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# Evaluation of elite genotypes of Nagpur mandarin for yield parameters in Vidarbha region

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## Abstract
The present study was conducted to evaluation of elite genotypes of Nagpur mandarin (*Citrus reticulata* Blanco) for yield parameters in Vidarbha region during the *Ambia* bahar seasons of 2022-23 and 2023-24. Nine elite genotypes including a standard check were assessed for yield and yield attributing parameters such as average fruit weight, number of fruits per plant, fruit yield per plant and fruit yield per hectare. Significant differences were observed among the genotypes for all the traits studied in both individual years and pooled analysis, indicating substantial genetic variability. Among the all genotypes, genotype KAL-19 consistently recorded the highest number of fruits per plant, fruit yield per plant and fruit yield per hectare, while genotype ACH-37/20 exhibited the highest average fruit weight. Genotypes KAL-14 also showed superior and stable performance for yield attributes. The lowest yield was recorded in genotype M-22. The study highlights the potential of genotype KAL-19, followed by genotype KAL-14 for higher productivity and suitability for commercial cultivation under Vidarbha conditions. These genotypes may be further exploited in varietal improvement programmes.

**Keywords:** Nagpur mandarin, elite genotypes, yield attributes, fruit yield, Vidarbha region

## Introduction
Citrus is one of the most important fruit crops cultivated worldwide owing to its wide adaptability, high nutritional value and significant economic contribution. Belonging to the family *Rutaceae*, the genus *Citrus* comprises several commercially important fruits such as sweet orange, mandarin, lemon, lime, grapefruit and pummelo (Gmitter *et al.*, 1992) [7]. Among these, mandarin (*Citrus reticulata* Blanco) is highly preferred by consumers due to its attractive flavour, easy peelability and richness in vitamins and antioxidants. In India, mandarin occupies the largest area among citrus crops, covering approximately 4.74 lakh hectares with an annual production of about 60.75 lakh metric tonnes (Anon., 2024) [1]. Nagpur mandarin, a prominent cultivar group of mandarin is especially valued for its excellent fruit quality, distinctive taste and high market demand.

The Vidarbha region of Maharashtra represents the principal production belt of Nagpur mandarin and plays a crucial role in the citrus economy of the country. Despite its commercial importance, the productivity of Nagpur mandarin orchards in the region often remains inconsistent. Variations in yield can be attributed to multiple factors, including genotype, agro-climatic conditions, orchard management practices and their interactions. Among these, the genetic potential of planting material is one of the most critical determinants influencing yield and its stability over seasons.

Yield in citrus is a complex trait governed by several yield-attributing characters such as average fruit weight, number of fruits per plant, fruit yield per plant and fruit yield per hectare. These parameters directly influence orchard profitability and are therefore important criteria for evaluating the performance of genotypes. Differences in flowering behaviour, fruit set, fruit retention, and fruit development among genotypes lead to considerable variation in yield performance. Consequently, the evaluation of elite genotypes under specific agro-climatic conditions is essential to identify superior types with higher productivity and better adaptability.

Genotypic evaluation not only facilitates the selection of promising cultivars for commercial cultivation but also provides valuable information for crop improvement programmes. The presence of variability among genotypes reflects underlying genetic diversity, which serves as the foundation for breeding efforts aimed at enhancing yield potential, stability, and adaptability to environmental stresses. Several researchers have reported significant genotypic differences for yield and yield-contributing traits in citrus crops, emphasizing the importance of regional evaluation and selection (Bhattacharya and Dutta, 1956; Verma *et al.*, 2012; Barbora *et al.*, 2019; Ghatul *et al.*, 2024) [4, 17, 2, 6]. However, systematic and comparative information on the yield performance of elite Nagpur mandarin genotypes under Vidarbha agro-climatic conditions remains limited.

In this context, the present study was undertaken to evaluate the yield performance of selected elite Nagpur mandarin genotypes during the Ambia bahar seasons of 2022-23 and 2023-24 under Vidarbha conditions. The objective of the investigation was to assess genotypic variation for yield and yield-attributing traits and to identify promising genotypes suitable for enhancing productivity and sustainability of Nagpur mandarin cultivation in the region.

