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Early Season Cultivation of Bottle Gourd: Effect of Dates of Sowing and Growing Conditions on different Growth Parameters

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ABSTRACT: *The research work was conducted at the research farm and laboratory of Department of Vegetable Science, CCS Haryana Agricultural University, Hisar during 2011-12. The experiment was laid out in split plot design replicated thrice with five different date of sowing as main plot treatments and three different growing conditions as sub-plot treatments, thus making a total of fifteen treatment combination. From the various parameters recorded percent establishment of seedlings at 30 days of sowing, vine length (cm) at 30, 45, 60 & 75 days after sowing and at final harvest, primary branches per plant, fruit length (cm), fruit diameter (cm) & fruit weight (g) were maximum with 15th December date of sowing (D_1) and direct seed sowing under poly-tunnel (M_2) growing condition* i.e. D_1M_2. *While, number of days taken to first harvest was minimum with 15th February date of sowing (D_5) and direct seed sowing under poly-tunnel (M_2) growing condition* i.e. D_5M_2. *So, it was concluded that to get good crop establishment & growth, quality fruit production and to get earliest season yield to capture the high market value in offseason, the crop should be sown on 15th December (D_1) with direct seed sowing under poly-tunnel (M_2) planting methods* i.e. D_1M_2.

Keywords: *early yield, offseason, planting methods, poly-tunnel*

INTRODUCTION

Cucurbits form one of the largest and most important group among vegetable crops grown throughout the world. Among the various cucurbitaceous vegetable crops, bottle gourd [*Lagenaria siceraria* (Mol.) Standl] is commonly known as *Ghia* or *Lauki* has emerged as highly profitable crop due to its high yield potential, fresh consumption and steady market prices throughout the season/year. In India, bottle gourd is extensively grown in tropical and subtropical areas in open as spring summer and rainy season crop. The fruits remain available from April to November, thus causing glut in the market, which leads to price crash in the main season. By modifying microclimate, which helps to raise the cucurbits in the early summer, the availability span of bottle gourd can be increased. Among the various forcing techniques green house, poly house and net house are quite popular in western countries, however, these structures are costlier and unaffordable by the small and marginal farmers.

An alternative method is the low-tunnel / poly-tunnel technology, which protects the plants against low temperature and captures the market in early season to get good return of crop produce. Another advantage of this technology is that poly-tunnels can be easily erected and also dismantled to utilize in the subsequent years.

Low tunnels are miniature structures, which usually are 1m in width and 0.5 m in height, though it may vary depending upon nature of growth of the plants. They are used for raising seedlings by modifying the microclimate [Ken-bar (1)]. The shape of frame of low tunnel may vary but the farmer cannot work inside the low tunnels. These tunnels facilitate increase in temperature and entrapment of carbon dioxide, thereby enhancing the photosynthetic activity of the plants and hence the yield. They create a favourable microclimate around the crops by providing frost and pest protection and reducing moisture loss [Butler and Ross (2)]. These structures also protect the plants from high winds, rain, frost and snow. Low tunnels are being used for producing good quality crops such as tomato, cucurbits and capsicum. They are used in early spring to help

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seedlings to get a good start and warm the atmosphere around the plant. Although these covers allow air circulation yet it is advisable to remove the covers in warm weather.

Thus keeping in view the above aspects and to find out the best date of sowing and growing condition to get good crop establishment and growth, quality fruit production and to get earliest season yield to capture the high market prices in offseason, this experiment was planned and conducted at Vegetable Research Farm of CCS Haryana Agricultural University, Hisar during December, 2011 to June, 2012.

MATERIAL AND METHODS

The experiment was carried out at Vegetable Research Farm, Department of Vegetable Science, CCS Haryana Agricultural University, Hisar during 2011-2012. Hisar is situated at the latitude of 29°.10¢ N, longitude of 75°.46¢ E and at a mean altitude of 215.2 meters above sea level. This place is characterized by hot and dry summer (April to June) followed by a hot and humid monsoon period and cold winters during December-January. The weekly soil temperature data of bottle gourd crop growing period are shown here as under.

