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Comparative Performance of Cherry Tomato and Lettuce Genotypes Under Different Protected Structures in Low-Hills of Himachal Pradesh

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ABSTRACT
The present investigation was carried out to assess the performance of different genotypes of cherry tomato and lettuce under different protected structures at Regional Horticultural Research and Training Station, Jachh, Kangraof Dr. YS Parmar UHF, Nauni, H.P. Five genotypes each of cherry tomato (Solan Red Round, Red Beauty, Tuptim Rache, Laila and Roja) and lettuce (Baiyoke, Lolla Rosa, Romaine, Garishma and Iceberg) were planted in naturally ventilated polyhouse and net house during Kharif 2016 and Rabi 2016, respectively. Experimental results revealed that mean performance of different genotypes of cherry tomato and lettuce for different yield and its contributing traits was better in nethouse conditions as compared to naturally ventilated polyhouse. Among all the genotypes under study, cherry tomato 'Red Beauty' and Lettuce genotype 'Romaine' recorded highest yield both under nethouse(16.18 kg m^{-2} and 2.90 kg m^{-2}, respectively) and polyhouse (14.34 kg m^{-2} and 2.13 kg m^{-2}, respectively) conditions. Hence, these genotypes can be recommended for commercial cultivation under naturally ventilated polyhouse and nethousein low-hills of Himachal Pradesh.
Keywords: *Cherry tomato, Lettuce, Polyhouse, Nethouse, Genotypes*

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INTRODUCTION

After the advent of green revolution in India, more emphasis has been laid on both the quantity and quality of the agricultural produce to meet out the ever-growing food and nutritional requirements[1]. This can be met when the environment for the plant growth is suitably controlled. The need to protect the crops against unfavourable environmental conditions led to the development of protected agriculture. Protected cultivation under different types of structures protects the crops from severe winters and extends cultivation period for off-season crop production. It also ensures high quality produce and more production per unit area with increased input use efficiency. Besides this, protected cultivation of vegetables for domestic and export purposes could be a more efficient alternative for land use and other resources [2]. However, profitability in protected cultivation mainly depends upon the choice of protected structure, selection of crop and varieties, production technology and market price [3].

Protected cultivation has expanded nowadays to improve agricultural productivity and with the advancement in horticulture, various types of protected cultivation practices suitable for a specific type of agro-climatic zone of India have emerged[4]. Green house, polyhouse, shade nethouse and low tunnels are the different types of protected cultivation structures commonly adopted by the Indian farmers [5]. Among these protected structures, naturally ventilated polyhouse and nethouse are very useful for mid- and low-hill conditions of Himachal Pradesh and have good economics as compared to High-tech polyhouses. Therefore, in the present scenario of continuous demand for vegetables and drastically shrinking land holdings, protected cultivation of high value exotic vegetables for domestic as well as export purposes is the best alternative for using land and other resources more efficiently[6].Cherry

tomato (*Solanum lycopersicum* L. var.*cerasiforme*)and (*Lactuca sativa* L.) are considered as important exotic vegetables. In order to ensure high quality produce with enhanced productivity, these exotic vegetables can be grown under protected conditions[7]. Several varieties/hybrids of cherry tomato and lettuce are available in the market. However, a very few reports are available on evaluation of different varieties/hybrids of cherry tomato and lettuce under protected conditions. Therefore, scantiness of research on identification of suitable varieties/hybrids of cherry tomato and lettuce for protected cultivation motivated us to undertake this study.

MATERIALS AND METHODS

The present investigation was carried out to assess the performance of different genotypes of cherry tomato and lettuce under different protected structures at Regional Horticultural Research and Training Station, Jachh, Kangra of Dr. YS Parmar UHF, Nauni, Solan during *Kharif* 2016 and *Rabi* 2016, respectively. Five genotypes each of cherry tomato (Solan Red Round, Red Beauty, TuptimRache, Laila and Roja) and lettuce (Baiyoke, Lolla Rosa, Romaine, Garishma and Iceberg) were planted in naturally ventilated polyhouse and nethouse in randomized complete block design at a spacing of 45 × 30 cm, accommodating six plants per plot. The standard cultural practices for raising a healthy crop of cherry tomato and lettuce as recommended in the "Package of Practices" for Vegetable Crops, published by the Directorate of Extension Education, Dr. YS Parmar UHF, Nauni, Solan have been followed during entire period of investigation [8]. The observation were recorded on different horticultural traits of cherry tomato (table 1 and 2) and lettuce (table 3 and 4) and data so obtained were subjected to analysis of variance in OPSTAT softwareby using the formulae given by Panse and Sukhatme[9].

