Mango Cultivar Evaluation

Technical Report

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Preliminary Laboratory Results

Laboratory analysis was conducted on the 12 target cultivars as specified in MANGO SUB-SECTOR STUDY ATUT Publication No. 9, as well as 9 additional cultivars that were targeted according to their potential for marketability. (Note: 'Mabrouka' was observed in two collections, a 10-fruit sample from Ismailia and a second, 5-fruit sample from Giza, because we were told that the same cultivar from different areas may vary in the quality of its fruit.)

The laboratory analysis consisted of three (3) distinct evaluations, as follows: (a) Phenotypic and Organoleptic Evaluation, (b) Pomological Evaluation, and (c) Laboratory Analytic Evaluation. These three evaluations are discussed more fully later in this section. The methodology employed for the most part followed that cited in the publication **Evaluating important fruit characters in mango germplasm** (Knight, 1993). Due to the strong influence this paper had upon the methods used in the current work, a copy of it is included in Appendix A. It in turn was based on the rating system for horticultural material developed by E. B. Morrow *et al.* (1949).

The cultivar samples we observed were collected from various sources to include local growers, wholesale markets and private plantings. The samples were selected at random, and were judged to be typical of each of their respective cultivars. Sample lots of the original 12 targeted (major) cultivars consisted of no less than ten (10) individual fruits. Samples of the ten cultivars (including 'Mabrouka' from Giza) of the secondary sample group consisted of no less than five (5) individual fruits. As a rule the analysis for a given sample took place within 48 hours of sample collection to avoid the possibility of sample degradation. An exception was 'Pairi', evaluated six days after collection.

Results are presented in Tables 1, 2, 3 and bar graphs in Appendix A.

The phenotypic portion of the total analysis was conducted by R. Knight and R. Sanford using a prepared data collection sheet. A modified version of this sheet (Phenotypic Evaluation Sheet--Form A) can be found in Appendix A. The areas addressed by this form were as follows: Name of Cultivar; Collection Point; Date of Collection; Date of Evaluation; Shape; Size; Firmness; Color; Disease; Fiber; Taste; and Remarks. Scores were assigned on the basis of marketable attributes.

SHAPE was assigned numerical values on the following basis: (1) Round; (2) Ovate-Round; (3) Ovate; (4) Oblong; (5) Oblong-Cylindrical.

The SIZE column was given numerical values as follows: (1) Small (*i.e.* fruit weights of 75-100 g) to (10) Largest (*i.e.* fruit weighing more than

approximately 600 g). Due to market dynamics, a score of (5) and below merited only discard, whereas a rating of (6) was considered the minimal size for marketing.

The FIRMNESS column was filled in on the following basis: (1) Exceptionally soft to the touch, to (10) Rigidly firm and resistant to any touch. Due to market dynamics a score of (5) and below merited only discard, whereas a score of (6) was considered minimal for marketing.

The COLOR column was filled in on the following basis: (1) darkest green; to (5) Yellowish with perhaps a beginning blush; to (10) Brightest Red or Purple blush covering most of the fruit's surface. Due to market dynamics, a score of (5) and below merited only discard, whereas a (6) score was considered the minimum for meeting export market demands.

The DISEASE column was scored on the following basis: (1) 100% coverage of the fruit's surface by lesions; to (5), 50% coverage of the fruit surface; to (10), No disease visible (0% coverage) on the fruit's surface. Due to market dynamics a score of (5) and below merited only discard, whereas a score of (6) was considered minimal for marketing.

The FIBER column was filled in on the following basis: Two distinct areas were addressed to arrive at a score for this trait. Fiber Abundance and Fiber Texture. The rating for this column was a rating of fiber objectionability that took into account both factors. The scoring was from (1) Most Objectionable; to (10) Least Objectionable. Due to market dynamics a score of (5) and below merited only discard, whereas a (6) was considered the minimum for marketing.

Scores in the TASTE column were reached on the following basis: (1) Metallic taste, excessive turpentine, excessive acidity, and/or extremely bland tastes; to (10) Most pleasant or desirable taste. Due to the wide variability in this area, scores of (5) and below indicate only discard, whereas scores of (6) and above indicate the degree of expected acceptability to the general public.

The REMARKS column allowed for annotation of disorders such as Jelly Seed, Internal Breakdown, Premature Germination or any other anomalous condition or occurrence.

The pomological portion of the analysis was mostly a generalized description of the cultivar, and was tabulated as a quick reference for ascertaining particular common attributes. A form was made to collect these data (Pomological Evaluation Sheet--Form B), and a copy can be found in Appendix A. Although the Dimensions and Weights are used in the analytic procedure, they find relevance in the pomological section because it lists

descriptors of a given cultivar; accordingly, they are listed on this sheet. The areas addressed by this form, then, were as follows: External Attributes (Shape, Lateral Compression, Cavity, Shoulders, Conformity of Convex Side, Sinus, Apex and Height of Nak if present); Skin (Thickness, Basic Color, Color Overlay, Dot Size, Dot Color and Dot Texture); Flesh (Color, Adherence to Skin, Adherence to Seed); Fiber (Near Skin, Near Seed); and Seed Embryony (Monoembryonic, Polyembryonic); Dimensions (Length, Width, Thickness); and Weights (Fruit weight, Stone [Seed plus Endocarp] weight). This section is best explained by referring to the provided Form #2.

The remaining portion of this study was the analytic portion, which was conducted in the laboratories at Suez Canal University. The objective of this work was to collect the following data from each fruit of each sample lot: Mechanical Resistance to Penetration (Firmness 2), Brix Count, pH Determination, and Total Acidity from Tissue Titrations. Mean values for these attributes as well as the phenotypic features we evaluated are given in **Tables 1, 2** and **3**. Tissue samples from each fruit were also retained at Suez Canal University for future analysis, should it be required. Seeds from the fruit we investigated were retained at the University for planting.

Within-cultivar correlations in the 22 samples examined were calculated for all the 15 organoleptic and measured characters evaluated, using the SAS System. The greatest number of positive correlations occurred between **fruit size rating** and **fruit weight**, where 17 of 22 correlations were positively significant, 10 at the .05 level of probability, 7 at the .01 level and 5 non-significant. Little positive significance was found among other traits examined except for apparent coincidence in some cases. An additional fact of some interest was that in **none** of the 22 samples was a positive, significant correlation found between **fruit weight** and **stone weight**. This indicates that cultivars with large-sized fruit do not necessarily have proportionately large stones. Thus ‘Mesk’, with a fruit weight of 312.6 grams (g), had a stone weighing 52.49 g, whereas the fruit of ‘Mabrouka’ from Ismailia weighed nearly 481 g, but had a stone weighing 50.7 g.

Evaluation of Egyptian Mangos for Export Potential

The mango cultivars grown in Egypt over a period of years have established themselves in the affections of the people who live here and have long known them (El-Khoreiby, 1997). They are said to have come originally to this country from India (El-Tomy, 1953), but this has been questioned because of observable differences in many Egyptian cultivars from well-known Indian varieties (Knight, 1995). There is no question that from the standpoint of taste and aroma, the best Egyptian mangos are of top eating quality. In addition to the home market, an export market has developed in the States of the Persian Gulf as people there have grown to know Egyptian mangos, and this market in addition to the large market within Egypt itself can be expected to remain important for the foreseeable future, whatever efforts are made to promote exports.

However, if Egypt plans to increase and send a greater portion of its fruit production to large overseas markets with potential for expansion (such as western Europe), its fruit will have to compete with cultivars already established there if good prices are to be realized. Thus, more attention must go toward producing fruit that can compete in eye appeal (*i.e.* is highly colored), and in long shelf life, which results from a combination of firmness, tolerance of handling and refrigeration, and resistance to storage diseases.

As a preliminary effort to improve Egypt's market stance, the seasonally available cultivars currently grown in commercial quantities were examined in the first half of September, 1997, for any potential they may have for the export market. Two groups were examined, the first made up of 12 considered by our Egyptian colleagues to be major commercial cultivars ('Alphonso', 'Bullock's Heart', 'Company', 'Ewais', 'Hindi Besennara', 'Hindi Khassa', 'Mabrouka', 'Mesk', 'Pairi', 'Taimour', 'White Succari', and 'Zebda'; plus another four cultivars considered to be of lesser importance ('Excellent Succari', 'Genovea', 'Khanefy', and 'Nabeel') plus five seedlings felt to have varietal potential (See Table 1).

Firmness. Examined for this trait, seven of the 12 major cultivars have mean values for firmness (Firmness 1) of 7 or above and two, 'Ewais' and 'Mabrouka', have a mean firmness rating of 8 or above. 'Ewais', however, has a serious drawback in that 10 of 10 fruit examined showed severe jelly seed. Unless improved fertilizer practices or some other countermeasures can control this disorder, 'Ewais' may have little potential for export. 'Mabrouka', on the other hand, certainly could compete with most internationally traded cultivars in resistance to packing, shipping and storage stresses. 'Taimour', with a mean firmness rating of 7.8 (1.6 for

Firmness 2) does not differ significantly from ‘Mabrouka’ from Ismailia for this trait and should withstand packing and shipping stresses well.

Disease. Examined for resistance to diseases of the fruit’s surface, a number of cultivars got high ratings, with ‘Bullock’s Heart’ at 8.9 the highest. Others nearly equally good were ‘Taimour’ (8.8), ‘Hindi Khassa’ (8.7), and ‘Mabrouka’ (8.5). ‘Zebda’ (rating 8.2) shows respectable disease resistance, as do ‘Company’ and ‘White Succari’ (7.9), ‘Alphonso’ and ‘Ewais’ (7.8). The disease resistance of ‘Pairi’ (7.5) appears adequate to sustain this otherwise outstanding cultivar on the export market.

Color. Egyptian mango cultivars as a group are less outstanding for their fruit’s external color than are some other cultivars, notably ‘Tommy Atkins’ and ‘Van Dyke’. Nonetheless, some of the Egyptian fruit examined, notably that of ‘Mabrouka’, ‘Mesk’ and ‘Pairi’ as well as Seedling #2 from Giza show bright enough color to suggest that improved pruning, fertilizing, and quality control practices might produce fruit attractively blushed and acceptable in international markets on the basis of eye appeal.

Taste. A number of the Egyptian clones examined have flavors on a par with the world’s finest, in the opinion of these writers. Among these are ‘Taimour’, ‘Excellent Succari’, ‘Hindi Besennara’ ‘Alphonso’, ‘Ewais’, and Seedling #15 from Ismailia. ‘Taimour’ is of particular interest because in this evaluation it has exhibited outstanding values across the board except for its color, a dark green that might not appeal to people seeing it for the first time and unaware of its true value.

Recommended Strategies

It must be emphasized that this laboratory study is only a beginning. Much serious work is yet to be done if Egypt is to become a first-class competitor in producing fresh mango fruit for export. Our work examined Egyptian mango cultivars for fresh fruit quality and those traits that are considered likely to influence a cultivar's acceptance in international markets. We did no evaluations of the postharvest performance of the cultivars we studied, and such work is essential (See below) before any cultivars can be selected for serious market development efforts overseas: how fruit will respond to transportation by ship, and what its subsequent shelf life will be, are critical questions that need to be answered. Our Egyptian counterpart is involved in postharvest work, and we believe he will make an important contribution in this area.

Another critical aspect of commercial mango production that our work did not address is the field performance of the cultivars we examined. This omission was unavoidable: when we arrived in Egypt on 30 August 1997, most cultivars had already been undergoing harvest for as long as six weeks, thus we could not assess the productivity of any cultivar by examining trees in the field. Regularly dependable **annual** (as opposed to **biennial**) production is essential to establishing a stable export industry. Equally important is resistance to (or control of) the **diseases** and **pests** that act as constraints to mango production in this country. Several diseases are cited anecdotally and some of them have been observed in the field by one of us, but we find little firm information (or agreement) as to their incidence and seriousness.

It also was brought out at our Workshop/Seminar that little or no firm information is currently at hand on the nutritional requirements of the mangos grown in Egypt comparable to that recently developed for Egyptian grapes, for example. Because of the high incidence of **jelly seed** (a serious defect) in our samples of 'Alphonso', 'Company', 'Ewais', 'Mesk', and 'Khanefy' (as opposed to 'Pairi', 'Taimour', 'Excellent Succari' and 'Genovea', most of which had firm interiors), we believe that high priority should be assigned to investigating mango nutrition in Egypt, as Dr. Stassen suggested at our meeting.

We therefore believe that in order to accomplish work that is seriously needed, it is essential to get teams of specialists familiar with mango problems elsewhere into the field in Egypt during the period when trees are in flower, and subsequently through the season as the crop develops, to observe and record the incidence and seriousness of disease, notably **powdery mildew** (*Oidium mangiferae),* **malformation** (*Fusarium*

subglutinans), **black spot** (*Alternaria alternata*), **stem-end rot** (*Lasiodiplodia theobromae* **et al.), anthracnose** (*Colletotrichum gloeosporioides*) and other pathogenic **fungi** and **bacteria, arthropod pests**, and any other organisms that act to lower production or reduce fruit quality. Equally important, these teams need to observe any resistance to disease or pests that specific Egyptian cultivars may show. This work needs to be done during more than one year, in order to determine how specific problems may vary from one season to another.

Field observations of the 12 major candidate cultivars also are essential to determine how profusely the trees flower and set fruit and, most important, the final extent of the crop. These observations need to be carried out for at least three (3) seasons when weather conditions are "normal" *i.e.* without severe cold, excessive winds or other agents of crop loss, before a good idea of a clone's true capacity for production can be arrived at. Once the information outlined here has been gathered, it will be possible to proceed with confidence, in a well-informed manner, to develop a sound, profitable mango export industry.

Acknowledging the need for the broadly-based research effort outlined above, and recognizing that our observations to date are limited by the constraints we have cited, we nevertheless believe that some strategies undertaken now can work toward building a sound future for Egypt's export mango industry.

These are refined to some extent and enumerated as follows:

1. **Create workshops to promote standardization of tests.** The key to any thorough study is standardization. As shown by the data obtained, the methodology employed was effective in achieving results that were objective and complete. It is our opinion that future studies would benefit by following the same protocol. In so doing, data may be used from previous studies to support continuing efforts in this area. This traditional type of "building block" approach in previous instances has allowed work to progress rather than become mired in repetitious studies. To accomplish this goal, it is suggested that workshops be made available to research personnel to teach the method employed here, and to provide a general platform on which various institutions can collaborate. As a result of the workshops, trained cadres of specialists will be available at all times to evaluate the market potential of currently-grown and new mango cultivars and seedlings.
2. **The need for broad-spectrum analysis of perceived problems.** It is well known that cultivar performance may differ from region to region. Climatic conditions, grove vigor, and standard agricultural practices of a

given area may all contribute to anomalous behavior of a given cultivar. The results of this report provide a reasonable expectation of performance of the cultivars analyzed. It should be noted, however, that the results presented here may not be all- inclusive. As seen in the data collected for 'Mabrouka', slight differences appeared in the fruit collected in one region as compared to fruit of the same cultivar from a different region. Although the differences are not greatly significant, this proves that future studies should take regional effects into account. Another example was the prevalent jelly seed disorder observed in a good many samples. Jelly seed and other physiological disorders have recently been linked to calcium deficiency (Schaffer *et al.*, 1994, p.186) It may therefore be argued that the data does not necessarily support the conclusion that our samples are highly susceptible to this condition, but rather that location effects and area practices are responsible for the high incidence of the problem. We recommend that a future study be designed to include duplicate samples of the same cultivars collected from separate sites. This would provide a more complete picture of cultivar variability.

3. **Need for storage stability testing.** Many factors influence the export potential of a given cultivar. One factor of particular importance is simple durability. The results of this study provide a solid basis for selecting those cultivars which possess this trait sufficiently to merit continued export evaluation. However, the only way to prove this conclusively is by carrying out storage stability tests. These tests would consist of monitoring the conditions to which fruit samples were subjected for given periods of time before taking specific readings in the areas of interest (*e.g.* firmness, total acidity, etc.). By ascertaining the predictable behavior of samples under specific conditions, shipping and storage problems can be successfully anticipated. The knowledge so gained could greatly enhance the marketability of a selected cultivar, and provide assurance of controlling performance effectively during the process of transportation.

4. **Effect of Post Harvest Interval (PHI) on samples for analysis.** When any set of samples is analyzed, a critical element is always the period of time elapsed between picking and testing. Because significant physiological changes occur quickly when fruit is separated from the tree, it is extremely important that evaluations be consistent with each other with regard to post harvest interval (PHI). A good example is provided by the Brix count, which gives a measure of sugar content: two samples are drawn from the same tree on the same day. The first sample is tested at a PHI of one (1) day, the second at a PHI of seven (7) days. Due

to the accumulation of sugars during ripening that occurs after picking (Gómez-Lim, 1997, p. 430), the first sample batch may have a significantly lower Brix reading than the second batch. Thus, if the PHIs are unknown, the possibility of an erroneous conclusion by the researcher with regard to the fruit's sugar content is great. This premise is of course true for acidity, firmness, taste, and numerous factors that are tremendously important when their effects on export potential are considered. Thus, efforts should be made to determine PHI in all studies of this nature.

5. **Need for work to improve mango fruit quality**. This can be achieved by attention to pruning and tree training, and by more effective use of fertilizers (*i.e.* learn how much **nitrogen** and other nutrients the mango in Egypt really needs, and do **not** overfertilize. This can improve fruit color and quality and hopefully reduce jelly seed and internal breakdown. See **2** above). As part of this general development effort, carry forward an aggressive program to eliminate malformation as a constraint to mango production in this country.

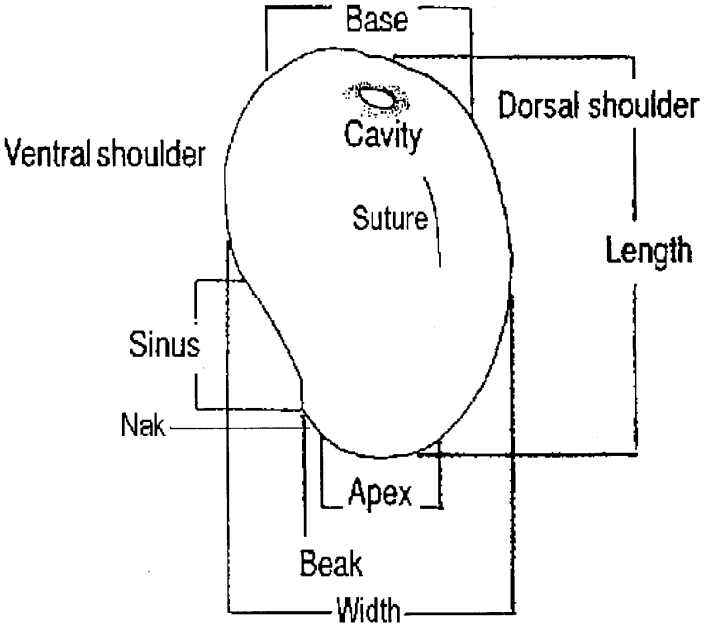
6. **Need to test mango cultivars that have achieved commercial success elsewhere.** As is projected, test outstandingly successful commercial mango cultivars from Florida, South Africa and Mexico to determine their performance and commercial potential in Egypt. Important among these candidate cultivars are 'Van Dyke', 'Tommy Atkins', 'Keitt' and 'Kent'. Make test plantings of sufficient volume that fruit can be produced in quantities that permit test marketing in Europe, the Gulf States and anywhere else a window of opportunity may present itself.

7. **Need to investigate 'Taimour's potential as a specialty crop.** But for its color, 'Taimour' has all the marks of a successful commercial mango, and we are told it sells well in the Gulf States. For that reason, we believe 'Taimour' should be the focus of a concentrated effort to produce it in quantity for the Arab countries where it is known and appreciated. When and if that market appears to be nearing saturation, an aggressive educational effort should be carried forward in other countries (France, for example) to educate the public as to the value of this **green but glorious** fruit. It can be done! The apple people did it in the recent past with the 'Granny Smith' cultivar, which now brings prices equal to more brightly colored (but less tasty) apples in U. S. markets.

8. **Conclusion.** In summation, this is a time of opportunity for the mango industry of Egypt. The potential for greater production and concomitant market expansion exists. Some marketable cultivars are already grown here. Others that can be brought from overseas promise a bright future.

Appendix

Mango Fruit Characters



After: Singh, L.B., 1960; IBPGR, 1982.

Table 1. Mean Values for Horticultural Characters in 12 Egyptian Mangos of Major Commercial Importance

Name	From	Shape[1]	Size	Firmness1	Color	Disease	Fiber	Taste	Remarks[2]
Alphonso	Ismailia	3.0f	7.2 efg	6.0 efg	3.8 bcde	7.8bcd	9.1a	8.3ab	JS 9/10
Bullock'sHeart	Ismailia	3.0 f	8.7 bc	6.9 cde	4.5 b	8.6ab	8.9 ab	5.4gh	
Company	Ismailia	3.2 f	8.3 bc	6.6 def	4.1 bcd	7.9 bcd	8.3 cd	6.7 ef	JS 8/10
Ewais	Ismailia	5.0a	6.5 gh	8.2ab	3.1 def	7.8 bcd	9.0a	8.2abc	JS 10/10
Hindi Besennara	Ismailia	5.0a	6.4 gh	5.9 fg	3.8 bcde	7.9 bcd	9.0a	8.5ab	JS 2/10
Hindi Khassa	Ismailia	5.0a	8.6 bc	7.2 bcd	4.2 bcd	8.7ab	9.0a	5.4 gh	JS 3/10; IB 1/10
Mabrouka1	Ismailia	4.2 c	8.0 cde	8.0 abc	5.4 a	8.5abc	6.5 g	6.6 efg	JS 3/10
Mesk	Ismailia	4.0 cd	6.8gh	7.1 cde	5.6 a	8.0 abcd	8.0de	7.4 bcde	JS 6/10; IB 4/10
Pairi	Ismailia	3.1f	7.2 efg	7.6abcd	5.7 a	7.5cde	8.4 bcd	8.1abcd	Interior sound
Taimour	Giza	3.9 cd	8.2 bcd	7.8abc	2.9ef	8.8ab	8.1 cde	8.8a	IB 1/10
White Succari	Ismailia	4.0cd	8.1defg	5.3 g	4.3 bcde	7.9 bcd	8.0 de	6.8 ef	JS 1/10; IB 3/10
Zebda	Ismailia	4.9a	9.8a	7.1cd	2.7f	8.2abcd	6.4 g	6.9 de	JS 2/10; IB 2/10

[1]Numbers followed by the same letter do not differ significantly at the .01 Duncan multiple-range level. [2]JS = Jelly Seed; IB = Internal Breakdown.

