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Investigation Into The Pesticides Properties Of Garlic In Preserving Grain (Cowpea As A Case Study)

Adeosun, Y.M[1] and Ayelegun, T.A[2]

Department of Agricultural and Bio-Environmental Engineering, The Federal Polytechnic, Ado-Ekiti

Abstract

The investigation into the pesticide property of garlic was carried out. Thirty-six prepare plastic containers in which equal numbers of viable bean seeds, 10 insects and varied concentration of pulped garlic were introduced into each plastic container for the verification of the pesticides property of garlic. The control containers contained the same numbers of bean seed and insects but no pulped garlic. The arrangement was subjected to closed observation in the laboratory. The result of the experiment revealed all insects died-off before the 4th day of introduction of the concentration of the pulped garlic. The higher the concentration the faster and the higher the mortality rate of insects. The correlation coefficient of the exponential, linear and logarithm equations on the first day of treatment were 98.9%, 98.9%, and 88.5%. This, however, declined and it was 92%, 9.8% 0.4% on the 2nd and third day of application of garlic. There was no mortality of insects recorded in control containers.

Keywords: Investigation, Pesticides, Properties, Preserving Grain

1.0 Introduction

The increasing incidence of food poisoning arising from the chemical used in preserving food items is a cause for concern. The World Health Organization (WHO) estimated in 1992 that three Million pesticide poisoning occur annually, causing 220,000 deaths. Recently, here in Nigeria, there ported cases of food poisoning as a result of preserving food items with harmful chemicals is a serious health issue which must be addressed before it killed and maimed millions. In Aprils 2008, several National dailies reported that 120 students of the Government Girls Secondary School, Doma in Gombe metropolis were rushed to the Gombe Specialist Hospital after consuming a meal of

beans that was suspected to have been preserved with a poisonous chemical. Ten of these students were reported to be in critical condition. Samples of cooked beans consumed, samples of the uncooked beans, palm oil, onions, Maggi, salt and other condiments used in cooking the beans were tested in the laboratory of the National Agency for Food and Drug Administration Commission (NAFDAC) to ascertain the cause of the problem. The results of the analysis showed that samples of the cooked beans and the uncooked beans contained outrageously high levels of Lindane. Lindane is a chlorinated pesticide that was banned under the 1989 Rotter Convention. Lindane, also commonly known as Gamalin affects the nervous system producing a range of symptoms ranging from nausea, vomiting, headaches, and dizziness to seizures, convulsion and sometimes death.

2.0 Health and safety issues of synthetic chemical pesticides.

The selective use of pesticides to control pests of food crop has played a major role in increasing the availability of produce and grains to the consumers. The consequences of using pesticides for food and the realization that some foods do contain pesticide residue are of paramount importance to today's health-conscious consumers (Fred Whitford et al, 2010). Specifically, the public continues to voice its concern by ranking pesticides residue as one of the top five food safety issues. Public opinion polls indicate foods are certified free of pesticides. The public's concern that consuming foods containing pesticides residues may adversely impact their health is critical. Potential hazards to consumers from the contamination of food with pesticides is currently a major public concern in developed countries (Halliday, 2010). Culliney and Bashore (1996) estimated 2.5 tonnes of pesticides use with no significant improvement in crop loss from pests. Pesticides may cause acute and delayed health effects on those who are exposed (USEPA, 2013). A 2007 systematic review found that most studies on non-Hodgkin Lymphoma and Leukemia showed positive associations with pesticides exposure and thus concluded that cosmetic use of pesticides should be decreased (Bassil et al, 2007). Strong evidence also exists for other negative outcomes from pesticides exposure including neurological, birth defects, fetal death (San Born et al, 2007), and neuro-developmental disorder (Jurewicz, 2008). The World Health Organization (WHO) and the United Nation Environmental Programme

(UNEP) estimated that each year, three million workers in agriculture in the developing world experienced severe poisoning from pesticides of which 18,000 dies (Miller, 2004)

