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Survey, collection and evaluation of elite types of Nagpur mandarin

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Abstract

An experiment entitled "Survey, collection and evaluation of elite types of Nagpur mandarin (*Citrus reticulata* Blanco.)" was undertaken during September-2020 to December-2020 of Ambia bahar fruits. Five talukas of Nagpur district namely Kalameshwar, Saoner, Parseoni, Bhiwapur and Ramtek were selected for survey of superior types of Nagpur Mandarin. In each selected taluka, farmers were selected on the basis of fruit trees with good size, fruit weight, high yielding potential, uniform deep orange colour, tight skin and good keeping quality of fruit. Among the 75 genotypes studied, NM-19 was found superior in fruit weight, fruit length, fruit breadth, number of segments per fruit, rind thickness and shelf life. NM-59 was found desired in fruit weight, number of seeds per fruit, cavity diameter, shelf life and juice per cent. NM-8 was found superior in fruit weight, fruit length, fruit breadth, number of segments per fruit and TSS. NM-4 was found positive in fruit weight, fruit breadth, number of segments per fruit, shelf life. NM-11 was found superior in fruit length, acidity, juice per cent and TSS: acidity ratio. NM-14 was found superior in fruit weight, fruit breadth and shelf life. NM-20 was found better in fruit length, number of segments per fruit, TSS: acidity ratio and colour. And NM-60 was found superior in fruit weight, fruit length, fruit breadth and number of segments per fruit. All these genotypes were found significantly superior over Nagpur mandarin (check). Nagpur mandarin genotypes viz., NM-7, NM-17, NM-20, NM-46 and NM-49 has orange coloured fruit while yellowish green coloured fruit has been observed in genotypes NM-1, NM-3, NM-4, NM-6, NM-8, NM-10, NM-12, NM-13, NM-15, NM-32, NM-33, NM-34, NM-59, NM-60, NM-65, and NM-71. with regarding to fruit compactness, it was found that all fruit were compact in nature. Based on the important characteristics viz., fruit weight, number of segments per fruit the genotypes NM-19, NM-59, NM-8, NM-4, NM-14 and NM-60 are found to be superior while the genotype NM-20 developed deep orange colour of rind.

Keywords: Nagpur mandarin, *Citrus reticulata* Blanco, elite genotypes, fruit quality, germplasm evaluation

Introduction

Area under citrus cultivation is gradually increasing day by day and there is a heavy demand for good quality fruits for export as well as local consumption. High yielding varieties act as the catalyst for more yields. Nagpur mandarin (*Citrus reticulata* Blanco) is an important commercial orange cultivar mainly grown in Vidarbha region of Maharashtra and adjoining states like Madhya Pradesh as well as Rajasthan. Considering the qualitative peculiarity of this orange fruit grown in Vidarbha region, very recently Dr. Panjabrao Deshmukh Krishi Vidyapeeth, [3] Akola received a 'Geographical Indication' for this wonderful variety for protection of the rights of growers. Nagpur mandarin is popularly known as Nagpur santra. Nagpur mandarin is the only cultivar of mandarin grown in Vidarbha for last 200 years in around 1.85 lakh ha and considered as one of the best mandarins in the world, because of its attractive colour, pleasant flavour and good taste. Cultivation of Nagpur mandarin is mostly concentrated in Amravati, Nagpur, Wardha, Yawatmal, Akola, Washim and Buldhana districts of Vidarbha region. In mandarin orange, there are three bahar viz., *Ambia*, *Mrig* and *Hast*. There are some types which are highly productive and better in physico-chemical qualities. Such types and variations are highly valued. The citrus industry of Nagpur region is in fast developing stage and there is heavy demand from cultivators for the supply of better types of mandarin orange bud grafts for production of quality fruits for consumption as well as for export. However, there are only few varieties/clones of mandarin orange in the region

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or state to meet the needs of the cultivators. The survey work revealed the existence of wide variability in yield and quality attributes among the different clones of mandarin orange. It will also improve yield and fruit quality by selection from the innumerable elite types already available under cultivation on farmer field of the region. At present, the acreage under Nagpur mandarin fruits is increasing day by day in every state of Indian union, so also in the state of Maharashtra so there is great scope for selection of superior type from existing Nagpur mandarin orchards. Farmers of the region are demanding for new variety suitable for distance market having dark, deep uniform orange peel colour along with longer shelf life of fruits with high TSS content. This study will be helpful to find out different Nagpur Mandarin genotypes and to evaluate high yielding best quality genotypes suitable for cultivation in Nagpur region. Therefore, the research work was initiated with following objectives.

