Mean performance of tomato (*Solanumlycopersicum* L.) genotypes for yield, yield parameters and quality traits

ABSTRACT

The experiment was done to evaluate the performance of twenty genotypes of tomato in the Horticulture Research Farm of the Department of Horticulture, Babasaheb Bhimrao Ambedkar University, Lucknow, Uttar Pradesh during RabiSeason of the year 2021-2022. Observations were recorded on five randomly selected competitive plants per replication for each entry on five randomly selected competitive plants per replication for each entry on nineteen quantitative and qualitative traits viz, plant height at 30, 60 and 90 days after transplanting (cm),~~Number~~ number of primary branches, days to first flowering (days), days to 50% flowering (days), days to maturity (days), number of flowers/cluster, number of clusters (truss) per plant, number of locule per fruit, pericarp thickness(mm), number of fruits per truss, number of fruits per plant, average single fruit weight (g), yield/ plant (kg), fruit length (cm), fruit diameter (cm), total soluble solids (^{o}Brix) and acidity (%).Among the genotypes used for evaluation Pusa Ruby (8.01kg/plant) were observed to have higher yield per plant followed by PusaDivya(7.33kg/Plant) and Himsona (6~~,~~.32kg/plant), while the minimum was recorded in genotype PusaSadabahar (1.25kg/plant) followed by Kashi Sarad (1.57kg /plant) and Pusa Gaurav(2kg/plant).The minimum Pericarp thickness was found in genotype PusaUpkar (3.25 mm), whereas maximum Pericarp thickness were observed in genotype PusaRuby (7.42 mm). For the minimum TSS was found in genotype Kashi Sarad (3.33) whereas, maximum TSS were observed in genotype Pusa Upkar (8.42). For the minimum Acidity % was recorded in genotype Kashi Amul (0.18%), whereas, the maximum Acidity % were observed in genotype Kashi Hemant (0.86%).

Keywords: Tomato, genotypes, performance, evaluation, quality, yield

Comment [N1]: What is TSS? It would be better to write without abbreviations

Introduction

Tomato (*Solanumlycopersicum* L.) belonging to the family Solanaceae and is native of Andean region that includes parts of Colombia, Ecuador, Peru, Bolivia and Chile (**Rick 1973, Taylor 1986) [7, 8]**. It is one of the most popular and widely grown crops of commercial and dietary significance in the world as it is a very versatile vegetable. It was first domesticated in Mexico where various plants with a variety of fruit sizes and ~~colors~~colours were selected (**Jones, 2008; Kelley and Boyhan, 2010) [1, 3].** Due to its high consumption rate in developed and developing countries, it is often referred to as a

luxury crop. In England, it is popularly known as love apple and is grown in all home gardens and by a large number of market and truck growers.

It is an excellent source of nutrients and secondary metabolites which are important for human health including minerals, vitamins C and E, β-carotene, lycopene, fla-vonoids, organic acids, phenolics and chlorophyll (**Naika, 2005) [4].** Tomato has medicinal values and being used for blood purification and curing digestive ailments (**Kaushik et al., 2011) [2]**.

2. Materials and Methods

The present study was carried out at the Horticulture Research Farm of the Department of Horticulture, Babasaheb Bhimrao Ambedkar University, Lucknow, Uttar Pradesh during rabi season of the year 2021-2022.The following is a list of the experimental materials utilised in this investigation comprising 20 diverse genotypes of tomato collected from different sources. The details of the genotypes are presented in Table-1. ~~A~~ Plantspacing of 60 cm × 60 cm was adopted and all the standard practices and plant protection measures were timely adopted to rise the crop successfully. Observations were recorded on five randomly selected competitive plants per replication for each entry on five randomly selected competitive plants per replication for each entry on nineteen quantitative and qualitative traits viz, plant height at 30, 60 and 90 days after transplanting (cm) Number of primary branches, days to first flowering (days), days to 50% flowering (days), days to maturity (days), number of flowers/cluster, number of clusters (truss) per plant, number of locule per fruit, pericarp thickness(mm), number of fruits per truss, number of fruits per plant, average single fruit weight (g), yield/ plant (kg), fruit length (cm), fruit diameter (cm), total soluble solids (^{o}Brix) and acidity (%).The data regarding above mentioned characters were averaged and subjected to analysis of variance.

