Management practices of growers using plastic low tunnel on flowering and fruiting behaviour of bitter gourd (Momordica charantia L.) during off season

Satish Kumar, Sardar Sunil Singh and Alok Kumar

Abstract

Bitter gourd is an important vegetable crop of the world. A trial was conducted during 2009-10 and 2010-11 to study the effect of low tunnel on flowering and fruiting behaviour during off season of bitter gourd var. Arka Harit at farm of Bihar Agricultural College Sabour Bhagalpur. The experiment was laid in randomized block design with seven treatments in three replications. The treatments comprised the seven date of sowing i.e., 30th November under open field, 15th December under open field, 30th December under tunnel, 15th January under tunnel, 30th January under tunnel, 15th February under open field and 28th February under open field. Result was found to be significant in flowering and fruiting behaviour during off season of bottle gourd. Number of days taken to first female flower appearance (53.50 days), and first harvest of fruit (61.00days) were minimum while, fruit length(12.70 cm) , fruit girth(7.32 cm), fruits/plant(13.50) and yield per hectare 1.260 (quintal) were maximum when the date of sowing was 30th December under low tunnel condition (T3). Time has come to force early flowering in off season to for getting premium price in market.

Keywords: Low tunnel, flowering behaviour, Fruiting behaviour, date of sowing

Introduction

Bitter gourd is an important vegetable crop which has many medicinal properties. It is antidiotal, antilypolytic, hypogenic, antipyretic tonic, appetizing, stomachic and antibilious and it shows purgative, anti-inflammatory, antiflatulent and has healing capacity (Kumar and Sager 2003) [9]. However it is availing during April to October at lower rate. So grower does not get fetch price. Low tunnel technology has attracted considerable research interest due to forcing on earlier flowering and fruiting. So grower get fetch price if produces dispose in market. Being a warm season crop it is grown successfully in tropical and subtropical areas in open as spring summer, summer and rainy season crop. For more than a decade, off season vegetable cultivation has gained both popularity and attention and among vegetable grower of the world. India has also entered in the era of greenhouse vegetable cultivation more recently and the total areas under protected vegetable production is not more than 10000 hectares. India being a vast country with diverse and extreme agro-climatic conditions, the protected vegetable cultivation technology can be utilized for year round and off season production of high value low volume vegetable crops (parthenocarpic cucumber, muskmelon capsicum etc.), production of virus free high quality seedlings, quality hybrid seed production and as a tool for disease resistance breeding programmes. Among the protected structure plastic low tunnel is a cheap and better way for off-season cultivation of cucurbits production. Plastic house cater to winter production of vegetable. The vast majority of the houses are covered with plastic polyvinyl chloride or polyethylene sheet usually called polytunnel. Plastics tunnel has spread in recent years because it prevents frost damage during flowering and fruiting stage.

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Temperature and relative humidity play an important role in leaf stomatal conductance (g,), and therefore in the transpiration rate and photosynthesis of the plant (Righi et al., 2012). Polyethylene film that are commonly used to cover greenhouse or tunnel can reduce transmission of photosynthetically active radiation (PAR) between 20% and 30% compared to radiation under unprotected conditions (Cowen et al., 2014). It has been found that a decreases in PAR availability may have negative effects on crop production under plastic because it decreases photosynthetic rate, which in turn affects yield and quality (Sandri et al., 2003). Low Tunnel can warm the soil and protect the plants from hail, cold wind, and injury and advance the crops than normal season because temperature goes below 8 °C for 30-40 days during winter season in plain of north India. The fruits remain available from April to November thus causing glut in market, which lead to price crash in the main season (Kumar et al., 2015). But the price of the produces have high premium value during their off-season availability by adopting the season forcing techniques like green house, poly house net house and low tunnel (Enoch and Enoch, 1999) but installation of these structures are costlier so unaffordable by the small and marginal farmers. Out of these techniques, low tunnel is found one of the best for non woody species, such as ornamental and vegetable (Zhao et al. 2014). Which can warm the soil and protect the plants from hail, cold wind, injury and advance the crops than normal season because temperature goes below 8 °C for 30-40 days during winter season in plain of north India? Technology for cucurbits production has been extended to the farming community successfully. Farmers are gradually adopting different protected structure to combat the climatic vagaries and emerging challenges in vegetable production. The low tunnel techniques can use for raising seedlings by modifying the microclimate (Ken-Bar 2004). Generally, the tunnels are made in north to south direction to receive maximum sunlight. Transparent plastic of 30-50 micron is commonly used for making low tunnels, which reflects infra-red radiation to keep the temperature of the low tunnels higher than outside. These tunnel increases the inside temperature and entrapment of carbon dioxide, resulted more photosynthetic activity of crops hence early produce. They create a favourable microclimate around the crops by proving, frost and pest protection and reducing moisture loss. (Butler and Ross, 1999).

In several part of country, especially in northern plains, temperature is hovering 4 to 15 °C during winter season. So warm season crops like bottle gourd, bitter gourd okra do not allow successful production in open field in open field during winter season Keeping all the above facts in view, the proposed study was planned with the objective to find out best date of sowing and growing condition to get earliest flowering and fruiting in bitter gourd for fetching higher price in market.