## Materials and Methods

The present study entitled "Evaluation of Elite Genotypes of Nagpur Mandarin (*Citrus reticulata* Blanco) for Yield Parameters in Vidarbha Region" was carried out during the *Ambia bahar* seasons of 2022-23 and 2023-24 in the Vidarbha region of Maharashtra. The investigation was conducted in the principal Nagpur mandarin growing areas of Nagpur and Amravati districts, which are characterized by a subtropical climate with hot summers, mild winters and an average annual rainfall of about 1250 mm largely received through the southwest monsoon. A systematic field survey undertaken during 2017-18 encompassed 534 orchards across five major Nagpur mandarin producing talukas namely Kalameshwar, Katol and Narkhed in Nagpur district and Morshi, Warud and Achalpur in Amravati district. Based on consistent regular bearing, yield potential, fruit quality and plant vigour, 30 promising genotypes were initially shortlisted, from which nine elite genotypes including a standard check were selected for detailed evaluation.

Data were recorded on major yield and yield contributing traits including average fruit weight, number of fruits per plant, fruit yield per plant, and fruit yield per hectare, using standard methods. The recorded observations were statistically analysed to determine significant differences among genotypes and to assess their comparative performance under Vidarbha agro-climatic conditions

## Results and Discussion

### Average fruit weight

The average fruit weight of different mandarin genotypes is presented in Table 1 and graphically represented in Fig. 1. It is revealed that significant differences were observed across the genotypes in both years of study. During 2022-23, the fruit weight was ranged from 155.80 g to 177.40 g, with a general mean of 165.27 g. Significantly maximum average fruit weight was observed in genotype ACH-37/20 (177.40 g) followed by genotype KAL-19 (176.60 g), genotype KAL-14 (168.60 g), genotype N-16/2 (167.00 g) and genotype K-1/03 (165.60 g), whereas the minimum fruit weight was recorded in genotype N-45 (155.80 g). In the subsequent year, 2023-24, fruit weight was ranged from 154.60 g to 179.40 g with a general mean of 165.42 g. Genotype ACH-37/20 (179.40 g) again recorded the highest fruit weight followed by genotype KAL-19 (178.80 g), genotype KAL-14 (166.20 g), genotype K-1/03 (165.20 g) and genotype N-16/2 (164.80 g), while the lowest fruit weight was found in genotype M-22 (154.60 g). Pooled data analysis over both years showed that the average fruit weight was ranged from 155.40 g to 178.40 g with a general mean of 165.34 g. Genotype ACH-37/20 consistently recorded the highest average fruit weight (178.40 g) followed by genotype KAL-19 (177.70 g), genotype KAL-14 (167.40 g), genotype N-16/2 (165.90 g) and genotype K-1/03 (165.40 g), while the lowest fruit weight was recorded in genotype M-22 (155.40 g).

The observed variation in average fruit weight among the genotypes can be attributed to their inherent genetic potential and the influence of prevailing environmental factors. These results are consistent with the findings of Josan and Kaur (2006) [8] in Mandarin, Kishore *et al*. (2010) [11] in Sikkim mandarin, Dorji and Yapwattanaphun (2011) [5] in Bhutanese mandarin, Kumar *et al*. (2011) [13] Acid lime, Bhatnagar *et al.* (2015) [3] in Nagpur mandarin, Khan *et al.* (2015) [10] in Sweet orange, Kale *et al.* (2018) [9] in Sweet orange, Korde (2021) [12] and Ghatul *et al.* (2024) [6] in Nagpur mandarin and Sekhar and Kundu (2025) [16] in Acid lime.