Table 1
Weekly mean soil temperature under poly-tunnel, straw mulch & open field from December 2011 to February-2012

Weekly period	*Mean soil temperature (^{0}C)*					
	Under poly-tunnel		*Under straw mulch*		*Open field*	
	Min.	*Max.*	*Min.*	*Max.*	*Min.*	*Max.*
15 - 21 Dec.2011	13.5	29.0	8.3	14.0	7.4	13.8
22 - 28 Dec.2011	12.2	27.8	6.4	13.2	5.2	12.8
29 Dec. 2011 - 4 Jan.2012	11.9	26.2	7.2	12.8	6.7	12.2
05 - 11 Jan.2012	12.2	25.8	8.0	11.9	6.2	10.4
12 - 18 Jan.2012	12.0	24.2	7.4	12.8	5.7	12.6
19 - 25 Jan.2012	11.8	22.8	6.5	12.5	4.4	13.0
26 Jan. - 1 Feb.2012	12.2	26.4	6.4	15.4	4.5	14.5
02 - 08 Feb.2012	15.0	28.2	8.0	16.7	6.8	15.9
09 - 15 Feb.2012	14.2	27.6	10.8	16.9	7.9	16.0
16 - 22 Feb.2012	15.2	28.5	12.9	20.2	8.9	19.1

Soil analysis revealed that the soil of the experimental field was sandy loam in texture, non-saline (pH=8.18), medium in organic carbon content (0.44%), low in available nitrogen (140 kg/ha), high in available phosphorus (21.0 kg/ha) and rich in potassium content (486.0 kg/ha).

The experiment was laid out according to Split Plot Design and replicated thrice with five different dates of sowing as main plot treatments *i.e.* 15th December (D_1), 30th December (D_2), 15th January (D_3), 30th January (D_4) & 15th February (D_5) and three different growing conditions as sub-plot treatments *i.e.* direct seed sowing under straw mulch (M_1), direct seed sowing under poly-tunnel (M_2) & transplanting of seedlings under poly-tunnel (M_3) in a plot size of 4.2 m × 2.0 m = 8.4 m^2 for each replication. A spacing of 1.5 m × 60 cm was maintained between line to line and plant to plant.

Seedlings were raised by sowing seeds in plastic pro-trays which were filled with growing media prepared by mixing coco peat: vermiculite: perlite in the ratio of 3:1:1. The seed sowing date for raising seedling in pro-trays for planting method M_3 was same as for the seed sown in field for planting methods M_1 and M_2.

Crop was sown in the field at five different planting dates from 15th December, 2011 to 15th February, 2012. Each date of sowing involved all the three growing methods [(1) Direct seed sowing in open field under straw mulch, (2) Direct seed sowing in field under poly-tunnel and (3) Transplanting of seedlings in field under poly-tunnel]. Sowing was done only on single side of the seed beds maintaining plant to plant spacing of 60 cm. The crop was protected against cold with low tunnels and straw mulch. These were removed when chance/ expectation of frost was over. For low tunnel, thick iron wire semi loops were pegged on both sides of water channel, covering the sowing pits of two beds and thereafter these iron wire structures were covered with semitransparent 100 gauge thick white plastic sheet. All the other cultural practices were carried as per package of practices during the growth period of the crop.

Five plants were randomly selected in each treatment for recording various plant growth

parameters in each replication. Mean values of different characters were used for statistical analysis. Various observations recorded were percent establishment of seedlings at 30 days after sowing, vine length (cm) at 30, 45, 60 and 75 days after sowing & at final harvest, number of primary branches per plant, days taken to first harvest, length of fruit (cm), diameter of fruit (cm) and weight of fruit (g).

The primary branches per plant are the total number of fruiting branches emerging from the main stem was counted at the time of last picking. The fruits selected for recording fruit length were used for measuring fruit diameter as well. The fruit diameter in centimeters was measured at middle periphery of fruit with the help of Verneer Calipers.

The analysis of variance was performed following the standard method suggested by Rao (2007). The significance of treatment differences was tested at 5% levels of probability.

RESULTS

Data presented in Table1 indicates that percent establishment of seedlings at 30 days of sowing, vine length (cm) at 30, 45, 60 and 75 days after sowing & at final harvest, days taken to first harvest and fruit length (cm) were significantly influenced by both dates of sowing and growing conditions. However, numbers of primary branches were significantly influenced by growing conditions but were found to be non-significant with dates of sowing. While, diameter of fruit (cm) and weight of fruit (g) were significantly influenced by dates of sowing but were non-significant with growing conditions.

