GENETIC VARIABILITY AMONG SEEDLING ORIGIN TREE POPULATION OF MANGO (MANGIFERA SPP.) IN HIMACHAL PRADESH, INDIA

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Abstract

A survey to the existing seedling origin tree population of wild *Mangifera* spp. was carried out at Hamirpur and Kangra districts of Himachal Pradesh, India. Eighty one healthy and bearing tree population originated from seedlings in the region were marked. Wide range of genetic variability in qualitative and quantitative characters were observed for fruit, stone, peel, pulp and other fruit characters. Hamirpur district exhibited a variety in quality of fruits with varied fruit shape, colour, attractiveness etc. The significant variation was observed for different fruit parameters like fruit dimensions, fruit weight, fruit volume, stone weight, stone length, of stone, stone thickness, of stone, pulp weight, peel weight, per cent of edible and non-edible portions, ratio of stone weight to pulp weight, ratio of peel weight to pulp weight, skin thickness and TSS (Total Soluble Solids). The selected genotypes could be classified into different categories based upon their utility, *viz.*, pickle, sucking, table purposes etc.

Introduction

The mango is undoubtedly the most important fruit crop of India. It covers largest area compared to any other fruit in the country and thrives in almost all regions except at altitudes above 3000 feet and prefers frost-free dry climates (Gangolly et al. 1957). Mango has a long period of domestication in India resulting in high genetic variability. The majority of the commercial varieties of mango in India have originated as natural chance selections (Dey and Singh 2004). Mango being a highly cross-pollinated and heterozygous fruit crop exhibits wide genetic variability in seedling population. Majority of cultivated mango varieties were developed through selection on the basis of fruit shape, size, colour, time of maturity, juice, content, TSS/acid blend, flavour, aroma, taste, etc. Presently, India harbours more than 1000 mango varieties/land races in regions of different diversity and represents the biggest mango genepool of the world. In sub-mountane zone of Himalayan region, old mango plantation predominantly from seedling origin are established naturally or propagated through selected stones from meritorious indigenous mango plants on the basis of fruit quality characteristics by local fruit lover during 19th and early 20th century. These are at present mostly growing along a strip of roads, riverbanks, undulated terrain in mountainous tracts, government revenue lands, mango groves, etc., exhibit a wide range of variability in desirable horticultural traits like fruit shape, size, juice consistency, bearing regularity, fruit yield, tolerance/resistance to various biotic and abiotic stresses (Navprem et al. 2011). Keeping this insight variation in seedling tree population of mango was explored to assess their possibilities in future fruit crop improvement program.

Materials and Methods

Mango, having an andromonoecious floral structures encourages cross pollination. This enables a greater diversity within. Mango harbours more than 1000 registered varieties but potential of seedling origin trees is still unknown. As each seedling origin mango exhibits a unique

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feature the survey was undertaken to explore the existing variability in mango of seedling tree origin in Himachal Pradesh for utilization its potential in future breeding programs. The study was conducted covering entire seedling mango tree population existed in Hamirpur and Kangra districts of Himachal Pradesh, India. It was carried out on existing seedling tree population of mango, during 2013 - 15. The region opted for research particularly falls under sub-mountain zone which stretched from N 31° 30' to N 32° 15' and E75° 45 to 76° 35' with elevation ranging from 551 - 2550 m. covering a ground distance of about 567 km which conceals entire seedling mango tree population existed. Out of total population 81 healthy and bearing seedling mango trees were subjected for selection. Fruits from each marked tree were subjected for detailed morphophysicochemical evaluation. A total of 20 fruits were selected randomly from all directions from each individual tree and used for evaluation. The traits considered for evaluation were fruit dimension, fruit weight, fruit volume, stone weight, pulp weight, peel weight, stone/pulp ratio, edible and non-edible portion per cent, fruit shape, skin color, fruit blush, skin thickness, skin texture, pulp texture, adherence of skin to pulp, fiber content, beak type, sinus type and slope of shoulders. The morphological characterization was done adopting standard mango descriptors developed by the IPGRI (IPGRI 2006). The chemical analysis conducted by following standard protocols.

Results and Discussion

The fruit characters are almost exclusively reliable for identification, description and classification of mango varieties and germplasm. Visual characters like fruit shape, peel color etc. could be considered as basic indicative tools in identification of germplasm (Naik and Gangolly 1950, Singh and Singh 1956). Cumulative length and breadth of fruits ranged from 13.98 (MkH1) to 80.58 cm² (HmH3) with an average dimension of 28.24 cm². Coefficient of variation was recorded as 38.59 per cent. Average fruit weight among sampled fruits was 60.62 gram. There existed a wide variation in terms of fruit morphological characters. Mean weight of fruit ranged from 27.55 (MkH6) to 169.12 g (KgH1). Coefficient of variation was recorded as 47.57 per cent. Volume of fruit measured among sampled tree population revealed that average fruit volume was 65.57 ml which ranged from 31.50 ml (MkH1) to 178.83 ml (HmH3). Coefficient of variation was recorded as 43.32 per cent. Growth is an irreversible increase in fruit dimensions, fruit weight and volume of the fruit. Due to cell division (increase in number) and cell enlargement (increase in size) fruit weight increases day by day. Fresh weight is less useful because it fluctuates, depending on the moisture status of the fruit. The variation in fruit morphological characters of the different seedling mango trees noticed may be due to genetic or physiological factors. These observations are in agreement with the findings of Iyer et al. (1988), Haque et al. (1993), Chaudhari et al. (1997), Desai and Dhander (2000), Anila and Radha (2003), Kumar and Bramhachari (2004), Kundu et al. (2013). The studies at various locations across the globe on fruit morphological characters of mango concluded a common phenomenon that genetic or physiological factors govern this wide existing variation among them (Table 1 and Chart 1). Weight of stone ranged between 6.34 (MkH6) and 40.31 g (KgH1). The average weight of stone was 14.43 g with 46.59 per cent coefficient of variation. Length of stone varied from 17.78 mm (UpH5) to 71.47 mm (SiH2). Average length of stone was 35.78 mm with 35.77 per cent coefficient of variation. Width of stone ranged between 10.95 (MkH1) and 51.28 mm (SiH2). The average width of stone was 24.17 mm with 36.79 per cent coefficient of variation. Thickness of stone varied from 14.83 (UpH5) to 37.26 mm (HmH3) with an average of 21.31. Coefficient of variation was recorded as 18.90 per cent. Though shape of fruit is considered as a diagnostic character for description and identification of mango fruit, but stone characters could be taken up as secondary character in classification of mango (Singh and Singh 1956). There exist numerous

