Original Research Article

Assessment of Morpho-Biochemical Traits in Watermelon (*Citrullus lanatus*) Cultivars across Staggered Sowing intervals Under the agro-climatic conditions of Assam, India

ABSTRACT

An experiment was conducted in the Experimental Farm, Department of Horticulture, Assam Agricultural University, Jorhat to study the effect of time of sowing on growth, yield and quality of the fruit and standardize the optimum time of sowing in watermelon.

The experiment was laid out in Factorial Randomised Block Design with two varieties- Saraswati (V_1) and Kiran (V_2) and five different time of sowing- October(M_1), November (M_2), December (M3), January (M_4) and February (M_5). Observations on growth, yield and quality parameters were recorded at 60, 90 and 120 days after sowing.

Results revealed that the variety Kiran sown in November recorded significantly the highest female flowers per plant (11.33), fruit set percentage (27.98 %) and fruit retention percentage (44.04 %). In addition this treatment combination was also able to register the maximum number of fruits per plant (2.67), fruit weight (4.32 kilogram), yield per plant (9.77 kilogram), yield per ha (44.58 tonnes), Total Soluble Solids (9.97 ^{0} Brix), total sugar (9.12 %) and ascorbic acid (7.03 milligram per 100 gram).

Thus, it may be inferred that watermelon variety Kiran sown in the month of November was the best treatment combination in terms of yield and yield attributing parameters and quality parameters as well.

Keywords: Watermelon, Biochemical characters, Quality parameters, Sowing time, Yield, Kiran

1. INTRODUCTION

Watermelon *Citrullus lanatus* (Thunb.) Matsum. & Nakai, is one of the important and popular dessert fruit consumed by almost all the age groups in our country. It belongs to the familyCucurbitaceae and is also known as *Tarbuj, Tarmuj, Kalindi*in different parts of India (Panigrahi & Sharma, 2017). It is a tender annual trailing creeper mostly grown in hot and dry regions under both irrigated river beds and rainfed conditions during *Rabi* and summer seasons in India. Maharashtra, Karnataka, Tamil Nadu, Punjab, Rajasthan, Madhya Pradesh, Uttar Pradesh, Gujarat and Andhra Pradesh are the major watermelon growing states in the country. These days, watermelon is considered as a “functional food” and a popular fruit endowed with important nutritional and bioactive compounds providing several health benefits. Both watermelon seeds and rind are edible and rich in nutrient and

bioactivecompounds. Watermelon seeds are also fried and eaten. Fruits of watermelon, unlike other cucurbits, are seldom cooked as a vegetable when immature (Maitra, 2007). It is rich in carbohydrates, vitamin A, vitamin C, minerals and contains lycopene, Beta carotene, sugar, and 92% water (Perkins *et. al.*, 2012) which makes it an excellent dessert fruit and its juice is very good as refreshing drink and cooling beverage. A watermelon fruit contain 95 percent water, 0.2 % protein, 0.3 %minerals and 3.3 % carbohydrates per 100g fresh weight(Edwards *et al.*, 2003). The fruit contains antioxidants properties as well. Value added products like jelly, squash, sauce, cakes,cookies, juice, jam are popular in the market. Cultivation is generally done in river beds by making trenches and sowing in hills or pits. The short duration and high yielding potential varieties are selected for watermelon cultivation throughout India. Farmers in Assam opt for the period from January-June as sowing time to escape the early rains otherwise which may lead to serious insect pest infestation. Information regarding the relative performance of watermelon grown during different seasons of the year is scanty. Moreover, farmers often left with no option in selecting the variety for its cultivation in Assam conditions. Therefore, under these circumstances, the present study has been undertaken to select the best sowing time and best variety out of two popular varieties in the state for watermelon under Assam conditions.

2. MATERIALS AND METHODS

The experiment was conducted in the Experimental farm, Department of Horticulture, Assam Agricultural University, Jorhat (26°47´ N latitude, 94.12´E longitude). This region is characterized by subtropical climate with a hot, muggy summer and a comparatively dry, chilly winter with average precipitation about 2400 mm. The summers here have a good deal of rainfall, while the winters have very little. The average temperature is 24.0° C.The time of sowing selected for planting was on monthly basis from October to February and abbreviated as: October-M_1, November-M_2, December-M_3, January-M_4 and February-M_5. The variety selected for the study was Saraswati (V_1) and Kiran (V_2) and was laid out in Factorial Randomized Block design with ten treatment combinations *viz.* M_1V_1, M_1V_2, M_2V_1, M_2V_2, M_3V_1, M_3V_2, M_4V_1, M_4V_2, M_5V_1, M_5V_2 with 03 (three) replications each.

