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A Caution Against Possible Sterility Due to Vegetative Propagation in Horticultural and other Crops

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Vegetative propagation is being adopted at present in many of horticultural and other crops. The primary object in adopting such vegetative methods is to secure a homogeneous plant material of the parent. In the case of dioecious crops where fruits and seeds are required, it is particularly useful, as otherwise there is a chance of all the seed-raised plants turning out to be male plants that are of no use.

Sterility appears to be a common feature in crops and plants raised by vegetative means, either by cuttings, layers or other methods. Gates and Good speed (1916) have recorded that pollen sterility is a physiological condition which may be due to various causes, hybridization and mutability being only two of them. Stout quoted by Dorsey (1916) mentions three kinds of sterility 1. sterility from impoxtence of pollen 2. sterility from incompatibility, and 3. sterility from abortion of the embryo. Sterility from incompatibility has been reported in several plants such as *Secale, Nicotiana, Cichorium* etc. Dorsey (1919) has given an exhaustive account of sterility in *plum* which he attributes to embryo abortion and incompatiblity. Rao (1923) has presented an account of pollen sterility in vegetatively raised *Thespesia populnea*, comparing it with seed raised plants.

There may be several causes for sterility but wherever there is vegetative propagation, sterility seems to set in, in a few generations, which may be expressed by shedding of flowers, fruits, irregular seed-setting or barrenness.

Of late, propagation by vegetative means is being resorted to indiscriminately, in almost all perennial and annual crops without proper enquiry into the effects of the methods adopted. In certain cases this may be inevitable or perhaps advantageous. To cite a few examples of sterility setting in due to vegetative propagation, mention may be made of *banana, crotons, sugarcane, sweet potato, roses, Bougainvillea, Hibiscus, turmeric* etc. which are not known to set seed, though complete sterility is not the rule of nature. Vegetative propagation in *tobacco, hemp, cinchona, senna, sweet potato, Gliricidia*

etc. in which seeds are not the desired products, is a welcome feature. Besides this, wherever parthenocarpy occurs, as in *banana* and certain *gourds*, vegetative propagation will be the best method of propagation without any disadvantages. There exist no two opinions about the superior vigour of seed-raised plants over those raised by vegetative means. For instance noxious weeds like *Trianthema portulacastrum* which propagate themselves by seed spread rapidly and in turn seed profusely. On the contrary, *Kikuyu grass*, *hariali* and *Cyperus rotundus*, which multiply by rhizomiferous stems set only scanty seeds showing very low percentage of germination. A causal observation of the pollen grains of *roses*, *Hibiscus*, *banana*, *Manihot* and other vegetatively-raised plants will indicate high percentage of sterility in pollen grains.

The present article is meant to point out the bad effects or advantages of vegetative propagation in certain crops and to suggest methods to overcome the difficulties. It is to be mentioned that there is not enough justification for vegetative propagation in certain crops like *coffee*, *groundnut*, *cashew*, *cotton*, *castor*, *cardamum* etc., where the seeds are the desired products. Though the explanation that vegetatively propagated plants will breed true, is correct, it need not be taken advantage of, at the expense of fertility. Hybridization within limits will enable us to evolve desirable types, which is being done in seed raised annuals like cereals and pulses. The following examples will indicate that vegetative propagation may be one of the major reasons for sterility in certain crops and repeated trials have to be conducted before the method is recommended for large-scale cultivation.

In crops like *mango*, vegetative propagation has to be adopted for obtaining quality fruits. The seed raised country mangoes are certainly healthier and there is not as much shedding of fruits and flowers as we find in grafted varieties. Yet we are prepared to sacrifice quantity for quality. Incidentally mango has the disadvantage of having the inflorescence in terminal position, being subjected to climatic disturbances. In *banana* the cultivated varieties which have been propagated vegetatively for long periods have lost their seed setting habit. The wild species such as *Ensete superba*, *Musa acuminata*, *M. balbisiana* and *M. textilis* which are propagated by seeds bear fruits with viable seeds. In banana vegetative propagation is decidedly an advantage since seeds are not the desired products. Besides this, the banana fruit develops parthenocarpically and as such pollen sterility does not interfere with fruit formation.

To aid in the parthenocarpic development of the fruit, the inferior position of the ovary is of much significance. But for the inferior position of the ovary and parthenocarpic development of the fruit, shedding of flowers or fruits may be exhibited, as in fruits developed from superior ovary. An observation of the pollen grains of the cultivated varieties of banana will show high percentage of sterility as contrasted with the pollen gains of wild species.

There is no justification for vegetative propagation in crops like *coffee, cotton, cashew, groundnut* etc., where seeds are the desired products. The Indian Coffee Board has been conducting elaborate trials to propagate coffee by vegetative means, (Sundaram - 1953 Pattabhiraman - 1953) the main objects being to obtain a homogeneous material and secure yields earlier. Much work is being done in cashew, recommending the vegetative propagation methods, particularly the advantages of air - layering (Abraham and Rao. V. N. M. - 1956) which is claimed to be one of the successful and easiest methods of cashew propagation. In cashew, seed is the part that is consumed and partial or complete sterility will certainly reduce the yield. Groundnut is an annual which has been so long successfully propagated by seeds and much breeding work has been done to evolve superior strains. Recently Bhavanisankar and Srinivasulu (1955) have investigated the possibility of raising the crop by vegetative means. The results of the investigations have favoured the arguments advanced in this paper. The growth is reported to be quicker but there was no pod formation.

In conclusion it is clear from a few cases like *roses, Bougainvillea, Hibiscus, Sugarcane, ginger, banana* etc., which have been vegetatively propagated from time immemorial that method of propagation may be one of the major reasons for sterility. It is a common sight to see enormous shedding of flowers in *Thespesia populnea, Gliricidia* and *Hibiscus*, which are generally raised by cuttings. The seed raised plants of *T. populnea* on the sea shores in Madras and Ramanathapuram Dt. seed profusely which show high percentage of germination. Cardamum when raised by rhizomes very frequently results in the production of barren capsules. Occasional reversion to cultivation by seeds is desirable.

Propagation by cuttings is recommended in the Cucurbits, at least in the genus *Coccinea indica*, which develops fruits by parthenocarpy, a character of the genus. Attempts are being made to propagate cotton by grafting methods, in spite of the fact that

it is the epidermal hairs on the seeds that are the desired products in cotton. The study may be of academic interest but recommendation of the methods has to be done with great caution after enquiring into the effects, with regard to fertility.

It is finally suggested that comparative studies of pollen fertility can be made in certain annuals like *onion* or *garlic*, raising them by seeds and bulbs. There may be several causes for sterility but wherever vegetative propagation is adopted, sterility appears to set in, in a few generations and the above mentioned examples will have to warn us the possible consequences due to asexual methods of propagation, where seeds are the desired products.

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ERRATA

M. A. J. Vol. XLIV. No. 2, Page 48 —53.

Page 47 lines 1 and 7 :
'Ripersia Oryzae' to be corrected as 'Ripersia oryzae'

Page 47 line 6 :
'Pets' to be corrected as 'pests'

Page 47 line 24 :
Omission : Insert the word 'the' between words 'of' and 'pest' occurring in lines 23 and 24.

Page 48 line 27 :
'Acre' to be corrected as 'area'

Page 49 line 30 :
'Folixol' to be corrected as 'folidol'

Page 51 lines 12 and 13 :
Words omitted : Insert "this interval" between words 'treatment' and 'was' in lines 12 and 13

Page 51 line 30 :
Repetition : Delete the words "and systox O, 15 %"