Table-1. List of tomato genotypes used in the study and their source:

S. No.	Name of Variety	Sources
1	Kashi Amrit	IIVR, Varanasi
2	Kashi Amul	IIVR, Varanasi
3	Kashi Aman	IIVR, Varanasi
4	Kashi Adarsh	IIVR, Varanasi
5	Kashi Anupam	IIVR, Varanasi
6	Kashi Sarad	IIVR, Varanasi
7	Pusa Ruby	IARI, New Delhi
8	Pusa Gaurav	IARI, New Delhi
9	Pusa Upkar	IARI, New Delhi
10	Kashi Sarad	IIVR, Varanasi
11	Kashi Vishesh	IIVR, Varanasi
12	Pusa Rohini	IARI, New Delhi
13	Pusa Sheetal	IARI, New Delhi
14	PusaSadabahar	IARI, New Delhi

15	Punjab Chhuhara	PAU, Ludhiana
16	Many Makar	IIVR, Varanasi
17	Kashi Hemant	IIVR, Varanasi
18	Pusa Divya	IARI, New Delhi
19	EC-538407	IIVR, Varanasi
20	Himsona	Syngenta

Results and Discussion

The analysis of variance for yield and its contributing characters under study are presented in Table 2. The mean sum of squares for genotypes was found to be significant for all the characters viz., Plant height at 30 DAT (cm), Plant height at 60 DAT (cm), Plant height at 90 DAT (cm), Number of primary branches, Days to first flowering (days), Days to 50% flowering (days), Number of flowers/cluster, Number of trusses per plant, Number of fruits per truss, Days to maturity (days), Average single fruit weight (g), Number of fruits per plant, Fruit length (cm), Fruit diameter (cm), Number of locules per fruit, Pericarp thickness (mm), TSS(^{0} Brix), Acidity (%), Yield / plant (kg). The character-wise mean performance of different genotypes is presented in Table 3.

Table -2. Analysis of variance (mean sum of square) for yield and quality parameters in different tomato genotypes

S. No.	Characters	Replication	Genotypes	error
1	Plant height at 30 DAT (cm)	129.7156	7.5449**	2.9459
2	Plant height at 60 DAT (cm)	137.5042	83.0715**	42.3353
3	Plant height at 90 DAT (cm)	32.6698	123.5664**	11.7378
4	Days to flowering (days)	236.85	4.8741**	4.8741
5	Days to 50% flowering (days)	89.0167	2.4728**	2.4728
6	Number of primary branches	64.0667	5.8232**	5.8232
7	Number of flowers/cluster	89.0167	10.6458**	2.7918
8	Number of trusses per plant	0.6292	66.6807**	0.4735
9	Number of locules per fruit	0.0667	7.8004**	0.0787
10	Pericarp thickness (mm)	0.0216	5.7541**	0.0089

11	Number of fruits per truss	2.8129	10.5937**	0.5063
12	Number of fruits per plant	589.3719	6612.1647**	531.6734
13	Average single fruit weight (g)	34.2635	677.8164**	8.7296
14	Days to maturity (days)	10.5385	3.8826	2.9892
15	Yield / plant (kg)	1.4374	15.3319**	1.0219
16	Fruit length (cm)	0.0696	4.6706**	0.0225
17	Fruit diameter (cm)	0.0388	1.6458**	0.0145
18	Total soluble solids (^{o}Brix)	0.0206	5.2112**	0.0123
19	Acidity (%)	1.4374	0.1131**	0.0001

* &** Significant at 5% & 1% respectively

Plant height at 30 days after transplanting (cm):

The growth rate of different genotypes was determined using plant height. At 30 DAT, plant height ranged from 23.67 to 31.92 cm and varied greatly, with a mean of 27.79 cm. Kashi Amrit (31.92cm) had the highest plant height followed by Pusa Sheetal (31cm) and Kashi Anupam (30.58cm). In genotype Kashi Sarad(23.67cm) however, the lowest plant height followed by Himsona(24.25cm) and Kashi Aman(24.83cm) was reported.

Plant height at 60 days after transplanting (cm):

Plant height after 60 days after transplanting differed significantly between genotypes, ranging from 67.17 to 52.42 cm on average, with an average plant height of 60.58 cm. The genotype Kashi Amrit (67.17 cm) had the highest plant height followed by Pusa Sheetal(66.33cm) and Kashi Anupam (65.17 cm), whereas Kashi Sarad (52.42 cm) followed by Kashi Aman (101.67 cm) EC-538407(56.33cm) had the lowest plant height.