### Number of fruits per plant:

The data in respect of the number of fruits per plant in different mandarin genotypes are presented in Table 1 and Fig. 2. In the year 2022-23, the number of fruits per plant was varied significantly and it was ranged from 530.00 to 950.00 with a general mean of 700.56. Significantly maximum number of fruits was recorded in genotype KAL-19 (950.00) which was followed by genotype KAL-14 (765.00), genotype ACH-37/20 (710.00), genotype N-16/2 (705.00) and genotype KAL-4 (690.00), while significantly minimum number of fruits per plant was recorded in genotype M-22 (530.00). During the year 2023-24, the number of fruits per plant ranged from 565.00 to 860.00 with a general mean of 649.44. Significantly maximum number of fruits was observed in genotype KAL-19 (860.00) which was followed by genotype KAL-14 (710.00), genotype K-1/03 (690.00), genotype N-16/2 (620.00), genotype KAL-4 (605.00) and genotype ACH-37/20 (595.00), while minimum number of fruits was recorded in genotype M-22 (565.00).

On the basis of pooled data, the number of fruits per plant was significantly influenced and it was ranged from 547.50 to 905.00 with a general mean of 675.00. Significantly highest number of fruits per plant was recorded in genotype KAL-19 (905.00) which was followed by genotype KAL-14 (737.50), genotype K-1/03 (667.50), genotype N-16/2 (662.50) and genotype ACH-37/20 (652.50), while minimum number was recorded in genotype M-22 (547.50).

The variability in number fruits per plant among the different genotypes might be attributed to different genetic make-up and environmental factors. Genotypes such as KAL-19 and KAL-14 consistently showed superior fruit-bearing capacity, suggesting their potential for higher productivity. These findings were aligned with the reports of Patil and Panchal (2016) [14] in Sweet orange, Kale *et al.* (2018) [9] in Sweet orange, Yadlod *et al.* (2018) [18] in Kagzi lime, Barbora *et al.* (2019) [2] in Khasi mandarin, and Prasanna *et al.* (2023) [15] in Acid lime and Ghatul *et al.*

(2024) [6] in Nagpur mandarin, who reported significant genetic variability in yield contributing traits among citrus genotypes.

**Fruit yield per plant**

The data regarding fruit yield per plant in different mandarin genotypes are presented in Table 1 and illustrated in Fig. 3. During the year 2022-23, the fruit yield per plant was varied significantly and it ranged from 70.37 kg to 142.60 kg with a general mean of 95.41 kg. Significantly highest fruit yield per plant was recorded in genotype KAL-19 (142.60 kg) which was followed by genotype ACH-37/20 (107.06 kg) and genotype KAL-14 (101.75 kg). However, minimum fruit yield per plant was observed in genotype M-22 (70.37 kg). During 2023-24, the fruit yield per plant was ranged from 76.17 kg to 130.70 kg with a general mean of 97.05 kg. Significantly maximum fruit yield per plant was recorded in genotype KAL-19 (130.70 kg) which was followed by genotype KAL-14 (108.07 kg) and genotype K-1/03 (102.51 kg). However, significantly minimum fruit yield per plant was observed in Nagpur mandarin (Check) (76.17 kg). Based on the pooled data fruit yield per plant was ranged from 75.26 kg to 136.65 kg, with general mean of 96.23 kg. Significantly highest fruit yield per plant was noted in genotype KAL-19 (136.65 kg) which was followed by genotype KAL-14 (104.91 kg) and genotype ACH-37/20 (98.90 kg). However, significantly minimum fruit yield per plant was recorded in genotype M-22 (75.26 kg).

The significant variation in fruit yield per plant among the different genotypes might be attributed due to genetic make-up and environmental factors influencing flowering behavior, fruit retention and overall plant vigor. Genotypes such as KAL-19 and KAL-14 consistently exhibited higher yields across both years, indicating their potential for commercial cultivation. The results are in close agreement with findings of Yadlod *et al.* (2018) [18] in Kagzi lime, Barbora *et al.* (2019) [2] in Khasi mandarin, Prasanna *et al.* (2023) [15] in Acid lime and Ghatul *et al.* (2024) [6] in Nagpur mandarin, who reported significant genotypic differences for fruit yield per plant in citrus.

