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Research Article

INFLUENCE OF DIFFERENT GROWING CONDITIONS ON YIELD PARAMETERS OF WATERMELON (*Citrullus lanatus*) CULTIVATION *VAR.* KIRAN

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Abstract- The field experiments were conducted to study the performance of watermelon (*Citrullus lanatus*) under both open field and polyhouse condition at the Division of Horticulture, UAS, Bangalore. The experiment was laid out in Factorial randomized complete block design with two main and sub treatments with five replications. The results revealed that the plants grown under polyhouse recorded significantly higher number of fruits plant^{-1} (2.92 fruits), maximum fruit weight plant^{-1} (2.54 kg), maximum fruit yield plant^{-1} (4.5 kg), estimated fruit yield per hectare (92.3 t ha^{-1}), maximum fruit length (20.15 cm), maximum fruit circumference (45.18 cm), maximum fruit volume (2.44 l), maximum pulp weight fruit^{-1} (1.93 kg), minimum rind thickness fruit^{-1} (1.39 cm) and maximum rind to pulp ratio (3.18). From this investigation it can be concluded that significant results were noticed in watermelon *var.* Kiran with respect to growth parameters when the plants were grown under polyhouse.

Keywords- Watermelon, *var.* Kiran, Polyhouse, Open field, Fruit characters.

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Introduction

Watermelon (*Citrullus lanatus*) belonging to the botanical family Cucurbitaceae is a tender annual trailing creeper. The crop is indigenous to tropical and sub-tropical regions of Africa. In India it occupies an area of 27,893 ha with an annual production of 3.71 lakh tonnes and productivity of 13.45 t ha^{-1}. Botanically the fruit of watermelon is a pepo, which is a modified berry formed from an inferior ovary with good carpel. wall. It is a monoecious or andromonoecious annual sprawling over the ground [1]. Leaves are pinnatifid, flowers are solitary and axillary and corolla is yellow in colour. Fruit is a many seeded pepo with red, green, yellow or whitish flesh and white, black or reddish yellow flat seeds. The sweetness and cooling effect of the juicy pulp of watermelon fruits is relished during hot summer months of tropics. Edible portion of watermelon is placenta, seeds are also eaten as snack after shelling and roasting. Deep pink and light pink colour of watermelon flesh is due to anthocyanin and lycopene pigments. Fruits are generally low in energy, fat and sodium and have many medicinal properties. It is often fed to people with kidney disorders. Watermelon juice is used as an antiseptic in typhus fever [2]. Presence of fair amount of beta carotene and high content of potassium is believed to make watermelon juice to possess valuable diuretic properties. Fruits have expectorant and diuretic properties. Watermelons contain Vitamin B, which is helpful in producing instant energy in the body. Itis also used in many versatile preparations such as jelly, pie, salsa, sherbet, muffin, sauce, cake and sandwich. Rind is also edible and sometimes used as a vegetable. It is used to cure wide range of ailments like, ulcers, asthma, bronchitis, jaundice, constipation and anaemia. As watermelon requires hot and dry climate for its cultivation, in order to grow watermelon in irrespective of season throughout the year and also to get maximum yield an attempt was made on watermelon cultivation under different growing conditions [3].

Material and Methods

The current study was carried out at the Division of Horticulture, Gandhi Krishi Vignyana Kendra, University of Agricultural Sciences, Bangalore during September 2015 to January 2016 with objective of knowing Performance of watermelon (*Citrullus lanatus*) in different growing conditions. The experimental station is located at the latitude of 12° 58' North and longitude of 77° 35' East with an altitude of 930 meters above the mean sea level. The maximum and minimum temperature in a year ranges between 17.50 °C and 30.40 °C respectively. The experiment was laid out in factorial randomised complete block design with two main treatments, two sub treatments and five replications and total experimental area was 214 sq. mt.[4].

The seeds of watermelon variety Kiran were brought from known you seed company at a cost of Rs. 1300 per 50 g were sown in the nursery bed of size 15 m length, 1.0 m width and 30 cm height. 14 days old, good, vigorous and uniform height seedlings were selected and used for transplanting in the main experimental plots (open field, polyhouse) at a spacing of 0.60 x 0.45 m, 1 × 1 m as per the treatment requirement. Weeding was done as and when the weeds were noticed and also plant protection measures were carried out against the incidence of fruit borers and gummy stem blight. Recommended doses of farm yard manure (25 t ha^{-1}), N, P_2O, K_2O (100:88:100 kg ha^{-1}) was applied. Observations on different yield parameters like fruit weight, pulp weight, rind thickness, number of seeds per fruit, pulp to rind ratio, fruit yield / plant (number basis), fruit yield / plant (weight basis), estimated fruit yield / hectare, fruit length , fruit volume and fruit circumference were recorded.