Table 2. Mean Values for Horticultural Characters in 9 Egyptian Mangos of Minor Importance, and 'Mabrouka'

Name	From	Shape[1]	Size	Firmness 1	Color	Disease	Fiber	Taste	Remarks[2]
Excellent Succari	Ismailia	4.0 cd	6.8 gh	7.0 cde	3.4 cdef	7.4de	9.0a	8.6ab	Interior sound 5/5
Genovea	Ismailia	4.6 b	6.2 h	7.8abc	3.2 def	7.8 bcd	8.0 de	7.6abcde	Interior sound 5/5
Khanefy	Giza	3.0 f	8.0 cde	7.8abc	5.8a	9.0a	8.0de	5.2 h	JS 4/5
Mabrouka 2	Giza	4.0 cd	9.0ab	7.6abcd	6.2a	8.8ab	9.0a	7.0 cde	JS 1/5
Nabeel	Ismailia	4.0 cd	8.6 bc	7.6abcd	4.0 bcd	6.8 e	6.4 g	5.6 fgh	1/5 Bitter taste
Seedling #1	Giza	3.0 f	6.6 gh	7.4abcd	3.8 bcde	8.8ab	8.4 bcd	7.0 cde	JS 3/5
Seedling #2	Giza	3.8d	6.8 gh	7.6abcd	6.2a	8.2abcd	8.4cd	7.0 cde	JS 5/5
Seedling #5A	Ismailia	3.0 f	7.8 cdef	8.0abc	4.0 bcd	8.2abcd	7.6 ef	6.6 efg	Interior sound 5/5
Seedling #15	Ismailia	3.0 f	7.0 fgh	7.0 cde	4.4 bc	8.2abcd	8.6abc	8.4ab	JS 1/5
Star Seedling	Ismailia	3.4 e	8.0 cde	8.4a	3.2 def	8.6ab	7.4 f	6.6 efg	Interior sound

[1]Numbers followed by the same letter do not differ significantly at the .01 Duncan multiple-range level. [2]JS = Jelly Seed; IB = Internal Breakdown.

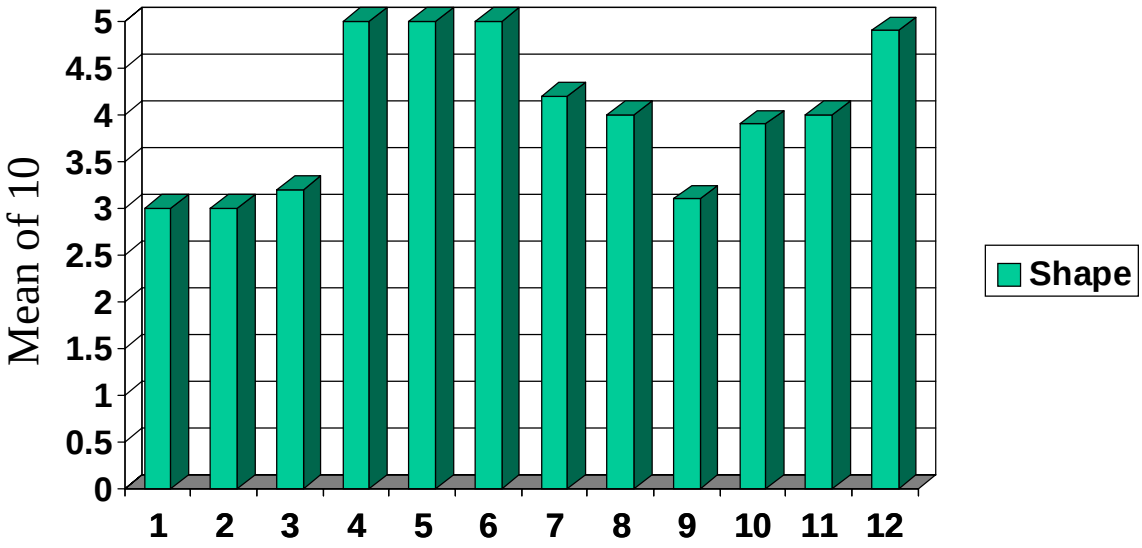
Table 3. Mean Values for Measurable Characters of 21 Egyptian Mangos

Name	From	Firmness2	pH	Total	ºBrix	Fruit wt	Stone wt	Length	Width	Thickness
Alphonso	Ismailia	1.275 de	5.0 gh	2.1 de	13.6 gh	351.1 ghi	39.7 efghi	9.96 hij	8.3 f	7.6 fgh
Bullock's Heart	Ismailia	1.35 de	6.3a	0.55 g	13.5 gh	472.95 cde	58.6 bc	11.1 g	9.2 bc	8.5ab
Company	Ismailia	1.575 cde	5.3 defg	1.82 ef	18.1 de	565.2 b	59.97b	12.37 ef	9.6ab	8.7a
Ewais	Ismailia	2.9ab	5.57bcd	1.13 efg	21.3 bc	276.74 ij	38.53 ghi	11.7 fg	7.2 gh	6.3 l
Hindi Besennara	Ismailia	1.75 cde	5.43 cdef	1.52 efg	21.8ab	319.03 hi	47.24 defg	15.4ab	6.7 i	6.4 kl
Hindi Khassa	Ismailia	2.53 bc	5.74bc	0.7 g	12.8 h	460.98 def	55.0 bcd	15.96a	7.3 gh	6.9 ijk
Mabrouka 1	Ismailia	1.7cde	5.48 cde	1.05 efg	15.5 fg	480.98 cde	50.7 bcde	12.54 ef	8.5 def	8.2abcde
Mabrouka 2	Giza	1.25 de	5.76 bc	1.14 efg	19.7 bcd	541.2 bc	56.02 bcd	13.68 cd	8.98 cd	7.7 efgh
Mesk	Ismailia	1.8 bcde	4.76 hi	3.01 cd	15.7 efg	312.6 i	52.49 bcd	11.3 g	7.4 gh	6.5 jkl
Pairi	Ismailia	1.2 e	5.12 efgh	1.4 efg	18.9 cd	278.5 ij	34.2 i	9.1 j	7.5 gh	6.8 ijkl
Taimour	Giza	1.6 cde	5.04 fgh	3.28 c	19.4 cd	507.7 bcd	50.8 bcde	12.8 de	8.4 ef	8.05 bcdef
White Succari	Ismailia	2.15 bcde	4.18 j	4.84 b	14.5 gh	411.2 efg	48.1 cdefg	11.3 g	8.37 ef	7.94 cdef
Zebda	Ismailia	1.83 bcde	5.12 efgh	1.51 efg	15.8 efg	662.2a	52.2 bcd	14.6 bc	9.71a	8.35abcd
Exlt Succari	Ismailia	1.75 cde	5.9 4b	1.68 ef	23.7a	281.42 ij	36.6 hi	11.12 g	7.06 hi	6.4 kl
Genovea	Ismailia	1.15 e	5.8 bc	0.98 efg	19.3 cd	234.5 j	41.4 efghi	11.1 g	6.04 j	5.6 m
Khanefy	Giza	2.05 bcde	5.5 cde	1.6 efg	15.9 efg	474.4 cde	56.3 bcd	10.6 ghi	8.34 ef	8.5abc
Nabeel	Ismailia	1.9 bcde	5.12 efgh	1.8 ef	12.8 h	494.4 bcd	56.6 bcd	14.24 c	9.0 cd	7.2 hi
Seedling #1	Giza	2.4 bcd	5.42 cdef	3.5 c	17.9 def	325.6 hi	46.7 defgh	9.62 ij	7.7 g	7.3 ghi
Seedling #2	Giza	2.05 bcde	5.5 cde	1.6 efg	15.8 efg	340.34 ghi	34.5 l	10.6 ghi	7.5 gh	7.0 ij
Seedling #5A	Ismailia	1.65 cde	4.54 i	4.7 b	18.8 d	431.74 def	48.34 cdefg	10.94 gh	8.3 f	7.86 defg
Seedling #15	Ismailia	2.00 bcde	5.6 bcd	1.34 efg	18.6 d	394.5 fgh	49.2 bcdef	9.84 ij	8.3 f	7.94 cdef
Star Seedling	Ismailia	3.55a	4.52 ij	6.12a	17.5 def	477.7 cde	82.2a	11.3 g	8.9 cde	7.98 bcdef

Graphics Keys

- **Major cultivars**
  - (1) = Alphonso
  - (2) = Bullocks' heart
  - (3) = Company
  - (4) = Ewais
  - (5) = Hindi Bessannara
  - (6) = Hindi Khassa
  - (7) = Mabrouka 1
  - (8) = Mesk
  - (9) = Pairi
  - (10) = Taimour
  - (11) = White Succari
  - (12) = Zebda
- **Minor cultivars**
  - (1) = Excellent Succari
  - (2) = Genovea
  - (3) = Khanefy
  - (4) = Mabrouka 2
  - (5) = Nabeel
  - (6) = Seedling # 1
  - (7) = Seedling # 2
  - (8) = Seedling # 5a
  - (9) = Seedling # 15
  - (10) = Star seedling

Major Cultivars



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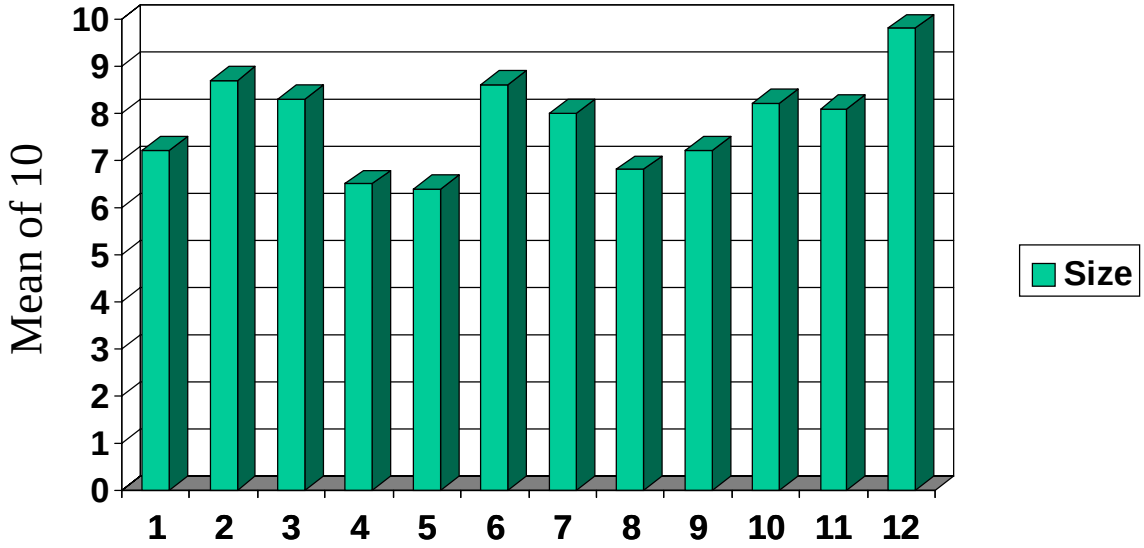

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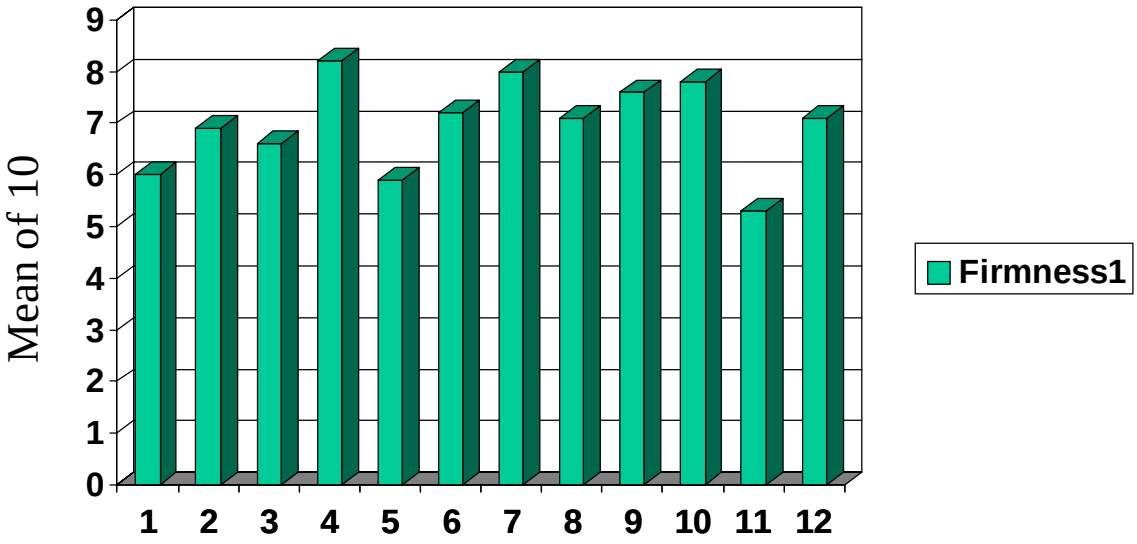

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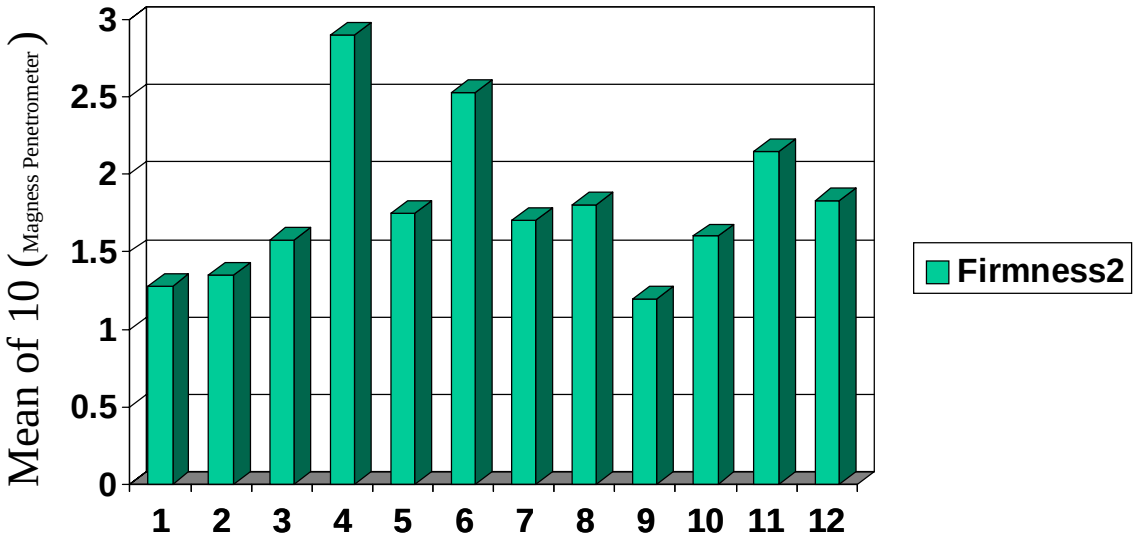

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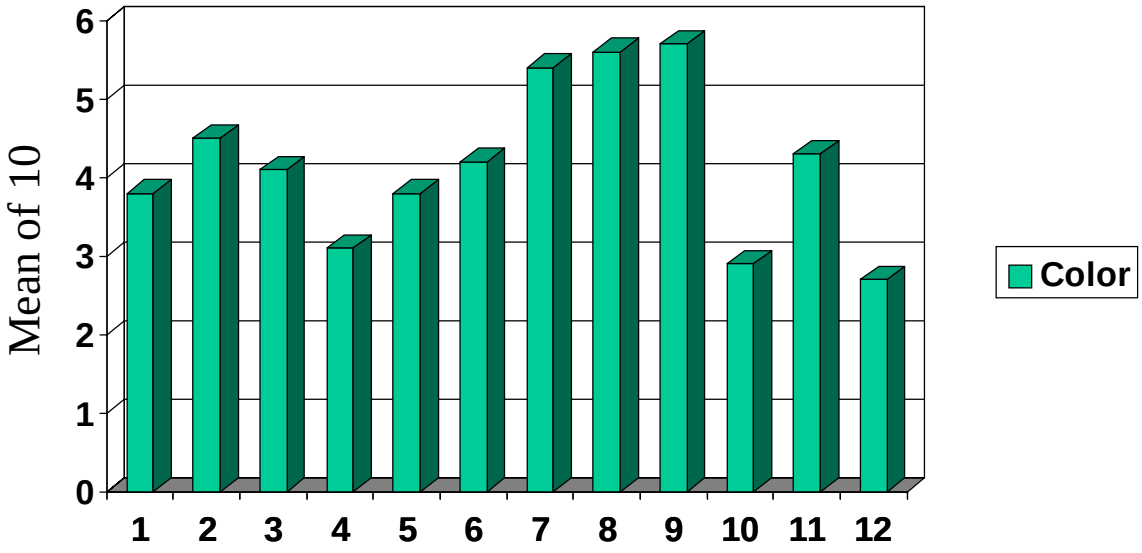

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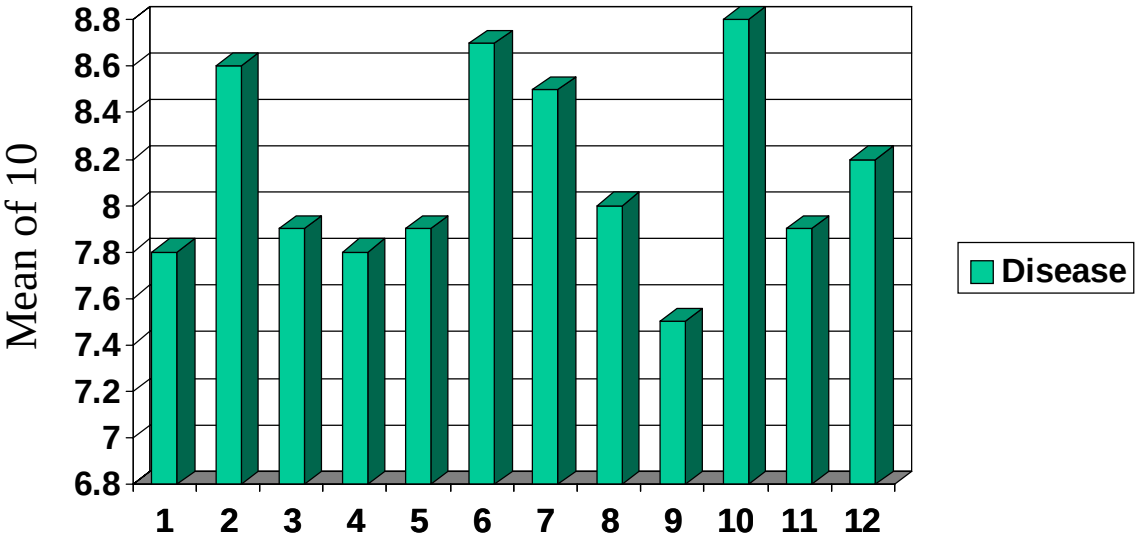

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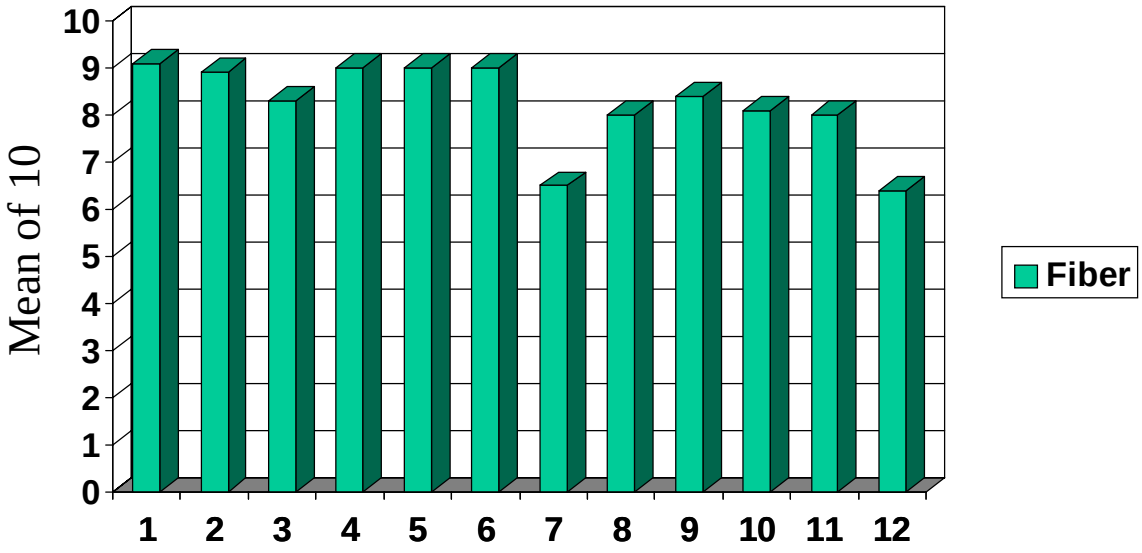

