EFFECT OF INTER AND INTRA ROW SPACING ON THE YIELD OF CUCUMBER, CUCUMIS SATIVUS L.

BY

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ABSTRACT
In order to examine the effect of different inter and intra row spacing on the growth and yield of cucumber, a field trial was conducted at Sindh Agriculture University Tandojam during the year 2004-05. The treatments included four inter and intra row spacings viz. T1=30 x 110 cm, T2=40 x 100 cm, T3=50 x 90 cm and T4=60 x 80 cm. It was observed that 60 x 80 cm inter x intra row spacing produced 168.33 cm length of vine, 15.99 fruits per plant, 122.33 g weight of single fruit, 9.65 cm vertical diameter, 6.21 cm horizontal fruit diameter and 13073.66 kg fruit yield per hectare. The inter x intra row spacing of 50 x 90 cm produced 159.66 cm length of vine, 14.22 fruits per plant, 119.0 g weight of single fruit, 9.12 cm vertical diameter, 5.99 cm horizontal fruit diameter and 13568.33 kg fruit yield per hectare. The inter x intra row spacing of 40 x 100 cm produced 154.00 cm length of vine, 12.38 fruits per plant, 117.0 g weight of single fruit, 8.43 cm vertical diameter, 5.69 cm horizontal fruit diameter and 14960.00 kg fruit yield per hectare. The inter x intra row spacing of 30 x 110 cm produced 130.00 cm length of vine, 10.29 fruits per plant, 105.33 g weight of single fruit, 7.45 cm vertical diameter, 5.67 cm horizontal fruit diameter and 12913.33 kg fruit yield per hectare. It was noted that although the single plant values of growth and yield contributing characters were superior under planting geometry of 60 x 80 cm inter and intra row spacing, but the highest fruit yield was recorded in 40 x 100 cm inter and intra row spacing.

Keywords: Cucumber, inter and intra row spacing, growth, fruit yield

INTRODUCTION
Cucumber, Cucumis sativus L., a member of Cucurbitaceae family, genus Cucumis, belongs to African group, comprising large part of Africa, Middle East, Central Asia extending to Pakistan and South Arabia. Reportedly, cucumber is indigenous to India, because there is evidence of existence of a cucumber like plant Cucumis hardwickii at the foot of the Himalyas. In many respects it resembles C. sativus. It was also stated that the cucumber has been under cultivation in India for more than 3000 years, from where it spread to China, and earlier and more rapidly to the West, where it was much appreciated by the Greeks and Romans. Cucurbits form an important and big group of vegetables cultivated extensively in Pakistan that consists of a wide range of vegetables, either used as salad or for pickling (Bose et al. 1993, Ahmad et al. 2007).

Cucumber is one of the important summer vegetables grown commonly throughout Indo-Pak region. There are 30 species found in Asia and Africa. It is used as a salad and pickle. It is also used as a cooked vegetable. The seeds of cucumber are used in Ayurvedic preparations. It is reported that the oil extracted from seeds is good for brain and body. Cucumber is a tender annual vegetable vine crop, grown for its fresh fruits. It is consumed in salads or taken as fresh fruit dessert. In addition to its lovely taste and fairly good caloric value, cucumber is reported to be of high importance to the human beings on account of its medicinal benefits. It is the best known natural diuretic, and thus can serve an active drug for secreting and promoting the flow of urine. Due to high content of Potassium, cucumber can be highly useful for
both the high and low blood pressure conditions. It is a good source of Vitamin-A contains "Erepsin", an enzyme that helps to digest proteins (Pant et al. 2001).

Bose et al. (1993) reported that cucumber is one of the most valuable vegetables used as salad, and its 100 g edible portion contains 96.3 g moisture, 0.4 g protein, 0.1 g fat, 0.3 g minerals, 0.4 g fibre, 2.9 g carbohydrates, 18 calories, 36 mg calcium, 19 mg phosphorus, 1.1 mg iron, 120 µg carotene, 0.02 mg thiamine, 0.06 g riboflavin, and 0.4 mg niacin. Cucumber is a warm season vegetable and it does not withstand even light frost. It tolerates a slightly cooler weather than melons, and grows best at temperatures between 18 and 24°C. However, it can be successfully grown on many kinds and classes of soil from sandy to heavy clays, but heavy yields are obtained on loam, silt loam or clay loam soils. Cucumber is also grown in Pakistan extensively, but under improper attention in terms of use of various inputs and management practices (Pant et al. 2001).

