
Effect of various sowing patterns on growth and yield of Indian squash (*Citrullus vulgaris*)

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Baloch, Q.B., Kaleri, I.A., Memon, N., Sharif, N. and Q.I. Chachar (2013) Effect of various sowing patterns on growth and yield of Indian squash (*Citrullus vulgaris*). Journal of Agricultural Technology 9(3):625-632.

Study was carried out to examine the impact of different sowing patterns on the growth and productivity of Indian Squash using raised bed at 100 x 75 and 120 x 100 cm between and within row spacing, ridge sowing at 100 x 75 and 120 x 100 cm between and within row spacing, flat bed at 100 x 75 and 120 x 100 cm between and within row spacing. On the basis of growth and yield components, Indian Squash sown on raised beds at 120cm x 100cm between and within row spacing ranked first taking 29.21 days to initiate flowering, 41.13 days to produce first harvestable fruit, 168.33 cm vine length, 5.86 branches per vine, 21.47 fruits per vine, 122.33 g single fruit weight and 11.826 tons fruit yield per hectare, while the crop sown on raised beds at 100cm x 75cm between and within row spacing ranked second, ridge sowing at 120cm x 100cm and 100cm x 75cm between and within row spacing ranked third and fourth, flat bed sowing at 120cm x 100cm and 100cm x 75cm between and within row spacing ranked fifth and sixth resulting simultaneous decrease in the values for all the growth and fruit yield traits under study when compared to treatment that ranked first. It was concluded that flat bed system show promising results, while raised bed at 120cm x 100cm between and within row distance proved to be most effective and efficient sowing pattern as compared to ridge sowing or flat bed sowing system, irrespective of between and within row spacing.

Key words: Indian Squash, sowing pattern, growth and yield

Introduction

Indian squash, (*Citrullus vulgaris*) belongs to the family *Cucurbitaceae*. *Cucurbitaceae* consist on warm season annuals which prefer hot, humid weather. In Indo-Pak region a number of names are given to this vegetable like tinda, dilpasand, round gourd, apple gourd or Indian baby pumpkin. (Sridhar *et al.*, 2002). It is also called Japanese Squash or Chinese Squash in the United States's supermarkets. It is a squash-like cucurbit grown for its immature fruit,

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native to India, very popular in Pakistani and Indian cooking with curry and many gourmet dishes. Fruit is called pepo approximately spherical in shape, 5–8 cm in diameter. Green colored, apple sized fruits are flattish round in shape and 50-60 grams in weight. Plants are vigorous, productive and begin to bear fruits in 70 days after planting.

Both winter and summer squash are perfect ingredients for entrees, appetizers, salads and desserts. They are low in calories, fat, sodium and cholesterol free. They are also a good source of vitamin C, carotene, riboflavin, calcium and iron. Unlike winter squash, summer squash can be eaten rind, seeds, and all (Lori Alden, 2005). Apart from the importance of Indian squash as delicious vegetable, it has always been considered as neglected plant in relation to research activities in Pakistan for knowing its planting and input requirements. Little is known commonly about its yield potential and mostly it is intercropped with other major crops. Research is needed to investigate the proper planting patterns such as effect of raised beds or hills on the growth attributes and fruit yield. Moreover, still work is needed to ascertain the effects on fruit yield if planted on flat beds or used ridge planting. According to Ibrahim *et al.* (2002). Indian squash would give excellent yield performance when planted on raised beds spaced at 6-8 feet, or hills of 8-12 feet, while flat bed sowing may create difficulties in crop management operations. Seeds planted about 2 cm deep in heavy soils and about 5 cm deep in sandy soils gave satisfactory results. Many seeds per hill planted to ensure a vigorous stand, and some thinning was done to obtain a final stand of 2 plants per hill and germination took 7 days. Keeping in view the above facts, the present study was carried out to evaluate the effect of various sowing patterns on the growth and production of Indian squash (Tinda) under agro-ecological conditions of Tandojam, Sindh Pakistan.

Materials and methods

Experiment was laid out in randomized complete block design, keeping sub-plot size of 6m x 4.5m (27m²). Commercial variety “Daudero” was used for this experiment. Land was prepared with disc plow. Then clods were crushed to eradicate weeds and stubbles. Then plots were worked with disc harrow, followed by two cross-wise cultivator plowings and leveling for uniform distribution of fertilizer and irrigation water. After getting well prepared seedbeds, total eighteen plots were prepared. Six plots were prepared with raised beds with different intra and inter row spacing; in six plots ridges were prepared by maintaining row and plant spacing. Similarly, remaining six plots were prepared as flat bed with different row and plant spacing. Sowing was completed according to the plan. Initially three seeds at one point were

sown and after 15 days of sowing, when the sowing was completed, thinning was done and only one healthy looking plant at each point was maintained.