Plant height at 90 days after transplanting (cm):

Plant height after 90 days after transplanting differed significantly between genotypes, ranging from101 to 126.08 cm on average, with an average plant height of 108.68 cm. The genotype Kashi Amrit (126.08cm) had the highest plant height followed byKashi Anupam(117.42cm) andPusa Divya (114cm)whereas Kashi Aman(101cm) followed by Himsona(101.67cm) and Kashi Sarad(102.08 cm) had the lowest plant height.

Number of Primary Branches:

The number of primary branches is most important traits of tomato its directly affected to the yield of tomato. the number of branches was differed significantly between genotypes, ranging from 10.25 to 26.33 branches on average, with an average number of branches of 16.45. the genotypes Many Makar (26.33branches) had the highest number of branches

followed by Pusa Divya (24.00 branches) and Punjab Chhuhara (21.33 branches), whereas Kashi Aman(10.25 branches)the lowest number of branches followed by PusaSadabahar(12branches) and Kashi Amul (12.50 branches) was reported.

Days to first flowering:

Days to flowering was recorded to determine the earliness of a particular genotype which was found to be statistically different for the genotypes. The average number of days taken to flower initiation was 45.97 days with a range from 41.33 to 52.17 days. The minimum number of days taken for flower initiation was Kashi Sarad (41.33 days) followed by EC-538407 (41.42days) and Himsona(42.08) whereas, the maximum number of days was taken by the genotype Kashi Amul (52.17 days) followed by Punjab Chhuhara(51.25 days) and Kashi Aman(50.52 days).

Days to 50 % flowering:

Earliness is one of the most important desirable trait, as early crop can earn a high market price. Days to 50 % flowering are desirable parameter to determine the earliness of a particular genotype. The values of days to 50 % flowering differed statistically among the genotypes and ranged from 47.17 to 55.50 days. The average number of days taken for 50% flowering over the total genotypes was 51.42 days. The minimum number of days taken for flower initiation was Kashi Vishesh(41.33days) followed by Pusa Divya (47.17days) and EC-538407 (48 days) and whereas, the maximum number of days was taken by the genotype Punjab Chhuhara(55.50 days) followed by Kashi Amrit (55.33days) and Kashi Aman(55.08days).

Number of flowers/ Cluster:

Mean performance for number of flowers per cluster showed significant differences among the genotypes, where the values varied from 6 to 16.83. The overall mean for this character was10.71. The genotype Pusa Rohini (16.83) recorded maximum number of flowers per cluster followed by Kashi Vishesh (15) and Pusa Sheetal (14.75) whereas PusaSadabahar (6.00) showed the lowest number of flower per cluster followed by Pusa Gaurav (6.67) and Kashi Amul (7.00).

Number of clusters (truss) per plant:

Significant difference for number of trusses per plant was noted in the genotypes and ranged from 9.5 to 24.17, with a mean value of 16.92.The genotype PusaRohini(24.17) recorded the highest number of trusses per plant followed by PusaSadabahar (23.17) and Kashi Hemant (23.50) whereas, the genotype Kashi Aman(9.5) exhibited the minimum number of trusses per plant followed by Pusa Gaurav(11.33) and Many Makar(12.08).

Number of fruits per cluster (truss)

Significant variation was observed among the genotypes investigated for number of fruits percluster. The number of fruits per cluster ranged from 3.67 to9.25, with a mean value of 6.35. The maximum number of fruits per truss was recorded in genotype Kashi Hemant (9.25) followed by Pusa Rohini (9.00) and Pusa Divya (7.75), whereas, minimum was recorded in genotype Kashi Amrit (3.67) followed by Pusa Gaurav (4.00) and Kashi Amul(4.25).

Number of fruits per plant:

The total number of fruits per plant is one of the most essential yield components that determines total yield per plant, implying that they are directly related.Among the different tomato genotypes, for number of fruits per plant the value varies significantly from 29.67 to 159.17 with general mean of84.69. The highest number of fruits per plant was recorded in genotype Pusa Divya (159.17) followed by Kashi Hemant (149.50) and Himsona (133.33) However, the genotype Kashi Aman (29.67) showed the lowest number of fruits per plant followed by Pusha Gaurav (37.08) and PusaSadabahar (38.92).

