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Evaluation of high yielding varieties of watermelon for river bed cultivation under solar based boat operated gravitational drip irrigation

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Abstract

A field study was conducted taking eight genotypes of watermelon at RPCAU, Pusa during spring-summer of 2019 and 2020 to judge their suitability of cultivation at river bed of dhab area. Watermelon is a promising vegetable crop grown in River bed area of rivers of Bihar. Farmers mostly grow 'land races' that leads to poor quality, low productivity and less market return and irrigating the field by uplifting water in bucket from side by river which is very tedious and expensive. The Dr. Rajendra Prasad Central Agricultural University, Pusa has started trial on "Evaluation of high yielding varieties of watermelon for river bed cultivation under solar based boat operated gravitational drip irrigation system. Eight varieties were assessed for various growths and yield attributes at river bed of dhab area of RPCAU, Pusa during spring-summer of 2019 and 2020. Significant variation was observed among the different varieties for all the character like vine length, number of branches per vine, fruit length, fruit circumference, average fruit weight, number of fruit per plant and fruit yield per plant. Maximum numbers of fruits per plant (3.51), average fruit weight (3.47 Kg) and fruit yield per plant (13.42 Kg) and fruit yield per hectare (51.18 t) were recorded with the variety Sangria followed by Sugar baby. So, it can be concluded that variety Sangria performed better fruit yield in the river bed of budhi gandak under solar based boat operated gravitational drip irrigation system.

Keywords: watermelon, river bed cultivation, gravitational drip irrigation

Introduction

River bed commonly known as diara land is a basin or bank area or area between two or more streams of river and known as Khadar, Kachhar, Doab, Dariyari, Kochar, Nad, Tali and Nadiari by several local names. In India, cultivation of cucurbits like watermelon, muskmelon, longmelon, pumpkin, summer squash, ridge gourd, smooth gourd, snake gourd, bitter gourd and bottle gourd occurs mostly in North and Central India.; bitter gourd, snake gourd etc. in some areas of Kerala and cultivation of pointed gourd in Eastern U.P., Bihar and West Bengal is more common under river bed conditions to catch early market and fetches more profit. The river-beds of Ganga, Burhi Gandak, Gandak, Kosi and some rivers are some of the important areas where cucurbits like bottle gourd, pumpkin, watermelons etc. are extensively grown. The area under diara agro-ecosystem in Bihar is reported to be 11.57 lakh ha distributed among Ganga, Burhi Gandak, Gandak, Kosi and some rivers (*Wadhvani and Singh, 2008*)^[22]. Presently not only in India, but in other south East Asian countries cucurbits are also commercially cultivated in the river bed areas. In survey it was observed that out of total area under cucurbits cultivation, 60% area is under river bed and during summer season around 75-80% of total cucurbits production is being produced in diara land area, which is available in the market from February of June. Main riverbed of Bihar, where cucurbits grown, are Ganga, Burhi Gandak, Gandak, Kosi. The river bed cultivation is done by the farmers using their own seeds of land races, as well as old aged indigenous production technology which results low productivity. Hence, there is urgent need for screening of the existing varieties and advanced lines of cucurbitaceous vegetables under riverbed condition. Mostly the farmers manually collect water in buckets from river and irrigate the crops which suffers from numerous

