Effect of different locations and transplanting dates on the performance of lettuce var. Great Lakes under wet temperate region of Himachal Pradesh- INDIA

ABSTRACT

Lettuce is the topmost leafy salad vegetable grown in the world. Performance of lettuce varieties varies erratically under different sowing conditions. Recommendation of varieties should be given after evaluating them in a particular area first. Sowing time and climatic conditions affects the production and quality of the produce immensely. To study the effect of different locations and planting time an experiment was conducted at three different locations of Seraj valley of Mandi district, a wet temperate region of Himachal Pradesh, in year 2020. Experiment was laid out in RBD-factorial design using lettuce variety Great Lakes and locations and transplanting dates as two factors of the study. The experiment was carried out in three locations viz. village Bagsiad (L_1), Lambathach (L_2), Majakhal (L_3) and the crop was transplanted on three transplanting dates viz. 15th April (T_1), 30th April (T_2), 15th May (T_3). Observations were recorded for traits such as days to head initiation, number of non wrapper leaves, leaf length (cm), leaf width (cm), plant height (cm), head weight (g), yield per plot (kg) and yield per hectare (q). The performance of lettuce variety Great lakes was found significantly better over all the other treatments at village Lambathach when transplanted on 30th April.

Key Words: Lettuce, Locations, Production, Transplanting dates, Yield

INTRODUCTION

Lettuce (*Lactuca sativa* L.) is an annual leafy herb which belongs to the family compositae and is one of the most popular salad crops grown in the world. It is used in various kinds of foods, such as soups, sandwiches and wraps (Hernandez *et al*., 1992).

It is popular for its delicate, crispy texture and slightly bitter taste with milky juice. Consumption of lettuce has some health benefits attributed to the presence of vitamin C, phenolic compounds, and fiber content (Mulabagal *et al*., 2010). It has the largest production area among salad crops in the world (Karam et al., 2002). The plant is rich in minerals and vitamins with lots of fibers. Lettuce is a good source of vitamin A and potassium, as well as a minor source of several other

vitamins and nutrients (Duke et al., 2007). The butter head lettuce has considerable nutritional value. The 100 g of lettuce contains 2.2 g carbohydrates, 1.1g dietary fiber, 0.2 g fat, 1.4 g proteins, 96 g water, 16 µg vitamin A, 73 µg Folate (Vitamin B9), 4 mg Vitamin C and 1.2 mg Iron (Shamnugavelu, 1989). Lettuce is generally grown as a hardy annual; and is easily cultivated. It requires relatively low temperatures to prevent it from flowering quickly. In present-day China is the leading producer of lettuce in the World, followed by the USA. India ranks 3rd in commercial production of lettuce and chicory of 1129374.25 MT (FAO estimates 2021).

Sowing time is a major factor to influence the crop yields. Earlier sowing times usually result in greater crop biomass, higher risk of lodging at the end of the season and increased risk of frost damage during flowering and pod setting (Regan and Siddique, 2006). The optimum sowing time for maximizing yield varies with location (Brinsmead, 1992). Planting dates are an important factor to influence the quantity and quality of lettuce and its varieties behave differently for growth and yield when grown under diversified temperature regimes (Gong and Gong, 1998). The climatic condition of Seraj valley suits for production of lettuce during summer. Keeping in view, the significance of planting date to provide suitable growing condition for lettuce production an experiment was planned with three planting dates and three locations to find out the best planting time for specific location.

