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Short communication

SESAME HARVEST LOSS CAUSED BY SESAME SEED BUG, *ELASMOLOMUS SORDIDUS* F. AT KAFTA-HUMERA SESAME FIELDS

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ABSTRACT: Sesame is an important cash crop in Ethiopia. In Humera, farmers are largely dependent on this important cash crop for their living. The production rate is, however, lower than the national average. There could be many factors for its reduced productivity, but pests especially sesame seed bug is one of the reasons. In this study, sesame seed weight loss due to sesame seed bug was determined at field and laboratory conditions. At both conditions, there was significant seed weight loss when the packaging materials were unlined jute and unlined polythene bags, although the loss at field conditions was severe. In both setups, there was small seed weight loss when the packaging materials were lined. This could be due to moisture loss from the seeds because the bugs could not penetrate the lined bags. From these, farmers are advised to use lined bags for storage and transport the harvested seeds to their stores as soon as possible.

Key words/phrases: Jute bags, lined bags, polythene bags, sesame seed, weight

INTRODUCTION

Ethiopia is predominantly an agrarian country endowed with large and diversified natural resources coupled with a friendly and pleasant climate for agricultural activities. The crops grown in Ethiopia are therefore diverse following the complicated mosaic agro-ecologies derived from the soil types, climate and cropping altitudes from more than 3000 meters above sea level to less than 600 meters above sea level (EEPA, 2004).

Oil seeds, important cash crops, are playing a vital role in developing Ethiopian economy. Among these Sesame seed, Ground nut, Line seed, Niger seed, Rape seed, Sunflower, Caster seed, Pumpkin and Mustard seed are the major crops in which Sesame and Niger seeds dominate largely the oil seed category. Sesame production is notably for export.

Sesame (*Sesame indicum* L.) belongs to the order Lamiales and family Pedaliaceae (Wikipedia, 2000). This cash crop is cultivated for its seeds. Due to its importance as a major export commodity in Ethiopia, the area coverage and production of sesame has been increasing from time to time. According to the data provided by the Ethiopian Export Promotion Agency (EEPA) in 2004, the total area covered by sesame in 2001/2002 was estimated to be 171,417 hectares with production of 65207 tons mainly from three areas (North Gonder, Western Tigray and East Wellega). In 2003 national sesame area increased by 10% to 189,965 hectares of which 81,000 hectares were noted to be commercial plantings in Humera and its surroundings. In addition to the availability of wide area for sesame farming, Humera is also important in that the sesame farms in that area do not use chemical fertilizers hence, the potential to sell under organic labelling by acquiring appropriate certification is enormous (EEPA, 2004). Regardless of this merit and its high potential, the sesame yield obtained in Humera is still not satisfactory. According to Gebre Hadgu (2006), there is a wide gap between the national yield average of 600 kg/ha and the 2200 Kg/ha yield recorded under experimental stations in Melka Werer. On the other hand, the average yield of sesame in the study area ranges from 400 kg/ha to 450 kg/ha (Personal Observation), which is far below the national average. This information in

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general indicates that sesame productivity is very low in Kafta-Humera. According to ENUPI (2002) report, the causes for low-level productivity of the crop are many and diverse, among which the following are mentioned as most important. These are scarce, uneven distribution of rainfall and high evapo-transpiration; prevalence of weeds; poor land preparation; delay on sowing and prevalence of pests. According to ENUPI (2002), damage from insect pests ranged form 5% to 50% of the total sesame production. Weiss (2000) also reported that insects reduce about 25% of the potential yield of sesame in the world. There are a number of pests known in attacking sesame. The most common pest in Kafta-Humera is sesame seed bug locally known as "Setayto". Even though no quantitative data was reported, a great loss has been caused in this area by this pest. For many years, sesame producing farmers in Kafta–Humera district used pesticides for control. However, the efficacy of this practice remained unsatisfactory in view of the repeated high level re-infestation within few days. Hence, this study was initiated to quantitatively show the amount of loss of yield due to the insect pest. By doing so, all concerned would be aware on the gravity of the problem and could work towards averting the existing and potential losses during harvest and storage.

MATERIALS AND METHODS

Description of the study area

The research area, Kafta-Humera (Fig. 1), is located 13°45′ to 14°28′ north latitude and 36°20′ to 37°31′ east longitude (ENUPI, 2002). It is 1000 km far from Addis Ababa via the Gonder road and is bordered by Eritrea and the Sudan Republic in the north and west, respectively. The area has a flat topography with an altitude range between 500–800 meters above see level (m.a.s.l). It is generally characterized by arid climatic condition with mean annual temperature of 30°C and mean annual rainfall of 581.2 mm, which ranges from 380 mm to 870 mm. The rainfall distribution is limited to four months in a year, from June to September.

Sesame seed weight loss assessment

Weight loss assessment was done by using 500g of sesame seed contained each in six bagging materials and each replicated three times. The bagging materials, treatments, were closed hard plastic bottle, lined jute bags, lined polythene bags, unlined jute bags, unlined polythene bags and open sacks (Table 1). The experiment was done under laboratory (indoor) and field (outdoor) conditions.

