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Efficacy of insecticide incorporated bags against major insect pests of stored paddy in Sri Lanka

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Abstract

A study was conducted to evaluate the efficacy of an insecticide (deltamethrin) incorporated bags (Zerofly®) against the insect attacks during paddy storage under Sri Lankan conditions. The study was conducted at Institute of Post Harvest Technology (IPHT), Anuradhapura and at the warehouse of Paddy Marketing Board (PMB), Anuradhapura. Paddy sample in Zerofly® sacks were stacked at both locations and for controls, untreated polysack bags were used. Paddy samples that were collected before storage and at monthly intervals during the storage period were analysed for moisture content, weight loss due to insect damages, Thousand Grain Mass (TGM), germination percentage, Total Milling Yield (TMY) and Head Rice Yield (HRY). Data was analyzed using Analysis of Variance (ANOVA) by Statistical Analysis System (SAS). The moisture content of paddy grains fluctuated between 13.3 – 14.3% during storage period but any significant difference was not observed among bag types. The level of insect damages in control was increased with storage time while the initial level of insect damage of treated bags remained unchanged. The mass loss due to insect damages of grains was significantly higher ($p=0.05$) in untreated bags than treated bags. The insect damage was reduced by 3.5-4.4% using Zerofly® bags during paddy storage. In addition, dead insect bodies were found on outer surface of the insecticide incorporated bags but no live or dead insects were found on untreated bag surface during storage. Mainly rice weevil (*Sitophilus oryza*) and lesser grain borer (*Rhyssoperthadominica*) were found in paddy samples of untreated bags and number of insects increased with time. The germination percentage of grains in untreated bags was significantly higher than to the control. It was reduced from 93% to 60-64% and 93% to 82-83% in control and treated bags respectively. During the six months of storage, TGM did not show any significant difference ($p=0.05$) among different treatments. TMY and HRY resulted significantly ($p=0.05$) lower values of paddy stored in untreated bags than Zerofly® bags. Use of insecticide incorporated bags can reduce the loss of TMY and HRY of paddy during storage. The study revealed that insecticide treated bags are an appropriate packaging material to protect stored paddy from insect infestations under Sri Lankan conditions.

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Keywords: Deltamethrin, Zerofly bags, insect damages, insecticide incorporated bags

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1 Introduction

A major loss in post harvest handling of grains occurs during storage due to improper and inadequate storage facilities. Recent studies have revealed that in Sri Lanka, like in other tropical countries, the loss of grains during storage under normal ware-house conditions due to various reasons is about 4-6% and 80% of this amount is due to insect attacks⁶. Improving the proper storage techniques will help in increasing the income of farmers and traders not only by reducing these qualitative and quantitative losses but also through sale of produce during off season at higher prices.

Storing in woven polypropylene sacks is the most popular and commonly used method to store grain. Exposing of grain to insects, rodents, birds and high moisture environment during the storage is unavoidable in Sri Lanka¹. Currently, application of insecticides and fumigation are the main insect pest control methods practiced in Sri Lanka and storing grains in a hermetic storage structures is another method in controlling insects.

A novel and innovative tool, an insecticide-incorporated polypropylene sacks, has been designed to protect grains and seeds against destructive insect pest infestations during storage³. Zerofly® storage bag is a woven polypropylene bag developed by VESTERGAARD S.A., Switzerland for postharvest storage of grains. The active ingredient, Deltamethrin is incorporated into the polypropylene yarns woven together and the active ingredient is released on the surface of the material in a sustained manner so that the commodities stored in the sacks are continuously protected against insect infestation⁴. It has earlier been revealed that deltamethrin incorporated bags provide a powerful killing action against the common insects found in Sri Lanka and the insects were unsuccessful in boring this bag materials⁵.

If people are receptive to new technologies that offer alternative solutions to problems being faced by the grain industry, the food security could be assured by minimizing postharvest grain loss. Therefore, this study was carried out to evaluate the efficacy of insecticide incorporated bags under Sri Lankan conditions.

2 Materials and Methods

2.1 Experimental setup

The study was conducted at the Institute of Post Harvest Technology (IPHT) and at the main warehouse of Paddy Marketing Board (PMB) Anuradhapura, Sri Lanka, where bulk amount of paddy is stored under $29^{\circ}\text{C} \pm 4$ of ambient temperature and $67\% \pm 5$ of relative humidity. Paddy (long white grain type), harvested from *Maha* season, 2013/2014 season was purchased and dried to about 14% of moisture content. Then the whole paddy stock was fumigated to ensure that paddy grains were total free from any insect infestations. Paddy sample bagged in Zerofly® sacks were stacked at IPHT and PMB warehouses and as controls, untreated polysack bags were used at both locations together with treated bags. All the treatments and controls were replicated three times for the experiment.

2.2 Data collection and quality analysis

Composite paddy samples were collected before storage and at monthly intervals during the storage period, and were analyzed for moisture content, weight loss due to insect damages, thousand grain mass, germination percentage, total milling yield and head rice yield. Ambient temperature and relative humidity were recorded daily.

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