All the cultural practices, pre & post maintenance and land preparation of the experimental plot were done as per Package of practcies, Assam Agricultural University, 2021. The whole experimental plot was covered with 50-micron black polythene mulch to facilitate weed suppression and retention of optimum moisture.05 (Five) plants were randomly selectedfrom each combinations for recording data on different yield and yield

attributing characters. Methods followed in recording various quality parameters and reproductive parameters are discussed as below.

2.1 Quality parameters

2.1.1 Total soluble solid (TSS)

The TSS was estimated by Zeiss Hand Refractometer at room temperature. The reading was expressed in °Brix.

2.1.2 Reducing sugar

10 g juice was extracted from the pulp and poured in a volumetric flask and the volume was made up to 100 ml with distilled water and centrifuged. The supernatant was taken in a burette. 5 ml of each Fehling's 'A' and 'B' solutions were taken in a conical flask and heated. The sugar solution was titrated against heated Fehling's solution using methylene blue as an indicator till the end point of brick red precipitation with white bubbles. Reducing sugar was determined using the following formula:

$$\text{Reducing sugar (\%)} = \frac{\text{mg of invert sugar} \times \text{volume made up}}{\text{Titrate value} \times \text{Wt. of sample}} \times 100$$

The Fehling's 'A' and 'B' solutions were used as described by Lane & Eynon, (1923) to estimate the sugar content in the samples.

2.1.3 Total invert sugars

Twenty five ml of solution used for the estimation of reducing sugar was taken in a conical flask and 2.5 ml of concentrated HCl was added, kept overnight. The solution was then neutralized with 1N NaOH, volume made up to 75 ml and titrated against fehling's solution A and B using methylene blue as an indicator to the end point of brick red colour. From the titre value, percentage of total invert sugar was calculated using the formula:

$$\text{Total invert sugars (\%)} = \frac{0.05 \times \text{Volume made up} \times \text{Volume of the stock solution}}{\text{Titrate value} \times \text{Aliquot taken} \times \text{Weight of sample taken}} \times 100$$

2.1.4 Non-reducing sugar

The non-reducing sugar was calculated with the help of following formula:

Non-reducing sugar = {Total invert sugars (%) – Reducing sugar (%)} x 0.95

2.1.5 Total sugars

The sum of reducing and non-reducing sugars was expressed as total sugars.

Total sugars (%) = Reducing sugar (%) + Non-reducing sugar (%)

2.1.6 Titrable acidity

Titrable acidity content of watermelon pulp was calculated by using the procedure given by Ranganna (1979) which includes the use of following reagents:

i. 0.1 N Standard NaOH solution

ii. 1% phenolphthalein solution

Five g of fruit juice was extracted from the pulp and diluted with small amount of distilled water. Then it was filtered through whatmann No.42 filter paper. The volume was made up to 50 ml and 5 ml aliquot was taken for titration against N/10 sodium hydroxide (NaOH) solution using phenolphthalein indicator. The appearance of pink color was considered as the end point. The result was calculated by the formula :

$$\text{Titrable acidity (\%)} = \frac{\text{Titrate value} \times \text{Normality of NaOH} \times 64 \times \text{Volume made up}}{\text{Weight of the sample} \times \text{Aliquot taken} \times 1000} \times 100$$

2.1.7 Sugar acid ratio

The ratio of sugar to acid was determined by dividing the per cent of total sugar with titrable acidity.

$$\text{Sugar acid ratio} = \frac{\text{Total sugar}}{\text{Titrable acidity}}$$

2.1.8 Ascorbic acid

Ascorbic acid was determined using 2,6-dichlorophenolindophenol dye method (Freed,1966). 5g sample was taken and with 25 ml of 4% oxalic acid, filtered through whatmann No.42 filter paper and filtrate were collected in a 50 ml volumetric flask, the volume made up to 50 ml with 4% oxalic acid and titrated against the standard 2,6-dichlorophenol-indophenol dye solution to pink end point. Amount of Ascorbic acid was calculated and expressed as mg per 100g as follows:

$$\text{Ascorbic acid (mg/100g)} = \frac{\text{Titre value} \times \text{dye factor} \times \text{volume made up}}{\text{Aliquot taken} \times \text{Weight of sample taken}} \times 100$$

