

## **Vegetative Propagation Studies in Kola (*Cola* spp.)**

### **111 Potential use of Leaf Cuttings for Rooting**

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#### **Abstract**

Old and young leaves of *Cola acuminata* (P. Beauv) Schott and Endlicher and three clones of *C. nitida* (Vent.) Schott and Endlicher (AA125, AA176 and AA231) were set in the propagator either as a whole leaf, lower half or upper half leaf cuttings. At the end of six months after setting, only the young leaves of *C. acuminata* rooted with the upper halves rooting better than either whole leaf or lower half leaf setting. The bases of the differential in rooting ability between the two species, as well as the magnitudes of rooting in *C. acuminata* with leaf cutting position are discussed.

#### **Introduction**

There are several horticultural techniques of propagating plants vegetatively. One of these techniques is the use of leaf cuttings. It has been used with success in the rooting of several species such as citrus (Salomon and Mendel, 1965; Farugue and Mahmood 1973), begonia (Cohi and Moser, 1976), sedum (Boe et al., 1972). However, production of shoots from such leaf cuttings has been difficult in many plants (Boe et al., 1972), except in some succulent plants like bryophyllum and begonia both of which are ornamentals. Salomon and Mendel (1965) unsuccessfully produced shoots from citrus leaf cuttings.

In Kola, Eijnatten (1969) reported success in the rooting of leaf cuttings, but no shoot was produced. However, in that report, he was not specific as to what species was used in the experiment. Ibikunle (1972) succeeded in rooting *C. nitida* through the use of leaf bud cuttings. Since these contained the auxiliary buds of the mother plants, they are morphologically not leaf cuttings in the strict sense of lamina with petiole. They were best regarded as stem cuttings with considerably reduced size.

In the present study, efforts were made to root both *C. acuminata* and *C. nitida* by using leaf cuttings. Selection work has been carried out on *C. nitida* but not on *C. acuminata*; hence three clones of *C. nitida* (AA125, AA176 and AA23) were compared with the unselected *C. acuminata*.

#### **Materials and Methods**

Two types of leaves (2 and 6 months old herein referred to as young and old leaves

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respectively) of *C. acuminata* and three clones of *C. nitida* (Aa125, AA176 and AA231) were used. Twigs of these two categories were removed from the appropriate mother trees very early in the morning and were kept in transparent polythene bags in which they were transported to the nursery (Oladokun, 1986). The leaves were removed from the twigs and were set in the propagator (Oladokun, 1986) as whole leaf setting (the entire lamina with petiole inserted into the wet and weathered sawdust medium), lower half leaf setting (a single leaf cut into two transversely at the middle and lower part set into the propagator by inserting the petiole into the wet and weathered sawdust medium), and upper half leaf setting (the apical half of the leaf set by inserting the broad middle part into the medium).

There were four blocks of 10 cuttings per replicate with the treatments assigned in a Randomised Complete Block design. Watering was done twice daily. Records of the number that callused, the number that rooted and their root length were taken at the end of six months. The experiment was carried out twice.

## Results and Discussion

Table 1 shows the final records of the percent of cuttings that callused, the percent that rooted and their root length. The rooted cuttings are shown in Figure 1. Though there were three clones of *C. nitida*, none of the cuttings from them rooted. Only the cuttings from *C. acuminata* rooted and these were limited to cuttings from young leaves as compared with old and upper halves of the hardened leaves. Some of the lower and upper halves of the hardened leaves, callused but none rooted. In the young leaf cuttings of *C. acuminata*, half leaves tended to root better than the whole leaves. The highest rooting percentage of 10% was recorded for upper half of the leaf.

The results agree well with those of Salomon and Mendel (1965) who found rooting of citrus leaf cutting to vary with species, size, portion and age of leaf. Faruque and Mahmood (1973) also found that apical half leaf cuttings of citrus rooted better than whole leaf as found in this experiment. However, the fact that half leaf cuttings rooted better than whole leaves demands some explanation. Three possible explanation may be advanced. The respiratory demand on the whole leaves might be higher and much more detrimental to the rooting processes than it was for the half-leaf cuttings. Also, the high rate of transpiration in whole leaves could cause the retardation of rooting particularly when moisture was limiting. Since watering was frequently ensured, however, this factor could be reasonably discounted. Alternatively, or additionally, the wound caused on the leaf midribs when the leaf was cut into halves might be more inductive for rooting of the half cuttings than would be with the petiole. This is further supported by the fact that the upper half leaves, with the midribs part inserted into the medium, rooted better than the lower halves which had the petioles inserted into the medium. However, Faruque and Mahmood (1973) contended that apical half cuttings rooted better than the entire

