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Effect of Sprouting Medium on the Survival of Yam Peelsetts

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ABSTRACT

The presprouting survival of yam peelsetts, 1cm thick and 2cm^2 3cm^2 and 4 cm^2 periderm surfaces, in sprouting media (direct soil, soil in container, straw, river sand and sawdust) was investigated. Sprouting was achieved in all media. Optimum sprout count was observed in sawdust and least sprout count was in straw. Insect larvae, nymphs and millipedes physically ate up setts and the rot (dry and wet) conditions observed were associated with fungi which were suspected to be the causative agents. The preferred medium for presprouting peelsetts was sawdust, which can be hot water or steam sterilized for maximum results.

Key Words: Peelsett; Sprouting medium; Yam; Rots; Survival

INTRODUCTION

The minisett technique of seed-yam multiplication whereby one tonne of minisetts (25 g pieces) equaled or outyielded 2.5 tonnes of seed-yams (250 g each) has been widely adopted by farmers in the yam-producing areas of Nigeria and beyond (Okoli *et al*., 1982; Igwilo, 1988). Propagules from smaller yam setts, therefore, tended to be more efficient than propagules from larger yam setts. Reports have shown that by progressively slicing down the ground tissue (cortex) of the minisetts to setts 1 cm thick or thinner tended to give higher percentage sprouting than setts thicker than 1 cm including the minisett controls. This observed trend was more pronounced in *Dioscorea rotundata* cv obiaoturugo than in *D. alata cv*. Um 680 (Igwilo, 1986). The minisetts 1 cm thick (now called peelsetts) can further be cut into smaller sett sizes with 2 cm^2, 3 cm^{2-} and 4 cm^2 periderm surfaces (called peel microsetts). While yam setts with 3 cm^2 and 4 cm^2 periderm surfaces sprouted more than 2 cm^2 periderm surfaces, the differences between setts with 3 cm^2 and 4 cm^2 periderm surfaces were inconsistent in maximum as well as in earliness of sprouting (Igwilo, 1988).

The yam farmer prefers yam setts with uniform sprouting in order to plan other field operations such as staking, fertilizer application and weeding. In the experiments referred to above, the yam setts were planted directly into the field. It is not known whether the inconsistency in earliness and maximum sprouting and in fact the damage and/or diseased state of setts was due to the sprouting medium used, as yam setts can be pre-sprouted and transplanted (Okoli *et al*., 1982). In the study reported here, the peel microsetts with 2, 3 and 4 cm^2 periderm surfaces were pre-sprouted in direct soil, soil in container, grass straw, river sand and sawdust.

It has been observed that a substantial percentage of the setts are lost to various rots (suspected to be caused by bacterial and fungal pathogens), insect, nymphal and larval pests, nematodes and myriapods, which are found, associated with the damaged setts. It is thought that the increased surface area of the peeelsetts and the sprouting medium predispose the setts to the menace. This study was aimed at. (i) Investigating the effect various sprouting media may have on the presprouting survival of the setts, and (ii) Making a preliminary survey of organisms associated with the disease and damage conditions.

MATERIALS AND METHODS

Two varieties of yam- *Dioscorea rotundata (*cv. *Obiaturugo)* and *Dioscorea alata (*cv. Um. 680) were used for the experiment. The tubers were obtained from the yam barn of the IAR&D in April, in each of the years, when dormancy of the tubers had been broken (Okoli *et al.*, 1982 & Igwilo, 1989). The peelsetts were prepared using the method described by Igwilo (1997). Three surface areas of periderm (2cm^2, 3cm^2 and 4cm^2), with sett thickness of 1cm were used. The setts were not treated in any way, by applying pesticides and/or chemicals, hygiene at the preparation did not go beyond cleaning of bench tops with moist duster, washing of cutting implements and hands with clean tap water.

A total of five different media were used to sprout the setts. The media were direct soil, soil in container, straw, river sand and sawdust. The media, except direct soil, were all placed in wicker baskets, the type used for packaging tomatoes and such like fruits for conveyance. The baskets were each about three-quarters full. The materials were not treated in any way for sterility. A total of 48 baskets were acquired for the purpose. The direct soil was tilled over.

The three periderm surface areas and the five media were factorially combined to give 15 treatments for each yam variety, arranged in a randomized complete block design and replicated two times. The baskets were arranged in rows of five, with a sixth stand of direct soil in the ground, so that each periderm surface area had two rows and two mounds for each variety. Ten peelsetts were planted in each basket and mound. The setts were arranged in an outer ring of eight and two pieces placed in the centre of the ring. The setts were planted 3cm deep (Igwilo, 1997) and evenly spaced, on the 5th of May, 2001 and 14th of April, 2002. Sprout counts were taken at intervals, first after 14 days, subsequently, two 10 days intervals and five days intervals thereafter until all setts were sprounted or dead; setts were dug up for sprout examination, final transplant of sprouted setts was on the 9th of June, 2001 and 23rd May, 2002 for the respective years. Establishing counts were taken on the 139th day ie 29/9/01 and 4/10/02 respectively.