Dye Factor: 50 ml of L-ascorbic acid was brought from which 2.5 ml was taken in a beaker and volume made up to 25 ml with 4% oxalic acid. Again from this newly prepared solution

5 ml was taken in a 100 ml conical flask and 5 ml 4% oxalic acid was added. This was titrated with dye. Dye factor was calculated with the following formula:

$$\text{Dye factor} = \frac{0.5}{\text{Titrate value of standard ascorbic acid}}$$

2.2 Reproductive parameters

2.2.1 Days to 50% flowering

Number of days taken for 50 per cent flowering was recorded from the respective treatment when half of total plants per treatment had flowered.

2.2.2 Fruit set percentage

In each of the plants under observation in all of the treatments, five unopened flower buds were randomly tagged. Periodically, the number of fruits formed from the tagged buds was counted, and the formula was used to calculate the percentage of fruits formed (Madhuri, 2017).

$$\text{Fruit set (\%)} = \frac{\text{Number of fruits per plant}}{\text{Number of flowers per plant}} \times 100$$

2.2.3 Fruit retention percentage (%)

Number of fruits retained in each of the selected plants were counted and average was calculated (Madhuri, 2017).

$$\text{Fruit retention (\%)} = \frac{\text{Number of retained fruits per plant}}{\text{Total number of fruits per plant}} \times 100$$

2.2.4 Flowering to harvesting interval (days)

The total number of days taken from flowering to harvesting of the mature fruit was recorded from each of the selected plants and the average was calculated.

2.2.5 Days to harvesting

The total number of days taken from sowing to harvesting of mature fruit was recorded from each of the selected plants and the average was calculated.

In addition other than the above parameters some more physic-morphological parameters likeNumber of fruits per plant, Fruit length, Fruit diameter, Fruit volume, Fruit

weight, Pulp weight, Rind weight, Pulp to rind ratio, Number of seeds per fruit, Fruit yield per plant, Yield per hectare, Days to germination, Vine length, Number of leaves per plant, Number of primary vines, Number of nodes per vine, Leaf area were taken into account for the study

2.3 Yield and yield attributing characters

2.3.1 Number of fruits per plant

The total number of fruits per plant was obtained by summing up the number of fruits including the damaged ones from each harvest.

2.3.2 Fruit length

Randomly selected five fruits from each harvest were cut longitudinally and the length of the fruits was measured by measuring scale, average was calculated and expressed in cm.

2.3.3 Fruit diameter

Randomly selected five fruits from each harvest were cut transversely and the diameter of fruits was measured at the middle portion by measuring scale, average was calculated and expressed in cm.

2.3.4 Fruit volume

Fruit volume of randomly five selected fruits of each harvest was measured by water displacement method, and average was calculated and expressed in cc.

2.3.5 Fruit weight

Five Fruits in each harvest were weighed and the average was calculated to obtain the average weight of fruit and expressed in kg.

2.3.6 Pulp weight

The pulp of the randomly selected five fruits was separated and average weight was calculated and expressed in g.

2.3.7 Rind weight

The rind of the randomly selected five fruits was separated from flesh carefully and average weight was calculated and expressed in g.

2.3.8 Pulp to rind ratio

Pulp to rind ratio was calculated by dividing the weight of the pulp by weight of rind of the same fruit.

2.3.9 Number of seeds per fruit

Number of seeds per fruit of each treatment and replication were recorded from five randomly selected fruits and average was calculated.

2.3.10 Fruit yield per plant

The total yield per plant was calculated by adding up fruit weight of each harvest and average was calculated and expressed in kg.

2.3.11 Yield per hectare

The fruit yield of individual plots was recorded from each treatment and per hectare yield was computed from the plot yield and expressed in t.