RESULTS AND DISCUSSION

Performance of cherry tomato genotypes under naturally ventilated polyhouse and nethouse conditions

Significant differences among different genotypes of cherry tomato under naturally ventilated polyhouse were recorded for all the traitsunder study except for fruit length, fruit breadth and average fruit weight (Table 1). Among all the genotypes, highest plant height was recorded in the genotype Laila and it was found statistically at par with Roja and Red Beauty, while minimum plant height was observed in TuptimRache. The genotype Roja followed by Laila took minimum days to first flowering and first harvest, while maximum days were recorded in Solan Red Round. The maximum fruit length, fruit breadth and average fruit weight was reported in the genotype Solan Red Round, however results were found non-significant. While, number of flower clusters/plant, number of fruits/clusters and number of fruits/plant were recorded maximum in the genotype Red Beauty followed by Laila. Yield/plant and yield/m^2 was found highest in the genotype Red Beauty, which was found statistically at par with Laila and Solan Red Round, while minimum yield was observed in TuptimRache. Dunsin *et al.*[10] had also reported considerable variations for number of fruits and average fruit weight in five cherry tomato genotypes, while Kanwar [11] found significant variations for different yield and its attributing traits in tomato grown under naturally ventilated polyhouse.

Under nethouse conditions, significant differences were observed among different genotypes of cherry tomato for all the traits under study except for fruit length and fruit breadth (Table 2).The highest plant height was recorded in the genotype Laila and it was found statistically at par with Roja and Red Beauty, while minimum plant height was observed in TuptimRache. The genotype Roja followed by Laila took minimum days to first flowering and first harvest, while maximum days were recorded in Solan Red Round. The maximum fruit length and fruit breadth was reported in the genotype Solan Red Round, however results were found non-significant. Average fruit weight was recorded maximum in the genotype Solan Red Round and it was found statistically at par with the genotype Red Beauty, while minimum fruit weight was observed in the genotype TuptimRache. The number of flower clusters/plant were observed maximum in the genotype Red Beauty followed by Roja and Laila. In the mean while, number of fruits/clusters and number of fruits/plant were recorded statistically maximum in the genotype Red Beauty, while minimum values were observed in the genotype TuptimRache. Yield/plant and yield/m^2 was found highest in the genotype Red Beauty, which was found statistically at par with Solan Red Round and Laila, while minimum yield was observed in TuptimRache. Wide variations for yield and its attributing traits in cherry tomato grown under shade nethouse have also been reported earlier by Mantur *et al.[*7], Prasad [12] and Ramya et al.[13].

It is evident from the results that mean performance of cherry tomato genotypes under nethouse conditions was found better in comparison to naturally ventilated polyhouse for different traits under study. Further, the genotype Red Beauty was found most promising under both protected structures.

Therefore, cultivation of cherry tomato genotype Red Beauty can be recommended for protected cultivation in low-hill areas of Himachal Pradesh.

Performance of lettuce genotypes under naturally ventilated polyhouse and nethouse conditions

Under naturally ventilated polyhouse conditions, significant differences were observed among different genotypes of lettuce for all the traits under study (Table 3). Minimum days to first picking were recorded in the genotype Garishma followed by Iceberg, while maximum days to first picking were taken by the genotype Baiyoke. Number of leaves/plant were observed maximum in the genotype Romaine, which was found statistically at par with the genotype Iceberg and Lolla Rosa. In the meanwhile, genotype Romaine was found statistically superior than rest of others for plant height, leaf length, leaf breadth, leaf weight, leaf yield/plant and Leaf yield/m^2 and minimum performance for above said traits was observed in the genotype Garishma.Thakur *et al*.[14] and Kumar *et al*. [15] evaluated different genotypes of lettuce under naturally ventilated polyhouse and recorded wide variations for different horticultural traits under study.

The significant differences among different genotypes of lettuce under nethouse conditions were recorded for all the traits under study (Table 4). Among all genotypes, minimum days to first picking were recorded in the genotype Garishma, while maximum were observed in the genotype Baiyoke. Number of leaves/plant were observed statistically maximum in the genotype Romaine, while minimum were recorded in the genotype Baiyoke. In line with polyhouse conditions, again the genotype Romaine was found statistically superior than rest of others for plant height, leaf length, leaf breadth, leaf weight, leaf yield/plant and Leaf yield/m^2 and minimum performance for above said traits was observed in the genotype Garishma. Till date, no information is available in the literature pertaining to evaluation of lettuce genotypes under nethouse conditions.

In general mean performance of lettuce genotypes under nethouse conditions was found better than in naturally ventilated polyhouse for different traits under study. Further, the genotype Romaine performed outstanding both under polyhouse and nethouse conditions. Hence, cultivation of lettuce genotype Romaine can be recommended for protected cultivation in low-hill areas of Himachal Pradesh.

Table 1.Mean performance of different genotypes of cherry tomato for different horticultural traits under naturally ventilated polyhouse.