Fertilizers were applied as per recommendations and all Phosphorus (in the form of single superphosphate) and Potassium (in the form of muriate of potash) along with one third of Nitrogen (in the form of urea) was applied as basal dose at the time of sowing by mixing in soil, while remaining N was divided into two equal splits and was applied at the second and third irrigation. All the necessary cultural operations were maintained throughout growing period uniformly according to the crop requirements in all the plots till maturity. The crop was monitored critically for any sort of insect pest or disease incidence. The pickings of fruits were done at weekly interval and total eight pickings were carried out. Observations were recorded on randomly selected three vines in each sub-plot. The data thus collected were subjected to statistical analysis using Analysis of variance technique and LSD (Least Significant Difference) test was employed to discriminate the superiority of treatment means using Mstat-C Micro-Computer Statistical Software, following Gomez and Gomez (1984).

Results and discussions

Number of days taken to first flowering

The Indian Squash sown on ridges at 120cm x 100cm between and within row distance initiated flowering averagely in 31.00 days, followed by first flower emergence averagely in 30.31 and 29.74 days recorded in flat bed sowing at 120cm x 100cm and 100cm x 75cm between and within row spacing, respectively (Table-1). The results further indicated that the Indian Squash sown on raised beds at 100cm x 75cm between and within row distances took averagely 29.31 days to initiate flowering, while crop sown on ridges at 100cm x 75cm between and within row spacing took 29.29 days for emergence of first flower. However, the Indian Squash sown on raised beds at 120cm x 100cm between and within row distance took minimum (29.21) days to initiate flowering. These results corroborated the findings of Burki (1966). who reported the same number of days taken to first flowering in Tinda.

Number of days taken to first fruit harvest

Indian Squash sown on flat beds at 100cm x 75cm between and within row distance produced first harvestable fruit averagely in 42.76 days, followed by the crop sown on flat beds at 120cm x 100cm between and within row spacing, where first harvestable fruit received averagely in 42.53 days (Table-

1). The crop sown on raised beds at 100cm x 75cm between and within row distance produced first harvestable fruit averagely in 42.20 days, while ridge sowing at 100cm x 75cm between and within row distance produced first harvestable fruit averagely in 41.80 days. Similarly, Indian squash sown on raised beds at 120cm x 100cm between and within row spacing produced first harvestable fruit averagely in 41.13 days, while most early harvestable first fruit in 40.60 days on average was resulted in crop sown on ridges at 120cm x 100 cm between and within plant spacing. The results are also in support with Nenwani (2005). used to sow, Indian squash variety Daudero on raised beds at 100 cm and vine spacing of 100 cm took significantly lesser number of days to bear flowering and first fruit harvest with significantly greater vine length, vertical/horizontal fruit size, greater number of fruits per plant, more single fruit weight and significantly higher fruit yield per unit area and further suggested that variety Daudero should be the first choice of the farmer for getting high economic returns using raised bed or ridge at 120 cm apart with 50 cm vine spacing system of planting.

Table 1. Number of days taken to first flowering, first fruit harvest, vine length, number of branches per vine of Indian Squash as influenced by different sowing patterns

Treatments	No. of days taken to first flowering	No. of days taken to first fruit harvest	Vine length (cm)	No. of branches per vine
T1=Raised beds at 100 cm distance with 75 cm vine spacing	29.31	42.20	152.00 b	5.20 b
T2=Raised beds at 120 cm distance with 100 cm vine spacing	29.21	41.13	168.33 a	5.82 a
T3=Ridges at 100 cm distance with 75 cm vine spacing	29.29	41.80	145.33 b	4.80 bc
T4=Ridges at 120 cm distance with 100 cm vine spacing	31.00	40.60	150.00 b	5.06 b
T5= Flat beds with 100 cm row and 75 cm vine spacing	29.74	42.76	137.00 c	4.06 d
T6= Flat beds with 120 cm row and 100 cm vine spacing	30.31	42.53	145.00 b	4.26 cd
S.E.±	0.9060	1.4715	1.7438	0.1456
CV%	5.26	6.09	2.02	5.17

Vine length (cm)

The sowing on raised beds at 120cm x 100cm between and within row distance resulted significantly maximum vine length (168.33cm), followed by the crop sown on raised beds at 100cm x 75cm between and within row spacing, and ridge sowing at 120cm x 100 cm between and within row distance with 152.00 and 150.00 cm average vine length, respectively (Table-1). The results further showed that relatively shorter vines were observed when Indian Squash was sown on ridges at 100cm x 75cm between and within row distance and flat bed sowing at 120cm x 100cm between and within row spacing with average vine length of 145.33 and 145.00 cm, respectively. However, the minimum vine length of 137.00 cm was recorded when Indian Squash was sown on flat bed at 100cm x 75cm between and within row spacing.

