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PRESENCE OF AXILLARY BUD AND APPLICATION OF PLANT GROWTH HORMONES ON ROOTING AND TUBERIZATION OF YAM (DIOSCOREA SP.) VINE CUTTINGS.

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ABSTRACT

Young cuttings of yam varieties Obiaoturugo (Dioscorea rotundata) and Um 680 (D. alata)- were grown in pots in the greenhouse. Half the cuttings bore axillary buds and half had none. The cuttings were sprayed with a factorial combination of indole acetic acid (IAA), benzyladenine (BA) and giberellic acid (GA_3). Cuttings of Obiaturugo survived better than those of Um 680 and cuttings with lateral buds performed better than those without. IAA had no effect but GA_3 depressed rooting (p=0.05) and tuberization (p-0.01) of the cuttings. The results showed that in the presence of axillary bud in young cuttings, clean yam tubers can be raised in the greenhouse without recourse to use of mist chambers.

KEY WORDS: Axillary buds, growth hormones, rooting and tuberization, yam vine cutting.

INTRODUCTION

Tubers raised from yam vine cuttings are important in cleansing planting material of diseases and pests such as fungi, viruses and nematodes using sterile media for preserving a germplasm collection, for inter-country transfer of planting materials in order to meet quarantine requirements and for safeguarding and multiplying limited breeder's materials in a single season. Previous workers grew yam vine cuttings in mist chanbers (Zaag and Fox, 1981; Cabanlilas and Martin, 1979, Akoroda and Okonmah, 1982; Ng, 1990). Those workers used cuttings from vines of seed yams (250-500g) from the zone of opposite phyllotaxy. Paired leaves are developed in these vines later in the plant's growth, about 120-150 days after planting, especially in white yam (D.rotundata) predominantly grown in West Africa. It has been observed that propagules of smaller yam pieces (about 25g) expand their leaves earlier, within the first three modes (Igwilo and Okoli, 1988). These young yam plants have alternate phylotaxy, it is known that younger leaves are more resistant to abscission and senescence than older leaves (Phillips, 1971; Wilkins, 1990). These young leaves therefore withstand environmental stresses better than older leaves. Some of the earlier studies involved the use of exogenous plant growth hormones. But stem apices and young expanding leaves (buds) are centres of synthesis of endogenous plant growth hormones (Thimann, 1969; Cleveland, 1960; Fox, 1969; Wilkins 1990). Thus effects of presence of axillary buds and exogenous plant growth substances on rooting and tuberizaion of two yam varieties were investigated under greenhouse conditions.

MATERIALS AND METHODS

Minisetts (25g yam pieces) of two yam varieties Obiaoturugo (Dioscorea rotundata) and Um 680 (D. alata) were planted in the field on 7th May and cuttings were collected from their alternate leaf propagules on 29th July (83 days after planting). Each cutting, collected from the lower nodes, had six fully expanded leaves plus two extra defoliated nodes below. Half of the cutting had axillary buds and half had none. The cuttings were planted in 5-litre perforated plastic buckets ¾ full of builder's coarse sand and each cutting was tied to a small bamboo stick. The defoliated nodes were stuck into the sand medium which had been copiously watered. While the sand medium was covered with polythene sheet, the yam leaves were sprayed with the appropriate hormonal solutions using plastic hand fine sprayers obtained from IITA. Distilled water served as control. The hormonal solution were indole acetic acid (IAA). 50 ppm; gibberllic acid (GA_3), 5ppm and benzyladenine (BA), 10ppm. These solutions at two levels (with or without) were factorially combined and sprayed. The hormonal treatments together with the yam varieties gave 32 treatment combinations which were replicated four times to give 128 treatments (plots). The pots in each replicate were arranged in a completely randomized design. Each bucket (plot) carried a single cutting. The vine cuttings kept in the greenhouse roofed with alternate regions of asbestos and transparent plastic sheets. The buckets were kept under asbestos to reduce insolation. The vine cuttings were sprayed with distilled water 4 times/day for the first 7 days reducing to 3 and 2 times subsequently while the sand medium was regularly kept moist. The average reduction in total solar radiation intensity was 64.9% of the intensity outside the greehouse while the photosynthetic active radiation (PAR) was reduced by 71.3%. Solar radiation intensity ranged between 93 and 950W/M^2. The light measurement were taken with quantum/radiometer/photometer, Model LI-185B (Lamda Instruments Corporation, Nebraska, USA). Average maximum temperature in the greenhouse was 32°c, minimum temperature 21°C, relative humidity was 82.9% (9.am) and 75% (3p.m). After 14 days, the experiment was terminated and data collected.

RESULT

Number of Living Vines

After 14 days, Obiaturugo (D.rotundata) had 41% (P=0.01) more surviving cuttings than Um 680. Cuttings with axillary buds were 15% more than cuttings without buds. On the average, 51% of the cutting were alive (71% in Obiaoturugo and 30% in Um 680). There was no yam variety X axillary bud interaction. Exogenous hormones had no effect on the survival

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of vine cuttings (Table 1).

Number of vines with leaves

Obiaoturugo had 17% more cutting with leaves (P=.0.05) than Um 680. A xillary buds increased the number of cuttings with leaves by 14%. Exogenous growth substance had no significant effect. There was no interaction between yam variety and lateral buds (Table 2).

Number of Rooting Cuttings

Presence of axillary buds increased (P=0.05) the number of rooting cuttings in both varieties and there was no interaction between yam varieties and presence of axillary buds (Table 3a). Gibberellic acid depressed (p=0.05) the number of cuttings with roots in both varieties (Table 3b). There was no interaction between presence of axillary buds and GA_3.