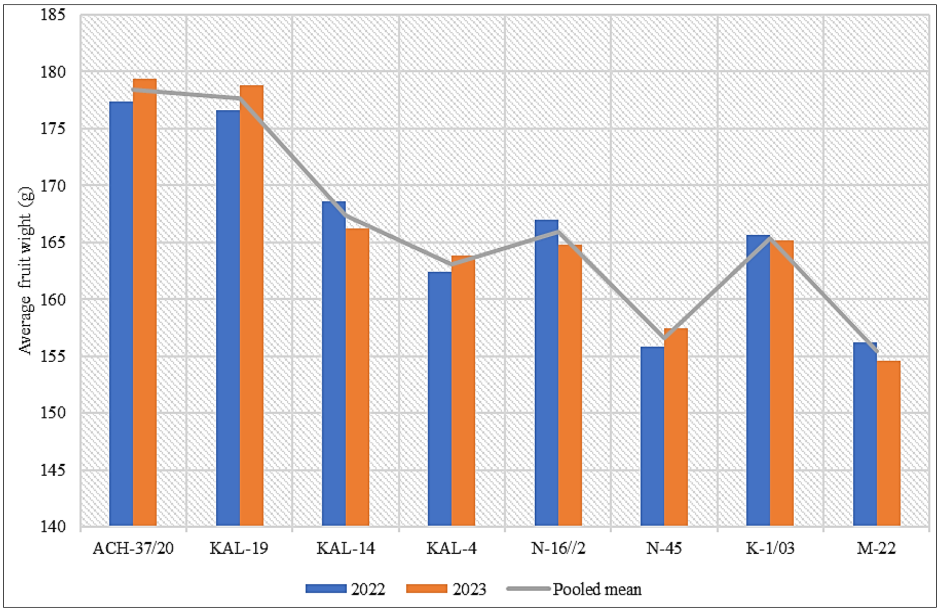


**Fig 1:** Average fruit weight in different Nagpur mandarin genotypes.

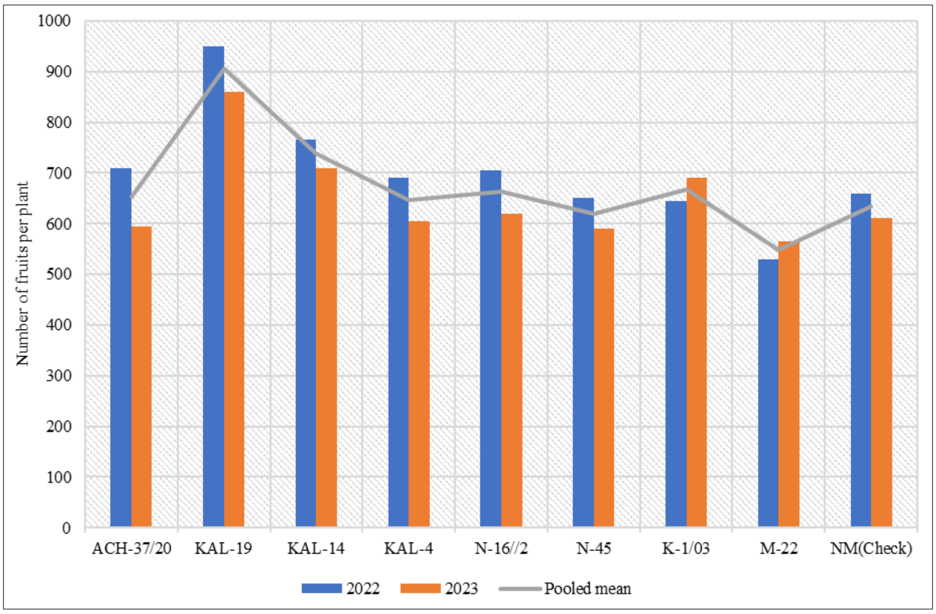


**Fig 2:** Number of fruits per plant in different Nagpur mandarin genotypes.

**Table 1:** Average fruit weight, Number of fruits per plant and Fruit yield in different Nagpur mandarin genotypes.

| Tr. | Genotypes | Average fruit weight (g) | | | Number of fruits per plant | | | Fruit yield (kg plant$^{-1}$) | | | Fruit yield (t ha$^{-1}$) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2022-23 | 2023-24 | Pooled mean | 2022-23 | 2023-24 | Pooled mean | 2022-23 | 2023-24 | Pooled mean | 2022-23 | 2023-24 | Pooled mean |
| 1 | ACH-37/20 | 177.40 | 179.40 | 178.40 | 710.00 | 595.00 | 652.50 | 107.06 | 90.73 | 98.90 | 29.66 | 25.13 | 27.40 |
| 2 | KAL-19 | 176.60 | 178.80 | 177.70 | 950.00 | 860.00 | 905.00 | 142.60 | 130.70 | 136.65 | 39.50 | 36.20 | 37.85 |
| 3 | KAL-14 | 168.60 | 166.20 | 167.40 | 765.00 | 710.00 | 737.50 | 101.75 | 108.07 | 104.91 | 28.18 | 29.94 | 29.06 |
| 4 | KAL-4 | 162.40 | 163.80 | 163.10 | 690.00 | 605.00 | 647.50 | 83.51 | 96.07 | 89.79 | 23.13 | 26.61 | 24.87 |
| 5 | N-16/ 2 | 167.00 | 164.80 | 165.90 | 705.00 | 620.00 | 662.50 | 88.01 | 98.76 | 93.38 | 24.38 | 27.36 | 25.87 |
| 6 | N-45 | 155.80 | 157.40 | 156.60 | 650.00 | 590.00 | 620.00 | 86.08 | 90.31 | 88.19 | 23.84 | 25.02 | 24.43 |
| 7 | K-1/03 | 165.60 | 165.20 | 165.40 | 645.00 | 690.00 | 667.50 | 90.79 | 102.51 | 96.65 | 25.15 | 28.39 | 26.77 |
| 8 | M-22 | 156.20 | 154.60 | 155.40 | 530.00 | 565.00 | 547.50 | 70.37 | 80.16 | 75.26 | 19.49 | 22.20 | 20.85 |
| 9 | NM (Check) | 157.80 | 158.60 | 158.20 | 660.00 | 610.00 | 635.00 | 88.53 | 76.17 | 82.35 | 24.52 | 21.10 | 22.81 |
