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FRUIT TREES BREEDING IN EGYPT: OBJECTIVES AND CONSTRAINTS

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Modern approaches in fruit breeding should be extensively manipulated to overcome constraints that hinder and slow down fruit breeding and improvement. Fruit trees have some distinguished features from the standpoint of breeding and improvement. Such features should be fully understood and measured to overcome the difficulties they present to genetic improvement should be worked out. This article will emphasize on reviewing goals of fruit trees breeding in Egypt and some constraints that would face fruit breeders.

Objectives of fruit breeding in Egypt

These may be summarized as follows:

A) Increased fruit yield is the main objective of fruit trees plantations . The fruit breeder should overcome all obstacles related to horticultural fruit set such as selection and production of high yield cultivars, sterility, pollen incompatibility and fruit drop.

B) Development of cultivars tolerant to different pests and pathogens: such as insects (citrus, apples, date palms, olives, pomegranate), fungi (citrus), (mangoes and grapes), mildews (stone fruits), bacteria (apples), fire blight (peaches), virus (stone fruits, citrus), nematodes (stone fruits), root knot and others.

C) Development of cultivars adapted to specific environments dominant in Egypt

1. Cultivars with low chilling requirements for the subtropics and areas of mild winters as in case of deciduous fruit trees. Available chill units in Egypt is about 150 to 300 hours below 7.2 °C (45 F), which is considered very limited for bud break of excellent cultivars of apples, peaches, plums and pear. Therefore there is a great necessity for development cultivars of low chilling requirements with better fruit quality. In this respect, some cultivars of apple, peaches and apricots of low chilling requirements were introduced and now are commercially growing but their qualities are influenced by adaptation to environments of different localities in Egypt. The effects included fruit skin color (apple), sugars and acidity (peaches and apricots).

2. High (deciduous fruit trees) and low (banana, mangoes and other tropical fruit trees) temperatures. High temperatures greatly affect fruit quality of deciduous fruit trees while low temperature (sometime frost) is a limiting factor for production of subtropical and tropical fruit crops in Egypt.

3. Drought and low humidity (domain in central and upper Egypt) affect fruit set of fruit crops (e.g. citrus (El-Agamy *et al* 2000) , pineapple, papaya).
4. Light: photoperiod (coffee), intensity and quality (citrus, coffee).
5. Soil conditions e. g. water table (stone fruits, apple, pear), pH (pineapple, blueberry), soil texture (citrus) and salinity (mangoes, apples, citrus).

D) Development of cultivars that suit certain purposes: such as taste and other fruit qualities (local vs. export) and juice quantity and quality (TSS %) as in fruit preservatives and canning. Great demands in Egypt are now directed to export; early (grapes and citrus) as well as late (mangoes and citrus) cultivars. Fruit juice such as mangoes, citrus and guava was found to be of high demand in the international markets (particularly the gulf countries) as well as the local market which emphasizes the development of new cultivars with high juice content associated with high total soluble solids-(T S S %) .

CONSTRAINTS TO FRUIT BREEDING

The following are some of constraints faced by fruit breeders in fruit breeding and improvement generally and in Egypt ; particularly:.

1.Long juvenility

Fruit trees are generally characterized by long juvenility (up to 10 years as in mango, olive and date palm) particularly for seed propagated plants (e. g. sexual hybrids). In addition, hybrids are evaluated by grafting on adult rootstocks in order to hasten fruiting, which could affect performance, as a result of the effect of rootstocks. Moreover, backcrossing is a routine breeding method to fix economic traits in some hybrids however; backcrossing is delayed by the long juvenility. High- and ultra-density nursery planting of new genotypes were found to be an important tool to overcome such problems (Sherman & Sharp 1973). Selection in this case will be focused on precocious hybrids as has occurred in apples and peaches. In addition, early screening using some associate traits (gene markers) would partially help overcoming the long juvenility obstacle(El-Agamy and Sherman 1987).

2. Heterozygosity

Fruit trees are known to be heterozygous for most of their genes. Selection is usually practiced for fruit quality and yield followed by asexual propagation is the ordinary procedure to maintain genetic identity Therefore, when hybrid are made, the arising wide segregation would present a problem for the breeder in terms of time and effort to deal with segregants. Pure lines are not known in fruit species. However such lines may be developed using modern techniques of biotechnology such as doubling of haploid genotypes through the *In vitro* anther culture).