2.4 StatisticalAnalysisoftheData

Fisher's method of analysis of variance was used in Randomized Block Design with two factors to statistically assess the experimental data gathered from multiple observations (Panse &Sukhatme, 1995). Calculating the corresponding "F" values allows one to determine whether or not the variance caused by the effects of the different treatments is significant. Utilizing the formula, the standard error of the differences is calculated.

$$S.Ed = \sqrt{\frac{2EMS}{r}}$$

To determine the mean difference between the treatments, the critical difference (C.D.) at a % probability level is determined. The following phrase is used to calculate CD.

$$CD = S.\ Ed \times t_{5\%} \text{ for error degrees of freedom}$$

Where,t = tabulated value of t at 5% probability level for appropriate degree of freedom

3. RESULTS AND DISCUSSION

3.1 Quality parameters

In the study, it has been observed that the variety Kiran exhibited the highest Total Soluble Solids (TSS) out of two varieties comparatively in the month of November. Significant variations were found in Total Soluble Solids (TSS) among the treatments (Table 1). The

highest TSS was recorded in M_2 (9.72 ^{0}Brix). This could be due to moderately higher temperature during November which may be major factor in improving TSS that leads to significant increase in photosynthate generation, accumulation and sugar conversion inside the plant and also production of more leaf and greater leaf area. Such findings are in close conformity with the findings of Saimbhi& Gill (1988) in tomato who reported that increased TSS might also result from a number of enzymes working more effectively to support physiological processes, which most likely led to an increase in fruit's TSS.

From Table 1, it has also been observed that both Reducing sugars (6.13 %) and total sugars (9.08 %) were recorded highest in M_2. This might be due to increased accumulation of proteins, sugar and other soluble solids. Due to better vegetative growth along with availability of photosynthates and better movement of metabolites into sink and maximum nutrients uptake by plants during earlier sowing augmented the sugar contents and rapid hydrolysis of acids, starch, and polysaccharides into soluble sugars may also the cause of the rise in total sugars. The results are in agreement with Erdem *et al*. (2001), Campagnol *et al.* (2012) & Parmar *et al.* (2013) in watermelon.

In the present investigation from Table 2, Watermelon sown in the month of November (M_2) exhibited significantly lower Titrable acidity values (0.20%) which might be due to decrease in the concentration of citric acid or might be due to the usage of organic acid during the respiratory process. Such findings are in agreement with that of Okur and Yagmur (2004) & Parmar *et al.* (2013) in watermelon. In addition, with high sugars and less acidity, M_2 exhibited the highest sugar acid ratio among all the months of sowing (Table 2). Moreover, time of sowing had significant effect on ascorbic acid content (Table 2). The maximum ascorbic acid (6.77 mg/100 g sample) was recorded in M_2 which might be due to seasonal variation. The results are in line with the findings of Marisiddaiah& Gowda (1978). However, the ascorbic acid content of the varieties might be largely regulated by their genetic makeup.

Table 1: Effect of TSS, Reducing sugar, Non-reducing sugar and Total sugar on varying sowing dates with respect to different varieties

	TSS (^{0}Brix)			Reducing sugar (%)			Non reducing sugar (%)			Total sugar (%)		
Treatments	**V_1 : Saraswati**	**V_2 : Kiran**	**Mean**	**V_1 : Saraswati**	**V_2 : Kiran**	**Mean**	**V_1 : Saraswati**	**V_2 : Kiran**	**Mean**	**V_1: Saraswati**	**V_2: Kiran**	**Mean**
M1	8.80	7.50	8.15	5.93	5.43	5.68	3.18	3.50	3.34	9.08	8.93	9.01
M2	9.47	9.97	9.72	6.25	6.00	6.13	2.79	3.12	2.96	9.04	9.12	9.08
M3	7.57	8.17	7.87	5.42	6.56	5.99	3.39	2.40	2.90	8.81	8.96	8.89
M4	7.07	6.90	6.98	5.55	5.38	5.46	2.77	1.90	2.34	8.32	7.28	7.80
M5	7.03	6.87	6.95	5.55	5.17	5.36	2.76	2.65	2.70	8.31	7.82	8.07
Mean	7.99	7.88		5.74	5.70		2.98	2.71		8.42	8.71	
	SEd (±)		**CD (5%)**	**SEd (±)**		**CD (5%)**	**SEd (±)**		**CD (5%)**	**SEd (±)**		**CD (5%)**
M	0.41		0.86	0.22		0.47	0.24		0.52	0.20		0.44
V	0.25		NS	0.14		NS	0.15		NS	0.13		0.28
M x V	0.58		NS	0.22		0.66	0.34		0.735	0.29		NS

Table 2: Effect of Titrable acidity, Sugar acid ratio, Ascorbic acidon varying sowing dates with respect to different varieties