| Range | | 155.80-177.40 | 154.60-179.40 | 155.40-178.40 | 530.00-950.00 | 565.00-860.00 | 547.50-905.00 | 70.37-142.60 | 76.17-130.70 | 75.26-136.65 | 19.49-39.50 | 21.10-36.20 | 20.85-37.85 |
| General Mean | | 165.27 | 165.42 | 165.34 | 700.56 | 649.44 | 675.00 | 95.41 | 97.05 | 96.23 | 26.43 | 26.88 | 26.66 |
| S. D. | | 8.11 | 8.70 | 8.36 | 113.45 | 91.97 | 99.48 | 20.56 | 16.18 | 17.55 | 5.70 | 4.48 | 4.86 |
| S.E. (m) ± | | 2.70 | 2.90 | 2.79 | 37.82 | 30.66 | 33.16 | 6.85 | 5.39 | 5.85 | 1.90 | 1.49 | 1.62 |
| C. V. % | | 4.90 | 5.26 | 5.06 | 16.19 | 14.16 | 14.74 | 21.55 | 16.67 | 18.23 | 21.55 | 16.67 | 18.23 |

**Fruit yield per hectare**

Fruit yield per hectare the regarding data in different mandarin genotypes are presented in Table 1 and depicted in Fig. 4. During the year 2022-23, fruit yield per hectare ranged from 19.49 to 39.50 t ha$^{-1}$ with a general mean of 26.43 t ha$^{-1}$. The significantly highest fruit yield per hectare was recorded in genotype KAL-19 (39.50 t ha$^{-1}$) which was followed by genotype ACH-37/20 (29.66 t ha$^{-1}$), genotype KAL-14 (28.18 t ha$^{-1}$) and genotype K-1/03 (25.15 t ha$^{-1}$), whereas lowest fruit yield per hectare was observed in genotype M-22 (19.49 t ha$^{-1}$). During 2023-24, fruit yield was varied between 21.10 and 36.20 t ha$^{-1}$ with a general mean of 26.88 t ha$^{-1}$. The genotype KAL-19 again recorded the highest yield (36.20 t ha$^{-1}$) which was followed by genotype KAL-14 (29.94 t ha$^{-1}$), genotype K-1/03 (28.39 t ha$^{-1}$) and genotype N-16/2 (27.36 t ha$^{-1}$). However, lowest fruit yield per hectare was noted in Nagpur mandarin (Check) (21.10 t ha$^{-1}$).

