

Evaluating the conditions of family farming maize storage in Mahelane, Mozambique

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Received in: 30/11/2021 | Accepted in: 31/01/2022

Abstract

The problems of storage of agricultural products are an object of permanent study. The objective of this work was to survey some stages of production, mainly storage, by interviewing producers in Mahelane, Namaacha district, in Mozambique. We conducted semi-structured interviews with 40 producers, selecting those who work with the District Services of Economic Activities - SDAE, in a total area of 44 ha of production of various crops, especially corn. Respondents were selected through a non-probabilistic sampling, the “snowball” technique. The parameters evaluated were: the interviewees’ characterization, mean grain moisture, number of weevils, grain mass, and primary post-harvest operations run by small producers. Women represent the largest percentage of labor in the maize production fields in the Mahelane area. The stored maize moisture rate ranges between 14.5 % and 16.4 %, and storage time is between 9 months and 12 months. The maize in Mahelane is mostly stored on the cob, 65 %, and with straw, 75 %. The interviewed producers have several problems regarding the post-harvest of maize, requiring technical assistance and training, especially the local population, who need guidance on the best way to store the grain and the seed.

Keywords: Grain/cob. Moisture. Weevil. Family farming.

Introduction

In family farming, post-harvest, especially in the storage phase, is seen as one of the most important and indispensable phases, as the annual rate of loss of agricultural products at this stage can reach 100 % of total production (SILVA *et al.*, 2021).

In many cases, family producers have created their own methods to store and conserve agricultural products (SILVA *et al.*, 2021). Some of those traditional methods are quite efficient, often requiring only minor improvements (FAO, 2014).

Most of the time, however, traditional methods cannot eliminate the high rates of storage losses, requiring new tools. Therefore, in searching for reduced losses of stored products, it is important that farmers use new technologies to help traditional techniques (RODRIGUES *et al.*, 2018).

In Mozambique, the traditional knowledge about managing its local seeds in the post-harvest phases and during storage is dispersed among small farmers. Most storage structures are traditional and built with low-cost local materials (FAO, 2014). Therefore, there are several materials used in construction in different provinces because, in all structures, the fundamental objective is to ensure the longevity of the grains (PINTO, 2000).

On the other hand, the surplus of the crop, together with changes at the market level, increases the need to adopt other storage methods to reduce losses (ANDRADE *et al.*, 2020). It is extremely important to know the optimal environmental conditions for the storage of each product, to avoid the favoring and proliferation of pests (LORINI, 2015).

The storage problems of agricultural products are an object of permanent study, aiming to

maximize the quality of the stored products, whether seeds or grains, avoiding unnecessary losses in stored grains, which could greatly minimize hunger worldwide (LORINI, 2015).

In this context, it is opportune to investigate the traditional methods that are still being applied, reproduced, and valued since they tend to be lost if they are not strengthened. Thus, this work surveyed some stages of production, mainly maize storage, through interviews with producers in Mahelane, Namaacha district, Mozambique.

Material and methods

The research was conducted in the geographic region of Mahelane, the administrative post of Changalane, in Namaacha district, southern Mozambique. The place is at the altitude: 376 m, latitude: 26°20'46.12"S, and longitude: 36°15'39.9"L (GOOGLE EARTH, 2017). The prevailing climate is dry tropical, with an average annual temperature of 21 °C and an annual rainfall of 751.1 mm (MINISTÉRIO DA ADMINISTRAÇÃO ESTATAL – MAE, 2005).

The region was chosen based on the maize crop, cultivated by the local population for several years, and its agricultural history (IIAM, 2009).

Semi-structured interviews were carried out "through a previously prepared script" (MANZINI, 2004) with 40 producers that work at the District Services of Economic Activities (SDAE), in a total area of 44 ha of several crops, with emphasis on maize.

The interviews began in April and ended in May 2017, coinciding with the availability of maize in the barns. Respondents were selected using a non-probabilistic "snowball" sampling technique, which consisted first of interviewing group representatives or key informants, who, in turn, indicated others who fitted into the intended profile for interviews in this study (BALDIN; MUNHOZ, 2011).

The parameters evaluated were: the interviewees' characterization, average grain moisture, number of weevils, grain mass, and primary post-harvest operations run by small producers.

To characterize the small producers, the following variables were measured: gender participation in agriculture and level of education (TOMAS *et al.*, 2012).

We made three repetitions of moisture measurement with a moisture meter in a sample of corn grain. The grains were introduced into the meter, which provided the moisture content of the sample. After that, we counted the number of weevils after we threshed the corn cobs. Finally, we weighed 1,000 grains (ABICHANDEO, 2002).