Results and Discussion

All the yield attributes like fruit weight, pulp weight, rind thickness, number of seeds per fruit, pulp to rind ratio, fruit yield / plant (number basis), fruit yield / plant (weight basis), estimated fruit yield / hectare, fruit length , fruit volume and fruit circumference was significantly influenced by different spacing and growing conditions.

With regards to fruit characters, plants grown under polyhouse condition (C_2) recorded. Significantly maximum number of fruits per plant was recorded at spacing of 1×1 m (2.50) (S_2). Similarly, when watermelon plants were grown under polyhouse condition (C_2) the highest number of fruits per plant (2.92) was recorded, at a spacing of 1 × 1 m (S_2) significantly maximum fruit yield per plant (4.00 kg plant^{-1}) was recorded. Similarly, when watermelon plants were grown under polyhouse condition (C_2) highest fruit yield per plant (4.50 kg plant^{-1}) was recorded, the significantly maximum estimated fruit yield per hectare was recorded at spacing of 0.60 × 0.45 m (92.55 t ha^{-1}) (S_1). Similarly, when watermelon plants were grown under polyhouse condition (C_2) highest estimated fruit yield per hectare (92.30 kg t ha^{-1}) was recorded and it was also found to be statistically significant [Table-1]. Mean weight of the fruit was maximum when watermelon plants were grown at a spacing of 1×1 m(2.32 kg) and it was statistically significant. Similarly, when watermelon plants were grown under polyhouse condition (C_2) the mean fruit weight was also maximum and it was 2.54 kg per fruit. This was related to balanced nutrition, better uptake of nutrients by the plants which helped for better fruit set and fruit yield. This may be due to less competition for the nutrients, light and water use efficiency and also from favourable micro climate. Highest weight of the watermelon in the present study is influenced by the synthesis of photosynthates and production of plant hormones like IAA, GA_3, amino acids and vitamins. More number of fruits per plant and fruit weight ultimately contributed to more fruit yield per plant. Maximum yield under protected condition is also related to favourable micro climate of greenhouse conditions watermelon plant had put forth maximum vegetative growth and flowering due to the altered microclimate and controlled atmospheric conditions coupled with increased availability of nutrients eventually leading to better canopy coverage, better photosynthesis and translocation of photosynthates to the different plant parts.The results obtained are also in line with the findings in watermelon [5,6].

Among the spacing trial, the significantly maximum length of the fruit (19.23 cm) was recorded at spacing of 1 × 1 m (S_2). Similarly, when watermelon plants were grown under polyhouse condition (C_2) the fruit length was maximum (20.15 cm) [Table-2]. It was also found statistically significant. The significantly maximum circumference of the fruit was recorded at spacing of 1 × 1 m (40.92 cm) (S_2). Likewise, when watermelon plants grown under polyhouse condition (C_2) highest fruit circumference (45.18 cm) was recorded and it was also found to be statistically significant. At a spacing of 1 × 1 m (S_2) significantly maximum fruit volume (2.18 l) was recorded. Similarly, when watermelon plants were grown under polyhouse condition (C_2) the highest fruit volume (2.44 l) was recorded and it was also found to be statistically significant. This could be attributed to better photosynthetic activity and accumulation of carbohydrates which helps in better growth of fruits. Fruit characters was also influenced by favourable micro climatic conditions prevailing in the greenhouse which would have boosted the vegetative growth in turn improving length, circumference and volume of fruit. These results are in agreement with the findings in cucumber [1,3] and in watermelon [5].

At 0.65 × 0.45 m spacing (S_1) the significantly minimum number of seeds per fruit (326.62 seeds) was recorded. Whereas, when watermelon plants were grown under open condition (C_2) minimum number of seeds per fruit (251.00 seeds) was recorded and it was also found to be statistically significant. Among the spacing trial the significantly maximum weight of the pulp per fruit was recorded at spacing of 1 × 1 m (1.70 kg) (S_2). Likewise, when watermelon plants were grown under polyhouse condition (C_2) highest weight of the pulp per fruit was recorded (1.93 kg) and it was also found to be statistically significant. Significantly minimum rind thickness per fruit (1.51 cm) was recorded at spacing of 1 × 1 m (S_2). When watermelon plants grown under polyhouse condition (C_2) minimum thickness of the rind was minimum (1.39 cm) was recorded and it was also found to be statistically significant. At spacing of 0.60 × 0.45 m (S_1) the significantly maximum pulp to rind ratio (2.79) was recorded. Similarly, when watermelon plants were grown under polyhouse condition (C_2) highest pulp to rind ratio was recorded (3.18) and it was also found to be statistically significant. This is may be due to the maximum weight of the fruit is observed under protected condition which may be due to less competition for the nutrients, light and water increase and also from favourable micro climate. This is also related to balanced nutrition, better uptake of nutrients by the plants which helped for better fruit weight and fruit yield where the pulp to rind ratio obtained was also maximum. These results were in conformity with the findings of [9].