Tuber Formation

Obiaoturugo had more cuttings with tubers than *Um 680*. GA_3 again depressed the number of tuberizing cuttings (p=0.01). Presence of axillary buds also increased (P=0.05) the number of tuber-forming cuttings (Table 4). The interaction between axillary buds and GA_3 was not significant. Roots and tubers were formed at the lowest node of the cuttings.

Table 1: Effect of yam variety and axillary buds on survival of vine cuttings (numbers).

	i) Per Plant			ii) Total		
	Obiaoturugo	Um680	Bud Mean	Obiaoturugo	Um680	Bud Mean
Bud absent	0.63	0.22	0.43	20.2	7.0	13.6
Bud present	0.78	0.38	0.58	24.0	12.2	18.6
Variety mean	0.71	0.30	0.51	22.6	9.6	16.1
$LSD_{(0.05)}$ between variety and bud means		0.16			5.2	

Table 2: Number of cuttings with leaves after 14 days

	i) Per Plant			ii) Total		
	Obiaoturugo	Um680	Bud Mean	Obiaoturugo	Um680	Bud Mean
Bud absent	0.28	0.10	0.19	9.0	3.2	6.1
Bud present	0.41	0.25	0.33	13.0	8.0	10.0
$LSD_{(005)}$ between variety and bud means		0.16			5.0	

Table 3a: Effect of yam variety and auxiliary bud on number of rooting cuttings per pot

	i) Per Plant			ii) Total		
	Obiaoturugo	Um680	Bud mean	Obiaoturugo	Um680	
Bud absent	0.33	0.40	0.37	10.6	12.8	
Bud present	0.74	0.55	0.65	23.7	17.6	20.7
Variety mean	0.54	0.48	0.51	17.2	15.6	16.2
$LSD_{(005)}$ between variety and bud means		0.17			5.5	

Table 3b: Effect of variety and GA_3 on number of rooting cuttings

	i) Per Plant			ii) Total		
GA_3 Mean	Obiaoturugo	Um680	GA_3 mean	Obiaoturugo	Um680	
GA_3 absent	0.63	0.56	0.60	20.4	18.0	19.9
GA_3 present	0.45	0.34	0.42	14.3	12.4	13.8
Variety mean	0.54	0.48	0.51	17.4	15.2	16.3
$LSD_{(0.05)}$ between variety and GA_3 means		0.15			5.3	

Table 4: Number of cuttings with tubers

	i) Per Plant			ii) Total		
	Bud Absent	Bud Present	GA_3 mean	Bud Absent	Bud Present	GA_3 means
GA_3 absent	0.75	0.75	0.75	24.0	24.0	24.0
GA_3 present	0.38	0.64	0.51	12.2	21.1	16.7
Bud means	0.57	0.70	0.63	18.1	22.6	20.4
$LSD_{(0.05)}$ between variety and bud means		0.17			5.2	

DISCUSSION

About 51% of the vine cuttings planted remained alive after 14 days, averaged across the two yam varieties (Table 1) and about 51% of the cuttings had roots no them (Table 3). This suggests that the same number of living cuttings had roots on them. However, only 27% of the living cuttings had leaves on them at the end of the experiment (Table 2). This shows that not all living cuttings had leaves. Interestingly, 63% of the cuttings had tubers showing that some of the cuttings had tuberised before death. This suggests that the supply of photosynthates from the cutting leaves to the lowest node was used in tuber growth even without rooting. Axillary buds with young expanding leaves and apical meristems which were active centres of auxin, cytokinin and gibberellic acid syntheses readily supplied the growth hormones necessary at the rooting and tubering node. The presences of axillary buds delayed senescence of whole vine cuttings (Table 1) and leaves (Table 2) and also promoted rooting as well as tuberization (Table 3a, 4), thus making exogenous hormones superfluous. In a previous experiment using the same concentrations of the hormones applied foliarly, IAA promoted rooting of yam vine cutting while BA and GA_3 had no effect (N. Igwilo. Unpublished). In the presence of axillary buds in this experiment, GA_3 depressed rooting as well as tuberization (Tables 3b, 4). It has been reported that adventitious root initiation is markedly reduced by GA_3 in shoot cuttings (Phillips, 1971; Wilkins, 1990) and GA_3 applied to the haulm of potatoes (*Solanum tuberosum*) retarded tuberization (Moorby and Milthorpe, 1975).

Thus young yam vine cuttings with alternate phyllotaxy should be used in yam multiplication and exogenous plant growth regulators may not be necessary. These young cuttings also withstand environmental stresses better than older cuttings.

Obiaoturugo (*D. rotundata*) cuttings performed better than *Um 680* (*D. alata*) cuttings in all the parameters examined (Table 1, 2, 3a and 4) *Um 680* is known to be more vulnerable to dry weather conditions than *Obiaoturugo*. *Um 680* leaves senesce faster and whole shoots dry faster than *Obioturugo* shoots when grown under irrigation in the field during dry season. In the rainy season, the reverse is the case. The dry weather response of *Um 680* has been attributed to inefficient water transport system (igwilo, 2001). The percentage of surviving cuttings compared favourably with the survival of cuttings obtained in mist chambers (Akoroda and Okonmah, loc. Cit.) suggesting that clean tubers to meet quarantine and phytosanitary requirements can be raised in the greenhouse.

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