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Survey the different indigenous methods of maize storage in the Udaipur district of Rajasthan

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Abstract

The survey was conducted to record the adoption of different maize storage methods by the farmers and damage caused by rice weevil, *S. oryzae* in stored maize from five blocks (Badgaon, Bhindar, Girwa, Gogunda and Jhadol) of the Udaipur district during 2020-21 at Department of Entomology, RCA, MPUAT, Udaipur. The most common methods of maize storage was use of celphos tablets (Aluminium phosphide) 38.40 per cent adoption followed by sun drying 25.60 per cent, use of ash or sand 16.80 per cent, neem leaves 10.40 per cent, ginger rhizomes 4.80 per cent, eucalyptus leave 3.20 per cent and garlic clove 0.80 per cent adoption by farmers. The maximum grain damage of 20.25 per cent and minimum grain damage of 3.94 per cent was recorded with practice of garlic clove and celphos tablets (Aluminium phosphide) in stored maize, respectively.

Keywords: Stored insect pest, *Sitophilus*, celphos, plant products and grain damage

1. Introduction

Maize (*Zea mays* L.) is the most widely grown cereal crop around the world in the tropical, subtropical and temperate region. Globally, maize is known as the queen of cereals because it has the highest genetic yield potential among the cereals. It is used as food, feed, fodder and also serves as basic raw material in industries such as beverage, confectionery, starch, ethanol, oil, cosmetic, food processing, textile, gum and paper industries. It is an important source of carbohydrate, protein, oil, vitamin B, minerals and crude fibre contents.

Currently, 1122.83 million metric tonnes of maize is being produced together by over 170 countries on an area of 198.81 million hectares with an average productivity of 5.75 tonnes/ha (World agriculture production, 2022). The United States of America stands first in maize production in the world contributing about 35 per cent of total world production and having the highest productivity. In India, it is the third most important cereal crop after rice and wheat and 23 per cent (human consumption), 51 per cent (poultry feed), 12 per cent (animal feed), 12 per cent (industrial processing) and 1 per cent (seed) (Harris *et al.*, 2007) ^[9]. Among the cereal crops, maize contributes 9.72 million ha area with production of 28.64 million tonnes and 2945 kg/ha having productivity in India. Karnataka stands (13.8 per cent) at the first position in maize production followed by MP (13.6 per cent), Telangana (10.4 per cent) and Rajasthan (4.2 per cent) among different Indian states (Agricultural statistics, 2020).

In India, maize is grown in both *Kharif* and *Rabi* seasons. The predominant maize growing districts in Rajasthan are Bhilwara, Chittorgarh, Udaipur and Banswara. In Rajasthan, maize is cultivated on 9.76 lakh ha area with a production of 2.71 million tonnes and productivity of 2769 kg/ha annually (Rajasthan Agricultural Statistics, 2020-21).

Protection of stored products from insect pests is most important to ensure food safety all over the world. In the way from field to storage structure, it is attacked by a large number of insect pests. The most important insect pests belong to order Lepidoptera and Coleoptera, which cause damage to maize in the field as well as storage and reduce production and productivity (Alam *et al.*, 2018; Eman and Tsedeke, 1999) ^[1, 7]. Among storage insect pests rice weevil, *Sitophilus oryzae* L. (Coleoptera: Curculionidae) is the most destructive insect pest of maize. Infestation due to rice weevil causes damage to an extent of 53.30 per cent resulting in 14 per cent weight loss in maize grains over four months of storage period (Soujanya *et al.*, 2013) ^[10].

2. Materials and Methods

The survey for the prevailing different indigenous methods of maize storage was carried out in five blocks of Udaipur district *viz.*, Badgaon, Bhindar, Girwa, Gogunda and Jhadol during 2021.

From each block, 5 villages comprising 5 farmers from each village were surveyed through a set of questions to gather quantitative information on the different indigenous methods of maize storage in the area. Data thus collected from 125 farmers belonging to 25 villages in five blocks of Udaipur. From each village, a sample of maize weighing approximately 100 gm was collected in a plastic polythene bag to determine the per cent grain damage.