1. To study the variability available in Nagpur mandarin in Nagpur region.
2. To identify the superior genotypes in Nagpur mandarin.

Materials and methods

Five talukas of Nagpur district namely Kalameshwar, Saoner, Parseoni, Bhiwapur and Ramtek were selected for survey of superior types of Nagpur Mandarin. Fruit survey conducted in regular fruiting season of Ambia bahar. Before undertaking survey work, information about popular Nagpur mandarin genotype plants available at various places was collected first from the cultivators.

In each selected taluka, farmers were selected on the basis of fruit trees with good size, fruit weight, high yielding potential, uniform deep orange colour, tight skin and good keeping quality of fruit. In all, 75 farmers were selected for survey and collection of sample. From selected plants of each orchard 10 fruits of uniform size and maturity were collected randomly from all the sides of tree. The fruit sample packed in CFB boxes separately for each genotype and brought to laboratory for further study. The physicochemical analysis of fruit samples carried out in the laboratory. Observation on Fruit weight (g), Fruit length(cm), Fruit breadth (cm), Seeds per fruit, Segments per fruit, Rind thickness (mm), Compactness, Fruit colour, Cavity diameter (cm), Shelf life and Juice (%), Total soluble solids ($^{\circ}$ Brix), Acidity (%), TSS and TSS: acidity ratio. Statistical analysis was analysed as per Panse and Sukhatme (1958)^[5].

Result and discussion

Physical characters

The data presented in table 1 it is revealed that average weight of fruit was found 185.97 g and there was more variability among fruit weight which were ranges between 135.83 g to 265.67 g. Besides that, maximum weight of the fruit was found in genotype NM-19 (265.67 g) and minimum weight of the fruit was observed in NM-21 (135.83g). According to the results obtained, the mean length of fruit was 6.49 cm. In respect to variation in length, it was varying from 5.60 cm to 7.48 cm. The highest length of fruit was noticed in genotype NM-14 (7.48 cm) and the lowest length was recorded in NM-10 (5.60 cm). In respect to breadth, the range was lies between 6.80 cm to 8.41 cm, while maximum breadth of fruit was observed in genotype NM-19 (8.41 cm) and minimum breadth of fruit was notice

in genotype NM-10 (6.80 cm). The average number of seed per fruit was recorded 9.26 and it ranges from 4.50 to 15.33. Out of 75 genotypes, NM-52 (4.50) recorded lowest number of seeds while NM-18 (15.33) recorded highest number of seeds. As per the result obtained the average number of segments per fruit was 10.19. The variability in number of segments per fruit was ranged from 9.00 to 11.67. Apart from this, NM-4 recorded maximum number of segments (11.67) and NM-10 recorded minimum number of segments (9.00). In relation to rind thickness, mean rind thickness was 3.05 mm and ranged lies between 2.00 mm to 3.99mm. The lowest rind thickness was observed in NM-31 (2.00 mm) while highest rind thickness of was noticed in genotype NM-67 (3.99 mm).

With regard to cavity diameter, the ranged was lies between 1.63 mm to 2.82 mm and minimum cavity diameter was recorded in genotype NM-45 (1.63 mm). From result the average shelf life of genotype was 7.12 and it was ranged between 5.67 to 9.67 days. However, the highest shelf life was recorded in genotype NM-14 and NM-19 (9.67 day) while lowest shelf was recorded in genotype NM-74 (5.67 days).

The maximum juice percentage was noticed in genotype NM-59 (52.32%) and minimum juice percentage was found in genotype NM-63 (32.67%). In all, 75 genotypes of Nagpur mandarin were undertaken in study, 11 genotypes had green colour, 16 yellowish green, 6 yellowish orange, 23 green yellow, 13 pale green, and 6 Orange colour and it was found that all fruit were compact in nature. Similar work was carried out by Aulakh *et al* (1992) in citrus cultivar, Barbora *et al* (2002) in Khashi Mandarin, Tilekar (2011) in sweet orange, Patil (2004) and Patel *et al* (2016) in citrus cultivar^[1, 2, 6, 7, 9].

