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Evaluation of Improved Gugu(local storage container) In Reducing Post –Harvest insect losses of sorghum for small farmer

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Abstract

This study was conducted in the period of (March, 2007- February, 2008), to evaluate the suitability of four types of storage units, (Improved gugu, local gugu, Guttia and brick store) made of local materials, which used by small farmers with regard to protecting stored sorghum cultivars (Gadam Alhamam and Fetterita) from insect damages during storage period of one year . The percentage weight loss of stored seeds was used as the parameter for determination of the efficiency of the storage units. Considerable losses were recorded at Renk, Upper Nile State, South Sudan and surrounding areas (Guwzrum, Gelhak, Geigar and Wadacona). The results show that, improved gugues (Sweiba) were better storage structure than the local gugues, guttias and small brick stores, because there were less insect infestation, decreased weight losses of grains and better seed quality in improved structures. The weight losses were increased gradually, no weight losses were recorded in the first months and the highest losses were recorded in the last months of the year. The mean cumulative percentage weight loss due to insect infestation during (February)in Gadam Alhamam were approximately 5.30%, in an improved gugu,17.27%, in a local gugu,17.81% in Guttia, (Hut) and 21.01%, in brick stores.While in Fetterita; they were 12.41%, 30.84%, 28.65%, and 25.37%, in improved gugu, local gugu, Guttia and brick stores respectively.

Keywords: Post harvest losses, stored insect pests, improved gugu, Sorghum storage.

Introduction

Sorghum (*Sorghum bicolor* "L." Moench) is of tropical origin, but it has also been adapted through selection to sub-tropical regions. It is the staple food for many people in Africa, Asia and is a major animal feed in Argentina, Australia, Mexico, USA and South Africa. It was probably domesticated some 3000-5000 years ago, in northern Africa, in an area extending from the Ethiopian Sudanese border to Chad (Doggett, 1970; de Wet, *et al*., 1976) and has since been cultivated throughout the dry areas of the world. This hardy grass is grown for its seeds, which are used as human food and animal feed (Reed, 2005).

Sorghum is the most important world cereal crop (More, *et al*., 1992). Sorghum is the staple food of most of the inhabitants of Southern Sudan, except in the Zande area where cassava and eleusine are staple food. Fetterita, a sorghum cultivar is grown on

commercial basis in the central rain lands, especially in Renk in Upper Nile (Badal, 1999).

Proper storage of agricultural products is a very important post-harvest activity. Considerable amounts of grains are spoiled after harvest due to lack of sufficient storage and processing facilities (Singh and Satapathy, 2003). Grains losses in Africa, in general, have been estimated at 20% of potential harvest (Harris and Harris, 1967). The method of storage adopted has influence on the storability of the grains. It has to give protection for the stored products against insects, rodents, rains and all other adverse conditions (Saad, 1978). Generally, storage losses due to insect infestation in Sudan increase from north to south due to high relative humidity in Southern regions, where storage of food crops for more than six months is difficult (Darling, 1959; Itto, 1987). Losses of stored grains in Southern Sudan amount to about 20% by weight (Darling, 1959; Saad, 1978).

Storage practices vary from small to big stores indoor or outdoor, temporary or permanent and individual or community storage structures (Jain, *et al*., 2004).

Improvement in food grain storage can help to maximize benefits from the existing agriculture production. It is essential therefore to have good storage structures so as to minimize quantitive losses, overcome scarcity, and enhance the producer's financial benefits (Adesuyi, 1993).

The objective of this study was to evaluate the efficiency of four different types of stores units, stored by two sorghum cultivars that infested by stored product pests.

Material and Methods

The experiments were conducted during a period of one year (March, 2007 to February, 2008) at four localities within Renk County (Geigar, Guwzrum, Gelhak and Wadacona). Four of storage facilities (local gugues, improved gugues, guttia and brick stores) were built using local material.