Days to Maturity:

Early maturing fruits can ensure quick economic return on early harvest and may escape market gluts and give high returns. Significant differences were recorded among the observed values with respect to days to maturity The average days taken to first harvest was 103.09 days, with a range of 101.05 to 105.50 days. The minimum days taken to first harvest was in genotype KashiVishesh(101.50 days) followed by Pusa Gaurav(101.92 days) and Kashi Amrit (102.17 days) and maximum days was recorded in genotypes Kashi Anupam(105.5 days) followed by Kashi Amul(105.17) and Pusa Rohini (104.58).

Average single fruit weight (g):

A significantly wide variation was found among the tomato genotypes for average single fruit weight, which varied from 29.67 to 80.75 g, with an overall mean of 51.35 g. The genotype Kashi Anupam (80.75 g) had the maximum single fruit weight which was followed by Kashi Aman79.67g) and Kashi Amrit (73.92). The genotype Pusa Divya (29.67g)showed the minimum weight (21.52) followed by PusaSadabahar (31.50g) and Many Makar(34.67).

Yield per plant (kg):

Yield per plant is one of the most significant qualities that is getting increased attention in breeding programmes. It is critical to develop a genotype with the ability to thrive financially; otherwise, even if the genotype excels in other areas, it will be of limited economic value.From the observed values the yield per plant differed significantly for genotypes and the values ranged from 1.25 to 8.01 kg/plant. The general mean of genotypes observed was 4.29 kg/plant. The genotypes Pusa Ruby (8.01kg/plant) were observed to have higher yield per plant followed by Pusa Divya(7.33kg/Plant) and

Himsona (6,32kg/plant), while the minimum was recorded in genotype PusaSadabahar (1.25kg/plant) followed by Kashi Sarad (1.57kg /plant) and Pusa Gaurav(2kg/plant).

Fruit length (cm):

Significant differences were observed among the genotypes for fruit length/ polar diameter of the fruit. It ranged from 3.42 to 6.23 cm, with a mean value of 4.47cm. The maximum fruit length was recorded in genotype Kashi Amrit(7.03cm) followed byEC-538407(7cm) and Pusa Sheetal(6.88cm)whereas minimum in genotype Kashi Sarad (3.42 cm)followed by Kashi Amul (3.7cm) and Kashi Adarsh(3.73cm). Majority genotypes were found to be around the mean value.

Fruit diameter (cm):

The fruit diameter differed significantly with maximum being recorded in genotype PusaSdabahar(6.23cm) followed by Pusa Sheetal (6.10)and Kashi Amrit(5.5cm)whereas the minimum in Pusa Rohini(6.63cm) followed by Kashi Sarad(3.88cm) andKashi Hemant(3.99cm).it ranged from 3.63 to 6.23 cm, with a mean value of 4.47 cm.

Number of locules per fruit:

Number of locules per fruit of tomato varied significantly among the genotypes. It ranged from 2.5 to 8.0, with a mean value of 4.83.The maximum number of locules was recorded in the genotype Kashi Aman(8.00) followed by Kashi Amul (5.03) and Pusa Ruby(6.08) whereas minimum number of locules was recorded in the genotype Pusa Rohini (2.5) followed by PusaSadabahar (2.83) and Kashi Sarad (3.00).

Pericarp thickness (mm):

Pericarp thickness per fruit ranged from 3.25 to 7.42mm, with a mean value of 5.37mm. PusaSadabahar (2.83mm) and Kashi Sarad (3mm) observed the maximum pericarp thickness in genotype Pusa Ruby (7.42 mm) followed by Kashi Adarsh (7.33mm) and Kashi Amul (7.26mm), while the minimum with in genotype Pusa Upkar (3.25m m) followed.

Total Soluble Solids (^{o}Brix):

The TSS has a direct impact on tomato flavour and is a crucial biochemical feature for the processing industry. High TSS improves the quality of fruits and results in higher recovery of processed products. The general mean of TSS content for the fruit at the marketable stage was 5.69 ^{o}B and the range lies between 3.33 to 8.42^{o}B. The highest TSS content was recorded in fruits of genotype Pusa Upkar(8.42^{o}B) followed by Himsona (7.46 ^{0}B) and Kashi Adarsh (7.34^{o}B) which were significantly superior over rest of the genotypes, whereas, the least was observed in fruits of Kashi Sarad (3.33^{o}B) followed by Kashi Sarad (5.33^{o}B) and Kashi Anupam (3.53^{o}B).