As sprout inspection was carried out, the setts were also inspected for signs of disease, damage and presence of associated organisms (bacterial ooze, fungi and other pests). Damaged and/or diseased setts were taken away for macroscopic and microscopic examination for associated organisms.

RESULTS

Year 2001. A general increase in sprout count was observed at 39 DAP across peelsett sizes, media and varieties (Table 1). Sawdust gave the highest mean sprout count which was 1.45 folds ($p = 0.01$) more than straw, which gave the lowest mean sprout count. Sprout count in straw medium was 12.26, 15.09 and 3.77% ($p = 0.01$) less than direct soil, soil in container and river sand, respectively. These differences were not significant. There were no significant differences due to yam variety and no significant interactions. In both varieties 4 cm sett-length gave 9.09% more sprout counts ($p = 0.01$) than 2 cm and 3 cm sett-lengths, between which there were no significant differences. There were no significant differences due to variety, but there were significant interactions between variety and sett-length. Sprout counts in the 4 cm sett-length of *D. alata* were higher than and significantly different from those of *D. rolundata* (Table I).

Year 2002. It was observed that sprout counts of the two varieties caught up with one another at this DAP (i.e. 39DAP) (Table 1). Sawdust gave the highest mean sprout count which was 3.71 folds ($p = 0.01$) more than straw, which gave the lowest mean sprout count. Sprout count in straw medium was 68.18, 67.82 and 70.53% ($p = 0.01$) less than direct soil, soil in container and river sand, respectively, which were significantly different ($p = 0.01$) from the count in straw, but not between the three media. In both varieties there were no significant differences between sprout counts on 3 cm and 4 cm sett-lengths, which were 21.35% and 16.67% ($p = 0.01$) respectively more than 2 cm sett-length. There were no significant differences due to variety, but significant interactions ($p= 0.05$) were observed between sett-length and medium. Sprout counts in the 3 cm sett-length were more in sawdust medium.

In both trial years (2001 & 2002), dry rot and soft rot were the major disease conditions observed in the setts.

Table I. Sprout counts at 39 days after planting

Surface area of periderm (cm^2)	Sprouting medium	Maximum sprout count (2001)		Maximum sprout count (2002)	
		Dr	Da	Dr	Da
	DS	9.0	7.5	6.5	5.0
	SIC	8.0	7.0	6.0	6.5
2	ST	6.5	3.5	1.5	1.0
	RS	9.0	8.5	7.0	8.5
	SD	10.0	9.5	8.5	9.0
	DS	7.5	9.5	9.5	8.5
	SIC	7.5	7.0	8.5	8.5
3	ST	7.0	6.0	2.5	3.5
	RS	8.5	9.5	9.0	9.0
	SD	8.5	10.0	10	9.0
	DS	8.5	8.0	8.0	9.0
	SIC	9.0	9.5	8.0	8.5
4	ST	6.0	8.5	1.5	0.5
	RS	9.5	10.0	8.0	9.5
	SD	9.5	10.0	10.0	10.0
	$LSD_{(0.05)}$ between means				
Peelsett size			0.601		0.489
media			0.775		0.632
Variety			0.490		0.400
Peelsett size/variety interaction			0.850		0.692
medium/peelsett size interaction			1.344		1.094
Variety/medium interaction			1.096		0.894
Variety/peelestt size/medium iteraction			2.005		1.548

Key: DS = direct soil; SIC = soil in container; ST = grass straw; RS = river sand; SD = saw dust; *Dr = Dioscorea rotundata; Da = Dioscorea alata.*

Associated with the dry rot were *Aspergillius sp. Penicillium sp, Mucor sp. Botryoplodia sp, and Fusaruim sp.* And associated with the soft rot were *Penicilluum sp., Trichoderma sp, Sclerotium sp, Macor sp,* and *Fusarium sp.* Details of the occurrence in the various media are shown in Table II. Other pests associated with the soft rot condition were unidentified nematodes, earthworm, and insect larvae. The nymphs of crickets and millipedes were observed to eat up whole setts leaving only the outermost leathery skin. These conditions were observed in all non-sprouted setts and were in traces in river, sand and sawdust.

Table III shows final stand count at 139 DAPS. In all 3 periderm surface areas and both years and cultivars establishment rate was highest in transplants from sawdust and least in grass straw.

DISCUSSION

Using yam pieces 1 cm thick and 3-4 cm^2 periderm surface (i.e. peelsetts) as planting materials have been found to be a more efficient method of raising seed yams than the minisetts (Igwilo, 1998) and that the 4 cm^2 peelsett is the preferred size has been corroborated by the results of this investigation (Table I), but the bane of the method in the field has been the low presprouting survival rate of the peelsetts. The 4 cm^2 size is preferred because it survives long enough to sprout. The others may not have done so well because of the further increased surface areas exposed to the influence of biotic and abiotic factors in the sprouting medium.