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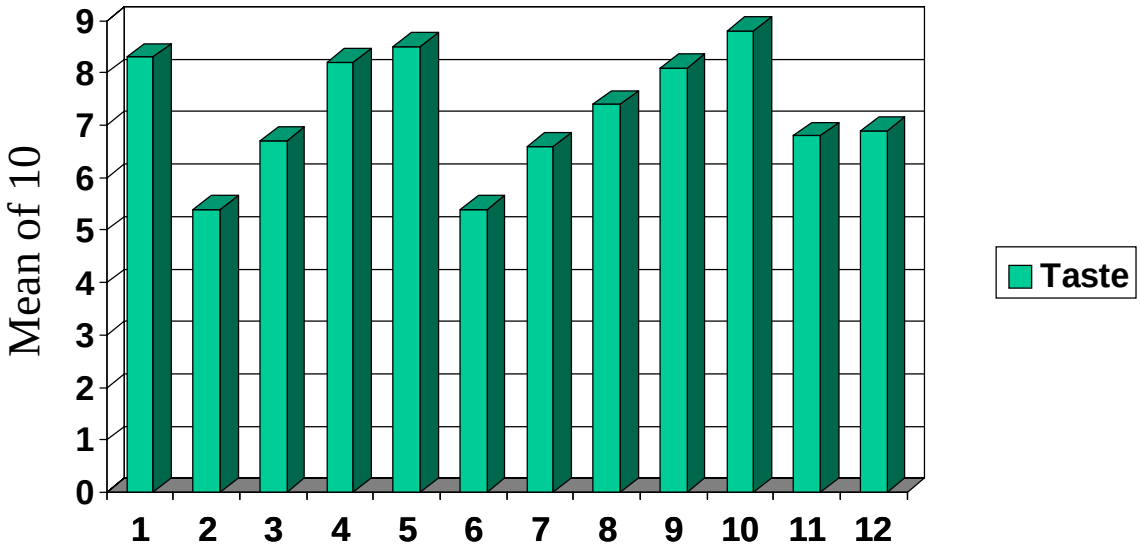

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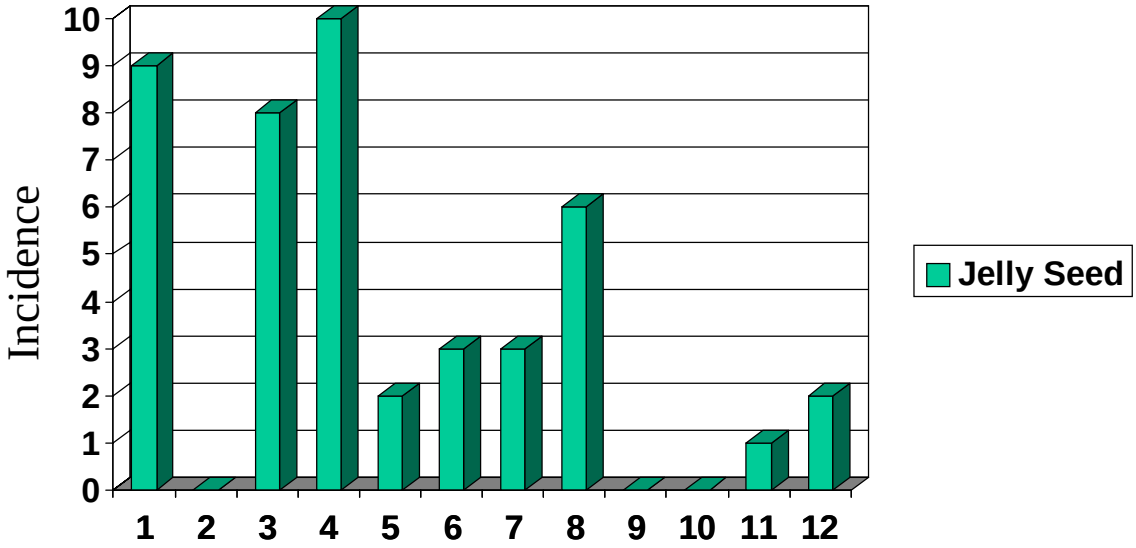

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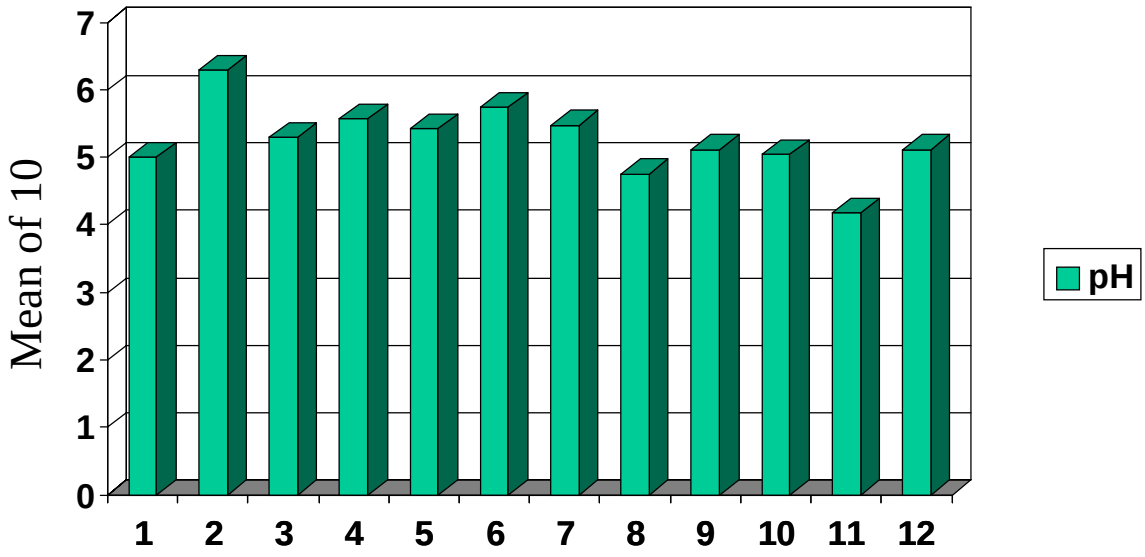

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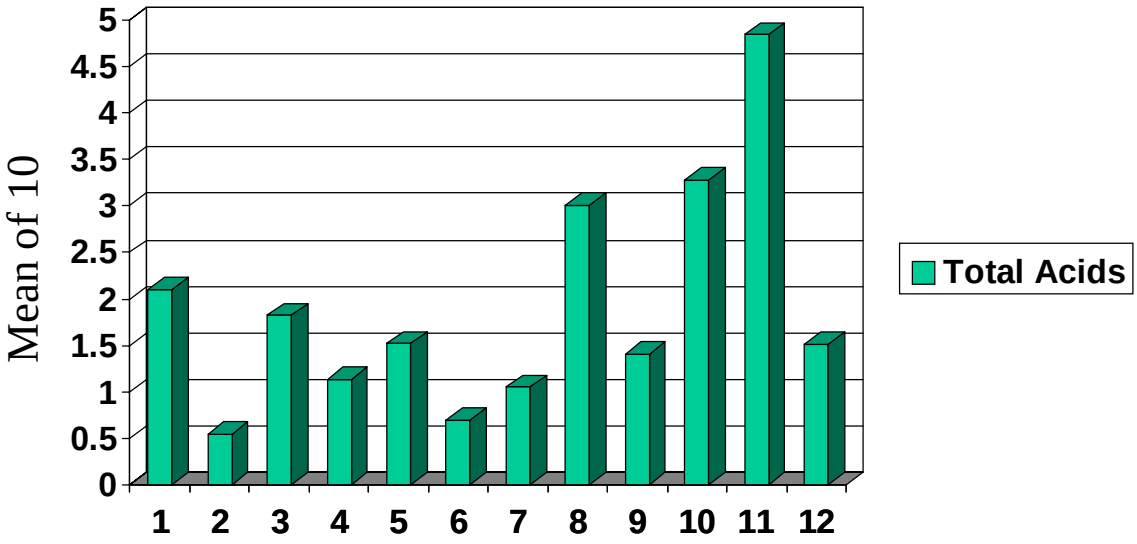

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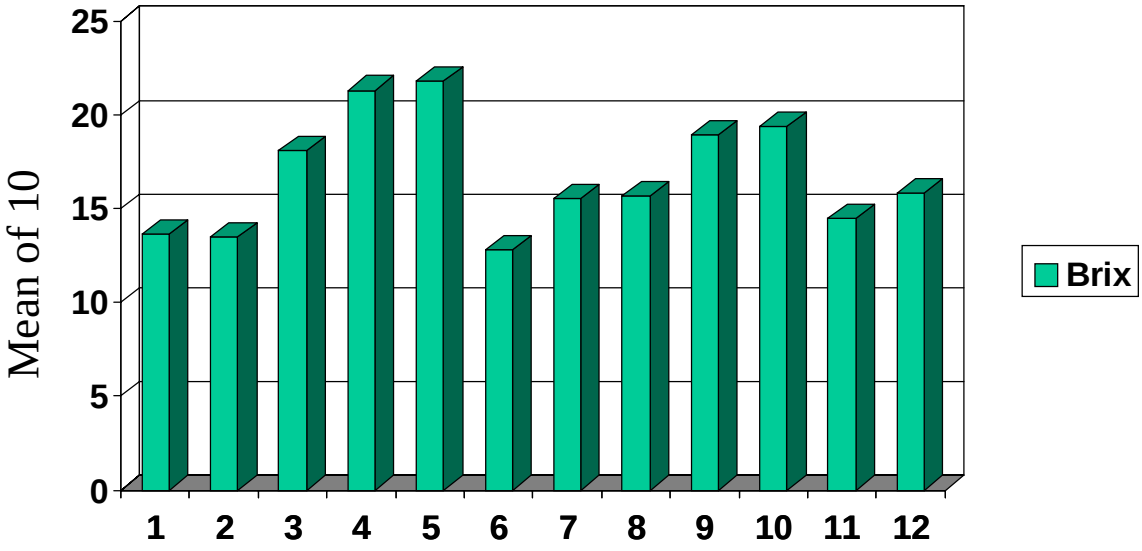

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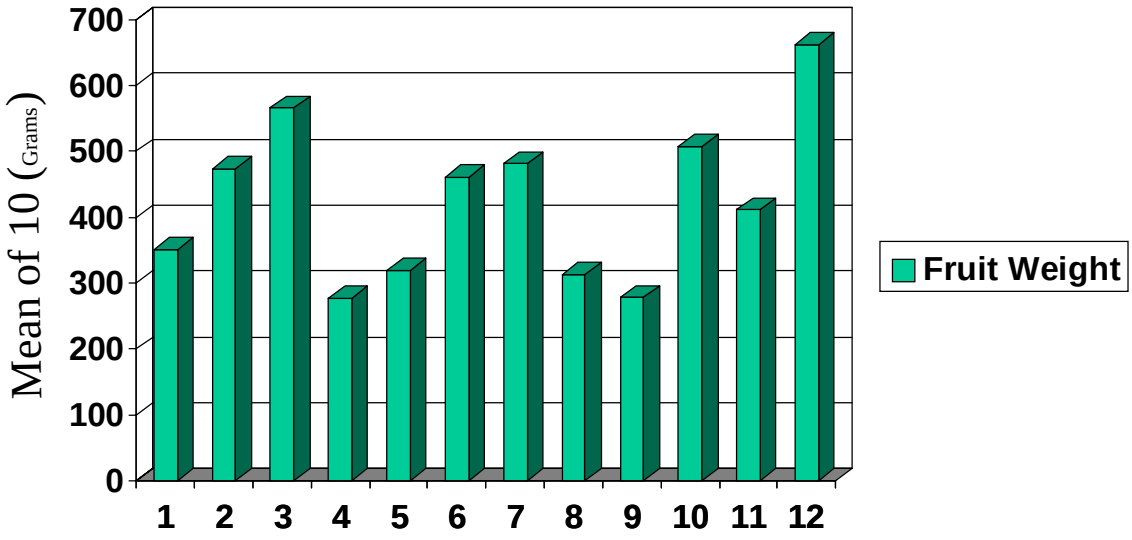

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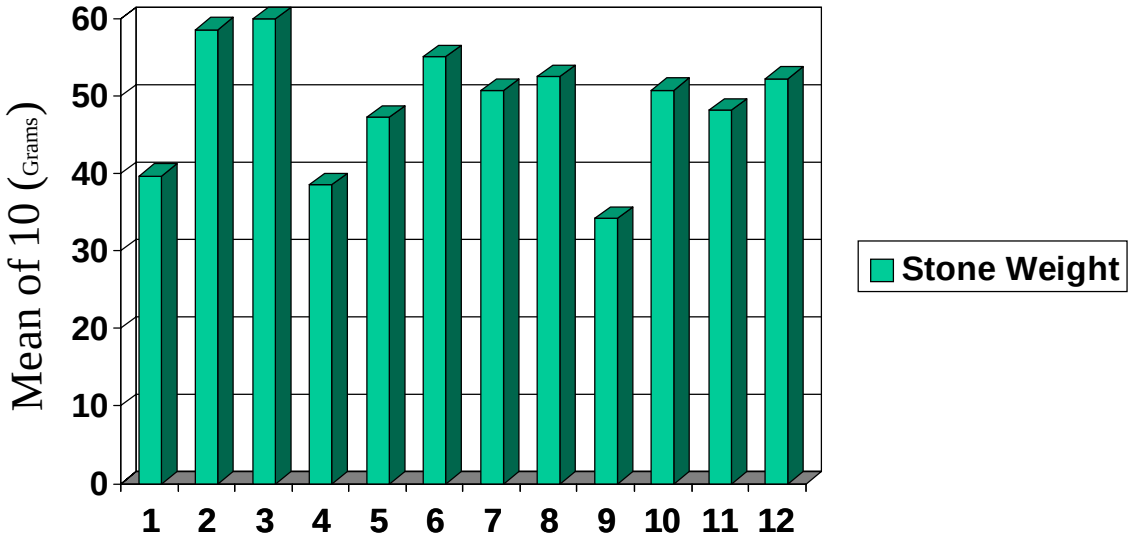

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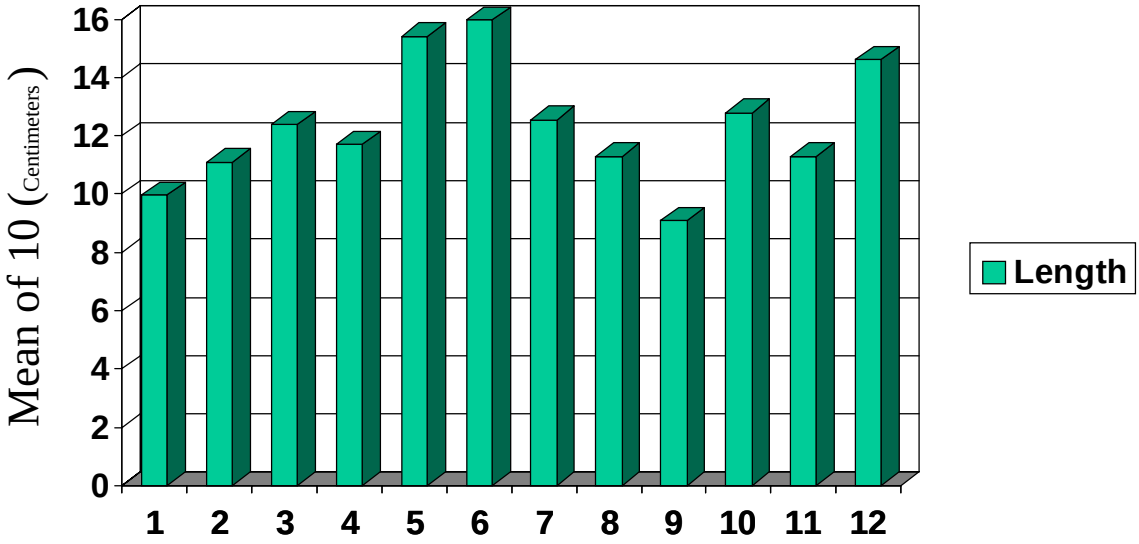

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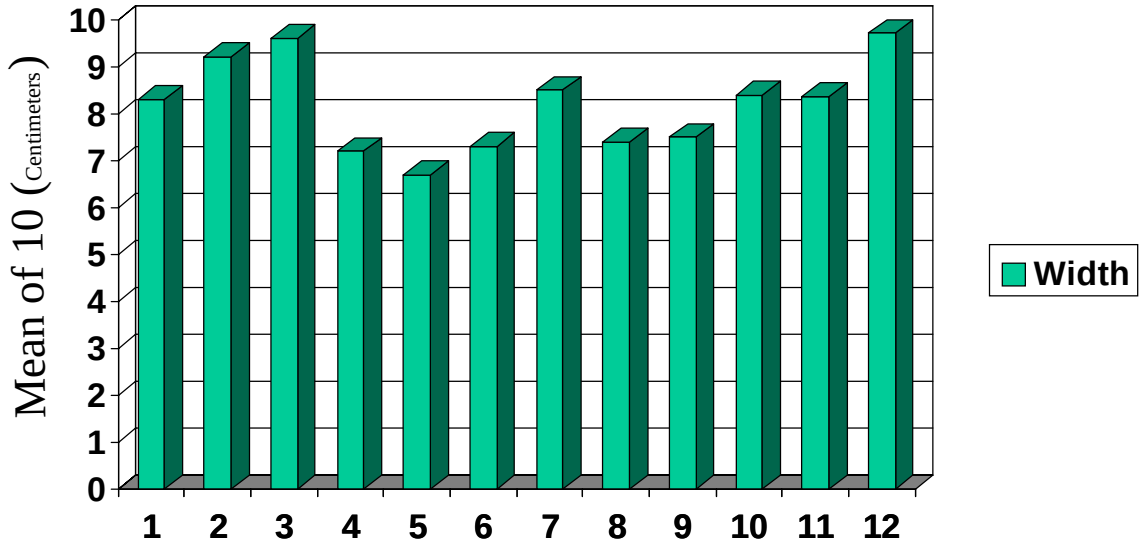
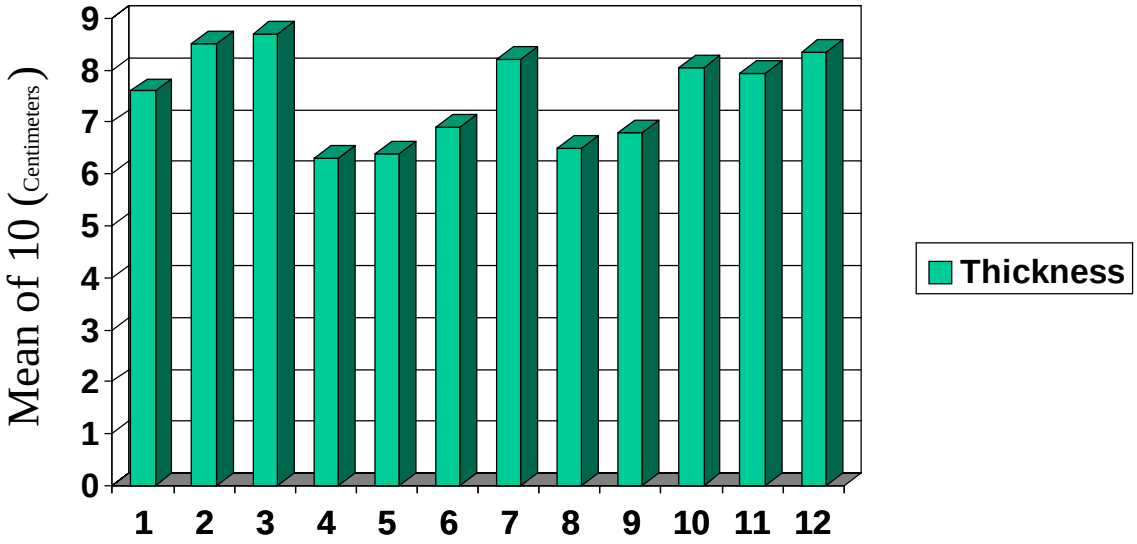


Major Cultivars



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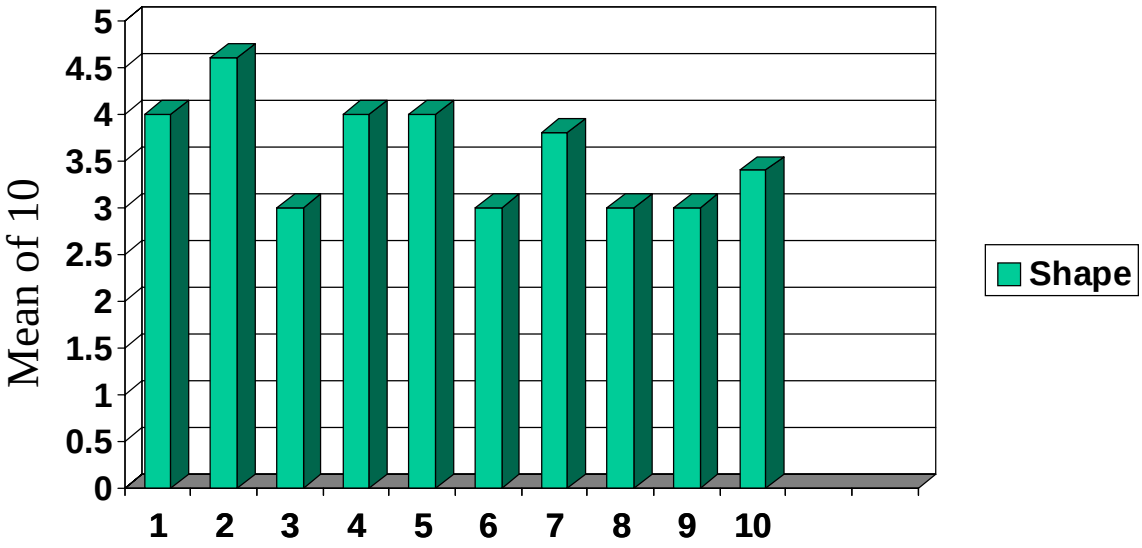