Information on the primary post-harvest operations run by small producers and the main causes of post-harvest losses in storage were obtained through questionnaires applied to 40 small producers in the locality (ABICHANDE, 2002).

For data analysis, we used the following analysis methods: content analysis and inductive analysis. By means of statistical packages for data processing, the SPSS 13.0 software was used.

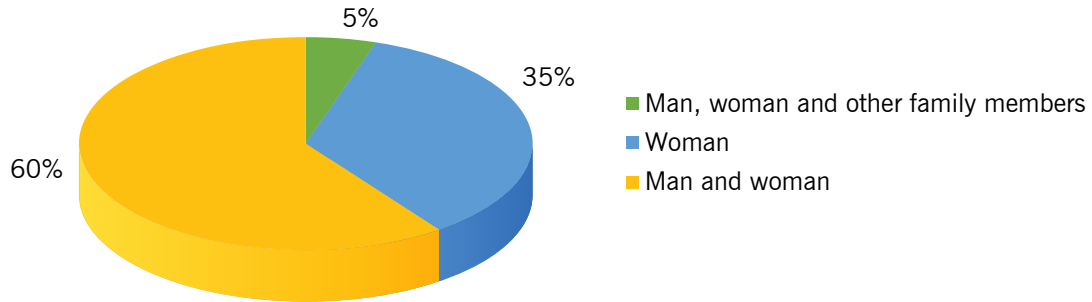
Results and discussion

Characteristics of the interviewed producers

According to the results of the interviewees' characterization, the informants' profile in the category of gender participation in agriculture can be seen in Figure 1.

The gender category was subdivided according to its link to farming, in which: men and women represented 60 %; men, women, and other family members, 5 %; women, 35 %. The research also found that the men did not participate in farming activities. In the work carried out in Angola by Tomas *et al.* (2012),

Figure 1. Gender participation in farming, in Mahelane



Source: Elaborated by the authors (2017).

research data showed that gender participation in agricultural activities was divided into men, 12 %; men and women, 41 %; men, women, and children, 15 %; women, 32 %.

Both surveys showed a large percentage of women’s participation in farming in different regions of the African continent.

The profile of respondents in the education level category is shown in Figure 2.

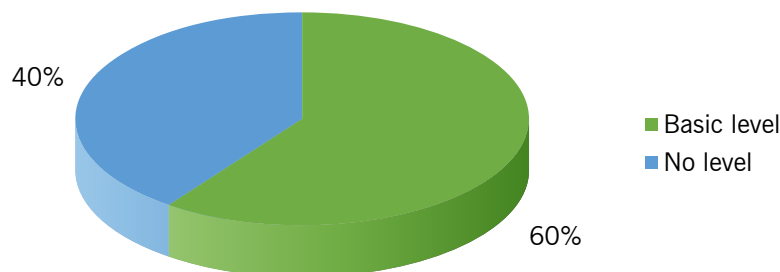
The level of education in the region was low. As shown in the figure above, 40 % of the respondents do not have any level of education, and the other 60 % are at the elementary level of education, while no data about the secondary level of education was found. Those data are similar to Come and Cavani’s (2014) research in Manhiça District, in Mozambique, where the range of small producers interviewed was: non-educated: 30 %; elementary education: 61.5 %.

In general, the low level of education of the population in the place is due to the local conditions of teaching and learning, which are still very precarious. This scenario could be mitigated through government policies.

According to Figure 1 - Gender participation and Figure 2 - Level of education, women participate more in farming than men, which can be explained by the low insertion of women in schools, which contributes to their low level of schooling. Another important issue that must be taken into account is the culture of the place, which preaches that women should be responsible for household chores and work in the fields.

This scenario can also be seen in other countries, such as Brazil, where we can affirm the presence of sexist ideas, according to which men and women do not have the same mental capacities (STASCXAK; SALES, 2020).

Figure 2. Level of education of the producers in Mahelane



Source: Elaborated by the authors (2017).

Analysis of corn grain samples

Mean moisture (MU), the number of weevils (NG), and grain mass (MG) can be seen in Table 1.

The corn stored by the interviewed family farmers has mean moisture between 14.5 % and 16.4 %. In Abichande's (2002) research done in the village of Muecate, in Nampula province, in Mozambique, the percentages ranged from 11.1 % to 12.9 %, showing that, in our work, the moisture percentages for Mahelane are above those recommended, which may imply a greater susceptibility to pests and diseases of corn stored in granaries (TABLE 1).

