 a	1.00 a	213.00 e	321.00 d	9.63 e
V_3T_2	10.00 a	6.33 a	1.07 a	219.67 d	257.00 g	10.77 cd
$LSD_{0.05}$	0.361	1.034	0.552	4.318	3.947	0.648
CV (%)	6.527	4.732	3.856	11.389	10.524	5.706

$V_1 \Rightarrow$ Green aroma, $V_2 \Rightarrow$ Green giant, $V_3 \Rightarrow$Indian variety
$T_0 \Rightarrow$ Control, $T_1 \Rightarrow$ Cowdung, $T_2 \Rightarrow$ Vermicompost
(Means with different letter denotes significant variation)

Table 14. Effect of different growth and leaf yield parameters of coriander affected by different cultivars and organic fertilizer using sowing time of June, 2017.

Treatments	Growth and leaf yield parameters					
	Plant height (cm)	Number of leaves plant^{-1}	Fresh weight plant^{-1} (g)	Number of plants m^{-2}	Fresh weight of plants m^{-2} (g)	Brix index (leaf)
V_1T_0	7.33 c	5.33 d	1.27 a	174.00 g	222.00 e	10.40 c
V_1T_1	8.33 ab	7.00 a	1.80 a	273.33 c	287.67 c	10.23 de
V_1T_2	7.67 bc	6.67 ab	1.63 a	287.00 b	319.33 a	10.20 de
V_2T_0	7.67 bc	6.33 bc	1.37 a	256.67 d	266.67 d	10.07 e
V_2T_1	8.67 a	7.33 a	1.67 a	313.67 a	320.33 a	9.83 f
V_2T_2	9.00 a	7.00 a	1.17 a	245.00 e	303.00 b	11.17 b
V_3T_0	8.00 b	5.67 cd	1.47 a	189.67 f	269.67 d	11.50 a
V_3T_1	7.67 bc	6.67 ab	1.70 a	255.33 d	283.33 c	9.90 f
V_3T_2	9.33 a	7.67 a	1.37 a	315.67 a	320.67 a	11.33 ab
$LSD_{0.05}$	1.102	1.011	0.526	3.671	5.687	0.236
CV (%)	5.289	6.376	3.871	10.244	12.389	4.375

$V_1 \Rightarrow$ Green aroma, $V_2 \Rightarrow$ Green giant, $V_3 \Rightarrow$Indian variety
$T_0 \Rightarrow$ Control, $T_1 \Rightarrow$ Cowdung, $T_2 \Rightarrow$ Vermicompost
(Means with different letter denotes significant variation)

Table 15. Effect of different growth and leaf yield parameters of coriander affected by different cultivars and organic fertilizer using sowing time of July, 2017.

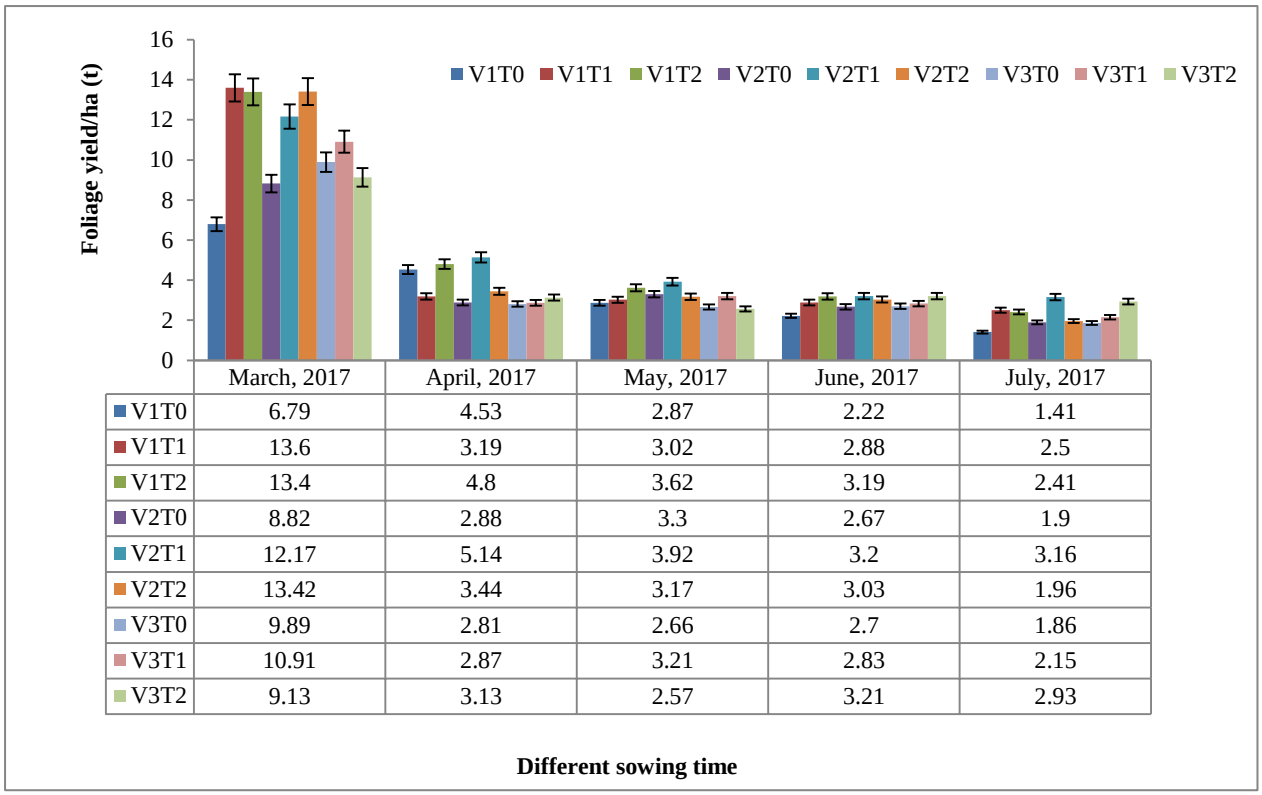
Treatments	Growth and leaf yield parameters					
	Plant height (cm)	**Number of leaves plant^{-1}**	**Fresh weight plant^{-1} (g)**	**Number of plants m^{-2}**	**Fresh weight of plants m^{-2} (g)**	**Brix index (leaf)**
V_1T_0	8.33 d	4.67 d	1.00 a	104.00 g	140.67 h	8.30 f
V_1T_1	9.00 bc	6.67 ab	1.17 a	236.33 b	250.00 c	10.93 b
V_1T_2	8.33 d	6.33 b	1.70 a	144.00 f	240.67 d	11.07 b
V_2T_0	9.00 bc	5.33 c	1.00 a	142.67 f	189.67 g	10.57 bc
V_2T_1	9.33 b	7.00 a	1.83 a	284.33 a	316.33 a	9.87 d
V_2T_2	7.67 e	5.33 c	1.20 a	176.67 d	196.33 f	11.73 a
V_3T_0	8.67 cd	5.33 c	1.73 a	149.33 e	185.67 g	8.10 f
V_3T_1	8.33 d	6.33 b	1.04 a	188.00 c	215.33 e	8.97 e
V_3T_2	10.33 a	7.33 a	1.40 a	282.00 a	292.67 b	10.00 cd
$LSD_{0.05}$	0.326	0.328	0.104	3.589	5.056	0.487
CV (%)	5.217	5.388	3.129	8.376	11.578	6.514

