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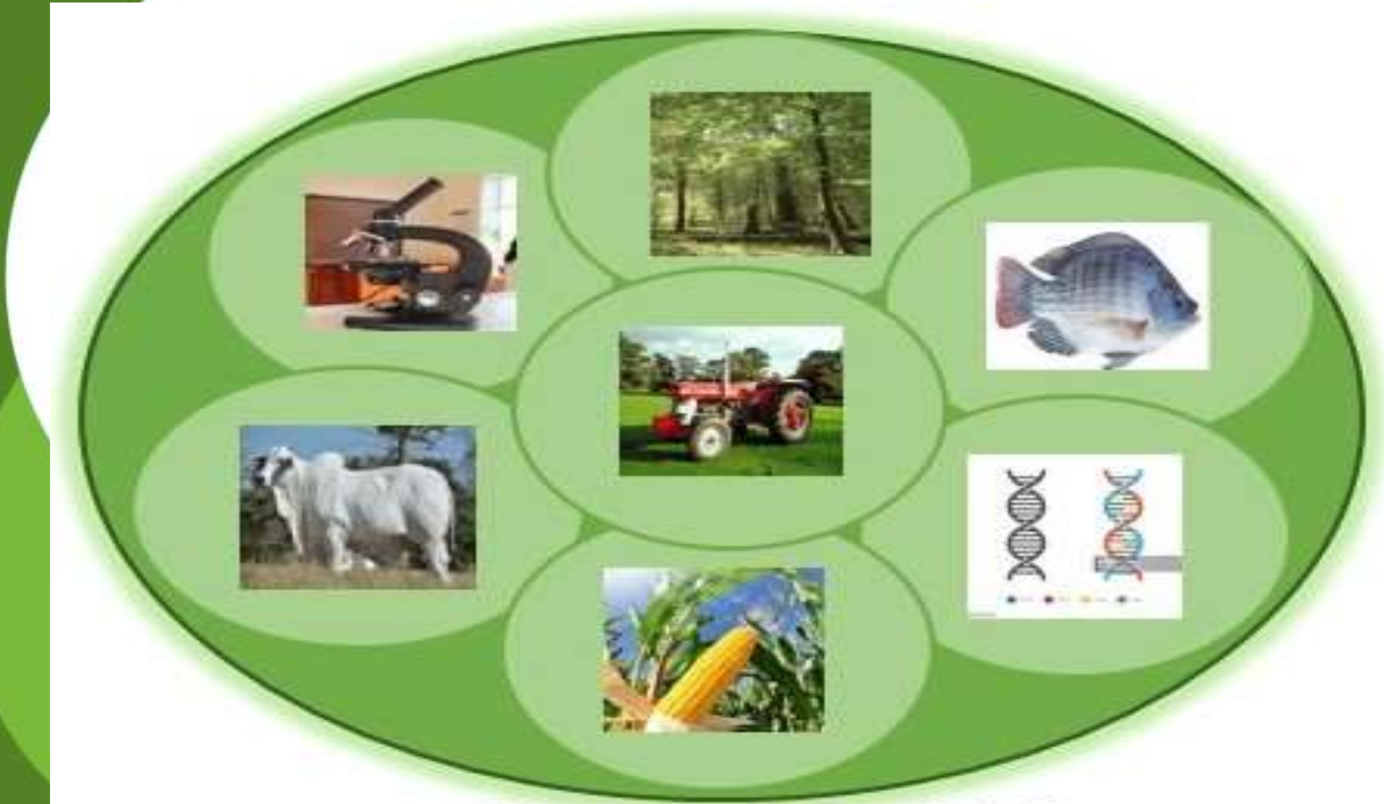

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**CONTACT:**

**The Editor,**
**Kebbi Journal of Agriculture and Natural Sciences,**
**Faculty of Agriculture,**
**Kebbi State University of Science and Technology Aliero,**
**PMB 1144, Birnin kebbi, Nigeria.**
**Email: kejaanseditor@ksusta.edu.ng, kejaans.foa@gmail.com.**
**Phone: +234 8039370546**



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The Kebbi Journal of Agriculture and Natural Sciences has the sole aim of providing an intellectual platform and ideas for scholars, by promoting interdisciplinary studies related to agriculture and natural science through publishing the latest scientific research findings that are of direct policy implications and beneficial to the research community. Consequently, the journal covers all aspects of Crop Science, Animal Science, Agricultural Economics, Agricultural Extension and Rural Development, Food Science, Fisheries and Aquaculture, Biotechnology, Soil Science and Agricultural Engineering, Forestry and Environment, Wildlife, Agricultural Education, Agro-allied Industries as well as all Natural Science researches related to Agriculture.

