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Performance study of some cooking type watermelon genotypes

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ABSTRACT

Cooking type watermelon is an underutilized vegetable crop of Red and Lateritic Zone of West Bengal which is locally known as 'Khero'. Thirteen landraces of cooking type watermelon were assessed for twelve quantitative traits during summer 2021 at Horticultural Farm of Sriniketan. The study revealed the presence of significant variation in different growth, flowering, yield and quality traits among the genotypes. Short vine length was recorded in genotype VC-9-2-1 and VC-22. The early flowering was observed in genotype VC-5-3. However, VC-13-3 took minimum days for first fruit harvest. Maximum fruit length as well as fruit circumference was produced by genotype VC-5-2. Maximum number of fruits plant^{-1} and total fruit yield plant^{-1} were observed in VC-12-2. These genotypes are suggested to use in future breeding programmer for earliness, higher yield and quality improvement.

***Keywords*:** *Citrullus*, genotype, landrace, underutilized, variation, yield

Watermelon (*Citrullus lanatus* Thunb.) is an annual cucurbit comes under the genus *Citrullus* and having diploid chromosome number 2n=22 (Whitaker and Davis, 1962; Renner *et al.*, 2017). Different study suggests that most of the wild cultivars were andromonoecious in nature, however common watermelon plants are monoecious (Rosa, 1928; Boualem *et al.*, 2016). Watermelon is widely grown in India as well as in different warmer countries of the world. It is generally grown as a summer crop in the plains as well as in the river beds of India (Singh *et al.*, 2018). Watermelon requires longer day length with hot dry climate and cooler nights for its cultivation. Watermelons are mostly loved for sweet juicy flesh. They are seldom consumed after cooking (Jadhav *et al.*, 2014).

Watermelon is believed to be originated from Africa; however, its domestication and distribution is still under debate (Chomicki and Renner, 2015; Nantoume *et al.*, 2012). Many cultivated and wild species of *Citrullus* are found in different regions of Africa. Classification of *Citrullus* genus based on species, subspecies and botanical varieties are contradictory. However continuous efforts are made to bring clarity on the classification (Paris, 2015). Fursa, 1972 and Guo *et al.* (2013) reported three sub species of *Citrullus i.e. C. lanatus* ssp. *lanatus* and *C. lanatus* ssp. *vulgaris* were represented sweet desert watermelon group and *C. lanatus* ssp. *Mucosopermus* was represented Egusi watermelon group having edible seeds. According to Munisse *et al*. (2011) and Dube *et al*. (2020), three types of watermelon (*Citrullus lanatus*) species such as desert type having white to red flesh, seed type having white flesh and cooking type having white to yellow flesh were found in Africa. They observed that cooking watermelons were less sweet and bigger in size than modern varieties. Cooking watermelon also known as cow melon generally used as animal feed (Mujaju *et al*., 2011). Rajasthan is known as home of different indigenous watermelon species. Mahla and Choudhary (2013) reported two seed type and cooking type watermelon landraces in Rajasthan.

Cooking type watermelon is a local landrace, commonly known as '*Khero*', cultivated in Birbhum district and its adjacent areas of West Bengal (Biswas *et al*., 2020). This minor vegetable has been cultivated mostly in the riverbeds and river sites during summer months. However, some farmers cultivate this crop during off season for high market price (Anumala *et al*., 2020). Tender immature fruits of *Khero* are harvested and consumed after cooking. Fruits are found in different shape and sizes starting from oval to cylindrical; however, people mostly prefer cylindrical immature fruits for consumption. Fruits are light to dark green in colour having whitish to light yellow flesh. Apart from human consumption fruits are also used for fodder purpose. Till date very less information is available on this crop. Scientific research works on cooking type watermelon are also meager (Biswas *et al*., 2020).

