



Field Trials using Cow Urine and Dung as Biopesticides against Sucking Bugs of *Amaranthus Cruentus*

Onunkun, O.

Agricultural Science Department,
Adeyemi College of Education, P.M.B. 520, Ondo, Nigeria.
Email: deleonunkun@gmail.com

Abstract – The effects of cow urine, cow dung as insecticide solutions and lambda-cyhalothrin were compared at different levels of concentrations on insect pests' infestations in amaranthus. The experiment was a randomized complete block design with seven treatments and four replicates. The treatments include the following: urine+water (1:1), urine+water (1:1), urine+water (1:1), dung+water (1:1), dung+water (1:1) and synthetic pyrethroid, lambda-cyhalothrin (5 mls per litre). The results showed the treatments performed significantly better than the control in plant growth parameters of plant height and number of leaves. The three urine treatments were most effective in enhancing the growth of amaranthus. The treatment, urine+water (1:1), was the most effective insecticide solution in the management of the three sucking bugs under investigation. The insecticide solutions were not as effective as the synthetic insecticide.

Keywords – Amaranthus, Cow Urine, Cow Dung, Lambda-Cyhalothrin, Synthetic Pyrethroid.

I. INTRODUCTION

Amaranth (*Amaranthus spp*) has been listed as one of the most commonly grown crops in the lowland region of Nigeria. Several species are popular and are a very rapidly growing and nutritious leafy green vegetable [1]. *Amaranthus* is a promising vegetable species often adapted to limiting growing conditions such as low nutrient soils. The crop is well-adapted to both arid and humid environments [2]. The high quality of amaranth is combined with its agronomic productivity; it compares favourably with the more commonly utilized crops and could possibly be used as a forage alternative. There is a high content of proteins (50%) in leaves of amaranth, also mineral substances, mainly Fe, Ca and vitamins, especially ascorbic acids [3]. In Nigeria, amaranth greens are commonly eaten boiled. Its mild flavor and tender texture complements many starchy dishes well. Young plants can be eaten whole, and young leaves can be harvested continuously from mature plants [4].

There are no practical reasons why Nigeria should not be self sufficient in vegetable production to meet her local food demand. However, the incidence of insects and diseases pests poses serious threat to vegetable production and these two problems have been the major impediments to the goal of our realization of self-sufficiency in vegetable production [5]. The yield of amaranth is adversely affected by biological factors of insect pests, diseases, weeds and nematodes. According to NAFIS [6] amaranth is susceptible to damage by foliar insects such as leafminers, leafrollers, cutworms, aphids, flea beetles, and

mites. As noted by [7] insects are the most serious problem for amaranth growers. Caterpillars (*Spodoptera litura*, *Helicoverpa armigera* and *Hymenia recurvalis*) and sometimes grasshoppers are the most harmful. The larvae of the stem borer, *Lixus truncatulus* often cause serious damage, sometimes already in the seedbed. The basal part of the plant containing the pupae swells and plant growth is much retarded. Many other insects such as aphids, leafminers, stinkbugs, mole crickets and mites also attack amaranth but generally cause only minor damage.

To reduce infestation and losses caused by insect pests many commercial growers use insecticides as foliar spray regularly. These toxic chemical insecticides and pesticides often result in harmful effects and biomagnifications in the environment as fertile lands are continuously polluted and rendered infertility. No doubt they are providing hopeful results in eradication of insects, pests and diseases but they are also killing useful organism present in soil due to which the fertility of the soil is rapidly declining. The conventional farming practice which uses chemical methods to kill both useful and harmful life forms indiscriminately result in the malfunctioning of food chain and food web. Bio-control is the best method to cope with the losses done by the chemicals [8] (ICBSE, 2010). In the present study the effects of insecticidal solutions of cow urine and cow dung were investigated on insect pests' population and growth of amaranthus.

