



## Modified ground pollination technique for hybridization in coconut

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### Introduction

Root (wilt) is a serious disease of coconut in Kerala State and in certain districts of Tamilnadu State. As the disease cannot be controlled by conventional plant protection measures, development of disease resistant/tolerant variety is the most practical method for the management of this malady. Based on systematic evaluation trials, ICAR-CPCRI Regional Station, Kayamkulam has released one tolerant hybrid (Kalpa Sankara) for the root (wilt) disease prevalent tract. Kalpa Sankara is produced by crossing root (wilt) disease-free Chowghat Green Dwarf as female parent and root (wilt) disease-free West Coast Tall as male parent. Kalpa Sankara gave a ten year cumulative average

yield of 84 nuts/palm/year, copra out turn of 2.50 t/ha and oil yield of 1.70 t/ha. Kalpa Sankara is rapidly becoming a popular coconut hybrid in the root (wilt) prevalent tract.

**Modified ground pollination was developed to refine ground pollination technique to suit pollination of dwarf palms from ground level for production of CGD X WCT (Kalpa Sankara) hybrids. The technique developed was attempted on tall palms as well.**

Considering the huge demand for Kalpa Sankara hybrids, efforts are being made for large scale production of the hybrid. The two key components required for production of this hybrid is the availability of Chowghat Green Dwarf mother palms and disease-free West Coast Tall male parental palms. Chowghat Green Dwarf mother palms are available in farmer's plots and such palms can be used for production of D X T hybrids. Since these palms are located in far off places in the root (wilt) disease affected tract and to overcome the shortage of skilled



climbers for undertaking pollination and attempts were made to mechanize artificial pollination.

Devakumar *et al.*, 2018 developed a ground pollination technique for mechanization of pollination on tall palms from ground level. Modified ground pollination was developed to refine ground pollination technique to suit pollination of dwarf palms from ground level for production of CGD X WCT (Kalpa Sankara) hybrids. The technique developed was also attempted on tall palms as well.

## Equipments for modified ground pollination

### ► Pollination equipment

The equipments for artificial pollination includes pollination bag, pollen applicator for spraying pollen grains, incubator for drying male flowers for collecting pollen and dessicator. The refinements made over the ground pollination technique (Devakumar *et al.*, 2018) include using flexible PVC pipe (6 mm diameter) instead of 8 mm diameter clear PVC tube. The vertical air blower powered by a 12 volt battery used for pumping the pollen-talc mixture was replaced with 5 litre hand pump pressure sprayer. To aid uniform dusting of pollen-talc mixture onto

receptive female flowers inside the pollination bag, a 6 mm micro sprinkler attached to 6 mm adapter was fixed onto the top end of the PVC pipe inserted inside the pollination bag.

### ► Operational details

In the traditional method, female parental palms are selected and emasculation is done 2-3 days prior to initiation of female phase. Emasculation is followed by bagging. As and when the female phase starts, the pollen grains from selected male parental palm is mixed with a suitable diluent like purified talc in 1:6 ratio and filled in the applicator, just before use. Since stigmatic exudation/secretion occurs progressively during the morning hours, 7 am to 11 am is the most preferred time for conducting artificial pollination. On completion of the fertilization process the stigma turns brown and subsequently the pollination bag is removed.

Using the modified ground pollination technique, the climber initially ties the pollen delivery tube on to the top part of the pollination bag. The pollination bag attached with pollen delivery tube is fixed on the emasculated inflorescence. The pollination bag is stitched in such a way that the cloth never comes in contact with the stigmatic surface of buttons. On initiation of female phase, pollen: purified talc mixed in 1: 6 ratio is filled in the pollen tray. One end of the pollen tray is connected to the pollen delivery tube and the other end is attached to the PVC tube of the 5 litre plastic sprayer (after removing the nozzle portion). Pressure build up by manual pumping is released till the pollen-talc spray reaches the emasculated inflorescence. Pollen application is repeated during 7am-11 am on 6-8 consecutive days till the receptivity of all buttons on the emasculated inflorescence get completed.

Studies conducted at different stations of ICAR-CPCRI revealed that modified ground pollination technique in coconut resulted in a fruit setting of 18.5-25.0%, which is comparable to the setting observed under natural pollination. The cost analysis was also worked out to compare the economics of modified ground pollination over manual pollination.

### ► Costing

The cost for installing one ground pollination unit is approximately Rs. 400 (which includes cost of purchasing 6-8 meter HD flexible PVC tube, cost of pollination bag, fabricating pollen tray and other accessories) and Rs. 600 for purchasing one 5 litre sprayer which can be used for pollinating 25 palms



(Rs. 600/25 palms = Rs.24/palm). Accordingly, the cost of one ground pollination unit works out to Rs. 424 (Rs. 400 + Rs. 24). This ground pollination unit can be used for pollinating atleast six inflorescences in one year. Hence, the cost per inflorescence works out to Rs. 424/6 ≈ Rs. 70.

Pollen application process which has to be carried out continuously for 3-5 days in the case of tall parental palms or 6-8 days in the case of dwarf parental palms during the receptive female phase can be efficiently carried out without the help of skilled climbers by using this device. Instead of paying Rs. 300 for climbing the coconut palm for consecutive pollen application for 6 days (Rs. 50 for each climbing X 6 times), the cost can be reduced to Rs. 70 for competing pollen application on one inflorescence. Hence, the dependence on skilled climbers can be limited just for emasculating, bagging and bag removal.

### Advantages of modified ground pollination

This technique will reduce the cost incurred in planting material production, especially production of coconut hybrids. Moreover this technique will be beneficial to the health of dwarf parental palms as otherwise there are chances of breakage of fronds/petioles of dwarf palms due to frequent climbings

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done for carrying out artificial pollination. In modified ground pollination, climbings can be limited to two times, one for installing the ground pollination unit after emasculating and the second climbing for bag removal. In the traditional method, the skilled climber has to climb atleast eight times for carrying out various operations like emasculating, bagging, pollen application and bag removal. Success of this technique has potential application in undertaking controlled pollination in other palms like oil palm and date palm.

In the concept proposed for National Coconut Challenge 2019, refinements were proposed for making the ground pollination technique more user friendly. The hand pump for pumping pollentalc mixture on to the top of coconut palms will be replaced by a quick and light weight pressure delivery system and the entire ground pollination components will be made available as a Ground Pollination Kit.

The ground pollination kits will also made available through RAIDCO or KAICO outlets throughout Kerala.

Pollen stored in the central pollen cryo-preservation at ICAR-CPCRI, Kayamkulam will be made available through deep freezers which are already available with Primary Health Centres of Department of Health & Family Welfare.

The purified talc used for diluting pollen will be enriched with biomolecules with potential for increasing fruit setting upon artificial pollination.

### References:

Devakumar, K., Arumuganathan, T., Thomas, R. J., Niral, V., Anitha Karun and Chowdappa, P. 2018. A cost-effective ground pollination system for hybridization in tall coconut palms. *Current Science* 114 (5): 964-970 ■