| TSS | (°Brix) | 11.52 | 8.85 | 9.64 | 10.84 | 11.71 | 11.38 | 8.82 | | 9.37 | 9.37 10.72 | 9.37 10.72 12.58 | 9.37 10.72 12.58 13.66 | 9.37 10.72 12.58 13.66 12.52 | 9.37 10.72 12.58 13.66 12.52 11.00 | 9.37 10.72 12.58 13.66 11.00 11.00 | 9.37 10.72 12.58 13.66 12.52 11.00 11.00 12.26 | 9.37 10.72 12.58 13.66 12.52 11.00 12.26 12.26 12.26 | 9.37 10.72 12.58 13.66 12.52 11.00 12.26 10.63 12.18 12.63 | 9.37 10.72 12.58 13.66 12.52 11.00 12.26 10.63 12.18 12.18 12.63 14.05 | 9.37 10.72 12.58 13.66 13.66 12.52 11.00 12.52 12.63 12.18 12.63 12.63 12.63 12.63 | 9.37 10.72 12.58 13.66 13.66 12.52 10.63 12.26 10.63 12.18 12.63 12.63 12.63 14.05 12.63 14.05 12.77 | 9.37 10.72 12.58 13.66 12.52 12.52 10.63 12.64 12.65 1 | 9.37 10.72 12.58 13.66 12.52 12.63 12.06 12.06 12.05 12.63 14.05 12.63 14.05 12.63 14.05 12.63 14.05 12.77 14.52 12.87 | 9.37 10.72 12.58 13.66 12.52 12.63 12.06 12.06 12.63 14.05 12.63 14.05 12.77 14.52 14.55 1 | 9.37 10.72 12.58 13.66 12.52 12.63 12.06 12.63 12.63 12.63 12.63 12.63 12.63 12.63 12.63 12.63 12.63 12.63 12.77 12.56 12.77 12.56 12.57 12.56 12.56 12.55 12.56 12.55 1 | 9.37 10.72 12.58 13.66 12.52 12.63 14.05 12.18 12.63 14.63 12.63 14.52 12.63 14.52 12.63 14.52 12.63 14.52 12.63 14.52 12.54 14.52 11.15 1 | 9.37 10.72 12.58 13.66 12.52 12.63 10.63 12.18 12.63 14.52 14.52 14.52 14.52 14.52 14.54 11.15 14.54 11.15 11.15 11.132 | 9.37 10.72 12.58 13.66 12.52 12.63 10.63 12.63 12.63 12.63 12.63 12.63 14.24 12.87 1 | 9.37 10.72 12.58 13.66 12.52 12.63 11.00 12.18 12.63 14.26 12.63 14.26 12.63 14.26 12.87 12.87 11.15 11.424 11.424 11.424 11.424 11.424 11.424 11.424 11.424 11.424 11.424 11.424 11.424 11.424 11.424 11.424 11.427 12.8777 12.877 12.877 12.87777 12.87777 12.87777 12.87777 12.87777 12.87777 12.87777 12.87777 12.877777 12.877777 12.87777777 12.8777777777777777777777777777777777777 | 9.37 10.72 12.58 13.66 12.52 12.63 11.00 12.63 14.05 12.63 14.05 12.63 14.05 12.63 14.24 11.15 11.45 12.87 11.45 11.45 12.77 12.87 11.45 12.87 11.32 12.87 1 |
|-----------------|----------------|----------|-------|-------|-------------|-------|-------|-------|-------|---------|---------------|---------------------------|---------------------------------|--|---|---|---|---|---|---|---|---|---|--|---|---|---|--|---|---|---|
| Skin | (mm) | 0.93 | 0.88 | 1.66 | 1.05 | 1.34 | 1.54 | 1.18 | | 1.10 | 1.10 0.95 | 1.10 0.95 1.31 | 1.10 0.95 1.31 2.53 | 1.10 0.95 1.31 2.53 2.00 | 1.10 0.95 1.31 2.53 2.00 1.65 | 1.10 0.95 1.31 2.53 2.60 1.65 1.79 | 1.10 0.95 1.31 2.53 2.00 1.65 1.79 1.79 | 1.10 0.95 1.31 2.53 2.53 2.60 1.65 1.79 1.36 1.05 | 1.10 0.95 1.31 2.53 2.60 1.65 1.65 1.79 1.36 1.05 1.05 | 1.10 0.95 1.31 2.53 2.60 2.60 1.65 1.79 1.36 1.36 1.05 1.38 | 1.10 0.95 1.31 2.53 2.60 1.65 1.65 1.79 1.36 1.36 1.05 1.38 1.33 1.33 | 1.10 0.95 1.31 2.53 2.60 1.65 1.65 1.79 1.65 1.36 1.36 1.38 1.38 1.93 2.96 | 1.10 0.95 1.31 2.53 2.00 2.50 1.65 1.65 1.79 1.05 1.36 1.38 1.93 2.96 1.93 | 1.10 0.95 2.53 2.00 2.00 1.65 1.65 1.65 1.79 1.21 1.21 1.21 1.23 1.93 2.96 2.96 2.96 | 1.10 0.95 2.53 2.00 2.00 1.65 1.65 1.79 1.21 1.21 1.21 1.93 2.96 2.96 2.96 2.61 | 1.10 0.95 2.53 2.00 1.65 1.65 1.79 1.79 1.36 1.38 1.93 2.96 1.93 2.96 1.92 2.96 1.92 2.61 1.30 | 1.10 0.95 2.53 2.00 1.65 1.79 1.79 1.36 1.38 1.38 1.38 1.93 2.96 2.96 1.92 2.96 1.92 2.96 1.30 1.30 1.30 1.32 1.32 1.32 1.32 1.33 | 1.10 0.95 1.31 2.53 2.00 1.65 1.65 1.79 1.36 1.38 1.93 2.96 1.93 2.96 1.93 2.96 1.92 2.96 1.92 1.92 2.96 1.92 2.96 1.30 1.30 1.30 1.33 1.33 1.33 1.33 1.33 | 1.10 0.95 1.31 2.53 2.00 1.65 1.75 1.36 1.38 1.38 1.93 2.96 1.93 2.96 1.93 2.96 1.93 1.92 2.96 1.30 1.24 1.24 1.30 1.30 1.30 1.30 1.33 1.33 1.33 1.33 | 1.10 0.95 2.53 2.60 1.65 1.65 1.76 1.78 1.93 1.93 2.96 1.93 2.96 1.93 2.96 1.93 1.92 1.92 1.92 1.30 1.78 1.78 | 1.10 0.95 2.53 2.60 1.65 1.65 1.76 1.78 1.92 1.92 2.96 1.92 2.96 1.92 1.92 1.92 1.92 1.92 1.24 1.78 1.78 1.78 1.78 1.78 |
| Peel: | Pulp | 0.539 | 0.417 | 0.498 | 0.368 | 0.545 | 0.459 | 0.451 | 0.456 | · · · · | 0.547 | 0.366 | 0.366 0.468 0.468 | 0.547 0.366 0.468 0.431 | 0.547 0.366 0.468 0.431 0.472 | 0.547 0.366 0.468 0.431 0.431 0.472 0.423 | 0.547 0.366 0.468 0.431 0.472 0.472 | 0.547 0.547 0.468 0.431 0.431 0.472 0.472 0.477 | 0.547 0.366 0.468 0.431 0.472 0.477 0.477 0.465 0.465 | 0.547 0.366 0.468 0.431 0.472 0.472 0.477 0.477 0.448 0.448 | 0.547 0.547 0.566 0.468 0.463 0.477 0.465 0.448 0.442 0.448 0.442 | 0.547 0.547 0.468 0.468 0.431 0.477 0.477 0.423 0.448 0.448 0.448 0.442 0.448 | 0.547 0.566 0.468 0.463 0.471 0.477 0.477 0.477 0.448 0.448 0.442 0.442 0.442 0.442 0.442 | 0.547 0.567 0.468 0.463 0.471 0.477 0.477 0.477 0.448 0.448 0.442 0.442 0.442 0.442 0.442 0.442 0.442 0.442 0.442 0.442 0.442 0.442 0.442 0.442 0.442 0.442 0.442 0.442 0.447 0.447 0.472 0.477 0.477 0.477 0.477 0.4777 0.477 0.477 0.477 0.477 0.477 0.477 0.47777 0.4777 0.4777 0.4777 0.4777 0.4777 0.4777 0.4777 0.4777 0.4777 0.4777 0.4777 0.4777 0.4777 0.4777 0.4777 0.47777 0.47777 0.47777 0.47777 0.477777 0.47777777777 | 0.547 0.567 0.468 0.431 0.477 0.477 0.477 0.477 0.448 0.448 0.448 0.442 0.442 0.442 0.442 0.442 0.442 0.442 0.411 0.190 | 0.547 0.566 0.468 0.431 0.472 0.472 0.477 0.477 0.448 0.448 0.448 0.442 0.448 0.442 0.442 0.442 0.442 0.442 0.433 0.442 0.433 | 0.547 0.566 0.468 0.468 0.431 0.477 0.477 0.442 0.442 0.442 0.442 0.442 0.442 0.442 0.443 0.442 0.443 0.442 0.443 0.4443 0.4430 0.4430000000000 | 0.547 0.566 0.468 0.468 0.431 0.477 0.477 0.448 0.448 0.4420 0.4420 0.4420 0.4420 0.4420 0.4420 0.4420 0.44200 0.4420000000000 | 0.447 0.566 0.468 0.468 0.431 0.477 0.477 0.448 0.442 0.442 0.442 0.442 0.442 0.411 0.190 0.436 0.436 0.436 0.436 0.436 0.426 | 0.447 0.566 0.468 0.468 0.477 0.477 0.477 0.448 0.442 0.442 0.411 0.436 0.412 0.4130 0.4120 0.4236 0.4226 0.4226 0.4226 | 0.447 0.566 0.468 0.468 0.477 0.477 0.477 0.448 0.442 0.442 0.411 0.438 0.442 0.413 0.4126 0.438 0.442 0.423 0.4206 0.42266 0.4226 0.42666 0.42666 0.42666 0.426666 0.42666 0.42666666 0.42666666666666666666 |
| Stone: | dInd | 0.560 | 0.428 | 0.519 | 0.425 | 0.514 | 0.467 | 0.468 | 0.468 | | 0.468 | 0.468 0.369 | 0.468 0.369 0.477 | 0.468 0.369 0.477 0.464 | 0.468 0.369 0.477 0.464 0.534 | 0.468 0.369 0.477 0.464 0.464 0.534 0.534 | 0.468 0.369 0.477 0.464 0.534 0.534 0.510 | 0.468 0.369 0.477 0.464 0.534 0.534 0.510 0.510 0.482 | 0.468 0.369 0.477 0.464 0.464 0.534 0.534 0.451 0.451 0.482 0.487 | 0.468 0.369 0.477 0.477 0.464 0.534 0.534 0.451 0.451 0.482 0.482 0.457 0.457 | 0.468 0.369 0.477 0.464 0.534 0.534 0.5310 0.451 0.510 0.482 0.482 0.487 0.487 0.487 | 0.468 0.369 0.477 0.464 0.534 0.534 0.534 0.530 0.451 0.457 0.457 0.457 0.436 0.436 0.438 0.438 | 0.468 0.369 0.477 0.464 0.534 0.510 0.510 0.482 0.482 0.487 0.487 0.487 0.471 0.471 0.473 0.458 0.458 0.458 | 0.468 0.369 0.477 0.464 0.534 0.510 0.510 0.482 0.482 0.487 0.471 0.471 0.471 0.473 0.458 0.458 0.458 0.458 | 0.468 0.369 0.477 0.464 0.534 0.510 0.451 0.510 0.482 0.482 0.487 0.471 0.471 0.473 0.458 0.458 0.458 0.458 0.420 0.420 0.3640 | 0.468 0.369 0.477 0.464 0.534 0.510 0.451 0.451 0.451 0.451 0.453 0.453 0.458 0.458 0.458 