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CULTURAL MANAGEMENT OF *Cylas puncticollis* (Boheman) IN UMUAHIA NIGERIA.

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Abstract

Cylas puncticollis (Boheman) is a major insect pest resulting in the reduction of the quantity of sweetpotato roots. Cultural practices in agriculture can be a suitable option to the hazardous use of synthetic insecticides. In Umuahia Nigeria, two field experiments were carried out in two cropping seasons on Umuspo/1 and Umuspo/3 orange fleshed sweetpotato varieties were: (i) Three levels of earthing-up and (ii) Mulching with leaves of three plants; *Tephrosia vogelii*, *Alchornea cordifolia* and *Ageratum conyzoides*. The 2×4 factorial experiments were laid out in randomized complete block design with three replicates. Plot size was 6m^2. Parameters evaluated were weevil progeny development, population density, marketable and unmarketable sweetpotato roots. There was high significant difference (P≤ 0.05) in the low weevil population density observed on the mulched plots. It also, obtained significantly lower *Cylas puncticollis* progeny development and higher marketable roots compared to the control plots in both cropping seasons. Twice and thrice earthing-up plots significantly recorded low weevil population density in both cropping seasons. Generally, significantly (P≤ 0.05) higher weevil population density, progeny development, and unmarketable roots were recorded in the controls of the two experiments in both cropping seasons. These studies revealed the effectiveness of earthing-up twice practice and mulching with botanical leaves for better management of *Cylas puncticollis*. These economical cultural practices should be applied to boost production of sustainable orange fleshed sweetpotato root crop in Nigeria.

Keywords: Cultural practices, orange-fleshed sweetpotato, *Cylas puncticollis*, mulching and earthing-up.

INTRODUCTION

Sweetpotato is one of the fifth maximum crucial crops in forty growing nations after rice, wheat, maize, and cassava (Elameen *et al*., 2008). In 2014, China, Nigeria, Uganda, Indonesia, and the United Republic of Tanzania were the high five main producers of sweetpotato (FAO, 2015). Nigeria's harvest estimate was 3.5 million metric tons, approximately 3.3% of total global production in 2014. Nigeria increased production and was ranked as the fourth biggest producer within the world and the third in Africa with a record of 4,013,786 metric tons representing 3.6% global production in 2017 (FAOSTAT, 2017). In Nigeria, it is grown mainly for the enlarged storage roots, which might be generally eaten fresh, boiled, fried or roasted and the

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leaves may be eaten as a vegetable or by livestock as forage (Agrodok, 2013). Orange fleshed sweetpotato is one of the generous suppliers of beta-carotene, a precursor of bio-available vitamin A that has the ability of preventing Vitamin A deficiency among rural resource-limited farmers in lots of developing nations (Low *et al*., 2007). *Cylas puncticollis* are primary pest broadly dispersed in tropical areas of the world, and their control is a major challenging issue confronted by farmers in sweetpotato producing nations (Ames *et al*., 1996). The infested root produced bitter taste and becomes unsuitable for human intake and animal feed (Worku *et al*., 2014).

Many African farmers increasingly resort to regular use of commercial synthetic pesticides due to the severity of crop insect pests, which is hazardous to human and the environment (Abate and Ampofo, 1996). The modification of cultural practices, manipulates pest habitat and is a natural pest control mechanism applicable in integrated pest management, which emphasizes on the growth of a healthy crop with the least possible disruption to agro-ecosystems (sandler, 2010). Earthing-up is a cultural control strategy that limits crack formation on the soil by adding more soil to cover the top soil. This works to prevent the entry of sweetpotato weevil's tuber into and oviposition by female weevils (Worku *et al*., 2014). Mulch is a material (such as shredded vegetation, stone, plastic films etc.) used to cover the top layer of the soil to protect, insulate, discourage weed, retain soil moisture and improve soil fertility in agriculture. Mulching is a cultural practice, in which some materials are used as mulch, some investigations proved that it is effective in minimizing soil cracks, conserve soil moisture and have provided a physical barrier that reduced the entry of sweetpotato weevils to roots (Telakar, 1987). Mulching also replenishes soil nutrient, thus improves soil fertility leading to increase in crop productivity (Okwu and Ukanwa 2010).

