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Effect of different planting geometry on yield and quality of watermelon (*Citrullus lanatus* Thunb.)

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ABSTRACT : A field experiment was conducted at Hi-tech Horticulture Park, Department of Horticulture, Junagadh Agricultural University, Junagadh during Late *Kharif* season in the year 2010 with mulch to study the effect of planting geometry on yield and quality of watermelon. It consists of twelve treatment combinations, comprising of three levels of planting geometry *viz.*, diagonally paired row with 80 cm spacing (G_1), parallel paired row with 80 cm spacing (G_2) and parallel paired row with 40 cm spacing (G_3) were embedded in a Split Plot Design in CRD with four replications. The experiment resulted that with maximum yield and quality attributing characters under study were significantly affected by planting geometry treatments. Highest fruit length (21.25 cm), fruit girth (13.81 cm), yield tons per hectare (44.33 t/ha), pulp weight (1712.57 g), lowest rag weight (610.90 g), total soluble solids (10.98 °B), non-reducing sugars (3.91 %), reducing sugars (1.72 %), total sugars (5.25 %) and ascorbic acid content (7.90 mg/100 g pulp) were recorded under G_1 (Diagonally paired row with 80 cm spacing). While, superior fruit yield in terms of kg per plot (38.38 kg) was found in G_3 (Parallel paired row with 40 cm spacing).

KEY WORDS : Watermelon, Planting geometry, Yield, Quality, Spacing, Mulch

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Watermelon (*Citrullus lanatus* Thunb.) also known as *Tarbuj*, *Tarmuj*, *Kalinga* and *Kalindi* is one of the important vegetable crops grown extensively in India and in tropical and sub tropical countries of Europe and Africa. Though it can be grown in garden land, it is a major river-bed crop of Uttar Pradesh, Rajasthan, Gujarat, Maharashtra and Andhra Pradesh. As a common summer season crop, it is grown from the lower Himalayan region to southern parts of India. Punjab, Haryana, Karnataka, Assam, West Bengal, Orissa, Himachal Pradesh, Uttar Pradesh, Tamil Nadu and Rajasthan are major watermelon growing states. It is a popular dessert vegetable, with year round availability which is originated from indigenous tropical Africa. Its growth is favoured by long period of warm, dry weather. A temperature of 25^0 C to 30^0 C is ideal for growth and 25^0 C is the best temperature for fruit setting of watermelon. Environment significantly influences the flavour and sweetness of watermelon. Farmers of Saurashtra region are cultivating watermelon in field as well as river bed on large scale. Farmers growing watermelon grow plants in linear row with single plant per hill. Increasing the plant density by sowing 2 plants per hill with close spacing may be beneficial for better yield and quality produce.

In Indian conditions very less research work

regarding the same has been carried out till the present day. Mulching in general is a beneficial practice for crop production. Mulch conserves soil moisture, retends heat as well as it suppresses weed growth.