0.458 0.458 0.458 0.420 0.420 0.424 0.424 0.424 | 0.468 0.369 0.477 0.464 0.510 0.510 0.451 0.451 0.451 0.457 0.458 0.458 0.458 0.458 0.458 0.420 0.420 0.420 0.421 0.423 | 0.468 0.369 0.477 0.464 0.510 0.510 0.451 0.451 0.457 0.457 0.458 0.458 0.458 0.458 0.458 0.458 0.458 0.458 0.458 0.458 0.458 0.458 0.453 0.453 0.453 0.453 0.453 0.453 0.5100 0.5100 0.5100 0.5100 0.5100 0.5100 0.5100 0.5100 0.5100 0.510000000000 | 0.468 0.369 0.477 0.464 0.510 0.510 0.451 0.451 0.457 0.457 0.457 0.458 0.458 0.458 0.458 0.458 0.458 0.458 0.458 0.458 0.439 0.439 0.439 0.439 0.439 0.439 | 0.468 0.369 0.477 0.464 0.510 0.510 0.451 0.451 0.457 0.457 0.458 0.458 0.458 0.458 0.458 0.458 0.458 0.458 0.458 0.439 0.439 0.439 0.439 0.439 0.439 0.439 | 0.468 0.369 0.477 0.464 0.510 0.510 0.451 0.451 0.457 0.457 0.458 0.458 0.458 0.458 0.458 0.458 0.458 0.458 0.458 0.439 0.439 0.439 0.439 0.439 0.439 0.439 0.439 0.439 0.436 0.436 0.436 0.436 0.436 0.436 0.436 0.436 0.436 0.436 0.436 0.436 0.436 0.436 0.436 0.436 0.436 0.457 0.5100 0.510 0.5100 0.5100 0.5100 0.5100 0.5100 0.5100 0.5100 0.5100 0.5100 0.5100 0.5100 0.5100 0.5100 0.510000000000 |
| Non- edible | portion (%) | 50.60 | 43.44 | 47.53 | 42.61 | 50.76 | 47.73 | 47.16 | 47.67 | | 49.10 | 49.10 41.90 | 49.10 41.90 47.81 | 49.10 41.90 47.81 47.20 | 49.10 41.90 47.81 47.20 49.71 | 49.10 41.90 47.81 47.20 49.71 46.56 | 49.10 41.90 47.81 49.71 46.56 49.31 | 49.10 41.90 47.20 49.71 49.71 49.31 49.31 | 49.10 41.90 47.20 49.71 49.71 49.31 48.29 47.43 | 49.10 41.90 47.81 49.71 49.71 49.31 49.31 47.43 47.3 | 49.10 41.90 47.81 49.71 49.71 49.31 49.31 47.3 47.3 47.3 | 49.10 41.90 47.81 47.3 47.3 47.3 47.3 47.02 | 49.10 41.90 47.81 49.71 49.31 49.31 49.31 47.3 47.3 47.3 47.3 47.18 | 49.10 41.90 47.81 49.71 49.71 49.31 47.3 47.4 4 | 49.10 41.90 47.81 49.71 49.71 49.31 47.3 47.3 47.3 47.3 47.3 47.3 47.3 35.44 | 49.10 41.90 47.81 47.20 49.31 49.31 47.43 47.43 47.43 47.18 | 49.10 41.90 47.81 47.20 49.31 47.43 47.43 47.43 47.18 47.18 47.18 47.18 47.18 47.18 47.18 47.18 47.56 47.58 48.54 | 49.10 41.90 47.81 47.20 49.71 47.43 47.43 47.43 47.3 47.18 47.18 47.18 47.18 47.18 47.28 47.35 47.58 48.64 48.64 48.64 48.64 48.64 48.64 48.64 | 49.10 41.90 47.81 47.20 49.71 49.31 47.43 47.3 47.4 | 49.10 41.90 47.81 47.20 49.71 49.71 49.31 47.43 47.43 47.43 47.35 47.18 47.18 47.18 47.18 47.35 47.55 48.64 46.72 46.72 46.72 46.72 46.72 46.72 46.46 46.46 46.46 | 49.10 41.90 47.81 47.20 49.71 49.71 49.31 47.35 47.35 47.38 47.48 < |
| Edible | (%) | 49.4 | 56.56 | 52.47 | 57.39 | 49.24 | 52.27 | 52.84 | 52.33 | | 50.90 | 50.90 58.10 | 50.90 58.10 52.19 | 50.90 58.10 52.19 52.80 | 50.90 58.10 52.19 52.80 50.29 | 50.90 58.10 52.19 52.80 50.29 53.44 | 50.90 58.10 52.19 52.80 50.29 53.44 53.44 | 50.90 58.10 52.19 52.80 50.29 53.44 50.69 51.71 | 50.90 58.10 52.19 52.80 50.29 53.44 51.71 51.71 | 50.90 58.10 52.19 52.80 50.69 51.71 51.71 52.57 52.57 | 50.90 58.10 52.19 52.80 50.69 51.71 51.71 52.57 52.57 52.70 54.72 | 50.90 58.10 52.19 52.80 50.29 50.29 51.71 51.71 51.71 52.57 52.57 52.70 52.70 52.70 | 50.90 58.10 52.19 52.80 50.29 50.29 51.71 51.71 52.70 52.70 52.70 52.70 52.70 52.82 | 50.90 58.10 52.19 52.80 50.29 51.71 51.71 52.57 54.72 54.72 52.98 55.44 | 50.90 58.10 52.19 52.80 50.29 51.71 52.70 52.70 52.70 52.44 55.44 55.44 55.44 | 50.90 58.10 52.19 52.80 50.29 51.71 52.57 52.70 52.70 52.44 52.28 55.44 55.44 55.44 55.44 55.48 | 50.90 58.10 52.19 52.80 50.69 51.71 52.82 52.82 52.82 52.82 55.44 52.82 55.44 55.44 55.44 55.48 55.44 51.36 | 50.90 58.10 52.19 52.80 50.69 51.71 52.82 52.44 52.82 52.82 55.44 55.44 55.44 55.44 55.44 55.44 51.36 51.36 54.45 | 50.90 58.10 52.19 52.80 50.29 51.71 52.82 52.44 52.82 52.82 52.82 55.44 55.44 53.28 53.26 55.27 55.27 55.26 55.26 55.26 55.26 55.26 55.26 55.26 55.26 55.27 55.26 55.26 55.26 55.26 55.26 55.26 55.27 55.27 55.27 55.27 55.27 55.27 55.27 55.27 55.27 55.27 55.26 55.26 55.26 55.26 55.26 55.26 55.26 55.26 55.26 55.26 55.27 55.26 | 50.90 58.10 52.19 52.80 50.29 51.71 52.82 52.82 52.82 52.82 52.82 53.28 53.28 53.28 53.28 53.28 53.28 53.28 53.28 53.28 53.28 53.28 53.28 53.54 | 50.90 58.10 52.19 52.80 50.29 51.71 52.67 52.67 52.82 52.82 52.82 52.82 52.82 53.28 53.28 53.28 53.28 53.28 53.28 53.54 53.28 53.54 53.54 53.54 53.54 |
| Peel | (g) | 7.51 | 7.48 | 14.87 | 6.16 | 12.21 | 12.30 | 8.84 | 8.89 | | /1./ | /.1/ 11.37 | /.1/ 11.37 26.45 | /.1/ 11.37 26.45 14.30 | /11/ 11.37 26.45 14.30 12.61 | /11/ 11.37 26.45 14.30 12.61 15.24 | 7.17 11.37 26.45 14.30 12.61 15.24 9.69 | 7.17 11.37 26.45 14.30 12.61 15.24 9.69 8.06 | 7.17 11.37 26.45 14.30 12.61 15.24 9.69 8.06 8.06 | 7.17 11.37 26.45 14.30 12.61 15.24 9.69 8.06 8.06 11.26 | 7.17/ 11.37 26.45 14.30 12.61 15.24 9.69 8.06 8.06 11.26 11.26 | /.1/ 11.37 26.45 14.30 12.61 15.24 9.69 9.69 8.06 11.26 10.05 11.26 24.44 | /.1/ 11.37 26.45 14.30 12.61 15.24 9.69 9.69 9.69 10.05 11.26 11.26 13.66 | /.1/ 11.37 26.45 14.30 12.61 15.24 9.69 9.69 9.69 9.69 11.26 11.26 11.26 11.26 13.66 23.44 | /.1/ 11.37 26.45 14.30 15.24 9.69 9.69 9.69 9.69 11.26 11.26 11.26 11.26 11.26 11.26 | /.1/ 11.37 26.45 14.30 15.24 9.69 9.69 9.69 11.26 11.26 11.26 11.26 11.26 11.26 11.26 8.05 | /.1/ 11.37 26.45 14.30 15.24 9.69 9.69 8.06 11.26 11.26 11.26 12.44 11.26 1 | /.1/ 11.37 26.45 14.30 15.24 9.69 9.69 10.05 11.26 11.26 12.444 11.26 <li< td=""><td> /.1/ 11.37 26.45 14.30 15.24 9.69 9.69 10.05 11.26 10.05 11.26 11.26 12.44 11.26 12.44 13.66 19.67 13.12 13.12 13.12 13.12 14.67 </td><td> /.1/ 11.37 26.45 14.30 15.24 9.69 9.69 10.05 11.26 10.05 11.26 10.42 13.66 8.95 10.42 13.12 13.12 14.67 7.27 </td><td> /.1/ 11.37 26.45 14.30 12.61 15.24 9.69 8.06 10.05 11.26 10.42 13.12 19.67 8.95 10.42 11.48 11.48 </td></li<> | /.1/ 11.37 26.45 14.30 15.24 9.69 9.69 10.05 11.26 10.05 11.26 11.26 12.44 11.26 12.44 13.66 19.67 13.12 13.12 13.12 13.12 14.67 | /.1/ 11.37 26.45 14.30 15.24 9.69 9.69 10.05 11.26 10.05 11.26 10.42 13.66 8.95 10.42 13.12 13.12 14.67 7.27 | /.1/ 11.37 26.45 14.30 12.61 15.24 9.69 8.06 10.05 11.26 10.42 13.12 19.67 8.95 10.42 11.48 11.48 |
| Pulp | (g) | 16.35 | 20.15 | 36.07 | 19.68 | 23.64 | 27.38 | 20.78 | 20.03 | 14.04 | 14.04 | 32.14 | 32.14 60.40 | 32.14 60.40 33.26 | 32.14 60.40 33.26 27.47 | 32.14 60.40 33.26 27.47 36.09 | 14.04 32.14 60.40 33.26 27.47 36.09 20.84 | 14.04 32.14 60.40 33.26 27.47 36.09 20.84 17.80 | 14.04 32.14 60.40 33.26 27.47 36.09 36.09 20.84 17.80 22.51 | 22.14 32.14 60.40 33.26 27.47 36.09 20.84 17.80 22.51 26.20 | 22.14 32.14 60.40 33.26 33.26 27.47 27.47 27.47 27.47 27.47 27.47 27.47 27.47 26.20 42.66 | 22.14 33.26 33.26 33.26 35.09 36.09 20.84 17.80 22.51 22.51 22.51 22.53 26.23 56.23 | 14.04 32.14 33.26 20.84 17.80 17.80 20.84 17.80 22.51 22.51 22.53 31.25 56.23 31.25 | 14.04 32.14 33.26 20.84 17.80 17.80 22.51 22.51 22.51 31.25 56.23 31.25 | 22.14 32.14 60.40 33.26 35.09 35.09 17.80 17.80 22.51 26.20 42.66 56.23 31.25 56.23 31.25 | 20.52 20.52 20.52 20.84 20.84 20.84 20.55 20.55 20.52 20.52 20.52 20.52 | 22.14 33.26 33.26 33.26 35.09 35.09 20.84 17.80 22.51 26.23 31.25 56.23 31.25 20.52 20.52 20.52 | 22.14 33.26 60.40 33.26 33.26 35.09 17.80 20.84 22.51 31.25 56.23 31.25 20.52 20.52 33.00 | 22.14 32.14 60.40 33.26 33.26 36.09 17.80 20.84 56.23 31.25 56.23 31.25 56.23 31.25 33.00 33.50 33.50 | 22.14 32.14 60.40 33.26 20.84 17.80 22.51 26.23 31.25 56.23 31.25 56.23 31.25 20.52 33.00 33.50 105.23 31.25 105.23 31.25 105.23 31.25 105.23 31.25 105.23 31.25 105.23 31.25 105.23 105.25 105.25 105.25 105.25 105.25 105.25 105.25 105.25 105.25 100.25 105.25 105.25 105 | 22.14 32.14 60.40 33.26 20.84 17.80 22.51 22.51 105.23 31.25 56.23 31.25 56.23 31.25 56.23 31.25 56.23 31.25 58.81 107.10 |
