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EVALUATION OF YIELD AND RESISTANCE EFFECT OF SOME YAM GENOTYPES (*DIOSCOREA ROTUNDATA* PIOR) TO PEST ATTACK AT HARVEST IN UYO, SOUTHEASTERN NIGERIA

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ABSTRACT

Two years study was carried to assess level of resistance to yam beetle and termite attack by some yam genotypes in Uyo, southeastern Nigeria. The experiment was laid out in randomized complete block design replicated three times. The five yam genotypes tested for yam beetle and termite attack at harvest were; TDr 95/19127, 95/18894, 95/19531, 75/1/2 and Uyo popular local variety *eteme.* The results showed variations in yield and susceptible to termite and beetle attack at harvest. The TDr 75/1/2 had highest yield 30.41 and 29.75t/ha, followed by TDr 95/18894, 28.86 and 27.93t/ha in 2008 and 2009 respectively. The local variety had lowest yield 9.75 and 10.07 t/ha in 2008 and 2009 respectively. The local variety had 14.58% termite attack in 2008 while 95/19127 had 12.64% in 2009. The local variety had highest beetle attack 45.83% and 32.76% in 2008 and 2009 respectively. The least prone to termite and beetle attack was recorded in TDr 75/1/2, 2.72 and 8.15% respectively in 2008 and 2.99 and 6.59% in 2009 respectively. The study suggested that TDr 75/1/2 and 95/18894 should incorporate in the farming system of the study area due to their high yielding capacity and resistance to pest attack at harvest.

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INTRODUCTION

Yam is one of the most importance tuber crops in Nigeria. It is a major staple food, which contributes substantially to Nigeria's food security. Global yam output was estimated 50 million metric tonnes in which Nigeria alone produce 35.0 million metric tonnes equivalent to 70% of total world production (FAOSTAT, 2019). Yam is reputed for the high prices of it commands as a result of its socio-cultural values (Chukwu and Chukwu, 2002, Agbaje *et al*; 2002). Despite the importance of yam as a major source of carbohydrates, its production is less than the national demand. its production is faced with problems notable among which are high cost of labour, unavailability of improved planting materials or seed yam, low soil fertility, scarcity of staking materials and harvesting difficulty as well as increasing levels of field and storage pest and diseases (Ikeh, 2010). Yams are attack by several insects both in the field and during storage. Foliar insect pest are less serious compared to tuber pests (Tobih, *et al*; 2009). The yam leaf beetles *Crioceris livida* (Dalm) and *lema armata* (Fab) both occurs together in yam farm but C. *livida* has been reported to be the dominant species in Nigeria (Onwueme, 1978). Mealybug species known to attack yam include *Planococcus citri*, *Planococcus dioscorea*, *Planococcus halli* Ezat McConnel (Akinlosotu, 1984). Other insects that attack yam include yam cricket with species such as Gymnogryllus lucens, Brachytrypes membranceus, all belong to (Orthoptera: Gryllidae). (Tobih, 2009). Other minor field insect pest of yam include leaf miner *Laccoptera* sp (cecidomiidae) which include galls on yam leaves while termite (Isoptera) with species like Amitermes, macrotermes and microtermes are widely distributed in west Africa (Tobih, *et al* 2009). Yield less attributed to termite attack ranges from zero to 15% (wood *et al*; 1980).

The major and greatest constraints to optimal yam production in yam production in yam growing zones of south and southeastern Nigeria is to the damage inflicted on yam tubers by the *Monophagous dynastid* beetles, the *Heteroligus* species which belongs to the order Coleoptera: *Dynastidae* (Taylor, 1964, Onwueme, 1978; Tobih *et al*; 2007; 2009). The beetles is highly veracious and losses in field yam tuber as a result of the yam beetle damages has been reported by (Tobih and Emosairue, 2006; Tobih and Emosairue, 2008). According to Tobih *et al,* (2009) the incidence, distribution, damage potentials of most importantly, the management of yam tuber beetles is of current concern throughout the yam growing belts in Nigeria and the continent of Africa where yam is grown. Farmers in this region found it difficult to have information on way forward against these destructive pests. There was no much information on how to tackle yam beetle termite attack in the study area. This study

was design to provide prêt information(s) on those yam genotypes that are resistance and those susceptible to beetle and termite attack.

MATERIALS AND METHODS

The experiment was conducted at the University of Uyo Teaching and Research Farm, Use-Offot Uyo, Akwa Ibom State of Nigeria. The site is located at Latitude $5^0 17^I$ and $5^0 27^I$N, Longitude $7^0 27^I$ and $7^0 58^I$E and on altitude of 38.1m above sea level. This rainforest zone receives about 2500mm rainfall annually. The rainfall pattern is bimodal, with long (March - July) and short (September – November) rainy seasons separated by a short dry spell of uncertain length usually during the month of August. The mean relative humidity is 78% and the atmospheric temperature is 30^0C. The mean sunshine hours is 12 (Peters *et al,* 1989).