Results and discussion
The impact of climate change is likely to have a great influence on the agriculture and eventually on the food security. Protected structures i.e., low tunnel can play important role to minimize the impact of temperature fluctuation over precipitation, fluctuating sun shine hour and infestation of disease and pest. Such analyses are being made to support the regional policies for making agriculture sector resilient to climate change. The major results and discussion related to present research with different parameters are discussed below:

Flower attributing parameters
Days taken to first female flower appearance and first harvest were significantly influenced by the sowing date and growing conditions. Minimum number of days taken to first female flower and first harvest was observed when the sowing was done on 30th December under low tunnel (T3) over other date of sowing under low tunnel. Tunnel forces the early harvest of crop which can earn high market value in off-season. The favourable effect of low tunnel on flowering and harvesting might be due to the conducive microclimate condition through
which crop had reached to early flowering and fruiting by increasing the temperature at that time. Ogden and van Iersel (2009) have also indicated that low tunnels modify climatic conditions, promoting earlier flowering and fruit ripening as well as fruit precocity production. Obshato and Shabalina (1984) opined that the time of fruiting was related to early temperature condition which favour to low tunnel structure. In similar study conducted by Ibarra et al. 2001 observed that muskmelon crop grown under plastic cover flowered 24 days earlier than uncovered plants.

**Fruiting parameters**

Perusal of data presented in Table 1 revealed that fruit length, fruit girth, fruit weight, yield per plant and yield per hectare, were significantly influenced by the sowing date and growing conditions. Maximum fruit length, fruit girth, fruit weight, yield per plant, fruit per plant and yield per hectare were found when the sowing was done on 30th December under low tunnel (T6) over other date of sowing under low tunnel. It might be due to better growth and development of all yield contributing parameters under low tunnel which increases the net photosynthesis and production of more assimilates available for individual to grow. Similar results were also given by Singh et al (1989). Vegetative growth was greatest in plants in the tunnel where the thermal condition were best early and total marketable yield were highest under the poly tunnel (Siwek and Capecka 1999) It is important to note that no significant differences were observed in fruit weight in both condition i.e., grown in tunnels and in open field.

**Table 1:** Effect of flowering and fruiting behaviour of bitter gourd under low tunnel.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Female flower</th>
<th>First picking</th>
<th>Fruit length(cm)</th>
<th>Fruit girth(cm)</th>
<th>Fruits/plant</th>
<th>Fruit weight (kg)</th>
<th>Yield/ plant</th>
<th>Yield/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1=30th Nov. Open field</td>
<td>60.00</td>
<td>64.50</td>
<td>8.40</td>
<td>5.55</td>
<td>8.75</td>
<td>85.70</td>
<td>0.788</td>
<td>138.88</td>
</tr>
<tr>
<td>T2=15th Dec. Open field</td>
<td>62.50</td>
<td>71.50</td>
<td>8.80</td>
<td>5.45</td>
<td>6.60</td>
<td>71.40</td>
<td>0.471</td>
<td>54.86</td>
</tr>
<tr>
<td>T3=30th Dec. under tunnel</td>
<td>53.50</td>
<td>61.00</td>
<td>4.70</td>
<td>7.32</td>
<td>13.50</td>
<td>93.40</td>
<td>1.260</td>
<td>255.09</td>
</tr>
<tr>
<td>T4=15th Jan. Under tunnel</td>
<td>56.50</td>
<td>65.00</td>
<td>10.20</td>
<td>6.80</td>
<td>12.50</td>
<td>91.20</td>
<td>1.004</td>
<td>173.72</td>
</tr>
<tr>
<td>T5=30th Jan. tunnel</td>
<td>58.00</td>
<td>65.50</td>
<td>10.80</td>
<td>5.73</td>
<td>12.35</td>
<td>82.50</td>
<td>1.018</td>
<td>136.09</td>
</tr>
<tr>
<td>T6=15th Feb. Open field</td>
<td>58.50</td>
<td>63.50</td>
<td>10.35</td>
<td>7.10</td>
<td>10.35</td>
<td>91.70</td>
<td>0.040</td>
<td>33.79</td>
</tr>
<tr>
<td>T7=28th Feb. Open field</td>
<td>54.00</td>
<td>62.50</td>
<td>11.10</td>
<td>7.65</td>
<td>10.65</td>
<td>89.00</td>
<td>1.008</td>
<td>21.70</td>
</tr>
<tr>
<td>SD</td>
<td>1.67</td>
<td>1.87</td>
<td>0.33</td>
<td>0.25</td>
<td>0.48</td>
<td>2.66</td>
<td>0.03</td>
<td>7.76</td>
</tr>
<tr>
<td>CD at 5%</td>
<td>3.40</td>
<td>3.80</td>
<td>0.67</td>
<td>0.52</td>
<td>0.99</td>
<td>5.43</td>
<td>0.06</td>
<td>16.91</td>
</tr>
</tbody>
</table>

**Economics**

Net income and cost benefit ratio is significantly influenced by off season flowering and fruiting induced by low tunnel technology. Net income and cost benefit ratio was maximum when sowing the crop on 30th December under tunnel. This might be due to high market value in off-season. Growers typically reported satisfaction with adopting this technology.

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**References**