| Stone | (mm) | 16.00 | 15.41 | 23.32 | 15.02 | 20.50 | 21.28 | 17.33 | 17.51 | 15 55 | CC.CI | 19.83 | 19.83 24.73 | 19.83 19.83 24.73 24.75 | 19.83 24.73 24.75 20.45 | 24.73 24.75 24.75 20.45 22.39 | 19.83 24.73 24.75 24.75 20.45 22.39 18.31 | 19.63 19.83 24.75 24.75 20.45 20.45 22.39 18.31 16.63 | 19.83 19.83 24.75 20.45 20.45 20.45 22.39 18.31 16.63 18.95 | 24.73 24.73 24.75 24.75 20.45 20.45 20.45 18.31 18.31 18.95 16.63 18.95 20.22 | 24.73 24.73 24.75 24.75 20.45 20.45 18.31 18.31 18.95 18.95 20.22 24.11 | 24.73 24.75 24.75 24.75 22.39 16.63 18.95 18.95 20.22 24.11 24.11 31.16 | 24.73 24.73 24.75 24.75 22.39 16.63 18.95 18.95 18.95 20.22 24.11 22.52 22.52 | 24.73 24.73 24.75 24.75 22.39 16.63 18.95 18.95 18.95 18.95 28.11 24.11 24.41 | 24.73 24.73 24.75 24.75 20.45 22.39 18.95 18.95 18.95 24.11 31.16 24.11 31.16 22.52 24.41 24.41 28.83 | 24.73 24.73 24.75 24.75 20.45 22.39 18.95 18.95 24.11 31.16 24.11 31.16 24.41 22.52 24.41 31.16 28.83 18.00 | 24.73 24.75 24.75 24.75 22.45 20.45 18.31 16.63 18.95 24.11 31.16 22.52 24.41 31.16 22.52 24.41 31.16 18.00 19.18 | 24.73 24.75 24.75 24.75 22.45 18.31 18.95 16.63 18.95 24.41 31.16 22.52 24.41 22.52 24.41 19.18 19.18 19.18 | 24.73 24.75 24.75 24.75 24.75 22.39 18.95 18.95 31.16 31.16 22.52 24.41 19.18 19.18 24.41 22.83 21.47 22.87 22.87 | 24.73 24.75 24.75 24.75 24.75 22.39 18.95 18.95 31.16 24.41 19.18 24.41 19.18 24.41 19.18 22.52 24.41 19.18 22.83 24.41 19.18 22.83 24.41 19.18 22.83 24.41 19.18 22.83 24.41 19.18 22.83 24.41 19.18 22.83 24.41 19.18 24.75 22.39 24.75 25.39 24.75 26.45 27.39 26.45 27.39 27.45 27.39 27.45 27.39 27.45 27.39 27.45 27.39 27.45 27.39 27.45 27.39 27.45 27.39 27.45 27.39 27.45 27.39 27.45 27.39 27.45 27.39 27.45 27.39 27.45 27.39 27.45 27.39 27.45 27.39 27.45 27.39 27.45 27.39 27.45 27.39 27.41 10.65 27.45 27.39 27.45 27.52 | 24.73 24.73 24.75 24.75 24.75 22.39 18.95 18.95 31.16 24.41 31.16 24.41 28.83 24.41 19.18 28.83 19.18 21.47 22.87 19.18 19.18 |
| Stone | (mm) | 17.61 | 14.89 | 31.14 | 10.95 | 19.84 | 21.63 | 15.65 | 15.88 | 16 41 | 14.01 | 19.33 | 19.33 19.33 27.73 | 19.33 19.33 27.73 26.24 | 19.33 19.33 27.73 26.24 23.74 | 19.33 19.33 27.73 26.24 23.74 29.07 | 19.41 19.33 26.24 26.24 23.74 29.07 17.28 | 19.41 19.33 26.24 26.24 23.74 17.28 17.28 | 19.33 19.33 26.24 26.24 23.74 17.28 17.28 14.49 18.20 | 19.33 19.33 26.24 26.24 23.74 17.28 14.49 18.20 20.36 | 19.33 19.33 26.24 26.24 23.74 17.28 14.49 18.20 20.36 31.52 | 10.41 19.33 26.24 26.24 23.74 17.28 14.49 18.20 18.20 31.52 31.52 43.04 | 10.41 19.33 27.73 26.24 23.74 17.28 14.49 18.20 18.20 20.36 31.52 24.59 | 10.41 19.33 27.73 26.24 23.74 17.28 14.49 18.20 18.20 20.36 31.52 31.52 43.04 42.91 | 10.41 19.33 27.73 26.24 23.74 14.49 18.20 18.20 20.36 31.52 31.52 31.52 24.59 242.91 51.28 | 15.41 19.33 26.24 26.24 29.07 14.49 18.20 20.36 31.52 31.52 31.52 24.59 42.91 51.28 51.28 | 10.41 19.33 26.24 28.24 17.28 14.49 18.20 20.36 31.52 31.52 43.04 42.91 15.93 15.93 18.41 | 10.41 19.33 26.24 26.24 29.07 17.28 14.49 18.20 31.52 31.52 43.04 42.91 15.93 15.93 15.93 15.93 15.93 24.88 | 10.41 19.33 26.24 26.24 29.07 17.28 14.49 14.49 18.20 31.52 43.04 42.91 51.28 15.93 15.93 15.93 24.59 24.59 15.93 24.59 24.59 24.59 24.59 24.59 24.59 24.59 24.59 24.59 27.73 27.73 27.73 27.73 27.73 27.73 27.73 29.07 17.28 29.07 29.27 20.27 | 13.04 19.33 27.73 26.24 29.07 17.28 14.49 18.20 31.52 43.04 42.91 51.28 15.93 | 19.33 19.33 27.73 26.24 29.07 17.28 18.20 18.20 18.20 31.52 42.91 51.28 15.93 |
| Stone | (mm) | 19.70 | 18.80 | 39.34 | 17.81 | 31.08 | 33.11 | 23.48 | 23.75 | 19 02 | 17.71 | 29.96 | 29.96 36.81 | 29.96 29.96 36.81 38.20 | 29.96 29.96 36.81 38.20 35.10 | 29.96 29.96 36.81 38.20 35.10 41.19 | 29.96 29.96 36.81 38.20 35.10 41.19 25.64 | 29.96 29.96 36.81 38.20 35.10 41.19 25.64 21.46 | 29.96 29.96 36.81 38.20 35.10 41.19 25.64 21.46 21.46 27.11 | 29.96 29.96 36.81 38.20 35.10 41.19 25.64 21.46 21.46 21.46 31.25 | 29.96 29.96 36.81 35.10 35.10 41.19 25.64 21.46 21.46 27.11 31.25 44.08 | 29.96 36.81 35.10 35.10 41.19 25.64 21.46 21.46 21.46 21.46 21.46 21.46 21.46 21.46 21.46 21.11 31.25 44.08 | 29.96 36.81 35.10 35.10 41.19 25.64 21.46 27.11 31.25 44.08 62.71 62.71 | 29.96 36.81 35.10 35.10 41.19 25.64 25.64 21.46 21.46 21.46 21.11 31.25 44.08 62.71 62.71 | 29.96 36.81 35.80 35.10 35.10 25.64 25.64 25.64 21.46 21.46 21.46 27.11 331.25 44.08 62.71 62.71 62.77 | 29.96 36.81 35.10 35.10 41.19 25.64 25.64 25.64 21.46 27.11 31.25 44.08 62.71 62.71 62.71 24.61 | 29.96 36.81 36.81 35.10 35.10 41.19 25.64 21.46 21.46 21.46 62.71 37.24 69.77 69.77 24.61 27.78 | 29.96 36.81 36.81 35.10 41.19 25.64 21.46 27.11 31.25 69.77 69.77 71.47 71.47 23.39 35.39 | 29.96 36.81 36.81 35.10 41.19 25.64 21.46 27.11 31.25 69.77 71.47 71.47 71.47 33.39 39.15 | 29.96 36.81 36.81 35.10 41.19 25.64 21.46 27.11 31.25 69.77 69.77 71.47 24.61 37.24 69.77 71.47 33.39 39.15 39.15 | 29.96 36.81 36.81 35.10 41.19 25.64 21.46 27.11 31.25 37.24 69.77 69.77 71.47 24.61 37.24 69.77 71.47 335.39 39.15 30.12 |
| Stone | (g) | 8.47 | 7.16 | 15.58 | 7.21 | 11.61 | 12.55 | 9.25 | 9.17 | 6 34 | 10.0 | د ریا 11.63 | 11.63 27.70 | 11.63 27.70 15.39 | 11.63 27.70 15.39 14.26 | 11.63 27.70 15.39 14.26 16.15 | 27.70 11.63 15.39 14.26 16.15 10.41 | 2 11.63 15.39 15.39 14.26 16.15 10.41 8.37 | 2 11.63 15.39 14.26 16.15 10.41 8.37 10.27 | 04 27.70 15.39 14.26 16.15 10.41 8.37 10.27 10.27 | 04 11.63 27.70 15.39 14.26 16.15 10.41 8.37 10.27 10.27 10.27 112.09 | 10.24 11.63 15.39 15.39 14.26 16.15 10.41 8.37 10.27 10.27 10.27 10.27 10.27 12.09 18.31 25.45 | 0 11.63 15.39 14.26 16.15 8.37 10.41 8.37 10.27 112.09 18.31 18.31 14.17 | 2 11.63 15.39 15.39 16.15 16.15 8.37 10.27 10.27 18.31 18.31 18.31 14.17 25.45 25.45 25.45 25.45 25.45 | 9.5.7 11.63 15.39 14.26 16.15 10.41 18.31 12.09 12.09 13.37 14.17 14.17 14.17 38.13 38.13 | 9.04 11.63 11.63 15.39 16.15 16.15 10.41 16.15 10.27 10.27 114.17 25.45 114.17 25.45 114.17 25.45 114.17 25.45 114.17 25.45 114.17 12.09 13.813 14.16 12.09 12.09 12.09 12.09 12.09 12.09 12.000 12.000 12.000 12.000 12.000 12.000 12.000 12.0000 12.0000000000 | 9.03 11.63 11.63 15.39 16.15 10.41 16.15 10.41 18.31 12.09 18.31 12.09 18.31 14.17 25.45 14.17 12.09 18.31 12.09 10.98 | 9.03 11.63 11.63 14.26 16.15 10.41 10.41 18.31 18.31 18.31 14.17 25.45 14.17 25.45 14.17 25.45 14.17 14.35 14.35 14.35 | 9.03 11.63 11.63 14.26 16.15 10.41 10.41 18.31 18.31 18.31 14.17 25.45 14.17 25.45 14.17 12.09 14.17 14.35 14.35 16.98 14.35 16.98 | 9.03 11.63 11.63 11.63 11.63 16.15 10.41 18.31 19.27 14.17 14.17 14.17 38.13 9.08 14.17 14.35 14.35 14.35 14.35 14.35 14.35 16.98 | 9.03 11.63 11.63 11.63 11.6.15 10.41 10.41 11.2.09 11.17 11.10 9.08 11.15.16 11.5.16 11.5.16 11.5.16 11.5.16 11.5.16 |