The treatments were five yam genotypes. The experiment was laid out in a randomized complete block design (RCBD) in three replicates. Each plot size was 6m x 6m with a space of 1m between each plot and 2m between blocks. Planting was done March, 2008 and 2009 respectively. The yam genotypes were obtained from traditional barn of National Root Crop Research Institute (NRCRI) Umudike Umuahia, Abia State, Nigeria while popular local variety eteme was obtained from Urua Afaha Ibesikpo Asutan, Akwa Ibom State Nigeria. The yam genotypes sett size of 180g was planted on mounds according to treatments cultural weeding with aid of weeding hoes was done at 4, 8 and 12 weeks after planting. Staking was done when the yam shoots were about 1m. Harvesting was at 8 months after planting, when the yam genotypes attained 100% senescence. The yams were grown under rain-fed condition. Data collection; the freshly harvested tubers were counted weighed using top loading weighing scale, the weigh obtained were converted to tonnes per hectare. The harvested tubers were physically examined for termite and beetle feeding holes. The identified holes were counted with aid of black marking pen. Percentage tuber attacked by the termite and beetle were calculated by subtracting all tubers with termite and beetle feeding holes from the total number of tubers harvested in each plot. This was further divided by the total number of tubers harvested per treatment and multiple by 100.

Data collected at harvest included: tuber yield (t/ha), number of tubers per plot, number of termite and beetle hole/tuber, percentage of tuber attacked by termite, beetle and unaffected tubers. All data collected were subjected to analysis of variance (ANOVA) and significant means were separated by Duncan multiple Range Test (DMRT) at 5% level of significant.

RESULTS

The result of evaluation showed that yam tuber yield varied significantly ($p<0.05$) in both cropping seasons. TDr 75/1/2 genotype produced highest tuber yield, 30.41 and 29.75 t/ha in 2008 and 2009 respectively, followed by TDr 95/18894 genotype, 28.86 and 29.93 t/ha in 2008 and 2009 respectively. The least tuber yield was obtained from local variety *eteme*, 9.75 and 10.07 t/ha in 2008 and 2009 respectively. The TDr 75/1/2 produced about 5-68 % and 6-66% more tuber yield than other genotypes in 2008 and 2009 respectively. The result also showed significant difference on number of tubers per plot. The TDr 75/1/2 genotype produced highest number of tubers per plot, 184 and 167 in 2008 and 2009 respectively, followed by TDr 95/18894, 108 and 101 tubers per plot in 2008 and 2009 respectively. The least number of tubers per plot was recorded in local variety *eteme*, 48 and 58 tubers per plot in 2008 and 2009 respectively (Table 1 and 2). The TDr 75/1/2 genotype superseded other genotypes by producing about 41-74 and 40-65% number of tubers per plot above other genotypes. The result of total number of tubers attacked by termite showed significant difference ($p<0.05$) in both cropping seasons (Table 1 and 2) the highest total number of tuber per plot at harvest was recorded in TDr 95/19129 genotype, 13 and 11, tubers per plot while the least termite attack was recorded in TDr 75/1/2 genotype, 5 tubers in 2008 and TDr 95/18894 genotype, 2 tubers per plot in 2009. The termite attack was in TDr 95/19127 was about 23-62 and 36-82% more severity compared to the other genotypes. The total number of termite feeding hole per tuber varies significantly in both cropping seasons (Table 1 and 2). The local variety *eteme* had the highest termite feeding hole, 11.40 and 9.81 in 2008 and 2009 respectively followed by TDr 95/19531 genotype, 10.11 and 9.11 feeding holes. The least number of termite feeding holes per tuber was recorded in TDr 75/1/2 genotype 7.25 and 7.30 termite feeding holes per tuber. The total number of tubers attacked by yam tuber beetle attack harvest showed significant difference in both planting seasons. However, the most damage tubers per plot was recorded in local varieties *eteme,* 22 and 19 tubers, followed by TDr 95/19531 genotype, 20 and 18 tubers per plot. The least beetle damage was recorded in TDr 95/18894, 10 and 8 tubers per plot in 2008 and 2009 respectively, followed TDr 75/1/2 genotype, 15 and 11 tubers per plot in 2008 and 2009 respectively.