MATERIALS AND METHODS

EXPERIMENTAL SITE

A field experiment was conducted in Umuahia at the Forestry Research Institute of Nigeria, within 2 cropping seasons from August to November 2018 and 2019.

PLANTING MATERIALS

Sweetpotato vines- The two varieties of orange fleshed sweetpotato vine cuttings UMUSPO/1 and UMUSPO/3 were procured from the National Root Crops Research Institute, Umudike (NRCRI) and used for the experiments.

Botanicals- Three Plant materials used as mulch were leaves of:
Tephrosia vogelii (Fish-bean-poison / Rose bush)
Alchornea cordifolia (Christmas bush)
Ageratum conyzoides (Goat weed)

Experiment 1: Effect of earthing-up in the control of sweetpotato weevil (*C. puncticollis*) on orange fleshed sweetpotato varieties in Umuahia, Nigeria.

The experiment was a 2×3 factorial experiment laid out in a Randomized Complete Block Design (RCBD) with three replications. 960 of orange fleshed sweetpotato (var. UMUSPO/1: 480 and UMUSPO/3: 480) vine cuttings were planted at angle 45^o.

Earthing up was done manually using shovel at 4, 8 and 12 weeks after planting (WAP).

Experiment 2: Effect of mulching in the control of sweetpotato weevil (*C.

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***puncticollis*) on orange fleshed sweetpotato varieties in Umuahia, Nigeria.**

The fresh leaves of *T. vogelii, A. conyzoides* and *A. cordifolia* were collected, weighed (500g per plant) and used as mulch on the bases of sweetpotato plants at 5 WAP (after fertilizer application at 4th WAP) and 10 WAP (during tuberization).

Field preparation

The field was cleared manually of existing vegetation with cutlasses and the debris removed. Ridges were made manually using hoe and shovel 1m × 0.3m spacing (Ehisianya, 2013).

DATA COLLECTION

Insect count - Assessment of the number of *C. puncticollis* was carried out in the study from 6 WAP at 2 weeks' intervals by direct visual counting of adult *C. puncticollis* from ten randomly selected plants. The counting was done between 6am to 8am when the insects were relatively less active on plant foliage and stem (Mtunda *et al*., 2001).

Insect Study

Harvested infested roots from the field (experiment I and II) were taken to the laboratory for dissection and insect sorting into immature and adult progenies of *C. puncticollis*.

Number of marketable and unmarketable roots per plot.

Harvested roots were separated depending on the size and healthiness of the root into marketable (healthy) roots when the weight of the roots is greater or equal to 100g and is healthy. Unmarketable (infested) roots are when the weight of the roots is less than 100g and visually infested tubers by sweetpotato weevils collected from the plot (Mtunda *et al*., 2001).

Experimental Design/Statistical Analysis

The two field experiments were arranged in Randomized Complete Block Design (RCBD). and replicated three times. All data collected were subjected to analysis of variance (ANOVA) using, GENSTAT (2007). Significant means (P<0.05) were separated using Fishers protected Least Significant Differences (LSD) at 5% level of significance.

RESULTS

The result obtained from table 1 showed that 2018 cropping season **s**ignificantly (P≤0.05), recorded higher insect progeny in Umospo/3 infested roots than 2019 cropping season. Earthing-up thrice and twice recorded the least immature and adult progeny emergence in infested root in and 2019 cropping seasons. The treated mulched plots significantly (P≤0.05) obtained lower insect progeny emergence in infested roots than the control unmulched plot.

Generally, the control plots in experiment one and two recorded higher number of immature and adult progeny emergence in the infested roots.

