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Preservation of Cowpea Against Callosobruchus Maculatus Using Gamma-Irradiation

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Abstract:- Cowpea seeds were irradiated with gamma at different doses of (0 - 900) Gy and stored for period of six months. During this period data were taken by counting the number of damage and death weevil (*Callosobruchus maculatus)*. The results show that there are significant difference between non-irradiated (0 Gy) cowpea when compare with irradiate cowpea, while there is no significant difference in the radiated gamma doses of 300 Gy, 600 Gy and 900 Gy. The non-irradiated showed high damaged from weevil (*Callosobruchus maculatus)* (P<0.05) when compared to the 300 Gy, 600 Gy and 900 Gy. This research shown that gamma radiation of 300 – 900 Gy can effectively preserved cowpea against weevil (*Callosobruchus maculatus)* during storage for period of six months. Based on this result, these doses are recommended.

Keywords:- *Cowpea, Calosobruchus Maculatus, Gamma-Irradiation, Preservation.*

I. INTRODUCTION

Irradiation has been accepted as a reliable process of preservation because it increases hygienic and nutritional value of storage crop and prolong storage life. These technique appears to be very attractive and healthy alternative when compared to conventional chemical treatments such as fumigation techniques, physical and thermal treatments [1]. Irradiation intended to disinfects storage crops, sprouting inhibition, achieving partial or incomplete inactivation of cells of particular pathogens of potential decomposition microorganisms, that may naturally existing in unprocessed food [2].

Gamma-irradiation is prepared from radioactive decay that includes the use of radioisotopes of cobalt-60 and cesium-137 that make changes in cell structure, DNA damage etc. Irradiated foods are not radioactive as the rays do not stay in the food or storage crop, and It has insignificant effects on the flavor, texture and aroma [3, 4].

Many literatures have reported effectiveness of sterilization using gamma radiation on fecundity and fertility of adults *callosobruchus maculatus* which reduces their reproduction and population during storage Present research focuses on irradiation of cowpea seeds with less than 1 kGy doses of gamma from ceasium-137 against weevil (*Callosobruchus maculatus*) in order to limit or prevent the effect of cowpea weevils.

II. MATERIALS AND METHOD

Cowpea seed samples were collected from Niger State College of Agriculture, Mokwa Farm in 2016 harvest season. The physically damaged and immature seed were sorted out and discarded. The samples were transported to the Centre for Energy and Research Training (CERT) Zaria, Nigeria for irradiation.

2.1Irradiation Technique

The samples were irradiated with cesium-137 gamma radiation source at doses of 0.3 kGy, 0.6 kGy, 0.9 kGy at dose rate 90.4 mSv/hr and non-irradiated as a control. The samples were all sealed in the rubber container of air tight after irradiation and stored at room temperature for period of six (6) months. In each month data were taken by counting the number of damage cowpea, live weevil and dead weevil (i.e *Callosobruchus maculatus*) in order to determine the effect of gamma irradiation on the preservation and control of *Callosobruchus maculatus* during the storage.

III.RESULTS AND DISCUSSION

All data were analyses using univariate Analysis of variance (ANOVA). The Duncan multiple range test were used to separate the means at $P < 0.05$ level of significance, using SPSS (23) version IBM statistical Software program.

The table 1 shows the mean of spoilt irradiated and non-irradiated cowpea at different doses, the results show that there is significant difference in non-irradiated 0 Gy cowpea when compare with irradiate cowpea, while there is no significant difference in the radiated gamma doses of 300 Gy, 600 Gy and 900 Gy. This could be attributed to fact that gamma radiation doses of these range effectively killed *Callosobruchus maculatus* at any stage of development of the adults in less than 4 days [5].

Gamma radiation has the ability to disinfection, decontamination, reduction pathogenic microorganisms, sterilization and reduces fecundity of the damage insect [6, 7]. According to James *et al.*, (2012), gamma radiation 1 – 1.4 kGy can effectively inhibit sprouting, preserved the quality and macronutrients of yam tubers for 7 months. Similarly, irradiation of tomato with 0.25 - 1 kGy gamma doses did not affect the color, texture, flavor and taste [8, 9].

Table 1 shows the mean of spoilt irradiated and non-irradiated cowpea at different gamma doses

Dose (Gy)	Mean	Lower bound	Upper bound
300 Gy	3.17±0.28[b]	2.60	3.73
600 Gy	2.75±0.28[b]	2.19	3.31
900 Gy	2.58±0.28[b]	2.02	3.15
0 Gy	4.67±0.28[a]	4.10	5.23

Values are means ± slandered deviation

3.2Effect of gamma radiation doses on the storage period of cowpea.

Table 2 shows storage period of one to six months at different gamma doses, the results show that non- irradiated cowpea recorded highest mean of spoilt cowpea for the period of six months of storage which show no significant within the month. At first month of storage, the number of spoilt cowpea were higher in 0 Gy with 4.50±0.71 followed by 300Gy, 600Gy and 900 Gy with 3.25±0.71, 2.50±0.71 respectively. The number of spoilt cowpea increase and also reduce within months of storage. These result corroborated with the work of Jakarpong *et al.*, (2005) that after irradiation of *Callosobruchus Maculatus* with gamma doses 500 Gy and 800 Gy recorded high percent of modalities when compared with 100 Gy and 300 Gy [10].

Table 2 Shows doses and month of storage of irradiated cowpea

Month	300 Gy	600 Gy	900 Gy	0 Gy
First	3.50±0.71	2.50±0.71	2.50±0.71	4.50±0.71
Second	2.50±0.71	3.50±0.71	3.00±1.41	5.50±0.71
Third	3.50±0.71	2.00±0.00	2.00±1.41	5.50±0.71
Fourth	3.50±0.71	1.50±0.71	3.50±0.71	4.00±1.41
Firth	2.50±0.71	2.50±0.71	2.00±1.41	4.00±1.41
Sixth	3.50±0.71	4.50±0.71	2.50±0.71	4.50±0.71

Values are means ± slandered deviation

3.3Effect of irradiation on the mortality weevil (Callosobruchus Maculatus)

The table 3 shows ANOVA Table of irradiated and non-irradiated cowpea. The result show that there was significantly difference ($P<0.05$) in gamma radiation doses while there is no significant difference ($P>0.05$) within the month of storage.

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Table 3 Shows ANOVA for irradiated and non-irradiated (control) of cowpea samples stored for six months

Source	Type III Sum Of squares	df	Mean square	F	Sig
Corrected model	37.58a	8	4.69	5.04	0.00
Intercept	520.08	1	520.08	558.26	0.00
Dose	32.42	3	10.81	11.59	0.00
Month	5.17	5	1.03	1.11	0.37
Error	36.33	39	0.93		
Total	594.00	48			
Corrected Total	73.92	47			

IV.CONCLUSION

This research has shown that gamma radiation of (0.3 – 0.9kGy) can effectively preserved cowpea against weevil (*Callosobruchus maculatus)* in the storage for period of six months. It is therefore recommended for large scale storage of cowpea. Further should be carry out on nutritional value of grains.

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