The yam beetle attack at harvest was about 9-55% and 5-58% in local variety above other yam genotypes. The total beetle feeding holes per tuber as influenced by yam genotypes showed significant difference in both cropping seasons. The local variety had the highest feeding holes per tuber on average 9.63 and 8.41 in 2008 and 2009 respectively, followed by

TDr 95/19531 genotype, 8.75 and 6.81 feeding holes in 2008 and 2009 respectively. The least number of beetle feeding hole per tuber on average observed in TDr 95/18894 genotype 3.73 and 2.75 in 2008 and 2009 respectively. The total number total of unaffected tubers by termite and yam beetle was significant ($p < 0.05$). The TDr 75/1/2 genotype had highest number of unaffected tubers per plot, 164 and 151 tubers in 2008 and 2009 respectively, followed TDr 95/18894, 88 and 91 tubers. The least number of unaffected tubers was recorded in local variety, 19 and 32 tubers per plot in 2008 and 2009 respectively. The percentage termite and beetle attack was highest in local variety, 14.58 and 45.85%, in 2008. The percentage of termite attack was highest in TDr 95/19127, 12.64% in 2009 while highest beetle attack, 32.76% was recorded in local variety in 2009. Comparing all the yam genotypes, the highest percentage of unaffected tubers at harvest 89.13% and 90.45% was recorded in TDr 75/1/2, followed by TDr 95/18894, 81.48 and 90.10 in 2008 and 2009 respectively. The lowest percentage of unaffected tubers was recorded in local variety, 39.58 and 55.17% followed by TDr 95/19531 genotype, 66.28% in 2008 and TDr 95/19127, 68.97% in 2009.

DISCUSSION

The result of analysis of variance indicated highly significant ($p < 0.05$) difference on yield and pest attack at harvest. The harvest tuber yield and yield component was obtained in two genotype; TDr 75/1/2 and TDr 95/18894 while lowest yield was recorded in local variety. This could be due to varietial differences. This is similar to report of the differences in growth, yield and yield component among the yam genotypes could be attributed to the inherent varietial characteristics as also reported IITA (1990), Onwueme and Charles (1994) and Asadu (1996). IITA (1990) reported that the actual number of roots which eventually from tubers depends on several factors including genotypes, assimilate supply, photoperiod and temperature. Asadu (1996) reported that apart from location and fertilizer cultivar significantly affect tuber yields. Onwueme and Charles (1994) reported that average yield of tuber varies among the major producing areas and is influenced by species, seed piece and growing environment. The yield of 8-50mt/ha in commercial yam production has been reported, the elect value depends on variety, location and cultivation practices. The result showed that TDr 95/19127 and local variety had highest percentage of termite and beetle attack at harvest. This could be due to varietal differences. According to Degras (1993) disparities observed in the infestation level and the severity between yams cultivars could be partly attributed to their biochemical composition. The tolerance/resistance of some yam

genotypes to termite and yam beetle observed in some genotypes could be attributed differences in tuber initiation formation. Tuberisation of most of the genotypes could coincide with the peak destructive periods of beetle and termite population density. Emehute, *et al* (1998) reported that of all known food yam species in Nigeria, only D. esculents is fully resistance or immune to yam beetle damage. The percentage of termite attack recorded in both planting season ranged from 2.72-14.58% in 2008 and 2.99 to 12.64% in 2009, that is 2.86-13.61% on average was in similar report of wood *et al* , (1980), that yield loss attributed to the attack by termites ranges from zero to 15%. The high incident of beetle attack observed the study agreed with Onwueme (1978); Tobih *et al* (2007) that the major and greatest constraints to optimum yam production in yam growing zones such as Delta Niger areas of Nigeria is the damage inflicted on yam tubers by *Monophagous dynastid* beetles.

CONCLUSION

The results of two years study indicated that TDr 75/1/2 and 95/18894 were generally less susceptible to termite and yam beetle attack than TDr 95/19127, 95/19531 and local variety *eteme* . The TDr 95/18894 and 75/1/2 genotype also produced significant higher tuber yields in both cropping season. Therefore farmers in Uyo agro-ecology showed select TDr 95/18894 and 75/1/2 genotypes for high tuber yield, moreover both were less suseptible to beetle and termite attack at harvest in the study area.

Table 1: Tuber Yields and Termite/Beetle Attack at Harvest as Influenced by Yam Genotypes in 2008

yam genotypes	Total tuber yield(t/ha)	Total number of tuber per plot	Total tubers affected by termite	Total number of feeding hole by termite/tuber	Total number of feeding hole affected by beetle	total number of feeding hole by beetle	Total number of unaffected tubers	Percentage of tuber attack by termite	Percentage of tuber attack by beetle	Percentage of unaffected tubers
TDr 95/19127	14.516	98c	13a	8.31b	18ab	6.13 b	67c	13.27a	18.37b	68.37b
TDr 95/18894	28.86a	108b	10ab	5.25c	10c	3.73 d	88b	9.26b	9.26c	81.48a

TDr 95/19531	25.95a	86d	9b	18.11a	20a	8.75a	57d	10.47b	23.26c	66.28b
TDr 75/1/2	30.41a	184a	5d	7.25b	15b	5.33c	164a	2.72c	8.15c	89.13a
Local variety	9.75c	48e	7c	11.40a	22a	9.63a	19e	14.58a	45.83a	39.58c