The same results for grain moisture were found in the work by Tembe (2000) in Namapa, in Nampula province, in Mozambique.

The stored grain moisture must be 13 % over one year and 14.5 % for the range of 6 months to 9 months (BOXALL *et al.*, 1997).

The number of weevils was between 12 and 98, and the mass of 1,000 grains was 204 g to 239 g. Similar data were found in Tembe's work (2000).

Corn drying methods

The results showed that about 100 % of the interviewed family farmers dry the corn in the field while still in the plant to prevent them from rotting, losing germination power, and being attacked by insects. Respondents stated that this kind of drying is not very safe because production is subject to pest attacks while still in the field. These results are comparable to the researches from Abichande (2002) and Boxall *et al.* (1997), conducted in the village of Muecate district, Nampula province, in Mozambique, and in India, in which about 93 % and 94 % dry their products in the field.

Reasons for drying corn

The respondents mentioned several reasons for choosing to dry their products. All of them said they dry their production. Of these, 47 % answered that they dry the maize to prevent it from rotting, about 18 % dry the crop to avoid the attack of insects, 15 % dry it to avoid the attack of weevils, and about 20 %, to have the seed better preserved and maintain the germinative power of the seeds (FIGURE 3). These results are similar to Abichande's (2002) data, in work done in the

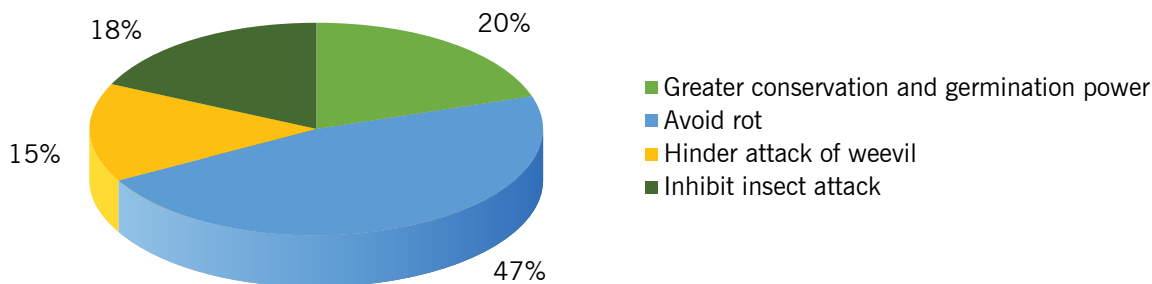
Table 1. Means of moisture (MU), numbers of weevils (NG), and grain mass (MG), in Mahelane

Number of corn cobs	MU (%)	NG (uni)	MG (g)
1	14.7	12	236
2	14.5	23	239
3	14.5	46	206
4	16.0	78	207
5	14.9	30	210
6	16.0	98	204
7	14.6	48	230
8	16.2	81	220
9	15.4	17	212
10	16.4	39	222

N=40.

Source: Elaborated by the authors (2017).

Figure 3. Reasons for drying corn, according to the interviewed producers in Mahelane



Source: Elaborated by the authors (2017).

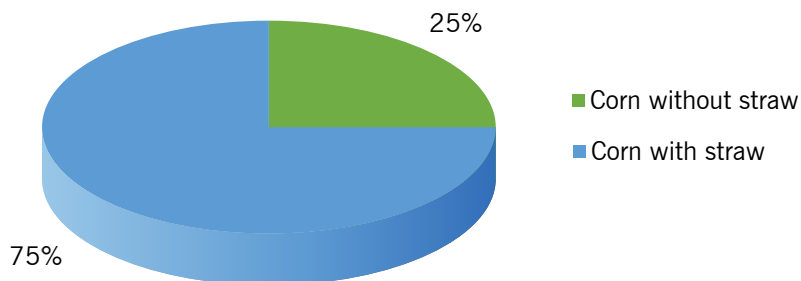
village of Muecate District, in Nampula province, in Mozambique, where most smallholders store the maize to prevent it from rotting, while about 82 % let the maize dry in the field.

so that the grains are not susceptible to insect attack and are not affected by environmental conditions, such as precipitation and light, which can damage the grain and impair seed germination when exposed outside the warehouse (FIGURE 4; FIGURE 5). Family farmers store their production with unthreshed corn cobs, as they consider that the grain stored in this condition is less prone to pest attack (GWINNER *et al.*, 1997).

