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EFFECT OF GARLIC, POTASH AND LEMON RIND ON THE CONTROL OF STORAGE INSECT PESTS OF COWPEA (VIGNA UNGUICULATA L. WALP) IN NIGER STATE, NIGERIA

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ABSTRACT

The trial was conducted at Pest Management Technology Laboratory of Niger State College of Agriculture, Mokwa, located on 09^0 18^1N, 05^0 04^1E of the equator in Southern Guinea Savanna agro-ecological region of Nigeria in 2011 and 2012 cropping seasons. The experiment was aimed at determining the effect of garlic powder, potash, lemon rind and Actellic dust in the storage of cowpea (*Vigna unguiculata* L. walp), with Kano white variety of cowpea. The experiments were arranged in a complete randomized design (CRD) consisted of eight treatments, 4g and 8g of each of garlic powder, potash and lemon rind, actellic dust as well as no application (control) all replicated three(3) times. The parameters measured include number of live insects found, number of dead insects found, insects' damage score and weight loss of the grain. The result showed that the number of live, dead weevils, the cowpea damage score and weight loss during the storage at 30^{th} days, 60^{th} days, and 90^{th} days were significantly similar with all treatments of garlic powder, potash and lemon rind when compared to the control. They are therefore recommended for usage during storage of cowpea for safer management method and cheaper for resource poor farmers; however at 4g and 8g dosage potash is more effective for management of *Callosobruchus maculatus* in the cowpea store.

KEYWORDS: *Callosobruchus maculates*, Cowpea Garlic, Insect Pests, Lemon Rind and Potash

INTRODUCTION

Cowpea (*Vigna unguiculata* L. walp) is grown extensively in 16 African countries with Nigeria producing two-third of the total (Rachie, 2005). Food and Agricultural Organization (FAO) estimated that 3.3 million tons of Cowpea dry grains were grown worldwide annually (FAO, 2001), with Nigeria producing 2.1 million tons of this making it the world largest producer followed by Niger Republic (650,000 tons and Mali (110,000 tons). The growers faced some production challenges ranging from production practices to pest complex management because severe pest from vegetative to field/store pests can cause total failure of cowpea. The impact of this loss in terms of production has been effectively offset by increasing crop yield obtained through the use of higher yield varieties that are more tolerant to field insect pest attack but storage loss still remained a great constraint (Singh, 2008).

From the store the crop is subjected to serious infestation from insect pest by stored cowpea weevil, *Callosobruchus maculatus*. The infestation of cowpea by this pest could be as high as 100 % on unprotected cowpea stored between 3-5 months of storage (Singh, 2007). Various control measures in the management of stored cowpea weevil

include the use of synthetic insecticides. The high cost of these insecticides coupled with their high mammalian toxicity due to poor handling and persistent residues are reasons for research efforts into the use of botanical or natural insecticides (Daziel, 2004). The report of the effectiveness of garlic in the control of field insect pests is of great concern and that is the reason of evaluating its effectiveness in the store and further re-evaluates the effectiveness of potash and lemon rind as an alternative to the continuous use of synthetic pesticides. The objective of this study therefore was to determine the effect of garlic, potash, and lemon rind on the control of stored insect pest, *Callosobruchus maculatus*, in the management of cowpea grains.

MATERIALS AND METHODS

The trial was conducted for two cropping sessions, 2011 and 2012, at Pest Management Technology Laboratory of Niger State College of Agriculture, Mokwa, located on 09^0 18^1N , 05^0 04^1E of Southern Guinea Savannah Zone of Nigeria. The garlic and lemon rind were collected fresh and air dried and grinded into powder form using pestle and mortar, while potash was grinded into powder directly. The screened cowpea (Kano white) variety was obtained from International Institute of Tropical Agriculture (IITA) and subjected to disinfestation method using Santhoy and Rejesus (1975) through oven drying at 45^{0c} for 30hours while *Callosobruchus maculatus* were collected directly from farm through harvested but infested cowpea in December as naturally infested cowpeas but cultured on room temperature range of 25^{0c}-$32^{0c}$and RH of 75±80% in the plastic cups tightened with rubber bands in laboratory and 10 teneral insects each irrespective of the sexes obtained from the culture were introduced into the trials.