MATERIALS AND METHODS

Experimental Layout

The present research work was conducted to check the performance of lettuce variety “Great Lakes” at three different locations in seraj valley of mandi district with different planting dates in the year 2020. The experiment was laid out in RBD – factorial design with locations as one factor viz. village Bagsiad (L_1), Lambathach (L_2), Majhakhal (L_3) and transplanting dates as second factor viz. 15th April (T_1), 30th April (T_2), 15th May (T_3). The land was prepared by giving two ploughings to bring the soil to fine tilth. Well decomposed farm yard manure was mixed in the soil @ 100 quintal per hectare at the time of field preparation. After preparation of a land, raised beds were prepared. The seeds of lettuce variety Great lakes were sown in nursery beds one month prior to transplanting. Seedlings were transplanted in the main field at three sowing

dates viz 15th April 2020(T_1), 30th April 2020 (T_2), 15th May 2020 (T_3). The recommended dose of fertilizers viz. 135 kg urea (N), 250kg Super phosphate (P) and 65 kg muriate of potash (K) were applied to the crop. The whole quantity of P and K along with one third of N was applied at the time of sowing by mixing in the soil, while the remaining N was applied in two equal split doses; after one month of sowing and the second split at one month interval. One month old seedlings were transplanted in the raised beds at a spacing of 45 x 30 cm spacing. After transplanting the crop was irrigated immediately. In general, the experimental crop was irrigated at weekly interval. The lettuce experimental fields were kept clean and periodical manual weeding was performed. The crop was well monitored and cared from insect pest and diseases throughout the growing period of crop. Observations were recorded on days to head initiation, number of non wrapper leaves, leaf length (cm), leaf width (cm), plant height (cm), head weight (g), yield per plot (kg) and yield per hectare (q). The collected data were statistically analyzed using analysis of variance (ANOVA).

RESULTS AND DISCUSSION

Significant variations were observed for all the traits under study.

Days to head initiation

The effect of different locations on days to head initiation was non-significant. However, the effect of different transplanting dates was significant with maximum days to head initiation on first transplanting date i.e. on 15th March (59.15) and minimum (55.95) by transplanting on 15th May. Their interaction effect was again non-significant for this trait. Early sowing resulted in maximum days taken to head formation. This could be resulted due to prevalence of cold at the time of transplanting which resulted in slow vegetative growth at the initial stages. Similar observations were also reported by Steingrobe (1994) and Sharma *et al*. (2001).

Number of non-wrapper leaves

Different location, transplanting dates and their interactions had shown significant variation for this trait. Among different locations maximum number of non wrapper leaves (9.11) was observed in village Lambathach (L_2) and minimum in village Majakhal (L_3) (8.41).

Transplanting on 15th May (T_3) had shown production of lettuce with maximum number of non-wrapper leaves (8.92) whereas, planting on 15th March (T_1) had resulted minimum number of non wrapper leaves (8.59). Among their interaction treatment combination of second location i.e. Lambathach and third transplanting date i.e. 15th May (L_2T_3) had shown maximum value (9.36) for this trait. This could be contributed by suitable microclimate at village Lambathach which resulted in good vegetative growth. Earlier sowing leads to slow initial growth of the plants due to low temperature. Whereas, late sown crops encounter heavy rainfall during maturity period which aggravate diseases and pests incidence and ultimately lower down the yield and product quality. Similar results had been reported by Brinsmead (1992) and Regan and Siddique, 2006.

Leaf Length (cm)

Significant effect of transplanting dates and locations was seen for this trait. Maximum leaf length (14.56 cm) was observed at second location i.e., village Lambathach whereas, minimum (12.61 cm) at Village Majakhal (L_3). Transplanting on 30th April (T_2) had resulted in maximum leaf length (13.84 cm) whereas, transplanting on 15th April (T_1) had shown minimum value (12.95 cm) for leaf length. Among their interactions the treatment combination of second location i.e., village Lambathach and third date of transplanting i.e.15th May (L_2 x T_3) had shown maximum value for leaf length. Same genotype behaved differently in different locations and different time of sowing. These results are in conformity with Kaleri et al. 2016.

Leaf width (cm)

The effect of locations was non- significant for this trait. However, different dates of transplanting had posed significant effect on leaf width. Maximum leaf width was found in transplanting on 30th April (T_2) whereas, minimum on 15th April (T_1) transplanting. The treatment combination of second location i.e., village Lambathach and third date of transplanting i.e., 15th May (L_2 x T_3) had shown maximum value (17.22 cm) for leaf width. Availability of suitable climatic conditions favored good vegetative growth at this treatment combination.

