

Methods to be adopted to Maximise the Production and Development of Improved Strains and Plant Material, in Relation to Horticulture *

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Fruits, vegetables, flowers and other horticultural crops have always had a perennial interest for man. Horticulture received considerable attention from the Hindu and Moghul Emperors who beautified their capitals and pleasure resorts with fruit and ornamental trees; some of the former, like the Jehangir and the Himayuddin varieties of mangoes are even now reputed for their luscious qualities. But then, horticulture had been a hobby of the well-to-do or the aristocracy and was not taken up as a serious avocation by the ordinary grower. There has therefore been a gradual and great decadence. However, the few gardens that have survived to the present day, still bear witness to the excellence reached by Ancient and Medieval India.

Lack of enterprise and tardiness in the adoption of improved methods have arrested to some extent the development of superior types. Some of the finest varieties which have originated by chance in nature, can only be perpetuated by artificial means, for, under free competition of natural selection they would disappear. As for systematic research and rapid building up of really comprehensive experimental plantations, we have yet a field of highly useful, most remunerative and intensely interesting work before us.

Present drawbacks: Some of the factors which have been responsible for lack of any tangible progress in this field are enumerated by Naik (2) as follows: Neither among the producers nor among the consumers of our country, standardised fruit quality has counted for much. Quantity rather than quality, cheapness, rather than a standard of excellence, have been the ruling features of our fruit and vegetable markets. Even those who can afford and are willing to pay for good fruit are not always fortunate in securing what they desire. Under-production of good quality fruit is almost a common feature of all gardens or orchards. The private nursery trade and the indiscriminate purchase of plants may also be partly responsible for this state of affairs. The same spirit of indifference and ignorance explains the failure to take timely measures to control pests and diseases. Vegetable seed production being

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uncontrolled, the growers are largely at the mercy of irresponsible suppliers of seeds. While bad seed in agriculture results in the loss of a season's crop, a bad plant in fruit growing leads to recurring loss for many years.

Possibilities: It is indeed fortunate that Madras State possesses immense potentialities for development in this direction, on account of its diverse soil and climatic conditions. Horticultural crops of a wide range of types are found to thrive to an unexcelled degree and have proved to be the source of several essential and supplementary foods on the basis of quality, calorific content and nutritive value, and also have yielded highest returns per unit area.

Any plan of *development* of an improved strain has necessarily to follow one of *production*. Some of the methods through which such improved strains can be produced, are discussed below.

Introduction of varieties: The foremost plank of fruit development as stated by Rao (4) is introduction and testing of varieties. Most of the economic and industrial plants of Nilgiris are of a foreign origin. The apple, pear, plum, peach, strawberry, persimmon, mangosteen, litchi, durian, passion fruit, avocado etc. are some of the notable introductions in fruits. The Singapore jack introduced recently from Ceylon by the Director of Agriculture, Sri M. S. Sivaraman, has proved its worth by its precocious tendencies at the Kallar fruit station and has also been found to thrive successfully in four other districts of the State. Countless number of medicinal plants, plants yielding oil, essences, dyes, spices, beverages, condiments etc. which are all of great commercial value are found to thrive in our stations, and it is up to us to add to this wealth by constant introduction both from our rich native flora and from abroad. As Popeno (6) says, *Pomona* (meaning the Goddess of fruit) still shows herself as a savage beauty in the tropics, requiring the aid of culture for the full development of her attractions.

Selection: With most tree fruits, the earliest horticultural breeding consisted in sowing of seeds from specially grown trees, this being followed by multiplication of selected types by budding, grafting, layering and other such vegetative methods of propagation, for obtaining stable varieties. Later came the occasional selection through bud variation etc. By such means were obtained and preserved a number of cultivated forms from which most of our varieties have been selected.

Chance seedlings: By far the largest number of varieties grown at present have been obtained from seedling trees not grown with the purpose of producing new varieties. Singh (8) observes that selection of chance seedlings has given thousands of outstanding horticultural varieties of fruits, vegetables and flowers that 95% or more of the varieties produced in the world may be said to have been derived from some type of simple

selection. The *Chinnaswarnarekha* mango of the Circars, *Mundappa* of South Kanara and *Padiri* of Tamilnad are notable examples of such selection, the seed parents of which are believed to be alive even till today. A constant and vigorous search should therefore be made among our orchards, forests, home gardens etc., for spotting such outstanding types.