The trials were laid out in a Complete Randomized Design (CRD) consisted of eight treatments (4g and 8g) of lemon rind powder, potash, garlic and actellic dust each replicated thrice. 200g of screened Kano white variety of cowpea each was mixed up with the treatments while actellicdust that served as check was mixed at a rate of 0.2g active ingredient to 200g of cowpea as control. The observation and records taken were, number of insects(dead and alive) at 30^{th}, 60^{th}, and 90^{th} days of storage; percentage weight loss of seeds at 90^{th} days of storage using rating by Anon(2005); percentage of seed damage at 30^{th}, 60^{th}, and 90^{th} days of storage; percentage weight loss of grain was calculated according to Boba-Tierto (2001). The data obtained were subjected to analysis of variance (ANOVA) and means treated to Duncan's multiple range test (DMRT) at 5% probability using standard error of difference.

RESULTS AND DISCUSSIONS

From Table 1at 30^{th} day of the storage for the two seasons, it was observed that there was no significant difference in number of living *Callosobruchus maculatus* found in cowpea treated with various levels of garlic powder, lemon rind powder and potash compared with control. But at 60^{th} day of the storage for the two years treated with actellic dust showed significant difference in terms of number of living *Callosobruchus maculatus* compared with the application of the botanicals. Quantity of treatments used in the trials impacted significantly on the protection of the cowpea. Cowpea applied with 8g of all the treatments had significant impact on the *Callosobruchus maculatus* compared with those treatments that protected cowpea at 4g. The highest number of live *C. maculatus* was recordedat control compared with actellic insecticide at 90^{th} day.

The number of dead insects at 30^{th} day of the storage actellic dust had significantly ($P \leq 0.05$) highest number of dead *Callosobruchus maculatus* compared with other treatments evaluated for the two seasons. Comparing dosages, botanicals with higher dosages (8g) had same impact with 4g dose of potash in terms of values of dead insects. But at 60^{th}

day, the dead *C. maculatus* recorded with actellic dust was greater as compared with treatments irrespective of dosage or type of treatment applied. At 90th day of storage, actellic dust recorded higher dead toll followed by 8g of potash and 4g of potash, then 8g of lemon rind equal to 8g of garlic powder and 4g of garlic powder (Table 2).

In terms of insect damage score there was no significant difference in the grain damage of cowpea treated with botanicals and synthetic (actellic dust) insecticide with control at 30days of the trials. But at 60th day of the storage trials with a ctellic dust had significantly ($P \leq 0.05$) lowest grain damage compared with botanicals. However, cowpea with dosages of 8g of potash, 8g of lemon rind, and 8g of garlic powder compared with grain damage of cowpea with 4g of garlic powder and 4g of lemon rind. At 90 days of storage lowest grain damage was obtained with a ctellic dust (Table 3).

Recordings for the percentage weight lost during the storage was not significantly different ($P \leq 0.05$) among all the treatments evaluated (Table 4)

DISCUSSIONS

This result showed that cowpea storage for longer duration with actellic dust as check, potash, garlic and lemon rind with higher dosages would protect cowpea effectively according to (Daziel, 2004). Higher insect mortality value, weight of cowpea grain and lower grain damage for 90 days is an indication that actellic dust, potash, garlic powder and lemon rind had varying effect in reducing the attack of cowpea grain from *Callosobruchus maculatus*as reported by (Anon, 2005). Isah *et al*(2007) reported the effectiveness of garlic bulb, garlic chilly in the control of Egyptian cotton leaf worm aphids in the field. Daziel (2004) had also reported the effectiveness of synthetic chemicals and some natural herbs in the management of in sectpests. Isah *et al* (2007) evaluated mango tree extracts(leaf, bark and roots) at 60, 75 and 90 days after storage and it was discovered that mango extract significantly caused higher insect pest mortality on stored cowpea than all others as well as no application.

CONCLUSIONS

It can be concluded that bean weevils can be effectively managed using garlic powder, potash, lemon rind and actellic dust during storage; and at dosage of 4g and 8g of antidote on cowpea. The poor-resource farmers are therefore recommended to use them as they offer less toxicity and residual effect upon consumption. Nutritional quality of stored cowpea after storage with the garlic powder, potash, and lemon rind and actellic dust is being investigated. Finally, the recommended storage materials are cost effective (i.e. low cost) and readily available in large quantities in Nigeria markets for use in the control of storage insect pests of cowpea weevils.

