Varieties resistant to root (wilt) disease of coconut

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Coconut root (wilt) disease is now contiguously prevalent in eight southern districts and sparse occurrence of this disease has also been reported from the remaining six districts of Kerala. Root (wilt) disease has also been reported from parts of Tamil Nadu and Karnataka, adjoining Kerala State. The disease is caused by Phytoplasma transmitted by lace wing bug (*Stephanitis typica*) and plant hopper (*Proteista moesta*).

As the disease cannot be controlled by conventional plant protection measures, cultivation of resistant varieties are the most ideal and practical method for management of this disease. One of the most important constraints for coconut production in the root (wilt) prevalent tracts, is the lack of root (wilt) resistant planting materials. Requirement for planting materials in the disease prevalent tracts is estimated to be 1.2 million seedlings. With the spread of the disease to more neighbouring districts in Kerala and adjoining states of Tamil Nadu and Karnataka, demand is expected to grow further in the coming years.

Varieties resistant to coconut root (wilt) disease were not reported prior to 1988. A comprehensive breeding programme for resistance/ tolerance to coconut root (wilt) disease was launched during 1988 and the following resistant varieties were released and notified by the Central Variety Release Committee for cultivation in the root (wilt) disease prevalent tracts.

Kalparaksha (MGD selection): This variety (originally an introduction from Malaysia) was identified as resistant to root (wilt) disease only during 2004. This has significant advantage over CGD because of the higher yield, larger nut and copra size. Quantity of tender nut water is also more (275 ml) when compared to CGD. At present only 290 palms of this variety are available in India (200 palms in Seed Garden Comlex, Munderi, Malappuram district and 90 palms in CDB farm at Neriamangalam, Ernakulam district). In a comparative study of the yield of MGD and WCT palms from a seed production plot at CDB farm at Neriamangalam, MGD gave 88 nuts/palm/year whereas WCT gave only 46 nuts/palm/year (five year average). MGD gave the highest copra yield of 2.85 t/ha and oil yield of 1.85 t/ha whereas WCT gave copra yield of 1.69 t/ ha and oil yield of 0.95 t/ha only.

In Kerala, where there is severe shortage of climbers, this variety will find greater acceptance because of its semi-tall nature and easiness in harvesting. MGD is remarkable not only for its high yield but is also suitable as a tender nut variety. It has got more quantity of tender nut water which is sweet and tasty. Since all the palms give largely uniform quality and quantity of tender nut water, MGD variety is more suitable for tender nut purpose. Kalparaksha was released as a resistant variety to coconut root (wilt) disease by Central Variety Release Committed during July 2008.

Kalpasree (CGD selection): This is a dwarf variety which is cultivated in the homesteads especially in the root (wilt) disease-prevalent tracts. This is the shortest among all dwarf varieties of coconut. In an intensive survey in the disease hot- spots of Alapuzha, Pathanamthitta, Kollam and Kottayam districts, 200 CGD palms were observed for root (wilt) disease incidence. It was found that 75% of them were disease-free, whereas the WCT palms standing in the same plots had the disease incidence to the extent of 80% or more indicating that CGD variety is having higher level of resistance to coconut root (wilt) when compared to WCT. This observation regarding resistance was further confirmed from a screening trial carried out at CPCRI Regional Station, Kayamkulam involving CGD and nine exotic coconut varieties

The CGD variety grows to height of nearly 1.88 m (13 year old

palm) with narrow stem, marked with prominent leaf scars and shorter internodes. Detailed data on morphological and nut characters are given in table 1. Among the resistant varieties reported so far, CGD is the most resistant. In a study of 250 CGD palms at CDB farm, Neriamangalam, it was observed that CGD gave 55 nuts/ palm/year, producing copra yield of 0.94 t/ha and oil yield of 0.55 t/ ha (ten year average). The kernel has good cooking qualities and good oil content (66.3%). Quantity of tender nut water content is 172 ml per nut and it is also sweet and tasty. Because of the small crown size, this variety can be grown at a distance of 6.5 m x 6.5m. It is more suitable for cultivation in homestead gardens, an advantage especially in Kerala where coconut is largely cultivated in small holdings. Because of its short stature, it can easily be harvested. But major disadvantages of this variety are small size of the nut and less copra content. Five CGD nuts are considered approximately equal to three WCT nuts for trade purposes. Kalpasree was released as a variety suitable for cultivation in the root (wilt) disease prevalent tracts by the Central Variety Release Committee during March 2012.

Kalpa Sankara (CGDxWCT hybrid): This hybrid attains a height of around 3.80 m at 13 years of age. It is early flowering (four years after planting) in nature. Being a semi tall variety, harvesting will be easy. The quantity of tender nut water is 373 ml per nut and it is sweet in taste.

In the studies conducted at CPCRI, the CGD X WCT hybrids gave a ten year cumulative average yield of 84 nuts/palm/year, copra yield of 2.50 t/ha and oil yield of 1.69 t/ha. However, after 18 years of planting, 67.7 % of these hybrids showed symptoms of root (wilt) disease. The disease-free hybrids gave an average yield of 107 nuts/palm/year whereas the disease-affected hybrids gave 72 nuts/palm/year (Table 1). With regard to the resistance to root (wilt) disease, hybrid palms were intermediate between parental varieties namely CGD and WCT. The hybrid was superior in yield performance when compared to both the parental varieties. Like other hybrids, CGD X WCT also requires good management for better performance. Utmost care shall be taken for selecting dwarf and tall parental palms with typical characteristics for production of vigorous hybrids with high yield and resistance /tolerance to root (wilt) disease.

