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Effect of Different Storage Methods on Development of Post Harvest Rot of *Solenostemon rotundifolius* (poir) J.K.Morton in Yola, Adamawa State-Nigeria.

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Abstract
Investigation into the effects of different storage methods on the development of post-harvest rot of Hausa potato [Solenostemon rotundifolius (Poir.)] were carried out in the Biological Sciences Laboratory of Modibbo Adama University of Technology, Yola using completely Randomized Design (CRD). One thousand grammes of healthy Hausa potato tubers were stored in medium-sized (25x20x19cm) clay pots labeled as A,B,C and D. Tubers in A were covered with guinea corn chaff, B with saw dust, C with wood ash and D served as control (untreated). Data were collected every month for four months on percent weight loss and disease incidence, the data obtained were analyzed using Analysis of Variance (ANOVA) and the means that were significant were separated using the Least Significant Difference (LSD). Results showed that wood ash provided the best storage medium with a mean weight loss of 74g after four months, followed by sawdust 113g and the least was guinea corn chaff which gave 162g. On disease incidence wood ash also proved most effective in controlling rot development with a percentage of 2.4, followed by sawdust 3.2 while guinea corn chaff was the least with 4.1. Analysis of variance showed significance differences among the various treatments. Storage of Solenostemon rotundifolius tubers in wood ash and sawdust are the most suitable control measure.
Key words: *Solenostemon rotundifolius*, weight loss, disease incidence, sawdust, guinea corn chaff and wood ash.

1 Introduction

Solenostemon rotundifolius (Poir.) J. K. Morton, (Hausa name-*Tumuku*), a root tuber and a dicotyledonous annual herb belonging to the family Labiaceae (Schippers, 2002), originated from tropical Africa (Tindall, 1983) and is currently cultivated in many African countries (Ghana and Nigeria) (Jada *et al.*, 2007). In northern Ghana, farmers use it to bridge the hunger gap between planting and harvest of the main staple crops (AGREN, 2002). In Nigeria, many farmers cultivate it as a supplement in family menus. The plant produces edible tubers (Blench, 1997) that contain 75% water, 1.4% protein, 0.5% fat, 21% carbohydrate, 0.1% fibre, 1% ash, 17mg calcium, 6 mg iron, 0.05 mg thiamine, 0.02 mg riboflavin, 1 mg niacin , 1 mg ascorbic acid (Grubben and Denton, 2004). The tubers are boiled, baked, fried or roasted and eaten as snack or cooked with spices in various combinations with other foods such as beans and cook vegetables (Grubben and Denton, 2004). Tindall (1983) reported that one of the major problems of *Solenostemon rotundifolius tubers* is loss during storage. The skin of the tubers is easily damaged from pre-harvest operations, through harvesting and subsequent handling operations predisposing them to attack by microorganisms due to harvesting techniques, environmental factors, insects and microorganisms. This results in weight loss (Larus *et al*., 2007 and 10- 30% reduction in tuber quality (Muktar and Abdullahi, 2004, Kehinde and Kadiri 2006 and Basiri *et al.,* 2011). Also, shrivelling and sprouting of the tubers during storage increases their weight loss, which becomes an economic loss when the produce is marketed as well as being less attractive to potential customers (FAO, 1990). Chemical methods have been developed to control deterioration during storage (Karim and Fasasi, 2009), however, the hazards involved in using these chemicals associated with high cost and in accessibility to indigenous farmers make alternative control measures desirable (Ebele, 2011). Various traditional methods of sweet potato storage using grass ash, soil and saw dust have been practiced in Nigeria and across African countries by farmers (Edward and Christopher 2007, Oguntade and Adekunle , 2010 and Dandago and Gungula

2011). This work is therefore aim at investigating the efficacy of wood ash, guinea corn chaff and saw dust as storage media for controlling *Solenostemon rotundifolius tuber* rot.

2 Materials and Methods

2.1 Collection of Samples

A total of three thousand and two hundred samples were collected from Yola town and Jimeta markets of Adamawa state located between latitude $9^0$11' to $9^0$19' N and longitude $12^0$20' to $12^0$30' E. Samples of *Solenostemon rotundifolius* tubers were collected from different selling points randomly in the markets and were taken to the laboratory for studies. Sixteen medium-sized clay pots (25x20x19cm) were purchased from Yola market for the storage of the tubers.

2.2 Collection and Preparation of plant materials

Guinea corn chaff purchased from Yola market, sawdust obtained free from a carpenter at Jimeta and wood ash collected from domestic burnt wood of *Anogeissus leiocarpus* wood. Five hundred grammes of each of the plant materials in four replicates were placed into sterile polythene bags and taken to the laboratory.