2.1.0 The needs for safe pesticides for food preservation

The use of chemical pesticides, especially when wrongly applied, pose danger to consumers of food who do not have the specialized knowledge to determine the safe level of pesticides in food. Aside from health issue, the resistance warrants the development of a new pesticide (Chrispeels and Sadava, 1994). Attaining food security means the supply of wholesome foods to the people at affordable prices. In effect, food security has three key components – availability, affordability, and safety. But there is great concern about the safety of foods, especially when pesticides are used to preserved foods. This, therefore, necessitates the needs to look for safe preservatives which will not pose any danger both to human and animals

3.0 Materials and Methodology

3.1 Materials

The materials for the study which include:

Garlic cloves, Bean Seeds, Weevils (cowpea weevils), transparent plastic containers with lids, mortar and pestle, sensitive electronic balance, thermometer, hygrometer and optical lens (hand lens) were sourced from the Port-Harvest Laboratory of the Department of Agricultural and Bio-Environmental Engineering, the Federal Polytechnic Ado-Ekiti.

3.1.2 Methodology

i. **preparation of the plastic containers**

The plastic containers were prepared and labeled in the order as shown below with an adhesive paper tape:

$A_{1,1}$	$A_{1,2}$	$A_{1,3}$	$A_{1,4}$
$A_{2,1}$	$A_{2,2}$	$A_{2,3}$	$A_{2,4}$
$A_{3,1}$	$A_{3,2}$	$A_{3,3}$	$A_{3,4}$

$A_{4,1}$	$A_{4,2}$	$A_{4,3}$	$A_{4,4}$
$A_{5,1}$	$A_{5,2}$	$A_{5,3}$	$A_{5,4}$
$A_{6,1}$	$A_{6,2}$	$A_{6,3}$	$A_{6,4}$
$A_{7,1}$	$A_{7,2}$	$A_{7,3}$	$A_{7,4}$
$A_{8,1}$	$A_{8,2}$	$A_{8,3}$	$A_{8,4}$
$A_{9,1}$	$A_{9,2}$	$A_{9,3}$	$A_{9,4}$
C_1	C_2	C_3	C_4

The plastic containers labeled $A_1 – A_9$ contained the varied concentration of pounded pulp of garlic from 5g to 45g (see Table 1). The plastic containers labeled $C_1 – C_4$ contained only the seeds of bean and insects and they served as controls. The lids of the plastic containers were perforated to allowed sufficient air but the perforated holes not big enough so as to prevent the escape of the insects in the plastic containers.

ii. **Preparation of the Garlic pulp**

The scales covering the cloves of garlic were removed, thereafter the cloves are pounded/crushed to a pulp on mortal using a pestle. The thoroughly crushed pulp of garlic was weighed to the desired concentration.

Containers were labeled $A_1 – A_9$ according to the desired concentration.

iii. Preparation of the beans seeds

Only the good seeds were selected for the study. To ascertain the state of “fitness” of the seeds for the study, the seeds were scrutinized using the powerful optical lens. The seeds that were discovered to have been pierced by insects were removed. One hundred seeds that were proved to have passed the test were introduced into each plastic container including the containers that served for control.

iv. Introduction of insects into plastic containers

In each container, ten insects (weevils) were introduced. Each container was subjected to an observation throughout the period of study. All the containers including those for control were put in the same laboratory with same environmental condition prevailing.