RESEARCH METHODS

The present investigation was carried out during late *Kharif* season at Hi-tech Horticulture Park, Department of Horticulture, Junagadh Agricultural University, Junagadh. The farmyard manure applied at the rate of 20 tonnes per hectare, was mixed in soil during the last harrowing. The fertilizers were applied at the rate of 125:62:62 NPK kg/ha, respectively. The seeds were sown on 10th August 2010. Single seed of variety 'Kiran' was dibbled in row per hill at a distance mentioned in treatment between row and plant, respectively in which silver on black plastic mulch with 25 micron thickness was used. It consists of twelve treatment combinations, comprising of three levels of planting geometry *viz*., diagonally paired row with 80 cm spacing (G_1), parallel paired row with 80 cm spacing (G_2) and parallel paired row with 40 cm spacing (G_3) were embedded in a Split Plot Design in CRD with four replications. Size of gross plot was 3.20 m x 0.60 m and size of net plot was 1.60 m x 0.30 mafter carrying out the layout as per the standard technique of design.The whole quantity of P_2O_5 and K_2O as basal dose was given in form of single super phosphate and muriate of potash, respectively. Half quantity of nitrogen in the form of urea was applied as basal dose and remaining half nitrogen as top dressing after 30 days of sowing. Standard agronomic practices were followed through out the study.The data on yield attributing characters *i.e.*, fruit length (cm), fruit girth (cm), average fruit weight (kg), fruit yield kg per plot as well as fruit yield tons per ha and quality attributing characters *i.e.*, pulp weight (g), rag weight (g), pulp/rag ratio, total soluble solids (%), non-reducing sugars (%), reducing sugars (%), total sugars (%) and ascorbic acid (mg/100g of pulp) were analyzed with the help of following methods. The methods described by Ranganna (1979) were adopted for determining reducing sugars (%), Total sugars (%) and ascorbic acid (mg/100 g of pulp). The data of all characters were studied subjected to statistical analysis of variance technique as described by Panse and Sukhatme (1967). The treatment differences were tested by "F" test of significance on the basis of Null hypothesis. The appropriate standard error of mean (S.E.) was calculated in each case and the critical difference (C.D.) at one per cent and five per cent level of probability was worked out to compare the significancy between the two treatment.

RESEARCH FINDINGS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented under following heads :

Yield of watermelon :

The data presented in Table 1 revealed the yield of watermelon as influenced by different levels of planting geometry.The findings indicated that the levels of planting geometry were found significant on fruit length, fruit girth, fruit yield (kg/plot) and fruit yield (tons/ha). The maximum fruit length(cm) and girth(cm) were found in treatment planting geometry (G_1) *i.e.* 21.25 cm and 13.81 cm, respectively. The highest fruit yield in terms of kg per plot and tons per hectare was found in treatment planting geometry (G_3) 38.38 kg and (G_1) 44.33 t/ha. whereas minimum fruit length and fruit girth were in treatment planting geometry (G_3) *i.e.* 19.84 cm and 12.89 cm, respectively. Significantly lowest yield in terms of kg per plot was found in treatment planting geometry (G_2) *i.e.* 28.80 kg. Significantly the lowest fruit yield in ton per hectare was recorded in planting geometry (G_3) *i.e.* 41.96t/ha.

A marked improvement in fruit length, fruit girth and number of fruits per plot by the planting geometry might be due to the improved physiological activities like photosynthesis during which food is manufactured by

Table 1 : Effect of different planting geometry on yield of watermelon (*Citrullus lanatus* Thunb.)

Planting geometry levels	Fruit length (cm)	Fruit girth (cm)	Fruit weight (kg)	Yield (kg/plot)	Yield (t/ha)
G_1 : Diagonally paired row with 80cm spacing	21.25	13.81	2.40	29.67	44.33
G_2 : Parallel paired row with 80cm spacing	21.01	13.66	2.39	28.80	43.44
G_3 : Parallel paired row with 40cm spacing	19.84	12.89	2.33	38.38	41.96
S.E. ±	0.24	0.15	0.06	0.25	0.57
C.D. (P=0.05)	1.10	0.68	NS	1.14	1.82

NS=Non-significant

Table 2 : Effect of different planting geometry on quality of watermelon (*Citrullus lanatus* Thunb.)

Planting geometry levels	Pulp weight (g)	Rag weight (g)	Pulp/rag ratio	Total soluble solids (°B)	Non-reducing sugar (%)	Reducing sugar (%)	Total sugars (%)	Ascorbic acid (mg/100g pulp)
G_1 : Diagonally paired row with 80cm Spacing	1712.57	610.90	42.99	10.98	3.91	1.72	5.25	7.90
G_2 : Parallel paired row with 80cm Spacing	1607.84	691.78	42.01	10.80	3.60	1.63	5.12	7.17
G_3 : Parallel paired row with 40cm Spacing	1496.24	718.16	42.06	10.53	3.29	1.636	5.00	6.59
S.E. ±	48.55	25.38	0.57	0.09	0.14	0.02	0.06	0.25
C.D. (P=0.05)	155.30	73.65	NS	0.28	0.44	0.06	0.19	0.79