problems such as considerable seepage, higher energy cost; leaching of costly agricultural inputs causing sub-surface water pollution (Singh *et al.* 2017a; Singh *et al.* 2017b; Singh *et al.* 2017c; Singh *et al.* 2018; Tiwari *et al.* 2018; Tiwari *et al.* 2019a; Tiwari *et al.* 2019b; Kour *et al.* 2019; Singh *et al.* 2019) [11-19]. Watermelon (*Citrullus lanatus*) is a monoecious vine, a scrambling and trailing vine in the flowering plant family Cucurbitaceae. Watermelon (*Citrullus lanatus* (Thunb.) Matsum. and Nakai) is an important summer season crop which is prized for sweet juicy flesh. It is a rich source of important phytochemicals that promote human health and reduce the extent of cancer insurgence, cardiovascular disorders, diabetes and macular diseases. (Naz *et al.*, 2014) [8]. Worldwide watermelon is grown over 3.5 million ha and produced 104 million tons (FAOSTAT, 2012) [2]. China is the leading country in watermelon production followed by Turkey. In India, area under watermelon is 100.88 thousand ha and production of 2479.71 thousand MT. Among the states of India, Uttar Pradesh stands first in area (13.07 thousand ha) and production (588.54 thousand MT) while, Bihar ranked 12th in area (1.41 thousand ha) and production (30.00 thousand MT) (Anonymous, 2017) [1]. Till day no technology is standardized for riverbed or diara land based on research. Thus standardization of riverbed technologies for cucurbits becomes a matter of research so that scientific information regarding varietal suitability and other input parameters of river bed technology can be refined, standardized and documented. By these, productivity of cucurbit crops as well as vegetables will be increases and socio-economic status of farmer will also improve. The Dr. Rajendra Prasad Central Agricultural University, Pusa has taken the lead and started a multi-disciplinary project "Evaluation of high yielding varieties/hybrids of watermelon for river bed cultivation under solar based boat operated gravitational drip irrigation system.

Materials and Methods

The experiment was conducted during spring-summer 2019 and 2020 at the River bed of Budi Gantak river of Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur situated at 25.9809856° N latitude and 85.6881059° E longitudes with an altitude of 52.0 m above MSL. The soil of the experimental field is deep and comes under the soil order *Entisols*. It is loamy sand in texture, whitish-brown in color and alkaline in reaction due to presence of excess (23.62 %) free CaCO₃ in surface soil. At the time of field preparation surface soil samples (0-0.15m) were taken and processed for the analysis of the initial soil properties in laboratory. The pHs of the experimental fields were 7.94 to 8.12, EC 0.46 to 0.53 dSm⁻¹, CEC (c mol (p+) kg⁻¹) 11.26 to 13.14 and organic carbon was 0.36%. The N statuses of the experimental field were low (184 to 206 kg ha⁻¹), low in available P (18.40 to 20.14 kg ha⁻¹) and medium in available K status (143.2 to 157.4 kg ha⁻¹). Well decomposed FYM or Vermicompost according to the treatment was incorporated thoroughly in the soil at the time of field preparation. Full dose of phosphorus and potash and ½ dose of nitrogen were applied at the time of sowing. Half dose of nitrogen was applied as split dose one month after sowing. The source of nitrogen, phosphorus and potash were urea, SSP and MOP, respectively.

The experiment material was comprised of five hybrids AS-Kajal, Sangria, Saras Shaktiman-81, BSS 2000 and three open pollinated Sugar Baby, Arka Manik and Arka Muthu varieties of watermelon. Experiment was conducted following randomized block design with three replications. FYM (25 t

ha⁻¹) and NPK fertilizers (100:70:60 kg ha⁻¹) were applied to grow this crop. Full dose of FYM and phosphorus and one third dose of nitrogen and potash were applied as basal. Rest nitrogen and potash were applied in equal split doses at 30 and 45 days after sowing as top dressing. Seeds were soaked overnight and then treated with fungicide (Carbendazim 50% WP @ 3g/kg of seed) before sowing. Spacing between row to row was given 2.0 m and plant to plant 0.6m.

Data taken from five randomly selected plants from each treatment and replications. Observations were recorded on vine length, branch number, number of fruits plant⁻¹ in the field. After harvesting different fruits characters (fruit length, circumference and average fruit weight) were taken. Fruit yield plant⁻¹ was computed by adding weight of each fruits of a plant. The mean values of various characters thus obtained were subjected to statistical analysis. The total variation for different varieties was tested for significance by F test using analysis of variance technique. Critical differences were calculated for each character to the test the significance of difference between means of different genotypes. For statistical analyses Panse and Sukhatme (1985) [10] was followed.

Results and Discussion

Significant variation was observed among the different varieties for plant height and number of branch per vine (Table 1). Longest vine (288.65 cm) was observed in Sangria which was found statistically at par with Saras. Shortest vine length was recorded in BSS 2000. Medium to short vines with compact growth habit is a desirable character in watermelon. 'Saras' was recorded maximum branch number among the variety which was not significantly different from Sangria. Gichimu *et al.* (2010) [4] reported that the landrace had the highest yield compared to commercial varieties owing to its long vines and extensive branching. Long main vine and extensive branching was found to be highly correlated to yield. Mohanta and Mandal (2019) [7] reported longest vine in Shaktiman and Shortest vine in Arka Muthu.