Trait/ Genotype	Plant height (cm)	Days to first flowering	Days to first harvest	Number of flower clusters /plant	Number of fruits/clusters	Number of fruits/plant	Fruit length (cm)	Fruit breadth (cm)	Average fruit weight (g)	Yield/plant (kg)	Yield/m^2 (kg)
Solan Red Round	161.83	38.67	83.00	21.67	5.43	118.10	3.57	3.40	16.20	1.91	11.49
Red Beauty	171.37	36.33	81.00	24.00	6.63	159.27	3.47	3.27	14.90	2.39	14.34
Tuptim Rache	151.33	37.00	79.67	17.33	5.00	86.57	3.10	3.03	12.40	1.07	6.42
Laila	174.67	33.67	76.67	23.00	6.17	141.73	3.37	3.13	14.10	2.00	12.00
Roja	172.33	32.00	75.33	23.33	5.57	129.87	3.17	3.03	12.67	1.64	9.85
C.D. (p=0.05)	6.49	2.79	2.44	2.29	0.55	20.81	NS	NS	NS	0.62	3.72
C.V. (%)	2.04	4.11	1.62	5.48	5.00	8.56	6.41	5.19	11.19	17.93	17.99

Table 2.Mean performance of different genotypes of cherry tomato for different horticultural traits under nethouse conditions.

Trait/ Genotype	Plant height (cm)	Days to first flowering	Days to first harvest	Number of flower clusters /plant	Number of fruits/clusters	Number of fruits/plant	Fruit length (cm)	Fruit breadth (cm)	Average fruit weight (g)	Yield/plant (kg)	Yield/m^2 (kg)
Solan Red Round	165.17	37.00	82.33	22.33	5.63	125.83	3.77	3.60	18.00	2.28	13.68
Red Beauty	176.20	35.00	79.00	24.67	6.90	170.03	3.53	3.40	15.87	2.70	16.18
TuptimRache	155.50	34.33	78.00	18.00	5.10	91.87	3.27	3.10	13.33	1.23	7.35
Laila	179.33	32.00	76.33	23.67	6.23	147.27	3.57	3.20	15.20	2.24	13.44
Roja	177.67	31.00	75.00	24.00	5.67	135.80	3.33	3.17	13.90	1.89	11.32
C.D. (p=0.05)	7.26	3.18	2.67	1.64	0.55	13.25	NS	NS	2.79	0.53	3.17
C.V. (%)	2.22	4.91	1.79	3.80	4.90	5.17	5.87	6.42	9.56	13.42	13.37

Table 3.Mean performance of different genotypes of lettuce for different horticultural traits under naturally ventilated polyhouse.

Trait/ Genotype	Days to first picking	Plant height (cm)	Leaf length (cm)	Leaf breadth (cm)	Leaf weight (g)	Number of leaves/plant	Leaf yield/plant (g)	Leaf yield/m^2 (kg)
Baiyoke	65.67	14.47	12.73	11.53	7.03	24.00	167.97	1.01
Lolla Rosa	64.33	14.43	12.97	11.73	7.23	27.67	200.67	1.17
Romaine	63.00	17.50	16.27	15.23	11.80	30.33	357.23	2.13
Garishma	56.33	14.17	12.60	11.37	6.80	25.67	175.17	1.03
Iceberg	58.00	14.57	12.90	11.67	7.17	29.33	209.93	1.27
$C.D._{(p=0.05)}$	2.33	1.71	1.21	1.01	1.36	2.73	27.68	0.19
C.V. (%)	1.98	5.95	4.69	4.30	8.89	5.20	6.52	7.35

Table 4.Mean performance of different genotypes of lettuce for different horticultural traits under nethouse conditions.

Trait/ Genotype	Days to first picking	Plant height (cm)	Leaf length (cm)	Leaf breadth (cm)	Leaf weight (g)	Number of leaves/plant	Leaf yield/plant (g)	Leaf yield/m^2 (kg)
Baiyoke	63.33	16.10	14.37	13.17	9.00	25.67	231.50	1.40
Lolla Rosa	62.00	16.00	14.63	13.40	9.33	29.33	273.87	1.63
Romaine	61.00	19.07	18.07	16.87	14.50	33.00	478.60	2.90
Garishma	54.00	15.77	14.20	12.97	8.77	27.67	242.50	1.47
Iceberg	55.67	16.10	14.37	13.13	9.00	32.00	287.37	1.70
$C.D._{(p=0.05)}$	1.62	1.49	0.87	0.78	1.17	1.80	22.46	0.14
C.V. (%)	1.43	4.68	3.00	2.93	6.06	3.18	3.88	4.14

CONFLICT OF INTEREST

No potential conflict of interest was declared by authors.

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