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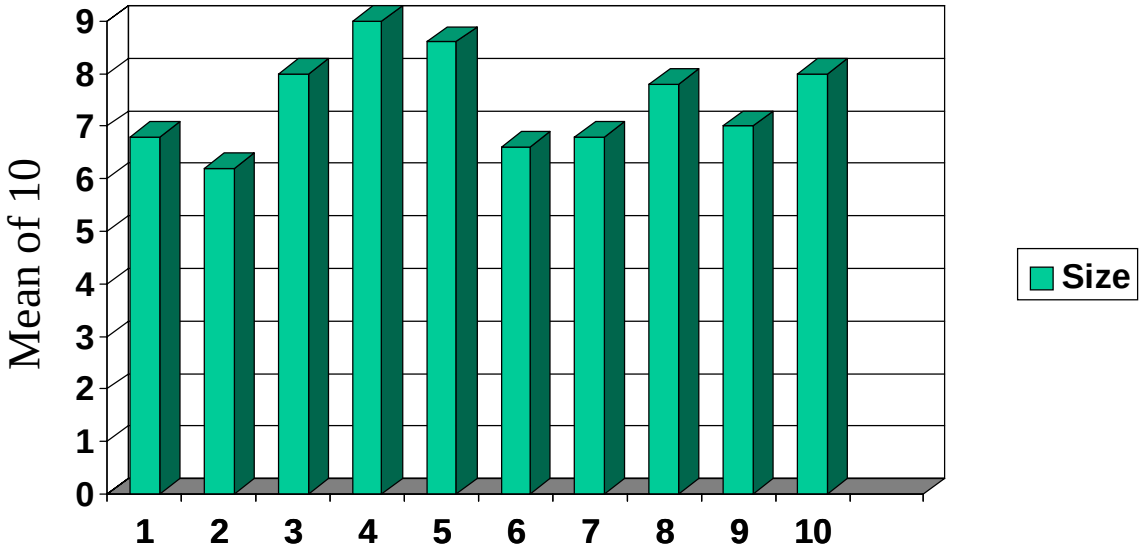

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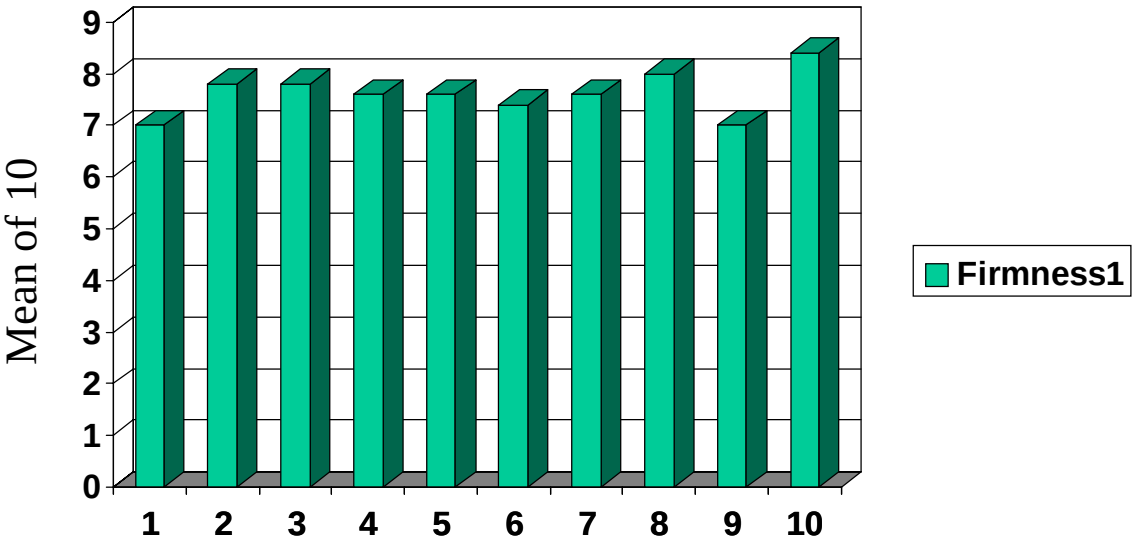

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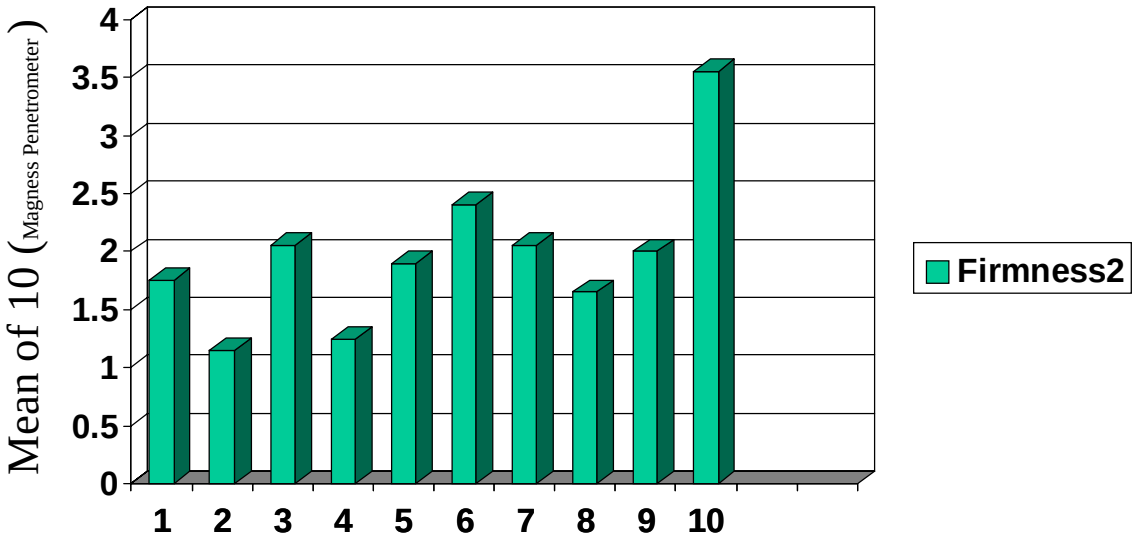

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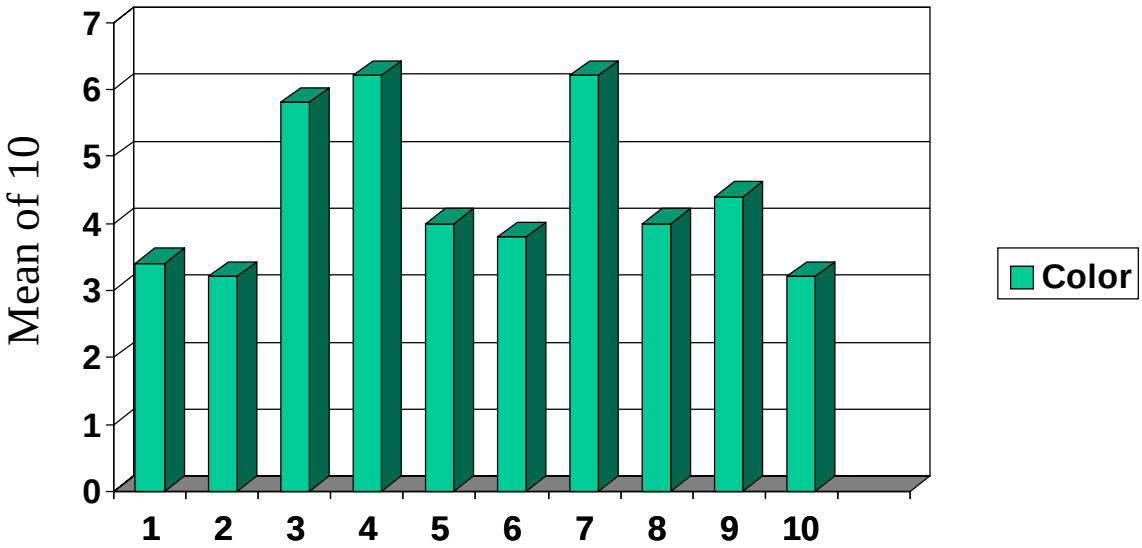

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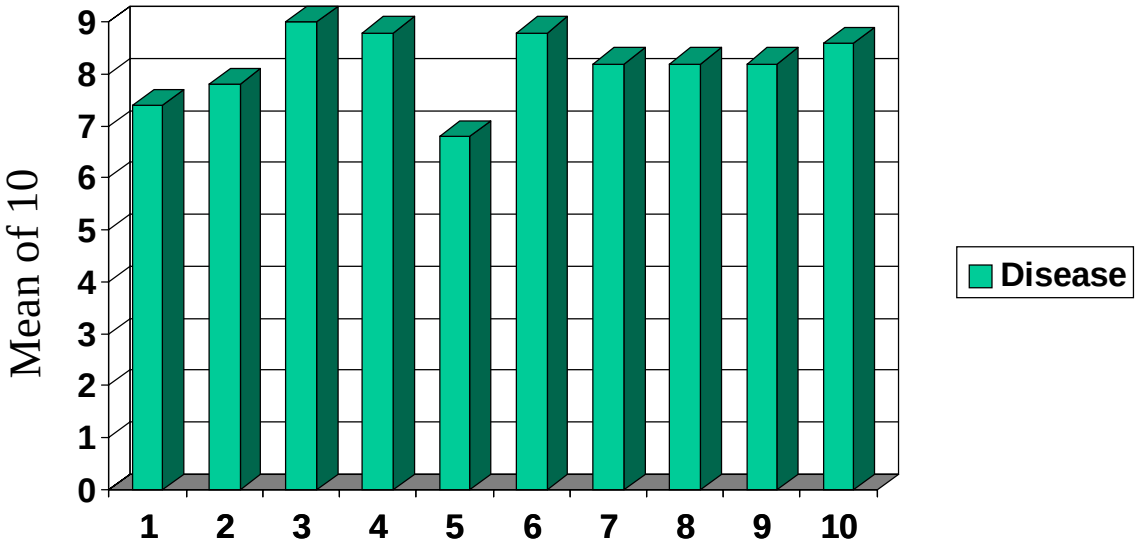

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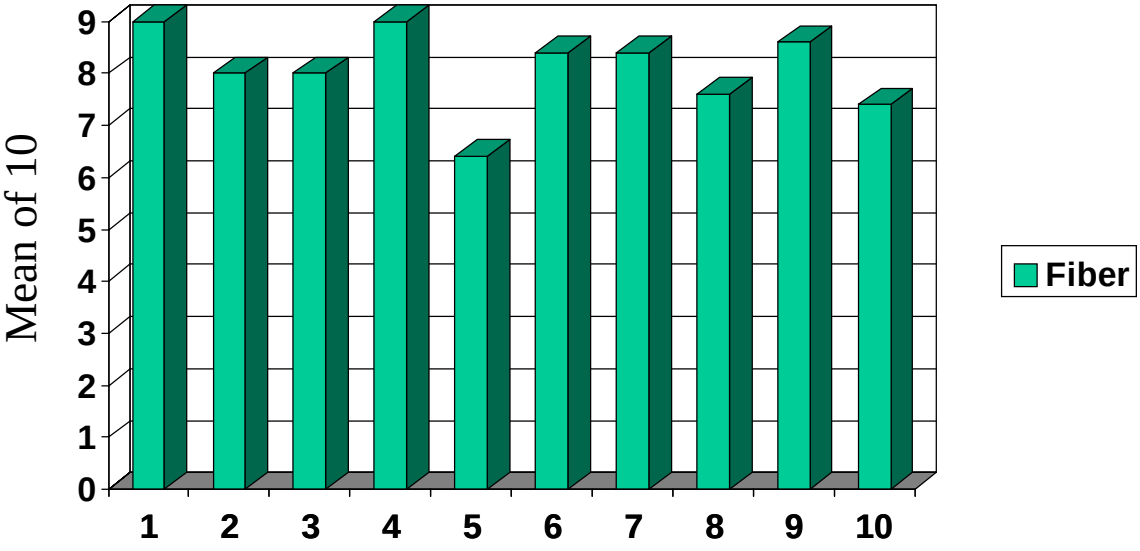

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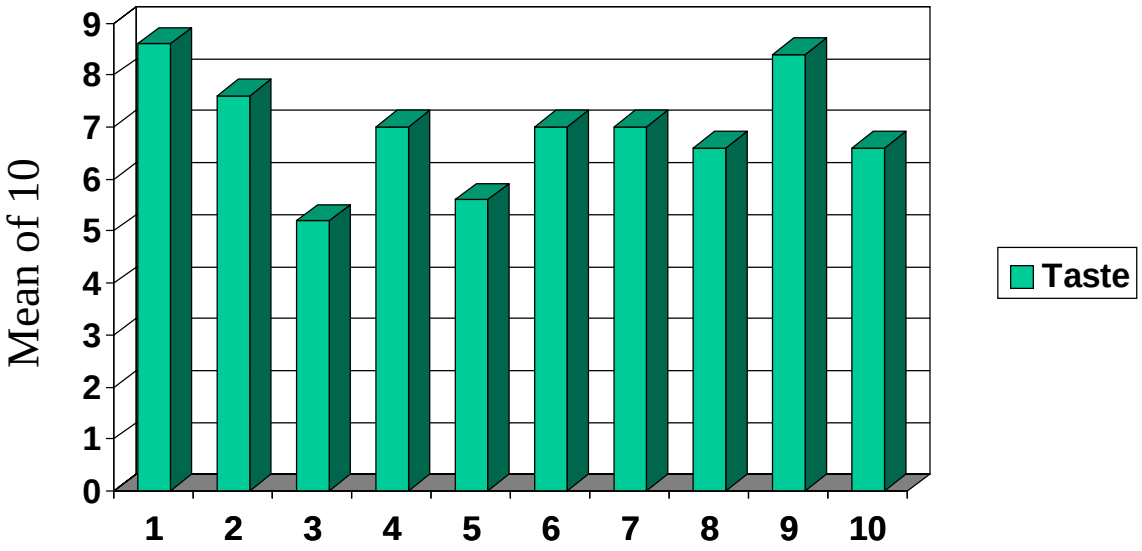

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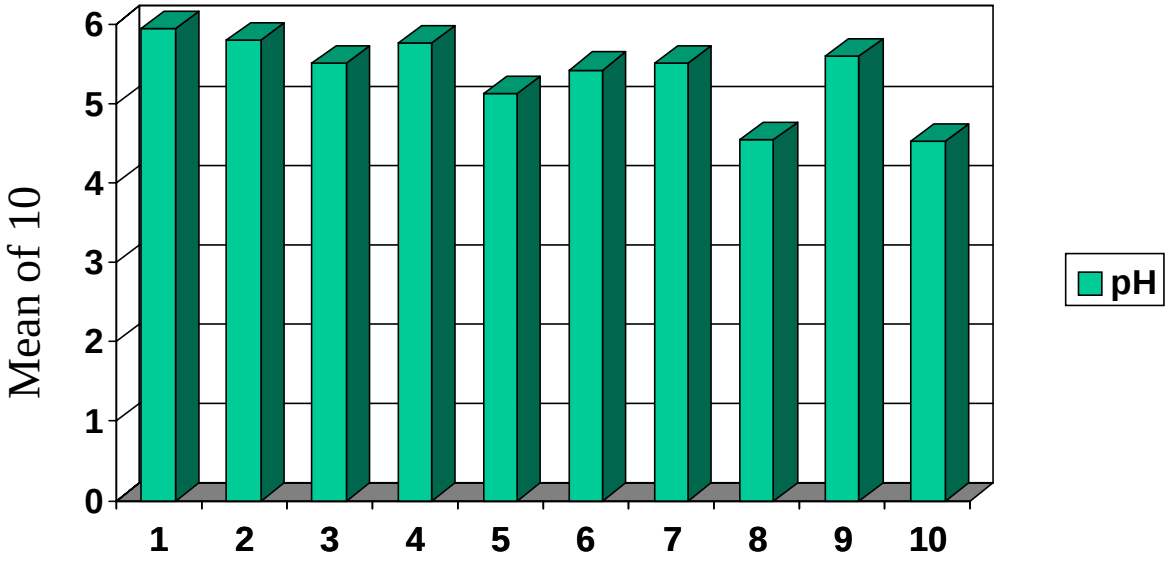

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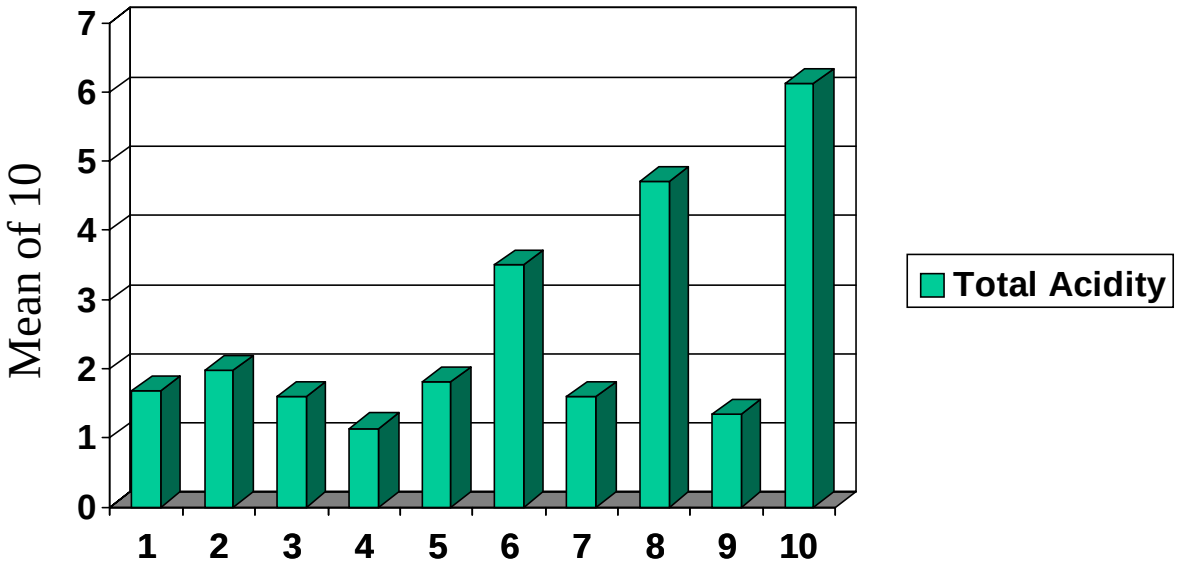

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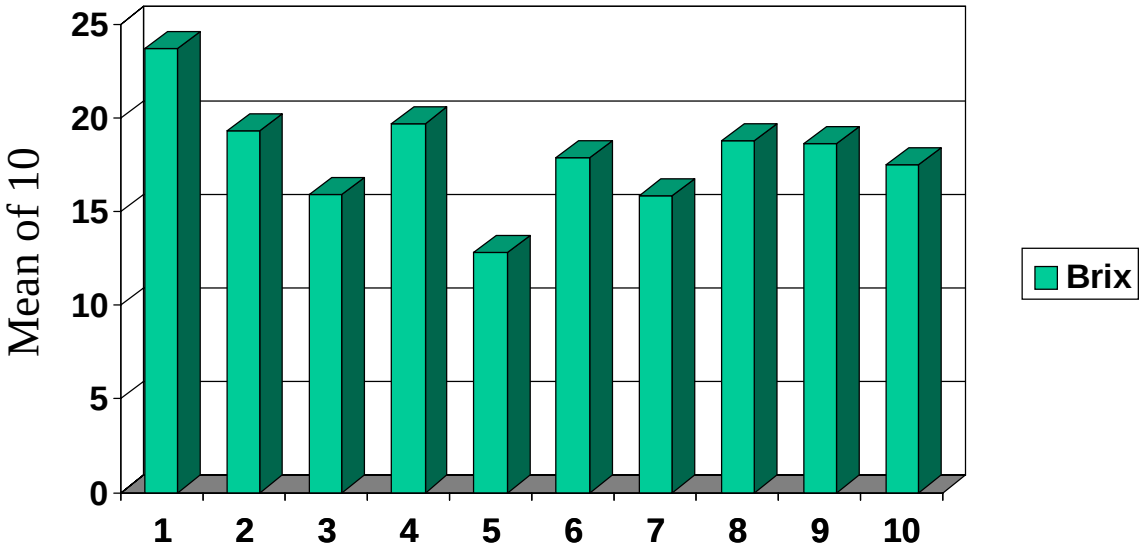

