International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2020; SP-8(5): 161-162

Received: 25-07-2020
Accepted: 10-09-2020

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Influence of rice husk ash on controlling insect pests on storage of maize (*Zea maize* L.) Seeds under Manipur condition

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DOI: https://doi.org/10.22271/chemi.2020.v8.i5c.10497

Abstract
An experiment was conducted in the Agronomy Department, College of Agriculture, Central Agricultural University, Imphal, in 2017-2018, to study the "Influence of rice husk ash on controlling insect pests on storage of maize (*Zea maize* L.) Seeds under Manipur condition". It was observed that when we mixed the rice husk ash with maize seeds properly and stored in a polythene bags for one year at the rate of 400g rice husk ash and above per ` 10 cobs of maize, there was no loss of maize seeds from the insect pests. But in control where no rice husk ash was mixed, after one year of storage, all the cobs were affected i.e. 100 percent, by the insect pests.

Keywords: Maize cobs, rice husk ash, insect pests

Introduction
India is one of the top ten maize producers in the world. It contributes around 2-5% of the total maize produced globally and is one of the top 5 maize exporters in the world contributing almost 14% of the total maize exported to different countries around the world. South- East Asia is the biggest market for Indian maize with almost 80% of the exported Indian maize going to Indonesia, Vietnam and Malaysia (www.Kleffmann.com). Maize is the second cereal crop grown in the state of Manipur with a total area of 19,440 hectares and production of 2.29Mt per hectare. Maize is grown in all the hill and valley districts of Manipur. Stored grains are affected by insect pests seriously and damaged percentage is very high. Several synthetic pesticides were used, but they have shown adverse effects on environment and persist for longer period in form of residues and entered in the food chain after utilization of products of organisms (Prakash *et al*. 2016) [1]. In Manipur, majority of the farmers are small and marginal farmers. So, storing of grains after their harvest has always been a problem for farmers as the stored grains are found to be often infested with insect pests. As a result small and marginal farmers who grow maize are unable to store their seeds at a lower price. Seeds kept for sowing for the next season are also infested and hence, cannot be used for sowing thereafter. Timely sowing of maize is also one of the factors for high yield of maize but sometime farmers could not effort it due to damage the maize seeds by insect pests as well as rodents which they kept stored. The insect pests directly feed on the stored grains and other stout beetles lay their eggs on stored grains. The larvae thus developed from the eggs bore and feed on the grains, thereby reducing the quality of the produce, if we do not use any synthetic or organic pesticides.Now-a-days, with the popularization of organic farming in the state of Manipur, farmers are willing to explore and adopt more organic solutions within their capability by utilizing of locally available materials in order to improve their income as well as to save the environment and human health. Hence to bring about a suitable storage method with eco-friendly and farmers friendly, an experiment was conducted at College of Agriculture, Department of Agronomy, Central Agricultural. University, Imphal, from the year 2017 to 2018,"Influence of rice husk ash on controlling insect pests on storage of maize (Zea maize L.) seeds under Manipur condition".

Methodology
Well mature maize cobs having the size of about 25cm in length and 18cm in circumference, in an average, were collected from the farmers' fields and then unhusked them.

The cobs were dried well under the sun for 5 days and then cooled them. Then stored them in polythene bags by mixing well with rice husk ash at different proportions as follows: - T1 (10 no. of maize cobs – without rice husk ash as control), T2 (10 no. of maize cobs +200g of rice husk ash), T3 (10 no. of maize cobs +300g of rice husk ash), T4 (10 no. of maize cobs +400g of rice husk ash), T5 (10 no. of maize cobs + 500g of rice husk ash), T6 (10 no. of maize cobs +600g of rice husk ash), T7 (10 no. of maize cobs +700g of rice husk ash) and T8 (10 no. of maize cobs +800g of rice husk ash), and then stored with the ends of bags tied. Each treatment consists of three replications. The upper most layer of each treatment was covered with a layer of rice husk ash, and was placed on a plank in the experimental room for a year. The stored maize cobs were monitored and damaged percentage was recorded for each consecutive year i.e. from 2017 to 2018.

Result and Discussion

It was found that there was no damage of maize seeds by insects pests in the treatment T4 to T8 i.e. when the maize cobs were mixed with the rice husk ash at the ratio as 10:400g, 10:500g, 10:600g, 10:700g and 10:800g as shown in Table 1.

Table 1: Effect of rice husk ash on 1 year storage of maize seeds (2017-18)

Treatments		Damage percentage (%)
	2017	2018
T1 (10 no. of maize cobs – without rice husk ash as control)	100	100
T2 (10 no. of maize cobs +200g of rice husk ash)	65	70
T3 (10 no. of maize cobs +300g of rice husk ash)	35	38
T4 (10 no. of maize cobs +400g of rice husk ash)	0	0
T5 (10 no. of maize cobs + 500g of rice husk ash)	0	0
T6 (10 no. of maize cobs +600g of rice husk ash)	0	0
T7 (10 no. of maize cobs +700g of rice husk ash)	0	0
T8 (10 no. of maize cobs +800g of rice husk ash)	0	0

It may be due to fact that rice husk ash which contains Iron oxide (Fe_2O_3 = 0.05%), Silicon Dioxide (SiO_2 = 96.7%), Aluminium Oxide (Al_2O_3 =1.01%), Calcium Oxide (CaO =0.49%), Potassium Oxide (K_2O = 0.91%) (Kartinic 2011). Rice husk as interferes with insect feeding and also hinders fungal pathogen multiplication as well as affects the insect movement to search for making partners. Friction of the dust particles with the insect's cuticle leads to desiccation and hampers the developments of the pests (Rekha *et al*. 2014) [3]. Similar result was also obtain by Singh and Devi (2019, 2020) [6] that rice husk ash controls insect pests on storage of soybean and pea seeds, Singh (2020) [4], black gram seeds. Dust, such as silica gel or diatomaceous earth can be combine with certain grains to provide protection against insect damage (Rajasri and Kavitha 2015). So the same result was found from T5 to T8 with T4 it may be due to that in these treatments the maize seeds could be covered well with the rice husk ash evenly, as a result insect pests could not damage. In the similar way, Singh and Devi (2020) [5], Singh (2020) [4] observed that rice husk ash could control insect pests on storage of pea seeds and black gram seeds. In The treatments T2 and T3, in the first year i.e. 2017, the damage percentage of maize seeds were 65 and 35 respectively, and in the second year i.e. 2018 the damage percentage were 70 and 38 respectively which were comparatively less damage than treatment T1 i.e. control without rice husk ash. It might be due to sparse coverage by rice husk ash which let the insect pests to develop in the possible space.

Conclusion

Maize seeds could be stored in rice husk ash at the ratio 10 maize cobs/400g and above to protect from the damage of insect pests for one year in Manipur condition. Hence it can replace synthetic insecticides safer eco-friendly and farmer friendly as well as increase the socio economics of the farmers of Manipur.

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