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EFFECT OF DELAYED PLANTING AND CHEMICAL TREATMENT ON THE PERFORMANCE OF YAMS GROWN FROM MINISETTS

(Effet de la plantation tardive et des traitements chimiques des minifragments sur les performances de la culture d'igname)

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SUMMARY

Experiments were carried out to evaluate the potentials of curing and use of wood ash seed dressing as an alternative to chemical seed dressing of yam setts, before planting, especially for commercial production of seed yams by the minisett technique. Curing was at the ambient temperature for periods of 1, 2, 3, 4 and 5 days. These were compared with treatment with two recommended seed dressing chemicals (Thioral and Aldrex T).

Curing of yam minisetts for 3 days and above resulted in high moisture loss and rapid drying of the cut surfaces.

There were no significant differences in the rate of germination and final percentage sprout between yam setts treated with chemicals and those cured for one or two days. There was delayed sprouting and very low percentage sprout when curing extended up to 3 days and above.

Reductions in leaf area, leaf area index, number of leaves and final tuber yield at harvest occured when curing extended up to 3 days. These parameters did not differ significantly between yam setts cured for 1 or 2 days and those treated with chemicals.

Wood ash from oil palm inflorescence was as good as any of the chemicals used.

RESUME

Des expérimentations ont été réalisées pour évaluer les potentialités du CURING en substitution à l'enrobage chimique des fragments d'igname avant plantation et ce pour la commercialisation des semences d'igname par la technique des minifragments. Le CURING a été réalisé à température ambiante pendant 1, 2, 3, 4 et 5 jours en comparaison avec deux traitements par des produits d'enrobage chimique recommandés : Thioral et Aldrex T.

A partir de 3 jours et au delà le CURING des minifragments a entraîné une forte perte d'humidité et un dessèchement important des surfaces sectionnées.

Il n'y avait pas de différence significative de taux de germination et de pourcentage final de germes entre les fragments traités avec les produits chimiques et ceux traités par CURING pendant 1 à 2 jours. Il y a eu un retard de levée et un pourcentage faible de germes quant le CURING était prolongé à 3 jours et plus.

Il y a eu réduction de la surface foliaire, de l'index de surface foliaire, de la longueur des tiges, du nombre de feuilles, du rendement en tubercule à la récolte quand le CURING a été prolongé à 3 jours. Ces paramètres ne diffèrent pas significativement pour les fragments traités par CURING pendant 1 à 2 jours et ceux traités chimiquement.

La cendre de l'inflorescence du palmier à huile était aussi bonne que chacun des produits chimiques utilisés.

INTRODUCTION

Yam (*Dioscorea* spp.) is an annual climber that is best propagated by means of the tuber which is a stem structure (BURHILL, 1960 ; NJOKU, 1963). The yam crop, a starchy food, is one of the most expensive sources of calories in human diet in the tropics. Nervertheless, it still plays an important role in socio-economic lives of the people, especially in Nigeria. Because of its demand, and the high cost of production and low multiplication ratio, there is a need to find methods of improving the multiplication ratio of yams (OKOLI, 1978), to increase the amount of "seed" available for "seed" and ware-yam production.

The development of the minisett technique at the National Root Crops Research Institute was therefore indicated. Prior to the development of the minisett technique, OKOLI, (1978) developed the segmentation method. The segmentation method made use of small setts with reasonable food reserves and vigorously growing sprouts, but the technique, which involved carving out sprouted segments from the main tuber, was laborious and expensive. The minisett technique which consisted of cutting up seed yam tuber (200 - 500 g

wt.) into 25 g - 3.0 g setts was more practical and less expensive (OKOLI et al) 1982. Because of the small size, the little food reserve and the amount of cut surface exposed to micro-organisms (such as *Fusarium moniliforme*, *Botryodiplodia theobromae* and most importantly *Sclerotium rolfsii*) were (NWANKITI, 1982), the initial vigour of the sprouts was generally poor and establishment was uncertain.

Protective fungicides were, therefore, applied to the minisetts before planting. However, some of the fungicides were not quite safe considering that Nigerians roast and boil yams with their periderm before eating. Many farmers who have decided to go into commercial production of seed yams, find that the cut minisetts were not planted till after three or four days because of the amount of materials they handled. An alternate approach to overcome the difficulty of procurement of chemicals and probably the hazards involved in using the chemicals is to cure the minisetts.