Acidity (%)

The acidity of the fruit also plays a role in the flavouring of tomato products. Citric acid is the most common organic acid present in tomatoes, accounting for the majority of the total titrable acidity. The acidity at marketable stage fruits differed significantly among genotypes and ranged from 0.18 to 0.86 %. The general mean for acidity of fruit was 0.41%. The highest acidity was recorded in fruits of Kashi Hemant(0.86 %) followed by Pusa Upkar (0.84%) and EC-538407 (0.55 %), while it was noticed minimum in fruits of Kashi Amul (0.18 %) followed by Pusa Divya(0.26%) and Kashi Aman (0.33 %).

At the 5% level of significance, the analysis of variance for several characters showed extremely significant differences among genotypes. Ranges based on mean values are also useful for examining the genetic variability of germplasm. In the current study, all parameters showed high range differences except acidity. The widest range was observed for average single fruit weight followed by days to maturity and plant height at 90 days after transplanting.

The calculated components of variance for all of the traits revealed a large range of variability. In the tomato, broad ranges of variations have been found for many quantitative and qualitative traits. Similar results are reported by **Kumar *et al*.(2018), Pandey *et al*.(2018), Rawat*et al*.(2020),Behera *et al*.,(2020)[9,10,11,12]** for almost all characters studied. **Bhandari *et al*.,(2017)**
[13] showed the maximum range for average fruit weight followed by fruit yield (Kg)/plant and total number of fruits/plant.**Meena *et al*.,(2018)[14]** recorded the widest range for average fruit weight followed by plant height, fruits per plant, flowers per cluster, days to 50% flowering, flower clusters per plant, fruits per cluster, branches per plant, locules per fruit.

