PROPAGATION OF LESSER YAM (*DIOSCOREA ESCULENTA*) USING VINE CUTTINGS

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ABSTRACT

The traditional practice of propagating yams using setts consumes a significant proportion of harvested tubers. An attempt was made to root Dioscorea esculenta *(Lour.) Burk. vine cuttings as alternative planting material. Various rooting substances and sucrose solution were applied to five-month old yam vine cuttings. Sucrose solution prolonged the lifespan of 2-node cuttings up to 9 weeks. The cuttings (n=30) treated with sucrose (80 g l^{-1}) alone produced 13% rooting, while cuttings traeted with sucrose (80 g l^{-1}plus Serdix (3 g kg^{-1} beta - IBA) had 17% rooting. Those treated with sucrose (80 g l^{-1}) plus IBA (200 g l^{-1}) had 20% rooting. However, the growth of plants at the nursery and in the field was not vigorous, and the tubers produced weighed less than 20 g. It was demonstrated that* D. esculenta *vine cuttings can take root, but could not substitute for tubers as commercial planting materials because of the low rooting percentage and poor growth in the field. It was suggested that experimenting with vine cuttings younger than 5 months might improve the vigour and yield of the yam.*

Key words: *Yam,* Dioscorea esculenta, *vine cuttings*

INTRODUCTION

Yams (*Dioscorea spp.*) are a reasonably important food crop in certain parts of Papua New Guinea. Yams figure prominently as a traditional food and in prestige systems in Papua New Guinea, as well as in Africa, the Caribbean and other Pacific Island nations (Onwueme 1994). Of the six species of yam grown in Papua New Guinea, *D. esculenta* is the most important in terms of area grown and food produced, although *D. alata* is often more important culturally (R.M. Bourke, per. com.). Traditionally, yam is propagated using tuber setts. This involves storing 20-40% of harvested tubers as planting materials for the next season. This practice reduces the amount of tubers available for food. Therefore, if an alternative method of providing planting material can be developed, all the tubers produced each season can be consumed.

Several methods have been considered. These include tissue culture (Lacointe and Zinsou 1987), yam seeds (Okoli 1975) and vine cuttings (Njoku 1963). Vine cuttings were first used for the edible yams *D. alata, D. dumetorum* and *D. rotundata* (Njoku 1963; Hill *et al.* 1981), and Vanderzaag and Fox (1981) also successfully rooted 1-6 node vine cuttings of the above three yam species. Wilson (1982) reported that cuttings of *D. alata, D. rotundata* and *D. cayenensis* can form roots in 10 to 20 days. In this trial no rooting hormones were used to initiate rooting, instead the cuttings were placed in a humid mist chamber at 80% relative humidity. The cuttings were arranged horizontally in tree-draining trays filled with clean river sand. The rooted cuttings were later transferred into soil pots, "hardened" and then planted in the field.

Most previous studies have concentrated on *D. alata, D. rotundata, D. cayenenis* and *D. dumetorum*. There have been very few reports of attempts to root vine cuttings of *D. esculenta*. Cabanillas and Martin (1978) attempted unsuccessfully to root the vine cuttings of *D. esculenta*. Therefore, the objectives of this study were to investigate whether *D. esculenta* could be rooted successfully, whether various readily available growth substances could facilitate rooting, and if vine cuttings of *D. esculenta* could substitute for tubers as planting material.

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MATERIALS AND METHODS

Vine cuttings of *D. esculenta* were taken from three sections of 5 months old plants. These were the extreme tip, the base and the middle portions. The cuttings were initially rooted in clean river sand (< 0.5 mm grain size) in four-litre pots, perforated at the base. Two-node cuttings were planted in a slightly slanting position such that one node was beneath the sand.

Two trials were conducted in an attempt to root *D. esculenta*. Trial 1 incorporated six treatments as listed in Table 1. Each treatment was replicated three times, with ten cuttings per replicate (n=30). In this trial most of the cuttings dried up after two weeks, except those receiving the sucrose treatment.

Table 1. *Treatments applied to initiate rooting of* D. esculenta *vine cuttings in Trial 1.*

Treatment number	Treatment
1	Seradix 3 g Kg^{-1} beta-IBA 3 g 1^{-1}
2	sucrose 80 g 1^{-1}
3	acetylene gas
4	napthalene acetic acid (NAA) 2 g 1^{-1}
5	indulbutyric acid (IBA) 200 g 1^{-1}
6	water (control)

In Trial 2, sucrose was combined with rooting substances; indulbutric acid (IBA), Seradix (a commercial rooting powder containing 3 g kg^{-1} beta-IBA), napthalene acetic acid (NAA), and acetylene gas (Table 2). The second trial was done to determine which of the rooting substances would be most effective in initiating roots. Sucrose, IBA and NAA were applied in solution to the cuttings after planting. Seradix was applied by dipping the wet end of the cuttings in Seradix powder up to the lower node before planting. The treatment with acetylene gas involved first producing the gas by placing 3 g of calcium carbide in a plastic weighing vessel containing a few drops of water. The acetylene gas was trapped in an enveloping plastic bag in which the cuttings were fumigated for twelve hours before planting.