Maximum fruit length was obtained in variety AS-Kajal (39.24 cm) which was at par with Sangria (36.84 cm) while minimum (29.34 cm) was recorded in Arka Manik. Maximum fruit circumference was observed in Sangria (56.34 cm) which was recorded statistically similar to Saras, and AS-Kajal. Fruit length and circumference were determined the size and shape of fruit. Ogwu *et al.* (2016) [9] studied fruit diameter in four varieties of watermelon. Mohanta and Mandal (2016) [6] reported that watermelon variety KSP1127 had maximum polar and equatorial diameter of fruit. Maximum number of fruits per plant (3.51) was found in variety Sangria followed by varieties Sugar Baby and Saras. On an average 2.75 fruits per plant was recorded. Among the varieties, Sangria produced the heaviest fruits. Fruit weight of Sangria was 3.47 Kg which was at par with AS-Kajal (3.14 Kg) while minimum was in Arka Manik (2.42 Kg). Number of fruits per plant and fruit diameter was positively correlated with fruit yield (Samadia, 2007 and Sundaram *et al.*, 2011) [20, 21]. Variation in watermelon fruit weight was also reported by Ogwu *et al.* (2016) [9]. Gichimu *et al.* (2010) [4] studied three commercial watermelon varieties in Kenya and compared to a local landrace. They observed that 'Yellow Crimson' had significantly biggest and heaviest fruits averaging 3.01 kg. In Maharashtra, Jadhav *et al.* (2014) [5] observed that 'Ayesha F1 Hybrid' was significantly superior with maximum weight of single fruit.

Sangria (13.42 kg) gave highest fruit yield per plant which out

yielded other varieties. Sugar Baby, Kajal and BS-2000 produced average 10 kg fruit yield per plant. Minimum fruit yield was recorded in variety Arka Manik (5.26 Kg). These findings were supported by Jadhav *et al.* (2014) [5], Gichimu *et al.* (2008 and 2010) [3, 4] and Mohanta and Mandal (2016) [6]. It was found that on an average the hybrids produced 10 kg

fruit yield per plant; while open pollinated varieties gave an average yield of 7.0 kg per plant. Fruit yield per hectare was also recorded maximum with Sangria (51.18 t/ha) and minimum was recorded with Arka Manik (29.19 t/ha). Thus, in general, it may be assumed that selecting a hybrid offer better yield remuneration.

Table 1: Growth and yield attributing traits of watermelon varieties

Varieties	Vine length (cm)	No. of branch per vine	Fruit length (cm)	Fruits circumference (cm)	Average fruit weight (kg)	Number of Fruit plant ⁻¹	Yield plant ⁻¹ (kg)	Yield per ha (t)
Sugar Baby	231.05	4.35	33.21	54.50	2.81	3.31	11.74	42.01
Arka Manik	245.31	4.57	29.34	48.62	2.42	1.81	5.26	29.19
Arka Muthu	250.12	4.41	29.87	49.79	2.45	1.88	5.62	31.12
AS-Kajal	233.14	4.12	39.24	52.14	3.14	2.86	10.45	39.86
Sangria	288.65	4.87	36.84	56.34	3.47	3.51	13.42	51.18
Saras	267.15	4.91	32.94	55.14	2.81	3.12	8.74	38.44
Shaktiman-81	198.45	3.59	34.61	51.02	2.76	2.56	7.56	37.09
BSS 2000	184.39	3.98	32.12	50.23	2.61	2.81	10.21	38.88
Mean	237.28	4.35	33.52	52.22	2.81	2.73	9.13	38.47
CD (0.05)	16.54	0.45	3.14	4.12	0.52	0.32	1.31	4.21

Conclusion

The present study on evaluation of watermelon hybrids and varieties measured the characters of growth and yield. Significant variation was observed in all the characters of watermelon hybrids and varieties. So, it can be concluded that Sangria performed better fruit yield in the river bed of budhi gandak under solar based boat operated gravitational drip irrigation system

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