| Fruit | (ml) | 35.67 | 35.00 | 71.33 | 31.50 | 54.67 | 58.83 | 42.50 | 43.33 | 22 02 | 00.00 | 53.50 | 53.50 76.67 | 53.50 53.50 76.67 68.50 | 53.50 53.50 68.50 61.83 | 53.50 53.50 76.67 68.50 61.83 137.50 | 53.50 53.50 68.50 61.83 137.50 46.83 | 53.50 53.50 76.67 68.50 61.83 137.50 46.83 38.33 | 53.50 53.50 68.50 61.83 61.83 46.83 38.33 47.17 | 53.50 53.50 68.50 68.50 61.83 46.83 38.33 38.33 55.33 | 53.50 53.50 68.50 68.50 61.83 1137.50 46.83 38.33 38.33 55.33 79.83 | 53.50 76.67 68.50 68.50 61.83 1137.50 46.83 38.33 38.33 47.17 55.33 79.83 | 53.50 76.67 68.50 68.50 61.83 137.50 46.83 38.33 38.33 38.33 47.17 55.33 79.83 118.33 65.00 | 53.50 76.67 68.50 68.50 61.83 137.50 46.83 38.33 38.33 38.33 47.17 55.33 79.83 118.33 65.00 | 53.50 76.67 68.50 68.50 61.83 46.83 38.33 38.33 79.83 118.33 65.00 160.83 | 53.50 76.67 68.50 68.50 61.83 46.83 38.33 38.33 79.83 118.33 65.00 160.83 108.67 44.17 | 53.50 76.67 68.50 68.50 61.83 46.83 38.33 38.33 79.83 118.33 65.00 160.83 118.33 44.17 44.17 | 53.50 76.67 68.50 68.50 61.83 46.83 38.33 38.33 79.83 79.83 118.33 65.00 160.83 118.33 65.00 160.83 108.67 44.17 64.17 | 53.50 76.67 68.50 68.50 61.83 46.83 38.33 38.33 79.83 79.83 118.33 65.00 160.83 118.33 65.00 160.83 108.67 44.17 44.17 70.00 | 53.50 76.67 68.50 68.50 61.83 46.83 38.33 79.83 79.83 79.83 118.33 79.83 118.33 79.83 65.00 160.83 118.33 79.83 65.00 64.17 70.00 70.00 | 53.50 76.67 68.50 68.50 61.83 46.83 38.33 79.83 79.83 118.33 79.83 118.33 79.83 118.33 79.83 118.33 79.83 65.00 160.83 118.33 70.00 54.50 54.50 |
| Fruit | (g) | 32.33 | 34.80 | 66.53 | 33.05 | 47.46 | 52.22 | 38.88 | 38.09 | 33 22 | CC.17 | 55.13 | 55.13 55.13 114.54 | 55.13 55.13 114.54 62.95 | 55.13 55.13 114.54 62.95 54.34 | 55.13 55.13 114.54 62.95 54.34 67.48 | 55.13 55.13 114.54 62.95 54.34 67.48 40.94 | 27.25 55.13 55.13 62.95 54.34 67.48 67.48 40.94 34.24 | 27.33 55.13 114.54 62.95 54.34 67.48 40.94 34.24 34.24 | 27.55 55.13 114.54 62.95 54.34 67.48 40.94 42.83 42.83 | 27.35 55.13 55.13 62.95 54.34 67.48 40.94 42.83 42.83 49.54 49.54 77.78 | 27.55 55.13 114.54 62.95 54.34 67.48 40.94 40.94 42.83 49.54 49.54 77.78 | 27.33 55.13 114.54 62.95 54.34 67.48 40.94 40.94 42.83 49.54 49.54 77.78 106.12 59.08 | 27.35 55.13 114.54 62.95 54.34 67.48 40.94 40.94 49.54 49.54 49.54 77.78 106.12 59.08 | 27.55 55.13 114.54 62.95 54.34 67.48 40.94 40.94 42.83 49.54 49.54 49.54 77778 106.12 59.08 1123.43 | 27.55 55.13 114.54 62.95 54.34 67.48 40.94 40.94 49.54 49.54 49.58 106.12 59.08 106.12 59.08 1123.43 163.03 | 27.55 55.13 114.54 62.95 54.34 67.48 40.94 49.28 34.24 49.54 106.12 59.08 116.12 59.08 116.3.03 38.56 44.03 | 27.55 55.13 114.54 62.95 54.34 40.94 40.94 49.54 49.54 106.12 59.08 123.43 163.03 38.56 44.03 60.46 | 27.33 55.13 114.54 62.95 54.34 67.48 40.94 49.54 49.54 49.54 106.12 59.08 123.43 163.03 38.56 60.46 60.46 64.42 | 21.00 55.13 114.54 62.95 54.34 67.48 40.94 49.54 49.54 49.54 106.12 59.08 1123.43 163.03 38.56 60.46 60.46 64.42 31.9 | 27.33 55.13 114.54 62.95 54.34 67.48 40.94 49.54 49.54 49.54 106.12 59.08 1123.43 163.03 38.56 64.42 64.42 64.42 64.42 52.46 |
| Fruit dimen- | sions (cm^2) | 15.33 | 15.10 | 31.55 | 13.98 | 24.56 | 26.50 | 18.61 | 19.04 | 14.68 | 14.00 | 23.55 | 23.55 39.59 | 23.55 39.59 30.64 | 23.55 23.55 39.59 30.64 28.00 | 23.55 23.55 39.59 30.64 28.00 26.77 | 23.55 23.55 39.59 30.64 28.00 28.77 20.47 | 23.55 23.55 30.64 28.00 26.77 20.47 17.12 | 23.55 23.55 39.59 30.64 28.00 26.77 20.47 17.12 21.42 | 23.55 23.55 39.59 30.64 28.00 26.77 20.47 17.12 21.42 24.77 | 23.55 39.59 30.64 28.00 26.77 20.47 17.12 21.42 21.42 24.77 35.90 | 23.55 39.59 30.64 28.00 28.00 26.77 21.42 21.42 21.42 21.42 23.06 | 23.55 39.59 30.64 28.00 28.00 26.77 21.42 21.42 21.42 24.77 23.06 53.06 | 23.55 39.59 30.64 28.00 28.00 28.77 21.42 21.42 21.42 24.77 23.06 53.06 53.06 | 23.55 39.59 30.64 28.00 28.00 28.17 21.42 21.42 24.77 23.90 53.06 53.06 53.06 53.06 | 23.55 39.59 30.64 26.77 26.77 20.47 17.12 21.42 23.90 53.06 53.06 53.06 53.06 29.54 49.85 | 23.55 39.59 30.64 26.77 26.77 20.47 17.12 21.42 35.90 53.06 53.06 53.06 53.06 29.54 29.54 29.54 29.54 29.54 29.54 29.54 29.54 | 23.55 23.55 23.55 26.77 26.77 20.47 17.12 21.42 23.54 29.54 29.54 29.54 29.54 29.54 29.54 29.54 29.54 22.01 | 23.55 23.55 23.55 28.00 28.00 21.42 21.42 21.42 23.54 29.54 29.54 29.54 29.55 29.54 29.58 29.58 29.58 23.00 23.50 33.40 35.90 37.90 | 23.55 23.55 23.55 28.00 28.00 20.47 21.42 21.42 29.54 35.90 53.06 53.06 29.54 29.54 29.54 29.54 29.54 29.54 31.37 22.01 | 23.55 39.59 30.64 28.00 28.00 20.47 17.12 21.42 29.54 35.90 53.06 53.06 53.06 53.06 29.54 19.28 35.40 22.01 19.28 31.37 22.01 15.95 24.57 |
| Tree | code | KaH1 | KaH2 | KaH3 | MkH1 | MkH2 | MkH3 | MkH4 | MkH5 | мьнк | ATTVIA | MkH7 | MkH7 RsH1 | MkH7 RsH1 RsH2 | MkH7 RsH1 RsH2 RsH2 RsH3 | MkH7 RsH1 RsH2 RsH3 RsH3 RiH1 | MkH7 MkH1 RsH1 RsH2 RsH3 RiH1 RiH1 | Right Right Right Right Right Right Right | MkH7 RsH1 RsH2 RsH3 RsH3 RiH1 RiH1 RiH2 RiH2 LgH1 | Likano MkH7 RsH1 RsH3 RsH3 RiH1 RiH1 LgH1 LgH1 LgH2 | MkH7 MkH7 RsH1 RsH3 RsH3 RiH1 RiH1 RiH2 LgH1 LgH2 LgH2 LgH3 | MkH7 MkH7 RsH1 RsH3 RsH3 RiH1 RiH1 RiH2 LgH1 LgH3 LgH3 HaH1 | MkH7 RsH1 RsH2 RsH3 RsH3 RiH1 RiH1 LgH1 LgH3 LgH3 LgH3 HaH1 HaH2 | MkH7 MkH7 RsH1 RsH2 RsH3 RiH1 RiH1 LgH1 LgH3 LgH3 LgH3 HaH1 HaH2 SiH1 | MkH7 RsH1 RsH2 RsH3 RsH3 RiH1 LgH1 LgH3 LgH3 LgH3 HaH1 SiH1 SiH2 SiH2 SiH2 | MkH7 RsH1 RsH2 RsH3 RsH3 RiH1 LgH1 LgH1 LgH1 LgH3 HaH1 HaH1 SiH1 SiH2 SiH2 SiH2 SiH2 | MkH7 RsH1 RsH2 RsH3 RsH3 RtH1 LgH1 LgH1 LgH3 LgH3 HaH1 HaH1 SiH1 SiH2 SiH2 SiH2 SiH2 SiH2 SiH2 | MkH7 RsH1 RsH2 RsH3 RsH3 RtH1 LgH1 LgH1 LgH1 LgH3 LgH3 LgH3 LgH3 LgH3 SiH1 SiH2 SiH2 SiH2 SiH2 SiH2 SiH2 SiH2 SiH2 | MkH7 RsH1 RsH2 RsH3 RsH3 RtH1 LgH1 LgH3 LgH3 LgH3 LgH3 LgH3 LgH3 SiH2 SiH2 SiH2 SiH2 SiH2 SiH2 SiH2 SiH2 | MkH7 MkH7 RsH1 RsH2 RsH3 RtH1 LgH1 LgH3 LgH3 LgH3 LgH3 HaH1 HaH1 HaH1 SiH2 SiH3 SiH2 SiH2 SiH3 SiH2 SiH3 UpH1 | MkH7 MkH7 RsH1 RsH2 RsH3 RsH3 RiH1 LgH1 LgH3 LgH3 LgH3 LgH3 LgH3 HaH1 HaH1 HaH1 GsH1 GsH3 GsH3 UpH1 UpH2 |
| SI. | no. | <u>-</u> | 2. | 3. | 4. | 5. | .9 | 7. | 8. | ¢ | у. | 9. 10. | 9. 10. | 7. 11. 12. | 9. 11. 13. | 9. 10. 10. 10. 11. 12. 14. 15. 15. 15. 15. 15. 15. 15. 15. 15. 15 | % 10. 13. 13. 15. | 9. 10. 11. 13. 16. | 9. 11. 11. 11. 11. 11. 11. 11. 11. 11. 1 | 9. 10. 11. 13. 16. 17. 18. | 7 | 9. 111. 113. 114. 116. 118. 119. 20. | 9. 111. 112. 113. 113. 113. 220. 21. | 9. 110. 111. 114. 117. 116. 117. 117. 117. 117. 110. 110. 110. 110 | 9. 111. 112. 113. 114. 119. 119. 22. 23. 23. | 9. 111. 112. 113. 119. 119. 22. 23. 24. | 9. 11. 11. 11. 11. 11. 11. 12. 13. 13. 14. 13. 12. 13. 13. 14. 17. 17. 17. 17. 17. 17. 17. 17. 17. 17 | 9. 11. 11. 11. 11. 11. 11. 12. 13. 14. 12. 14. 12. 14. 12. 14. 17. 17. 17. 17. 17. 17. 17. 17. 17. 17 | 9. 111. 11. 11. 11. 11. 11. 11. 11. 11. | 9. 111. 11. 11. 11. 11. 12. 13. 22. 22. 22. 23. 23. 23. 23. 23. 23. 2 | 9. 111. 11. 11. 11. 11. 11. 11. 11. 11. |