The objective of this study were to : evaluate the effect of delayed planting for a few days and treatment of cut setts with wood ash on germination and establishment of minisetts as compared with chemically treated ones ; and to determine the effect on yield and yield components.

MATERIALS AND METHODS

In 1983, (16/5/83), healthy tubers of cv. Nwopoko (*Dioscorea rotundata*) stored for 5½ months and weighing between 200 and 1000 grams and commonly grown in Nigeria, were cut to the minisett sizes of 25 g. These were either dipped in solutions of Thiabendazol or suspensions of Benlate each at 3000 ppm for 16 hours or treated with dusts of a range of chemicals namely Thiabendazol, Benlate, Aldrex T and Fernasan D at 1.3 kg/ha. Yam setts in each treatment were spread out in a well - ventilated room under uncontrolled ambient conditions (temperature between 26 and 38°C and Rh between 66 and 85 per cent). There was a control of freshly cut setts with no chemical treatment.

This experiment was carried out using sandy loamy soil medium on a site left fallow for 3 years. Three randomized blocks each of 18 plots 6 x 1,75 m for each plot were used. Each of the chemical treatment and the control was divided into 4 planting dates at 1 day interval. Sowing was at 25 cm spacing on the ridge. Staking was done one week after sowing using small stakes of *Acioa barteri*.

In 1984, (17/5/84) two cultivars of *Dioscorea rotundata* namely cv. Nwopoko and cv. Okwocha which were in storage for 5 1/2 months were used for confirmation. These were cut to the minisett sizes of 25 g. They were treated with Thioral or Aldrex T each at 1.3 kg/wt or with wood ash from two sources (Oil palm inflorescence and *Eupatorium odoratum*,. The chemical composition of the wood ash are :

	K	Ca+Mg	%NA	% N
Wood Ash (oil palm inflorescence)	4.69	189	.04	.07
Wood Ash (*Eupatorium odoratum*)	1.28	113.5	.04	.14

The wood ash from the two sources were used at 10 kg/wt. Control treatments consisted of setts cut and kept at uncontrolled ambient conditions (temperature between 26 and 30°c) and Rh between 66 and 85 per cent).

The thickness of the cut surfaces were measured and setts reweighed at each planting date. Seed setts treated with chemicals and wood ash were planted immediately after treatment. Three randomized blocks each of 18 plots of 6 x 1,75 m for each plot were used. Sowing was done at 25 cm spacing on the ridge to about 6 cm depth. Staking was done one week from sowing using stakes of *Acioa barteri*, of about 2 metre heights.

Germination scores were started 4 weeks after sowing and subsquently at 7 days interval, until no more germination was observed.

In each plot the last two stands on the last two ridges (except where no germination occurred in which case the third or the fourth ridge was used) were sampled for leaf area index and total leaf area 52 (daf), 82 (daf) and 104 (daf). The rest were harvested for yield determinations after 8 months.

RESULTS

Cured Minisetts :

Immediately the tubers were cut, exposed surfaces quickly darkened in colour especially in cv. Nwopoko. After about 3 to 4 hours of cutting, the exposed surfaces became covered with white milky substance which later coated the surface. Within a period of 3 days, sections cut at right angles to the original cut surface revealed that a dark dry layer had been formed. In some of the cut surfaces an inner thin layer which blocked off the healthy layer from the dried layer was formed. The dry outer layer increased up to 5 mm in cv. Okwocha and up to 6 mm in cv. Nwopoko. Weight loss of the cut minisetts increased from 20.4 per cent on the 3rd day to up to 30.4 per cent on the 5th day for Okwocha and 32.4 per cent for cv. Nwopoko. On the 4th day, 12.5 per cent of the cut setts were mouldy which increased to 33.3 per cent on the 5th day for Okwocha and 40 per cent in Nwopoko. Organisms isolated from some of these were *Aspergillus* sp. and *Bortryodiplodia theobroma*. No isolations were obtained from some of the dried surfaces.