It is revealed from the data recorded for various observations that percent establishment of seedlings at 30 days of sowing, vine length (cm) at 30, 45, 60 and 75 days after sowing and at final harvest, number of primary branches per plant, fruit length (cm), fruit diameter (cm) and fruit weight (g) were maximum with 15th December date of sowing (D_1) and direct seed sowing under poly-tunnel (M_2) growing condition *i.e.* D_1M_2. While, number of days taken to first harvest was minimum with 15th February date of sowing (D_5) and direct seed sowing under poly-tunnel (M_2) growing condition *i.e.* D_5M_2.

DISCUSSION

In view of the literature information available, the result presented in the previous tables is discussed here as under. In the present investigation among the various sowing dates maximum plant establishment percentage was recorded when the sowing was done either on 15th December (D_1) or 30th December (D_2). In later dates of sowing the seedling establishment decreased. It is clear from the table that seed germination and survival percentage of seedling sown under poly-tunnel (M_2) was observed maximum, and there was no germination in M_1 due to low temperature and also seedling establishment of transplanted seedling in M_3 was inadequate due to poor establishment of tap root system. Vine length was significantly influenced by dates of sowing and planting methods at all the stages of plant growth. The vine length decreased as the sowing was delayed. Similar findings were also reported by Waterer [3] confirmed that early growth and fruit yield were highest in row covers with black polyethylene mulch followed by row covers alone. The crop with black plastic soil mulch alone was slow to develop and most fruit failed to mature before first frost. Early planting increased fruit yield when row covers were used. Nair and Ngouajio [4] in cucumber also observed increased vine length and plant growth under row covers.

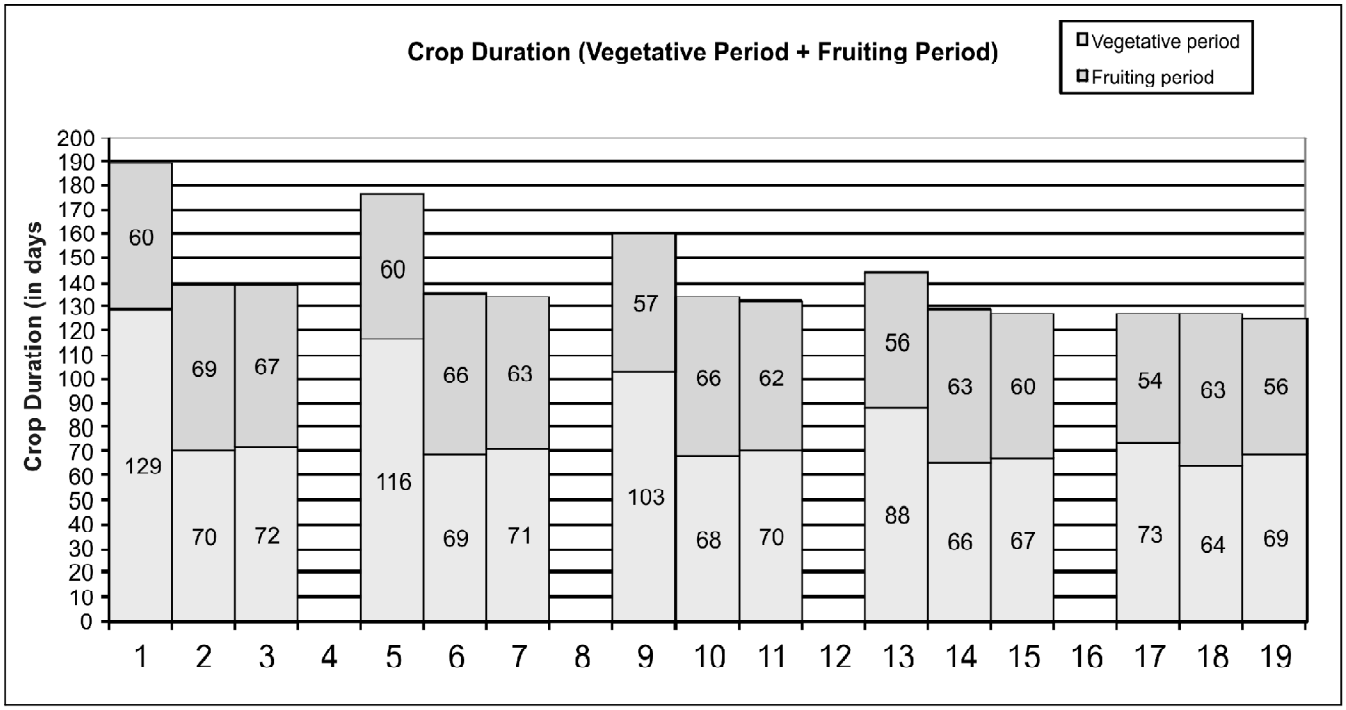
There were significant differences in the number of branches per vine due to planting methods. Maximum numbers of primary branches were observed when the seeds were directly sown under the poly-tunnel (M_2). This might be due to the presence of favourable soil and air temperature leading to better establishment of seedling of directly sown seed. However, no significant differences in number of primary branches per plant occurred due to different sowing dates. Non-significant effects of dates of planting had also been recorded in sweet pepper and hot pepper by Kaur [5].