II. MATERIALS AND METHODS

Field trials were carried out during the cropping season of 2009 at the Teaching and Research Farm, Adeyemi College of Education, Ondo, Nigeria. The study area is located at Latitude 07° 05'N, Longitude 04° 50'E and altitude 27.5 m above sea level. The experiment was conducted on a previously cultivated site. This operation was followed by ploughing with disc plough and harrowing two days later. The experimental site which was overgrown with weeds was cleared with cutlass and then left for 15 days to decay. The experimental plot was divided into 24 plots with each measuring in both seasons. The experiment was laid out into 24 plots in both seasons. The experiment was laid out in a randomized complete block design with six treatments and 4 replicates. There were 24 plots measuring 4 × 5m each and separated by a 1 m pathway. The seeds were planted directly by drilling method in an inter row spacing of 60cm. the seedlings were later thinned to 3 seedlings per stand to an intra brow spacing of about 20cm.



2.1 Preparation of spray solutions from cow dung and cow urine

The animal materials, cow dung and urine, were obtained from three abattoirs at Ondo, in Ondo State in Nigeria. Cow urine was collected fresh in a 15-litre plastic container early in the morning and allowed to stand for two weeks to prevent spread of diseases caused by microorganisms and also to avoid loss of ammonia and entry of pathogens (Using urine and ash). Four different insecticide solutions/dilutions representing four urine treatments were prepared: 1:1(1 part of urine + 1 part of water; 1:2(1 part of urine + 2 parts of water); 1: 3(1 part of urine + 3 parts of water). The resulting insecticide treatments were filtered using white muslin cloth to obtain a clear solution for spraying. In order to make the insecticide solutions stick to the crop, 100g of 'omo' detergent was added as a surfactant. lambda-cyhalothrin

Insecticidal solutions were also prepared from cow dung by mixing 5 litres of water to 5 kg of cow dung (1:1). The second insecticidal solution of cow dung was also prepared by mixing 5 kg cow dung with 10 litres of water. These two solutions represented two treatments from cow dung. The cow dung solutions were thoroughly mixed and covered in a 15- liter plastic container for 4 days. Stirring was done twice in a day during the period of storage of the solutions. This was kept in a shaded place for 4 days to ferment. The prepared solution was also filtered and squeezed with muslin cloth early in the morning of application to get clear solution and to avoid blocking the nozzle of the 15- liters knapsack spraying pump with particles. 100g of 'omo' detergent was added as a surfactant. A conventional organic synthetic insecticide, lambda-cyhalothrin 150g a.i/ha, was included as a treatment and applied at the recommended dosage for the purpose of comparison. All treatments were applied during the cool hours of the day, 06:30 – 07:30hrs and 18:30 – 19:00hrs. Precautionary measures such as wearing of rubber hand gloves and washing of hands with soap after handling of cow urine and dung were observed.

2.2 Collection of Data

Data were collected on two parameters: plant growth and insect pests population. On plant growth, three characteristics of the plant were considered: plant height, stem girth and number of leaves. Three samples comprising of 10 stands per sample were randomly selected and tagged for data collection on plant growth characteristics of height, stem girth, leaves and branches. Collection of data on the growth related characters started 2 weeks after transplanting (WAT). Average data on these characteristics were recorded per treatment per replicate. Data on the following sucking bugs were collected: brown stink bug, *Aspavia armigera*; green stink bug, *Nezara viridula* and the coreid bug, *Clavigralla tomentosiccolis*.

The three insect pest species of brown shield bug, *Aspavia armigera*, the coreid bug, *Clavigralla tomentosiccolis* and the green stink bug, *Nezara viridula* were also counted visually. Counting was done at flowering stage usually in the morning when their

activities are reduced [9]. Three samples comprising of 10 stands per sample. Timing of sampling was 24hrs before application of insecticide solution treatments and 24hrs, 48hrs and 72hrs after.

2.3 Data Analysis

Plant growth characteristics of height, stem girth and number of leaves were subjected to one-way analysis of variance (ANOVA). Where there were significant differences in means Students Newman's Keuls was used to separate treatment means at 5% level of significance. Data on insect pest population were adjusted for normality using square root and or arcsin transformation where appropriate. The results were expressed as means with standard errors. All analyses were conducted by the use of Statistical Package for Social Sciences (SPSS v 17).