The yields per unit area obtained in our country are far less than the potential exists, or as compared to other advanced vegetable producing countries of the world. The causes of this low cucumber production are varied i.e. improper sowing time and land preparation, inadequacy of irrigation, use of chemical fertilizers and planting densities. When the merit of above factors is considered for better cucumber production, perhaps not a single factor could be held responsible and all are associated with each other in one or the other sequence. However, along with the basic inputs such as: good seed, irrigation water and chemical fertilizer, plant to plant and row to row distance also have great significance and planting geometry have always proved its significance. Adams (2001) mentioned that the plant spacing and row spacing combinations are experimented to determine the most effective and responsible spacing to develop feasibility in crop management and give high crop production. Experimentally, it has been proved world over that moderately spaced plants (45 cm to 60 cm) will produce good results, while the row spacing can be beneficial up to 100 cm.

No significant research work has been noted published on the cucumber fertilization under Tandojam conditions. Thus keeping its importance as salad crop in view, the present investigation was carried out to evaluate the effect of different row and plant spacings on the growth and fruit yield of cucumber under soil and climatic conditions of Tandojam.

MATERIAL AND METHODS

A suitable piece of land was selected in the Orchard, Department of Horticulture, Sindh Agriculture University Tandojam and the selected land was prepared by giving 2 dry plowings followed by clod crushing. The leveling was also practiced to eradicate the weeds and to facilitate the uniform distribution of irrigation water. Finally ridges were prepared. The experiment was laid out in a four replicated randomized complete block design having net sub-plot size of 4.5m x 5.5m.

The seed of a commonly grown “Local oval shaped” cucumber variety was purchased from Hyderabad market. The sowing was done by dibbling the seeds at different spacings on both the sides of raised beds on 10.02.2004. The first observation on seed emergence was recorded on February 15, 2004. The crop was fertilized with a recommended Nitrogen dose of 75 kg per hectare which was applied in the form of urea fertilizer (46 % N) in two equal doses and was applied on March 05, and April 15, 2004 as side dressing. The crop was kept clean, and a periodical weeds removal practice was carried out to avoid any possible constraint against the experimental process. Thus, all the cultural practices were performed uniformly in all the plots, keeping in view the crop requirement. Interculturing and weeding operations were performed when the crop had good stand. Plant protection measures were also kept in operation and crop was sprayed when it was felt that the pest population is crossing economic injury level. For identification of insect pests and spraying recommendations, the help was acquired from Entomology Section of Agriculture Research Institute, Tandojam.

The length of vine and number of fruits per plant was recorded on the basis of five randomly selected plants/vines, from ground level up to the tip of the main vine in each treatment, whereas vertical and horizontal diameter and single fruit weight were recorded on the basis of 5 randomly selected fruits in each treatment. The fruits were harvested for observations after a uniform period of one week (7 days) of fruit setting. The yield per plot was obtained by weighing the fruits harvested from all the plants in each treatment including the sample fruits throughout the cropping season. On the basis of yield per plot, the yield per hectare was calculated. The data, thus collected were subjected to statistical analysis of variance using L.S.D. test to discriminate the superiority of treatment means, while DMR was applied to analyze the significance within treatment groups.

Shaheen, et al. (2007). Row spacing effect on Cucumber
RESULTS AND DISCUSSION

Length of vine (cm)
Vine length of cucumber was increased significantly (168.33 cm) under 60 x 80 cm inter and intra row spacing arrangement, followed by average vine length of 159.66 cm and 154.00 cm average vine length observed in planting geometry of 50 x 90 cm and 40 x 100 cm, inter and intra row spacing arrangement, respectively. However, the minimum vine length of 130.00 cm was observed in the plots arranged in a narrow plant and wider row spacing of 30 x 110 cm. Vine length in surface spread crops generally reflects the growth response of different treatments. It was observed that vine length of cucumber was significantly (P<0.01) affected due to different inter and intra row spacing arrangements and it was increased significantly under 60 x 80 cm inter and intra row spacing arrangement as compared to rest of the spacing arrangements. This greater vine length under such planting geometry was mainly associated with the greater space available for vines to receive nutrients, moisture and light as compared to those when planted in narrow plant spacing. These results are in concurrence to those of Cohen et al. (2000) and Baloch (2001), who reported that in wider row spacing vine length was increased.