Weight loss of sesame seed under laboratory conditions

Each material under treatment was kept in a bucket containing 200 active feeder seed bugs, adults and nymphs. The bugs were let to feed from the bagged materials. Dead bugs were replaced to maintain the number constant in each bucket. Weight loss data, at mid day (12:00–3:00), was collected daily for 15 days by weighing each treatment using 0.00gram sensitive electrical balance.

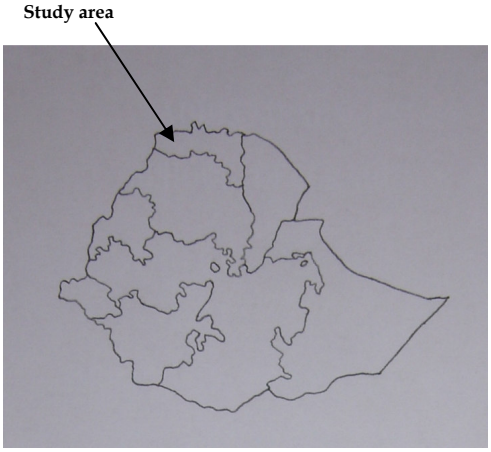

Fig. 1. Map of Ethiopia. The arrow indicates the study area (Kafta-Humera District in Tigray Region).

Weight loss of sesame seed under field conditions

The experiment was conducted to assess the weight loss at field conditions. Sesame stock with high infestation of the bug and evenly distributed in 10 m x 15 m area was purposefully selected. Then each treatment was randomly placed in the selected areas and weight data was taken every day for 11 days.

Data analyses

Analyses of variance (ANOVA) was conducted using the general linear model (GLM) procedure of SAS to assess effects on seed weight reduction due to sesame seed bug of different storage containers, length of time spent in the store, and the premises it can be stored, i.e., in the field or indoors. Least square means were separated using the Student Newman-Keuls (SNK) test at $P = 0.05$.

Data taken at intervals were analyzed using the repeated measures analyses to determine the differences in seed weight reduction. The weight of the seed samples were measured daily for 11 days

in the field experiment and for 15 days in the laboratory experiment. Number of measuring days at outdoors was reduced due to difficult environmental conditions.

RESULTS AND DISCUSSION

In the field, the seeds stored in open sacks had significantly the highest seed weight reduction followed by the unlined jute and unlined polythene bags, respectively (Table 1). Storing seeds of sesame in closed bottles, lined jute and lined polythene bags effectively and significantly protected the seeds from bug damage and thus had lower seed weight reduction (Table1). While storing seeds in closed bottles, lined jute and lined polythene bags fully protected the seeds from bugs, there was significant weight reduction from the 5th day onwards on seeds stored in unlined jute bags, from the 10th day onwards in the unlined polythene bags and from the 3rd day onwards in the open sacks (Table1).

The percentage weight loss recorded in the field at the 11th day in the opened sacks, unlined jute bags, unlined polythene bags, lined jute bags, lined polythene bags and the closed bottle were 94.7%, 12.9%, 9.3%, 0.6%, 0.3% and 0% while in the laboratory the loss at 15th day were 1.1%, 2.3%, 1%, 0.1%, 0.2% and 0%, respectively for similar treatments.

Table 1. Effect of length of storage time and storage containers on the weight reduction of sesame seeds caused by sesame seed bugs in Kafta-Humera, Ethiopia. (Starting weight is 500 g).

Storage time	Treatments							
	Closed bottle	Lined jute bags	Lined polythene bags	Unlined jute bags	Unlined polythene bags	Open sack	F value	P value
Field (outdoors)								
Day 1	500	500.0	500.0	500.0a	500.0a	500.0a	-	-
Day 2	500	500.0	500.0	493.0a8	496.0a	489.0a	3.04	0.0580
Day 3	500A	500.0A	500.0A	491.2aA	493.7abA	466.5abB	45.30	<0.0001
Day 4	500A	500.0A	499.8A	487.5abA	490.8abA	434.0bB	25.81	<0.0001
Day 5	500A	498.5A	499.8A	478.8bcA	487.8abA	334.0cB	30.21	<0.0001
Day 6	500A	498.5A	499.8A	472.7dcA	482.7abcA	236.0dB	202.18	<0.0001
Day 7	500A	498.5A	499.5A	465.2deB	478.3abcB	185.0eC	696.40	<0.0001
Day 8	500A	497.0A	499.5A	459.2efA	472.2abcA	104.7fB	289.53	<0.0001
Day 9	500A	497.0A	499.3A	451.2fgB	468.8abcAB	64.3gC	483.37	<0.0001
Day 10	500A	497.0A	498.3A	442.5ghB	461.2bcB	38.2gC	770.44	<0.0001
Day 11	500A	497.0A	498.5A	435.3hB	453.5cB	26.3gC	951.57	<0.0001
F value	-	1.26	1.69	45.90	4.76	204.40		
P value	-	0.3117	0.2005	<0.0001	0.0011	<0.0001		
Laboratory (indoors)								
Day 1	500	500.0	500.0	500.0a	500.0	500.0a	-	-
Day 2	500	499.7	500.0	499.5a	499.7	500.0a	1.33	0.3179
Day 3	500	500.0	500.0	499.0a	499.7	499.3ab	2.74	0.0706
Day 4	500A	500.0A	499.8A	498.2abB	499.0AB	499.2abAB	4.74	0.0127
Day 5	500A	500.0A	499.8A	498.0abB	498.8A	499.2abA	9.19	0.0009
Day 6	500A	500.0A	499.8A	497.3abB	498.7A	499.2abA	9.41	0.0008
Day 7	500A	500.0A	499.7A	497.2abB	498.3AB	499.2abA	7.45	0.0016
Day 8	500A	499.8AB	499.5AB	495.8abcD	498.0C	498.7abcBC	25.30	<0.0001
Day 9	500A	499.8A	499.5A	494.7bcdC	497.8B	498.3bcdAB	23.44	<0.0001
Day 10	500A	499.7A	499.5A	493.3cdeB	494.2B	497.8dcA	7.99	0.0016
Day 11	500A	499.7A	499.5A	491.7defC	494.0BC	497.5edAB	9.13	0.0009
Day 12	500A	499.7A	499.5A	490.7efC	493.7BC	496.7efAB	10.39	0.0005
Day 13	500A	499.5A	499.5A	490.0efC	493.2BC	496.0fgAB	14.30	0.0001
Day 14	500A	499.5A	499.0A	489.2fC	493.0B	495.2gB	16.92	<0.0001
Day 15	500A	499.5A	499.0A	488.7fC	493.0B	494.2hB	19.33	<0.0001
F value	-	1.25	2.50	17.98	3.68	36.56		
P value	-	0.2958	0.0573	<0.0001	0.0513	<0.0001		