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A conscience introduction of the background to the subject is required and should include a brief statement of the problem, significance and purpose of the research and relationship to earlier works with well acknowledged references.

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**Materials and Methods**

This section must be presented with adequate clarity and provide sufficient details to permit the repetition of the experimental work. The techniques and the methodologies adopted should be supported with standard references. Subheadings under this section should be in lower case except the first letter.

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Results should be presented concisely. Only in exceptional cases will it be permissible to present the same set of results in both Table and figure. In discussion, point out the significance of the results and place the results in the context of other work and theoretical background. Results and Discussion part could be written separately if author so wish.

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Avoid the use of figures /numbers at the beginning of a sentence. Write out one through nine unless a measurement, a designator, or a range (e.g five seeds, 8cm, 3yr, 5-11 flowers)

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# INSECTICIDAL EFFECT OF PAWPAW (*Carica papaya* L.) LEAF POWDER ON MAIZE WEEVIL (*Sitophilus zeamais*) IN STORED MAIZE SEEDS

[1]Kwaifa, N. M., H. F. Garba[1], I. J. Yusuf,[1] A. Musa,[1] Abdullahi M.[3], M. Lukman[1] and A. A. Maru[2]

[1]Department of Crop Science, Kebbi State University of Science and Technology, Aliero, Kebbi Sate, Nigeria.
[2]Department of Agricultural Technology, College of Agriculture and Animal Science Bakura, Zamfara State, Nigeria.
[3]Department of Agricultural Education, School of Vocation, Kwara State College of Education Technical, Lafiagi, Kwara State, Nigeria.

Corresponding Email: nasirkwaifa@gmail.com, +2348064129611

**ABSTRACT**

*Laboratory experiment was conducted at the Kebbi State University of Science and Technology Aliero, to investigate the insecticidal effect of Pawpaw (Carica papaya) leaf powder in controlling maize weevils (Sitophilus zeamais) in stored maize seeds. The organically produced powder prepared was applied at 2.5g per 100g grains, 5g per 100g, 10g per 100g, an untreated Control and a standard Synthetic check, laid out in a Completely Randomized Design with replications. The powders were tested alongside with untreated maize. Result showed significant effects among the treatments depicting a significant effect in reducing S. zeamais infestation on stored maize. The study observed that treatment of maize grains with Pawpaw leaf powder significantly reduced loss of weight in all the treatments on Maize stored seeds. A significant difference ($p<0.05$) was observed between treated and untreated (control) with the weight of damaged seeds was significantly ($p<0.05$) higher in treated grains than the untreated control (40.28). The Maize grains treated with C. Papaya powder at different concentration 2.5g, 5.0g and 10g; having varying degree of weight damages on seeds and was significantly lower than the untreated control. Maize treated with 2.50g of C. papaya recorded seed damage of 31.06, with 5.0g of Carica papaya producing a weight loss of 19.24 and Maize treated with 10.0g of C. papaya leaf powder had recorded seed damage of 9.23. The study confirmed that the use of organic C. papaya leaf powder had significantly reduced S. zeamais infestation on the stored maize during storage.*