Number of fruits per vine
The number of fruits per vine of cucumber was increased substantially (15.99) under 60 x 80 cm inter and intra row spacing arrangement, while the average number of fruits per vine was relatively in reducing trend with average of 14.22 and 12.38 fruits per vine observed in planting geometry of 50 x 90 cm and 40 x 100 cm, inter and intra row spacing arrangement, respectively. However, the lowest number of fruits per vine of 10.29 was received from the plots arranged in a narrow plant and wider row spacing of 30 x 110 cm. It was noted that the number of fruits per vine was remarkably higher when the crop was sown in increased plant spacing and reduced row spacing. This greater number of fruits per vine under wider plant and narrow row spacing was probably due to more space available for vines in a row and the individual vines shared relatively greater amounts of light, moisture and nutrients, while in narrow plant spacing, the plants become more competitive for light, moisture and nutrients and thus, performance of the crop relatively suppressed. Similar results have also been reported by Baloch (2001), Bradley et al. (2001) and Pant (2001) whose consolidated findings suggested that under wider spacing fruits per vine were increased.

Single fruit weight
Single fruit weight of cucumber was increased remarkably to the level of 122.33 g under 60 x 80 cm inter and intra row spacing arrangement, closely followed by 119.00 and 117.00 g average single fruit weight, which was recorded in planting geometry of 50 x 90 cm and 40 x 100 cm, inter and intra row spacing arrangement, respectively. However, the minimum single fruit weight of 105.33 g on average was produced by the crop raised in narrow plant spacing and wider row spacing of 30 x 110 cm. It was noted that the single fruit weight was remarkably higher when the crop was sown in increased plant spacing and reduced row spacing. However, the differences in the single fruit weight was statistically non-significant (P>0.05) when 60 x 80 cm, 50 x 90 cm and 40 x 100 cm inter and intra row spacing was compared. Supporting the findings of present investigation, Adam (2001) and (Adams, 2003) concluded that single fruit weight in cucumber was greater in wider row spacings.

Vertical diameter of fruit
The vertical diameter of fruit of cucumber was significantly highest (9.65 cm) on average under planting geometry of 60 x 80 cm inter and intra row spacing arrangement, followed by average vertical diameter of 9.12 cm and 8.43 cm average vertical diameter of fruit, which was observed in the planting geometry of 50 x 90 cm and 40 x 100 cm inter and intra row spacing arrangements, respectively. However, the lowest vertical diameter of fruit of 7.45 cm on average was recorded in the crop raised in narrow plant spacing and wider row spacing of 30 x 110 cm. It was observed that the vertical diameter of fruit was substantially increased when the crop was raised in increased plant spacing and reduced row spacing. This increase in vertical diameter of fruits was mainly associated with the availability of adequate space to individual plants in a row which helped the plants to receive more quantities of light, moisture and other soil applied nutrients, resultanty the crop produced healthier fruits. Similar results have been reported by Rampal (2001), (Adams, 2002) and Baloch (2001) who were of the experience that in wider inter and intra row spacing, thicker and longer fruits were obtained.
Horizontal diameter of fruit (cm)

Horizontal diameter of fruit of cucumber was significantly (P<0.01) affected due to various inter and intra row spacing arrangements and it was significantly maximum (6.21 cm) on average under planting geometry of 60 x 80 cm inter and intra row spacing, followed by average horizontal diameter of 5.99 cm and 5.69 cm average horizontal diameter, which was observed in the planting geometry of 50 x 90 cm and 40 x 100 cm inter and intra row spacing arrangements, respectively. However, the lowest horizontal diameter of fruit of 5.67 cm was recorded in the crop raised in narrow plant spacing and wider row spacing of 30 x 110 cm. The diameter was significantly maximum under planting geometry of 60 x 80 cm inter and intra row spacing and lowest under 30 x 110 cm. It was observed that the horizontal diameter of fruit was significantly increased when the crop was sown in higher plant spacing and lower row spacing. This increase in horizontal diameter of fruits was mainly associated with more the availability of adequate space to individual plants in a row which helped the plants to receive more quantities of light, moisture and other soil applied nutrients, hence the crop produced healthier fruits. These results are in agreement with the findings reported by Rampal (2001), Adams (1999) and Baloch (2001), who were of the experience that in wider inter and intra row spacing, thicker and longer fruits were achieved.