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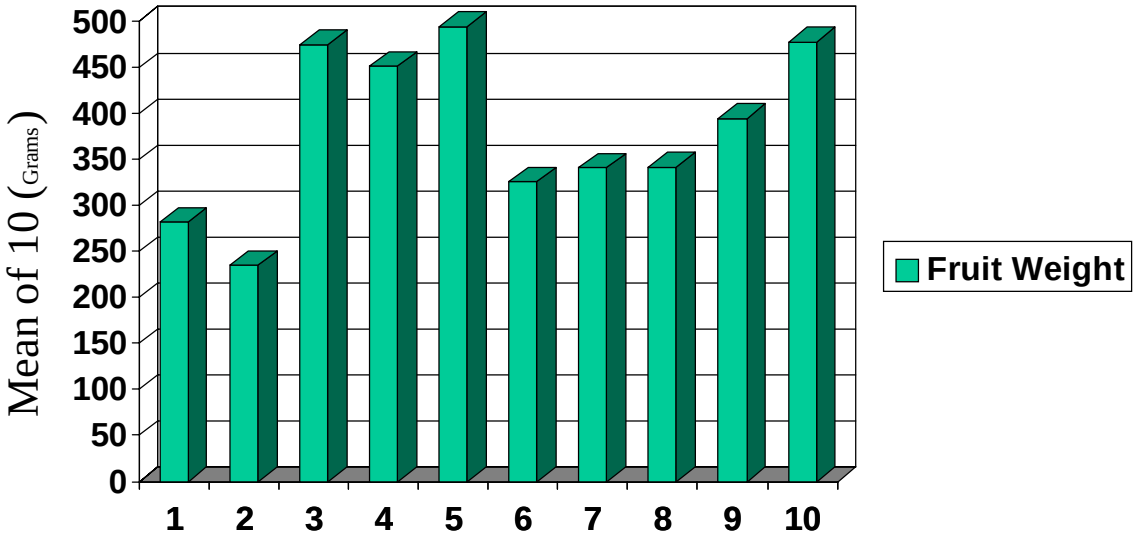

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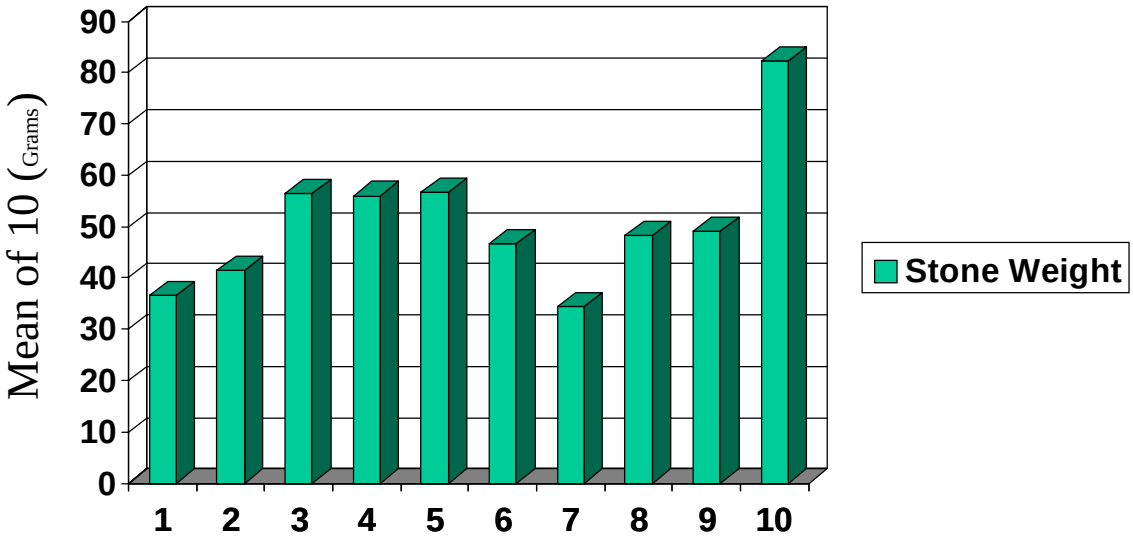

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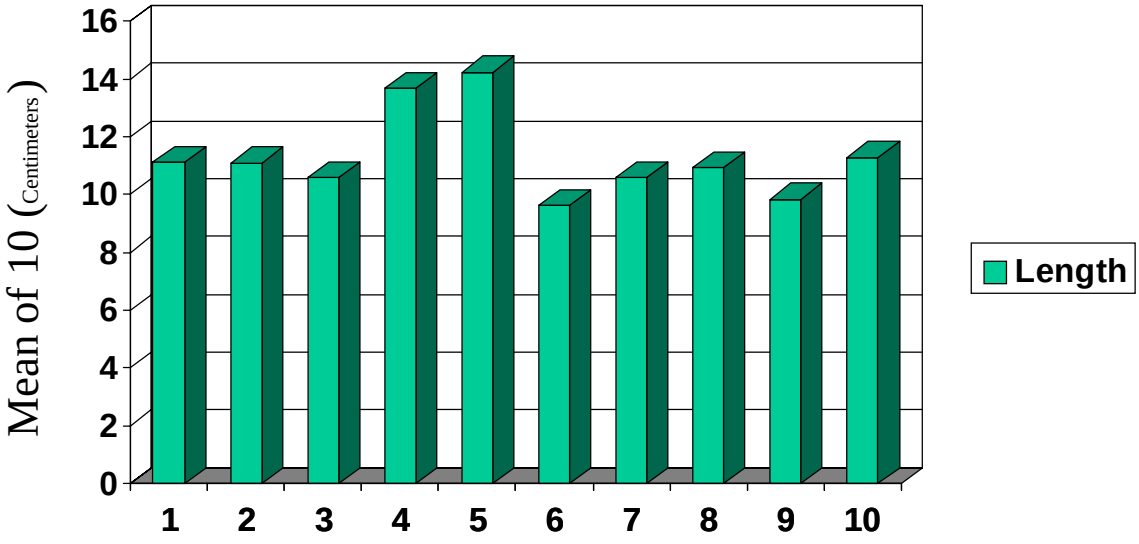

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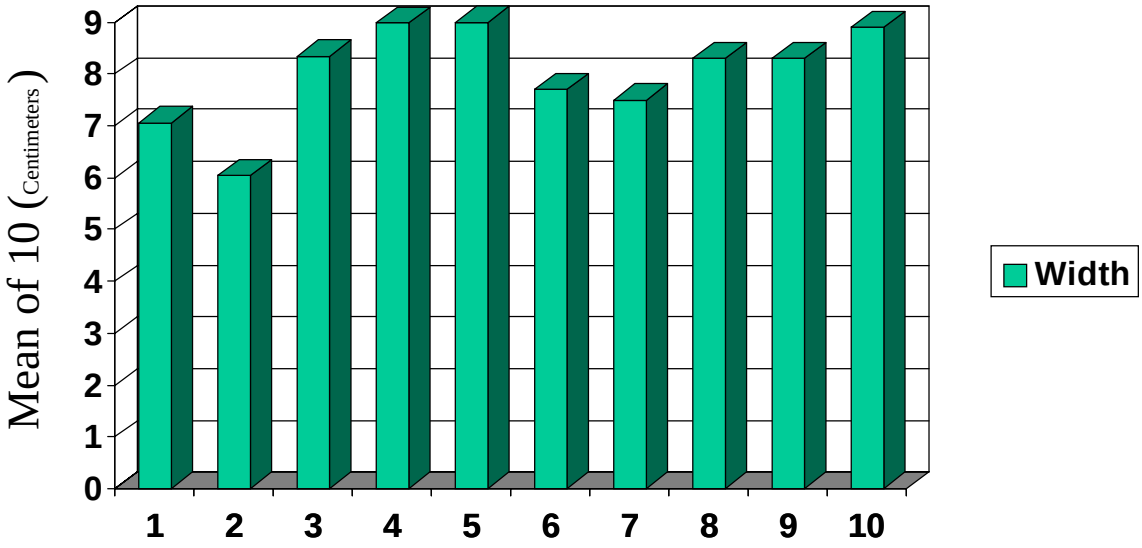

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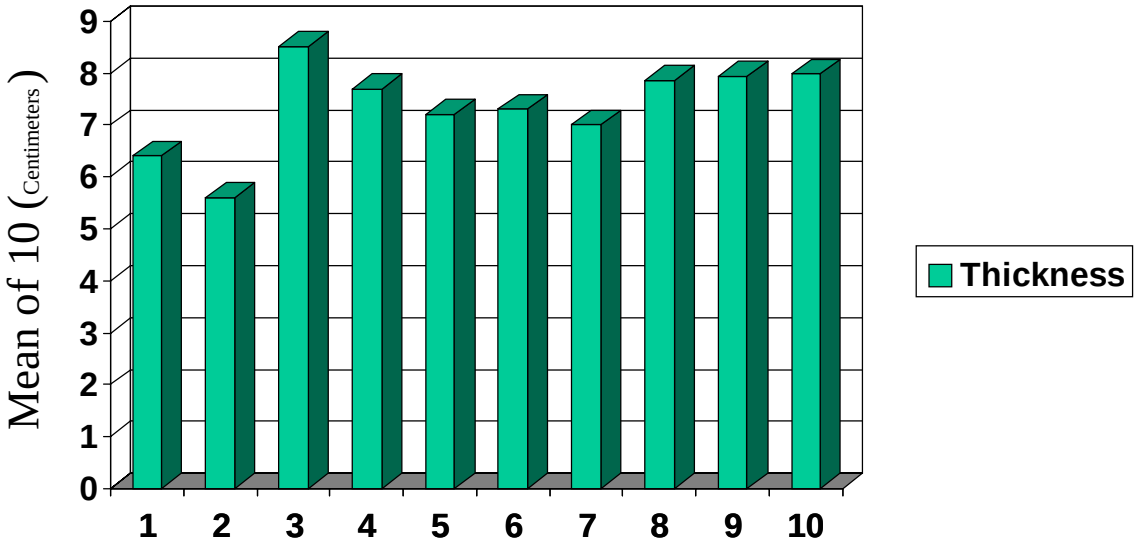

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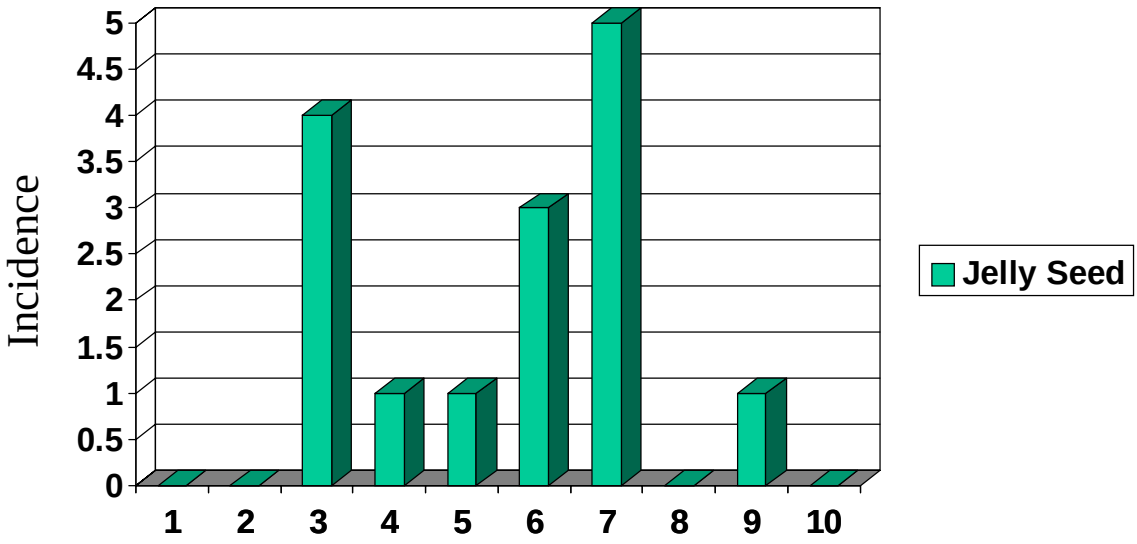


Short Description Of Mango Cultivars Grown In Egypt

Major commercial cultivars

Alphonso.—Tree vigorous; fruit medium-sized (weight 350 g), greenish-yellow with a rose overlay, with medium-sized light-brown, smooth dots, ovate in shape with convex side and apex rounded, a shallow stem-end cavity, 10 cm long by 8.3 cm wide by 7.6 cm thick, with thick, adherent skin relatively free of surface disease; flesh deep orange, susceptible to jelly seed, with light fiber near the skin and abundant, fine fiber near the stone, not objectionable, and a sweet, strong taste of very good eating quality. Seed monoembryonic in a medium-sized (39.7 g) stone. Season early. Said to have been introduced from India, but the Egyptian fruit observed lack the clear yellow exterior exhibited by this cultivar elsewhere, possibly because of local cultural methods.

Bullock's Heart.—Tree vigorous; fruit large (475 g), light yellow with orange overlay, with small, white to green , smooth dots, ovate in shape ("heart shaped") with convex side and apex rounded, a deep stem-end cavity, 11.1 cm long by 9.2 cm wide by 8.5 cm thick, adherent skin quite free of surface disease; flesh yellow to orange, firm, with a few long fibers near the skin and abundant, fine fiber near the stone, none objectionable, and a taste ranging from passable to not of acceptable quality for export. Seed polyembryonic in a large (58.6 g) stone. Late midseason.

Company.—Tree vigorous; fruit large (565 g) yellow with no blush, with medium-sized yellow dots of corky texture, ovate-oblong in shape with convex side and apex rounded, a shallow stem-end cavity, 12.4 cm long by 9.6 cm wide by 8.7 cm thick, with thin, adherent skin reasonably free of surface disease; flesh yellow, susceptible to jelly seed, juicy, with no objectionable fiber, of a mild, passable taste, of acceptable but not outstanding quality. Seed polyembryonic in a large (60 g) stone. Late season.

Ewais.—Tree vigorous; fruit small (275 g), yellow with no blush, with small, light brown dots that are slightly corky, oblong-cylindrical in shape with convex side rounded but flattened apex, a shallow stem-end cavity, 11.7 cm long by 7.2 cm wide by 6.3 cm thick, with adherent skin of intermediate thickness, relatively free of surface disease; flesh orange, juicy but susceptible to jelly seed, with very little fiber near the skin, not objectionable, and none near the stone, sweet and agreeable in taste, of very good quality. Seed polyembryonic in a large (38.5 g) stone. Midseason.

Hindi Besennara.—Tree of medium vigor; fruit small to medium-sized (319 g), green with orange overlay, with small, white corky dots, oblong-

cylindrical in shape with convex side and apex rounded and a shallow stem-end cavity, 15.4 cm long by 6.7 cm wide by 6.5 cm thick, with thick, non-adherent skin, relatively free of surface disease,; flesh orange, yielding and juicy with sparse fiber near the skin and sparse, long fiber near the stone, not objectionable, pleasantly sweet in taster, of a very good quality. Seed polyembryonic in a large (47.2 g) stone. Season early.

Hindi Khassa (Monoembryonic Variant).—Tree vigorous; fruit medium to large (461 g), yellow with no blush, with intermediate-sized smooth, light yellow dots, oblong-cylindrical in shape with convex side and apex rounded and a shallow stem-end cavity, 16 cm long by 6.6 cm wide by 6.9 cm thick, with thick, adherent skin, relatively free of surface disease; flesh orange, firm and juicy with abundant fine fiber near the skin and the stone, not objectionable, poor in taste and of a quality not acceptable for export. Seen monoembryonic (and thus at variance with typical Hindi Khassa) in a large (55 g) stone. Late midseason. **Mabrouka**.—Tree moderately vigorous; fruit large (weight 481 g), yellow with orange to red blush, with small, light yellow, smooth dots, ovate-oblong in shape with convex side rounded, and a shallow stem-end cavity, rounded apex 212.5 cm long by 8.9 cm wide by 8.2 cm thick, with thick, non-adherent skin, relatively free of surface disease; flesh yellow, firm and juicy with abundant fine fiber near the skin and abundant long fiber near the stone, not objectionable, moderately agreeable in taste, of acceptable quality. Seed monoembryonic in a moderately large (51 g) stone. Late midseason; said to ship well, and was observed on sale in Poland (from Egypt) some years ago.

Mesk.—Tree vigorous; fruit small to medium (weight 312.5 g), yellow with a red blush, with small yellow dots corky in texture, ovate-oblong in shape with convex side rounded and without a stem-end cavity, rounded apex, 11.3 cm long by 7. 4 cm wide by 6.5 cm thick, with intermediate, adherent skin, fairly free of surface disease; flesh orange, frequently jelly-seeded, juicy with a few long fibers near the skin and short fibers near the stone, none objectionable, sweet and agreeable in taste, o f very good quality. Seed polyembryonic in moderate-sized (52.5 g stone. Season late.

Pairi.—Tree vigorous, making a rounded, moderately open canopy; fruit medium-small (weight 278 g), greenish-yellow brushed orange to red, with small light yellow dots smooth in texture, ovate in shape with base rounded and without stem-end cavity, rounded apex with prominent beak, 9 cm long by 7.5 cm wide by 6.89 cm thick, with tough, thick, adherent skin, smooth, relatively free of surface disease; flesh deep orange, firm and juicy with light fiber near the skin and abundant fiber near the stone, none objectionable, very sweet with some acid and a pleasant aroma, of excellent quality.

Seed monoembryonic in full, thick, medium-sized (weight 34.2 g) stone. Season early; reported to ship well. Said to have been introduced from India and closely resembles fruit of this cultivar grown elsewhere.

Taimour.—Tree vigorous; fruit large (weight 500 g), dark green with large light brown dots smooth in texture, ovate-oblong in shape with shallow stem-end cavity, rounded apex without beak, 12.8 cm long by 8.4 cm wide by 8 cm thick, with intermediate, non-adherent seed, quite free from surface disease; flesh orange, firm (free of jelly seed) and juicy with a few long fibers near the skin and abundant fine fiber near the stone, not objectionable, of a delightfully rich, sweet taste, of excellent quality. Seed polyembryonic in a thin, medium-sized (50.8 g) stone. Season late.

White Succari.—Tree vigorous; fruit medium-large (weight 410 g), greenish-yellow with yellow overlay, small brown dots of smooth texture, ovate-oblong in shape with no stem-end cavity, rounded apex, 11.25 cm long by 8.3 cm wide by 8.0 cm thick, with thin adherent skin, reasonably free of surface disease; flesh orange, yielding and juicy with a few fine fibers near the skin and abundant fine fiber near the stone, none objectionable, of an agreeable sweet taste, of very good quality. Seed polyembryonic in a moderate to large-sized (49 g) stone. Season early.

Zebda.—Tree vigorous and regularly productive; fruit large (weight 660 g), green with no overlay, small light brown dots of smooth texture, oblong-cylindrical in shape with a deep stem-end cavity, rounded convex side and rounded apex, 14.6 cm long by 9.7 cm wide by 8.3 cm thick, with n on-adherent skin, quite free of surface disease; flesh deep orange, firm and juicy, with abundant long fiber near the skin and abundant fine fiber near the stone, not objectionable, of a mild sweet taste, of acceptable quality. Seed polyembryonic in a moderately small (52 g) stone. Late midseason maturity.

Minor Commercial Cultivars and Selections

Excellent Succari.—Tree vigorous; fruit small (280 g), green with a yellow overlay and small, yellow smooth dots, ovate-oblong in shape with no stem-end cavity, a rounded convex side and apex, 11 cm long by 7 cm wide by 6.4 cm thick, with non-adherent skin of intermediate thickness, quite free from surface disease; flesh orange, melting (without jelly seed) and juicy, with a few long fibers near the skin and a few short ones near the stone, none objectionable, of a delightful, sweet taste and excellent eating quality. Seed polyembryonic in a stone moderately large (36.6 g) for the fruit's size.

Genovea.—Fruit small (234.5 g), green with a yellow overlay, medium-sized smooth yellow dots, ovate-oblong in shape with no stem-end cavity, a rounded convex side and apex, 11 cm long by 6 cm wide by 5.6 cm thick, a

thin, adherent skin relatively free of surface disease; flesh orange, firm (no jelly seed) and juicy, with abundant long fibers near the skin and abundant fine fibers near the stone, none objectionable, of a sweet, agreeable taste and acceptable quality. Seed polyembryonic, in a large (53 g) stone.

Khanefy.—Fruit large (475 g), greenish-yellow with an orange overlay and large, brown smooth dots, ovate in shape with no stem-end cavity, a rounded convex side and a flattened apex, 10.7 cm long by 8.3 wide by 8.6 cm thick, an adherent skin quite free of surface disease; flesh yellow, often with jelly seed, juicy, with sparse, fine fibers near the skin and the stone, none objectionable, of a bland, unacceptable taste that destroys fruit quality. Seed monoembryonic in a moderately large (53 g) stone.

Nabeel.—Fruit large (495 g), green with small yellow dots that are smooth, ovate-oblong in shape with a shallow stem-end cavity, a flattened convex side and a rounded apex, 14 cm long by 9 cm wide by 7 cm thick, with adherent skin relatively free of surface disease; flesh orange, firm and juicy, with abundant, long fibers near the skin and near the stone, none objectionable, having a passable but not exceptionally pleasing taste, and acceptable but not high quality. Seed polyembryonic in a large (56.6 g) stone.

Seedling #1.—Fruit small (325 g), greenish-yellow with small, brown corky dots, ovate in shape with a shallow stem-end cavity, a rounded convex side and a rounded apex, 9.6 cm long by 7.7 cm wide by 7.3 cm thick, with thick, non-adherent skin that is highly resistant to surface disease; flesh orange, firm and juicy, with abundant fine fibers near the skin and sparse fine fibers near the stone, none objectionable, having a taste rating above passable but not outstanding. Seed monoembryonic in a large (46.7 g) stone.