2.1 Per cent grain damage

The damaged and healthy grains were counted separately at 30, 60, 90 and 120 days after treatment and per cent grain damage was calculated by the following formulas.

$$\text{Per cent grain damage} = \frac{\text{Number of damaged grains}}{\text{The total number of grains used}} \times 100$$

3. Result and discussion

3.1 Different maize storage methods adopted by farmers of different blocks of Udaipur

A survey was conducted to collect information about the different maize storage methods adopted by farmers of the Udaipur district during 2020-21 (Table 1). The survey was carried out in five blocks of Udaipur district *viz.*, Badgaon, Bhindar, Girwa, Gogunda and Jhadol. From each block, 5 villages were selected for the study. The villages that were surveyed are in Badgaon - Ferniyo Ka Gurha, Chikalwas, Loyara, Thoor, Hathi Dhara; in Bhindar - Bhatewar, Khokharwas, Navania, Modi, Majawada; in Girwa - Meeta Neem, Pai, Kerget, Nichala Fala, Kaladwas; in Gogunda - Naya Gurha, Bhadwi Gurha, Bhilwara, Sahavato Ka Gurha, Chor Bawadi; in Jhadol - Selana, Makradeo, Banswari, Dheemri, Badad. During the study, 125 farmers were surveyed through the set of questionnaires and it was observed that the participatory farmers adopted different methods in order to safeguard their produce, of which the most popular method adopted by the farmers was the use of celphos tablets (Aluminium phosphide).

Among participatory farmers 38.40 per cent farmers use only celphos tablets (Aluminium phosphide) followed by sun-drying by 25.60 per cent farmers, ash or sand by 16.80 per cent farmers, neem leaves by 10.40 per cent farmers, use of ginger rhizomes by 4.80 per cent farmers, eucalyptus leaves by 3.20 per cent farmers and garlic cloves by 0.80 per cent farmers. In the present investigation, it was recorded that most of the stored maize in surveyed blocks was infested by *Sitophilus oryzae* (L.). It was apparent from the results of survey that the farmers in five blocks of Udaipur district adopted the different practices for protecting maize in storage with maximum number of farmers using celphos tablets (Aluminium phosphide) followed by sun drying, use of ash or sand, neem leaves, use of ginger rhizomes, eucalyptus leaves and garlic cloves.

Among different blocks, the maximum per cent of farmers adopting the use of celphos tablets (Aluminium phosphide) for protecting maize grain in storage was recorded in Bhindar blocks (40.00 per cent) followed by Girwa (40.00 per cent), Jhadol (40.00 per cent), Badgaon (36.00 per cent) and Gogunda (36.00 per cent). Among the five blocks, the numbers of farmers practicing the sun drying were 28.00 per cent in Badgaon followed by 28.00 per cent in Girwa, 28.00 per cent in Gogunda, 24.00 per cent in Bhindar and 20.00 per cent in Jhadol. After the sun drying, the use of ash or sand was most prevailing practice with 20.00 per cent farmers in Bhindar and Jhadol, 16.00 per cent farmers in Badgaon and

Girwa and 12.00 per cent farmers in Gogunda. The use of neem leaves was next in order of adoption by farmers with 12.00 per cent farmers in Badgaon, Bhindar and Gogunda and 8.00 per cent in Girwa and Jhadol practicing the use of neem leaves for protecting their grains

The use of ginger rhizomes was adopted maximum at Jhadol 8.00 per cent followed by Badgaon, Bhindar, Girwa and Gogunda where 4 per cent farmers adopted the ginger rhizome for safety of grains. The use of eucalyptus leaves in storage maize was 8.00 per cent at Gogunda followed by Girwa and Badgaon was 4.00 per cent each whereas use of eucalyptus leaves was not in prevalence among the farmers of Bhindar and Jhadol. The use of Garlic cloves was found among the farmers of Jhadol only *i.e.*; 4.00 per cent. The maximum per cent of farmers used celphos tablets followed by sun drying and ash or sand in storage.

The results of the present investigation are in conformation with the studies of Bhusal and Khanal (2018) ^[6] who surveyed maize growing areas of Surkhet and Chitwan Nepal (April to May 2017) and reported that overall 70.80 per cent of households used celphos tablets and 25.80 per cent used botanicals (like dried neem leaves, sweet flag, neem oil *etc.*) to control rice weevil.