*Keyword**:** Maize weevil; Insecticide; Pawpaw; Powder; Maize grain; Storage.*

## Introduction

Maize (*Zea mays* L.) is a monocotyledonous plant belonging to the family of *Poaceae* which is an edible grain. Maize was first domesticated by native people in Mexico for about 10,000 years ago (Kemabonta, 2013). The crop is an important staple food for human beings and animals. It is a major cereal which is cultivated by a vast majority of rural household and in all parts of the world. In addition, it is also used as an important feed and fodder for animals. The important constituent of maize are carbohydrates, proteins, fats oil and minerals. The protein quantity in maize is relatively low and ranges from 8 to 15%, but has relatively high percentage of sulphur containing amino acids, methionine and cysteine. The important constituent of maize are carbohydrates, proteins, fats oil and minerals. The protein quantity in maize is relatively low and ranges from 8 to 15%, but has relatively high percentage of sulphur containing amino acids, methionine and cysteine. Maize is a rich source of starch (60-80%), protein (8-12%), fat (3-5%) and minerals (1-2%) as reported by Effiong and Sanni (2009). Maize is the single largest source of calories (Vellegas, 2000) Classification of maize includes; Dent corn, Flint corn, Flour corn, sweet corn and popcorn.

However, the availability of maize is often hindered by infestation of insect pests which constitute a major problem in its production and storage. The most important storage pest of maize is Maize weevil (*Siitophilus zeamais*). In stored maize, heavy infestation of this pest may cause weight losses of as much as 30-40% (Casey, 1994). This insect pest causes heavy economic losses to maize and other grains throughout the world and their impacts are more devastating in poor countries (Boxall *et al*., 2002). The maize weevils are among the most destructive crop pests responsible for deterioration in the nutrient quality of maize and contamination of the interior contents by producing harmful compounds and allergens (Rajendran and Parveen, 2005). These weevils infest the grains during storage and transportation, grain infestation usually starts in the field; Subsequent infestation in store result from the transfer of infested grain into store or from pests flying into storage facilities, probably attracted by the odour of the stored grains. The chewing damage caused by the insect brings about increased respiration in the seeds which promotes evolution of heat and moisture which in turn provides favourable living condition for moulds and other fungal species such as *Aspergillus* and *Penicillium* spp. leading to the production of mycotoxin such as aflatoxin in the seeds (Effiong and Sanni, 2009).

Damages caused by this insect become noticeable when the adult insect bore holes that reach approximately 1.0 mm in size on the grain and deposits its eggs within the hole. To reduce these risks associated with synthetic pesticides, alternative products are being sought by both farmers and consumers in controlling storage pests of maize. The use of plant products in the control of pests is fast gaining grounds due to their ability to effectively reduce the pest population and at the same time cheaper and safer than the conventional synthetic pesticides that have detrimental effects on the environment as well as on humans and animals and biodegradable (Kemabonta, 2013). Research work done over the years have revealed that, some plant extracts possessed pesticidal properties and could therefore replace the hazardous synthetic products currently being used.

## Materials and Methods

### Study Area

The experiment was conducted at Kebbi State University of Science and Technology Aliero, Crop Science Laboratory. Maize seeds used for this study was obtained from a newly stocked maize seeds free of insecticides from Jega, Kebbi State, Nigeria. Maize seeds were cleaned and disinfested at 5 $^{o}$C for 7 days to kill all hidden pests. This is because all the life stages, particularly the eggs are very sensitive to cold. The maize seeds were then placed inside an oven at 40 $^{o}$C for 4 hours and therearfter air dried in the Laboratory to prevent mouldiness before they were stored in plastic containers with tight lids till when needed.

**Treatments and Experimental Design**

Fifty (50) grains of maize were placed in a Kliner jar with a lid covered on top which allowed free flow of aeration. The different amount of the plant powder of 2.5g 5g, 10g and 0g were used during the experiment. Ten live maize weevils were introduced into each container. The mixture was thoroughly mixed and then covered with muslin cloth. The treatments were arranged in a Completely Randomized Design (CRD) in four replicates.

**Insect culture**

Maize weevils (*S. zeamais*) were obtained from infested stock of maize at Aliero main Market, Nigeria. The insects were reared on whole maize in glass Kliner Jars and grains were sterilized at $40^0$C in the oven. After three weeks of oviposition the parent insects were removed and discarded by freezing while the emerging generation of same age insects were re-cultured at 37 $^0$C.

**Preparation of Pawpaw Leaf Powder**

Fresh pawpaw leaves were collected washed with clean water, air dried and grinded in the Laboratory using small Mortar and pestle. The powder was further sieved and passed through 1 $mm^2$ Sieve. The powder was packed in plastic containers with tight lids and kept safe one day prior to the experiment.