TABLE 1. PERCENTAGE ROOTING OF KOLA CUTTINGS

Species/Clones	Leaf Part Set	Percent Cellused	Percent Rooted	Root length per Cutting (cm)
<i>laminata</i>	Fresh green whole leaf	8.75	3.75	3.10
	Fresh green lower half	7.50	5.00	5.62
	Fresh green upper half	12.50	11.25	20.31
	Hardened whole leaf	0	0	0
	Hardened lower leaf	6.25	0	0
	Hardened upper leaf	6.25	0	0
	Mean	6.78	3.33	4.84
S. D	4.09	4.45	7.91	
SA 125 ( <i>C. nitida</i> )	Fresh green whole leaf	0	0	0
	Fresh green lower leaf	1.25	0	0
	Fresh upper leaf	1.25	0	0
	Hardened whole leaf	0	0	0
	Hardened lower half	0	0	0
	Hardened upper half	0	0	0
	Mean	0.42	0	0
S. D	0.64	0	0	

**Table 1 Continue**

AA 176 ( <i>C. nitida</i> )	Fresh green whole leaf	0.17	0	0	0
	Fresh green lower half	0.10	0	0	0
	Fresh green upper half	2.25	0	0	0
	Hardened whole leaf	0	0	0	0
	Hardened lower half	0	0	0	0
	Hardened upper half	0	0	0	0
	Mean	0.42	0	0	0
S. D	1.02	0	0	0	
AA 231 ( <i>C. nitida</i> )	Fresh green whole leaf	0.16	0.42	0	0
	Fresh green lower half	0.48	0.33	0	0
	Fresh green upper half	0	0	0	0
	Hardened whole leaf	0.32	0	0	0
	Hardened lower leaf	0.72	0	0	0
	Hardened upper half	0	0	0	0
	Mean	0.20	0.06	0	0
S. D	0.48	0	0	0	
Grand Mean	1.93	0.83	1.21		
Grand S. D.	3.53	2.54	4.27		

Each figure is a mean of eight replicates and is in Arcsin transformed values. Data were collected at the end of a six-month period.

Fig. 1: Rooted leaf cuttings.

- A. Upper leaf cutting
- B. Lower leaf cutting
- C. Whole leaf cutting
- cp = Callus at the petiole
- cm. = Callus at the midrib
- l = whole lamina
- uh = upper half lamina
- lh = lower half lamina
- p = petiole
- r = root



The type of cutting determined the point where callusing and/or root formation took place. While these took place at the midvein in the upper leaf cuttings, they took place at the pulvinus in the cases of lower half and whole leaf cuttings.

leaf-cuttings probably because of the presence of more natural auxins in the young meristematic cells of the apical leaf-cuttings.

The better rooting performance of young foliage than hardened (old) ones could be due to two possible reasons. First, hormonal constituents and balance in both categories differ with growth inhibitors increasing with maturity of plant tissue (Paton *et al.*, 1970; Lipecki and Dennis, 1972). Secondly, mechanical hindrance to emergence of root primordia tends to increase while meristematic activities tend to decrease with maturity of plant tissue (Kachecheba, 1975a, 1973b; Brustch *et al.*, 1977). Several workers have found the age of leaf to be important in rooting of the leaf cuttings in some plant species (Swingle, 1940).

With respect to the question of failure to produce shoots, cognisance must be taken of the fact that in the report of Hagemann (1931) as cited by Swingle (1940), only 289 plant species of 1204 species tested with detached leaves produced both roots and shoots while 501 were found to yield roots alone and 25 species shoots alone. Thus, there is a higher tendency for root production alone in leaf cuttings than there is for either both root and shoot production or for only shoot production. *C. acuminata* which is the only species that rooted in the present study, apparently belongs to the group of species that produce root alone especially since observation made on the rooted cuttings for another period of six months in the hardening chamber did not indicate any shoot.

The failure of *C. nitida* leaf cuttings to root while those of *C. acuminata* rooted requires further studies on comparison of the rooting abilities of the two species. The need for shoot production from rooted cuttings is of paramount importance. Hence, in subsequent trials, efforts will be directed towards inducing shoot production by exogenous application of specific growth substances and their combination as earlier reported to be more efficient for stem cuttings (Samananda *et al.*, 1972). Success along this line will provide a more economic method of vegetable propagation of kola than that of leaf bud cutting proposed by Ibikunle (1972).

### Conclusion

*C. acuminata* leaf cuttings rooted while those of *C. nitida* failed to root. Young leaves of *C. acuminata* rooted while the hardened (old) ones failed to root. Half leaf cuttings rooted better than whole leaves while upper halves rooted better than lower halves. There is a need for further study in this direction to successfully induce shoot production in kola leaf cuttings.

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