III. RESULTS AND DISCUSSION

3.1 Effects of cow urine and cow dung insecticide application on the growth of Amaranthus

The effects of cow urine and cow dung insecticide solutions on growth parameter of amaranthus are as shown in Figures 1, 2 and 3. The insecticidal solutions of cow urine and cow dung did not significantly increase plant height of amaranthus at 20 DAT. However, the treatment applications of amaranthus are as shown resulted in gradual increases in plant height 35- and 50 DAT (Fig. 1.). The highest height (25cm) of the plant at 20DAT was observed in urine+ water (1:1) treated plots, while the shortest (22cm) was recorded in the control plot where only water was applied as a placebo. The effect of application of cow urine and cow dung insecticide solutions was also found to be significant ($p < 0.05$) on plant height of amaranthus at 35 DAT. While there was no significant difference in plant height among treatments urine + water(1:3), dung + water(1:1), dung + water(1:2) and the synthetic pyrethroid, they were significantly different from treatments urine + water(1:1) and the control(placebo). The treatment, urine + water (1:1), compared to control and the other treatments was significantly different in plant height.

Similar trend of growth in plant height was also observed in amaranthus with cow urine and cow dung insecticide solutions at 50 DAT. The other two parameters of growth, number of leaves and stem girth (figures. 2 and 3 respectively) followed similar pattern of growth. The increase in plant height, number of leaves and stem girth observed in urine + water (1:1) treated plots confirms the findings of [10] which reported that urine and ash are rich in several plant nutrients and that urine is specifically a rich nitrogen source while ash is a rich potassium source. Both of these nutrients are important for proper plant growth. On top of preventing/controlling pests and diseases, applying this preparation helps to boost soil fertility. In a study, urine was noted to compare favourably well with mineral fertilizer in the growth and yield of egg plant, gombo and tomato vegetable crops in a three years of field trials in Burkina Faso[11].

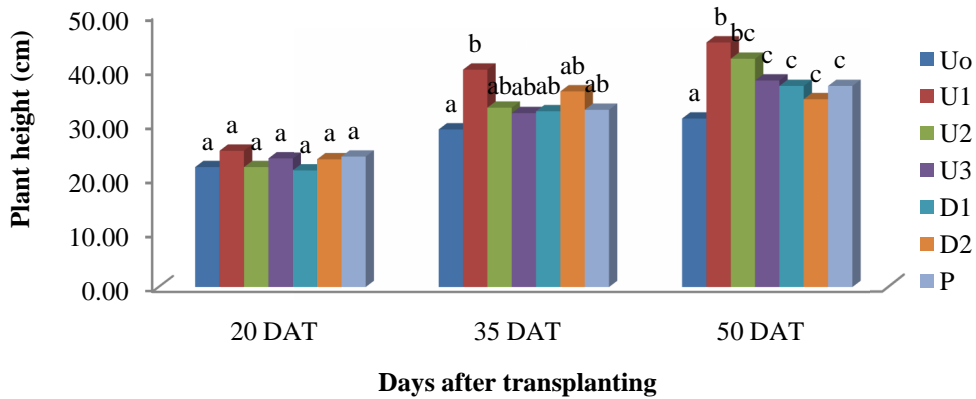


Fig.1. A bar chart showing effect of insecticidal solutions of cow urine and dung on plant height of amaranthus

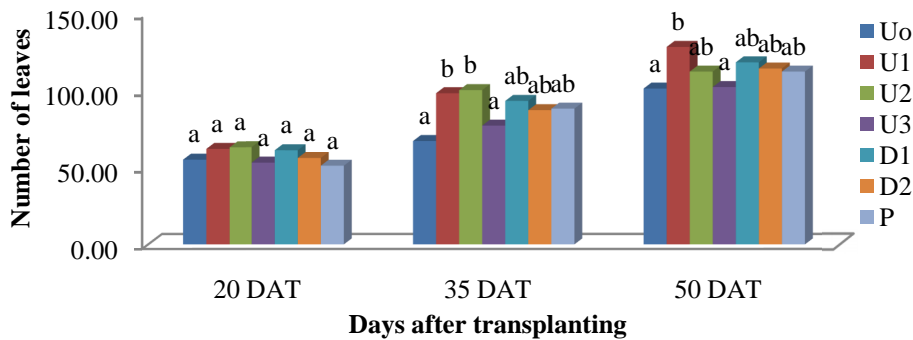


Fig.2. A bar chart showing effect of insecticidal solutions of cow urine and dung on leave number of amaranthus

