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# Effect of variety and nutrient on insect pest infestation of *Amaranthus* spp

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**ABSTRACT:** *Amaranthus* species is one of the plants often considered as the most important green leaf vegetable in Nigeria and other countries. Its production has been plagued with an array of factors including incidence of insect pest. This experiment took place in Agricultural farm of University of Benin, Edo state Nigeria from February to April 2013 and 2014. The aim was to investigate the effect of Nutrient and Variety on Insect Pest infestation of *Amaranthus* spp. The experimental design used was completely randomized design with three replicates comprising a factorial combination of three types of Soil and three varieties of Amaranth. The result showed that *Amaranthus cruentus* suffered more insect pest attack than other Amaranthus used and that Amaranths planted on poultry manure attracted more insect pests than Amaranths planted on other Nutrients. These results can be employed as part of cultural control methods in the management of insect pests of Amaranths. © JASEM

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***KEYWORDS:*** Variety, Nutrient, *Amaranthus* spp, Insect Management.

## INTRODUCTION

Amaranthus or pigweed belongs to the family Amaranthaceae. Approximately 60 species of Amaranthus are presently recognized (Dorling 2008). It is believed to have originated from Central and South America (Grubben and Von Sloten 1981) where it has been cultivated for more than 8,000 years. In Africa, Nigeria is the largest producer and consumer of amaranth.

As many other crops, Amaranth production faces a major challenge due to pest infestation, with the increase in Amaranth production, more studies have been conducted in order to evaluate the insect complex associated with the crop. In the 1990's, some isolated reports were carried out regarding insect species that were found to cause damage to the crop.

Espitia (1990) mentioned five species of insects that cause important damage to Amaranth in the central plateau of Mexico: *Lixus truncatulus* fab. (Coleoptera: Curculionidae), *Disonycha melanocephala* (Coleoptera: Chrysomelidae), *Lygus lineolaris* P. deBeauvois (Hemiptera: Miridae), the "green worm" (Lepidoptera, unidentified) and a "black aphid" (Homoptera: Aphididae, unidentified).

Louw et.al (1995) recorded seven weevil species in their studies on curculionidae (Coleoptera) associated with Amaranth, the seven species include *Hypolixus haerens* (Boheman), *Gasteroclisus cuneiformis* (fahraeus), *Neocleonus sannio* (Herbst) *Baris sp, Hypurus sp, Microlarinus angustulus* and *Protostrophus sulcatifrons.*

Kigali et al 2013: in their study on insect species occurring in cultivated amaranth in Meru country, Kenya concluded that the pest causing significant yield loss are coreid bug's (*Cletus spp*) which attacks the grain, Amaranth weevils (*Hypolixus nubilosus*) which causes damage on stems and leaves and webworm (*Herpetogramma bipunctalis*) which also attacks the stems and leaves. The pest's results to significant yield loss on both grain and leave which are the harvestable parts of Amaranth in the region.

In Nigeria insect pest infestations are also the most important constraint to production of amaranths and also one of the primary causes of low quality and yields, from the results of the survey conducted by Aderolu et al 2013 in the southern part of Nigeria, sixty insect species associated with Amaranth crop were determined; of these the species with the major presence level on the foliage were *Hymenia recurvalis*, *Sylepta derogata*, followed by the borers group, curculionids and the white grubs.

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Degri and Randy (2014) in their study on the effect of variety and spacing on insect pest infestations and growth of Amaranth in Northern part of Nigeria also included *Spodoptera spp*, *Sylepta spp* and *Liriomyza spp* as pest of amaranth.

Other problems encountered by Amaranth growers include decreasing soil fertility and quantity of manure required for optimum crop productivity (Lucas and Ojeifor, 1983, Adeyemi et.al, 1987). Animal manure is known to be effective in maintenance of adequate supply of organic matter in soil, with improvement in soil physical and chemical condition and enhanced crop performance (Ikpe et.al, 2002, Powel et.al, 1998), poultry cattle, sheep and pig manure has been found to improve soil fertility and crop yield (Adeniyan and Ojeniyi 2003, Ojeniyi and Adegboyega, 2003). Ewulo (2005) reported that addition of poultry and cattle manure to soil lead to increase in soil PH, Organic Carbon, Nitrogen, Phosphorus, Calcium, Potasium, Magnesium, Sodium and CEC, he also reported that poultry manure improved soil chemical properties more than cattle manure especially as regards the Organic Carbon and Nitrogen status.
Many literatures emphasized the use of insecticides as control measure for these insect pests but little emphasis has been laid on the use of cultural practices. Thus, the aim of this work is to investigate the effect of Variety and Nutrient on Insect Pest Infestation of *Amaranthus* spp.