Based on pooled data, fruit yield per hectare was ranged from 20.85 to 37.85 t ha$^{-1}$ with a general mean of 26.66 t ha$^{-1}$. The genotype KAL-19 was found superior with the highest pooled fruit yield per hectare (37.85 t ha$^{-1}$) which was followed by genotype KAL-14 (29.06 t ha$^{-1}$), genotype ACH-37/20 (27.40 t ha$^{-1}$) and genotype K-1/03 (26.77 t ha$^{-1}$). However, the lowest yield was recorded in genotype M-22 (20.85 t ha$^{-1}$).

The significant variation in fruit yield per hectare among different genotypes might be attributed due to genetic potential, plant vigor and adaptability to environmental conditions. The consistently high yield performance of genotype KAL-19 and genotype KAL-14 highlights their suitability for productivity improvement. These results are in agreement with the findings of Verma *et al.* (2012) [17] in Nagpur mandarin, Barbora *et al.* (2019) [2] in Khasi mandarin, Prasanna *et al.* (2023) [15] in Acid lime and Ghatul *et al.* (2024) [6] in Nagpur mandarin, who also reported wide genotypic differences in citrus yield potential.

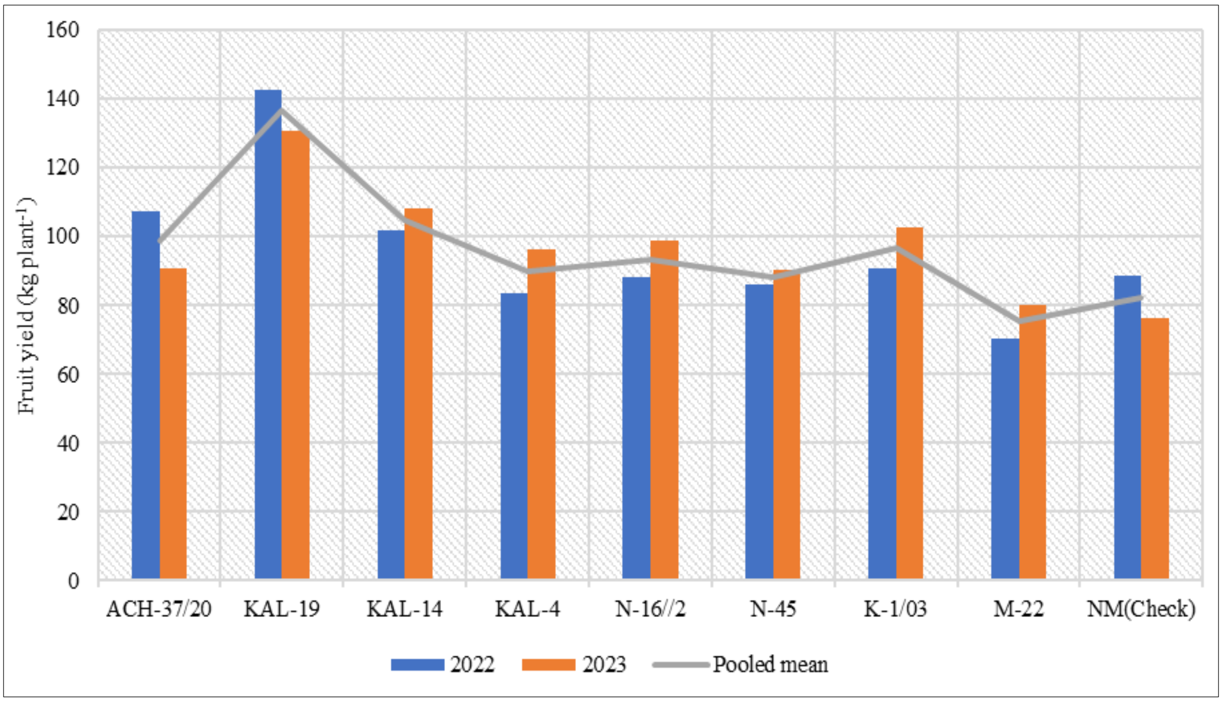


**Fig 3:** Fruit yield kg per plant in different Nagpur mandarin genotypes.

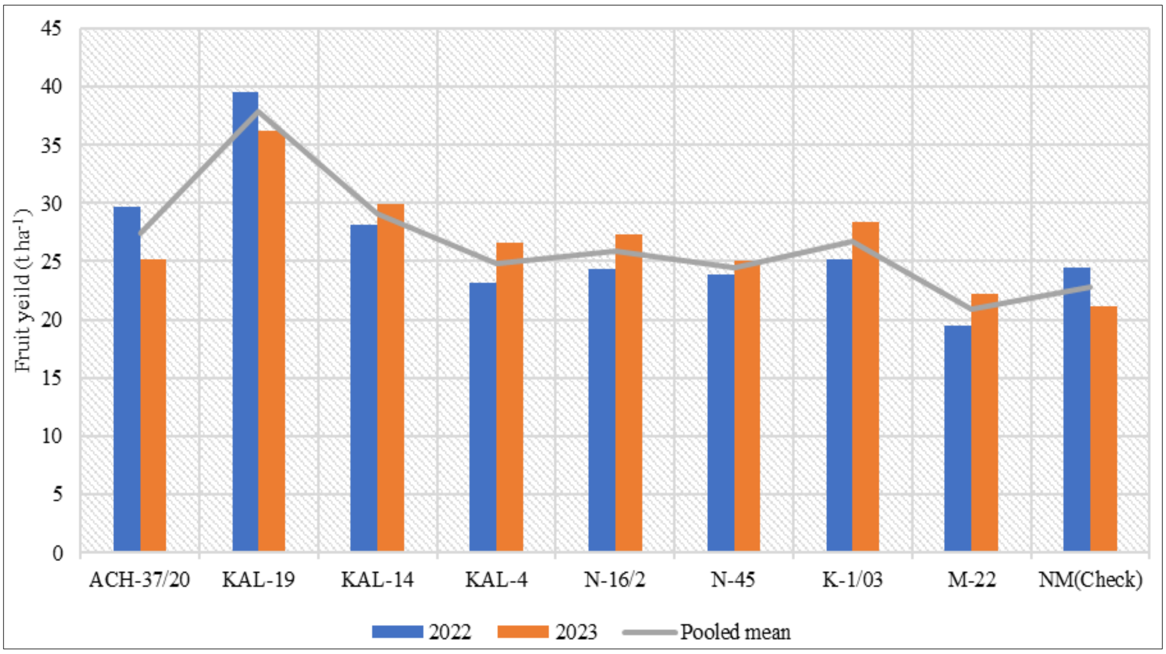


**Fig 4:** Fruit yield per hectare in different Nagpur mandarin genotypes.

## Conclusions

The evaluation of elite Nagpur mandarin genotypes under Vidarbha conditions revealed significant genotypic variation for yield and yield-attributing traits. Among the all genotypes. Genotype KAL-19 consistently recorded the highest number of fruits per plant, fruit yield per plant and fruit yield per hectare during both years and in pooled analysis indicating its superior yield potential and adaptability. Genotypes KAL-14 also exhibited promising performance for yield parameters, while genotype M-22 showed the lowest productivity. The observed variability highlights the scope for selection of superior genotypes and genotype KAL-19, followed by genotype KAL-14 can be recommended for further evaluation and commercial cultivation under Vidarbha region.