TABLE 1 : EFFECT OF CURING MINISETTS 1 TO 5 DAYS UNDER AMBIENT UNCONTROLLED CONDITIONS ON WEIGHT LOSS, SURFACE DRYING AND MOULD.
(1984)

Curing Period (days)	Weight Loss %		Surface thickness (mm)		Mould % infected	
	cv Okwocha	cv Nwopoko	Okwocha	Nwopoko	Okwocha	Nwopoko
1	3.2	3.1	*	*	0	0
2	9.2	7.6	*	*	0	0
3	20.4	20.8	3+.5	1.5±.3	5.6	4.1
4	26.0	27.6	3.5±.5	4.5±.7	12.5	16.7
5	3.0.4	32.4	5±1	6±1.2	33.3	40.0

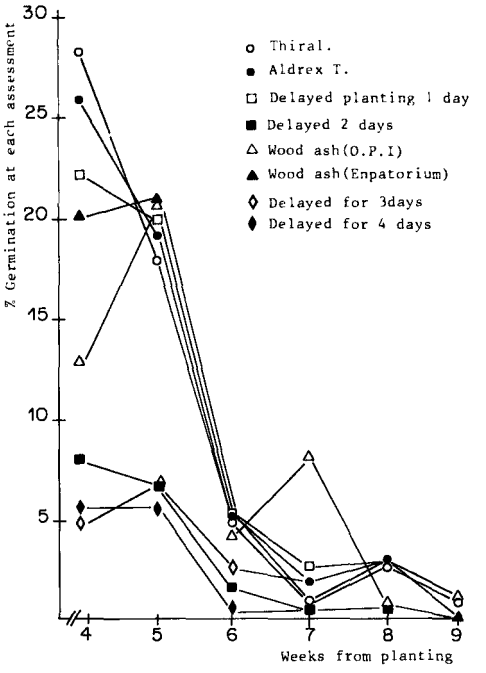

Fig.1 : Effect of chemical seed dressing and delayed planting of non-treated setts on germination

TABLE 2 : EFFECT OF CHEMICAL TREATMENT AND TIME OF PLANTING AFTER CHEMICAL TREATMENT ON SPROUTING OF MINISETTS. FROM cv. OBIACTURUGO OF D. rotundata (1983)

Pre-planting Treatments	Means % Germination Cumulative total
Fernasan D	16.10
Aldrex T	60.16
TB2 Dust	47.67
TB2 liquid	42.58
Benlate Dust	37.73
Benlate liquid	33.58
Control	53.24
LSD < 0.01	2.8

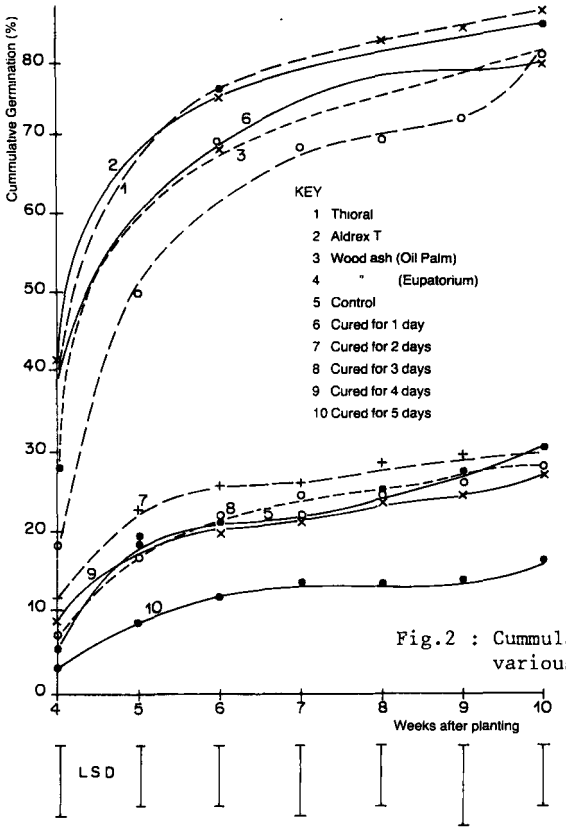

Fig.2 : Cummulative % germination following various pre-planting treatments(1984)

Germination :

Table 2 shows percent cumulative germination for the preliminary trial in 1983. The result was inconsistent, especially with the flowable concentrates. Some of the cut setts treated with flowable concentrate of Benlate and Thiabendazol became mouldy by the third day. However, percentage sprout was significantly ($P<0.01$) affected by type of chemical used and time of planting minisetts. Aldrex T chemical was best followed by air curing. There was a significant interaction between chemical and time of planting of treated setts.