Table 3.0 Mean performance and range

Traits	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
T1	31.92	67.17	126.08	13.58	49.92	55.33	6.00	13.42	3.67	102.17	64.08	48.83	7.03	5.50	6.08	3.37	6.13	0.36	3.14
T2	28.50	61.42	111.58	12.50	52.17	53.83	7.00	20.25	4.25	105.17	73.92	82.08	3.70	4.16	7.17	7.26	5.20	0.18	6.08
T3	24.83	53.67	101.00	10.25	50.42	55.08	7.08	9.50	4.50	103.58	79.67	29.67	6.33	5.22	8.00	6.45	6.28	0.33	2.36
T4	26.25	56.50	105.42	16.00	48.00	53.17	10.75	14.33	6.92	102.17	54.33	83.67	3.73	4.12	5.08	7.33	7.34	0.26	4.56
T5	30.58	65.17	117.42	18.42	48.08	52.42	11.33	12.50	6.00	105.50	80.75	72.17	5.53	4.43	8.00	6.30	3.53	0.25	5.82
T6	28.17	63.08	111.08	20.25	46.33	53.50	10.58	13.33	5.58	102.33	34.92	43.92	6.22	4.58	3.00	6.82	3.33	0.25	1.57
T7	27.50	57.67	105.25	13.17	47.08	51.83	10.92	22.50	6.00	102.67	62.33	128.50	5.70	4.37	6.08	7.42	5.08	0.47	8.01
T8	26.58	57.75	106.17	14.25	44.25	48.92	6.67	11.33	4.00	101.92	53.92	37.08	5.50	4.28	5.08	4.35	6.23	0.26	2.00
T9	28.00	62.50	112.92	15.58	46.83	53.42	10.92	15.67	7.17	103.17	50.67	112.42	4.08	4.04	4.83	3.25	8.42	0.84	5.68
T10	28.42	61.42	108.00	18.92	46.83	52.58	10.58	15.58	6.00	103.00	52.75	60.67	3.42	3.88	5.00	4.28	5.33	0.35	3.21
T11	23.67	52.42	102.08	13.17	41.33	48.08	15.00	16.58	8.33	101.50	45.58	56.00	5.40	4.60	4.08	5.25	5.20	0.35	2.54
T12	26.25	59.58	103.08	15.33	45.17	51.00	16.83	24.17	9.00	104.58	29.67	105.67	4.78	3.63	2.50	5.80	5.69	0.44	4.78
T13	31.00	66.33	113.42	14.67	45.17	50.67	14.75	24.17	6.25	102.33	37.42	64.75	6.88	6.10	3.50	3.71	5.56	0.35	2.43
T14	30.00	64.17	108.25	12.00	42.25	49.00	6.00	23.17	3.67	104.42	31.50	38.92	5.95	6.23	2.83	5.77	6.21	0.47	1.25
T15	28.58	57.25	105.25	21.33	51.25	55.50	11.00	15.25	7.58	102.17	44.92	83.08	6.88	4.14	4.25	6.37	5.50	0.35	3.74
T16	28.67	63.67	111.58	26.33	45.58	50.00	8.17	12.08	6.17	103.50	34.67	117.25	5.43	4.44	3.08	5.18	7.24	0.67	4.03
T17	28.25	62.25	107.00	14.75	42.92	50.25	14.17	23.50	9.25	102.08	41.17	149.50	4.46	3.99	3.92	4.50	5.28	0.86	6.13
T18	29.42	63.17	114.00	24.00	42.33	47.17	11.83	13.17	7.75	102.67	52.50	159.17	5.39	4.35	5.08	5.22	5.29	0.26	7.33
T19	25.00	56.33	102.33	16.17	41.42	48.00	11.25	22.42	6.50	102.75	54.67	87.17	7.00	3.70	5.25	3.42	3.54	0.55	4.78
T20	24.25	60.08	101.67	18.33	42.08	48.58	13.42	15.50	8.33	104.17	47.50	133.33	6.18	3.70	3.83	5.32	7.46	0.34	6.32
Mean	27.79	60.58	108.68	16.45	45.97	51.42	10.71	16.92	6.35	103.09	51.35	84.69	5.48	4.47	4.83	5.37	5.69	0.41	4.29
CV %	5.80	5.07	3.15	10.88	5.17	4.81	15.60	6.61	12.32	1.87	5.73	17.93	6.99	2.69	5.81	4.16	1.95	5.02	20.72
SE	0.93	1.77	1.98	1.03	1.37	1.43	0.96	0.65	0.45	1.11	1.70	8.77	0.22	0.07	0.16	0.13	0.06	0.01	0.51
CD5%	2.66	5.08	5.67	2.96	3.93	4.09	2.76	1.85	1.29	2.24	4.87	25.10	0.63	0.20	0.46	0.37	0.18	0.03	1.47
CD1%	3.57	6.80	7.59	3.96	5.27	5.48	3.70	2.48	1.73	3.00	6.52	33.62	0.85	0.27	0.62	0.49	0.25	0.05	1.97
MAX	**31.92**	**67.17**	**126.08**	**26.33**	**52.17**	**55.50**	**16.83**	**24.17**	**9.25**	**105.50**	**80.75**	**159.17**	**7.03**	**6.23**	**8.00**	**7.42**	**8.42**	**0.86**	**8.01**
MIN	**23.67**	**52.42**	**101.00**	**10.25**	**41.33**	**47.17**	**6.00**	**9.50**	**3.67**	**101.50**	**29.67**	**29.67**	**3.42**	**3.63**	**2.50**	**3.25**	**3.33**	**0.18**	**1.25**

1= Plant height at 30 DAT (cm), 2= Plant height at 60 DAT (cm), 3= Plant height at 90 DAT (cm), 4=Days to flowering (days), 5=Days to 50% flowering (days), 6=Number of primary branches, 7=Number of flowers/cluster, 8=Number of trusses per plant, 9=Number of locules per fruit, 10=Pericarp thickness (mm), 11=Number of fruits per truss, 12=Number of fruits per plant, 13=Average single fruit weight (g), 14=Days to maturity (days), 15=Yield / plant (kg), 16=Fruit length (cm) ,17=Fruit diameter (cm), 18=Total soluble solids (^{o}Brix), 19=Acidity (%)

Conclusion

Considering the mean performance, some superior genotypes for fruit yield viz., Pusa Ruby (8.01kg/plant), Pusa Divya(7.33kg/Plant) and Himsona (6,32kg/plant), may be released as pureline or inbreeding programmes after testing their stability over location and years for commercial cultivation. The genotypes with superior quality traits viz., Pusa Upkar(8.42^{o}B) followed by Himsona (7.46 ^{0}B) and Kashi Adarsh (7.34^{o}B) and Kashi Hemant for acidity (0.86 %) can be included in pedigree selection for further improvement.

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