3.Polyembryony

Some fruit trees; such as citrus and mangoes produce seeds, which in addition to the sexual embryo have one or more vegetative- or nuclear embryos. Such embryos can not be morphologically distinguished and usually suppress the sexual embryo (hybrid), therefore would act against the breeder's interest. In addition, vegetative embryos are genetically identical with maternal tissues. Several techniques are proposed to overcome the problem of polyembryony:

i) Utilization of mono-embryonic female parent such as Shaddok (Citrus maxima) in citrus and Alphonse, Pairi, Mabrouka and Figri Kalan cultivars in mangoes. However, this approach may introduce some undesirable traits from the female parent that require additional back crossings to the male parent which in addition to the long juvenile stage , would further extend the breeding program.

ii) Use of parents that have morphological traits (gene marker) which can be distinguished in the progeny [e,g. trifoliate leaf in citrus ; leaf color, stipules, glands in peaches and nectarines .etc (El-Agamy & Sherman 1987) as well as the breeder's experience in detecting sexual hybrids.

iii) Use of chromatographic separation, banding patterns and DNA fingerprinting for distinguishing between embryo types.

4. Asexual Propagation

Fruit trees are normally propagated by asexual means and this is good for both consumer and grower but not for the breeder since:

i) Asexual propagation would block the appearance of beneficial (for breeder) trait (s) that normally appear in segregation occur by sexual propagation.

ii) Asexual propagation is sometimes associated with viral transmission, which would influence the performance of hybrids and their progenies.

5. Sterility & Incompatibility

Sterility & Incompatibility are widespread phenomena among fruit crops such as stone fruits (cherry, almond , peaches and plums), annonas, pineapple, cacao, citrus and blueberries (El-Agamy *et al* 1983). Several other fruit crops may have some sort of unfruitfulness or low yield that may be related to incompatibility, sterility or fertility. However, this phenomenon might be overcome by some horticultural practices such as fertilization and application of growth regulators. Therefore, unless the fruit breeder is aware of the presence of such phenomena in the crop of interest, much of his efforts and time may be wasted. Fluorescent microscopy (El-Agamy *et al* 1982) and embryo rescue (El-Agamy & Sherman 1983) techniques were found as a useful tools to determine source(s) of unfruitfulness. The pioneer pollen concept (El-Agamy &

Sherman 1987) can also be used, as pollen of incompatible male parents may be induced to develop seed if they have been used shortly after pollination by compatible pollens of another male parent (which would pave the way to the incompatible ones). In addition, in vitro fertilization can also be a suitable technique in this respect.

6. Mutation and Chimera

Although natural mutation and chimera occur frequency in some fruit crops, less beneficial ones were detected (navel orange, for example). Larger numbers of mutations and chimeras can be lost if not recognized by breeder and / or the site of chimera (inner mutant layer(s) as thorn-less blackberry periclinal chimera. Moreover, it is well known that chimera's breeding is very hard to follow since they are normally unstable.

7. Sexual Propagation of Rootstocks

It is a common practice that horticulturists use sexual propagation in the production of rootstocks on which new hybrids are grafted.

The performance of these grafted hybrids might be influenced by the variation among-rootstocks resulting from sexual propagation. In vitro clonal propagation of rootstocks (Bondok *et al.* 1987, 1989 for apples and plums) would provide rootstocks of uniform genotype for testing hybrids .

8. Polyploidy

About 50 % of fruit crops contain some degree of polyploid (banana, cherry, apple, citrus, strawberry, blueberry ... etc). Inheritance of traits in polyploid species represent a further complication for the breeder needs more time and effort to deal with enlarged numbers of genotypic segregates.

9. Tree Size , Spacing and Height

Large tree size of fruit crops compared to other crops (vegetables, field crops) requires larger plant spacing. Therefore, the fruit breeder, unlike breeders of other crops has to expend more effort and resources that may not be available for him to follow crosses and progenies at such large scale in addition to the increased chances of loss of some genotypes due to unfavorable climatic factors. High-density plantation as described by Sherman *et al* 1973 represents an excellent technique that enhanced peach breeding program in Florida. Tree height (date palms, mangoes, papaya, coconut, oil palms) may also need certain facilities to implement the fruit breeder's work adding further difficulties to the breeding process.