Fruit yield per hectare

Fruit yield per hectare of cucumber was remarkably maximum (14960 kg) on average under planting geometry of 40 x 100 cm inter and intra row spacing, followed by cucumber fruit yields of 1358.33 kg and 13073.66 kg per hectare, recorded in the treatments managed with 50 x 90 cm and 60 x 80 cm inter and intra row spacing arrangements, respectively. However, the lowest fruit yield per hectare of 12913.33 kg on average was recorded in the crop raised in closest plant to plant distance and maximum row to row distance 30 x 110 cm. The behaviour of the results suggested that the highest fruit yield per hectare was recorded in plots sown in 40 x 100 cm inter and intra row spacing, while the yield was significantly diminished when plant and row spacing was further increased. This decrease in fruit yield under wider plant spacing and narrower row spacing might be the result of decrease in the plant population. On the basis of results, it could be suggested that for a maximum crop harvest in cucumber crop, the planting geometry may be maintained at 40 x 100 cm. Similar results have also been reported by Baloch (2001) who opined that cucumber fruit yields were significantly higher under high density plantation irrespective of superiority of low density plantation for other growth and yield contributing characters, probably due to less plant population under low density plantation.

Conclusions

After going through the results of the present experiment, it was concluded that although the single plant values of growth and yield contributing characters were superior under planting geometry of 60 x 80 cm inter and intra row spacing, but the highest fruit yield was recorded in 40 x 100 cm inter and intra row spacing, while the yield was substantially reduced when space between plant was further increased and between rows reduced. This decrease in fruit yield under wider plant spacing and narrower row spacing might be the result of decrease in the plant population. Thus, on the basis of findings of present study, 60 x 80 cm inter and intra row spacing was considered optimum.
Table 1: Mean values for growth and fruit yield characters of cucumber as affected by different inter and intra row spacings.

<table>
<thead>
<tr>
<th>Plant X Row spacing</th>
<th>Vine length (cm)</th>
<th>No. of fruits vine⁻¹</th>
<th>Wt. of single fruit (g)</th>
<th>Vertical diameter of fruit (cm)</th>
<th>Horizontal diameter of fruit (cm)</th>
<th>Fruit yield (kg ha⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 30 X 110 cm</td>
<td>130.00c</td>
<td>10.29d</td>
<td>105.33b</td>
<td>7.45c</td>
<td>5.67c</td>
<td>12913.33b</td>
</tr>
<tr>
<td>T2 40 X 100 cm</td>
<td>154.00b</td>
<td>12.38c</td>
<td>117.00a</td>
<td>8.43 bc</td>
<td>5.69 bc</td>
<td>14960.00a</td>
</tr>
<tr>
<td>T3 50 X 90 cm</td>
<td>159.66ab</td>
<td>14.22b</td>
<td>119.00a</td>
<td>9.12 ab</td>
<td>5.99 ab</td>
<td>13568.33b</td>
</tr>
<tr>
<td>T4 60 X 80 cm</td>
<td>168.33a</td>
<td>15.99a</td>
<td>122.33a</td>
<td>9.65 a</td>
<td>6.21 a</td>
<td>13073.66b</td>
</tr>
</tbody>
</table>

S.E.± 2.69 0.3109 1.8390 0.2247 0.0875 157.9344
S.D 0.05 7.436 1.105 6.543 0.7996 0.3132 561.90
LSD 0.01 10.42 1.550 9.173 1.121 0.4391 787.80
CV% 6.73 5.70 7.17 5.19 3.01 7.32

Values followed by similar letters do not differ significantly at 0.05 percent probability level.

REFERENCES