Table 1. Extent of variation in fruit characters of seedling origin mango tree in Himachal Pradesh/.

GENETIC VARIABILITY AMONG SEEDLING ORIGIN TREE POPULATION

| T | Fruit | Fruit | Fruit | Stone | Stone | Stone | Stone | Pulp | Peel | Edible | -uon | Ctonor | Dool. | Skin | υoυ |
|----------|----------|--------|--------|--------|--------|-------|-----------|--------|--------|---------|---------------|---------|-------|-----------|---------|
| aali | dimen- | weight | volume | weight | length | width | thickness | weight | weight | portion | edible | Stolle. | Leel. | thickness | (" |
| code | (cm^2) | (g) | (ml) | (g) | (mm) | (mm) | (mm) | (g) | (g) | (%) | poruon (%) | dınd | dını | (mm) | (XIIG.) |
| UpH4 | 17.37 | 34.74 | 40.00 | 8.23 | 21.94 | 14.66 | 16.85 | 18.27 | 8.23 | 52.52 | 47.48 | 0.456 | 0.455 | 66.0 | 8.71 |
| UpH5 | 14.03 | 28.07 | 31.67 | 6.59 | 17.78 | 11.74 | 14.83 | 14.92 | 6.56 | 53.13 | 46.87 | 0.445 | 0.444 | 0.86 | 9.11 |
| JsH1 | 35.34 | 72.34 | 78.83 | 17.63 | 44.09 | 29.53 | 24.60 | 38.52 | 16.19 | 53.17 | 46.83 | 0.462 | 0.424 | 1.80 | 11.89 |
| JsH2 | 44.86 | 91.39 | 100.00 | 21.52 | 56.35 | 39.98 | 27.85 | 49.22 | 20.65 | 53.86 | 46.14 | 0.438 | 0.421 | 2.48 | 13.93 |
| JsH3 | 30.73 | 61.46 | 68.50 | 15.03 | 38.54 | 25.56 | 22.96 | 32.09 | 14.33 | 52.10 | 47.9 | 0.475 | 0.455 | 1.91 | 12.61 |
| CbH1 | 28.20 | 54.74 | 63.33 | 12.89 | 36.14 | 24.63 | 22.07 | 28.37 | 13.48 | 51.79 | 48.21 | 0.459 | 0.486 | 1.71 | 13.07 |
| CbH2 | 17.72 | 35.43 | 40.33 | 8.50 | 22.45 | 14.74 | 16.95 | 18.62 | 8.32 | 52.57 | 47.43 | 0.457 | 0.449 | 1.15 | 13.00 |
| LkH1 | 16.27 | 32.53 | 35.50 | 7.80 | 20.53 | 13.56 | 16.07 | 17.20 | 7.53 | 52.78 | 47.22 | 0.460 | 0.447 | 0.96 | 12.50 |
| LkH2 | 28.88 | 57.75 | 64.00 | 14.18 | 36.62 | 24.02 | 22.28 | 29.94 | 13.63 | 51.86 | 48.14 | 0.475 | 0.457 | 1.55 | 13.39 |
| GIK1 | 29.67 | 59.34 | 65.00 | 14.23 | 37.46 | 24.64 | 22.57 | 31.19 | 13.92 | 52.53 | 47.47 | 0.459 | 0.451 | 1.72 | 13.97 |
| GIK2 | 21.24 | 42.48 | 47.50 | 10.33 | 26.59 | 17.41 | 18.67 | 22.33 | 9.82 | 52.38 | 47.62 | 0.472 | 0.452 | 1.32 | 10.63 |
| HmH1 | 27.50 | 55.00 | 60.83 | 13.19 | 34.51 | 22.64 | 21.51 | 29.12 | 12.69 | 52.77 | 47.23 | 0.463 | 0.448 | 1.52 | 13.11 |
| HmH2 | 31.87 | 63.73 | 70.00 | 15.28 | 40.46 | 26.74 | 23.56 | 33.75 | 14.70 | 52.97 | 47.03 | 0.456 | 0.438 | 1.81 | 12.50 |
| HmH3 | 80.58 | 92.33 | 178.83 | 21.64 | 58.87 | 38.78 | 37.26 | 49.36 | 21.32 | 53.49 | 46.51 | 0.441 | 0.433 | 2.53 | 16.95 |
| JdH1 | 34.72 | 64.56 | 77.50 | 17.24 | 42.80 | 27.48 | 23.92 | 31.08 | 16.24 | 48.10 | 51.90 | 0.561 | 0.525 | 2.08 | 12.76 |
| CeH1 | 31.34 | 62.67 | 69.50 | 15.03 | 39.62 | 26.08 | 23.40 | 32.83 | 14.81 | 52.35 | 47.65 | 0.460 | 0.454 | 1.90 | 14.95 |
| CeH2 | 27.40 | 54.80 | 60.83 | 13.14 | 34.68 | 22.65 | 21.78 | 28.86 | 12.79 | 52.65 | 47.35 | 0.458 | 0.445 | 1.65 | 15.15 |
| CeH3 | 57.06 | 118.17 | 126.67 | 28.49 | 70.84 | 48.39 | 31.31 | 73.22 | 16.47 | 61.92 | 38.08 | 0.390 | 0.226 | 1.94 | 8.93 |
| GuH1 | 24.96 | 53.68 | 55.83 | 12.94 | 34.66 | 22.67 | 19.63 | 28.04 | 12.70 | 52.15 | 47.85 | 0.470 | 0.461 | 1.70 | 14.03 |
| JiH1 | 25.7 | 51.41 | 56.17 | 12.20 | 32.93 | 19.67 | 20.00 | 27.46 | 11.75 | 53.33 | 46.67 | 0.451 | 0.437 | 1.49 | 13.04 |
| JiH2 | 21.24 | 42.47 | 46.83 | 10.02 | 26.94 | 18.87 | 18.00 | 22.47 | 66.6 | 52.91 | 47.09 | 0.448 | 0.447 | 1.27 | 11.92 |
| BdH1 | 40.54 | 81.09 | 90.67 | 19.78 | 51.40 | 33.22 | 23.91 | 42.45 | 18.86 | 52.33 | 47.67 | 0.469 | 0.450 | 2.15 | 17.87 |
| BdH2 | 33.87 | 69.40 | 75.83 | 16.24 | 42.51 | 30.93 | 23.15 | 36.97 | 16.19 | 53.20 | 46.80 | 0.440 | 0.442 | 2.07 | 11.61 |
| JrH1 | 24.43 | 48.86 | 60.00 | 11.72 | 30.97 | 20.00 | 18.41 | 25.67 | 11.47 | 52.57 | 47.43 | 0.457 | 0.448 | 1.54 | 14.92 |
| MiH1 | 26.41 | 62.82 | 58.33 | 15.06 | 39.61 | 26.21 | 20.80 | 33.10 | 14.66 | 52.67 | 47.33 | 0.457 | 0.447 | 1.76 | 12.08 |
| KgH1 | 46.16 | 169.12 | 104.5 | 40.31 | 68.98 | 50.84 | 26.66 | 112.00 | 16.80 | 66.21 | 33.79 | 0.360 | 0.150 | 2.00 | 8.89 |
| HbH1 | 27.41 | 88.76 | 80.83 | 21.29 | 55.90 | 39.40 | 22.23 | 46.73 | 20.75 | 52.59 | 47.41 | 0.459 | 0.450 | 2.53 | 13.72 |
| CnK1 | 20.67 | 41.34 | 46.00 | 9.91 | 26.28 | 17.29 | 18.40 | 21.66 | 9.77 | 52.40 | 47.60 | 0.459 | 0.451 | 1.49 | 9.68 |
| CnK2 | 19.73 | 39.46 | 44.67 | 9.46 | 24.97 | 16.50 | 17.88 | 20.73 | 9.27 | 52.54 | 47.46 | 0.458 | 0.449 | 1.17 | 11.36 |
| CnK3 | 31.18 | 62.36 | 69.67 | 14.95 | 39.61 | 26.00 | 23.10 | 32.69 | 14.72 | 52.44 | 47.56 | 0.458 | 0.451 | 1.71 | 12.45 |