But sports, mutations, chimeras, polyploids etc.: Several new varieties and strains of fruit are known to have originated as budsports and many more ornamental plants have so originated. These sports or mutations are heritable variations in stem, leaf or fruit, resulting as a sudden change in the genetical constitution. Shamel (7) goes to the extent of saying that the differentiation of horticultural varieties in such a group as sweet orange or lemon has taken place mainly by somatic change or bud variation, without any frequent recombination of genes in sexual reproduction. Such changes have contributed significantly to the origin of new and improved plants. In the Washington Navel orange of U. S. A., 19 strains of considerable importance and five of minor economic sequence together with a large number of individual fruit and limb variations have been discovered. Improved plants of sweet pea, raspberry and other horticultural plants have similarly been obtained. It is beyond the scope of this paper to detail the several such discoveries in each kind of plant.

Instances of the undesirable results of such changes are also equally numerous and perhaps constitute a factor which deserves a more serious consideration. In fact, it is said that it was the discovery of perpetuation of worthless bud variations through unintentional propagation in commercial nursery practice that led to the study of bud variations. A study of a Washington Navel orange orchard is stated to have shown 352 very undesirable entire tree variations out of a total of 1,500 trees.

Polyploidy: Forms exhibiting polyploidy have also a similar importance. Many cultivated species of *Rubus* and common European plum are polyploids. Recently a giant form of pear, producing fruits of better quality and about twice the size and weight of the parent variety, has been reported from England. Citrus workers in California have spotted many tetraploid forms.

Artificial methods of inducing mutations, etc.: The origin and evolution of all such plants is primarily due to accidental changes occurring in the cell during the course of reproduction. Modern research, however, has made it possible to induce such changes at will. The plants are subjected to any one of the following treatments (1) decapitation (2) extremes of temperature (3) X-ray (pollen or seeds can easily be given a sufficiently uniform X-ray on a rather large scale or flowers may be treated at the time of opening) and (4) use of radio-active substances etc.

Another such feature is the occurrence of Chimeras. Frost (1) recognised nearly eight such forms in citrus. While much cannot be said in favour of this phenomenon towards the improvement of varieties, the possibility may be explored to protect a variety against certain diseases by providing an epidermis of a more resistant variety. Some of the variegated forms arising out of such chimeras are more or less suited for use as ornamentals.

Bud selection and tree selection: Experience has however shown that bud variations produce horticulturally inferior varieties more frequently than superior strains. 'Bud selection' as suggested by Frost (1) is more likely to maintain the standard type of a variety. Improvement and standardization by selection are recognised as highly important in Japan and the rapid growth of the *Satsuma* orange industry in the last 25 years is as stated by Tanaka, quoted by Shamel (7) largely the result of painstaking work on the part of nurserymen and growers along this line.

Bud selection may be used to isolate superior strains originating as bud variations to eliminate inferior strains through avoiding propagation of undesirable bud variations and to maintain the efficiency of valuable strains through systematic use of buds obtained from inherently stable and uniformly good fruiting trees.

The Fruit Growers Supply Company of Los Angeles, California organised a bud selection department in 1917, to supply growers and nurserymen with reliable citrus buds, obtained from carefully selected trees, of all the important citrus varieties in California. The number of buds of different varieties sold to growers and nurserymen was nearly six million. In addition to the buds supplied by the company, several growers developed their own sources of selected citrus buds. The trees selected are in the best available orchards, most of which have been planted to trees grown from "Supply Company" buds.

Hybridization: In recent times, the most important and perhaps one of the methods in wide practice is the production of improved strains through hybridization. Hybrids already produced in India and elsewhere indicate that fruits of especial excellence can be obtained by resorting to controlled crossing. Some of the noteworthy results in this field are:

(1) the production of over a dozen promising hybrid progenies of mango at the Fruit Research Station, Kodur, with the prospect of obtaining many more through nearly 100 progenies which have yet to fruit.

(2) Considerable number of varieties have been obtained by crossing the two species of *Fragaria* (Strawberry).

(3) With the apple, breeding of late blooming varieties was found possible. Promising results were obtained in breeding for a long keeping variety by crossing two varieties of apple.

(4) Nearly all varieties of grapes of American origin having very high quality have been the result of crosses between the American Species and varieties of *Vitis vinefera*.

(5) Citrus hybrids like tangelos, tangors, citranges, citrange-quats are only a few of the large number of hybrids produced by Swingle and his coworkers after considerable research.

(6) In fruit trees such as prunes, species hybridization has given rise to the common cultivated forms of *P. domestica*.

(7) The successful production of wilt resistant cabbage, tomatoes, watermelons and cowpea are other achievements in U. S. A.

(8) Success in ornamental gardening is phenomenal, notable among which are hybrids of *Antirrhinum*, *Dahlia*, *Delphinium* etc.

Exploitation of hybrid vigour is just beginning to receive attention. Among vegetables considerable amount of work on brinjals and tomatoes has been done in other countries, notable among which is that of Kakizaki, who evolved promising hybrids of brinjals.