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APPENDICES

Table 1: Effect of Garlic Powder, Lemon Rind, Potash and a Ctellic Dust on Survival Rate of Cowpea Insect Pests in 2011 and 2012

Sampling Periods at						
Treatments	**30 days**		**60 days**		**90 days**	
	2011	**2012**	**2011**	**2012**	**2011**	**2012**
Garlic powder (4g)	5.67	5.21	5.33	5.01	4.33	4.00
Garlic powder (8g)	5.00	4.48	5.00	4.48	4.00	3.22
Lemon rind (4g)	5.33	5.00	5.33	5.00	4.67	4.37
Lemon rind (8g)	5.00	4.48	4.67	4.37	4.33	4.00
Potash (4g)	5.00	4.48	6.00	5.48	3.00	2.48
Potash (8g)	4.67	4.37	5.33	5.00	2.67	1.66
Actellic powder	0.00	0.00	6.00	5.48	0.00	0.00
Control	10.00	5.00	12.33	6.11	0.00	0.00
SE ±	NS	NS	0.06	0.03	1.04	1.02

SE ± - Standard Error of Difference
NS - Not Significant at 5% probability
*- Significant at 5% probability

Table 2: Effect of Garlic Powder, Lemon Rind, Potash and a Ctellic Dust on Mortality Rate of Cowpea Insect Pests in 2011 and 2012

Sampling Periods At						
Treatments	**30 days**		**60 days**		**90 days**	
	2011	**2012**	**2011**	**2012**	**2011**	**2012**
Garlic powder (4g)	**4.33**	**4.01**	4.67	4.17	4.67	4.17
Garlic powder (8g)	**5.00**	4.00	5.67	4.67	5.00	4.00
Lemon rind (4g)	**4.67**	4.17	4.67	4.17	4.67	4.17

Lemon rind (8g)	**4.67**	4.17	5.00	4.00	5.33	4.33
Potash (4g)	**5.00**	4.00	5.33	4.33	7.00	6.00
Potash (8g)	**5.33**	4.33	6.67	5.17	7.33	6.33
Actellic powder	**10.00**	7.00	10.00	7.00	10.00	7.00
Control	**0.00**	0.00	1.33	0.78	2.33	1.33
SE ±	**0.41***	1.01*	1.17*	0.99*	1.74*	1.24*

SE ± - Standard Error of Difference
NS - Not Significant at 5% probability
*- Significant at 5% probability

Table 3: Effect of Garlic Powder, Lemon Rind, Potash and a Ctellic Dust on Insect Damage Score by Cowpea Insect Pests in 2011 And 2012

Sampling Periods At						
Treatments	**30 days**		**60 days**		**90 days**	
	2011	**2012**	**2011**	**2012**	**2011**	**2012**
Garlic powder (4g)	1.67	1.27	2.33	1.30	2.33	1.30
Garlic powder (8g)	1.33	1.01	1.67	1.27	1.67	1.27
Lemon rind (4g)	1.67	1.27	2.00	1.80	2.00	1.80
Lemon rind (8g)	1.33	1.01	1.67	1.27	1.67	1.27
Potash (4g)	1.33	1.01	1.67	1.27	1.67	1.27
Potash (8g)	1.00	0.99	1.67	1.27	1.67	1.27
Actellic powder	1.00	0.99	1.00	0.99	1.00	0.99
Control	1.33	1.01	3.00	2.00	3.33	2.01
SE ±	NS	NS	0.25*	0.05*	0.66*	0.03

SE ± - Standard Error of Difference

NS - Not Significant at 5% probability

*- Significant at 5% probability

Table 4: Effect of Garlic Powder, Lemon Rind, Potash and a Ctellic Dust on the Mean Weight Loss from Initial 200g of Stored Cowpea by Insect Pests (Bean Weevil) in 2011 and 2012

Treatments	**Mean Weight of Cowpea (G)**	
	2011	**2012**
Garlic powder (4g)	192.3	191.0
Garlic powder (8g)	192.7	191.3
Lemon rind (4g)	191.3	190.7
Lemon rind (8g)	191.0	190.1
Potash (4g)	195.3	193.3
Potash (8g)	195.7	193.1
Actellic powder	199.6	197.3
Control	145.3	143.1
SE ±	NS	NS

SE ± - Standard Error of Difference
NS - Not Significant at 5% probability
*- Significant at 5% probability