Table 1: Effect of Integrated management on progeny development of sweetpotato at harvest in 2018 and 2019

	2018			2019		
TREATMENT	ADULT	IMMATURE	PROGENY	ADULT	IMMATURE	PROGENY
EXPERIMENT 1						
VARIETY						

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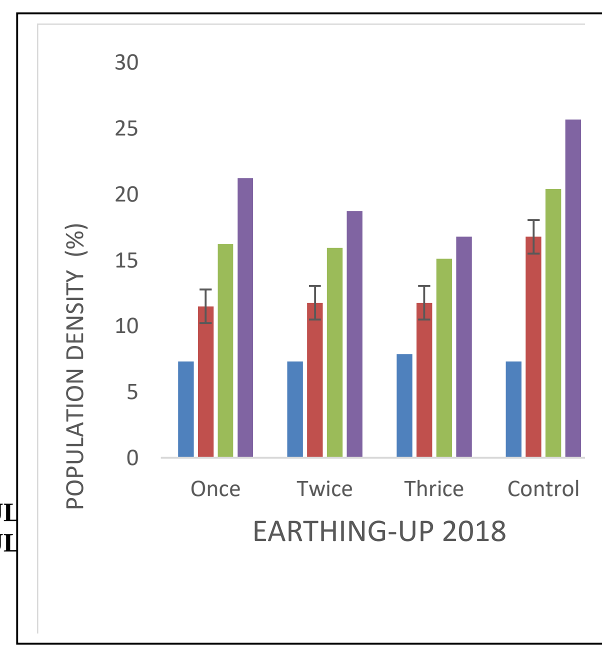
Umuspo-1	6.62	15.11	21.65	6.35	13.72	19.98
Umuspo-3	15.81	34.60	50.32	11.63	20.40	31.95
LSD	4.23	8.99	5.93	4.58	8.79	13.12
(0.05) Variety						
EARTHING UP						
Once	11.22	25.13	36.27	10.10	19.29	29.31
Twice	7.88	20.12	27.92	6.76	17.34	24.02
Thrice	2.87	6.76	9.55	0.08	0.08	0.08
Control	22.91	47.40	70.22	19.01	31.54	50.46
MEAN	**11.22**	**24.86**	**35.99**	**8.99**	**17.06**	**25.97**
LSD	5.99	12.71	8.38	6.48	12.43	18.56
(0.05) Earthing-up						
EXPERIMENT 2						
VARIETY						
Umuspo-1	6.70	14.28	20.26	4.12	9.13	13.17
Umuspo-3	13.30	27.64	40.86	4.43	18.04	26.11
LSD	4.20	7.89	11.95	3.03	6.60	4.27
(0.05) Variety						
LEAF MULCH						
T. vogelii	5.65	11.50	17.06	2.31	4.54	6.21
A. cordifolia	5.93	15.67	21.52	3.15	8.71	11.77
A. conyzoides	5.93	12.33	18.18	2.31	6.49	8.71
Control	21.24	44.34	65.49	17.34	34.60	51.85
MEAN	**21.24**	**20.96**	**30.56**	**6.28**	**13.58**	**19.64**
LSD	5.94	11.16	16.91	4.28	9.33	6.04
(0.05) Plant Extract						



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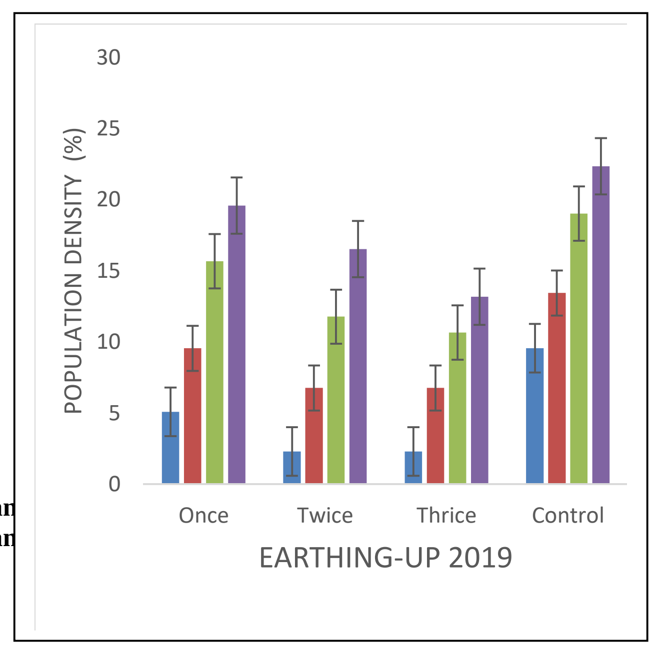