Number of branches per vine

The crop sown on raised beds at 120cm x 100cm between and within row distance produced significantly greater number of branches (5.86) per vine, followed by the crop sown on raised beds at 100cm x 75cm between and within row spacing, and ridge sowing at 120cm x 100 cm between and within row distance with 5.20 and 5.06 average number of branches per vine, respectively (Table-1). It was further observed that Indian Squash sown on ridges at 100cm x 75cm between and within row spacing resulted in averagely 4.80 branches per vine, while number of branches further reduced to 4.26 per vine, when the crop was sown on flat beds at 120cm x 100cm between and within row spacing. However, the lowest number of branches (4.06) per vine was observed when crop was sown on flat beds at 100cm x 75cm between and within row distance.

Number of fruits per vine

Indian Squash sown on raised beds at 120cm x 100cm between and within row distance produced significantly greater number of fruits (21.47) per vine, followed by the crop sown on raised beds at 100cm x 75cm between and within row spacing, and ridge sowing at 120cm x 100 cm between and within row distance with 17.72 and 16.20 average number of fruits per vine, respectively (Table-2). The results further indicated that Indian Squash sown on ridges at 100cm x 75cm between and within row spacing resulted in averagely 15.24 fruits per vine, while number of fruits further declined to 12.74 per vine when the crop was sown on flat beds at 120cm x 100cm between and within

row spacing. However, the lowest number of fruits (11.43) per vine was observed when crop was sown on flat beds at 100cm x 75cm between and within row distance.

Table 2. Number of fruit per vine, weight of single fruit (g) and fruit yield (tons per ha) of Indian Squash as influenced by different sowing patterns

Treatments	No. of fruits per vine	Weight of single fruit (g)	Fruit yield (tons per ha)
T1= Raised beds at 100 cm distance with 75 cm vine spacing	17.72 b	112.66 b	10.848 b
T2= Raised beds at 120 cm distance with 100 cm vine spacing	21.47 a	122.33 a	11.826 a
T3= Ridges at 100 cm distance with 75 cm vine spacing	15.24 bc	103.66 c	9.945 c
T4= Ridges at 120 cm distance with 100 cm vine spacing	16.20 b	109.33 bc	10.445 b
T5= Flat beds with 100 cm row and 75 cm vine spacing	11.43 d	82.33 e	7.545 e
T6= Flat beds with 120 cm row and 100 cm vine spacing	12.74 cd	96.33 d	8.303 d
S.E.±	0.6359	1.5623	0.1602
CV%	6.97	4.59	4.83

Weight of single fruit (g)

The crop sown on raised beds at 120cm x 100cm between and within row distance caused maximum weight of single fruit (122.33 g), followed by the crop sown on raised beds at 100cm x 75cm between and within row spacing, and ridge sowing at 120cm x 100 cm between and within row distance having 112.66 and 109.33 g average weight of single fruit, respectively (Table-2). It was further noted that the crop sown on ridges at 100cm x 75cm between and within row distance and flat bed sowing at 120cm x 100cm between and within row spacing resulted 103.33 and 96.33 g average weight of single fruit, respectively. However, the lowest weight of single fruit (82.33 g) was recorded when Indian Squash was sown on flat bed at 100cm x 75cm between and within row spacing.

Fruit yield per hectare (tons)

It was noted that the crop sown on raised beds at 120cm x 100cm between and within row distance produced significantly maximum fruit yield of 11.826 tons ha⁻¹, followed by the crop sown on raised beds at 100cm x 75cm between

and within row spacing, and ridge sowing at 120cm x 100 cm between and within row distance with average fruit yield of 10.848 and 10.445 tons ha⁻¹, respectively (Table-2). The crop sown on ridges at 100cm x 75cm between and within row distance and flat bed sowing at 120cm x 100cm between and within row spacing resulted 9.945 and 8.303 tons average fruit yield ha⁻¹, respectively. However, the minimum fruit yield of 7.545 tons ha⁻¹ was obtained when Indian Squash was sown on flat bed at 100cm x 75cm between and within row spacing. These results are further supported by Cortes and Hernandez (1996). obtained the highest yields at the 3 X 2 m spacing, Damarany and Farag (1999). experimented three spacing, viz. 45, 90 or 180 cm between hills within ridges (ridges were 3.6 m long and 2.0 m wide) and found that wider spacing either on ridges or on hills produced greater yields of Indian Squash than narrow spacing.

In another study, Ishaq and Sadiq (2006). concluded that planting Indian squash vines on ridges gave higher fruit yields, while Choudhari and More (2007). examined three spacing (1.80 m x 0.30 m, 1.80 m x 0.45 m, 1.80 m x 0.60 m) on Indian squash and higher yields were recorded under 1.80 m x 0.45 m spacing plant and row spacing.

Conclusion

After going through the results in detail, it was concluded that flat bed system showed promising results, while raised bed at 120cm x 100cm between and within row distance proved to be most effective and efficient sowing pattern as compared to sowing on ridges on flat bed sowing system, irrespective of between and within row spacing. Discussion can be concluded with the comments that raised bed sowing pattern under wider between and within row spacing is more effective and efficient, because it can use irrigation water more efficiently and facilitate the interculturing practices as compared to ridges or flat bed sowing patterns.

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(Received 8 January 2013; accepted 30 April 2013)