Table 3 shows cummulative germination taken 40 days from planting and subsequently at 1 weekly interval for 1984 trials. At forty days from planting Thioral gave significantly ($P<0.05$) higher percentage germination over all the other treatments (42.2 per cent), while curing from 1 day treating with Aldrex T and wood ash gave significantly ($P<0.05$) higher percentage germination over curing for more than one day. The trend continued until after 68 days from planting when treating with Aldrex T, Thioral wood ash and curing for 1 day were not significantly different in percent germination, but were significantly different ($P<0.05$) from curing for over 1 day. Final percentage germination count taken 82 days from planting (Table 3) shows that there were no significant differences between treatment with Thioral, Aldrex T, wood ash and curing for 1 day (84.9, 86.9, 79.9, 81.0 and 79.6 per cent respectively). These scores significantly differed from curing for between 2 - 5 days and planting immediately after cutting. There were significant interactions ($P<0.05$) between cultivars and chemical treatment and curring.

Figure 2 indicates that highest number of setts either curred for 1 day or treated with Thioral or Aldrex T germinated after 30 days from planting while treatment with wood ash and curing for 2 - 5 days produced their highest number of sprouts planting, 37 days from planting (daf).

In all the treatments, percent number of setts that germinated at each assessment decreased with time ; except with wood ash where a slight increase was obtained at 51 days over the 44th day from planting. Results Table 4 shows leaf number which represent vigour of the growing plants. Stands from setts treated with Aldrex T or Thioral or cured for 1 day produced significantly ($P<0.05$) higher number of leaves (181.7, 147.5 and 151.5) respectively than wood ash and curing for above 2 days, at the first sampling (4 months after planting).

At 60 days (daf) the trend was the same as at (dap), but stands treated with wood ash produced as many leaves as stands from setts treated with either Thioral, Aldrex T, or cured for 1 day. Total leaf areas followed the trend obtained for number of leaves. Three periods of sampling for leaf area index (LAI) indicated that curing for 1 day gave LAs of 2 :

TABLE 3 : CUMULATIVE PERCENTAGE GERMINATION FOLLOWING VARIOUS PRE-PLANTING TREATMENTS. (1984)

Pre-planting Treatments	Percentage Cummulative germination						
	18/6/84	25/6	2/7	9/7	16/7	23/7	14/8
Thioral	42.2	69.5	76.6	78.6	81.4	82.9	84.9
Aldrex T	38.9	67.8	75.8	79.4	83.3	84.5	86.9
Wood Ash (Oil Palm)	19.4	51.2	57.2	68.7	70.2	72.6	81.0
Wood Ash (Eupatorium)	29.4	60.8	69.8	71.8	76.2	78.6	81.0
Control - freshly cut setts	6.2	19.5	21.5	22.6	25.6	26.8	31.6
Curing for : 1 day	33.3	61.1	68.7	73.5	78.6	78.6	79.8
2 days	11.9	23.0	25.8	26.5	28.9	29.8	30.6
3 "	7.2	17.5	22.2	25.0	25.0	27.8	28.6
4 "	9.2	19.0	20.2	22.2	24.2	25.0	27.6
5 "	3.6	8.4	12.3	13.9	13.9	14.3	17.1
LSD < 0.05	8.8	7.3	7.8	8.4	7.6	9.9	7.7

TABLE 4 : AVERAGE NUMBER OF LEAVES PER STAND OF YAMS FOLLOWING VARIOUS PRE-PLANTING TREATMENTS OF MINISETTS FROM cv. OBIAOTURUGO OF D. ROTUNDATA (1984)

Pre-planting Treatments	Average Number of Leaves at	
	52 (DAF)	104 (DAF)
Thioral	147.5	188.7
Aldrex T	181.7	145.7
Wood Ash (Oil Palm)	107.3	196.8
Wood Ash (Eupatorium)	128.2	191.7
Control - freshly cut setts	84.1	101.2
Curing : for 1 day	151.5	142.0
2 days	110.7	107.7
3 "	62.7	58.3
4 "	61.8	90.7
5 "	47.0	54.5
LSD < 0.05	15.14	24.07

or daf

dfp

TABLE 5 : LEAF AREA INDEX OF YAMS GROWN FROM MINISETTS FOLLOWING VARIOUS PRE-PLANTING TREATMENTS (1984)