Figure 1: Earthing-up 2018

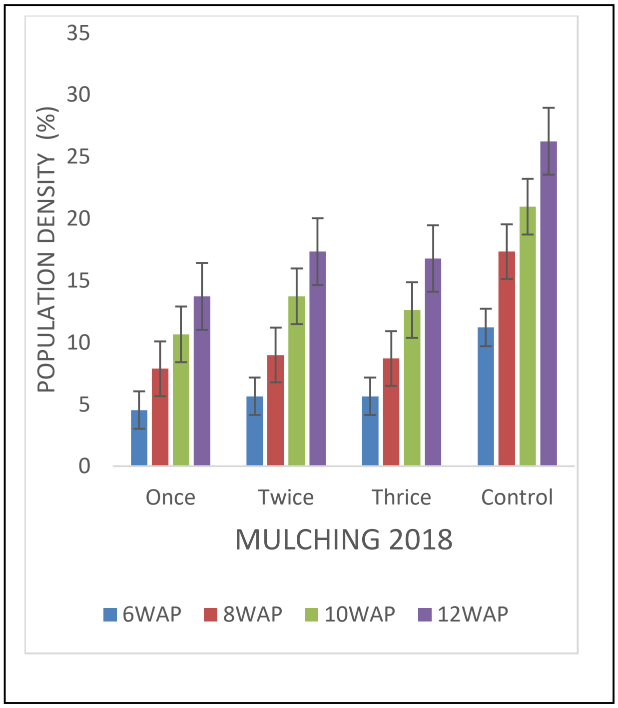

Figure 3: Mulching 2018

Figure 2: Earthing-up 2019

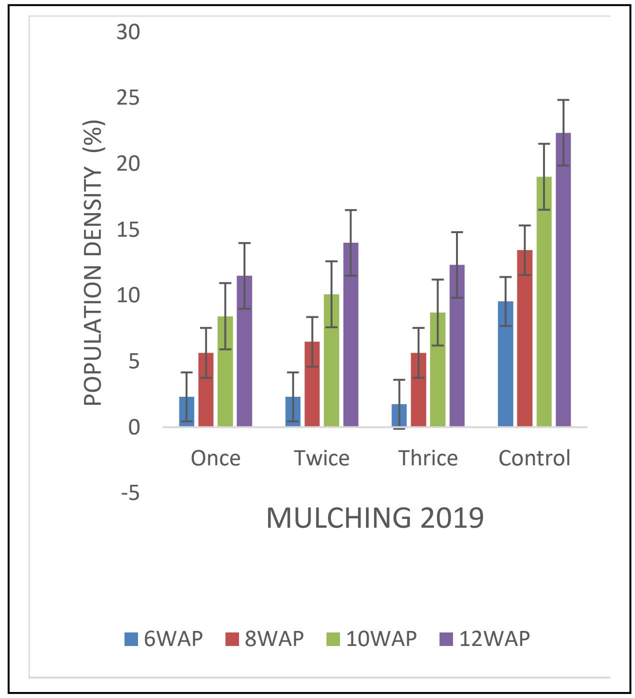

Figure 4: Mulching 2018

Figures 1 to 4 above are bar chart presentation of weevil population density on earthing-up and mulching practices in 2018 and 2019 cropping seasons. These showed a steady progressive significant ($P \leq 0.05$) increase in sweetpotato weevil population density of *C. puncticollis* recorded from 6weeks to 12weeks after planting in this study. Although, 2019 indicated low population density than 2018 cropping seasons in both experiments. Earthing-up thrice and twice plot recorded lower ($P \leq 0.05$) population density of *C. puncticollis* in the observed weeks.

All mulched plots in both cropping seasons had similar effect and lower weevil population density compared to the control plot. Generally, the control plots had higher population density of *Cylas puncticollis* in the observed weeks on earthing-up and mulched plots in 2018 and 2019 cropping seasons.