Chemical characters

The variation with regard to TSS of juice (Table 1) was ranged from 6.33 ($^{\circ}$ Brix) to 9.33 ($^{\circ}$ Brix) with mean value 7.77 ($^{\circ}$ Brix). The highest TSS was recorded in genotype NM-3 (9.33 $^{\circ}$ Brix) and lowest TSS was recorded in genotype NM-64 (6.33 $^{\circ}$ Brix). The fruit acidity of selected 75 genotypes was range varied between 0.51% to 0.99% with the mean value 0.63%. The minimum acidity was recorded in genotype NM-39 and NM-40 (0.51%) while maximum acidity was recorded in genotype NM-44 (0.99). From results (Table1) it is clear that the genotype NM-13 was recorded highest TSS: acidity ratio (18.36) and genotype NM-44 recorded the lowest TSS: acidity ratio (7.99).

From the finding of present study (Table 2 and 3), we can conclude that out of 75 genotypes, NM-19 was found superior in fruit weight, fruit length, fruit breadth, number of segments per fruit, rind thickness and shelf life. NM-59 was found superior in fruit weight, number of seeds per fruit, cavity diameter, shelf life and juice per cent. NM-8 was found superior in fruit weight, fruit length, fruit breadth, number of segments per fruit and TSS. NM-4 was noticed in fruit weight fruit breadth number of segments per fruit, shelf life. NM-11 was seen superior in fruit length, acidity, juice per cent and TSS: acidity ratio. NM-14 was found superior in fruit weight, fruit breadth and shelf life. NM-20 was found superior in fruit length, number of segments per fruit, TSS: acidity ratio and colour. NM-60 was found superior in fruit weight, fruit length, fruit breadth and number of segments per fruit. All these genotypes were found

significantly superior over Nagpur mandarin (check). Similar work was carried out by Aulakh *et al* (1992) in citrus cultivar, Barbora *et al* (2002) in Khashi Mandarin,

Tilekar (2011) in sweet orange, Patil (2004) and Patel *et al* (2016) in citrus cultivar [1, 2, 6, 7, 9].

Table 1: General mean, range, standard deviation, coefficient of variance, standard error and variance for different characters in Nagpur mandarin

Sr.No.	Characters	General mean	Range	S.D.	C.V.%	S.E.(±m)	Variance
1.	Fruit weight (g)	185.97	135.83-265.67	19.90	10.70	2.30	396.07
2.	Fruit length (cm)	6.49	5.60-7.48	0.31	4.83	0.04	0.10
3.	Fruit breadth (cm)	7.34	6.80-8.41	0.30	4.14	0.04	0.09
4.	No. of Seeds per fruit	9.26	4.50-15.33	2.46	26.54	0.28	6.05
5.	No. of segments per fruit	10.19	9.00-11.67	0.46	4.54	0.05	0.21
6.	Rind thickness (mm)	3.04	2.00-3.99	0.38	12.58	0.04	0.15
7.	Cavity diameter (mm)	2.15	1.63-2.82	0.26	11.97	0.03	0.07
8.	Shelf life	7.12	5.67-9.57	0.80	11.29	0.09	0.65
9.	Juice (%)	39.98	32.67-52.32	4.54	11.35	0.52	20.60
10.	TSS (⁰ Brix)	7.77	6.33-9.33	0.71	9.18	0.08	0.51
11.	Acidity (%)	0.63	0.51-0.99	0.08	13.14	0.01	0.01
12.	TSS: Acidity ratio	12.93	7.99-18.36	1.94	14.96	0.22	3.75