**Data Collection**

**Weevil Mortality**

The number of dead weevil was counted and recorded, this was done by observing and counting the dead weevils weekly using tooth pick to probe the insects and those that do not move were considered dead.

**Grain Damage**

Weevil damage was assessed at the end of the storage period. The number of grains with holes and those turned into powder were counted as damaged through weevil feeding.

**Weight of Maize Seeds**

The initial weight of the Maize seeds was measured before the commencement of the experiment and at the end of the experiments the second weight was measured after the experiment in the Laboratory and the mean differences were obtained and analysed.

**Data Analysis**

Data generated from this experiment were analysed using Analysis of Variance (ANOVA) and Least Significant Different test (LSD) at 5% level of significance was used for mean separation.

**Results and Discussion**

Seed weight loss before insect infestation

Result showed significant ($P<0.05$) effect on grain weight loss due to the application of *C. papaya* powder in reducing the maize weevil attacks (Table 1.) Results revealed that application of standard synthetic insecticide resulted to highest weight lost (49.9), this was followed by Pawpaw Leaf Powder (PLP) at 10g (46.3), then 5.0g (44.4), which was in turn higher than PLP at 2.5g (41.2). The least seed weight loss was in untreated control (30.7). The result indicated that the higher the concentration of PLP the more its effectiveness on weight of maize.

Seed weight loss after insect infestation

Result obtained revealed the weight after infestation and the percentage mortality, with the Synthetic insecticide being significantly highest in weevil mortality 98.6%, control had the lowest mortality 10.0%. Pawpaw leaf powder (PLP) at 10g had 90.0%, 5.0g had 70.0% while the PLP at 2.5g concentration had

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60.0%. The result indicated that the higher the concentration of PLP the more it effectiveness on *S. zeamais.* Results revealed the synthetic insecticide had lowest undamaged seeds 29.87 while untreated grains (Control) were found to have highest weight of undamaged seeds 49.87. The grains treated with *C. Papaya* at different concentration 2.5, 5.0 and 10 respectively; having varying degree of weight of undamaged seeds which was less than the untreated (control) grains. Maize treated with 2.50g of *C. Papaya* had 45.97 5.0g had 40.37 and Maize treated with 10.0g of *C. Papaya* had 34.53 respectively. This result indicated that higher the PLP concentration the more the damage cause by *S. zeamais* on maize seeds.

Table1. Seed weight loss before and after infestation

| Treatments | Weight before infestation (g) | Weight after infestation (g) | % mortality |
|---|---|---|---|
| PLP 2.5 | 50 | 41.2[d] | 60.00[c] |
| PLP 5.0 | 50 | 44.4[c] | 70.00[b] |
| PLP 10.0 | 50 | 46.3[b] | 90.00[ab] |
| Control | 50 | 30.7[e] | 10.00[d] |
| S.I | 50 | 49.9[a] | 98.6[a] |
| LSD 0.05 | | 4.24 | 4.24 |

Means with the same letter(s) are not significantly different (P>0.05)

The result on the weight of undamaged seeds after infestation (Table 2) indicated mortality of *S. zeamais* was observed for three weeks, however, untreated (control) grains had more weight of undamaged seeds (49.87) and followed by 2.5g which contained the lowest concentration of Paw-Paw Leaf Powder (PLP) which had 45.97 weight of undamaged seed, 5.0g and 10.0g revealed lower seed weight compared control the least was observed in synthetic insecticide (S.I) with 29.87. Moreover, in terms of mortality the case is reversed, higher mortality rate was observed from the maize seeds treated with 10.0g of Paw-Paw Leaf Powder giving 49.87 untreated (control) grains was ranked second with 45.97 5.0g and 2.5g were ranked third and fourth 40.37c and 34.53 while synthetic recorded the least mortality rate 29.87. The result revealed that synthetic insecticide dust had lowest number of infested seeds 014.01 while untreated grains (Control) were found to have highest number of seeds infested 46.30. The grains treated with *C. Papaya* at different concentration 2.5, 5.0 and 10 respectively; having varying degree of number of infested seeds which was less than the untreated (control) grains. Maize treated with 2.50g of *C. Papaya* had 41.20, 5.0g had 40.40 and Maize treated 10.0g of with had 30.60 respectively. This result indicated that lower the PLP concentration the more the number of infested maize seeds **Discussion**