	Titrable acidity (%)			Sugar-acid ratio			Ascorbic acid (mg/100 g)		
Treatments	**V_1 : Saraswati**	**V_2 : Kiran**	**Mean**	**V_1 : Saraswati**	**V_2 : Kiran**	**Mean**	**V_1 : Saraswati**	**V_2 : Kiran**	**Mean**
M1	0.21	0.29	0.25	50.94	30.63	40.78	5.43	4.30	4.86
M2	0.19	0.20	0.20	57.55	47.66	52.60	6.50	7.03	6.77
M3	0.31	0.21	0.26	28.59	42.65	35.62	4.57	4.85	4.71
M4	0.35	0.24	0.29	21.70	20.42	21.06	4.30	4.06	4.18
M5	0.38	0.40	0.39	22.20	20.43	21.31	4.04	3.95	4.00
Mean	0.28	0.26		36.20	32.36		4.97	4.84	
	SEd (±)		**CD (5%)**	**SEd (±)**		**CD (5%)**	**SEd (±)**		**CD (5%)**
M	0.02		0.06	6.70		14.08	0.36		0.76
V	0.01		NS	4.23		NS	0.22		NS
M x V	0.04		NS	9.47		NS	0.51		NS

3.2 Reproductive parameters

Days to 50 percent flowering (Table 3) showed significant variation in response to the various sowing time and interaction effect of sowing time and variety. Least number of days (57.50 days) was recorded in November amongst all the other months for 50 percent flowering. This might be due to low evapotranspiration losses during reproductive period in M_2 which influenced on 50 percent flowering of the crop. This finding is in line with Oga &Umekwe (2013) and Sabo *et al.* (2013) in watermelon.

A higher fruit set is a result of excellent vegetative growth, a greater number of flowers and leaf area, effective pollination, fertilisation, and a reduced flower abscission rate. There was significant variation in fruit set percentage and fruit retention percentage (Table 3) among the treatments. The maximum values in both the cases were observed in November (M_2) sowing. Whereas, out of two varieties, Kiran (V_2) recorded the highest values in both the parameters. However, in the later sowing, higher temperature and high rainfall induces more staminate flowers and adversely affect fruit set owing to delay in harvesting. V_2 (Kiran) was the best in respect of fruit retention percentage. These results were in conformity with the findings of Noh *et al.* (2013) in watermelon.

Environmental conditions *viz.*, sunshine hours, optimum temperature and relative humidity during vegetative and reproductive period affects the phenological characteristics of plants especially in cucurbits. In the present investigation, the results in Table 3 revealed that the minimum days (49.33 days) was required from flowering to harvesting in M_2. Similarly in case of days to harvesting (Table 3), the minimum days (106.67days) was required in the month of November (M_2), followed by December (M_3). The early yield may be due to increase in nutrient uptake by the plants. The results supported the findings of Khan *et al.* (2001) in tinda gourd and Arshad *et al.* (2014) in cucumber

3.3 Yield and yield attributing characters

In the present study (Table 4), the highest number of fruits per plant (2.50) was recorded in November sowing (M_2) and by the variety V2: Kiran (2.67). The number of fruits was lowest (1.16) in M_5 which might be due to high rainfall during the fruiting period leading to rotting of fruits. It is evident from Table 4 and Table 5 that, fruit length (27.67 cm), fruit diameter (16.87 cm), fruit volume (4340.00 cc) and fruit weight (4.32 kg), respectively showed the best results in M_2V_2. This might be due to higher nutrient uptake by V_2, and increased fruit retention percentage due to well suited environmental condition in November. This might also be due to high carbon dioxide assimilation as photosynthetic rate increases with a greater number of chlorophyll synthesis induced due to proper utilization of nutrients and congenial climatic conditions. Such findings are in accordance with the findings reported by Jan *et al.* (2000) in bottle gourd.