All the yield attributes like fruit weight, pulp weight, rind thickness, number of seeds per fruit, pulp to rind ratio, fruit yield / plant (number basis), fruit yield / plant (weight basis), estimated fruit yield / hectare, fruit length , fruit volume and fruit circumference was significantly influenced by different spacing and growing conditions.

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Table-1 *Influence of open field and polyhouse growing conditions on production of fruit yield per plant (number basis), fruit yield per plant (weight basis), fruit yield per plant and estimated yield per hectare in watermelon*

Treatments	Fruit yield (number basis plant^{-1})	Fruit weight(kg)	Fruit yield (weight basis plant^{-1}) (kg)	Estimated Fruit yield (t ha^{-1})
Spacing (S)				
S_1	1.97	1.75	2.50	92.55
S_2	2.50	2.32	4.00	40.00
F test	*	*	*	*
S.Em±	0.04	0.02	0.01	0.12
CD at 5 %	0.14	0.08	0.05	0.37
Conditions (C)				
C_1	1.55	1.53	2.00	40.25
C_2	2.92	2.54	4.50	92.30
F test	*	*	*	*
S.Em±	0.04	0.02	0.01	0.12
CD at 5 %	0.14	0.08	0.05	0.37
Interaction (S×C)				
S_1C_1	1.11	1.25	1.50	55.50
S_1C_2	2.84	2.26	3.50	129.6
S_2C_1	2.00	1.81	2.50	25.0
S_2C_2	3.00	2.83	5.50	55.0
F test	*	*	*	*
S.Em±	0.06	0.03	0.16	1.62
CD at 5 %	0.20	0.11	0.33	5.01
CV (%)	5.68	6.26	6.24	5.49

*: Significant,NS : Non significant,S_1 :0. 60 × 0.45 m,S_2: 1 × 1m, C_1 : Open field, C_2 : Polyhouse

Table-2 *Influence of open field and polyhouse growing conditions on fruit length, fruit circumference, fruit volume and number of seeds per fruit in watermelon*

Treatments	Fruit length (cm)	Fruit circumference (cm)	Fruit volume (l)	Number of seeds fruit^{-1}
Spacing (S)				
S_1	17.57	36.66	1.61	326.62
S_2	19.23	40.92	2.18	355.01
F test	*	*	*	*
S.Em±	0.16	1.31	0.02	6.99
CD at 5 %	0.51	4.04	0.06	21.54
Conditions (C)				
C_1	16.65	32.40	1.36	251.00
C_2	20.15	45.18	2.44	430.64
F test	*	*	*	*
S.Em±	0.16	1.31	0.02	6.99
CD at 5 %	0.51	4.04	0.06	21.54
Interaction (S×C)				
S_1C_1	15.45	30.00	1.08	228.85
S_1C_2	19.7	43.32	2.15	424.40
S_2C_1	17.86	34.8	1.64	273.15
S_2C_2	20.6	47.04	2.73	436.88
F test	NS	NS	NS	NS
S.Em±	0.23	1.85	0.04	9.88
CD at 5 %	-	-	-	-
CV (%)	7.01	7.67	6.79	8.48

*: Significant, NS : Non significant,S_1 :0. 60 × 0.45 m,S_2: 1 × 1m, C_1 : Open field, C_2 : Polyhouse

Conclusion

Based on the results of the study it is concluded that plants grown under polyhouse at 1 × 1 m spacing proved to be the best considering the growth, and yield. In general growing of watermelon under protected condition leads to increases in yield and returns than the open field condition since the maintenance of higher plant population and prevalence of favorable micro climate conditions. There is a need to standardize the spacing level for Kiran *var.* and also other varieties of watermelon for utilizing the vertical height of polyhouse.

Table-3 *Influence of open field and polyhouse growing conditions on production of pulp weight per fruit in watermelon*

Treatments	Pulp weight (kg) fruit^{-1}	Rind thickness (cm) fruit^{-1}	Pulp to rind ratio
Spacing (S)			Spacing (S)
S_1	1.12	1.64	1.80
S_2	1.70	1.51	2.79
F test	*	*	*
S.Em±	0.04	0.01	0.0006
CD at 5 %	0.12	0.05	0.019
Conditions (C)			Conditions (C)
C_1	0.90	1.76	1.41
C_2	1.93	1.39	3.18
F test	*	*	*
S.Em±	0.04	0.01	0.0006
CD at 5 %	0.12	0.05	0.019
Interaction (S×C)			Interaction (S×C)
S_1C_1	0.61	1.82	0.96
S_1C_2	1.64	1.45	2.64
S_2C_1	1.18	1.70	1.86
S_2C_2	2.23	1.32	3.72
F test	NS	NS	NS
S.Em±	0.05	0.02	0.04
CD at 5 %	-	-	-
CV (%)	7.12	6.7	6.23

*: Significant,NS : Non significant,S_1 :0. 60 × 0.45 m,S_2: 1 × 1m, C_1 : Open field, C_2 : Polyhouse

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