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Productivity of cooking type watermelon is low in these areas due to lack of improved varieties. Though a prized summer season vegetable, still it is unknown to other localities and cultivated in limited areas only. Wide genetic variation present in the genotypes provides the breeder good opportunity to work upon and develop a desirable genotype according to market demand. Improved genotypes can be suggested to the farmers for boosting production. Additionally, superior genotypes can be used in crop improvement programme. So there is a need of developing improved cultivars of cooking type watermelon having all desirable traits. By understanding the value of this crop, the present study was designed and undertaken with the objective to study the production performance of cooking type watermelon genotypes under Red and Laterite Zone of West Bengal.

MATERIALS AND METHODS

The present field experiment was carried out at Horticultural Farm ($23^0$40´26.93 N latitude and $87^0$39´40.33 E longitude with an average altitude of 40 meter from mean sea level) of Visva-Bharati University, Sriniketan, Birbhum, West Bengal, India during February to June, 2019. Thirteen genotypes (VC-12-2, VC-12-3-1, VC-12-3-2, VC-3-4, VC-5-1, VC-5-2, VC-5-3, VC-9-2-1, VC-13-3, VC-22, VC-23, VC-25 and VC-26) of cooking type watermelons were collected from Department of Horticulture and Post-Harvest Technology, Palli Siksha Bhavana. Above genotypes were assessed by using randomized block design with three replications. For trailing of vines, 2.5 m wide beds were made and for irrigation, 70 cm wide irrigation channel were prepared. Along with irrigation channel, pits were prepared with a distance of 50 cm on the beds. Slightly acidic soil was recorded at the experimental site with a pH of 6.7. The soil also contained 204.1 kg ha^{-1} available nitrogen, 40.1 kg ha^{-1} available phosphorous, 167.8 kg ha^{-1} available potassium and 0.33 % organic matter. Well rotten FYM @ 20 t ha^{-1} was mixed with soil during final land preparation. NPK fertilizers @ 80:60:60 kg ha^{-1} were used at different growth stages of the crop. Seeds were treated with Bavistin (Carbendazim 50% WP) @ 2g l^{-1} of water before sowing. On every hill, three seeds were sown and later only one healthy seedling was kept per hill. Irrigation was given in channel as per crop demand. Ten random plants were tagged in each replication and observed for different characters such as vine length, days to first male flower appearance, days to first female flower appearance, node at which first male and female flower opening, days to first fruit harvest, number of fruits $plant^{-1}$, average fruit weight (g), fruit length (cm), fruit circumference (cm), fruit yield $plant^{-1}$ (kg) and TSS. ANOVA technique was followed to test the significance at 5% for different characters by using F test. C.D. value was worked out for comparison between means.

RESULTS AND DISCUSSION

Growth and flower traits

Shortest vine length was observed in genotypes VC-9-2-1 and VC-22 which were noted statistically at par with genotypes VC- 12-2, VC-25, VC-23, and VC-5-3. Maximum vine length was recorded in genotype VC-5-1. Gichimu *et al*. (2010) reported positive correlation between vine length and extensive branching which was responsible for high yield in watermelon. Mrema and Maerere (2018) reported significant and positive correlation between vine length and node number. Significant variation in vine length was reported by Mandal and Mohanta (2018) in tinda and Oraegbunam *et al*. (2016) in watermelon. Genotype VC-12-3-2 took maximum number of days to appear first male flower whereas genotype VC-5-3 took minimum days. Male flower opening varied between 45 and 50.7 days with an average of 47.5 days. For the opening of first female flower, number of days varied from 51.2 to 57.7 with an average of 54.8 days. Genotype VC-5-3 took minimum number of days to open first female flower, whereas maximum days was noted in VC-12-2. Alimari *et al*. (2017) reported significant variation among fourteen accessions of watermelon for number of days to opening of first male and female flower respectively. Anumala *et al*. (2020) reported positive correlation between days to first male and female flower opening in off season vegetable type watermelon. Node number on which first male flower appeared was varied from 5.1 to 8.3 with mean of 6.7. Similarly, node number on which first female flower appeared was varied from 17.7 and 24.4 with mean of 20.0. Genotype VC-12-3-2 and VC-23 were observed for maximum and minimum node number to first male flower opening respectively. Similarly, VC-13-3 and VC-22 was recorded maximum and minimum node number to first female flower opening. Variation in node number for cooking type watermelon flowering has also reported by Biswas *et al*. (2020). Average number to first fruit harvest was registered 69.5 days. Anumala *et al*. (2020) reported significant variation in cooking type watermelon for days to first fruit harvest.