## MATERIALS AND METHODS

This study was carried out in the experimental farm of Faculty of Agriculture, University of Benin, Benin City, Edo State Nigeria. Benin City is located at latitude $6^{o}36$'N and $6^{o}19$'E. It has a tropical climate with clear cut of rainy and dry seasons (the rainy season lasts between April and November, reaching its peak in July and September while the dry season lasts between November and March. The area has a bimodal rainfall with mean annual rainfall of 1761.90mm and a mean daily temperature of $26{:}5^{o}$C.

The experimental design used was completely randomized design (CRD) with three replications comprising a factorial combination of three types of soil (top soil: zero dung, top soil: cattle dung, top soil: poultry dung) and three varieties of Amaranth (*Amaranthus cruentus* (white-seeded), *Amaranthus hybridus* (red seeded) and *Amaranthus hybridus* (black seeded) were employed. Each replication had nine plots, forming a total of twenty-seven plots in the experiment.

A plastic bowl of area = 170.76cm$^2$ represented a plot, forming a total plot area of 46055.52cm$^2$. Nine bowls were filled 1cm away from the brim top soil; a second set of nine bowls were filled 1cm away from the brim with a mixture of top soil and cattle dung in a ratio of 1:1 by volume, while the last nine set of bowls were filled 1cm away from the brim with a mixture of top soil and poultry dung in a ratio of 1:1 by volume. The twenty-seven bowls were arranged in the field where they were left to further decompose for 14 day before sowing

The seeds used for the experiment were obtained from Department of agronomy, faculty of Agriculture, University of Benin. Edo State Nigeria. The seeds of the amaranth varieties were mixed with river sand in ratio of 1 part seed: 20 parts sand and appropriate amaranth varieties were broadcast on the corresponding soil according to treatment.

Crops were thinned to12 plants/plot, at a spacing of 12cm x 12cm, ten days after sowing
The plants on each plot were searched visually and the insects on the plants were counted taken into consideration the population size of each insect species. A representative of each species was collected and taken to the laboratory for identification.

Materials used for collecting insect samples include sweep nets for flying insects, pair of forceps and hand picking for larvae and slow moving insects. They were deposited into polyethylene bags labeled with the following information: Collection date, number of each species and the part of the plant of which the insects were found. Immature leaf eating stages were transported in pots to cages and leaves of amaranth were provided as food in order to allow for continuation of their development until they reach adult stage.

The sampling period occurred in one day of every week for 3 months from February -April 2013, and records were taken for at least 2 hours from 9.00am -11.00 am hours, a repeat of the work was carried out from February – April 2014.

The data collected were subjected to analysis of variance (ANOVA) to test the significance of treatment using the Statistical Analysis System (SAS) software package version 9.00 (2000). The means were separated with the Least Significance Difference (LSD) method described by Steel et al., (1997).

## RESULT AND DISCUSSION

A total number of one thousand seven hundred and fifteen (1,715) insects were recorded during the study from February – April 2013 and February – April 2014. The total number of the different Species is shown in Figure 1, Table 1 shows the percentage prevalence of insect pest and mean insect pest per Amaranth varieties cultivated on poultry manure, cow dung and soil (control). Amaranths planted on poultry manure recorded the highest number of total mean insect pest per Amaranth while *Amaranthus cruentus* recorded the highest number of percentage insect pest prevalence.