Methods to maximize development of improved strains: The material presented in the foregoing pages indicate the several directions in which the production of improved strains can be maximized. Having successfully produced a desirable and improved strain the next problem calling for attention will be how best can these improved strains be developed?

The following are some of the more important channels through which maximisation can be achieved.

Vegetative propagation: Propagation of selected strains through vegetative means of multiplication has been an ancient practice and continues to be the most effective method of perpetuating desirable strains. Several methods have been devised with fruits with varying results. Some are propagated easily while others are not or only with great difficulty. Horticultural literature is replete with instances of some propagational success in some part of the world, almost every day.

Scientific knowledge and skill in propagation: Scientific knowledge as Naik (2) observes, has not been utilised in this country to an appreciable extent, to secure a synthesis of the best in our native flora. This is especially true of horticultural propagation in which the few skilled workers are naturally confined to fruit growing localities. The Madras Department of Agriculture has now made a beginning to remedy this defect not only by organizing a post-graduate course in horticulture to train agricultural and science graduates in this specialised science, but also by training mazdoors at most of the Agricultural Research Stations in fruit propagation methods. The services of these trained personnel will be available for the fruit growers, for development of local promising types wherever they may exist. It is to be hoped that this step will help

detection of as many promising varieties as possible. This band of trained personnel while helping the growers in the above manner, could also be of service in guiding them to eliminate useless and unprofitable trees. Rao (4) in his survey of the fruit growing tracts in India reports about the success obtained in the Punjab where a number of useless ber orchards has been thus converted.

Progeny tests: The final test of stability and purity of a strain is the progeny test plot which determines the suitability of a strain for a particular region. Shamel (7) recommends that atleast four or preferably eight years of production by the progeny trees of the same strain should be used for study before conclusions regarding the nature of any progeny can be safely considered. From the progenies, which produce uniformly the fruit or foliage characters desired, further propagation of the most satisfactory trees can be made. The resulting trees may be considered as pedigree ones. Rao (4) cites the instance of a clonal progeny garden near Lyallpur where trees of different varieties have been raised from scion material collected of parents where fruits have won exhibition prizes. A similar progeny test with *Sathgudi* orange of known merit (also through exhibition prizes) is being carried out at the Fruit Research Station, Kodur, besides constant efforts for addition of such promising specimens to the nursery stock.

Establishment of regional stations: In order to carry out the above recommendations, it is very essential that regional horticultural research stations should be established. The National Planning Committee stressing this need have recommended the opening of a chain of horticultural research stations in each State where local problems with regard to the production and preservation of fruits, vegetables and flowers could be investigated in all their aspects.

A beginning has already been made in this direction by the establishment of five model orchard cum nurseries in the State. While the research stations serve as the workshops these model orchard cum nurseries are intended to be the show places where the results of research will be conveyed to the growers through practical demonstrations.

The National Planning Committee further suggested that a fruit section might be developed at the Indian Agricultural Research Institute, New Delhi, to serve as a clearing house for information on all aspects of fruit industry and to guide and coordinate research. The proposed section may also conduct an economic survey to prepare an accurate map of the country showing the relative merits and demerits of each tract for fruit and vegetable production. Till fruit research is undertaken on a more scientific basis in each region, the advisory work for extension of horticulture, will only be superficial based on uncertain foundations of foreign experience.

Vegetable Improvements: In the field of vegetable improvement, the quality of the seed material is of primary importance. The concluding plenary session of the Crop and Soils wing of the Board of Agriculture and Animal husbandry which met in April 1950, recommended enactment of legislation similar to the seed act in force in United Kingdom, U. S. A., Canada, etc. for assuring adequate and timely supply of pure seed of improved varieties. The importance of setting up regional seed testing laboratories was also emphasised. The role of Government vegetable seed stores in this regard has been largely recognised as beneficial. Rao (4) mentions details of schemes of vegetable seed production sponsored by the Indian Council of Agricultural Research at Kashmir and Quetta. The station at Quetta claims to be the largest seed producing centre in India for exotic vegetables. The organisation is said to consist of seven registered growers, who between them have nearly 300 acres under vegetable seed crops. None except the licenced growers, are allowed to raise vegetable crops for seed. The entire work of selection, segregation of allied types and different varieties of the same type, cultivation, roguing, harvests and seed collection is supervised by Government staff appointed for the purpose. The seed when collected is transferred to a central warehouse where the bags are sealed on arrival and labelled in the presence of the supervisory staff. No seed registering less than 70 per cent germination or which is more than two years old is distributed. This system is said to work satisfactorily as evidenced by large demand.

Propaganda: The results of research work have little value unless they are carried into practice on a large scale. The National Planning Committee suggested that propaganda should be intensified in the following directions.

