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Innovative approach for the use of rice husk ash on controlling insect pests on storage of pea seeds (Garden pea- *Pisum sativum* var. hortense L.) under Manipur condition

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Abstract
An experiment was conducted in the experimental laboratory of Agronomy Department, College of Agriculture, Central Agricultural University, Imphal, in 2016 to 2018, to study the "Innovative approach for the use of rice husk ash on controlling insect pests on storage of pea seeds, (Garden pea- *Pisum sativum* var. hortense L.) under Manipur condition. It was observed that when we mixed the rice husk ash with pea seeds and stored in the ratio pea: rice husk ash (1: 0.25 and above 250g of rice husk ash), there was no loss of the pea seeds from the insect pests. In control i.e. T1 (pea seeds without rice husk ash) was found 100% damage in one year and less damage from T2 toT4 where treatments with pea seeds: rice husk ash were 1:0.10, 1:0.15, and 1:0.20 respectively.

Keywords: pea seeds, rice husk ash, insect pests

Introduction
The main purpose of storage of pea seeds for small scale farmers in Manipur is to ensure household supplies and seed for planting, since agricultural production is seasonal while the demands for agricultural commodities are more evenly spread the year, proper storage of food grains is necessary to prevent spoilage increase keeping quality and for monetary reasons. Storage of pulse is one of the important links in the entire pulse production and its utilization chain. Proper storage of pulses facilitates the farmers to overcome the shortage in lean season and serves as a means of ensuring crop in the subsequent season (Shukla and Pati, 1998). Farmers of kavi block in Chitrakoot district practiced mixing of fine husk wheat collected during the threshing of wheat with chickpea seeds/grains at the rate 2kg per 50 kg of seeds (Sah *et al*., 2014) [5]. The dried pulse grains are heated by mixing wood ash/ cowdung/ sand stored in a new earthen pot to suppress the pest infestation growth during storage (Reddy, 2005) [4]. Dust, such as silica gel or diatomaceous earth, can be combined with certain stored grains to provide protection against insect damage (Rajasri and Kavitha, 2015) [3].
In Manipur, area under pea cultivation during the year 2016-2017 is 7860 hectare with the production of 80.48 metric tonnes (Horticulture Statistics at a Glance, 2017) [1]. Postharvest losses are very high in India which accounts for 33-35% reduction in pulse production as compared to developed countries. Out of which, upto 32.7% is from storage loss alone as compared to only 5% in that of developed country (Singh, 2017) [7]. In Manipur, majority of the farmers are small and marginal. 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 farmers who grow pea are unable to stored their produce seeds and are forced to sell 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. The insect pests beetles feed on stored grains and others stout beetles lay their eggs on the maturing pods in the field or in the stored grains.The larva 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.
Considering the above losses due to improper storage, an experiment was conducted at College of Agriculture, Iroisemba, Central Agricultural University, Imphal in the year 2016 to 2018 to bring about a suitable storage method to minimize the storage losses in pea by utilizing the rice husk ash which is a byproduct of rice.

Methodology
Pea seeds were collected from the farmers and clean properly. The seeds were spread thinly on a concrete floor under the sun for 5 days. It was cooled and stored in polythene bags.

The seeds were then mixed properly with rice husk ash at different proportions as T1 (T_1: 1kg pea seeds, control without RHS), T_2 (1kg pea seeds+ 100g RHS), T_3 (1kg pea seeds+ 150g RHS),T_4 (1kg pea seeds+200g RHS),T_5 (1kg pea seeds+ 250g RHS),T_6 (1kg pea seeds+ 300g RHS),T_7 (1kg pea seeds + 350 g RHS), T_8(1kg pea seeds + 400 g RHA),T9(1kg pea seeds + 450 g RHS),T_{10} (1kg pea seeds + 500 g RHS) and tied properly. Each treatment consists of five replications. Each of the upper most layer was covered with a layer of rice husk ash. They were kept in the laboratory room on a plank and stored for one year only. The stored grain were monitored and damage percentage were recorded each year for consecutive three years (2016 to 2018).

Results and Discussion

It was observed that there was no damage of pea seeds by insect pests in the treatments T5 to T10 ie., when the pea seeds were mixed with the rice husk ash at the ratio 1:0.25, 1:0.30, 1:0.35, 1:0.40, 1: 0.45 and 1: 50 (Table no. 1).

Table 1: Effect of rice husk ash on 1 year storage of pea

Treatments	Damage percentage (%)		
	2016	2017	2018
T1: 1kg pea seeds (control without RHS)	100	100	100
T2: 1kg pea seeds+ 100g rice husk ash	89	82	85
T3: 1kg pea seeds+ 150g rice husk ash	70	65	67
T4: 1kg pea seeds+ 200g rice husk ash	29	31	25
T5: 1kg pea seeds+ 250g rice husk ash	0	0	0
T6: 1kg pea seeds+ 300g RHS	0	0	0
T7: 1kg pea seeds + 350 g RHS	0	0	0
T8: 1kg pea seeds+ 400g RHS	0	0	0
T9: 1kg pe seeds+ 450g RHS	0	0	0
T10: 1kg pea seeds+ 500g RHS	0	0	0

*RHS =Rice Husk Ash

This may be due to the 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) [2]. Dessication or application of rice husk ash might have filled up the inter-granular spaces and effectively disrupted the reproductive behavior of the insect pests, thereby, preventing further infestation on the stored grains. Similar result was also obtained by Rajasri and Kavitha (2015) [3], that dust, such as silica gel or diatomaceous earth, can be combined with certain stored grains to provide protection against insect damage. These dusts killed target insects by dessication. In the similar way, Reddy (2005) [4] reported that traditional practice of protecting the pulse grains from the storage pests and insects, any one of wood ash or cow dung ash were mixed and kept stored in bins or bags. The farmers believed that these substances act as insect repellents. This practice protected the grains up to a few months from pests and insects. The pea seeds that were stored without any rice husk ash showed a 100% damage after a year of storage. But in treatments T_2 to T_4 i.e., 1:0.10, 1:0.15, 1:0.20, comparatively less damage was found than the T_1 i.e., control. It might be due to less area coverage by the rice husk ash which led the insect pests to develop in the possible space.

Conclusion

Pea seeds could be stored in rice husk ash at the ratio 1:0.25 and above to protect from the damage of insect pests for one year in Manipur condition, serving as a convenient organic method of storage. Rice is the staple food of Manipur hence, it becomes all the more convenient to procure rice husk for the purpose. It would be environmental friendly solution and could be promoted as one of the effective and useful agro-waste management practices.

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