Studies conducted at CPCRI indicated that CGD X WCT hybrid gives better yield under rainfed conditions in farmer's plots in the root (wilt) disease prevalent tract.

Table 1: Morphological and nut characters of Kalpraksha, Kalpasree & Kalpa Sankara.

Sl. No	Characters	Kalparaksha	Kalpasree	Kalpa Sankara
		mean values		
	Morphological characters			
1	Age of measurement (years)	13	13	13
2	Plant height (m)	4.14	1.88	3.80
3	Number of leaves	29.8	25.0	30.3
4	Length of petiole(cm)	132.0	109.4	115.3
5	Length of leaflet bearing portion (cm)	360.0	342.8	375
6	Girth of trunk (cm)	69.80	60.2	78.7
7	Number of leaf scars in 1 m length	31.20	35.8	20.1
8	Length of inflorescence (cm)	89.70	69.2	112.0
9	Number of inflorescence per year	9.5	7.4	15.4
10	**Nut characters Mature Nut** Length of fruit (cm)	19.9	17.0	18.7
11	Breadth of fruit (cm)	14.8	12.0	14.3
12	Weight of fruit (g)	854.0	683.4	839.2
13	Weight of dehusked nut (g)	428.0	349.5	527.8
14	Weight of kernel (g)	355.2	171.2	295.7
15	Quantity of water (ml)	196.8	82.2	111. 7
16	Copra weight	185.1	96.8	169.5
17	Oil content (%)	65.2	66.3	67.5
18	**Tender Nut** Quantity of nut water (ml)	275.0	172.3	373.3
19	*Sweetness of water	4	4	3
20	*Sweetness of meat	3	4	3

** Based on organoleptic test on a 1-5 scale*

Considering the better performance of CGD X WCT hybrid in the disease prevalent tracts, this variety was released for cultivation in the root (wilt) prevalent tracts by the name Kalpa Sankara by the Central Variety Release Committee during March 2012.

However, while identifying mother palms for production of planting materials, selection should be restricted to the palms conforming to typical morphological characters of CGD and MGD, as described in the Coconut Descriptor published by CPCRI (Ratnambal *et al.*, 1995). This will help to avoid selection of hybrid palms which are frequently found in farmer's plots as hybridity reduces the intensity of resistance compared to the resistant parent. It may also be noted that though Kalparaksha variety is known for its high yield, resistance to the root (wilt) disease, dwarf character and good tender nut qualities, availability of parental palms of Kalparaksha for seed nut production is limited (less than 100 mother palms) in Kerala. However, during the last few years, it is known that a few farmers have collected seed nuts of Malayan Green Dwarf from Kerala/Tamil Nadu and established coconut plantations in Tamil Nadu and Andhra Pradesh. Our observational study showed that these plantations contain approximately 8% typical MGD palms and the remaining ones, though high yielding, are non typical which are either natural cross dwarf hybrids or segregants of MGD. Selection should be restricted to palms showing typical characters of MGD as described in the coconut descriptor. It is recommended that parental palms should be selected based on typical morphological characters. It is also advisable to reconfirm its suitability using molecular markers.

Table 2. Distinguishing morphological characters of CGD, MGD and WCT

Character	CGD	MGD	WCT
Adult palm character			
Plant habit	Dwarf	Semi-tall	Tall
Crown shape	Small	Larger than CGD	Large
Leaves	Short leaves with short and narrow leaflets	Leaves & leaflets are comparatively longer and broader than CGD	Long leaves with long and broad leaflets
Stem	Narrow, cylindrical with closely spaced internodes & prominent leaf scars	Cylindrical stem and widely spaced internodes and less prominent leaf scars compared to CGD	Strong and stout with prominent bole, leaf scars usually not prominent
Flowering pattern	Overlapping male and female phases	Partial overlapping of male and female phases	Distinct male and female phase
Pollination type	Predominantly (95%) self pollinated	Largely (65%) self pollinated	Predominantly (90%) cross pollinated
Mature nuts	Small fruited with green coloured nuts. Nuts oval shaped with a beak and ring at the bottom	Large fruited with green colour. Nuts round shaped.	Large fruited. Fruit colour varying from green, yellow, brown and red. Nuts usually oval or oblong.
Tender nut water	170 ml, very sweet to taste	275 ml, sweet to taste	300 ml, taste not uniform and varies from palm to palm
Reaction to root (wilt) disease	Highly resistant	Resistant	Susceptible with sparse distribution of disease-free palms
Seedling character			
Germination	Early	Early	Late
Seedling height	Short in stature	Semi tall	Tall in stature
Leaflets	Short leaves with narrow and closely spaced leaflets	Longer and broader leaflets when compared to CGD	Longer leaves with long and broad leaflets

Selection criteria for Dwarfs (CGD and MGD)

- Should yield 100 nuts or more per year.
- Be more than 20 years old and surrounded by palms of which at least 80% are affected by the root (wilt) disease in an endemic area.
- Showing typical CGD/MGD characters.
- Free from all pests and diseases.

Selection criteria for Talls (West Coast Tall male parental palms)

- Regular bearers and should yield 80 or more nuts per year
- More than 35 years of age with typical WCT characters and surrounded by palms of which at least 80% are affected by the root (wilt) disease in an endemic area.
- Free from all diseases and pests.
- Nuts should be preferably large and the dehusked nuts should weigh not less than 600 g with copra content of 150 g.