Similarly, Bhandari *et al.* (2015) ^[5] also recorded that celphos (Aluminium phosphide) was used by 30.00 per cent of respondents, whereas 23.00 per cent used botanicals against storage pests. Sun drying was also observed as the efficient way of pest management practice which confirms the findings of the present investigation. The findings of Raghavendra *et al.* (2016) ^[12] and Thakur *et al.* (2011) ^[15] are also in close alignment with the results of present investigation, who recorded the use of natural plant products as effective protective measure in reducing the storage pests. Similarly, other researchers, Shashank *et al.* (2016) ^[14]; Midega *et al.* (2016) ^[11] during their investigations have found use of plant products as the most popular next to the use of celphos and widely adopted practice for the management of pest and reducing the losses due to different storage pests in various grain during the storage, which are in line with the findings of present investigation (Rani and Mohan 2007) ^[13].

3.2 Per cent grain damage in various maize storage methods adopted by the farmer of Udaipur district

During the survey, the sample of maize from various maize storage methods were collected from different blocks of Udaipur district and the per cent grain damage in each sample was recorded. The data recorded on per cent grain damage in samples of various maize storage methods adopted by farmers of 5 blocks of Udaipur district are presented in Table (2) and the observations showed that the stored maize was infested by rice weevil (*S. oryzae*) in all the five blocks surveyed *viz.*, Badgaon, Bhindar, Girwa, Gogunda and Jhadol of Udaipur.

The damage caused by the rice weevil in different storage method ranged from 3.94 to 20.25 per cent during the storage. The minimum per cent of grain damage 3.94 per cent was recorded in the practice of use of celphos tablets (Aluminium phosphide) followed by 9.52 per cent in use of ash or sand and 10.69 per cent in method of sun drying. The maximum damage of 20.25 per cent was recorded with use of garlic clove which was significantly at par with grain damage in use of ginger rhizomes, eucalyptus leaves and neem leaves where 17.00, 15.75 and 12.15 per cent grain damage of stored maize was recorded. The maximum number of farmers adopted single method for maize storage; however few farmers were observed to adopt more than one method which resulted in less infestation by the rice weevil during storage.

These results corroborates with the findings of Gautam and

Lamsal (2021) ^[8] who recorded that the per cent grain damage in metal bin storage with use of celphos tablet was 1.75 per cent in stored maize. Likewise, Wambugu *et al.* (2009) ^[16]

recorded maximum grain damage by insect pests in stored grain with traditional seed storage practices.

Table 1: Block-wise storage methods adopted by the farmers of the Udaipur district of Rajasthan during 2020-21

S. N	Storage method	Per cent Adoption (%)					
		Badgaon	Bhindar	Girwa	Gogunda	Jhadol	Mean
1	Sun drying	28.00	24.00	28.00	28.00	20.00	25.60
2	Celphos (Aluminium phosphide)	36.00	40.00	40.00	36.00	40.00	38.40
3	Ash or sand	16.00	20.00	16.00	12.00	20.00	16.80
4	Neem leaves	12.00	12.00	8.00	12.00	8.00	10.40
5	Ginger rhizomes	4.00	4.00	4.00	4.00	8.00	4.80
6	Eucalyptus leaves	4.00	0.00	4.00	8.00	0.00	3.20
7	Garlic cloves	0.00	0.00	0.00	0.00	4.00	0.80

Table 2: Block-wise per cent grain damage in different storage methods adopted by the farmers of the Udaipur district of Rajasthan during 2020-21

S.N	Storage method	Per cent Grain damage (%)					
		Badgaon	Bhindar	Girwa	Gogunda	Jhadol	Mean
1	Sun drying	10.85	11.33	8.57	10.85	12.40	10.69
2	Celphos (Aluminium phosphide)	4.22	3.10	4.90	3.88	3.66	3.94
3	Ash or sand	8.00	10.80	10.25	12.00	7.40	9.52
4	Neem leaves	13.66	12.33	11.50	12.66	9.50	12.15
5	Ginger rhizomes	17.00	20.00	25.00	12.00	14.00	17.00
6	Eucalyptus leaves	10.00	0.00	16.00	18.50	0.00	15.75
7	Garlic cloves	0.00	0.00	0.00	0.00	20.25	20.25

4. Conclusion

During the survey, the sample of maize from various maize storage methods were collected from different blocks of Udaipur district and results showed that the adoption of different maize storage methods was in order Celphos (Aluminium phosphide) > Sun drying > Ash or sand > Neem leaves > Ginger rhizomes > Eucalyptus leaves > Garlic cloves.

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