Means within rows followed by the same upper case letter and means within a column (separately for field and laboratory studies) followed by the same lower case letter are not significantly different at P≤0.05 (SNK); polythene bags are woven polypropylene bags made to store and transport grain products.

The repeated measures showed that storage in doors or outdoors, the use of different storage containers and the length of time in storage consistently and significantly affected the sesame seed weight loss due to sesame seed bugs (Table 2). The interactions of all combinations of factors were also significant.

Table 2. ANOVA table for the repeated measures analyses of grain weight reduction in 15-day storage.

Source	Numerator DF	Denominator DF	F value	P value
Set	1	23	674.19	<0.0001
Treatment	5	23	454.01	<0.0001
Time	14	277	302.88	<0.0001
Set*Treatment	5	23	459.27	<0.0001
Set*Time	10	277	385.65	<0.0001
Treatment*Time	70	277	193.98	<0.0001
Set*Treatment*Time	50	277	270.65	<0.0001

'Set' stands for two sets of experiments, *i.e.,* laboratory and field activities; 'time' stands for the length of time, i.e., the number of days, the weight loss data were recorded, which was recorded every day for 15 days; the star, *, stands for interaction between variables.

The sesame seed bug damage was high at harvest and threshing time in which the seeds were exposed to the pests. Both the adult as well as the nymph caused weight loss on the harvested sesame by sucking the seed contents and/ or taking away the whole seed to their resting or sheltering areas. As a result, feeding by the bugs reduces crop yield and quality of sesame seeds. Infected seeds became shrivelled and worthless which resulted in quality reduction. Therefore, the large weight loss, 94.7%, recorded for the open treatment in the field could be due to both quantity and quality loss of seeds.

In the field, the second highest weight loss was recorded from the unlined jute bags, 12.9%, followed by the unlined polythene bags, 9.3%. The weight constantly decreased with time in both treatments. In 2007, the Ministry of Agriculture and Rural Development reported 5–80% yield loss caused by sesame seed bug (MoARD, 2007). In extreme conditions, the damage could be high to such an extent that no grain could be harvested. With respect to the oil content of sesame seed, some survey studies showed that the pest can decrease the oil content of the seed by 51–60%. Ethiopian National Urban Planning Institute (ENUPI) (2002) also indicated that pests' percentage damage ranged due to this pest from 5% to 50% of the total sesame production. According to Weiss (2000), insects reduced about 25% of the potential yields of sesame in the world. Heavy infestation at harvest time is therefore the best to estimate loss. At this time, capsules dry and easily crack allowing bugs easily access and attack. On the other hand, the weight loss recorded for the lined materials in both, laboratory and field was lower than those of the unlined materials. The recorded losses for the lined bags could be possibly due to loss of moisture of the seeds rather than pest damage, because pests may not be able to penetrate the lined bags.

Most of the times, after the sesame seeds are collected in 100 kg sacks; the farmers do not transport the sacks immediately to their stores. They rather transport them to near-by camps. The sacks remain in the field for weeks or more depending on the availability of transportation. Moreover, the farmers in the study area use unlined jute bags and or unlined polythene bags for storing their sesame seeds. So during this time the sesame seed bug causes serious damage since the sacks are left on the open ground.

In conclusion, storing sesame seeds in open sacks and in unlined bags should be avoided for better protection of sesame seeds from sesame seed bugs. Storing sesame seeds in lined bags is strongly advised. Furthermore, the duration of storage should be as short as possible.

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