The local gugues were cylindrical, the inner and outer wall were made from plaited reeds and thin wood, plastered with about (10 cm) layer of clay mixed with cow-dung. The bottom made of reed and stiff grass plastered with clay and cow-dung. The roof was made of thin stiff grass. In improved gugu, the body is similar to that of local gugues. But both the roof and bottom were made of iron sheet, manufactured at Solar System cell company (SSCC), Khartoum North, Khartoum State, Sudan. The roof was (1.6 m) in diameter, there is a circular hood above the roof (25 cm) in diameter with opening, used for pouring grains inside the gugu. The above circular hood has four small holes covered with mosquito wire net to provide ventilation and prevent entry of insect and other pests. The circular neck is covered with a conical shaped lid to keep rain water out. The bottom is similar to the roof in design (1.1 m) in diameter without four small holes. At the bottom, there is small opening for discharge of grains. The improved gugu is raised (60 cm) above ground by three pieces of red wood which are relatively resistant to termite damages. The Guttia was built using local material. The wall was 15 cm thick, made of chaff and small wood plastered with mixture of mud and cow-dung. The roof is made of thatched grass and wood. The whole structure volume is $8m^3$ with capacity of 10 grain bags.Four small stores were rented (4X4X2.5 meters). The walls were built with bricks and plastered with cement. The roof was made of corrugated iron.

Five bags of each sorghum cultivars were stored in each storage units. The monthly random samples were taken (one thousand grains) for each storage units. The total number of samples was (64) per month and throughout a storage period of one year and the measurement of weight loss of each cultivar was recorded. The grains in each sub-

sample were separated into damage and undamaged categories. The grains in each groups were counted and weight using a sensitive electronic balance (Sartorious 4digital-madem china). The % weight loss of grains was calculated according to count and weight method described by Harris and Lindblad (1978)..

$$\% \text{ of weight loss} = \frac{N_d (W_u - W_d)}{W_u (N_d + N_u)} \times 100$$

where

W_u = Weight of undamaged grains.
W_d = Weight of damage grains.
N_u = Number of undamaged grains.
N_d = Number of damage grains.

Through these formulae, yearly losses in each store types were estimated.

Results

In Gadam Alhamam, during the first two months (March and April), no infestation was recorded in the four types of stores units (Improved gugues, Local gugues, Guttias and brick stores), hence no weight loss was detected. In May, no weight loss was recorded in the improved gugues and brick stores, although there was some weight loss in the other two types of storage units. The highest loss in weight was 5.30%, 17.27%,17.81%, and 21.01% in improved gugues ,local gugues guttias and brick stores respectivelyTable (1).

Table 1: Mean cumulative percentage weight loss per month of Gadam Alhamam cultivar in four types of stores during a period of one year(March.2007-February)

	Type of store			
Months	Improved gugu	Local gugu	Guttia	Brick store
March	0	0	0	0
April	0	0	0	0
May	0	0.73	0.91	0
June	0.60	0.98	2.20	1.20
July	0.66	0	3.70	1.20
August	0.23	0.94	8.30	11.90
September	1.08	4.51	9.10	11.25
October	1.80	4.44	14.38	13.18
November	2.93	8.14	14.87	14.19
December	2.17	10.44	14.52	15.02
January	4.69	11.53	16.22	18.31
February	5.30	17.27	17.81	21.01
mean	1.62	4.92	8.50	8.87

In Fetterita no weight loss was recorded in the first three months of storage (March, April and May), in the four types of stores units.

The highest loss in weight was 12.41%, 30.48%, 28.65%, and 25.37% in improved gugues, local gugues, guttias and brick stores, respectively (Table 2).