Table 2. *Treatments applied to initiate rooting of* D. esculenta *vine cuttings in Trial 2.*

Treatment number	Treatment
1	Seradix 3 g 1^{-1}
2	sucrose 80 g 1^{-1}
3	NAA 2 g 1^{-1}
4	IBA 200 g 1^{-1}
5	sucrose 80 g 1^{-1} + IBA 200 g 1^{-1}
6	sucrose 80 g 1^{-1} + Seradix (3 g kg^{-1} beta-IBA) 200 g 1^{-1}
7	sucrose 80 g 1^{-1} + NAA 2 g 1^{-1}
8	sucrose 80 g 1^{-1} + acetylene gas
9	water (control)

Cuttings were inspected once each week. At each inspection, cuttings were carefully dug up and inpsected for signs of root development. After 9 weeks, the cuttings that had rooted were transferred to a 3:1 mixture of sterilised soil and chicken manure. The planted cuttings were raised in a nursery under 70% shade until shoots formed. After 8 weeks in the nursery, the small plants were moved to full sunlight for one week, and then planted in prepared soil in the field. Observations were made subsequently on the field performance of the plants.

RESULTS AND DISCUSSION

Observations from Trial 1 showed that sucrose (treatment 2) helped to prolong the lifespan of the two-node cuttings. This was evident from the 80% survival rate observed after 2 weeks. In Trial 2, treatments incorporating sucrose solution kept the cuttings alive for up to 9 weeks as compared with 2 weeks where only water was used. Cuttings taken from the extreme base and tip did not root at all, only cuttings from the middle portion of the vines rooted. It was observed that the treatment of sucrose + IBA produced roots on 20% of the cuttings, while sucrose alone produced roots on 13% of the cuttings and sucrose + Seradix produced roots on 17% of the cuttings (Table 3). None of the growth substances were able to cause rooting by themselves unless sucrose was also present. This shows the importance of sucrose in the rooting medium.

Table 3. *The effect of sucrose on root initiation of* D. esculenta *vine cuttings (n=30) in Trial 2.*

	Treatment	Percentage of cuttings rooted
1	Seradix 3 g l^{-1}	0
2	sucrose 80 g l^{-1}	13
3	NAA 2 g l^{-1}	0
4	IBA 200 g l^{-1}	0
5	sucrose 80 g l^{-1} + IBA 200 gl^{-1}	20
6	sucrose 80 g l^{-1} + Seradix (3 g kg^{-1} beta-IBA) 200 g l^{-1}	17
7	sucrose 80 g l^{-1} + NAA 2 g l^{-1}	0
8	sucrose 80 g l^{-1} + acetylene gas	0
9	water (control)	

Although the results indicate low percentages of rooting, they show that *D. esculenta* vine cuttings can be rooted when sucrose and rooting substances like Seradix and IBA are applied. Wilson (1982) noted that other species (*D. alata, D. rotundata* and *D. cayenensis*) could root within 2 weeks. However, *D. esculenta* vine cuttings took 2 months to produce roots and showed a very low percentage of root initiation. Wilson (1982) did not report on the tuber formation of the vine cuttings. When the root cuttings were grown in the field, the resulting tubers after five months were very small and weighed less than 20 g each. This demonstrates that cuttings of *D. esculenta* are a poor substitute for tubers as planting materials for subsistence or commercial production.

It is possible that experimenting with younger plants and accounting for other variables, such as the nutrition of plants at the nursery and in the field, could yield more promising results.

CONCLUSION

The study showed that sucrose prolonged lifespan of vine cuttings and produced some rooted cuttings for this species, although, the percentage is still low. This is not improved much by using other agents such as Seradix and IBA. It is possible to get a small proportion of cuttings from the middle portion of vines to root, provided they are grown in sucrose solution and plants grown from vine cuttings produced very small tubers only. Hence the techniques investigated in this study have no immediate application by subsistence or commercial yam producers

ACKNOWLEDGEMENTS

The assistance of Mr Joshua Yauwo and Mr David Arapi in collecting materials and setting up the trials is gratefully acknowledged.

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