The results of the study observed that treatment of the maize with PLP significantly reduced loss of weight in all the treatments. A significant different at P<0.05 was observed between treated and untreated (control) in which weight of damaged seeds was higher on control 40.28. The grains treated with *C. Papaya* at different concentration (2.5g, 5.0g and 10g respectively, had varying degree of grain weight loss less than the untreated control. Maize grain treated with 2.50g of *C. Papaya* had weight loss of 31.06, 5.0g of *C. Papaya* had weight loss 19.24 and Maize treated 10.0g had *C. Papaya* had weight damaged seeds of 9.23 respectively. This results is in line with work of Danjuma *et al.* (2018) who reported that maize seeds treated with Actellic dust had least losses and damage (0.15 per cent) while untreated grains were found to have highest loss (16.10%). The grains treated with *C. aurantifolia* and *S. occidentalis* were having varying degree of losses which were less than the untreated (control) grains but a little bit higher than Actellic dust. Maize treated with 2.0g of *C. aurantifolia* had small weight loss (6.17%) while *S. occidentalis* (10.0%).

Table 2: Weight of undamaged seeds after infestation

| Treatments | Weight of Undamaged seeds (g) | Mortality | No. of infested seeds |
|---|---|---|---|
| PLP 2.5 | 45.97$^{b}$ | 34.53$^{d}$ | 41.20$^{b}$ |
| PLP 5.0 | 40.37$^{c}$ | 40.37$^{c}$ | 40.40$^{c}$ |
| PLP 10.0 | 34.53$^{d}$ | 49.87$^{a}$ | 30.60$^{d}$ |
| Control | 49.87$^{a}$ | 45.97$^{b}$ | 46.30$^{a}$ |
| S.I | 29.87$^{e}$ | 29.87$^{e}$ | 14.01$^{e}$ |
| LSD 0.05 | 0.015 | 0.106 | 0.163 |

Means with the same letters are significantly different (P<0.05).

The results obtained that shown that the higher the amount, the lower the weight damaged of seeds. The experiments revealed that PLP exhibited grain protection ability against *S. zeamais* infestations. At 10g concentration level of PLP the numbers of undamaged seeds were significantly higher p<0.05 than all other concentration levels. Maize grains treated with synthetic insecticide had less weight of undamaged seeds 29.89 grains which were significantly lower p<0.05 than untreated maize grains. The mortality of *S. zeamais* on the local maize variety treated with PLP confirmed the potentials of these products as insecticidal against maize weevil. A mixture of maize with PLP seems to be most effective in reducing the *S. zeamais* especially at higher doses and PLP produced moderate results compared with synthetic insecticide dust treated samples of grain showed higher mortality. The application of higher dose of 10g of the powder resulted in higher mortality but the differences among them were not significant. The differences in mortality exhibited by the different concentration of powders could be attributed to the presence of different bioactive components present in different quantity in PLP. This result is in line with the work of Danjumma *et al.* (2017), who reported a similar finding that mortality rate among weevils is associated with lethal doses of the treatment resulting in stomach poisoning and consequently leading to insect mortality. Similarly, Danjumma (2017), also reported that pesticidal activity of plant products including Neem, Phyrethrum and Tephrosia against insects in storage is effective in the control of insect pests of crops.

In this study PLP at a dosage of 10g caused significant mortality, implying that PLP is a good Botanical pesticide for managing *S. zeamais* in storage. The other dosage of PLP showed varying degrees of effectiveness towards reducing the number of *S. zeamais* on maize during infestation. Similar work by Owusu-Akyaw (1991), Cobbinah and Appiah-Kwarteng, (1989) are confirmed the effectiveness of applying some local plant materials possessing insecticidal and anti-feedant properties which could inhibit the pest activities and infestation of *S. zeamais*. Other reports supporting the results of this study have shown the insecticidal, repellent or anti-feedant and development inhibiting effects of various plants parts and plant products on *S. zeamais* with varying degrees of success (Asawalam *et al*., 2006). PLP extract exhibited insecticidal potency in addition to their toxic attributes, PLP applied at 10g resulted into higher mortality than the rest of the concentrations at lower concentration. This agrees with the reports of Owusu-Akyaw (1991), Cobbinah and Appiah-Kwarteng, (1989), that some local plants and plant parts exhibit insecticidal properties that inhibit the activities of *S. zeamais* at higher concentration. Death of *S. zeamais* might have been due to starvation because coating the grains with the extracts minimized contact between the grains and the weevils. Compounds found in Lamiaceae such as monomeric flavonoids, glycosides, terpenoids and tannins acted as feeding deterrent and thus enhanced mortality by starvation (Kemabonta, 2013).