(1) Holding short courses. (2) Holding regional fruit shows. (3) Arranging demonstrations and lectures with suitable illustrations at meetings and fairs. (4) Issuing circulars and leaflets of horticultural interest. (5) Organising market intelligence bureau. (6) Establishment of a Provincial Horticultural Board on the lines of the Punjab Fruit Development Board or the U. P. Fruit Development Board or the Fruit and Vegetable Marketing Committee of Bombay.

Government policy: The success in actual extension depends to a great extent on the Government policy. The following concessions given by the Baroda Government is an instance of Government aid.

(1) Assignment of wastelands to prospective growers without assessment for 7—15 years, and full assessment thereafter. (2) Grant of bounty of Rs. 20/- per *bhiga* on all newly raised plantations, for 5 years. (3) Fruit nurseries to be developed and given away to fruit growers' associations. (4) Long term takkavi loans granted at special concessional rates for fruit growers.

The Ceded Districts Economic Development Board is of the opinion that the following steps would lead to extension of fruit industry in Madras.

(1) Grant of subsidies at Rs. 25/- per acre for few years to start with having a target of 20,000 acres under fruits. (2) Sinking 1000 wells by Government to irrigate about 5000 acres. (3) Grant of liberal loans to irrigate the balance of area, the first instalment of repayment commencing when trees begin to yield. (4) Establishment of fruit nurseries in each district and control of private nurseries. (5) Technical advice. (6) Periodic surveys once in five years to assess the progress made and guide the orchardists on correct lines (A survey was undertaken in 1948 of most orchards in the State which have been planted to fruit varieties supplied by Government nurseries. A further survey is also being conducted on similar lines). (7) A soil map of the State showing the underground water table and a knowledge of success and failure of fruit plantations in different parts of the State.

Reporting on the facilities afforded by the Punjab Government Rao (4) says that the concessions in the shape of extra supply of canal water has stimulated all round interest in fruit culture and the owners are alive to the possibilities of improvement of the existing orchards and further extension.

Co-operative Societies; Multipurpose co-operative societies can be organised to secure the required finance and arrange for the purchase of required implements and manures, and dispersal of produce. Fruit marketing societies, as those existing at Kodur and Palacole in West Godavari may also be formed in all the fruit growing centres. Formation of fruit grower's associations is necessary to discuss and disseminate results of research.

Other facilities: Other requisites of no mean significance are good roads, transport facilities, availability of sufficient manure, skilled labour etc., all of which have contributed to phenomenal success in horticultural development in countries like France, England, U. S. A. and China of late.

Improvement of preservation and investigations on the manufacture of byproduct industries like papain, chickle, banana fibre etc. deserve careful attention to avoid wastage of raw material due to gluts in the market.

Trade facilities: In order to encourage external trade of horticultural produce import duties on foreign goods may be raised and brought to a level with duties charged by foreign countries. Transport charges may be lowered. If cold storage facilities are provided at the ports and on steam ships our country can build up a huge trade in mango alone, since this is the monopoly of tropical countries.

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Though not strictly relevant to the question of production, these are factors which the fruit grower is bound to take into consideration when embarking on a long range venture like horticulture.

Summary:

1. The present drawbacks in Indian horticulture with the possibilities for remedying them have been enumerated.

2. The following methods have been suggested for maximization of the production of improved strains and plant material.

(a) Introduction of varieties and study in relation to wild relatives.

(b) Selection.

(c) Location of chance seedlings, mutations, bud variations, chimeras, plants exhibiting polyploidy and methods to induce these changes by artificial means.

(d) Breeding to evolve economic and superior strains and exploitation of hybrid vigour.

3. For the development of improved strains, the following methods are suggested.

(a) Vegetative propagation.

(b) Conduct of progeny tests.

(c) Establishment of regional research stations and a central horticultural section.

(d) Vegetable seed distribution through Government vegetable depots and through licenced seedsmen.

4. The need for an efficient system of propaganda to transmit the results of research has been emphasised,

5. The necessity and importance of the part that Government could play in implementing the above suggestions by way of providing amenities such as assignment of land and under favourable terms, grant of loans, establishment of co-operative societies, provision of roads, improvement of transport and trade facilities, improvement of fruit product and byproduct industries etc. have been indicated.

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Crop and Trade Report

Cotton Raw in the Madras State: The receipts of loose cotton at presses and spinning mills in the Madras State from 1st February 1953 to 20—3—1953 amounted to 27,121 bales of 392 lb. The receipts in the corresponding Period of the previous year were 15,773 bales. 58,578 bales mainly of pressed cotton were received at spinning mills and 25 bales were exported by sea while 130 bales were imported by sea the progressive totals being 1,004 bales exported and 14,980 bales imported from 1—2—1953 to 20—3—1953.