In 2018 cropping season, earthing up twice and thrice had similar effect on the quantity of marketable roots in table 2 below while in 2019, Umuspo/3 marketable roots significantly recorded higher number of marketable (27.22kg/ plot), where thrice earthing up plot significantly recorded higher number of marketable 32.37 than twice earthing up plot 29.03. Also, thrice earthing up plot recorded lower unmarketable roots 0.08 than quantity of

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unmarketable root obtained from twice earthing up plot.

Mulched plots indicated significantly (P≤0.05) more marketable roots and less unmarketable roots than untreated control plots in both cropping seasons. Where plots treated with *T.vogelii* mulch significantly recorded higher marketable root in 2018 (60.50kg/ plot) and in 2019 (42.67kg/ plot) compared with other mulch treated plots.

Table 2: Effect of Integrated management on number of marketable and unmarketable roots of sweetpotato at harvest in 2018 and 2019 cropping season.

	2018		2019	
TREATMENT	**Marketable Root(kg)**	**Unmarketable Root(kg)**	**Marketable Root(kg)**	**Unmarketable Root(kg)**
EXPERIMENT 1				
VARIETY				
Umuspo-1	15.18	0.92	25.41	1.20
Umuspo-3	26.11	3.98	27.22	1.89
LSD (0.05) Variety	2.22	1.03	1.15	0.84
EARTHING UP				
Once	19.85	2.59	25.41	1.48
Twice	22.91	1.48	27.92	1.48
Thrice	25.69	0.08	31.81	0.08
Control	15.39	5.65	20.12	3.15
MEAN	**20.96**	**2.45**	**26.32**	**1.54**
LSD (0.05) Earthing-up	3.14	1.45	1.62	1.19
EXPERIMENT 2				
VARIETY				
Umuspo-1	37.32	1.53	27.64	1.06
Umuspo-3	52.43	7.54	35.43	1.48
LSD (0.05) Variety	7.73	2.69	3.97	NS
LEAF MULCH				
T. vogelii	60.57	2.93	42.67	0.36
A. cordifolia	45.23	2.93	28.75	0.92
A. conyzoides	45.69	3.39	34.32	0.36

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Control	28.03	8.51	20.40	3.42
MEAN	**44.88**	**4.44**	**31.54**	**1.27**
LSD	10.94	3.80	5.61	1.16

(0.05) Plant Extract

DISCUSSION

Earthing-up twice and thrice significantly reduced number of *C. puncticollis* population density which indicated that rehilling prevents the formation of soil cracks and thus possess a barrier to *C. puncticollis* penetration into root region during tuberization and at maturity of sweetpotato roots, disrupting reproduction and multiplication of sweetpotato weevil within the plant. This conforms with the work of Worku *et al*. (2014) on three times earthing-up which reduces number of tuber damage per plot because hilling up prevented soil cracking that helps to hinder adult weevil movement to reach the tubers underground for egg laying and subsequent damage by larvae. These works are consistent with the finding of IITA (2010) that tubers within the soil are less likely to be infested by the weevils.

The result obtained from this study showed that mulching with botanical leaves significantly influenced *C. puncticollis* population density and infestation of sweetpotato. These botanical mulches were antifeedants and repelled sweetpotato weevil from penetrating into the sweetpotato stem and root region. The effect of *T.vogelii* leaves on reduced weevil population density and higher marketable roots was due to the presence of rotenoids in the leaves which corresponds with the findings of Belmain *et al*. (2012) who stated that the biological activity of the plant was due to foliar rotenoids. This earlier research by Belmain *et al*. (2012) also indicated that azidiractin (*Azadirachta indica*), rotenone and its relatives (*Tephrosia vogelii*) are among some of the commercially important plant-derived efficacious metabolites used in modern pest control programmes.

CONCLUSION

Two and three levels of earthing-up reduced sweetpotato weevil infestation and produced better marketable root. This study found that earthing-up practice provided more space for improved tuberization, size and maturity of orange fleshed sweetpotato root. As well as minimized the formation of cracks which would have provided access for sweetpoato weevil penetration into the root.