Plant height (cm)

The effects of locations, date of transplanting as well as their interactions were found significant for plant height. Significant influence of transplanting date on plant height was also reported by Narzul and Zannat, 2020. Maximum plant height (16.56 cm) was achieved at location Lambathach (L_2) whereas, minimum (14.84 cm) at Majakhal (L_3). Treatment combination of

location Lambathach (L_2) and third date of transplanting i.e. 15th May (L_2 x T_3) had shown maximum (17.22 cm) plant height. Kaushal and Kumar 2010, Dolma *et al*. 2010 and Thakur *et al.* 2017 had also reported wide range of variation for plant height in lettuce.

Head weight (g)

The effect of locations as well as transplanting date was found to be significant for head weight. Maximum head weight (611.16g) was recorded at Lambathach (L_2) and minimum (541.83g) in Majakhal (L_3). Second transplanting date i.e. 30th April (T_2) had shown good performance in terms of head weight with a mean value (592.84g). The effect of location × transplanting date interactions was also found significant with maximum value of head weight (636.88g) in second location and second date of transplanting (L_2T_2). This may be due to the availability of favourable environmental conditions which favours good vegetative growth of lettuce. The optimum sowing time for getting higher yield varies with location (Brinsmead, 1992). Similar results have also been reported by Brinsmead (1992), Zani *et al.*, (1997), Zhao *et al.* (2000), Cheng et al. (2000). Wide range of variation for head weight in different genotypes of heading lettuce and yield had been reported by other workers in lettuce (Thakur *et al.*, 1997; Kaushal and Kumar 2010, Dolma *et al*. 2010 and Thakur et al. 2017). Kaleri *et al.* 2016 had reported that various sowing dates significantly affected all the important traits of the lettuce.

Yield per plot (kg)

The effect of different locations was found to be significant for yield per plot. Maximum yield of 12.22 kg/plot was observed at second location i.e. at village Lambathach whereas, minimum (10.84 kg/plot) at Majakhal. The effect of transplanting dates was also found to be significant with maximum yield per plot (11.86 kg) at second date of transplanting (T_2). Interaction between locations and transplanting dates was significant with maximum yield of 12.74kg in second location and second date of transplanting (L_2T_2) whereas minimum yield was observed in interaction L_3T_1 (10.63 kg). Steingrobe and Schenk 1994 and Kaleri *et al.* 2016 had also reported considerable variation for yield when sown on different dates.

Yield per hectare (quintals)

The effect of different locations, transplanting dates and interaction between them was found to be significant for yield per hectare. Maximum yield of 244.46 quintal/hectare was observed at second location whereas, minimum (216.73 quintal/hectare) in third location. Among the transplanting dates, maximum yield per plot (227.37q/ha) was observed on second date of

transplanting (T_2). Interaction between second location and second date of transplanting (L_2T_2) resulted in maximum yield of 254.75q/ha whereas, minimum yield was recorded in interaction L_3T_3 (210.25 q/ha). In the current study, all the investigated parameters of the lettuce were significantly influenced by various sowing dates and locations. The results of the present study are similar to the findings of Zani *et al*., (1997), Robert and Richard (2009), Zhao *et al.* (2000) which have also reported different responses to sowing dates. Cheng et al. (2000) reported that under moderate temperature, the growth of lettuce varieties was smoother and more yields were achieved as compared to those planted under lower and higher temperature regimes. The optimum sowing time for maximizing yield varies with location (Brinsmead, 1992).

In the current study, all the investigated parameters of the lettuce were significantly influenced by various sowing dates. The results of the present study are similar to the findings of Zani et al., (1997) who studied 84 lettuce cultivars under different planting dates in winter, summer and spring and response of varieties in all the seasons varied significantly for yield and resistance against biotic and abiotic factors. Robert and Richard (2009) examined the effect of sowing dates on the yield of new lettuce varieties and found that varieties Cirilla, Medaillon have the highest production of 0.84, 1.49 kg m-2 under early planting. Zhao et al. (2000) reported that different cultivars of lettuce show different responses to sowing dates. Cheng et al. (2000) studied the effect of planting date on fall lettuce cultivars in China and found that under moderate temperature, the growth of lettuce varieties was smoother and more yields were achieved as compared to those planted under lower and higher temperature regimes.