Table 2: Tuber Yields and Termite/Beetle Attack at Harvest as Influenced by yam Genotypes in 2009

Yam genotypes	Total tuber yield(t/ha)	Total number of tuber per plot	Total tubers affected termite	Total number of feeding hole by termite/ tuber	Total number of feeding hole affected by beetle	Total number of feeding hole by beetle	Total number of unaffected tubers	Percentage of tuber attack by termite	Percentage of tuber attack by beetle	Percentage of unaffected tubers
TDr 95/19127	16.75c	87c	11a	7.52b	16a	5.20b	60c	12.64a	18.39b	68.97b
TDr 95/18894	27.93a	101b	82c	6.75b	8b	2.75c	78.91b	1.98c	7.92c	90.10a
TDr 95/19531	24.31b	83c	6b	9.11a	18a	6.81a	58c	7.3b	21.69b	71.08b
TDr 75/1/2	29.75a	167a	5b	7.30b	11b	3.65c	151a	2.99c	6.59c	90.42a
Local variety	10.07d	58d	7a	9.81a	19a	8.41a	32d	12.07a	32.76a	55.17c

REFERENCES

Agbaje, G. O., Adegbite, A. A., Akinlosotu, T. A. and Soyinka S. A. (2002). Performance of new hybrid yam (Dioscorea rotundata Poir) varieties under different cropping system. African Journal of Root and Tuber Crops 5:1:8-11.

Akinlosotu, T. A. (1984). Planococus halli, a new mealy bug pest of white yam (*D. roundata*) at Moor plantation, Ibadan, Nigeria*, India Journal of Root Crops* 10 (1 & 2): 71-73.

Asadu, C. I. A., Akamigbo, F. O. R., Nweke, F. I. and Ezumah, H. C. (1996). Evaluation of six cultivars of white yam (*Dioscorea rotundata*) across three yam-growing areas in South Eastern Nigeria. *The Journal of Agricultural Science,* 127, pp. 463-468.

Chukwu, G. O. and Chukwu, K. E. (2004). Cosmovision and Folk science in yam production. Prodceeding 36th Annual Conference of Agricultural Society of Nigeria. Federal University of Technology, Owerri, pp 125-129.

Degras, L. M. (1993). The yam. A Tropical Root Crop. Macmillan Press Ltd., London and Basingstoke 408pp.

Emehute, J. K. U., Ikotun T., Nwauzor, E. C. and Nwokocha, H. N. (1998). Crop protection. In: Food yams; Advances in Research. Orkwor C. C. Asiedu, R and I. J. Ekanayake eds. Pp 141-186.

FAO (2019). Food and Agriculture Organisation statistics for yams, Rome. A Reference Manual. Pp 66.

Onwueme, I. C. (1978). The tropical Root and Tubers Crops: Yams, Cassava, Sweet Potato and Cocoyams. John Wiley and Sons. New York. 234pp.

Onwueme, I. C. and Charles, W. B. (1994). Tropical root and tuber crops: Production perspective and future prospects. FAO, Rome, Italy. Pp. 40-51.

Peters, S. W., Usoro, E. J. Udo, E. J. Obot, U. W. and Okpon, S. N. (eds), (1989). Akwa Ibom State: Physical background, soils and land use and ecological problems. A technical report of the task force on and land use survey, Akwa Ibom State. 603p.

Taylor, T. A. (1964). Studies on the Nigerian Yam Beetles II: Bionomic and control. Journal of West African Science Assoc. 9(1):13-31.

Tobih, F. O. and Emosairue, S. O. (2006). Assessment of yam beetle damage under a screen house condition. The Nigerian Agricultural Journal. 37:50-52.

Tobih, F. O. and Emosairue, S. O. (2008). Damage by yam beetle, Heteroligus meles (Coloeptera: Dynastidae) under different population in yam cropping system. Global Journal of Pure and Applied Sciences 14(1): 5-8.

Tobih, F. O. Emosairue, S. O. and Okonmah L. U. (2007). Studies on the occurrence and damage by yam tuber beetles (Heteroligus spp) in Aniocha and Oshimili Areas of Delta State, Nigeria. journal of Central European Agriculture 8(1):129-134.

Tobih, F. O., Eruotor, P. G. Okonmah, L. U. and Egho, E. O. (2009). Field evaluation of eight cultivars of Dioscorea for possible resistance to yam beetle damage in Oshimili area of Delta State, Nigeria. Niger Agric. J. 40 No. 1 (2009): 104-110.

Wood, T. G. Smith R. W. Johnson, F. A. and Komolafe, P. O. (1980). Termite damage and crop loss studies in Nigeria-preharvest losses to yam due to termite and other soil pests. Tropical pest management. 26(4):355-370.