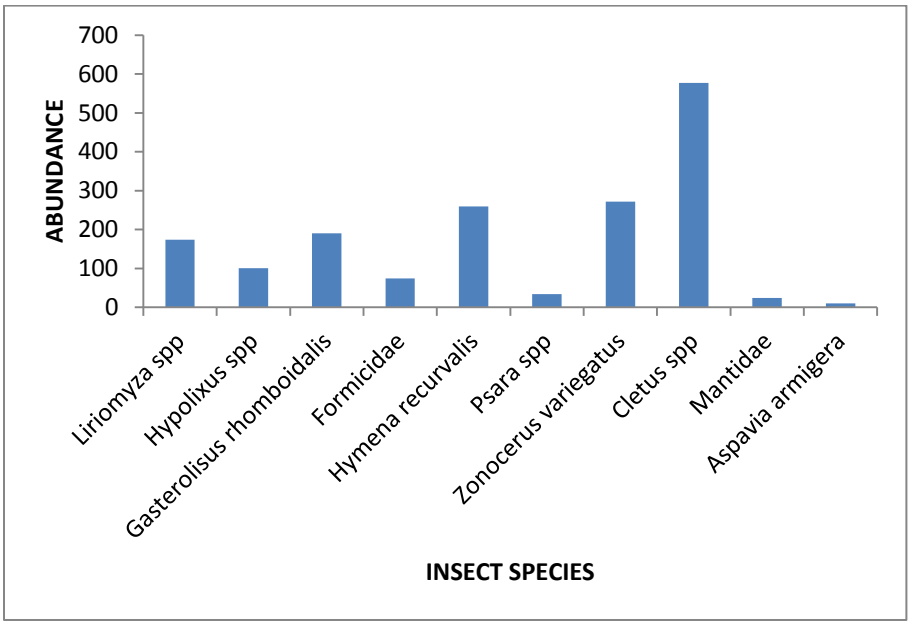


**Fig 1**: Total composition of insect species found on Amaranth.

Table 2 shows the statistical analysis carried out on the effect of variety on mean insect pest populations of Amaranth showed that there is high significant difference ($p<0.0001$) in the total number of insects population recorded on the various Amaranthus varieties Amaranthus varieties, with *Amaranthus cruentus* recording higher number of insects than other Amaranth varieties. There are also high significance differences ($p<0.0001$) in the number of *Gasteroclisus rhomboidalis* and *Zonocerus variegates* recorded on *Amaranthus cruentus* than on other Amaranthus varieties.

Statistical analysis carried out on the effect of poultry manure, cow dung and control on the total mean insect pest populations of *Amaranthus* species showed that there is high significance difference ($p<0.0001$), *Amaranthus* species planted on poultry manure recorded the highest number of total mean insect populations. There is also significant differences on the between number of Muscidae, *Gasteroclisus rhomboidalis*, *Zonocerus variegatus* and *Cletus* species recorded on Amaranths planted on Poultry manure than in other nutrients.

Statistical analysis on the effect of Age of *Amaranthus* species on the total mean insect pest populations showed that there is high significant difference between the Age of *Amaranthus* species and total number of insect populations recorded on the *Amaranthus* species. Also, also the mean number of most insect species showed significant differences with the age of Amaranthus species.

*Zonocerus variegatus* showed significant interactions between varieties and nutrients, varieties and age of Amaranthus spp, nutrient with Age of *Amaranthus* spp and among varietie, nutrient and age of *Amaranthus* spp. Muscidae and *Aspavia armigera* showed interactions only between nutrients and varieties, Mantidae showed interactions between varieties and nutrients while other insect species showed no significance interactions.

**Table 1**: Prevalence of Insect Pest on Amaranthus varieties cultivated on three different nutrients

| Nutrient | Vegetable | Mean pest caught | (%) Insect pest Per vegetable | Prevalence |
|---|---|---|---|---|
| **Cow dung** | ***Amaranthus cruentus*** | **64.49** | **47.43** | |
| | ***Amaranthus hybridus* (red seed)** | **41.26** | **30.35** | |
| | ***Amaranthus hybridus* (black seed)** | **30.21** | **22.22** | |
| | | **TOTAL** | **135.96** | **100** |
| **Poultry Manure** | ***Amaranthus cruentus*** | **70.14** | **39.78** | |
| | ***Amaranthus hybridus* (red seed)** | **52.81** | **29.95** | |
| | ***Amaranthus hybridus* (black seed)** | **53.38** | **30.27** | |
| | **TOTAL** | **176.33** | **100** | |
| **Soil (Control)** | ***Amaranthus cruentus*** | **50.61** | **45.93** | |
| | ***Amaranthus hybridus* (red seed)** | **34.03** | **30.88** | |
| | ***Amaranthus hybridus* (black seed)** | **25.55** | **23.19** | |
| | **TOTAL** | **110.19** | **100** | |