CONCLUSION

Based on the present study, it can be concluded that by transplanting on T_2 (30^{th} April) maximum number of non wrapper leaves, leaf length, leaf width, plant height, head weight and highest yield per plot as well as per hectare was recorded at village Lambathach followed by village Bagsiad and Village Majakhal indicating suitability of this transplanting dates for lettuce cultivation in these areas. Highest yield of was observed at second location i.e. at village Lambathach with second transplanting date i.e. on 30^{th} April whereas minimum yield of q/ha was observed at village Majakhal (L_3) with third date of transplanting i.e. on 15^{th} May. Therefore from this study it can be concluded that significantly different performance of a variety can be achieved by planting at different locations and time.

Table 1 Effect of location, transplanting date and their interactionson different horticultural traits of Lettuce var. Great Lakes

Factors	Treatments	Days to head initiation	Number of non wrapper leaves	Leaf Length (cm)	Leaf width (cm)
Location	Bagsiad (L_1)	56.85	8.66	13.30	15.34
	Lambathach (L_2)	53.90	9.11	14.56	16.45
	Majakhal (L_3)	61.11	8.41	12.61	14.46
$CD_{(0.05)}$		NS	0.09	0.33	NS
Transplanting dates	15^{th} April (T_1)	59.15	8.59	12.95	14.77
	30^{th} April (T_2)	56.77	8.67	13.84	15.80
	15^{th} May (T_3)	55.95	8.92	13.68	15.67
$CD_{(0.05)}$		0.88	0.09	0.33	0.40
Location* Transplanting date	L_1T_1	57.78	8.61	13.16	15.23
	L_1T_2	56.63	8.66	13.42	15.46
	L_1T_3	56.15	8.73	13.30	15.33
	L_2T_1	56.00	8.85	13.71	15.38
	L_2T_2	52.56	9.11	14.74	16.74
	L_2T_3	53.15	9.36	15.22	17.22
	L_3T_1	63.67	8.31	11.96	13.71
	L_3T_2	61.11	8.25	13.37	15.21
	L_3T_3	58.56	8.68	12.51	14.47
$CD_{(0.05)}$		NS	0.16	0.57	0.69

Table 2 Effect of location, transplanting date and their interaction on different horticultural traits and yieldof Lettuce var. Great Lakes

Factors	Treatments	Plant height	Head Weight	Yield per plot (kg)	Yield per hectare (q)

		(cm)			
Location	Bagsiad (L_1)	15.34	567.10	11.34	226.84
	Lambathach (L_2)	16.56	611.16	12.22	244.46
	Majakhal (L_3)	14.84	541.83	10.84	216.73
$CD_{(0.05)}$		0.19	9.44	0.19	3.75
Transplanting dates	15^{th} April (T_1)	15.19	559.54	11.19	223.81
	30^{th} April (T_2)	15.86	592.84	11.86	237.14
	15^{th} May (T_3)	15.69	567.71	11.35	227.08
$CD_{(0.05)}$		0.19	9.44	0.19	3.75
Location* Transplanting date	L_1T_1	15.23	561.69	11.23	224.68
	L_1T_2	15.46	573.24	11.46	229.30
	L_1T_3	15.33	566.37	11.33	226.55
	L_2T_1	15.71	585.47	11.71	234.19
	L_2T_2	16.74	636.88	12.74	254.75
	L_2T_3	17.22	611.12	12.22	244.45
	L_3T_1	14.63	531.45	10.63	212.58
	L_3T_2	15.37	568.42	11.37	227.37
	L_3T_3	14.51	525.63	10.51	210.25
$CD_{(0.05)}$		0.33	16.34	0.32	6.53

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