NS=Non-significant

the plant, translocation of assimilates from leaves to fruit and their storage in fruit as less the number of fruits more is the size of the fruits. Narrow spacing resulted in the increase in the number of fruits but primarily more extra-small and small fruit which was found out by Motsenbocker and Arancibia (2002). Smiljana *et al.* (2005) and Akintoyea *et al.* (2009) stated that with the increase in plant spacing average size of the fruit shifted to larger categories whereas with the increase in the plant density ultimately decreases the fruit size was observed. Nerson (1999) conducted a field experiment in muskmelon with different plant density and concluded that the highest plant density produced the lowest marketable fruit yield and unacceptable small fruits constituted 37%, 43% and 75% of the total yield at low, medium and high plant density, respectively.

Similar findings on fruit length and fruit girth and number of fruits were also confirmed by Kultur *et al.* (2001); Singh *et al.* (2001); Gualberto *et al.* (2001); Lima-e-Silva *et al.* (2003); Resende and de Costa (2003); Devi and Gopalakrishnan (2004); Qudeimat *et al.* (2004) and Ban *et al.* (2006) in muskmelon. The use of mulch also increases the yield as it makes earliness in the vegetatitve phase completion and longer harvesting span as stated by Brinen *et al.* (1979) and Soltani *et al.* (1995). Sanders *et al.* (1999) stated that alternate plant spacing gave higher yield than conventional planting. Yield was obtained higher in narrow spacing but total marketable fruits are less while wider spacing reduces yield per hectare but more marketable fruits are obtained have been noted by Motsenbocker and Arancibia (2002). Similar findings have also been found by Singh *et al.* (2001).

Quality of watermelon :

The data presented in Table 2 revealed the to quality of watermelon as influenced by different levels of planting geometry. The results showed that the different levels of planting geometry were found significant on pulp weight, rag weight, total soluble solids, non-reducing sugars, reducing sugars, total sugars and ascorbic acid content. The significantly maximum pulp weight and total soluble solids was found in treatment of planting geometry (G_1) *i.e.* 1712.57g and 10.98 °B, respectively. The significantly maximum non-reducing and reducing sugars, total sugars as well as ascorbic acid content (mg/100g pulp) were found in treatment of planting geometry G_1 *i.e.* 3.91%, 1.72%, 5.25% and 7.90 mg per 100g pulp, respectively.

The minimum rag weight was found in the treatment of planting geometry (G_1) 610.90 g whereas minimum pulp weight and total soluble solids was found in treatment of planting geometry (G_3) *i.e.* 1496.24g and 10.53 °B, respectively. Minimum non-reducing sugars, total sugars and ascorbic acid content was found in treatment of planting geometry (G_3) *i.e.* 3.29%, 5.00% and 6.59 mg per 100g pulp, respectively. The maximum rag weight was found in the treatment of planting geometry (G_3) 718.16 g. The minimum reducing sugars was found in the treatment of planting geometry (G_2) 1.63 %.

This perceptible increase in TSS and sugars might be due to the beneficial effect of planting geometry on plant which was confirmed by Kultur *et al.* (2001) in muskmelon. According to Qudeimat *et al.* (2004), the possible role of planting geometry might be in the enhancement of TSS content. Bhatia *et al.* (2007) stated that the TSS content increased in the fruit increased to 11.72 at temperature of 40^0C in the greenhouse.

Conclusion :

Foregoing results suggested that for growing watermelon in Saurashtra region planting the watermelon in diagonal pattern with 80 cm in-row spacing is the most beneficial practice for obtaining higher yield of watermelon with superior fruit quality.

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