| SI. | Tree | Fruit dimen- | Fruit weight | Fruit volume | Stone weight | Stone length | Stone width | Stone thickness | Pulp weight | Peel weight | Edible | Non- edible | Stone: | Peel: | Skin thickness | TSS |
|------|-------------|-----------------|-----------------|-----------------|-----------------|-----------------|-------------|--------------------|----------------|----------------|--------|----------------|--------|-------|-------------------|---------|
| II0. | code | (cm^2) | (g) | (ml) | (g) | (mm) | (mm) | (mm) | (g) | (g) | (%) | poruoii (%) | dınd | dını | (mm) | (XIIG.) |
| 61. | BdK1 | 27.07 | 55.80 | 60.83 | 12.98 | 33.83 | 22.26 | 21.28 | 30.23 | 12.60 | 54.15 | 45.85 | 0.431 | 0.418 | 1.61 | 13.22 |
| 62. | BdK2 | 23.11 | 44.55 | 50.00 | 10.84 | 29.56 | 19.40 | 19.65 | 22.66 | 11.05 | 50.76 | 49.24 | 0.484 | 0.504 | 1.42 | 11.55 |
| 63. | MiK1 | 27.96 | 55.93 | 61.33 | 13.66 | 35.34 | 23.18 | 21.86 | 28.96 | 13.30 | 51.68 | 48.32 | 0.478 | 0.464 | 1.59 | 12.73 |
| 64. | MiK2 | 29.08 | 58.16 | 64.50 | 13.95 | 36.92 | 24.11 | 22.15 | 30.58 | 13.63 | 52.58 | 47.42 | 0.459 | 0.448 | 1.72 | 10.68 |
| 65. | KIK1 | 23.89 | 46.10 | 53.50 | 10.82 | 30.65 | 18.55 | 19.99 | 23.85 | 11.42 | 51.75 | 48.25 | 0.457 | 0.488 | 1.47 | 9.93 |
| 66. | KIK2 | 20.70 | 41.40 | 45.50 | 9.93 | 26.35 | 17.91 | 18.44 | 21.65 | 9.82 | 52.29 | 47.71 | 0.461 | 0.454 | 1.25 | 8.45 |
| 67. | KIK3 | 31.54 | 64.75 | 70.33 | 15.46 | 39.43 | 26.21 | 23.14 | 34.63 | 14.66 | 53.47 | 46.53 | 0.447 | 0.424 | 1.71 | 12.00 |
| 68. | KaK1 | 20.04 | 40.08 | 45.00 | 9.61 | 25.35 | 17.38 | 17.97 | 21.13 | 9.34 | 52.67 | 47.33 | 0.459 | 0.446 | 1.30 | 12.02 |
| 69. | KaK2 | 22.13 | 44.26 | 49.67 | 10.61 | 27.94 | 17.92 | 18.96 | 23.37 | 10.28 | 52.71 | 47.29 | 0.461 | 0.446 | 1.26 | 11.82 |
| 70. | TrK1 | 48.02 | 164.66 | 140.00 | 37.09 | 57.38 | 39.05 | 26.55 | 105.47 | 22.10 | 64.06 | 35.94 | 0.353 | 0.211 | 2.49 | 18.37 |
| 71. | NiKI | 30.75 | 62.35 | 67.50 | 14.75 | 38.69 | 25.59 | 22.92 | 33.14 | 14.46 | 53.13 | 46.87 | 0.447 | 0.437 | 1.95 | 12.68 |
| 72. | NIK2 | 31.49 | 63.81 | 70.00 | 15.10 | 38.75 | 25.69 | 23.07 | 34.11 | 14.60 | 53.43 | 46.57 | 0.445 | 0.431 | 1.83 | 13.00 |
| 73. | RrK1 | 28.80 | 59.22 | 65.83 | 13.81 | 36.07 | 23.79 | 21.98 | 32.04 | 13.37 | 54.09 | 45.91 | 0.432 | 0.418 | 1.69 | 13.90 |
| 74. | SnK1 | 32.60 | 65.20 | 71.67 | 15.64 | 40.97 | 27.17 | 23.62 | 34.31 | 15.25 | 52.52 | 47.48 | 0.461 | 0.452 | 1.85 | 11.08 |
| 75. | SaK1 | 19.98 | 39.95 | 45.00 | 9.58 | 25.21 | 16.86 | 17.96 | 21.04 | 9.33 | 52.64 | 47.36 | 0.458 | 0.447 | 1.31 | 12.33 |
| 76. | MjKI | 30.60 | 61.20 | 67.83 | 14.68 | 38.85 | 25.46 | 22.79 | 32.17 | 14.36 | 52.57 | 47.43 | 0.459 | 0.448 | 1.68 | 12.48 |
| 77. | MjK2 | 31.84 | 63.67 | 70.33 | 15.27 | 40.02 | 26.53 | 23.31 | 33.51 | 14.89 | 52.57 | 47.43 | 0.459 | 0.450 | 1.83 | 14.74 |
| 78. | BpK1 | 16.30 | 32.60 | 37.17 | 7.82 | 20.61 | 13.61 | 16.12 | 17.07 | 7.72 | 52.31 | 47.69 | 0.461 | 0.455 | 1.12 | 9.93 |
| 79. | BpK2 | 30.66 | 62.99 | 68.33 | 14.71 | 38.30 | 24.37 | 22.80 | 34.00 | 14.28 | 53.96 | 46.04 | 0.435 | 0.421 | 1.63 | 12.33 |
| 80. | BrK1 | 45.54 | 90.00 | 103.83 | 21.84 | 56.16 | 37.78 | 28.35 | 46.74 | 21.42 | 51.93 | 48.07 | 0.469 | 0.464 | 2.53 | 10.00 |
| 81. | BrK2 | 26.20 | 56.17 | 57.83 | 12.57 | 33.34 | 21.78 | 21.19 | 30.98 | 12.62 | 55.13 | 44.87 | 0.407 | 0.412 | 1.74 | 13.05 |
| | Dance | 13.98 | 27.55- | 31.50- | 6.34- | 17.78- | 10.9- | 14.83- | 14.04- | 6.16- | 48.10- | 33.79- | 0.353- | 0.15- | 0.86- | 8.45- |
| | Naligo | -80.58 | 169.12 | 178.83 | 40.31 | 71.47 | 51.28 | 37.26 | 112.00 | 27.03 | 66.21 | 51.9 | 0.561 | 0.547 | 2.96 | 18.37 |
| | Mann+CF | 28.24 | 60.62 | 65.57 | 14.43 | 35.78 | 24.17 | 21.31 | 33.00 | 13.18 | 53.35 | 46.64 | 0.455 | 0.435 | 1.63 | 12.09 |
| | NICALITOL | ±1.21 | ±3.20 | ±3.16 | ±0.75 | ±1.42 | 40.99 | ±0.45 | ±2.06 | ±0.50 | ±0.32 | ±0.32 | 00.0≠ | ±0.01 | ±0.05 | ±0.22 |
| | SD | 10.9 | 28.84 | 28.4 | 6.73 | 12.8 | 8.89 | 4.03 | 18.56 | 4.49 | 2.91 | 2.91 | 0.03 | 0.06 | 0.48 | 2.02 |
| | CV (%) | 38.59 | 47.57 | 43.32 | 46.59 | 35.77 | 36.79 | 18.9 | 56.23 | 34.04 | 5.45 | 6.24 | 7.57 | 14.65 | 29.2 | 16.68 |



Chart 1. Extent of variation in fruit characters of seedling origin mango tree in Himachal Pradesh.

mango cultivars in different agro-climatic conditions across the Indian sub-continent. These are mostly similar but having different names to avoid confusion a careful classification based upon additional taxonomical characters like stone characters needed to be supplemented with present distinguishing characters (Teaotia 1971, Singh and Bana 1976). Further, it is a prerequisite for fruit breeders to design a breeding program considering viable strategy which boosts commercial utility of mango fruit. Thus, stone characters are very much vital for commercial exploitation in mango processing industries (Sadhu and Bose 1982) (Table 1 and Chart 1). Pulp weight ranged from 14.04 (MkH6) to 112.00 g (KgH1) with an average of 33.00 g. The coefficient of variation was recorded as 56.23 per cent. Peel weight ranged from 6.16 (MkH1) to 27.03 g (SiH1) with an average of 13.18 g. The coefficient of variation was recorded as 34.04%. Per cent edible portion in sampled mango fruit varied from 48.10 (JdH1) to 66.21 (KgH1) with an average of 53.35. The coefficient of variation was recorded as 5.45%. Per cent non-edible portion sampled mango fruit ranged between 33.79 (KgH1) and 51.9 (JdH1) with an average of 53.35. The coefficient of variation was recorded as 6.24%. Ratio of weight of stone to weight of pulp varied from 0.353 (TrK1) to 0.561 (JdH1) with an average of 0.455. Coefficient of variation was recorded as