## References


1. Anonymous. Ministry of Agriculture and Farmer Welfare. Database 2024.
2. Barbora AC, Saikia J, Kakoti RK, Deka S, Hazarika B, Gogoi A. Survey, selection and evaluation of elite Khasi mandarin (*Citrus reticulata* Blanco) genotypes for growth, yield, quality and biotic stress tolerance under climatic conditions of north-eastern region. International Journal of Pure & Applied Bioscience. 2019;7(1):469-474.
3. Bhatnagar P, Singh J, Jain SK. Physico-chemical variations in fresh 'Nagpur mandarin' fruits of Jhalawar district. Hort Flora Research Spectrum. 2015;4(4):293-300.
4. Bhattacharya SC, Dutta S. Classification of citrus fruits of Assam. Scientific Monograph No. 20. ICAR; 1956. p. 39-41.
5. Dorji K, Yapwattanaphun C. Morphological identification of mandarin (*Citrus reticulata* Blanco) in Bhutan. Kasetsart Journal (Natural Science). 2011;45:793-802.
6. Ghatul ID, Dhemre JK, Pawar PS, Jadhav SB, Lokhande PK. Evaluation of elite mandarin (*Citrus reticulata* Blanco) genotypes for yield parameters. International Journal of Advanced Biochemistry Research. 2024;8(7):298-301.
7. Gmitter JFG, Grosser JW, Moore GA. Citrus. In: Hammerschlag FA, Litz RE, editors. Biotechnology of perennial fruit crops. Wallingford: CABI; 1992. p. 335-369.
8. Josan JS, Kaur N. Variability and character association analysis in identified mandarin germplasm. Indian Journal of Horticulture. 2006;63(2):152-154.
9. Kale AS, Patil MB, Patil SG. Studies on performance of nucellar and Sathgudi varieties of sweet orange (*Citrus sinensis* Osbeck) under Jalna condition. Journal of Pharmacognosy and Phytochemistry. 2018;7(2):2611-2613.
10. Khan K, Rehman A, Zeb T, Jadoon M, Ullah I, Shamrez B. Performance evaluation of various sweet orange varieties under the agro-climatic conditions of Haripur Hazara. Asian Journal of Agricultural Sciences. 2015;7(1):1-3.
11. Kishore K, Kumar A, Rahman H, Monika N, Pandey B. Physico-chemical and sensorial attributes of Sikkim mandarin (*Citrus reticulata* Blanco). Indian Journal of Agricultural Sciences. 2010;80(2):164-167.
12. Korde SD. Survey, collection and evaluation of elite types of Nagpur mandarin (*Citrus reticulata* Blanco) in Nagpur region [thesis]. Akola: Dr Panjabrao Deshmukh Krishi Vidyapeeth; 2021.
13. Kumar M, Parthiban S, Saraladevi D, Aruna P. Evaluation of acid lime (*Citrus aurantifolia* Swingle) cultivars for yield attributes. Asian Journal of Horticulture. 2011;6(2):442-444.
14. Patil MB, Panchal VM. Comparative studies on 'Nucellar', 'Sathgudi' and 'Local' sweet orange (mosambi) (*Citrus sinensis* Osbeck) under Marathwada conditions. Journal of Horticultural Science. 2016;11(1):44-46.
15. Prasanna VSSV, Madhavi M, Mukunda Lakshmi L, Rajasekharam T, Amaravathi Y, Uma Krishna K. Assessment of variability in fruit, yield and biochemical characters of acid lime (*Citrus aurantifolia* Swingle)

germplasm. Pharma Innovation Journal. 2023;12(5):4232-4238.
16. Sekhar RS, Kundu S. Quantitative trait diversity in acid lime (*Citrus aurantifolia* Swingle) under West Bengal conditions. Journal of Applied Horticulture. 2025;27(1):3-7.
17. Verma S, Bhatnagar P, Yadav A. Physico-chemical, yield and yield attributing characteristics of Nagpur mandarin (*Citrus reticulata* Blanco) orchards surveyed in Jhalawar district of Rajasthan. Asian Journal of Horticulture. 2012;7(2):437-441.
18. Yadlod SS, Bhalerao RV, Ingle SN. Variability studies of strains of Kagzi lime (*Citrus aurantifolia* Swingle) in Latur district of Maharashtra, India. Agricultural Science Digest. 2018;38(1):48-51.