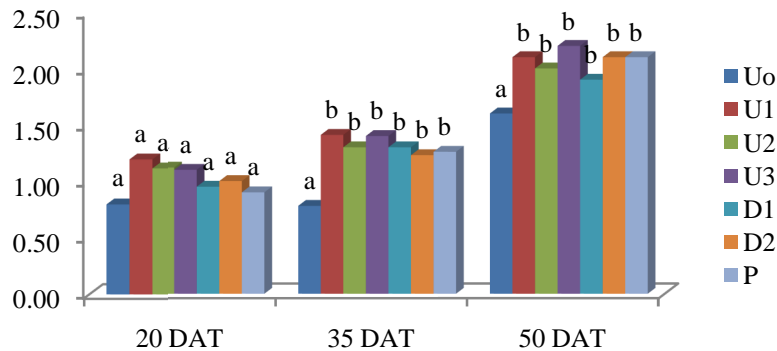


Fig.3. A bar chart showing effect of insecticidal solutions of cow urine and dung on stem girth of amaranthus

3.2 Effects of cow urine and cow dung insecticide application on insect pests population of Amaranthus

The effects of insecticidal solutions of cow urine and cow dung on *Aspavia armigera* population are shown in Table 3.1. The study revealed significant difference ($p < 0.05$) in population of *Aspavia armigera* 24 hrs after application of insecticide solutions of cow urine and cow dung. The population of the insect pest was significantly lowest in -cyhalothrin treated plots (0.03) and highest (1.67) in the control ($F_{6, 14} = 10.10, p < 0.05$). The two cow dung insecticide solutions were not significantly different from each other 24 hrs after application of treatment, so also was no significant difference between treatments,

urine + water (1:1) and urine + water (1:3). The population density of *Aspavia armigera* were significantly lower in insecticide solutions of cow urine and cow dung treatment when compared to control at 48, 72 and 120 hrs after application.

At 48 hrs after application there was no significant difference in population of *Aspavia* between the insecticide solutions of cow urine and cow dung treatments but were significantly different from those recorded in the control and conventional insecticide plots. The lowest population of the shield bug was recorded in plots treated with conventional insecticide.

Table 3.1: Effects of animal wastes applied as foliar spray on the population of brown, *Aspavia armigera*.

Treatments	Post- Application of Treatments			
	Pre- Application 24hrs	24hrs	48hrs	72hrs
Uo	1.67±0.67 ^a	1.63±0.11 ^c	3.07±0.67 ^c	1.83±0.21 ^c
U1	2.00±0.58 ^a	0.56±0.21 ^{ab}	0.39±0.31 ^{ab}	0.81±0.29 ^{ab}
U2	2.33±0.33 ^a	0.80±0.11 ^b	0.83±0.34 ^{ab}	0.86±0.19 ^{ab}
U3	1.33±0.33 ^a	0.59±0.21 ^{ab}	0.87±0.35 ^{ab}	1.07±0.17 ^{bc}
D1	2.67±0.33 ^a	1.14±0.14 ^{bc}	1.27±0.18 ^{ab}	1.15±0.05 ^{bc}
D2	2.50±1.04 ^a	1.24±0.24 ^{bc}	1.78±0.71 ^b	1.23±0.21 ^{bc}
P	2.00±0.58 ^a	0.03±0.03 ^a	0.01±0.00 ^a	0.18±0.14 ^a

Means followed by the same letter(s) in a column are not significantly different from each other at $p < 0.05$ according to Students Newman Keuls test

Keys: Uo -Untreated check; U1-Cow Urine +Water (1:1); U2-Cow Urine + Water (1:2); U3-Cow Urine + Water (1:3); D1- Cow Dung +Water (1:1); D1- Cow Dung +Water (1:2); P- Synthetic Pyrethroid