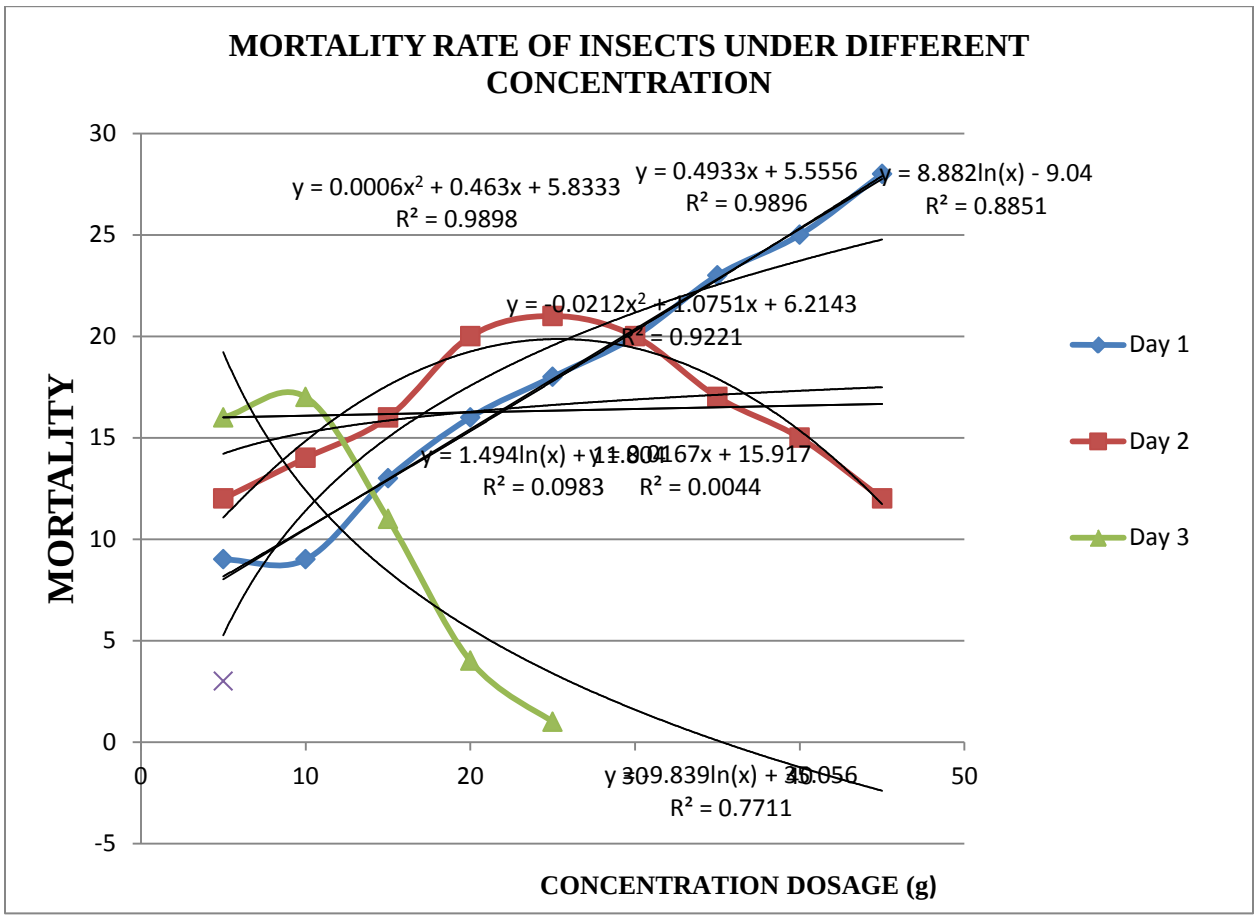
4.0 Results and Discussions

4.1 Results

The results of the study are presented in table 1 and in Figure 1.

Table 1: Mortality Rate of insects under different concentration

	Mortality rate per day			
Concentration	1	2	3	4
Dosage				
5	9	12	16	3
10	9	14	17	
15	13	16	11	
20	16	20	4	
25	18	21	1	
30	20	20		
35	23	17		
40	25	15		
45	28	1		



4.2 Discussion

From the table 1, the following observations were made:

i. Mortality of insects increases with the increases in the garlic concentration or dosage.

   As the concentrations or the dosages of the garlic increases the mortality of the insects also rises.

ii. The longer the length or the days the insects is/are exposed to garlic the higher the mortality of the insects.