$V_1 \Rightarrow$ Green aroma, $V_2 \Rightarrow$ Green giant, $V_3 \Rightarrow$Indian variety
$T_0 \Rightarrow$ Control, $T_1 \Rightarrow$ Cowdung, $T_2 \Rightarrow$ Vermicompost
(Means with different letter denotes significant variation)

3.2. Leaf yield parameter

3.2.1. Comparative foliage yield (weight basis) study under different sowing date

Different treat combinations showed foliage yield variation in different months (Fig. 1). It was found that foliage yield performance for all treatment combinations was almost twice in March compared to other sowing time (Fig. 1). Foliage yield variation was observed among the treatment combinations of variety and organic manure. Results established that treatment combination of V_2T_1 gave better performance in respect of foliage yield at all sowing time with its best performance (12.17 t ha^{-1}) in March. In addition, it was the best performer for sowing time April (5.14 tha^{-1}), May (3.92 t ha^{-1}) and July (3.16 t ha^{-1}). It was also observed that in advancement of time yield was decreased gradually (Figure 1). These variations resulted from genotypic diversity as well as availability of nutrients in variable climatic conditions. The same results were obtained in a field experiment conducted by Chaulagain *et al*. (2013). They studied the green leaf production potential of coriander (*Coriandrum sativum* L.) cultivars. Ten cultivars of coriander were evaluated. Coriander Local, Marpha Local, Mallika, Surabhi and Kalmi Chhattedar showed better performance as compared to others on growth, yield and quality parameters. The highest green leaf yield (10.09 mt/ha) was recorded in Coriander Local followed by Mallika (9.54 mt/ha), Surabhi (9.40 mt/ha) and Kalmi Chhattedar (9.24 mt/ha). Surabhi was found promising cultivar under late sowing condition. They concluded that there is good scope of coriander cultivation for green leaf production, however, it is more suitable to sow the seeds in usual time of sowing for the better performance of all the cultivars.



	March, 2017	April, 2017	May, 2017	June, 2017	July, 2017
V1T0	6.79	4.53	2.87	2.22	1.41
V1T1	13.6	3.19	3.02	2.88	2.5
V1T2	13.4	4.8	3.62	3.19	2.41
V2T0	8.82	2.88	3.3	2.67	1.9
V2T1	12.17	5.14	3.92	3.2	3.16
V2T2	13.42	3.44	3.17	3.03	1.96
V3T0	9.89	2.81	2.66	2.7	1.86
V3T1	10.91	2.87	3.21	2.83	2.15
V3T2	9.13	3.13	2.57	3.21	2.93

Figure 1. Foliage yield comparison of different treatment combinations at different sowing date.

4. Conclusions

In conclusion, the results show that, organic farming of Coriander for leaf yield can be a good alternative for farmers during summer. March sown seeds were recorded the highest plant height, fresh weight of plants per m^{-2} and were found to produce the highest leaf yield. Considering varietal performance, the highest number of plants m^{-2} (1016.20) was found from Green aroma and highest fresh weight of plants m^{-2} (1146.67 g) was found from Green giant. Considering organic manure application, the highest number of plants m^{-2} (1015.89), and highest fresh weight of plants m^{-2} (1222.56 g) was found from Cowdung.

Conflict of interest

None to declare.

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