Yield and quality traits

Fruit number was varied from 4.4 to 6.8 with a mean of 5.3. Maximum number of fruits $plant^{-1}$ was recorded in genotype VC- 12-2 which was statistically at par with VC-12-3-2; whereas minimum number of fruits $plant^{-1}$ noted in genotype VC-13-3. Singh *et al*. (2017) noted significant variation for this character in exotic cultivars of watermelon than local landraces of India. Fruit weight

Table 1: Growth and flowering parameters of cooking type watermelon genotypes

Genotype	Vine length (m)	Days to 1st male flower opening	Days to 1st female flower opening	Node to 1st male flower appearance	Node to 1st female flower appearance	Days to 1st fruit harvest
VC-12-2	3.3	49.8	57.7	7.8	18.5	69.0
VC-12-3-1	3.8	50.0	55.5	6.1	20.4	69.9
VC-12-3-2	3.7	50.7	56.8	8.3	21.9	69.2
VC-3-4	3.6	47.4	54.6	6.8	19.6	71.5
VC-5-1	3.9	48.1	55.3	6.9	19.1	69.5
VC-5-2	3.7	47.5	54.0	7.6	20.3	67.8
VC-5-3	3.5	45.0	51.2	6.9	20.9	67.6
VC-9-2-1	3.2	46.0	53.2	6.4	20.1	69.7
VC-13-3	3.6	46.2	54.7	5.5	24.4	66.7
VC-22	3.2	46.3	53.1	5.9	17.7	71.1
VC-23	3.5	47.0	57.4	5.1	19.9	71.0
VC-25	3.4	47.0	54.7	6.4	18.0	70.1
VC-26	3.6	46.4	54.1	7.1	19.6	70.3
GM	3.5	47.5	54.8	6.7	20.0	69.5
SEm (±)	**0.1**	**1.0**	**1.1**	**0.6**	**1.6**	**1.5**
LSD (0.05)	**0.3**	**2.1**	**2.2**	**1.2**	**3.2**	**NS**
CV (%)	**5.2**	**2.6**	**2.4**	**9.5**	**9.5**	**2.7**

Table 2: Yield and quality parameters of cooking type watermelon genotypes

Genotype	Number of fruits plant^{-1}	Average fruit weight (g)	Fruit length (cm)	Fruit circumference (cm)	Average Fruit yield plant^{-1}	TSS (^{0}B)
VC-12-2	6.8	583.9	24.1	27.5	3.9	4.6
VC-12-3-1	5.9	564.3	23.2	27.9	3.3	4.7
VC-12-3-2	6.1	613.2	23.5	26.8	3.7	4.6
VC-3-4	5.6	484.3	22.0	24.4	2.7	5.3
VC-5-1	4.8	568.1	25.1	26.8	2.7	5.2
VC-5-2	5.2	449.0	28.7	31.8	2.4	5.6
VC-5-3	4.6	563.0	26.7	30.1	2.6	5.3
VC-9-2-1	4.8	569.8	22.2	24.4	2.7	4.4
VC-13-3	4.4	657.0	25.0	28.0	2.9	4.5
VC-22	5.6	449.5	19.3	20.9	2.5	5.8
VC-23	4.7	503.0	21.5	25.5	2.4	4.5
VC-25	4.6	478.0	19.2	23.7	2.2	5.4
VC-26	5.3	557.3	22.9	26.1	2.9	5.2
GM	5.3	541.6	23.3	26.5	2.8	5.0
SEm (±)	**0.4**	**52.8**	**1.2**	**1.5**	**0.2**	**0.2**
LSD (0.05)	**0.8**	**108.9**	**2.4**	**3.2**	**0.6**	**0.4**
CV (%)	**8.6**	**11.9**	**6.1**	**7.2**	**12.9**	**4.6**