Table 3.2: Effects of animal wastes applied as foliar spray on the population of coreid bug, *Clavigralla tomentosicollis*

Treatments	Post- Application of Treatments			
	Pre- Application 24hrs	24hrs	48hrs	72hrs
Uo	3.33±0.88 ^a	3.33±0.33 ^b	3.47±0.37 ^d	4.40±0.26 ^c
U1	4.00±1.15 ^a	1.04±0.29 ^{ab}	0.77±0.23 ^{ab}	0.86±0.40 ^b
U2	3.33±0.33 ^a	1.93±0.55 ^{bc}	1.87±0.47 ^{bc}	1.72±0.15 ^b
U3	4.00±0.58 ^a	2.59±0.41 ^b	1.70±0.35 ^{bc}	1.53±0.29 ^b
D1	5.00±0.58 ^a	2.60±0.32 ^b	2.20±0.42 ^c	1.60±0.25 ^b
D2	4.00±0.58 ^a	2.82±0.43 ^b	2.67±0.24 ^{cd}	1.85±0.45 ^b
P	3.67±0.88 ^a	0.06±0.03 ^a	0.07±0.07 ^a	0.22±0.22 ^a

Means followed by the same letter(s) in a column are not significantly different from each other at $p < 0.05$ according to Student-Newman-Keul test

Keys: Uo –Untreated check; U1-Cow Urine +Water (1:1); U2-Cow Urine + Water (1:2); U3-Cow Urine + Water (1:3); D1- Cow Dung +Water (1:1); D1- Cow Dung +Water (1:2); P- Synthetic Pyrethroid.

Table 3.3: Effects of animal wastes applied as foliar spray on the population of coreid bug, *Nezara viridula*

Treatments	Post- Application of Treatments			
	Pre- Application 24hrs	24hrs	48hrs	72hrs
Uo	3.67±0.8	1.91±0.09 ^d	1.86±0.10 ^d	1.94±0.10 ^c
U1	3.33±0.6	0.93±0.21 ^b	0.85±0.15 ^b	1.12±0.19 ^b
U2	3.00±0.5	1.19±0.05 ^{bc}	1.35±0.17 ^c	1.31±0.06 ^b
U3	2.33±0.3	1.25±0.02 ^{bc}	1.29±0.14 ^c	1.23±0.12 ^b
D1	3.00±1.1	1.48±0.15 ^{cd}	1.47±0.14 ^{cd}	1.26±0.10 ^b
D2	3.00±0.5	1.56±0.15 ^{cd}	1.63±0.08 ^{cd}	1.34±0.17 ^b
P	3.67±0.8	0.03±0.03 ^a	0.03±0.03 ^a	0.52±0.26 ^a

Means followed by the same letter(s) in a column are not significantly different from each other at $p < 0.05$ according to Student-Newman-Keul test

Keys: Uo –Untreated check; U1-Cow Urine +Water (1:1); U2-Cow Urine + Water (1:2); U3-Cow Urine + Water (1:3); D1- Cow Dung +Water (1:1); D1- Cow Dung +Water (1:2); P- Synthetic Pyrethroid.

The population density of the insect pest remained the same in urine and conventional insecticide treated plots 5 days after application of treatments. Field studies using cow urine and dung to control insect pests of crops have been documented. [12] working on effects of natural products on traditional pest management practices on the aphid, observed that cow urine provided 80 percent mortality in 12 hrs after treatment and reached 90 percent after 24 hrs and was at par with neem leaf extract, sisal leaf extract, pytoxin and malathion. Interestingly, azadiractin offered only 28.67 percent mortality of

Decticoidea brevipennis which was almost 4 times lower than cow urine. Table 3.3 shows that the insecticide solutions of cow urine and cow dung and the conventional insecticide, -cyhalothrin significantly reduced the population of coreid bug, *Clavigralla tomentosicollis*, when compared to control 24 hrs after application ($F_{6, 14} = 18.46, p < 0.05$). The study revealed no significant difference between treatments, urine + water (1:3), dung + water (1:1) and dung +water (1:2). Similar level of efficacy of treatments on the population of the insect pest was observed 48- and 72 hrs after application.