**Conclusion**

Results in this study had revealed adult *S. zeamais* mortality recorded for 7, 14, and 21 days after the application of *C. papaya* leaves powder had significantly reduced *S. zeamais* population within twenty one days of infestation. As the doses of the PLP increased with extended time, the mortality rate of *S. zeamais* was also increased. There was significant differences recorded in mortality rate of *S. zeamais* adults with increased doses and extended time of treatments and the effectiveness between the treated and untreated maize grains. It could therefore be concluded that *C. papaya* leaves powder is effective and efficient in the control of *S. zeamais* on stored maize seeds.

**References**

Aggarwal, K. K., Tripathi, A. K., Prajapati V. and Kumar, S. (2001). Toxicity of *Carica papaya* towards three species of stored product coleopterans *Agroecosystem*, 6(2):95-102.

Asawalam, E. F., Emosairue, S. O. and Hassanali, A. (2006). Constituents of the Essential Oil of *Vernonia amygdalina* as Maize Weevil Protectants. *Tropical and Subtropical*

Boxall, R. A., Brice, J. R. Taylor, S. J. and Bancroft, R. D. (2002). Technology and management of storage. In: Goloh, P., Farrell, G. and Orchard, J.E. (eds), Crop Post-Harvest: Science and Technology, Principles and Practice. Natural Resource Institute, University of Greenwich. Pp 141-234.

Casey-Sclar, D. (1994). Neem: Mode of Action of compounds present in extracts and formulation of *Azadirachta indica* seeds and their efficacy to pests of ornamental plants and to Non-target species. [online]. Available from: http://www.colostate.edu/Depts/Entomology/courses/en570/papers1994/sclar.htm. Accessed 12/10/12.

Cobbinah, J. R. and Appiah-Kwarteng, J. (1989). Effects of Some Neem Products on Stored Maize Weevil. *Sitophilus zeamais* (Motsch). *Insect Science and Its Applications* **10** (1): 89-92.

Danjumma B. J., Majeed Q., Yusuf M. and Peni D. N. (2018). Effects of leaf powder of *Citrus aurantifolia* and *Senna occidentalis* on the development of maize weevil (*Sitophilus zeamais* Motschulsky, Coleoptera Curculionidae) *Journal of Entomology and Zoology Studies*, 6 (2):2216-2221

Danjumma B. J. (2017). Studies on varietal resistance of maize and insecticidal activities of selected plant leaves against maize weevil (*Sitophilus zeamais* Motschulsky, *Coleoptera curculionidae* infesting maize. Unpublished Ph,D thesis, submitted to the Postgraduate school, Umanu Danfodiyo University Sokoto. Nigeria,

Effiong, B. and Sanni, A. (2009). Effect of Duckweed meal on the rate of moulds infestation in stored pelleted fish feed. Journal of American Science 1 (5): 29-34.

Kemabonta K. A, and Falodu B. B. (2013). Bioefficacy of three plant products as post-harvest grain protectants against *Sitophilus oryzae* Linnaeus (Coleoptera: Curculionidae) on stored wheat (*Triticum aestivum*). *International Journal of Science and Nature*.4 (2): 259 264.

Owusu-Akyaw, M. and Afun, J. (1988). Ghana Grains Development Project. Tenth Annual Report 2. Kumasi. Ghana.

Rajendran, S. and Parveen, H. (2005). Insect infestation in stored animal products. *Journal of Stored Products Research* 41: 1-30. Universidad Autonoma de Yucatan Mexico

Villegas E. (2000). World Food Price for “Quality Protein Maize.” Action: The News Letter: Global Post Harvest Forum.