2.3 Effects of guinea corn chaff, saw dust and wood ash on the stored Solenostemon rotundifolius tubers.

One thousand grammes of healthy *Solenostemon rotundifolius* tubers were placed in 25 cm diameter clay pots labeled as A,B,C and D. Tubers in A were covered with guinea corn chaff, B with sawdust, C with wood ash and D served as control (untreated). Five hundred grammes of each of the treatment material were used. All the pots were arranged in a completely randomized design with four replications at room temperature. The experiment lasted for four months. During the storage period, data was collected on; weight loss in *Solenostemon rotundifolius* (in gms) and disease incidence (%) of *Solenostemon rotundifolius tubers* were determined using the formula as described by Tarr (1981).

$$\text{Disease incidence (\%)} = \frac{\text{Number of diseased samples}}{\text{Total number of samples examined completely}} \times 100$$

Randomized Design (CRD) was used as described by Gomez and Gomez (1984), and the experiments were replicated four times. Data generated were analyzed using analysis of variance (ANOVA), and the means that were significant were separated by least significant difference (LSD) at 1% probability level ($P<0.01$) according to Scheffe (1953).

3 Results

The results on mean percent weight loss of *Solenostemon rotundifolius* tubers stored in saw dust, guinea corn chaff and wood ash as storage mediums for four months period showed that weight loss was significantly ($P < 0.01$) affected by the treatments as shown in Table 1. Potato samples stored in wood ash had the lowest average weight loss (74g), while those in control recorded the highest weight loss (186g). Generally, weight loss of stored *Solenostemon rotundifolius* tubers increased with storage period. Shriveling and sprouting of the tubers were observed during storage. The means of percent incidence of disease in *Solenostemon rotundifolius* tubers stored in sawdust, guinea corn chaff and wood ash for four months showed highly significant ($P < 0.01$) effects of the preservatives as compared to the control. The highest incidence of disease (5.4%) was recorded in the control tubers which was significantly different from the other treatments. The lowest incidence of disease (2.4%) was obtained in tubers treated with wood ash (Table 2). Irrespective of materials used, disease incidence increased progressively with time of storage.

4 Discussion

Findings of the study showed that storage of *Solenostemon rotundifolius* tubers in guinea corn chaff, sawdust and wood ash was effective compared with the control, although wood ash proved most effective. This agreed with the findings of Oguntade and Adekunle (2010) who reported that wood ashes proved effective in preserving stored crops against pest and microbes. The present findings also agree with those of Victor (2009) and Dandago and Gungula (2011) on the effectiveness of sawdust for preservation of sweet potatoes. The study further revealed that there was increase in mean weight loss of the tubers with increase in storage period. Dandago and Gungula (2011) also observed that weight loss in stored sweet potatoes increased with storage period. The loss in weight according to Ray

and Ravi (2005) could be due to respiration and transpiration, reduction in moisture content (Karim and Fasasi, 2009), shrivelling, microorganism attack and sprouting (Edward and Vital, 2009). The highest mean weight loss of samples in the control could be due to non-protection from environmental agents (Dandago and Gungula, 2011), which implies that such storage may be feasible for short-term storage (consumption and sell). Low mean weight loss recorded in samples stored in saw dust could be due to low relative humidity provided by the sawdust (Dandago and Gungula, 2011). Among the preservatives, wood ash had the best performance in which decay of the samples was minimal, followed by sawdust. The low incidence of disease in samples stored in wood ashes could be due to its inhibitory effects against phytopathogenic fungi (Ijato, 2011).

5 Conclusion

This study has shown that Sawdust, guinea corn chaff and wood ash can serve` as storage materials of *Solenostemon rotundifolius* tubers. Wood ash and sawdust were good for storing *Solenostemon rotundifolius* for a period of four months, though storage in wood ash gave better result in terms of lower mean weight loss, and lower rotting. These are effective and alternative methods of minimizing post-harvest rot.

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Table 1: Mean Weight Loss (gm) of *Solenostemon rotundifolius* after Four Months of storage (September-January).

Treatment	October	November	December	January	Total	Mean
Sawdust	3.00	99.50	169.75	179.75	452	113
G/corn chaff	4.50	109.25	249.50	285.25	648.5	162
Wood ash	1.75	19.75	125.50	149.75	296.78	74
Control	8.25	159.50	279.50	299.75	747	186
Mean	4.38	97.00	206.06	228.63		
Pro. F	0.01	0.01	0.01	0.01		
SE	1.25	0.5	0.40	0.31		
LSD	1.79	3.94	1.01	0.88		

Table 2: Mean Disease Incidence (%) of *Solenostemon rotundifolius* for Four Months Storage Period.

Treatment	October	November	December	January	Total	Mean
Sawdust	1.04	3.29	3.71	4.79	12.83	3.2
G/corn chaff	1.46	3.93	4.81	6.33	16.53	4.1
Wood ash	0.62	2.14	2.82	3.98	9.56	2.4
Control	2.24	5.22	6.33	7.80	21.59	5.4
Mean	1.34	3.64	4.42	5.72		
Pro. F	0.01	0.01	0.01	0.01		
SE	0.47	0.33	1.05	1.06		
LSD	1.10	0.92	1.64	1.64		

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