Seedling #2.---Fruit small to medium-sized (340 g), greenish-yellow with a red blush, with medium-sized, light green smooth dots, ovate-oblong in shape with a shallow stem-end cavity, a rounded convex side and apex, 10.6 cm long by 7.5 cm wide by 7.0 cm thick, with thick, non-adherent skin that is relatively resistant to surface disease; flesh yellow, with jelly seed, juicy, with a few long fibers near the skin and a few short fibers near to stone, none objectionable, having a sweet, fairly pleasant taste, of acceptable quality. Seed polyembryonic in a medium sized (34.5 g) stone. Because of its blushed fruit and otherwise Acceptable qualities, Seedling #2 merits further observation with an eye to its possible commercial acceptability.

Seedling #5A.—Fruit of medium size (431.7 g), greenish-yellow, with large, light brown, smooth dots, ovate in shape with a shallow stem-end cavity, a rounded convex side and a rounded apex, 11 cm long by 8.3 cm wide by 6 cm thick, with thick, non-adherent skin that is acceptably resistant to surface

disease; flesh deep yellow, firm (no jelly seed) and juicy, having a few long fibers near the skin and abundant fine ones near the stone, none objectionable, having an acceptable but not outstandingly agreeable taste. Seed monoembryonic in a large (48.3 g) stone.

Seedling #15.—Fruit medium-sized (394.5 g), green with a red overlay, with small, light green smooth dots, ovate in shape with a shallow stem-end cavity, a rounded convex side and apex, 9.8 cm long by 8.3 cm wide by 8.1 cm thick, with thick, non-adherent skin that is relatively resistant to surface disease; flesh deep yellow, melting and juicy, with long, sparse fibers near the skin and short, abundant ones near the stone, none objectionable, having a sweet taste that is highly acceptable. Seed monoembryonic in a large (49 g) stone. Because some, but not all fruit from this seedling are of a color that is commercially acceptable, it probably merits further testing to see if improved cultural methods can produce greater numbers of fruit of acceptable quality.

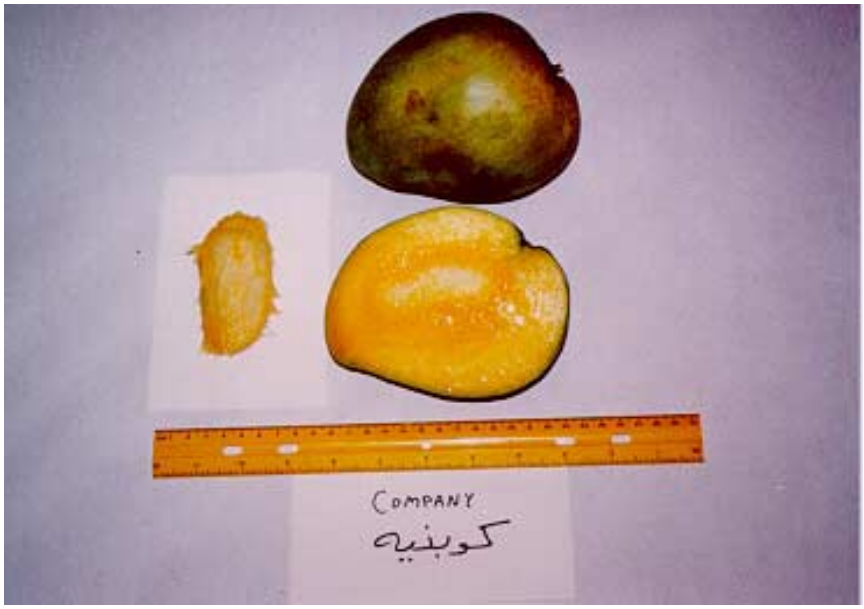
Star Seedling.—Fruit large (478 g), green with a yellow overlay, with small, light orange, smooth dots, ovate-oblong in shape with no stem-end cavity, a rounded convex side and apex, 11.3 cm long by 9 cm wide by 8 cm thick, with thick, non-adherent skin that is quite free of surface disease; flesh yellow, firm and juicy (no jelly seed), with a few long fibers near the skin, and abundant fine ones near the stone, none objectionable, of acceptable but not outstanding taste. Seed polyembryonic in a very large (82.2 g) stone.

Qualitative Examination, Dimensions and Weights

Cultivar:	ALPHONSO
Collection Date:	2 September 1997
Analysis Date:	2 Sept 97
Position:	Wholesale Market, Ismailia
Shape:	Ovate (3)
Lateral Compression	Yes (*slight*)
Cavity	Shallow
Suture:	None
Shoulders:	Ventral High
Convex Side:	Rounded
Sinus:	Absent
Apex:	Rounded
Height of Nak:	30 mm
Skin:	Thick
Basic Color:	Greenish-Yellow
Overlay:	Rose
Dots:	Intermediate
Dot Color:	Light Brown
Dot Texture:	Smooth
Overall External Appearance:	(4) out of (10)
Flesh Color:	Deep Orange
Adherence to Skin:	Yes
Adherence to Seed:	Yes
Fiber near Skin:	Light
Fiber Near Seed:	Abundant, Fine
Overall Objectionability:	No
Objectionability Rating:	(8) out of (10)
Taste Rating:	(8) out of (10)
Disease Rating:	(8) out of (10)
Seed Embryony:	Mono
Fruit Length:	9.96 cm
Fruit Width:	8.27 cm
Fruit Thickness:	7.58 cm
Fruit Weight:	351.13 g
Stone Weight:	39.73 g

Cultivar:	BULLOCK'S HEART
Collection Date:	2 Sept 97
Analysis Date:	3 Sept 97
Position:	Wholesale Market, Ismailia
Shape:	Ovate (3)
Lateral Compression:	No
Cavity:	Deep
Suture:	None
Shoulders:	Ventral High
Convex Side:	Rounded
Sinus:	Absent
Apex:	Rounded
Height of Nak:	Not reported
Skin:	Thick
Basic Color:	Light Yellow
Overlay:	Orange
Dots:	Small
Dot Color:	White to Green
Dot Texture:	Smooth
Overall External Appearance:	(5) out of (10)
Flesh Color:	Yellow to Orange
Adherence to Skin:	Yes
Adherence to Seed:	Yes
Fiber Near Skin:	Few, Long
Fiber Near Seed:	Abundant, Fine
Overall Objectionability:	No
Objectionability Rating:	(9) out of (10)
Taste Rating:	(5) out of (10)
Disease Rating:	(9) out of (10)
Seed Embryony:	Poly
Fruit Length:	11.1 cm
Fruit Width:	9.2 cm
Fruit Thickness:	8.5 cm
Fruit Weight:	472.95 g
Stone Weight:	58.58 g

Cultivar:	COMPANY
Collection Date:	6 Sept 97
Analysis Date:	6 Sept 97
Position:	Wholesale Market, Ismailia
Shape:	Ovate-Oblong (4)
Lateral Compression:	No
Cavity:	Shallow
Suture:	None
Shoulders:	Ventral High
Convex Side:	Rounded
Sinus:	Present
Apex:	Rounded
Height of Nak:	30 mm
Skin:	Thin
Basic Color:	Yellow
Overlay:	None
Dots:	Intermediate
Dot Color:	Light Yellow
Dot Texture:	Corky
Overall External Appearance:	(4) out of (10)
Flesh Color:	Yellow
Adherence to Skin:	Yes
Adherence to Seed:	Yes
Overall Objectionability:	No
Objectionability Rating:	(8) out of (10)
Taste Rating:	(6) out of (10)
Disease Rating:	(8) out of (10)
Seed Embryony:	Poly
Fruit Length:	12.37 cm
Fruit Width:	9.56 cm
Fruit Thickness:	8.66 cm
Fruit Weight:	565.19 g
Stone Weight:	59.97 g



Cultivar:	EWAIS
Collection Date:	2 Sept 97
Analysis Date:	2 Sept 97
Position:	Wholesale Market, Ismailia
Shape:	Oblong-Cylindrical (5)
Lateral Compression:	No
Cavity:	Shallow
Suture:	None
Shoulders:	Ventral High
Convex Side:	Rounded
Sinus:	Present
Apex:	Flattened
Height of Nak:	15 mm
Skin:	Intermediate
Basic Color:	Yellow
Overlay:	None
Dots:	Small
Dot Color:	Light Brown
Dot Texture:	Slightly Corky
Overall External Appearance:	(3) out of (10)
Flesh Color:	Orange
Adherence to Skin:	Yes
Adherence to Seed:	Yes
Fiber Near Skin:	Very Little
Fiber Near Seed:	No
Overall Objectionability:	No
Objectionability Rating:	(9) out of (10)
Taste Rating:	(8) out of (10)
Disease Rating:	(8) out of (10)
Seed Embryony:	Poly
Fruit Length:	11.72 cm
Fruit Width:	7.18 cm
Fruit Thickness:	6.28 cm
Fruit Weight:	276.74 g
Stone Weight:	38.53 g

Cultivar:	HINDI BESENNARA
Collection Date:	2 Sept 97
Analysis Date:	2 Sept 97
Position:	Wholesale Market, Ismailia
Shape:	Oblong-cylindrical (5)
Lateral Compression:	No
Cavity:	Shallow
Suture:	None
Shoulders:	Ventral High
Convex Side:	Rounded
Sinus:	Present
Apex:	Rounded
Height of Nak:	25 mm
Skin:	Thick
Basic Color:	Green
Overlay:	Orange
Dots:	Small
Dot Color:	White
Dot Texture:	Corky
Overall Appearance:	(3) out of (10)
Flesh Color:	Orange
Adherence to Skin:	No
Adherence to Seed:	Yes
Fiber Near Skin:	Sparse
Fiber Near Seed:	Sparse, Long
Overall Objectionability:	No
Objectionability Rating:	(9) out of (10)
Taste Rating:	(9) out of (10)
Disease Rating:	(8) out of (10)
Seed Embryony:	Poly
Fruit Length:	15.40 cm
Fruit Width:	6.67 cm
Fruit Thickness:	6.46 cm
Fruit Weight:	319.03g
Stone Weight:	47.24

Cultivar:	HINDI KHASSA*
Collection Date:	6 Sept 97
Analysis Date:	6 Sept 97
Position:	Wholesale Market, Ismailia
Shape:	Oblong-cylindrical (5)
Lateral Compression:	No
Cavity:	Shallow
Suture:	None
Shoulders:	Ventral High
Convex Side:	Rounded
Sinus:	Present
Apex:	Rounded
Height of Nak:	30 mm
Skin:	Thick
Basic Color:	Yellow
Overlay:	None
Dots:	Intermediate
Dot Color:	Light ellow
Dot Texture:	Smooth
Overall External Appearance:	(4) out of (10)
Flesh Color:	Orange
Adherence to Skin:	Yes
Adherence to Seed:	Yes
Fiber Near Skin:	Abundant, Fine
Fiber Near Seed:	Abundant, Fine
Overall Objectionability:	No
Objectionability Rating:	(9) out of (10)
Taste Rating:	(5) out of (10)
Disease Rating:	(8) out of (10)
Seed Embryony:	Mono*
*Additional Note: Properly designated **Hindi Khassa, Monoembryonic Variant**	
Fruit Length:	15.96 cm
Fruit Width:	6.55 cm
Fruit Thickness:	6.88 cm
Fruit Weight:	460.99 g
Stone Weight:	55.0 g

Cultivar:	MABROUKA
Collection Date:	6 Sept 97
Analysis Date:	6 Sept 97
Position:	Wholesale Market, Ismailia
Shape:	Ovate-Oblong (4)
Lateral Compression:	No
Cavity:	Shallow
Suture:	None
Shoulders:	Dorsal High
Convex Side:	Rounded
Sinus:	Present
Apex:	Rounded
Height of Nak:	35 mm
Skin:	Thick
Basic Color:	Yellow
Overlay:	Orange to Red
Dots:	Small
Dot Color:	Light Yellow
Dot Texture:	Smooth
Overall External Appearance:	(5) out of (10)
Flesh Color:	Yellow
Adherence to Skin:	No
Adherence to Seed:	Yes
Fiber Near Skin:	Abundant, Fine
Fiber Near Seed:	Abundant, Long
Overall Objectionability:	No
Objectionability Rating:	(6.5) out of (10)
Taste Rating:	(7) out of (10)
Disease Rating:	(8) out of (10)
Seed Embryony:	Mono
Fruit Length:	12.54 cm
Fruit Width:	8.51 cm
Fruit Thickness:	8.17 cm
Fruit Weight:	480.98 g
Stone Weight:	50.71 g

Cultivar:	MESK
Collection Date:	3 Sept 97
Analysis Date:	3 Sept 97
Position:	Wholesale Market, Ismailia
Shape:	Ovate-Oblong (4)
Lateral Compression:	Yes
Cavity:	None
Suture:	None
Shoulders:	Ventral High
Convex Side:	Rounded
Sinus:	Present
Apex:	Rounded
Height of Nak:	35 mm
Skin:	Intermediate
Basic Color:	Yellow
Overlay:	Red
Dots:	Small
Dot Color:	Yellow
Dot Texture:	Corky
Overall External Appearance:	(6) out of (10)
Flesh Color:	Orange
Adherence to Skin:	Yes
Adherence to Seed:	Yes
Fiber Near Skin:	Long, Few
Fiber Near Seed:	Present, Short
Overall Objectionability:	No
Objectionability Rating:	(8) out of (10)
Taste Rating:	(8) out of (10)
Disease Rating:	(8) out of (10)
Seed Embryony:	Poly
Fruit Length:	11.26 cm
Fruit Width:	7.37 cm
Fruit Thickness:	6.46 cm
Fruit Weight:	312.55 g
Stone Weight:	52.49 g

Cultivar:	PAIRI
Collection Date:	9 Sept 97
Analysis Date:	15 Sept 97
Position:	Mohd. Zeiri//Kasaseir//Ismailia Govt.
Shape:	Ovate (3)
Lateral Compression:	No
Cavity:	None
Suture:	None
Shoulders:	Ventral High
Convex Side:	Rounded
Sinus:	Present
Apex:	Rounded
Height of Nak:	27 mm
Skin:	Thick
Basic Color:	Greenish-Yellow
Overlay:	Red
Dots:	Small
Dot Color:	Light Yellow
Dot Texture:	Smooth
Overall External Appearance:	(6) out of (10)
Flesh Color:	Orange
Adherence to Skin:	No
Adherence to Seed:	Yes
Fiber Near Skin:	Few, Long
Fiber Near Seed:	Abundant, Fine
Overall Objectionability:	No
Objectionability Rating:	(9) out of (10)
Taste Rating:	(8) out of (10)
Disease Rating:	(8) out of (10)
Seed Embryony:	Mono
Fruit Length:	9.07 cm
Fruit Width:	7.48 cm
Fruit Thickness:	6.79 cm
Fruit Weight:	278.53 g
Stone Weight:	34.24 g

Cultivar:	TAIMOUR
Collection Date:	6 Sept 97
Analysis Date:	6 Sept 97
Position:	Giza
Shape:	Ovate-Oblong (4)
Lateral Compression:	No
Cavity:	Shallow
Suture:	None
Shoulders:	Ventral High
Convex Side:	Rounded
Sinus:	Present
Apex:	Rounded
Height of Nak:	No Nak Present
Skin:	Intermediate
Basic Color:	Dark Green
Overlay:	None
Dots:	Large
Dot Color:	Light Brown
Dot Texture:	Smooth
Overall External Appearance:	(3) out of (10)
Flesh Color:	Orange
Adherence to Skin:	No
Adherence to Seed:	Yes
Fiber Near Skin:	Few, Long
Fiber Near Seed:	Abundant, Fine
Overall Objectionability:	No
Objectionability Rating:	(8) out of (10)
Taste Rating:	(9) out of (10)
Disease Rating:	(9) out of (10)
Fruit Length:	12.76 cm
Fruit Width:	8.4 cm
Fruit Thickness:	8.05 cm
Fruit Weight:	507.7 g
Stone Weight:	50.84 g

Additional Note: May have Great Export Potential despite its Dark Green Color. See Phenotypic Data, Table 1.

Cultivar:	WHITE SUCCARI
Collection Date:	1 Sept 97
Analysis Date:	1 Sept 97
Position:	Khalaf Grove, Ismailia Govt.
Shape:	Ovate-Oblong (4)
Lateral Compression:	No
Cavity:	None
Suture:	None
Shoulders:	Ventral High
Convex Side:	Rounded
Sinus:	Present
Apex:	Rounded
Height of Nak:	25 mm
Skin:	Thin
Basic Color:	Greenish-Yellow
Overlay:	Yellow
Dots:	Small
Dot Color:	Brown
Dot Texture:	Smooth
Overall External Appearance:	(4) out of (10)
Flesh Color:	Orange
Adherence to Skin:	Yes
Adherence to Seed:	Yes
Fiber Near Skin:	Few, Fine
Fiber Near Seed:	Abundant, Fine
Overall Objectionability:	No
Objectionability Rating:	(8) out of (10)
Taste Rating:	(7) out of (10)
Disease Rating:	(8) out of (10)
Seed Embryony:	Poly
Fruit Length:	11.25 cm
Fruit Width:	8.34 cm
Fruit Thickness:	7.99 cm
Fruit Weight:	411.23 g
Stone Weight:	49.08 g

Cultivar:	ZEBDA
Collection Date:	1 Sept 97
Analysis Date:	1 Sept 97
Position:	Khalaf Grove, Ismailia Govt.
Shape:	Oblong-Cylindrical (5)
Lateral Compression:	No
Cavity:	Deep
Suture:	Light
Shoulders:	Ventral High
Convex Side:	Rounded
Sinus:	Present
Apex:	Rounded
Height of Nak:	20 mm
Skin:	Not Reported
Basic Color:	Green
Overlay:	None
Dots:	Small
Dot Color:	Light Brown
Dot Texture:	Smooth
Overall External Appearance:	(3) out of (10)
Flesh Color:	Deep Orange
Adherence to Skin:	No
Adherence to Seed:	No
Fiber Near Skin:	Abundant, Long
Fiber Near Seed:	Abundant, Fine
Overall Objectionability:	No
Taste Rating:	(7) out of (10)
Disease Rating:	(8) out of (10)
Seed Embryony:	Poly
Fruit Length:	14.56 cm
Fruit Width:	9.71 cm
Fruit Thickness:	8.35 cm
Fruit Weight:	662.23 g
Stone Weight:	52.22 g

Cultivar:	EXCELLENT SUCCARI
Collection Date:	7 Sept 97
Analysis Date:	10 Sept 97
Position:	Ismailia
Shape:	Ovate-Oblong (4)
Lateral Compression:	Yes (“Slightly”)
Cavity:	None
Suture	: None
Shoulders:	Dorsal High
Convex Side:	Rounded
Sinus:	Present
Apex:	Rounded
Height of Nak:	20 mm
Skin:	Intermediate
Basic Color:	Green
Overlay:	Yellow
Dots:	Small
Dot Color:	Yellow
Dot Texture:	Smooth
Overall External Appearance:	(3) out of (10)
Flesh Color:	Orange
Adherence to Skin:	No
Adherence to Seed:	Yes
Fiber Near Skin:	Few, Long
Fiber Near Seed:	Few, Short
Overall Objectionability:	No
Objectionability Rating:	(9) out of (10)
Taste Rating:	(9) out of (10)
Disease Rating:	(7) out of (10)
Seed Embryony:	Poly
Fruit Length:	11.2 cm
Fruit Width:	7.06 cm
Fruit Thickness:	6.4 cm
Fruit Weight:	281.42 g
Stone Weight:	36.6 g

Additional Note: Secondary Sample Group

Cultivar:	GENOVEA
Collection Date:	9 Sept 97
Analysis Date:	10 Sept 07
Position:	Ismailia
Shape:	Ovate-Oblong (4)
Lateral Compression:	No
Cavity:	None
Suture:	None
Shoulders:	Ventral High
Convex Side:	Rounded
Sinus:	Present
Apex:	Rounded
Height of Nak:	25 mm
Skin:	Thin
Basic Color:	Green
Overlay:	Yellow
Dots:	Intermediate
Dot Color:	Yellow
Dot Texture:	Smooth
Overall External Appearance:	(4) out of (10)
Flesh Color:	Orange
Adherence to Skin:	Yes
Adherence to Seed:	Yes
Fiber Near Skin:	Abundant, Long
Fiber Near Seed:	Abundant, Fine
Overall Objectionability:	No
Objectionability Rating:	(8) out of (10)
Taste Rating	(8) out of (10)
Disease Rating:	(8) out of (10)
Seed Embryony:	Poly
Fruit Length:	11.08 cm
Fruit Width:	6.04 cm
Fruit Thickness:	5.58 cm
Fruit Weight:	234.48 g
Stone Weight:	53.0 g