| CI | Tasa | Or | n year | (| Off year |
|-----------|------|-----------|------------------|-----------|------------------|
| SI. No | anda | Yield | Yield efficiency | Yield | Yield efficiency |
| INO. | code | (kg/tree) | (kg/cm^2) | (kg/tree) | (kg/cm^2) |
| 1. | KaH1 | 65.20 | 0.0169 | 5.10 | 0.0013 |
| 2. | KaH2 | 61.40 | 0.0238 | 3.50 | 0.0014 |
| 3. | KaH3 | 50.70 | 0.0176 | 1.60 | 0.0006 |
| 4. | MkH1 | 109.30 | 0.0175 | 2.30 | 0.0004 |
| 5. | MkH2 | 60.20 | 0.0262 | 4.10 | 0.0018 |
| 6. | MkH3 | 70.60 | 0.0077 | 0.50 | 0.0001 |
| 7. | MkH4 | 200.20 | 0.0174 | 20.65 | 0.0018 |
| 8. | MkH5 | 90.30 | 0.0118 | 7.36 | 0.0010 |
| 9. | MkH6 | 260.60 | 0.0253 | 21.41 | 0.0021 |
| 10. | MkH7 | 84.30 | 0.0103 | 7.40 | 0.0009 |
| 11. | RsH1 | 193.70 | 0.0168 | 4.10 | 0.0004 |
| 12. | RsH2 | 45.40 | 0.0129 | 2.90 | 0.0008 |
| 13. | RsH3 | 60.20 | 0.0625 | 1.76 | 0.0018 |
| 14. | RiH1 | 109.30 | 0.0260 | 1.25 | 0.0003 |
| 15. | RiH2 | 91.80 | 0.0158 | 3.10 | 0.0005 |
| 16. | RiH3 | 99.10 | 0.0148 | 5.80 | 0.0009 |
| 17. | LgH1 | 30.30 | 0.0470 | 0.00 | 0.0000 |
| 18. | LgH2 | 57.40 | 0.0427 | 5.20 | 0.0039 |
| 19. | LgH3 | 42.50 | 0.0441 | 2.50 | 0.0026 |
| 20. | HaH1 | 80.70 | 0.0176 | 8.10 | 0.0018 |
| 21. | HaH2 | 244.60 | 0.0392 | 21.20 | 0.0034 |
| 22. | SiH1 | 223.10 | 0.0194 | 20.50 | 0.0018 |
| 23. | SiH2 | 168.40 | 0.0480 | 4.60 | 0.0013 |
| 24. | SiH3 | 83.10 | 0.0322 | 3.10 | 0.0012 |
| 25. | GsH1 | 260.20 | 0.0226 | 20.20 | 0.0018 |
| 26. | GsH2 | 146.40 | 0.0417 | 6.41 | 0.0018 |
| 27. | GsH3 | 157.20 | 0.0292 | 7.20 | 0.0013 |
| 28. | UpH1 | 326.50 | 0.0284 | 5.60 | 0.0005 |
| 29. | UpH2 | 197.80 | 0.0341 | 8.20 | 0.0014 |
| 30. | UpH3 | 218.30 | 0.0326 | 6.43 | 0.0010 |
| 31. | UpH4 | 120.90 | 0.0344 | 9.30 | 0.0026 |
| 32. | UpH5 | 246.70 | 0.0322 | 7.60 | 0.0010 |
| 33. | JsH1 | 322.50 | 0.0266 | 5.32 | 0.0004 |
| 34. | JsH2 | 305.30 | 0.0266 | 20.10 | 0.0017 |
| 35. | JsH3 | 266.10 | 0.0289 | 6.34 | 0.0007 |
| 36. | CbH1 | 287.60 | 0.0312 | 6.70 | 0.0007 |
| 37. | CbH2 | 348.70 | 0.0303 | 7.80 | 0.0007 |
| 38. | LkH1 | 46.50 | 0.0346 | 5.60 | 0.0042 |
| 39. | LkH2 | 77.60 | 0.0337 | 6.20 | 0.0027 |
| 40. | GIK1 | 49.80 | 0.0370 | 1.30 | 0.0010 |
| 41. | GlK2 | 29.10 | 0.0162 | 0.00 | 0.0000 |
| 42. | HmH1 | 41.60 | 0.0363 | 4.90 | 0.0043 |
| 43. | HmH2 | 34.30 | 0.0532 | 3.10 | 0.0048 |

Table 2. Extent of variation in yield characters of seedling origin mango tree in Himachal Pradesh.

(Contd.)

| (Contd.) | |
|----------|--|
| | |

| | m | On y | ear | Off | year |
|-------|-------|------------------|-----------------------|---------------|---------------------|
| SI. | I ree | Yield | Yield efficiency | Yield | Yield efficiency |
| no. | code | (kg/tree) | (kg/cm ²) | (kg/tree) | (kg/cm^2) |
| 44. | HmH3 | 28.90 | 0.0567 | 9.40 | 0.0184 |
| 45. | JdH1 | 83.10 | 0.0216 | 0.00 | 0.0000 |
| 46. | CeH1 | 310.40 | 0.0270 | 4.21 | 0.0004 |
| 47. | CeH2 | 267.10 | 0.0274 | 11.40 | 0.0012 |
| 48. | CeH3 | 230.10 | 0.0301 | 10.20 | 0.0013 |
| 49. | GuH1 | 68.30 | 0.2030 | 0.00 | 0.0000 |
| 50. | JiH1 | 78.20 | 0.0303 | 2.98 | 0.0012 |
| 51. | JiH2 | 108.70 | 0.0258 | 6.92 | 0.0016 |
| 52. | BdH1 | 14.10 | 0.0105 | 0.00 | 0.0000 |
| 53. | BdH2 | 43.60 | 0.0169 | 1.20 | 0.0005 |
| 54. | JrH1 | 149.80 | 0.1307 | 7.65 | 0.0067 |
| 55. | MiH1 | 19.40 | 0.0144 | 0.50 | 0.0004 |
| 56. | KgH1 | 96.50 | 0.0166 | 0.00 | 0.0000 |
| 57. | HbH1 | 34.60 | 0.0679 | 1.87 | 0.0037 |
| 58. | CnK1 | 47.80 | 0.0355 | 0.68 | 0.0005 |
| 59. | CnK2 | 31.60 | 0.0110 | 0.27 | 0.0001 |
| 60. | CnK3 | 25.30 | 0.0188 | 0.43 | 0.0003 |
| 61. | BdK1 | 50.70 | 0.0176 | 2.76 | 0.0010 |
| 62. | BdK2 | 40.50 | 0.0628 | 3.19 | 0.0049 |
| 63. | MiK1 | 231.70 | 0.0202 | 7.31 | 0.0006 |
| 64. | MiK2 | 238.90 | 0.0178 | 8.91 | 0.0007 |
| 65. | KlK1 | 30.50 | 0.0473 | 0.61 | 0.0009 |
| 66. | KIK2 | 26.50 | 0.0411 | 0.94 | 0.0015 |
| 67. | KIK3 | 27.40 | 0.0538 | 0.00 | 0.0000 |
| 68. | KaK1 | 31.20 | 0.0232 | 0.00 | 0.0000 |
| 69. | KaK2 | 43.10 | 0.0320 | 0.00 | 0.0000 |
| 70. | TrK1 | 374.30 | 0.0280 | 3.87 | 0.0003 |
| 71. | NiK1 | 14.80 | 0.0186 | 0.00 | 0.0000 |
| 72. | NIK2 | 5.40 | 0.0056 | 0.00 | 0.0000 |
| 73. | RrK1 | 12.60 | 0.0195 | 0.00 | 0.0000 |
| 74. | SnK1 | 43.80 | 0.0382 | 2.78 | 0.0024 |
| 75. | SaK1 | 38.60 | 0.0168 | 5.94 | 0.0026 |
| 76. | MjK1 | 57.20 | 0.0163 | 2.93 | 0.0008 |
| 77. | MjK2 | 39.60 | 0.0154 | 0.00 | 0.0000 |
| 78. | BpK1 | 63.70 | 0.0473 | 1.48 | 0.0011 |
| 79. | BpK2 | 50.10 | 0.0777 | 2.10 | 0.0033 |
| 80. | BrK1 | 106.40 | 0.0412 | 3.76 | 0.0015 |
| 81. | BrK2 | 40.70 | 0.0227 | 6.95 | 0.0039 |
| Range | e | 5.4 - 374.3 | 0.0056 - 0.203 | 0.0 - 21.41 | 0.0 - 0.0184 |
| Mean | ± SE | 114.45 ± 10.91 | 0.03 ± 0.0029 | 5.03 ± 0.59 | 0.0015 ± 0.0002 |
| SD | | 98.25 | 0.026 | 5.35 | 0.002 |
| CV (% | 6) | 85.85 | 81.77 | 106.46 | 149.43 |

7.57%. Ratio of peel weight to pulp weight varied from 0.15 (KgH1) to 0.547 (MkH6) with an average of 0.435. Coefficient of variation was recorded as 14.65%. Pulp weight and per cent of edible portion are important characters from economic point of view. Thickness of skin ranged from 0.86 (UpH5) to 2.96 mm (HaH1 and SiH1) with an average of 1.63 mm. Coefficient of variation was recorded as 29.20%. There exists considerable variations in pulp and peel weight. But, when it comes to edible and non-edible portion percentage; also, stone to pulp ratio the distinctness among these characters is very low. From processing point of view mango should be pulpier having thinner skin and smaller stone. Lower pulp : stone in fruits makes it suitable for pickling industries (Nalini and Chimmad 2005). Depending upon the objectives of breeding program selection of donor parent should be carefully done. These results are in accordance with the results reported by Gangolly et al. (1957), Lodh et al. (1974), Rabbani and Singh (1988), Mannan et al. (2003). TSS (Total soluble solids) varied between 8.45 (KIK2) and 18.37 °Brix (TrK1) with an average of 12.09 °Brix. Coefficient of variation was recorded as 16.68. TSS content of a solution is determined by the index of refraction. It is widely used during fruit processing to determine the concentration of sugar in the products. During the development of the flesh of a fruit, in many species, nutrients are deposited as starch, which during the ripening process is transformed into sugars. The progression of the ripening process leads to increase in sugar levels. Sweetness of the pulp is the most essential criterion for table or sucking purpose of seedling mangoes. TSS is highly heritable so, strains possessing higher TSS can be directly selected as donor parent or utilized as parent in hybridization program. The consumptive use of mangoes like table, processing, sucking, etc. demands specific type of mango, lower TSS mostly preferred for processing while higher TSS preferred for table/sucking purposes (Das et al. 2007, Sunagar et al. 2015) (Table 1 and Chart 1). During 'on' year i.e. in 2014 sampled seedling mango trees flowered profusely ensuing in decent fruit harvest. The variation in terms of yield observed ranged from 5.40 (NIK2) to 374.30 kg/plant (TrK1) with an average of 114.45 kg fruits per plant. The coefficient of variation was 85.85%. There was exponential decrease in yield of fruits per plant. Many sampled trees failed to bear fruits but some of them managed to secure a little bit of it. The fruit yield in kg per plant varied between 0.00 and 21.41 (MkH6) with an average of 5.03 kg fruits per plant. The coefficient of variation was 106.46% (Table 2). The potential to yield in mango seems to be affected by additive gene which could be influenced by environmental factors. During 'on' year *i.e.* in 2014 yield potential ranged between 0.0056 kg/cm² (NIK2) and 0.203 (TrK1) with an average of 0.03 kg/cm². The coefficient of variation was 81.77%. In 'off' year i.e. 2015 observed data revealed wide range of variations in yield potential. There were many sampled trees which failed to bear fruit. The range of variation observed was 0.00 to 0.184 kg/cm² (HmH3) with an average of 0.0015 kg/cm². The coefficient of variation observed was 149.43%. The existing mango tree population originated from seedlings not only adds to biological diversity but can also be utilized in different mango breeding programs for development of superior varieties.

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