of watermelon was positively correlated to total fruit yield (Choudhary *et al*., 2012). Genotype VC-13-3 recorded highest average fruit weight which was statistically at par with genotypes VC-12-3-2, VC-12-2, VC-9-2-1, VC-5-1, VC-12-3-1 and VC-5-3. On the other hand, VC-5-2 had minimum average fruit weight. Average fruit weight was ranged from 449 to 657 g with mean of 541.6 g per fruit. Enujeke (2013) and AL-Juboori *et al*., (2018) reported significant variation in fruit weight of watermelon respectively. Fruit length was ranged from 19.2 to 28.7 cm with mean of 23.3 cm. Genotype VC-5-2 had longest and VC-25 had shortest fruits. Narine *et al*. (2019) observed significant variation among five hybrids of watermelon for fruit length in

Table 3: Correlation Matrix of different quantitative traits in cooking type watermelon genotypes

	AFYP	VL	DMFO	DFFO	NMFA	NFFA	NFPP	DFH	AFW	FL	FC	TSS
AFYP	1											
VL	0.121	1										
DMFO	0.750**	0.396	1									
DFFO	0.538	0.205	0.754**	1								
NMFA	0.527	0.202	0.490	0.109	1							
NFFA	0.224	0.372	-0.020	-0.016	-0.077	1						
DFH	-0.162	-0.207	0.099	0.210	-0.205	-0.675*	1					
NFPP	0.787**	-0.049	0.759**	0.487	0.567*	-0.271	0.239	1				
AFW	0.641*	0.226	0.230	0.215	0.117	0.687**	-0.528	0.037	1			
FL	0.166	0.508	0.046	-0.143	0.424	0.493	-0.770**	-0.049	0.291	1		
FC	0.204	0.538	0.144	-0.024	0.377	0.509	-0.765**	-0.029	0.301	0.940**	1	
TSS	-0.537	0.005	-0.327	-0.536	0.130	-0.510	0.174	-0.091	-0.730**	-0.023	-0.119	1

Here * and ** are significant at 5% and 1% level respectively.

Note: AYFP- Average Fruit yield plant^{-1}, VL- Vine length, DMFO- Days to 1st male flower opening, DFFO- Days to 1st female flower opening, NMFA- Node to 1st male flower appearance, NFFA- Node to 1st female flower appearance, DFH- Days to 1st fruit harvest, NFPP- Number of fruits plant^{-1}, AFW- Average Fruit Weight, FL- Fruit Length, FC- Fruit Circumference, TSS- Total Soluble Solid.

South America. Fruit circumference was ranged from 20.9 to 31.8 cm with mean of 26.5 cm. Maximum fruit circumference was observed in VC-5-2; whereas minimum was noted in VC-22. Mahla and Chaudhary (2013) reported significant variation among fifty-seven genotypes of watermelon for this character.

Fruit yield plant^{-1} was ranged between 2.2 to 3.9 kg with average of 2.8 kg. VC-12-2 and VC-25 registered maximum and minimum fruit yield plant^{-1} respectively. VC-12-2 was statistically at par to VC-12-3-2 and VC-12-3-1. Anburani (2018) and More and Chudasama (2020) observed significant variation among studied watermelon genotypes for fruit yield. Significant variation in fruit yield plant^{-1} was reported by Mandal and Mohanta (2018) in tinda; and Anumala *et al*. (2020) in vegetable type watermelon. Total Soluble Solid is an important quality parameter which ensures the quality of fruits. TSS was ranged between 4.4 to 5.8 ^{0}Brix with average of 5.0 ^{0}Brix. Genotype VC-12-2 followed by VC-5-2 and VC-25 recorded maximum flesh TSS, whereas it was found minimum in VC-9-2-1.