Table 2: Desirable genotypes of Nagpur mandarin based on their mean value

Sr.No.	Characters	Genotypes
1.	Fruit weight (g)	NM-19 (265.67), NM-14(233.67), NM-18(225.17), NM-8(219.17), NM-12(219.17), NM-60(218.33), NM-15(209.33), NM-52 (209.17), NM-4 (208.83), NM-59 (206.33).
2.	Fruit length (cm)	NM-14 (7.48), NM-19 (7.24), NM-60 (7.09), NM-18 (7.08), NM-11 (7.03), NM-20 (7.00), NM-5 (6.94), NM-6 (6.88), NM-8 (6.84), NM-12 (6.84).
3.	Fruit breadth (cm)	NM-19 (8.41), NM-14 (7.98), NM-18 (7.95), NM-8 (7.88), NM-50 (7.85), NM-60 (7.84), NM-4 (7.77), NM-73 (7.76), NM-40 (7.72), NM-67 (7.70).
4.	No. of Seeds per fruit	NM-52 (4.50), NM-16 (5.00), NM-40 (5.00), NM-51 (5.00), NM-53 (5.33), NM-49 (5.67), NM-26 (6.00), NM-39 (6.00), NM-59 (6.00), NM-55 (6.33).
5.	No. of segments per fruit	NM-4 (11.67), NM-55 (11.33), NM-60 (11.00), NM-74 (11.00), NM-3 (10.67), NM-7 (10.67), NM-8 (10.67), NM-16 (10.67), NM-19 (10.67), NM-20 (10.67)
6.	Rind thickness (mm)	NM-31 (2.00), NM-55 (2.33), NM-21 (2.40), NM-54 (2.46), NM-22 (2.51), NM-16 (2.56), NM-6 (2.59), NM-19 (2.59), NM-49 (2.60), NM-32 (2.60).
7.	Cavity diameter (mm)	NM-45 (1.63), NM-70 (1.67), NM-28 (1.70), NM-44 (1.72), NM-59 (1.75), NM-71 (1.76), NM-29 (1.78), NM-64 (1.81), NM-21 (1.83), NM-30 (1.88).
8.	Shelf life (days)	NM-14 (9.67), NM-19 (9.67), NM-4 (9.00), NM-3 (8.67), NM-39 (8.67), NM-45 (8.67), NM-59 (8.33), NM-62 (8.33), NM-65 (8.33), NM-70 (8.33).
9.	Juice (%)	NM-59 (52.32), NM-12 (52.08), NM-21 (50.42), NM-56 (48.60), NM-11 (48.49), NM-29 (48.14), NM-31 (47.62), NM-27 (46.04).
10.	TSS (0 Brix)	NM-3 (9.33), NM-13 (9.17), NM-65 (9.17), NM-1 (9.00), NM-8 (8.93), NM-6 (8.83), NM-7 (8.83), NM-2 (8.67), NM-17 (8.67), NM-73 (8.67).
11.	Acidity (%)	NM-39 (0.51), NM-40 (0.51), NM-35 (0.52), NM-11 (0.52), NM-41 (0.52), NM-37 (0.52), NM-36 (0.53), NM-23 (0.53), NM-27 (0.53), NM-52 (0.54).
12.	TSS: Acidity ratio	NM-13 (18.36), NM-11 (17.32), NM-37 (16.37), NM-1 (16.13), NM-35 (15.89), NM-65 (15.89), NM-27 (15.53), NM-61 (15.42), NM-51 (15.39), NM-20 (15.19).
13.	Colour (Deep orange)	NM-7, NM-17, NM-20, NM-46, NM-49.
14.	Compactness	All fruits are compact.

Among the 75 genotypes of Nagpur mandarin, 11 genotypes had green colour, 16 yellowish green, 6 yellowish orange, 23 green yellow, 13 pale green and 6 orange and with regards to fruit compactness and it was found that all fruit were compact in nature.

From the study (Table 3), it is revealed that eight superior genotypes of Nagpur Mandarin were selected for further evaluation.

Table 3: Superior genotypes and their characteristics

Sr.No.	Superior genotypes	Characteristics
1.	NM-19	Fruit weight (265.67 g), Fruit length (7.24 cm), Fruit breadth(8.41 cm), No. of segments per fruit (10.67), Rind thickness (2.59 mm), Shelf life(9.67 days).
2.	NM-59	Fruit weight(206.33 g), No. of Seeds per fruit(6.00), Cavity diameter(1.75 mm), Shelf life(8.33 days), Juice(52.32%).
3.	NM-8	Fruit weight(219.17 g), Fruit length(6.84 cm), Fruit breadth, No. of segments per fruit(10.67), TSS(8.93 ⁰ Brix).
4.	NM-4	Fruit weight (208.83 g), Fruit breadth(7.77cm), No. of segments per fruit(11.67), Shelf life(9.00 days).
5.	NM-11	Length of fruit(7.03 cm), Acidity(0.52%), Juice(48.49%), TSS: Acidity ratio(17.32%).
6.	NM-14	Fruit weight 233.67 g), Fruit length(7.48 cm), Fruit breadth(7.98 cm), Shelf life(9.67 days).
7.	NM-20	Fruit length(7.00 cm), No. of segments per fruit(10.67), TSS: Acidity ratio(15.19), Colour (deep orange).
8.	NM-60	Fruit weight(218.33 g), Fruit length(7.09 cm), Fruit breadth(7.84 cm), No. of segments per fruit(11.00).

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