Additional Note: Secondary Sample Group

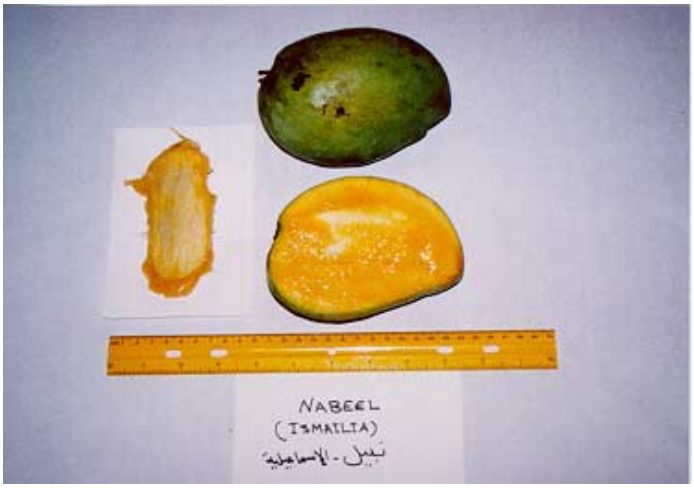
Cultivar:	KHANEFY
Collection Date:	8 Sept 97
Analysis Date:	10 Sept 97
Position:	Giza
Shape	Ovate (3)
Lateral Compression	No
Cavity	None
Suture	None
Shoulders:	Ventral High
Convex Side	Rounded
Sinus:	Absent
Apex:	Flattened
Height of Nak:	32 mm
Skin:	Not reported
Basic Color:	Greenish-Yellow
Overlay:	Orange
Dots:	Large
Dot Color:	Brown
Dot Texture:	Smooth
Overall External Appearance:	(6) out of (10)
Flesh Color:	Yellow
Adherence to Skin:	Yes
Adherence to Seed:	Yes
Fiber Near Skin:	Sparse, Fine
Fiber Near Seed:	Sparse, Fine
Overall Objectionability:	No
Objectionability Rating:	(8) out of (10)
Taste Rating:	(5) out of (10)
Disease Rating:	(9) out of (10)
Seed Embryony:	Mono
Fruit Length:	10.62 cm
Fruit Width:	8.34 cm
Fruit Thickness:	8.46 cm
Fruit Weight:	474.4 g
Stone Weight:	53.0 g

Additional Note: Secondary Sample Group

Cultivar:	MABROUKA
Collection Date:	8 Sept 97
Analysis Date:	10 Sept 97
Position:	Giza
Shape:	Ovate-Oblong (4)
Lateral Compression:	No
Cavity:	None
Suture:	None
Shoulders:	Ventral High
Convex Side:	Rounded
Sinus:	Present
Apex:	Rounded
Height of Nak:	35 mm
Skin:	Thick
Basic Color:	Yellow
Overlay:	Orange to Red
Dots:	Small
Dot Color:	Yellow
Dot Texture:	Corky
Overall External Appearance:	(6) out of (10)
Flesh Color:	Deep Yellow
Adherence to Skin:	No
Adherence to Seed:	Yes
Fiber Near Skin:	Few, Long
Fiber Near Seed:	Few, Fine
Overall Objectionability:	No
Objectionability Rating:	(9) out of (10)
Taste Rating:	(7) out of (10)
Disease Rating:	(9) out of (10)
Seed Embryony:	Mono
Fruit Length:	13.68 cm
Fruit Width:	8.98 cm
Fruit Thickness:	7.72 cm
Fruit Weight:	541.16 g
Stone Weight:	56.02 g

Additional Note: Secondary Sample Group

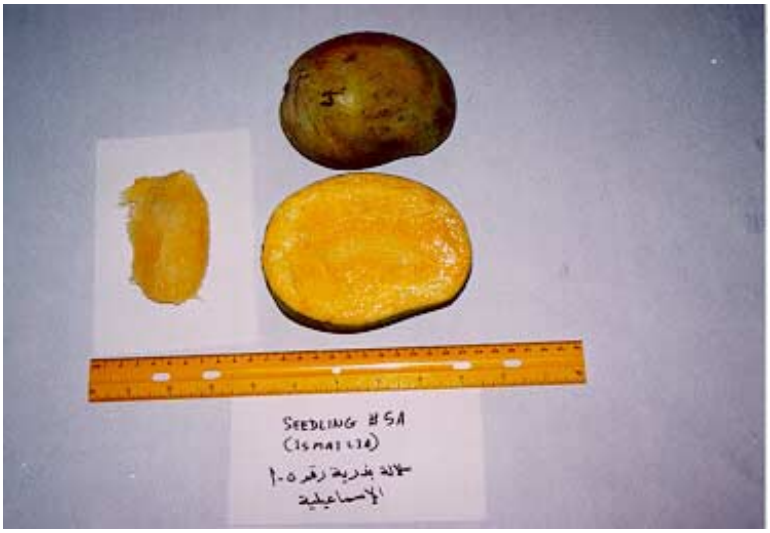
Cultivar:	NABEEL
Collection Date:	9 Sept 97
Analysis Date:	10 Sept 97
Position:	Ismailia
Shape:	Ovate-Oblong (4)
Lateral Compression:	Yes
Cavity:	Shallow
Suture:	None
Shoulders:	Ventral High
Convex Side:	Flattened
Sinus:	Present
Apex:	Rounded
Height of Nak:	30 mm
Skin:	Not reported
Basic Color:	Green
Overlay:	None
Dots:	Small
Dot Color:	Yellow
Dot Texture:	Smooth
Overall External Appearance:	(4) out of (10)
Flesh Color:	Orange
Adherence to Skin:	Yes
Adherence to Seed:	Yes
Fiber Near Skin:	Abundant, Long
Fiber Near Seed:	Abundant, Long
Overall Objectionability:	No
Objectionability Rating:	(6) out of (10)
Taste Rating:	(6) out of (10)
Disease Rating:	(7) out of (10)
Seed Embryony:	Poly
Fruit Length:	14.24 cm
Fruit Width:	9.0 cm
Fruit Thickness:	7.2 cm
Fruit Weight:	494.4 g
Stone Weight:	56.58 g
**Additional Note:	Secondary Sample Group**



Cultivar:	SEEDLING #1
Collection Date:	9 Sept 97
Analysis Date:	10 Sept 97
Position:	Giza (Dr. M. Bastawros)
Shape:	Ovate (3)
Lateral Compression:	No
Cavity:	Shallow
Suture:	None
Shoulders:	Ventral High
Convex Side:	Rounded
Sinus:	Present
Apex:	Rounded
Height of Nak:	30 mm
Skin:	Thick
Basic Color:	Greenish-Yellow
Overlay:	None
Dots:	Small
Dot Color:	Brown
Dot Texture:	Corky
Overall External Appearance:	(5) out of (10)
Flesh Color:	Orange
Adherence to Skin:	No
Adherence to Seed:	Yes
Fiber Near Skin:	Abundant, Fine
Fiber Near Seed:	Sparse, Fine
Overall Objectionability:	No
Objectionability Rating:	(6) out of (10)
Taste Rating:	(7) out of (10)
Disease Rating:	(9) out of (10)
Seed Embryony:	Mono
Fruit Length:	9.62 cm
Fruit Width:	7.66 cm
Fruit Thickness:	7.34 cm
Fruit Weight:	325.6 g
Stone Weight:	46.7 g
**Additional Note:	Secondary Sample Group**

Cultivar:	SEEDLING #2
Collection Date:	8 Sept 97
Analysis Date:	10 Sept 97
Position:	Giza (Dr. M. Bastawros)
Shape:	Ovate-Oblong (4)
Lateral Compression:	No
Cavity:	Shallow
Suture:	None
Shoulders:	Ventral Slightly High
Convex Side:	Rounded
Sinus:	Present
Apex:	Rounded
Height of Nak:	28 mm
Skin:	Thick
Basic Color:	Greenish-Yellow
Overlay:	Red
Dots:	Many
Dot Color:	Light Green
Dot Texture:	Smooth
Overall External Appearance:	(7) out of (10)
Flesh Color:	Yellow
Adherence to Skin:	No
Adherence to Seed:	Yes
Fiber Near Skin:	Few, Long
Fiber Near Seed:	Few, Short
Overall Objectionability:	No
Objectionability Rating:	(8) out of (10)
Taste Rating:	(7) out of (10)
Disease Rating:	(8) out of (10)
Seed Embryony:	Poly
Fruit Length:	10.6 cm
Fruit Width:	7.5 cm
Fruit Thickness:	7.0 cm
Fruit Weight:	340.34 g
Stone Weight:	34.48 g
**Additional Note:	Secondary Sample Group**

Cultivar:	SEEDLING #5A
Collection Date:	8 Sept 97
Analysis Date:	10 Sept 97
Position:	Ismailia (Dr. A. El-Sheikh)
Shape:	Ovate (3)
Lateral Compression:	No
Cavity:	Shallow
Suture:	None
Shoulders:	Ventral High
Convex Side:	Rounded
Sinus:	Present
Apex:	Rounded
Height of Nak:	25 mm
Skin:	Thick
Basic Color:	Greenish-Yellow
Overlay:	None
Dots:	Large
Dot Color:	Light Brown
Dot Texture:	Smooth
Overall External Appearance:	(4) out of (10)
Flesh Color:	Deep Yellow
Adherence to Skin:	No
Adherence to Seed:	Yes
Fiber Near Skin:	Few, Long
Fiber Near Seed:	Abundant, Fine
Overall Objectionability:	No
Objectionability Rating:	(8) out of (10)
Taste Rating:	(7) out of (10)
Disease Rating:	(8) out of (10)
Seed Embryony:	Poly
Fruit Length:	10.94 cm
Fruit Width:	8.32 cm
Fruit Thickness:	7.86 cm
Fruit Weight:	431.74 g
Stone Weight:	48.34 g
**Additional Note:	Secondary Sample Group**



Cultivar:	SEEDLING #15
Collection Date:	8 Sept 97
Analysis Date:	10 Sept 97
Position:	Ismailia (Dr. A. El-Sheikh)
Shape:	Ovate (3)
Lateral Compression:	No
Cavity:	Shallow
Suture:	None
Shoulders:	Ventral High
Convex Side:	Rounded
Sinus:	Present
Apex:	Rounded
Height of Nak:	32 mm
Skin:	Thick
Basic Color:	Green
Overlay:	Red
Dots:	Small
Dot Color:	Light Green
Dot Texture:	Smooth
Overall External Appearance:	(6) out of (10)
Flesh Color:	Deep Yellow
Adherence to Skin:	No
Adherence to Seed:	Yes
Fiber Near Skin:	Sparse, Long
Fiber Near Seed:	Abundant, Short
Overall Objectionability:	No
Objectionability Rating:	(9) out of (10)
Taste Rating:	(8) out of (10)
Disease Rating:	(9) out of (10)
Seed Embryony:	Mono
Fruit Length:	9.84 cm
Fruit Width:	8.30 cm
Fruit Thickness:	8.14 cm
Fruit Weight:	394.46 g
Stone Weight:	49.20 g
**Additional Note:	Secondary Sample Group**

Cultivar:	STAR
Collection Date:	7 Sept 97
Analysis Date:	10 Sept 97
Position:	Ismailia (*Seedling, Dr. A. El-Sheikh*)
Shape:	Ovate-Oblong (4)
Lateral Compression:	No
Cavity:	None
Suture:	None
Shoulders:	Ventral High
Convex Side:	Rounded
Sinus:	Absent
Apex:	Rounded
Height of Nak:	35 mm
Skin:	Thick
Basic Color:	Green
Overlay:	Yellow
Dots:	Small
Dot Color:	Light Orange
Dot Texture:	Smooth
Overall External Appearance:	(4) out of (10)
Flesh Color:	Yellow
Adherence to Skin:	No
Adherence to Seed:	Yes
Fiber Near Skin:	Few, Long
Fiber Near Seed:	Abundant, Fine
Overall Objectionability:	None
Objectionability Rating:	(7) out of (10)
Taste Rating:	(7) out of (10)
Disease Rating:	(9) out of (10)
Seed Embryony:	Poly
Fruit Length:	11.32 cm
Fruit Width:	8.86 cm
Fruit Thickness:	7.98 cm
Fruit Weight:	477.72 g
Stone Weight:	82.18 g
**Additional Note:	Secondary Sample Group**

PHENOTYPE EVALUATION -- Form (A)

Cultivar Name:
Selection Area:
Sample Date:
Rating Date:

SAMPLE I.D.	SHAPE	SIZE	FIRMNESS	COLOR	DISEASE	FIBER	TASTE	REMARKS
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

POMOLOGICAL EVALUATION -- Form (B)

NAME: _____DATE:_____SAMPLED FROM:

(I.) DIMENSIONS (cm):

(a.) Length {Top to Bottom}: (b.) Width {Front to Back}: (c.) Thickness {Side to Side}:

1.	6.	1.	6.	1.	6.
2.	7.	2.	7.	2.	7.
3.	8.	3.	8.	3.	8.
4.	9.	4.	9.	4.	9.
5.	10.	5.	10.	5.	10.

(II.) WEIGHTS (grams):

(a.) Fruit Weight:

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.

(b.) Stone Weight:

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.

(III.) EXTERNAL ATTRIBUTES:

(a.) Shape {Circle One}:
(1.)Round (2.)Ovate-Round (3.)Ovate (4.)Ovate-Oblong (5.)Oblong-Cylindrical
(b.) Lateral Compression {Circle One}:
Yes No
(c.) Cavity {Circle One}:
None Shallow Deep
(d.) Suture {Circle One}:
None Light Prominent
(e.) Shoulders {Circle One}:
Equal Ventral High Dorsal High
(f.) Convex Side {Circle One}:
Rounded Flattened
(g.) Sinus {Circle One}:
Present Absent
(h.) Apex {Circle One}:
Flattened Rounded Pointed
(I.) Height of Nak (cm):

(IV.) SKIN:

(a.) Thickness {Circle One}:
Thin Intermediate Thick
(b.) Basic Color {Circle One}:
(1.)Green (2.)Green-Yellow (3.)Yellow (4.)Orange (5.)Orange-Red (6.)Red (7.)Purple
(c.) Overlay {Circle One}:
(1.)Yellow (2.)Orange (3.)Red (4.)Purple
(d.) Dot Size:
Small Intermediate Large
(e.) Dot Color:
(f.) Dot Texture {Circle One}:
Corky Appearance Non-Corky Appearance

(V.) FLESH:

(a.) Color:
(b.) Adherence to Skin {Circle One}:
Yes No
(c.) Adherence to Seed {Circle One}:
Yes No

(VI.) FIBER:

(a.) Near Skin {Provide Description. E.g. Few & Long; Abundant & Fine; Sparse & Long; etc.}:
(b.) Near Seed {Provide Description. E.g. Few & Long; Abundant & Fine; Sparse & Long; etc.}:

(VII.) SEED EMBRYONY

(a.) Circle One:
Monoembryonic Polyembryonic

Evaluating Important Fruit Characters in Mango Germplasm

(**Fruit Varieties Journal 47(1):25-31. 1993** [*])

Abstract

Standardized criteria are needed to select mango (*Mangifera indica* L.) seedlings that merit retention in a varietal improvement program, and to compare selections and cultivars evaluated. Such criteria allow comparisons of seedlings and new or uncommon cultivars with well-known standards. Preferences vary in different regions of the world, and performance of a given cultivar may vary; however, applications of this system or clearly defined modifications of it can enhance the interchange of information and plant material worldwide. Traits of importance are shape, size, color, firmness, fiber content, disease resistance, flavor, and productivity. A tabular system for rating these characters was developed and is being used to advantage in a program of mango germplasm evaluation. Occasional defects such as fruit cracking, "jelly-seed" or internal breakdown, are noted when necessary in a "Remarks" column. A "Score" column provides a space to give an estimate of overall quality; also, a tree slated for discard is designated here by a special sign, "/x/."

The most efficient fruit varietal improvement programs entail an efficient exchange of information and also of germplasm that is evaluated for performance under a wide range of conditions. Such cooperative work involving the U.S. Department of Agriculture and various state and private organizations produced an array of new blueberry and strawberry cultivars superior to those in use earlier (2, 7). Specific criteria vital to a cultivar's success need to be applied to any possible selection to determine its varietal potential. Unless a specific genotype can produce acceptable fruit, resistant to disease and shipping and storage stresses, in sufficient quantities to supply market needs economically, it has no potential as a new cultivar despite other superior attributes it may have. Much time and expense is saved by rigorous use of a rating system that can pick out the few seedlings in a population that have varietal potential., and compare them realistically with currently important cultivars. Widespread application of such a system can enable one cooperator intelligently to select the most outstanding individuals from the working collections of others for trial under his or her own conditions. Limitations on land, water and labor increase the value of a system that permits such use of plant germplasm.

[*] Agricultural Research Service, U.S. Dept. of Agriculture, Miami, FL 33158-1399.

Careful laboratory analysis is required to obtain the precise data needed, and consistency over a period of years must be established before final decisions on varietal release are made. Before that time, however,. rapid evaluation procedures adapted to use on large numbers of individuals in the field are needed if adequate evaluation of seedling populations and first selections is to be carried forward. It is often helpful also to compare existing cultivars numerically. The application of a subjective rating system first used and described by Morrow *et al.* (6) affords such a means. Although each numerical rating is arrived at subjectively, the resulting figures from a panel of evaluators can be analyzed objectively so that the character and potential usefulness of a given individual or group of individuals can be conveyed with a minimum of confusion to others familiar with the system. Long used by breeders of deciduous fruit (2, 7) this approach has proved equally useful for evaluation of tropical and subtropical fruit in the Agricultural Research Service's Clonal Repository at Miami, notably avocado, carambola, lychee, and mango (5). Because of wide current interest in mango improvement and production of this fruit for North America and overseas markets, this system is now proposed to afford a uniform means of evaluating the performance and usefulness of specific mango cultivars and selections.

As a general rule, characters are rated on a scale of 1 to 10. (Fruit shape and yield, both special cases, are handled differently as discussed below.) A score of 1 indicates the least desirable, a score of 10 the most desirable rating for a particular trait. A score of 5 or lower for any character except fruit shape is enough to bar that clone from consideration for introduction, although it still may be selected for use in breeding if it has other desired attributes. Certain traits for which a given kind of fruit is rated may be critical in that fruit, such as fiber in the mango. Many characters, however, are of general importance. These include fruit size, color, firmness, taste, disease resistance, and productivity.

Characters for which mango germplasm is rated numerically include fruit shape, size, firmness, color, disease resistance, taste, fiber content, and yield (Table 1). A "Remarks" column also is added for field observations of conditions in one or a few plants that are not common enough in southeastern Florida to be regularly rated. Such remarked conditions include a tendency to crack, to be soft near the seed ("jelly seed"), to show internal breakdown at the stem end, to exhibit aborted seeds under some conditions, or to be otherwise deficient. Total value is summarized in a final column by assigning a 1- to 4-check rating of the plant as a whole (the greatest number of checks indicating the most valuable material), or by "/x/" if the plant is to be discarded. This system of check ratings is particularly useful where large numbers of trees are undergoing evaluation

because it quickly calls attention to the relatively few individuals in a column that are outstanding for a majority of the desired traits and so merit retention. Character ratings, and how these are estimated, are next discussed.

Shape. The numerical scale of 1 to 10 is not well adapted to describing mango fruit forms because the range of variation for this trait is narrower than such a range of figures would imply. Most fruit of a given mango cultivar consistently maintain a specific shape. Cultivars range from one extreme of nearly spherical, assigned a value of 1, through a more or less kidney-shaped intermediate form, given a value of 3, to an elongate cylindrical, sausage or parenthesis shape assigned a value of 5. Variants on these generalized forms occur, such as the presence or absence of a beak at the fruit's distal end and with or without a minute protuberance or nak at the stigmatic point on or above this, a sinus on the dorsal surface, or a depression at the peduncle's point of insertion. The last-named trait is a defect because it affords water a place to collect and promote fungal growth. Any obvious eccentricity of form can be entered under "Remarks." The 1 to 5 scale affords a useful method of quantifying form in seedling populations or of describing it briefly in a new selection or cultivar, but none of the numerical ratings given for shape warrants discard.

Size. Mango cultivars from parts of the world where the fruit is a traditional crop show a wide range of size. For example, cultivars commonly grown in India range from the small 'Dashehari,' which averages 172 g to 'Banganpalli,' which weighs approximately 625 g. Four other Indian cultivars, 'Chowsa,' 'Langra,' 'Pairi.' and 'Suvanarekha' all weigh less than 300g, while 'Neelum' at 364 g approximates the smallest size accepted in North America (3). The North American consumer's idea of proper mango size probably was influenced by 'Haden.' the first important commercial cultivar, which ranges from 460 to 685 g. Commercially successful cultivars in Florida now range in size from 'Van Dyke' (280-400 g) through 'Tommy Atkins' (460-685 g) to 'Keitt' (570-860 g) (1, 4). A fruit smaller than 'Van Dyke' would not be accepted, whereas 'Keitt', larger than some markets prefer, encompasses the maximum acceptable size. Accordingly, the numerical rating for 'Keitt' fruit size is 10, that of 'Tommy Atkins' is 9 and that of 'Van Dyke' is 6 or 7, depending on which end of its normal range the fruit under scrutiny approaches. The numerical rating thus reflects a mango fruit's relative size instead of the degree it conforms to the preferences of a specific market.

Firmness. Adequate firmness is essential to the success of any mango cultivar grown in one region and shipped to distant markets, just as it is for other fruit so handled. This trait varies widely within and between seedling populations. Fruit are rated for firmness when recognizably ripe, after color

break, at a stage of color and juiciness that permits fresh consumption and before obvious signs of aging appear. Old fruit of demonstrably firm cultivars, however, remain superior for this attribute. Firmness can easily be described by the subjective 1 to 10 rating system once the user has enough practice to learn the skill through handling the fruit. 'Van Dyke,' for one example, is among the firmest of well-known cultivars. 'Carrie,' on the other hand, has one of the least firm fruits of any named cultivar grown in Florida and would be rejected for commercial use even if it were otherwise acceptable. Firmness is unquestionably related to the amount and type of fiber in the fruit pulp; too little makes the fruit too soft to withstand packing and shipping stresses.