Corn storage method

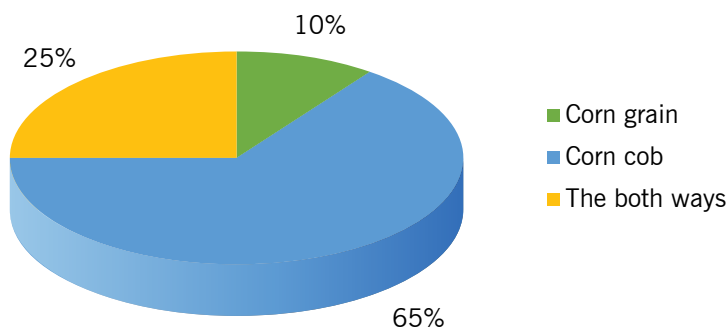
The results reveal that the interviewed family producers store more corn on the cob with straw: 75 %, than without straw: 25 %, so that the grains are not susceptible to insect attack and are not affected by environmental conditions, such as precipitation and light, which can damage the grain and impair seed germination when exposed outside the warehouse (FIGURE 4; FIGURE 5). Family farmers store their production with unthreshed corn cobs, as they consider that the grain stored in this condition is less prone to pest attack (GWINNER *et al.*, 1997).

Figure 4. Maize storage method by the interviewed producers in Mahelane

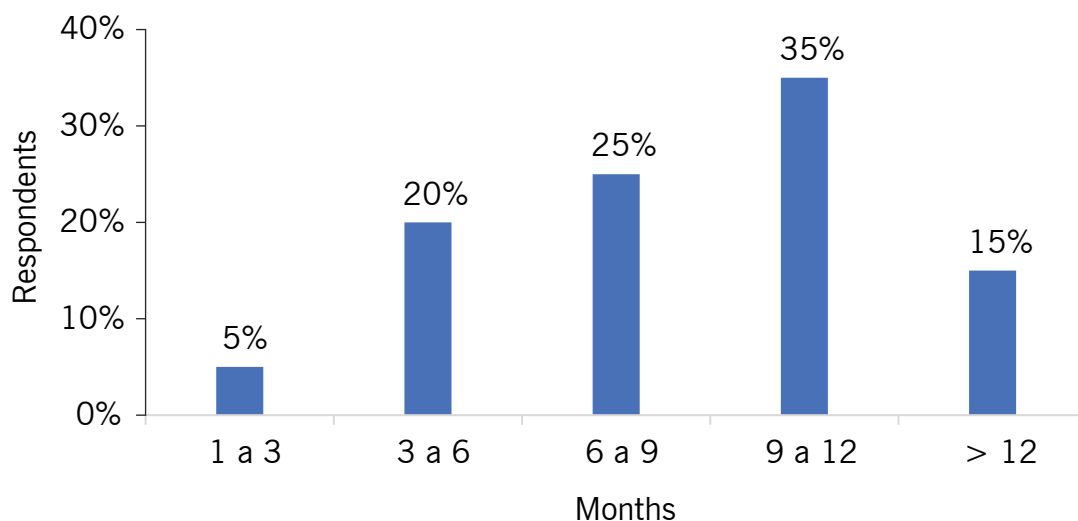


Source: Elaborated by the authors (2017).

Figure 5. Maize storage method by the interviewed producers in Mahelane



Source: Elaborated by the authors (2017).

Figure 6. Storage period at Mahelane

Source: Elaborated by the authors (2017).

Corn storage period

According to the results, about 5 % of family producers store their products between 1 and 3 months and approximately 20 %, from 3 to 6 months, 25 % from 6 to 9 months, 35 % from 9 to 12 months, and 15 % more than 12 months (Figure 6). These data are similar to Abichande's (2002), in a study carried out in the village of Muecate, in Nampula province, Mozambique, which also obtained the same results for maize storage in a range from 3 to 12 months and over 12 months. In Gustafsson and Ljungberg's (1998) study carried out in the districts of Boane and Marracuene in Mozambique, the cereals resulted in a range from 2 to 12 months. The storage period at the small farm level generally lasts between 6 and 12 months (GEWINNER *et al.*, 1997).

Conclusions

Women represent the largest percentage of the labor force in the maize production fields in Mahelane area.

The stored maize moisture rate ranges between 14.5 % and 16.4 %.

Maize storage time in Mahelane ranges from 9 and 12 months.

The maize in Mahelane is mainly stored with cob, 65 %, and straw, 75 %, which is the best form of storage.

The interviewed producers have several problems related to the post-harvest of maize, requiring technical assistance and training, especially for the local population, who need guidance on the best way to store the grain and the seed.

Acknowledgments

To the interviewed producers, for having provided the data to carry out the work.

To the employees of SDAE-Namaacha, especially Engineer Manuelito, and extension worker Chelton da Costa.

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