**Table 2**: Effect of Variety and Nutrient on Insect pest populations of Amaranths

| Treatment | Mean no. of insect pests/plant | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Variety (V) | Total | *Psara armigera* | *Liriomyza* sp | *Hypolixus* sp | *Gasterolisus* sp | *Hymenia rhomboidalis* | *Zonocerus* | *Cletus recurvalis* | *Aspavia variegatus* | *sp* |
| A.hybridus (red seed) | 32.08 | 0.98 | 3.75 | 1.89 | 5.00 | 5.63 | 3.98 | 10.18 | 0.67 | |
| A.hybridus (black seed) | 26.43 | 0.68 | 3.00 | 1.79 | 2.17 | 4.75 | 3.99 | 9.85 | 0.20 | |
| A.cruentus | 50.14 | 1.13 | 4.61 | 2.83 | 6.88 | 7.51 | 13.18 | 12.98 | 1.02 | |
| Significance | ** | ns | ns | ns | ** | ns | | ** | ns | ns |
| LSD | 0.17 | 0.04 | 0.08 | 0.06 | 0.08 | 0.09 | 0.061 | 0.13 | 0.01 | |
| Nutrient(N) | | | | | | | | | | |
| Poultry | 47.33 | 1.15 | 6.06 | 2.75 | 6.88 | 6.29 | 10.07 | 14.13 | 0.00 | |
| Cowdung | 35.38 | 0.94 | 3.35 | 2.58 | 4.55 | | 5.30 | 5.34 | 13.13 | 0.19 |
| Soil | 25.85 | 1.19 | 2.95 | 1.19 | 2.61 | | 6.33 | 3.74 | 7.76 | 0.08 |
| Significance | ** | ns | * | * | ** | | ns | ** | ** | ns |
| LSD | 0.17 | 0.04 | 0.08 | 0.06 | 0.08 | | 0.09 | 0.061 | 0.13 | 0.01 |
| Interaction | | | | | | | | | | |
| V*N | ns | ns | ns | ns | ns | | ns | * | ns | ns |

**Note: ** = Highly Significance, * = Significance, ns = Not Significance. LSD = Least Significance Difference.**

The result from this study also proved that *Amaranthus cruentus* suffered more insect pests attack than other Amaranthus varieties with a high significant difference of $p<0.0001$, with more infestation of *Hymenia recurvalis, Zonocerus variegatus,*and *Cletus sp*. This concurred with the findings of Charles et al, (2009) who reported that *Amaranthus cruentus* suffer more from Hemipteran, Lepidopteran and Orthopteran pest than other Amaranth varieties.

The highest insect pest populations recorded under *Amaranthus cruentus* could be due to their crop physiology and taste which attracted more insect pests to feed on it (Richard 1989, Rodriquez, 1997, Youdeowei, 2004, Geoff et al 2007). Also Charles et al (2009) reported that some *Amaranthus* species have quick establishment, drought tolerated, high biomass production and resistance to pests and diseases.

Amaranthus planted on poultry manure attracted more pest with a significant difference of $p<0.0001$ than Amaranth cultivated on cow dung with the least infestation recorded on the control nutrient. This indicates that the application of additional nutrient to soil could increase pest population on crops. Similar observations were made by Monchiah et. al 2011 who observed increase in pest populations on Cabbage on addition of either organic or synthetic fertilizers. Also, Jahn (2004) in his study on the effect of soil nutrients on the growth, survival and fecundity of insect pests of rice observed that the application of nutrients to soil aids plants to produce more broad, succulent and fresh leaves which could serve as suitable surfaces for egg laying by various insect pest.

Poultry manure has historically been used as a source of plant nutrients with nitrogen as its major component (Bechman 1973). The analysis carried out on the various nutrients (poultry manure, cow dung and soil) used for this study also indicates that poultry manure contained more nitrogen than cow dung, this in turn led to high protein content recorded on Amaranth planted on poultry (from the proximate analysis carried out on the Amaranth varieties planted on the different nutrient). This could be one of the reasons why Amaranth planted on poultry attracted more insect pest than those on cow dung.

Comparative analysis of different animal manure carried out by Smith et.al, 2001 showed that poultry manure had higher Nitrogen value (11.95%) compare with cow dung (4.1%). Also, studies by Ewulo (2005) revealed that soil that had poultry manure had higher value of Nitrogen than soil that had cattle manure. In this regard, Jahn (2004), reported that nitrogen has been found to affect the reproduction, longevity and overall fitness of certain pests. Phelan et al (1996), and Stone et al (2000) also reported that increasing soluble nitrogen levels in plant from organic manure can decrease their resistance to insect pest.

Also, studies by Asawalam *et al*. (2007) on the influence of some soil amendments on insect pest infestation of Okra indicated that plots that contain high nitrogen promoted the vegetative growth of the plant, also pest found the leaves of these plants succulent and fresh, this made these plots prone to high pest infestation.

This study has shown that application of nutrient to boost the growth and yield of Amaranths negatively impacted on plants by increasing the insect pest populations. Therefore, it must be noted that though soil amendments such as poultry manure and cow dung are essential for plant growth and must be applied at certain times to improve yield. But care should be taken in the selection and application of the nutrient and also the use of resistant variety should be employed. This will help reduce the incidence of pest and also reduce the indiscriminate use of synthetic pesticide.

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