The effects of insecticide solutions of cow urine, cow dung and the conventional insecticide on infestation of green stink bug, *Nezara viridula* in amaranthus are presented on Table 3. The insecticide solutions showed significant difference in reducing the population of the insect pest when compared with the control 24 hrs after application ($F_{6, 14} = 25.7, p < 0.05$). The highest efficacy was showed by the conventional insecticide. The most effective of the insecticide preparations was treatment, urine +water (1:1). However, the two dung treatments did not vary in effectiveness in reducing green stink bug infestation.

Dynamics of Grain Sucking Bugs of Upland Rice, *Oryza sativa*. *IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)* 7(2): 52 – 55.

REFERENCES

- [1] B. R French. Important Food Plants for Lowland Nigeria. 2011. [Online]. Available: www.foodplantsinternational.com
- [2] F. Liu, H. Stützel. 2004. *Scientia Horticulturae.*, 102, 15 – 27.
- [3] J. Víglasky; J. Huska; N. Langova; J. Suchomel. 2008. Multifunctional Use of Amaranth - Phytomass For Industry and Energy In Amaranth - Plant for the Future.
- [4] A. Tung. Amaranth: Food Production Without Attention. Nourishing the planet. 2014. [Online]. Available: <http://blogs.worldwatch.org/nourishingtheplanet/>
- [5] O. B. Adeniji. Chemical control in vegetable production in Kaduna state, Nigeria. 2008. *Continental J. Agricultural Economics* 2: 38 – 43.
- [6] National Farmers Information Service (NAFIS). Pest and Diseases of Amaranth. [Online]. Available: <http://www.nafis.go.ke/vegetables/grain-amaranth/pests-and-diseases/>. Accessed 10 March 2014.
- [7] G.J.H Grubben. *Amaranthus cruentus* L. [Internet] Record from PROTA4U. , 2004. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. <http://www.prota4u.org/search.asp>. Accessed 20 January 2014.
- [8] ICBSE School Projects. 2010. To study the importance, usage and preparation of bio-insecticides and pesticides. [Online]. Available: <http://projects.icbse.com/biology-339>
- [9] E. A. Heinrichs, S. Chelliah, S. L. Valencia, M. B. Arceo, L.T. Fabellar, G. B. Aquino, and S. Pickin. 1981 Manual for testing insecticides on rice. IRRI.
- [10] Adane Tesfaye and R D Gautam, Traditional pest management practices and lesser exploited natural products in Ethiopia and India: Appraisal and revalidation. *Indian Journal of Traditional Knowledge.* 2003. vol2 (2): pp. 189-201
- [11] Grameen Foundation (2012). Using urine and ash to control crop pests and diseases. [Online]. Available: <http://teca.fao.org/technology/>
- [12] A. Richert, R. Gensch, H. Jonsson, T. Stenstrom and L. Dagerskog, Practical Guidance on the Use of Urine in Crop Production. Stockholm Environment Institute, EcoSanRes. 2010:

AUTHOR'S PROFILE



ONUNKUN, Oladele

was born in Ilutitun, Ondo State, Nigeria. He holds M.Sc. Agricultural Biology (Entomology) from University of Ibadan, Nigeria in 1990. He is currently a Senior Lecturer in the Department of Agricultural Science, Adeyemi College of Education, Ondo, Ondo State, Nigeria. Recent

publications include:

- Onunkun, O. (2012). Evaluation of aqueous extracts of five plants in the control of flea beetles on okra (*Abelmoschus esculentus* (L.) Moench). *JBiopest*, 5 (supplementary): 62 – 67.
- Onunkun, O. (2013). Studies on the repellent activities of four common asteraceae in Nigeria against red flour beetle, *Tribolium castaneum*. *The International Journal of Engineering and Science (IJES)*. 2(12): 90-93.
- Onunkun, O. (2014). Field Efficacy of Insecticides on Population