The test bioactive botanical leaf mulch on applied plots acted as feeding deterrent and had repellent effect on sweetpotato weevils in and around the orange sweetpotato plant. This bioactivity as a result of the presence of botanical leaves at the base of sweetpotato plant possibly kept *C. puncticollis* away and minimized sweetpotato weevil attack on orange fleshed sweetpotato stem and penetration into root thus limiting weevil infestation in this study.

Cultural practices involving the application of either two levels of earthing up are economical and minimized crack formation on soil, thereby, successfully restricted weevil penetration. The botanical leaf mulch limited the presence of weevil and in addition improved soil fertility.

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These cultural practices should be adopted by sweetpotato growers towards providing sustainable root crop production in Nigeria.

REFERENCES

Abate, T. and Ampofo, J. K. (1996). Insect pests of beans in Africa: their ecology and management. *Annual Review Entomology*, 41: 45 - 73.

Agrodok, (2013). 28 CTA, P. O. Box 6700AJ, Wageningen. The Netherlands; Pp.35 -37.

Ames, T., Smit, N. E. J. M., Braun, A. R., O'Sullivan, J. N. and Skoglund, L. G. (1996). Sweetpotato: Major Pests, Diseases and Nutritional Disorders. International Potato Center (CIP). Lima, Peru: pp. 152.

Belmain, S. R., Amoah, B. A., Nyirenda, S. P., Kamanula, J. F. and Stevenson, P. C. (2012). Highly variable insect control efficacy of Tephrosiavogellichemotypes. *Journal of agricultural and Food Chemistry*, 60(40): 10055 - 10068.

Ehisianya, C. N., Ukeh, D., Isah, M., Lale, N. and Umeozor, O. (2013). Field Efficacy of Neem Seed Oil and Diazinon in the Management of Sweetpotato Weevil, *Cylas punticollis (*Boh.) in South-eastern Nigeria. *National Root Crops Research Institute, Umudike, Nigeria*, 2: 1

Elameen, S., Fjellheim, A. and Larsen, (2008). "Analysis of genetic diversity in a sweet potato (*Ipomoea batatas* L.) germplasm collection from Tanzania as revealed by AFLP," *Genetic Resources and Crop Evolution*, 55(3): 397 - 408.

F.A.O. (2015). Food and Agriculture Organization Statistical Database.

F.A.O.S.T.A.T. (2017). Farmer groups in Uganda to develop new sweetpotato cultivars: decentralization and building on traditionalapproaches. Euphytica; 159: 217–228.

I.I.T.A. (2010). International Institute of Tropical Agriculture. Cowpea. http://www.iita.org/cowpea/importance/production/harvesting/diseases.

Low, J. W., Arimond, M., Osman, N., Cunguara, B., Zano, F. and Tschirley, D. (2007). A food-based approach: introducing orange-fleshed sweetpotatoes increased vitamin A intake and serum retinol concentrations in young children in rural Mozambique. *Journal of Nutrition*, 137(5):1320 - 1327.

Mtunda, K. D., Chilosa, D., Rwiza, E. U., Kilima, M. and Kiozya, H. (2001). Damage shelf-life of sweetpotato during marketing. *African Journal* of *Crop Science*, 9: 301 - 307.

Okwu, D.E. and Ukanwa, N. (2010). Isolation and characterization of flavonoids chalcones of anthocyanidine glycoside from *Alchorneacordifolia* leaves. *E-Journal of Chemistry*. 7(1): 41 – 48.

Sandler, H. A. (2010). "Integrated Pest Management". *Cranberry Station Best Management Practices*. 1(1): 12 - 15.

CULTURAL MANAGEMENT OF *Cylas puncticollis* (Boheman) IN UMUAHIA NIGERIA.

Talekar, N. S. (1987). "Influence of Cultural Pest Management Techniques on the Infestation of sweetpotato weevil," *International Journal of Tropical Insect Science*, 8: 809 - 814.

Worku, W., Emana, G. and Waktole, S. (2014). Integrated Management of Sweetpotato Weevil (*Cylas puncticollis* (B.)) (Coleoptera: Curculionidae) at Chano Dorga, Southern Ethiopia. *Asian Journal of Agricultural Research*, 8(1):17 - 29.

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