Table II. Disease/damage conditions and associated organisms

Associated Organisms	Disease/damage														
	Dry rot					Soft rot					Damage				
	Sprouting medium														
	DS	SIC	ST	RS	SD	DS	SIC	ST	RS	SD	DS	SIC	ST	RS	SD
Aspergilus sp.	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-
Penicillium sp	+	+	+	-	-	+	+	+	-	-	-	-	-	-	-
Mucor sp	+	+	+	-	-	+	+	+	-	-	-	-	-	-	-
Rhizopus sp.	+	+	+	-	-	+	+	+	-	-	-	-	-	-	-
Fusarium sp.	+	+	+	-	-	+	+	+	-	-	-	-	-	-	-
Trichoderma sp	-	-	-	-	-	+	+	+	-	-	-	-	-	-	-
Rhizoctonia sp	-	-	-	-	-	+	+	+	-	-	-	-	-	-	-
Sclerotium sp	-	-		-	-	+	+	+	-	-	-	-	-	-	-
Nematode	-	-	-	-	-	+	+	+	-	-	-	-	-	-	-
Insect larvae	-	-	-	-	-	+	+	+	-	-	+	+	+	-	-
Cricket/other nymphs	-	-	+	-	-	-	-	-	-	-	+	+	+	-	-
Millipedes	-	-	+	-	--	-	-	-	-	-	+	+	+	-	-
Earthworms	+	-	-	-	-	+	+	-	-	-	+	-	-	-	-

Key: + = presence or associated; - = absence or not associated; DS = direct soil; SIC = soil in container; ST = grass straw; RS = river sand; SD = saw dust.

Presprouting and transplanting of yam setts is a known technique (Okoli, *et al*., 1982) although its labour intensiveness is counted as demerit against it, but in the present consideration this is a better evil than the loss of peelsetts.

Results show differences in sprout counts in the various media which were significant especially between sawdust and straw, the former giving optimum count and the latter least count. This was positively correlated to the presence of the rot symptoms and other pests. These were more prevalent in straw than all others. The porosity of straw allowed for free movement and circulation of the pests and air to cause the havoc. The difference in sprout counts between the two-years in straw can be explained. It was due to the texture and/or level of decay of the straw strands. The straw of the 2001 experiment was advanced in decay and so was more closely packed than those of the 2002 experiment, which was loose and less decayed. Moisture content and availability was another factor that contributed to the difference; there was less rain in 2002.

Table III. Final stand (establishment) counts at 139 days after planting

Surface area of periderm (cm^2)	Sprouting medium	Establishment count (2001)		Establishment count (2002)	
		Dr	Da	Dr	Da
	DS	6.0	7.0	6.0	4.5
	SIC	4.5	5.0	6.0	4.0
2	ST	4.0	3.0	1.5	1.0
	RS	5.5	6.0	4.0	6.5
	SD	5.5	9.0	8.5	8.0
	DS	2.5	9.0	9.5	7.0
	SIC	3.5	2.5	7.0	6.5
3	ST	2.0	2.5	2.5	2.0
	RS	2.5	3.0	7.5	8.0
	SD	5.5	10.0	10.0	9.0
	DS	6.0	7.5	8.0	9.0
	SIC	7.0	8.0	5.0	7.5
4	ST	5.0	3.5	1.5	0.5
	RS	7.5	9.0	7.5	8.0
	SD	7.0	7.5	8.5	10.0

Key: DS = direct soil; SIC = soil in container; ST = grass straw; RS = river sand; SD = saw dust; *Dr = Dioscorea rotundata; Da = Dioscorea alata.*

Although differences were observed between the two varieties, they weren't significant. *D. alata* showed better results in the 3 and 4 cm^2 setts, but the reverse was the case in 2 cm^2 setts, particularly in the 2001 results, were *D. rotundata* performed generally better in all media.

Insect larvae, nymphs and millipedes physically ate up setts. The activities of these may have predisposed setts to the rot organisms (Morse *et al.*, 2000). All the rot conditions were associated with fungi indicating that the conditions were caused by them as no bacterial ooze or wet rot was observed. These fungi (Table II) were reported to cause these rots in stored and marketed yam tuber (Amusa & Baiyewu, 1999; Amusa *et al.*, 2003). The source(s) of the causative agents are suspected to be the peelsett stock, the bench, the cutting implements, the media materials, the air etc. So it is suspected that improved sanitation in preparing the setts and treatment with pesticides (Ogundana *et al.*, 1971, 1981; Ogali, *et al.*, 1991; Osai, 1993; Amusa & Ayinla, 1997), before planting may improve the survival of peelsetts, especially if the media materials are sterilized before use. The preferred medium for the presprouting of peelsetts is the sawdust medium, which can be hot water or stream sterilized.

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