10.Dormancy & Chilling Requirements

Deciduous and temperate zone fruit crops are characterized by rest (endogenous dormancy) period that prevents hybrids embryos from germinating and therefore

requiring some chilling treatments (the same is also needed for bud dormancy breaking). Thus the fruit breeder has to devote more time and efforts to bring his hybrids to immediate germination (El-Agamy & Sherman 1983).

11.Parthenocarpy & Apomixis

Some fruit species tend to produce parthenocarpic fruits without pollination and / or fertilization (in addition to early embryo abortion), which would make it difficult for the fruit breeder to obtain sexual hybrids (banana, navel orange, apples, grapes). In vitro embryo rescue was found to be a good tool for overcoming this problem (El-Agamy & Sherman 1982).

12. Irregular & Alternate Bearing

It is a very common phenomenon in fruit species to have alternate and / or irregular bearing of fruits such as in apples, stone fruits, olive, date palm, and mangoes. Such phenomena would represent obstacles to the regularity of fruit breeding programs as the breeding plan may be encountered by un-flowering the whole year (may be more than a year) which effects efficiently of selection irregular flowering and fruit set..

13.Other Constraints

These would include:

1.The natural occurrence of inter- & intra – specific hybridization occur naturally.

2.Problems related to plant & flower structure such as: sex separation(date palm, papaya), sex reversion (papaya), sex ratios (mangoes, olives, date palm, papaya)..

3.Environmental conditions and hazards.

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تربية أشجار الفاكهة فى مصر: الأهداف والمعوقات

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إن تربية أشجار الفاكهة في أشد الحاجة لإستخدام بعض الطرق و التقنيات الحديثة للإسراع من برامج تربية الفاكهة و للتغلب علي بعض مشاكل تربية الفاكهة حيث تتميز أشجار الفاكهة ببعض الخصائص التي تزيد من صعوبات التربية في الأشجار المعمرة فضلا عن بطء التوصل إلي نتائج . و في هذه المقالة سوف يتم التعرض علي بعض خصائص شجرة الفاكهة من وجهة نظر مربي النباتات و أهم أغراض تربية الفاكهة في مصر

ومن أهم خصائص شجرة الفاكهة من وجهة نظر مربي النباتات :

طول فترة الطفولة ــ التباين الوراثي(الخلط) ــ تعدد الأجنة ــ الإكثار الخضري المستمر ــ انتشار العقم و عدم التوافق الذاتي و الخلطي ــ انتشار الطفرات و الكيميرا -التطعيم علي أصول جذرية ناتجة من الإكثار الجنسي ــ التضاعف الوراثي ــ كبر حجم و ارتفاع نباتات (أشجار) الفاكهة و الحاجة إلي زراعة النسل علي مسافات واسعة ــ العقد البكري للثمار و تكوين ثمار لا بذرية (لا هجين) ــ الكمون الداخلي (طور الراحة) في البذور و البراعم ــ عدم انتظام و تبادل حمل المحصول (المعاومة) ــ فضلا عن بعض الخصائص الأخري مثل الهجن النوعية ، تركيب الزهرة ، النسبة الجنسية ، ارتداد الجنس ، تأثير الإجهاد البيئي .

و تتركز أهداف تربية الفاكهة في مصر في : ١) التغلب علي ضعف المحصول ، ٢)إنتاج أصناف مقاومة للآفات و الأمراض كالحشرات (موالح و تفاح) ، الفطريات (موالح ، مانجو ، العنب ، الفواكه ذات النواة الحجرية) ، البكتريا (تفاح ، الخوخ) ، الفيروسات (الموز ، الموالح ، الفواكه ذات النواة الحجرية) ، النيماتودا (الموالح ، الفواكه ذات النواة الحجرية) ٣)إنتاج أصناف و أصول جذرية تتحمل ظروف البيئة المصرية من جفاف ، ملوحة ، ارتفاع مستوي الماء الأرضي ، قلة ساعات البرودة اللازمة للتغلب علي الكمون الداخلي في البذور (الأجنة و الهجن) و البراعم ، ارتفاع الحرارة و الصقيع ، ٤) إنتاج أصناف ملائمة للغرض من الزراعة (تصدير ، تصنيع ، ذوق المستهلك المحلي).