Table 2: Mean cumulative percentage weight per month of loss of Feterrita cultivar in four types of stores during a period of one year (March 2007-February 2008)

	Type of store			
Months	Improved gugu	Local gugu	Guttia	Brick store
March	0	0	0	0
April	0	0	0	0
May	0	0	0	0
June	0.70	0.46	0.48	0.71
July	0.91	0.46	1.12	1.49
August	0.60	14.45	11.95	11.18
September	5.85	16.56	10.03	11.58
October	7.13	15.09	16.45	15.56
November	11.26	18.69	20.21	15.54
December	10.21	16.50	22.52	22.48
January	11.99	26.62	26.95	24.71
February	12.41	30.84	28.65	25.37
Mean	5.09	11.81	11.54	10.75

Discussion

In Renk County, the problem of grains storage is serious because of the hot and humid condition and storage facilities used by the local population are very poor. These include; traditional gugu, Guttia and open storage system. Gugu were widely used by the rural population because of their cheapness, relatively safe and are easy to construct. The grain storage structure used by farmers and others do not provide satisfactory protection against infestation by the various stored products pests; that is mainly because of improper prophylactic treatments. Slight structural modification of the local gugu greatly improved the performance of this facility and reduced grain losses caused by the khapra beetle ,lesser grain borer and other species of stored product pests from 4.92 %(local gugu) to 1.6% (improved gugu) of Gadm Al-hamam and from 11.81% (local gugu) to 5. 09 % (improved gugu) of fetterita. Similar result were obtained by Shazali (1998) who reported significant decline in insect numbers in improved Sweiba(gugu) and 50% reduction in grain losses during a storage period of eight months. Ibrahim (2001) also reported that by using an improved Sweiba he was able to decrease grain losses from about 12% in traditional Sweiba to about 4% in improved Sweiba.

Conclusion

- More basic research is required to determine the economic importance of the stored products insect pests that infesting sorghum and other cereal crops in the county and guard against new insect pests which may enter through bordering countries.
- Extension and advisory services must be available to educate the farmers about the problems of stored products insect pests and modern storage practices.
- Improved gugu is easy to clean before and after storage of grains hence all storage facilities should be constructed in such a way that allows easy cleaning and maintenance.
- The moisture contents of grains must not be allowed to exceed the recommended level, because high moisture content causes serious storage problems especially with regard to fungal infestation.

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تقييم مواعين التخزين المحسن (وعاء التخزين التقليدي) لتقليل الفقد ما بعد الحصاد للذرة الرفيعة المخزنة بواسطة صغار المزارعين

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المستخلص

اجريت هذه الدراسة في الفترة (مارس 2007 – فبراير 2008) لتقييم اربعة انواع من طرز التخزين السائدة لدى صغار المزارعين (القوقو المحسن، القوقو التقليدي، القطية والمخزن) المصنوعة من المواد المحلية وذلك لحماية حبوب الذرة الرفيعة لفترة العام. تسبب آفات الحبوب المخزونة خسائر كبيرة لاصناف الذرة المخزونة (قدم الحمام، فتريتة). استخدمت اوزان الحبوب المخزونة المفقودة كمقياس لتحديد انواع طرز التخزين. سجلت فقد مقدر بمنطقة الرنك ولاية اعالي النيل جنوب السودان والمناطق المجاورة لها (قوزروم، جلهاك، قيقروواكونة). هدفت هذه الدراسة الي اجراء تجارب تقييم مواعين التخزين السائدة والمحسنة لدى صغار المزارعين . دلت النتائج ان القوقو المحسن(السوبية) افضل من انواع الطرز الاخر (القوقو المحلي، القطية والمخازن الصغيرة) من حيث قلة الاصابة وقلة الفاقد من الحبوب وجودة الحبوب المخزونة . يذداد الفقد تدريجياً في االصنفين (قدم الحمام، فتريتة) . لم يسجل فقد في الاوزان فى الشهور الاولى من التخزين ولكن سجلت في الشهور الاخيرة من عملية التخزين. يقدر نسبة المتوسط التراكمي للفقد نتيجة الاصابة بالحشرات في شهر فبراير في الصنف قدم الحمام بحوالي5.30 % في القوقو التقليدي المحسن مقارنة بنسبة17.27% في القوقو التقليدي غير المحسنة17.81 % في القطية21.01 % في مخازن التجارة التقليدية (مصنوعة من الطوب) . بينما في الصنف فترتية قدرت الفقد بحوالي12.41 % ،30.84 % ،28.65 % و25.37 % في القوقو المحسن ، القوقو التقليدي ، القطية و المخزن المصنوع من الطوب على التوالي .