Pre-planting Treatments	Leaf Area Index		
	52 (daf)	82 (daf)	104 (daf)
Thioral	1.7	1.5	1.3
Aldrex T	2.1	2.3	1.0
Wood Ash (Oil Palm)	1.5	2.0	1.6
Wood Ash (*Eupatorium*)	1.8	1.9	1.6
Freshly cut setts	1.2	1.05	.93
Curing : for 1 day	2.0	2.1	1.4
2 days	1.8	1.3	1.1
3 "	.92	1.1	.5
4 "	.98	1.2	.5
5 "	.38	.64	.4
LSD < 0.05 for dfp daf	.81	.78	.48

2.1 and 1.4 respectively for the three periods (Table 5) while curing for over 2 days. The highest LA was reached at the second sampling (4 months from planting) for all the treatments. Subsequently leaf area fell and very drastically when cured for over 2 days. Tuber yield values obtained at harvest 7½ months from planting reflect similar pattern, (Table 6). Setts treated with thioral and Aldrex T yielded more tubers (significantly $P<0.05$) than setts treated with wood ash and setts cured for 1 day. The yield were 5.58, 5.87, 4.58 and 4.81 t/ha for Thioral, Aldrex T, wood ash and curing for 1 day respectively. But delayed planting for 2 days reduces yield by 70,9, 72,4, 64.6, 66.3 per cent over treatment with Thioral, Aldrex T, wood ash or curing for 1 day. If the delay extended up to 5 days loss in yield over the four treatments mentioned above was 84.6, 85.3, 81.2, 82.1 per cent respectively.

DISCUSSION

Uniform and high percentage germination were two factors that affected seed yam production by the minisett technique. One of the major causes has been identified as rotting of the minisetts when planted in the soil (NWANKITI, 1984). Use of chemicals like Aldrex T was very useful.

This study indicates that an alternative approach to the solution of the problem of low percentage germination and problem of cost is to apply the curing technique. This study indicates that leaving cut minisetts for one day under uncontrolled ambient conditions gives over 78 per cent germination and establishment with reasonably high growth vigour and high tuber yield at harvest. While planting immediately after cutting reduces the germination capacity and vigour of the plant and gives poor tuber yield at harvest, curing for three days and above before planting reduced percentage germination and tuber yield at harvest.

PRIESTLEY and WOFFENDEN (1923) advanced a general view on the headling process of an exposed parenchymatous tissue. First the walls of the cells at the surface of the exposed tissue become covered with a deposit of a fatty nature (suberin). As a result of its formation, the intercellular spaces of the tissue below the exposed surface were cut off from the external atmosphere. the rate of blocking of the healthy tissue from the atmosphere was affected by temperature and humidity (WIGGINTON, 1974). Temperatures of (40°C) and high humidity (90 per cent rh) are adequate.

When the cut tuber is placed in the ground, it is important that it should be resistant to the entry of pathogenic organisms. A freshly cut surface which has exudates on the surface when planted would attract micro-organisms and therefore, will not beresistant to micro-organisms, hence, the low germination and low yield of freshly cut setts.

A layer of suberin formed on the cut surface

TABLE 6 : FRESH TUBER YIELD t/ha FOLLOWING VARIOUS PRE-PLANTING TREATMENTS. (1984)

Pre-planting Treatments	Fresh tuber yield t/ha		
	cv. Okwocha	cv Nwopoko	Means
Thioral	8.09	3.06	5.58
Aldrex T	7.46	4.27	5.87
Wood ash (Oil Palm)	6.38	2.79	4.58
Wood ash (Eupatorium)	5.71	2.78	4.25
Freshly cut setts.	2.81	.75	1.78
Curing : for 1 day	6.76	2.86	4.81
2 days	2.30	.94	1.62
3 days	1.78	.33	1.06
4 days	1.41	.39	.90
5 days	1.59	.15	.86
Means	4.43	1.83	

LSD < 0.05 for cultivars 1.02

LSD < 0.05 for treatments 2.20

if left for one day two ; and when this was planted in the soil, the healing process is completed before planting. This is similar to what was observed in the practice of potato production. Our results here agree with the results on potato by PRIESTLY and WOFFENDEN (1923).

The failure of the yam minisetts kept for over two days when planted may have been due to fungus attack both in storage and in the soil, and rapid drying of the cut surface which also resulted in water loss and consequently loss of viability. The alternative of using wood ash which disinfects the surface and facilitates curing process.

In conclusion, minisetts could be planted after curing for one day provided they are not piled in heaps but loosely spread out to allow free circulation of air and even suberization of the cut surface. If kept for too long, the cut surface dries out quickly and grows mouldy. Treatment with inexpensive wood ash could substitute treatment with fungicides.

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