Study revealed that the highest pulp weight (1726.33g), rind weight (1212.17 g), pulp to rind ratio (1.59), number of seeds per fruit (345.33) was recorded in M_2 (Table 5 and Table 6). Kiran variety (V_2) exhibited better performance in yield attributing characters except pulp to rind ratio. Increasing fruit weight in M_2V_2 leads to increase in pulp weight, rind weight and a greater number of seeds. Proper nutrients use and favourable climatic conditions might contribute in increased carbon dioxide assimilation. As both the varieties were grown in similar environmental condition with similar cultural practices so it could be stated that the hereditary characters might be the superior controlling factor among others that determine the growth and yield parameters of the varieties. These observations corroborated to studies of Nerson (2008) in melon.Maximum fruit yield per plant (7.48 kg) and yield per hectare (36.45 t) were recorded in M_2 as shown in Table 6. With respect to variety, Kiran (V_2) performed better in terms of fruit yield per plant and fruit yield per hectare. Moreover, in case of

treatment combination, M_2V_2 recorded as highest fruit yield per plant (9.77 kg) and yield per hectare (44.58 t). This might be due to prevailing more sunshine hours (8.1 hours per day), moderately high temperature (28.40° C) in day time which induced fruit set and proper growth and development of the fruit. The results are in agreement with the findings of Aluko *et al*. (2020) in muskmelon and Ufoegbune*et al.* (2013) in watermelon

Table 3: Effect of Days to 50% flowering, Fruit set percentage, Fruit retention percentage, Flowering to harvesting interval (days), Days to harvestingon varying sowing dates with respect to different varieties

	Days to 50% flowering			Fruit set percentage			Fruit retention percentage			Flowering to harvesting interval (days)			Days to harvesting		
Treatments	**V_1 : Saraswati**	**V_2 : Kiran**	**Mean**	**V_1 : Saraswati**	**V_2 : Kiran**	**Mean**	**V_1 : Saraswati**	**V_2 : Kiran**	**Mean**	**V_1 : Saraswati**	**V_2 : Kiran**	**Mean**	**V_1 : Saraswati**	**V_2 : Kiran**	**Mean**
M1	64.33	59.67	62.00	24.01	23.91	23.96	27.71	32.14	29.92	56.67	58.67	57.67	116.67	113.33	115.00
M2	55.00	60.00	57.50	25.82	27.93	26.88	36.05	44.04	40.05	48.67	50.00	49.33	103.33	110.00	106.67
M3	58.67	64.33	61.50	24.68	22.81	23.74	26.33	29.51	27.92	51.00	50.33	50.67	109.33	110.33	109.83
M4	63.33	61.67	62.50	20.11	21.40	20.75	18.09	21.42	19.76	57.67	63.00	60.33	117.67	123.00	120.33
M5	63.33	63.67	63.50	19.97	18.67	19.32	15.27	17.05	16.16	58.67	60.33	59.50	120.00	120.33	120.17
Mean	60.93	61.87		22.91	22.94		24.69	28.83		54.53	56.46		113.40	115.40	
	SEd (±)		**CD (5%)**	**SEd (±)**		**CD (5%)**	**SEd (±)**		**CD (5%)**	**SEd (±)**		**CD (5%)**	**SEd (±)**		**CD (5%)**
M	1.24		2.61	1.51		3.19	1.59		3.34	1.71		3.61	1.58		3.60
V	0.78		NS	0.95		NS	1.00		2.11	1.08		NS	0.99		2.27
M x V	1.75		3.69	1.51		NS	2.24		NS	2.42		5.10	2.23		5.09

Table 4: Effect of Fruits per plant, Fruit length, Fruit diameter, Fruit volume on varying sowing dates with respect to different varieties

	Fruits per plant (no.)			Fruit length (cm)			Fruit diameter (cm)			Fruit volume (cc)		
Treatments	**V_1 :**	**V_2 :**	**Mean**	**V_1 :**	**V_2 :**	**Mean**	**V_1 :**	**V_2 :**	**Mean**	**V_1 :**	**V_2 :**	**Mean**

	Saraswati	Kiran		Saraswati	Kiran		Saraswati	Kiran		Saraswati	Kiran	
M1	1.67	2.00	1.83	16.53	26.33	21.43	15.70	15.73	15.72	1771.67	3442.33	2607.00
M2	2.33	2.67	2.50	16.97	27.67	22.32	15.60	16.87	16.23	2620.00	4340.00	3480.00
M3	1.67	2.33	2.00	16.63	23.37	20.00	13.63	16.50	15.07	1943.33	3465.67	2704.50
M4	1.00	1.67	1.33	15.13	19.30	17.22	12.87	14.20	13.53	1642.00	3027.00	2334.50
M5	1.00	1.33	1.16	15.57	20.53	18.05	12.91	14.80	13.85	1642.67	2935.33	2289.00
Mean	1.47	1.93		16.17	23.44		14.14	15.62		1923.93	3442.07	
	SEd (±)		**CD (5%)**	**SEd (±)**		**CD (5%)**	**SEd (±)**		**CD (5%)**	**SEd (±)**		**CD (5%)**
M	0.30		0.65	0.66		1.40	0.24		0.51	120.67		253.53
V	0.19		0.41	0.42		0.89	0.15		0.32	76.32		160.35
M x V	0.43		NS	0.94		1.98	0.34		0.72	170.66		358.56