Correlation analysis

From the Correlation study it was observed that, fruit yield per plant showed significant positive correlation with days to first male flower opening (r = 0.750), number of fruits plant^{-1}(r = 0.787) and average fruit weight (r = 0.641). Similar result observed by Anumala *et al*. (2020) in vegetable type watermelon. They observed that average fruit yield per plant showed positive correlation with number of fruits per plant and average fruit weight. Days to first male flower opening was positively correlated with days to first female flower opening (r = 0.754) and number of fruits plant^{-1} (r = 0.787). Whereas, Number of fruits per plant had significant positive correlation with Node to first male flower appearance (r = 0.567) and negative correlation with fruit length (r = -0.770) and fruit circumference (r = -0.765). Node to first female flower appearance showed negative correlation with Days to first fruit harvest (r = -0.675) and positive correlation with Average fruit weight (r = 0.687). Fruit length showed positive correlation with fruit circumference (r = 0.940). Average fruit weight had negative correlation with TSS (r = -0.730).

CONCLUSION

Cooking type watermelon genotypes were significantly varied for different characters. Genotype VC-5-3, VC-22 and VC-23 had some earliness characters, whereas VC-12-2, 12-3-1 and VC-12-3-2 produced higher yield. So these genotypes could be used in crop improvement programme. VC-12-2 observed for several desirable traits including earliness and high

Fig. 1: Fruit diversity of cooking type watermelon

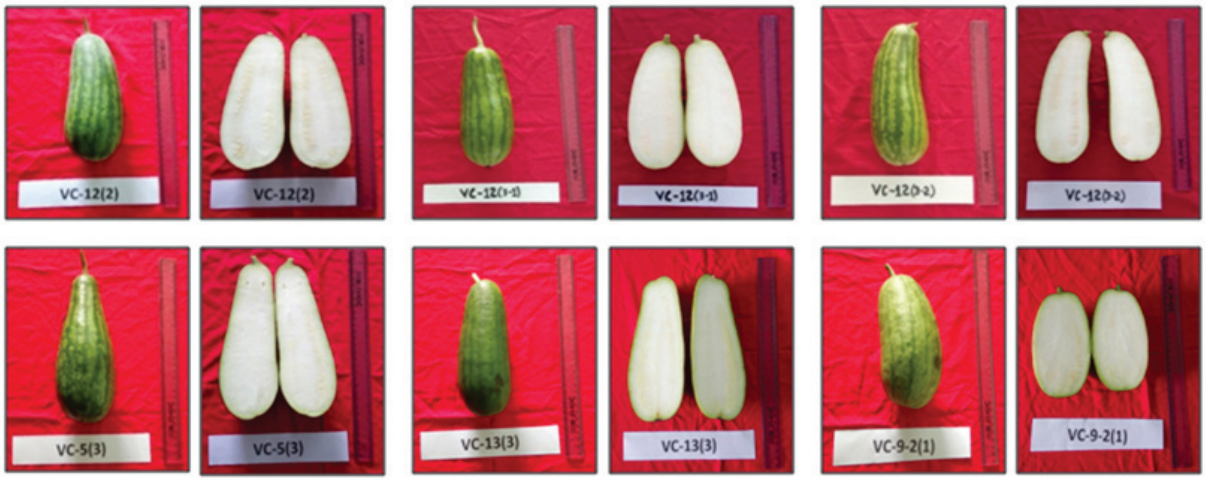

Fig. 2: Some desirable genotypes of cooking type watermelon

yield potential. This genotype can be grown by farmers commercially under Red and Laterite Zone of West Bengal.

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