Days taken to first harvest were significantly influenced by the sowing dates and growing methods. Minimum number of days taken to first harvest was observed when the sowing was done on 15th February (D_5). Although, delay in planting led to early flowering and harvesting, because the crop had reached the conducive climatic conditions and consequently the increased temperature at that time led to early flowering and fruiting. Direct seed sown crop under poly-tunnel (M_2) took lesser days for first harvest as compared to transplanting method when the crop was grown under poly-tunnel. In a similar study conducted Ibarra *et al.* [6] observed that muskmelon crop grown under plastic covers flowered 24 days earlier than uncovered plants.

Length and diameter of fruit significantly decreased with later date of sowing. This is similar to results reported by Randhawa and Singh [7] in bottle gourd. Fruit length was significantly increased in

Table 2
Effect of sowing time and growing conditions on growth and yield attributing parameters of bottle gourd

Treatment		*Percent establishment at 30 days after sowing*	*Vine length (cm) at 30 days after sowing*	*Vine length (cm) at 45 days after sowing*	*Vine length (cm) at 60 days after sowing*	*Vine length (cm) at 75 days after sowing*	*Vine length (cm) at final harvest*	*Number of primary branches per plant*	*Days taken to first harvest*	*Length of fruit (cm)*	*Diameter of fruit (cm)*	*Weight of fruit (g)*
Sowing dates												
D_1	15th December	97.61	16.50	44.09	99.30	176.33	430.94	8.19	70.92	29.05	8.14	763.17
D_2	30th December	97.61	14.83	39.88	96.17	166.79	417.50	7.72	70.13	28.00	7.78	758.03
D_3	15th January	92.85	13.50	38.00	88.88	159.79	406.25	7.61	68.83	26.50	7.33	753.70
D_4	30th January	92.85	12.34	34.96	83.13	154.29	400.97	7.31	66.67	25.25	7.19	746.63
D_5	15th February	88.09	11.50	32.42	77.96	147.71	395.14	7.14	63.63	24.11	7.20	742.63
C.D. (P=0.05)		4.90	1.13	2.49	4.98	6.23	14.16	N.S.	2.24	2.34	0.58	11.32
Growing conditions												
M_1	*Direct seed sowing under straw mulch*	*No germination*	*No germination*	*No germination*	*No germination*	*No germination*	*363.78*	*6.78*	*No germination*	*25.42*	*7.23*	*747.86*
M_2	Direct seed sowing under poly-tunnel	96.18	14.97	41.14	93.00	172.27	461.32	8.23	66.82	27.57	7.70	756.80
M_3	Transplanting of seedlings under poly-tunnel	91.42	12.50	34.60	85.17	149.70	405.38	7.77	69.25	26.77	7.65	753.84



direct seed sown crop under poly-tunnel ($M_{2)}$ growing method, however, fruit diameter showed a non-significant increase in this respect. Increased fruit length may be due to presence of a healthy and vigorous crop in M_2 method, which bears healthy and marketable size fruit.

Weight of fruit significantly decreased with later date of sowing. It might be due to better development of vines with early planting, which increased the net photosynthesis and production of more assimilates available for individual to grow. The differences in average fruit weight due to planting method were non-significant, however, maximum average fruit weight (756.80 g) was observed in M_2. Similar results were also given by Singh *et al*. [8] in case of summer squash.

CONCLUSION

The present study indicated that under the agro-climatic conditions of Hisar, for getting good crop establishment and growth, quality fruit production and to get earliest season yield to capture the high market prices in offseason, in case of bottle gourd variety GH-22, the 15th December date of sowing (D_1) and direct seed sowing under poly-tunnel (M_2) planting method was more economical.

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