Table 5: Effect of Fruit weight, Pulp weight per fruit, Rind weight per fruit, Pulp to rind ratio on varying sowing dates with respect to different varieties

	Fruit weight (Kg)			Pulp weight per fruit (g)			Rind weight per fruit (g)			Pulp to rind ratio		
Treatments	**V_1 : Saraswati**	**V_2 : Kiran**	**Mean**	**V_1 : Saraswati**	**V_2 : Kiran**	**Mean**	**V_1 : Saraswati**	**V_2 : Kiran**	**Mean**	**V_1 : Saraswati**	**V_2 : Kiran**	**Mean**
M1	1.40	2.93	2.17	705.33	1490.67	1098.00	512.00	1106.67	809.33	1.37	1.36	1.37
M2	2.21	4.32	3.27	1263.33	2189.33	1726.33	646.67	1777.67	1212.17	1.95	1.23	1.59
M3	1.76	3.19	2.47	852.00	1757.00	1304.50	627.00	1240.00	933.50	1.36	1.41	1.39
M4	1.29	2.74	2.02	679.00	1553.00	1116.00	483.33	940.67	712.00	1.41	1.68	1.55
M5	1.26	2.31	1.78	697.33	1376.67	1037.00	467.00	748.33	607.67	1.57	1.85	1.71

Mean	1.58	3.10		839.40	1673.33		547.20	1162.67		1.53	1.51	
	SEd (±)		CD (5%)	SEd (±)		CD (5%)	SEd (±)		CD (5%)	SEd (±)		CD (5%)
M	0.31		0.28	84.05		176.60	56.47		118.64	0.11		0.24
V	0.08		0.17	53.16		111.69	35.71		75.04	0.07		NS
M x V	0.18		0.39	118.87		249.75	79.86		167.78	0.15		0.33

Table 6: Effect of Seeds per fruit, Seeds per kg fruit, Fruit yield per plant, Fruit yield per hectare on varying sowing dates with respect to different varieties

	Seeds per fruit (nos.)			Seeds per kg fruit (nos.)			Fruit yield per plant (kg)			Fruit yield per hectare (t)		
Treatments	V_1 : Saraswati	V_2 : Kiran	Mean	V_1 : Saraswati	V_2 : Kiran	Mean	V_1 : Saraswati	V_2 : Kiran	Mean	V_1: Saraswati	V_2: Kiran	Mean
M1	204.67	289.33	247.00	123.16	98.61	110.89	3.96	5.89	4.92	14.61	35.08	24.84
M2	277.33	413.33	345.33	125.87	95.62	110.74	5.18	9.77	7.48	28.32	44.58	36.45
M3	286.67	301.33	294.00	164.22	94.51	129.36	3.63	6.71	5.17	14.82	27.06	20.94
M4	203.33	232.00	217.67	160.56	85.54	123.05	2.17	5.24	3.71	8.3	20.51	14.40
M5	180.33	224.33	202.33	139.83	98.37	119.10	1.83	3.96	2.90	5.22	12.71	8.96
Mean	230.47	292.07		142.73	94.53		3.35	6.32		14.25	27.98	
	SEd (±)		CD (5%)	SEd (±)		CD (5%)	SEd (±)		CD (5%)	SEd (±)		CD (5%)
M	19.42		40.82	9.40		NS	0.29		0.61	1.87		3.94
V	12.28		25.81	5.94		12.49	0.18		0.39	1.18		2.49
M x V	27.47		57.72	13.30		27.95	0.41		0.86	2.65		5.57

4. CONCLUSION

In the above study, it has been seen that the treatment combinations of November month of sowing and the variety Kiran (M_2V_2) were able to show the best results in terms of quality, reproductive and yield attributing parameters among all the other combinations. Therefore, it could be concluded that watermelon variety Kiran sown in the month of November was the appropriate technology which may be suggested for obtaining optimum yield and quality of the fruit.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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