The reasons that could be adduced for the (i) and (ii) observation could be:

a. Dosage concentration

When the concentrations were 15g, 20g, 25g, 30g, 35g, 40g, and 45g the corresponding mortalities on the first day of application were 13, 16, 18, 20, 23, 25 and 28 respectively (table 1). There is a correlation between the mortalities and dosage concentration. The correlation coefficient for three equations, (Fig 1.) the exponential, linear and logarithm were respectively 98.9%, 98.9% and 88.5% for the first day of application of garlic. The reasons for this marked observation on the first day could be:

i. The potency of the garlic is high on the first day. Allicin, a powerful antibiotic and antifungal compound present in garlic are with the high pungent choking smell of sulfur. This pungent choking smell of sulphur is known to be keeping birds and insects from eating fruits crops (Garlic and Barrier, 2010). The pungent choking smell must have been reduced on the second day and drastically on the third day. This explained the reasons marked a decline in the correlation as observed in the second and third days.

ii. The vaporization of the pungent choking smell of the garlic into the air must have caused the potency of the garlic to decline and this explained the decline in percentage as observed in second and third days of application of garlic. George et al (2005) and Hill et al (2004) found in their studies that sunflower treated with 4 percent and 97 percent respectively prevent the insects from attacking the fruit. Prolong absentee from feeding could cause the death of an organism and this could be the most probable reason for the increased mortality.

iii. The potency of the garlic was more effective on the first day of application of the garlic as indicated in figure 1. The correlation coefficient for the three equations; exponential, linear and logarithm, are respectively 98.9%, 98.9%, and 88.5%

iv. There was a marked decline in the potency of the garlic in the second and third days of application of the garlic. The correlation coefficient of the exponential, linear and logarithm equations differed greatly. The correlation coefficient begins to show a

decline indicating that the potency of garlic is waning. The correlations for the three equations exponential, linear and logarithm were respectively 92%, 9.8%, 0.4%.

The potency declined totally on the third-day with garlic effectiveness resulting into Zero for the exponential and linear equation. However, for the logarithm, it was 77.1%.

b. Garlic as pesticide

Garlic extract is a much more potent natural organic for protection of crop and seeds. In the study, all the insects in containers treated with Garlic pulp were eradicated within four days of treatment. The fact that insects could not have died of the absence of air in the treated container is that all the containers were perforated to allowed air into the containers. The mortality was proof that Garlic has pesticide effect.

In a study in Senegal, Garlic has proved to be an effective pesticide in biological pest control. The solution used for the treatment is made up 100g of Marseille soap. The solution was liberally applied to the lower side of the leaves without water for a whole day. The study established that two treatments within 6 days of each other were sufficient to eradicate Tetranvhus evansi (red spider) provided the pest is detected very early (spore, 2010). Slusarenko et al (2007) have also established that Allicin, a powerful antibiotic and antifungal compound present in garlic can effectively control seed-borne Alternaria spp in carrot, Phytophthora leaf blight of tomato and tuber blight of potato as well Magnaporthe on rice and downy mildew of Arabidopsis.

5.0 Conclusion and Recommendation

5.1 Conclusion

From the study, it is concluded as follows;

i. Garlic has pesticides property. The property in garlic which acts as an insect repellant is allicin.

ii. The higher the concentration of the garlic the greater the pesticidal effect, higher concentration have greater potency and quick action effect on the application.

5.2 Recommendation

Potential hazards to consumers from contamination of food with pesticides residues is currently a major public concern. Consumers of food wish that the food they consume be safe. The farmers whose crop is being threatened by insects wish that there be an alternate and effective pesticide without hazardous residues. Garlic as plant pesticides bridges the gap. Garlic which has numerous health benefits is hereby recommended for use as a pesticide for storage of crops.

It is also recommended that further work on garlic as pesticide be extensively carried out.

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