Color. Preference for a specific external appearance may vary more from one region to another worldwide than for many other traits. Certainly 'Carabao,' grown in the Philippines and exported from there to Japan, bears fruit of a light yellow color that would not be accepted on North American markets when more attractive fruit are available, nor would that of 'Alphonso,' one of India's most popular cultivars. North American markets favor a bright-colored fruit, blushed with red or purple, probably because of the long predominance of 'Haden' as the market standard here. Such a fruit invariably has a competitive advantage over less colorful fruit of the same season. Accordingly, color is rated from 1 to 10 based on a fruit's appearance, which is directly related to the amount of fruit surface covered by a blush, and the brilliance of the orange to red or purple coloration of the blush. The mango fruit's ground color is normally yellow, which will vary in intensity from a pale greenish hue to a deep shade that appeals to most consumers. Color preferences in the U. S. and Canada may change under the influence of recent immigrants from Southeast Asia and Latin America, just as the apple market has changed in recent years. Occasional mango selections without a bright blush are deemed sufficiently attractive to rate well above 5 for color. Such fruit has been rated "8Y," for example, so the unsuspecting colleague will know that an attractive fruit of predominantly yellow color (unblushed) is described.

Disease Resistance. Several fungal or bacterial diseases impact mangos in the course of fruit development. In Florida, anthracnose, caused by the imperfect fungus *Colletotrichum gloeosporioides* Penz., is far and away the most serious.. Mango scab, *Sphaceloma mangiferae* Bit. & Jenk., seriously mars the fruit of a few cultivars imported for experimental use, but it is not usually important on commercial cultivars or seedlings related to them. Susceptibility to scab definitely appears to be of genetic origin because some accessions regularly show it. Where this is observed, it can be noted under "Remarks," but scab is not common enough to justify rating every

clone for it. Powdery mildew, *Oidium mangiferae* Berthet, is unfortunately more common than scab in Florida, particularly in years when the flowering season finds warm sunny daytime weather followed by foggy, humid nights. Susceptibility to *Oidium* varies among mango cultivars both in Florida and elsewhere. Severely affected cultivars can lose most flowers to fungus-caused blight, and less affected ones may keep fruit that set but was infected; such fruit can mature with scars or surface depressions. Despite occasional severity, powdery mildew is not sufficiently frequent in Florida to justify rating all clones for it. Those observed to be severely infected need to have the fact remarked, and to be discarded unless otherwise so outstanding as to demand retention. Control of bacterial disease is not needed in Florida but is critically important in other areas, including Australia, Venezuela and some African countries. Where bacterial resistance is important, its incidence and severity will need to be observed and recorded.

Control of anthracnose caused by *Colletotrichum* fungus is a critical need in Florida, necessitating an effective spray program (1). Mango cultivars vary in field resistance to this disease, and some ('Tommy Atkins' and 'Keitt,' for examples) appear to retain considerable resistance after harvest. This is reflected in their superior shelf life. The commercial importance of these cultivars rests in part on their enhanced resistance to storage disease. However, no mango germplasm evaluated in Florida to date shows immunity to anthracnose disease; all unsprayed fruit shows symptoms to a greater or lesser degree. All mango introductions are evaluated for field resistance to anthracnose, however, because high resistance can augment a spray program in improving fruit quality and shelf life. A rating of 10 would indicate total freedom from infection, whereas a 1 rating is assigned to a fruit whose surface is entirely covered with anthracnose lesions. No mango introduction in the Miami repository is sprayed with fungicide during the season of flowering and fruiting, thus all can be compared for their relative resistance to anthracnose. Severity of infections can vary with the amount of early rainfall in a particular year, but relative differences among clones are reasonably consistent: those showing almost no infection in a "good" (dry) year continue to show less infection than more vulnerable cultivars in a "normal" or "bad" (wet) year.

Taste. Mango seedling populations often show remarkably wide variance in fruit flavor. Ratings for this attribute might be most influenced by preference. Undeniably it is more likely to be subjectively interpreted than most others. For this reason, it is important to keep in mind what would appeal to the widest audience, and to avoid letting preference for a particular regional or local type influence one's choice. This does not suggest that monotony is a desirable goal. On the contrary, the taste specific to fine named mango

cultivars needs to be kept as a criterion to avoid reducing all the selections made to a common level of blandness. In practice, rating mango seedlings and selections for taste is not difficult once experience is gained in the field, any more than is the case with blueberries, strawberries, or peaches, for other well-known examples. Furthermore, cultivars recognized as superior in one region are likely to be appreciated elsewhere as well. Certain well-known cultivars, such as 'Mulgoba,' 'Alphonso,' 'Edward,' 'Keitt,' and 'Cambodiana' can be kept as standards with which to compare newly tested clones. In addition, certain unacceptable flavors that crop up in seedling populations are easily recognized. Metallic taste, excessive turpentine, excessive acid, and extremely bland flavor are examples of what is often encountered and discarded. Use of a taste panel made up of knowledgeable individuals can reduce the subjectivity of this rating system. Progress is also under way to develop objective methods of complementing subjective data derived from mango taste tests (8).

Fiber Content. The first mangos grown in Florida were unimproved seedlings brought in from the Caribbean. The pulp of most contained abundant coarse fiber that tended to stick in the teeth and reduce the consumer's enjoyment of the fruit's eating quality. Improved germplasm imported later from India, the Philippines and Vietnam showed that the fruit's fiber content need not be objectionable. Evaluation of seedling populations from parents of good quality showed that coarse, objectionable fiber is not the rule in such material (5). In evaluating fiber content, two qualities need to be kept in mind: the fiber's relative abundance and its fineness or coarseness. Abundant fine fiber, of a texture unobjectionable to the consumer, is a necessity to protect the interior of a commercial cultivar from bruising and internal collapse during handling and shipping. Thus, a completely fiberless mango is not the goal of any well-conceived improvement program. Both 'Keitt' and 'Van Dyke,' with an abundance of fine, short-textured fiber, approach the ideal. Fruit of 'Tommy Atkins' is more fibrous, but this fact unquestionably enhances its shipping and storage abilities.

Yield. It may be questioned how much can be learned of the potential prolificacy of a mature cultivar through observation of its initial cropping as a young seedling. Furthermore, many mango clones are notorious for alternate bearing. For this reason, as much knowledge as possible of a potential cultivar's production needs to gained from the start of the evaluation period. Observation of different seedling populations over a period of years suggests that their early yields actually portend subsequent cropping behavior. The initial observations of this vitally important trait obviously must be confirmed by continuing observations throughout the

period of evaluation of a mango selection. There is no substitute for recorded kilograms and numbers-of-fruit data from replicated plantings to give a complete picture of a selection's potential vis-a-vis existing cultivars, and no new material should be seriously considered for release without such data . However, because of the ease of applying the 1 to 10 rating system (modified by the additional use of 0) as a field estimate of production, it deserves wide-scale used from the beginning of field observations. The ratings from 0 through 10 codify the rater's estimate of actual production compared to what it would be if a tree of a particular size were carrying a full crop, *i.e.* as much fruit as could be expected to mature normally. Thus, a tree with no fruit at all is scored 0; trees carrying a small number of fruit up to a crop of about 10 % of a full crop are scored 1; trees with greater crops up to 20% of normal are scored 2; and so on upwards, with a tree carrying 90% full crop scored 9 and one with a full crop, 10.

Application of the Rating System. Ratings derived through use of the system described here have been given mango seedlings and cultivars in the Miami germplasm collection over a period of years (5), based on their observed performance at that location. Modifications of the same system have been used in rating avocados, carambolas, longans and lychees.

More data are available on some accessions than others, depending on the length of time specific clones have been in the collection and the amount of attention devoted to them. Table 1 lists ratings of the most important Florida commercial cultivars and other local and foreign accessions. As more data are collected some ratings may change from those presented here, particularly the yield ratings, but Table 1 reports information currently available.

Table 1. Ratings assigned mango accessions in the USDA collection at Miami.

Clone	Shape[1]	Size[2]	Firmness	Color	nose	Fiber	Taste	Yield	Score[3]
Alphonso	3	5	7	2	3	7	9	1º	/x/
Boribo	3	8	8	4	7	9	5	6	/x/
Carabao	5	6	7	3	5	9	8	6º	/x/
Carrie	3	7	3	4	7	9	7	6	/x/
Gouveia	3	8	8	7	6	8	6	6	/
Haden	3	9	8	8	5	7	7	3º	/x/
Kensington	3	8	7	7	7	8	7	6	/
Keitt	4	10	9	6	8	9	8	8	/ / /
Langra	2	6	8	3	5	8	8	3º	/x/
M-13269	3	8	9	5	7	7	7	8	/x/
Ono	4	7	5	6	7	7	7	6	/x/
Pope	3	9	5	7	2	8	8	1	/x/
Ruby	5	5	10	8	8	8	8	5º	/x/
Tommy Atkins	3	9	9	9	9	6	6	7	/ / /
Tyler	1	9	9	3	4	9	4	6	/x/
Van Dyke	3	7	10	9	7	8	7	6	/ /
Winters (M-20222)	4	7	7	8	7	7	7	7	/

[1] Ratings of 1 (round) to 5 (long) indicate a fruit's shape, not its desirability.

[2] Ratings below 6 justify discard; those above 7 show size only, not merit.

[3] 1 or more checks indicates overall value; /x/ lacks commercial acceptability

ºTends markedly toward alternate bearing.

Daily Travel Log

August 30 (Saturday)

Arrive in Cairo, Egypt from Frankfurt, Germany, 7:00 PM.

August 31 (Sunday), Orientation and Introductions

Leave Hotel (Pyramisa Cairo) 8:45 AM. Arrive at ATUT Headquarters, 9:00 AM, and meet with Dr. Kelly Harrison, Project Director, then meet with Dr. Antonio Lizana, Horticultural Specialist, as well as Dr. Assam Sheltout, Horticulture Project Coordinator, and Dr. Ali El-Khoreiby, Mango Champion, Dr. Ibrahim Desouki, Professor of Horticulture at Ain Shams University who specializes in mangos, and Dr. Ahmed El-Sheikh, postharvest physiologist at Suez Canal University, Ismailia and our counterpart scientist. We reviewed the goals of the subsector project, our roles, and the schedule for our time in Egypt.

Collect Egyptian and imported mango cultivars and work with Egyptian colleagues to evaluate them for export potential, and determine which of those currently grown can realistically be expected to compete in international markets with cultivars from other countries now in commerce.

Enumerate those characters that enhance the export prospects of any cultivar that appears to have potential for the international market.

Present a workshop on our findings and submit a written report.

Completing our meeting at ATUT Headquarters, we went with Dr. El-Khoreiby and Dr. El-Sheik to Ain Shams University, Cairo, and met Dr. Narriman Mahmoud Abu El-Nasr, who breeds stone fruits, and visited with her in the laboratory there. We sampled some of her excellent almond selections.

September 1, 1997 (Monday),

First Visit to Suez Canal University, Ismailia.

Leave hotel at 7:00 AM and in the company of Dr. Desouki and Dr. Mahmoud Abu El-Nasr arrive at Suez Canal University at 9:00 AM, meeting

Dr. El-Khoreiby, Dr. El-Sheikh and Dr. Anwar Abd El Sattar, Vice Dean of the Faculty of Agriculture of the University.

We visited the orchard of Samir Khalaf at El Ferdan, not far from the University, and purchased fruit of ‘White Succari’ and ‘Zebda’. Mr. Khalaf’s orchard showed little or no evidence of the mango malformation disease. We

took the fruit we had bought back to the Plant Pathology Laboratory for evaluation, and initiated the work protocol that we followed for the balance of the tour (see Part II, Preliminary Laboratory Results).

Evaluation Procedure.--Each cultivar is phenotypically rated for **shape** on a 1 to 5 basis (1 being round, 3 kidney-shaped and 5 long and cylindrical). The numerical ratings for shape are strictly descriptive and are not a basis for retention or rejection. Cultivars are then subjectively rated from 1 to 10 for **size**, external **color**, **firmness, disease, fiber** content and **taste**, with values of 6 and above considered adequate for retention as an export cultivar. In addition, cultivars are rated on a worksheet for characters of fruit, flesh and seed that are used in making a **pomological description.** The third part of the evaluation consists of the collection of objective numerical measurements of **firmness** using a Magness penetrometer, and of fruit and seed **weights, dimensions** (length, width, thickness), **Brix** values of the juice to determine sugars, and also juice **pH** and **total acids**. Following this protocol, we collect data adequate to develop an accurate description of the fruit of any cultivar or seedling that is to be evaluated.

At 5:00 PM we returned to Cairo, arriving at the Pyramisa Hotel at 7:00 PM.

September 2, 1997 (Tuesday), Continuation of Work at Suez Canal University.

Leave hotel at 7:00 AM, arrive Suez Canal University at 9:00 AM and meet with colleagues to continue the evaluation work.

Visited the orchard of Zabal Shahata at Azadir, Kilo 4.5 on the Ismailia-Port Said road. Again this grove showed little infection with malformation. We purchased fruit of 'Excellent Succari' for future evaluation. Then we visited the Wholesale Market in Ismailia and purchased fruit of 'Alphonso', 'Bullock's Heart', 'Ewais', and 'Hindi Besennara', also for laboratory evaluation.

We returned to Dr. El Sattar's Plant Pathology laboratory and continued the evaluation work that we began on September 1. This laboratory, once we set up for analyses and photography, proved to be a congenial work area, and we continued to work here for the balance of the tour. A very helpful contribution was made by the students who, working under Dr. El-Sheikh's guidance, made titrations and obtained pH readings of the fruit we evaluated.

September 3, 1997 (Wednesday), Continuation of Work at Suez Canal University.

Evaluations of 'Bullock's Heart' and 'Mesk'.

September 4, 1997 (Thursday).

In a change from established routine, R. J. Knight met at 9:30 AM with Dr. Mamoudh Riad, Undersecretary of State in the Ministry of Agriculture and Land for Afforestation, and discussed this aspect of developmental activities in Egypt. One fact of particular interest was his indication that experimental plantings of *Khaya nyasica* (African mahogany) are being grown with success using recycled (sewage) water in Upper Egypt This suggests an important future development for the country since this tree gives a cabinet wood of fine quality. With Dr. Riad, visited an agricultural area along the Cairo-Alexandria highway that has developed in this sandy area over the past 20 years. A variety of crops are grown, including apples, apricots, dates, citrus and mangos. A planting of Atemoya (hybrid annona) trees was slated for removal because it does not fruit without hand pollination under desert conditions; this may be due to the very low humidity here. We also saw humus derived from Cairo city waste applied to the sandy soil to improve its texture and base exchange capacity. This product is presently expensive but might in time, if costs are reduced, become a useful soil amendment.

With Dr. Riad, visited the El-Dena Farm, a privately-owned enterprise located on 40,000 feddans, 10,000 of which currently are put to agricultural use. The farm has a dairy enterprise that produces powdered milk, and extensive plantings of alfalfa under circular irrigation; also plantings of vegetables, dates, citrus and mangos. We saw numerous trees of 'Ewais' mango, and one tree of 'Zebda' that carried nearly a full crop. As with other locations in Egypt at this time, it was difficult to assess the mango crop in general because orchard workers have been harvesting the fruit for the past six weeks. No ripe fruit were in evidence because they pick all mature fruit twice a day. No mango malformation was evident. Many young trees of about 6-7 meters height appear good prospects for frame development training.

Mr. Sanford spent the day entering raw data collected from the laboratory on the lap-top computer.

September 5, 1997 (Friday)

Day off.

September 6, 1997 (Saturday)

Continuing Laboratory Evaluations of Fruit.

We returned to Dr. Al-Sattar's laboratory and evaluated fruit of 'Company', 'Mabrouka' from Ismailia, 'Taimour' and a monoembryonic variant of 'Hindi Khassa'. This last-named was sold to us and our colleague (Dr. El-Khoreiby) in the Ismailia Wholesale Market as 'Hindi Khassa', and it was only after we

had completed lab evaluation and determined that it was monoembryonic (not polyembryonic, as 'Hindi Khassa' normally is) that its authenticity was questioned. This brings out an aspect of Egyptian mango culture different from that of Florida, Mexico and many other areas. Commercial mango cultivars in Egypt with a few exceptions (*i.e.* 'Alphonso', 'Mabrouka' and 'Pairi') are polyembryonic and are normally grown from seed. Most young seedling trees are from nucellar embryos that are genetic replicas of the maternal tissue, but if an occasional zygotic seedling appears that mimics the maternal phenotype, there is no way to separate it from its look-alike siblings unless, as happened here, it can be distinguished by the monoembryonic character. The only way to prevent future occurrences of this nature is to select healthy "mother trees" of acceptable phenotype from which all young trees of a given cultivar can be propagated by grafting. Because this particular fruit was represented to us as 'Hindi Khassa' and examined as such by us, the information on it will remain in our database with a note indicating the questionability of its true identity.

September 7, 1997 (Sunday).

Visit to Dr. Mikhail B. Bastawros, Head of Tropical Fruit Research Department, Ministry of Agriculture, Giza.

Dr. Bastawros discussed his 30-year experience in selecting outstanding mango seedlings that he feels may have varietal potential. He then took us to the Khanefy orchard near Giza, where the trees he works with grow. Because of the popularity of brightly blushed cultivars in the international market, we were particularly interested in his selection #2. (He subsequently gave us fruit of this and several other seedling selections for evaluation.) Selection #2 has a fruit that is not large, but is attractive. Some mango malformation was evident in the Khanefy orchard, and some trees appeared to show resistance. This disorder can be controlled if the grove managers continue to cut down the tall, 30-year old trees to manageable height and top-work them, as they have been doing, while carefully removing and burning all malformed tissue. Some cultivars showed freedom from malformation although they were growing next to infected trees, and thus appear to have genuine resistance. ('Mabrouka' may be one of these resistant cultivars, but we did not see enough trees to enable us to put confidence in this supposition. The possibility of resistance in some commercial cultivars merits further serious investigation.)

Sunday afternoon we visited ATUT-RONCO Headquarters and planned activities for the coming week.

September 8, 1997 (Monday).

Traveled from Pyramisa Hotel to ATUT-RONCO Headquarters to discuss the possibility of evaluating 10 or more minor cultivars and seedling selections that could be of merit. Authorization for a continuance of Mr. Sanford's participation past his original cutoff date was secured from the University of Florida, and travel arrangements were altered accordingly. Reached the University laboratories at Ismailia, with cultivars from the Giza plantings, by mid-afternoon. Remainder of the day was spent preparing for laboratory activities for the next day, and photographs were made of cultivars under evaluation. Arrived at Pyramisa at approximately 7:45 PM.

September 9, 1997 (Tuesday).

Traveled to Ismailia at 8:00 AM to conduct the aforementioned analyses on minor cultivars and seedling selections as planned. This activity took most of the day, and a large amount of the projected work was accomplished. Participation by graduate students at the lab, under the close supervision of Dr. Ahmed El-Sheikh, greatly aided our efforts to maximize use of time and resources.

September 10, 1997 (Wednesday).

Home-stretch Laboratory Evaluations of Fruit.

Leaving the hotel as usual we reached Dr. Al-Sattar's Plant Pathology lab in Ismailia at 9:00 AM and passed the workday evaluating fruit of the remaining mangos of our secondary cultivar group, "targets of opportunity," and of seedlings that some of our colleagues consider may have potential to become cultivars. Among these cultivars are 'Excellent Succari', 'Genovea', 'Khanefy', 'Mabrouka' from Giza (for comparison with the same clone from Ismailia), 'Nabeel', Giza seedlings #1 and #2; Ismailia seedlings #5A, #15, and 'Star' (a seedling selection). Completing this work we returned to Cairo, reaching the hotel at 7:30 PM.

September 11, 1997 (Thursday).

Work at ATUT Headquarters.

Left hotel at 8:30 AM, arriving at headquarters at 8:45. Passed the workday entering mango evaluation data in the computers at RONCO, for use in preparing our final report. Returned to the hotel at 6:00 PM.

September 12, 1997 (Friday)

Day off.

September 13, 1997 (Saturday)

Work on Final Report at ATUT Headquarters.

Left hotel at 9:00 AM, arrived at headquarters at 9:15. Passed the workday continuing to enter mango data in computers for use in preparing the report.

September 14, 1997 (Sunday),

Cairo Market Visit, Workshop and Office Work at ATUT Headquarters.

Left hotel at 7:00 AM and visited the Cairo Wholesale Fruit Market, to determine whether any Florida mango cultivars were available there. Extensive displays showed Egyptian cultivars in great variety, but we saw no fruit of 'Keitt', 'Kent' or 'Palmer', which we hoped to evaluate under Egyptian conditions. Future consultants in the project may find this market a useful source of fruit of important commercial cultivars to evaluate.

Reached ATUT Headquarters at 9:45 AM and engaged in office work until 11:00 AM, when we met with Egyptian research personnel, Dr. Antonio Lizana and Dr. Pieter Stassen, from South Africa, for an informal Workshop Discussion of our work to date and the Egyptian mango industry's potential for expansion and overseas market development.

At 1:00 PM Sunday we resumed office work related to the report, and at 5:30 returned to the Pyramisa Hotel.

September 15, 1997 (Monday),

Final Work Session at ATUT Headquarters.

Left Pyramisa Hotel at 8:00 AM, reaching ATUT Headquarters at 8:15 AM. Passed the full day engaged in office work and final fruit evaluation, of 'Pairi' from the farm of Mohammed Seiri at Kasaseir, Ismailia Governorate. Completed draft of report and returned to hotel at 8:00 PM. Packed to return to Florida.

September 16, 1997 (Tuesday),

Departure from Egypt.

Left Cairo International Airport at 7:15 AM. Arrived Miami, Florida at 8:01 PM.

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