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Fumicover™ An effort in reducing losses in stored grains at farm levels

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Abstract

In India estimated losses due to stored grain pests are about 10 % of the total production, or about 20 million tonnes a year. Fumigation with Aluminium Phosphide (AlP) is the most dependable, economical and convenient method of stored grain pest control. But fumigation can be carried out only under gas tight conditions.

“Fumicover™” was designed by Excel Crop Care Ltd., and was tested at Food Corporation of India (FCI) godown at Borivali, Mumbai. It is made of Multi Layer Cross Laminated polyethylene sheets. The size of “Fumicover™” was restricted to treat one tonne of grain. The covers were then sent across India, to test its effectiveness. At present our 25 Village Agricultural Practitioners (VAP) are educating farmers for use of Fumicover™ in 250 villages. For fumigation of one tonne of grains one Celphos (AlP 57 %) pouch of 10 gm was used. The results showed very high degree of efficacy and convenience. Fumicovers sent to countries like Nigeria, Ghana and Ethiopia have also given excellent results. The cost of Fumicover™ is approximately Indian Rs. 500/- (INR) only, which makes it very economical. We believe that “Fumicover™” will go a long way in addressing the issue, particularly in developing countries like India.

Key words: Fumicover™, Aluminium Phosphide, Celphos, Fumigation, Stored grain pests

Introduction

India is known as an agrarian country, where almost 70 % of the population depends on agriculture for livelihood. India has moved away from chronic food deficit to a surplus. India's food grain production is now at around 225-230 million tonnes. Additional 150 million tonnes food grain production has to be achieved to feed almost 1.5 billion people by 2040, at the present level of nutrition. Thus, the crusade for higher production of food grain as well as lowering the storage losses has to continue with increased vigour.

A recent estimate by the Ministry of Food and Civil Supplies, Government of India, put the total preventable post-harvest losses of food grains at about 20 million tons a year, which was nearly 10 per cent of the total production. Insect pests are a greater problem in regions like India where the high relative humidity coupled with warm temperature makes a conducive environment for insect multiplication.

A survey was carried out by our team at the village level. Experts visited the farmers in different areas of India and collected important data on various parameters like: the size of farm holding, production levels, quantity of storage, method of storage etc. Majority of the Indian farmers have a land holding of less than one hectare. Most of our farmers store their produce in gunny bags of 50 -100 kg capacity in store rooms or in conventional structure.

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Reducing storage losses

Although various traditional methods of grain protection are still used by some farmers, the most effective control technique is fumigation. Fumigation enclosures should be sufficiently gas-tight for the gas to remain in the commodity for long enough to kill all stages of the insects present in the grains. AIP is the most common chemical used for the purpose of fumigation at farm level. AIP has proved to be an ideal fumigant as it is effective against all type of insect pests and rodents that attack stored food grains and packed commodities. Phosphine liberated by AIP spreads evenly and rapidly to the most inaccessible corners and crevices. AIP does not taint, discolour, or disflavour the commodities treated. It does not impair seed viability. It leaves no hazardous residue. It is available in a solid ready to use tablet, pellet or pouch form and is safe and easy to use.

Fumicover™

At farm level, in developing countries the facility of gas tight enclosure for grain fumigation is generally not available. Inadequate gas tightness at the time of fumigation leads to control failure, resistance development and possible exposure hazard. Keeping this in mind we are offering the farmers an indigenous, 100 % safe, and very cost effective method of fumigation.

It is evident from the data on grain storage that the 1 MT size of fumigation lot will be most appropriate for Indian farmer. Such a farmer cannot afford a modern storage structure with all the facilities for proper and safe fumigation. Though government authorities like Save Grain Campaign are supplying metal bins to farmers, it is not at par with the requirement. Hence, Fumicover™ was designed, developed and tested by M/s Excel Crop Care Ltd, Mumbai.

Materials and methods

- ▣ A set of experiment was carried out to find

out the optimum size and dimensions of Fumicover™ for fumigating 1 tonne of grains.

Following method was used to establish the right size of Fumicover™.

1) A optimally filled gunny bag of 50 kg food grain was taken as a sample.

2) 20 such bags were taken out from the godown, which would make 1 tonne of food grain.

3) Different arrangements of these gunny bags were tried to derive upon the one, that occupies minimum space.

4) Subsequently after a few trials, we designed the Fumicover™ made up of gas tight material, which would cover the 20 bags of 50 kg. each and will have minimum air pockets (Figure 1).

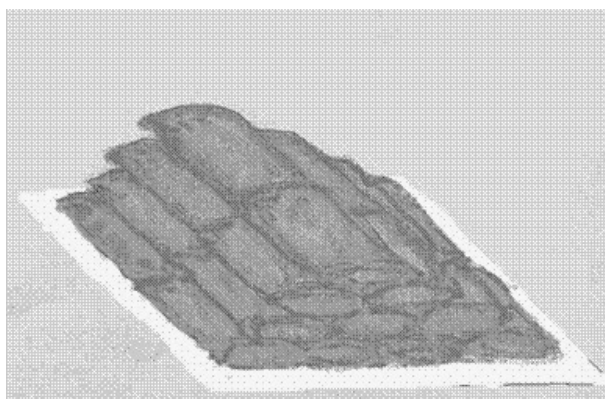


Figure 1. Stack of 50 kg bags.

▣ Another set of experiment was carried out to test the efficacy of the Fumicover™ alongwith use of Celphos pouch. Full fledged scientific experiments were carried out on the following aspects of Fumicover™ use:

1) The Fumicover™ was sent to 6 locations across India for testing under different climatic conditions.

2) It was tested along with Celphos pouch for its efficacy.

3) It was tested in 10 different kinds of food grains.

4) Live Rice Weevils were kept in a beaker/ bottle covered with a cloth under Fumicover™ during fumigation with Celphos. Mortality was counted after fumigation.

Experimental Procedure

The initial testing was conducted at Food Corporation of India (FCI), Borivali godown,

Mumbai, India. The step by step procedure followed during the FCI, and other trials is given below (Figures 2 to 10).



Figure 2. Clean the floor.



Figure 3. Place an MLCL sheet (8'x 6') over the floor.



Figure 4. Arrange the gunny bags on the sheet in 4 layers. Layer 1: Two rows of four gunny bags each.



Figure 5. Arrange the gunny bags on the sheet in 4 layers. Layer 2: Two rows of three gunny bags each.



Figure 6. Arrange the gunny bags on the sheet in 4 layers. Layer 3: Two rows of two gunny bags each.



Figure 7. Place the Cephos pouch (10 g) in between the bags. Layer 4: Two rows of one gunny bag each.



Figure 8. Cover the gunny bags using Fumicover™.



Figure 9. Seal the sides using sand snakes.



Figure 10. Keep it for 5-7 days. Open all the windows and ventilators (if done indoor). Remove the sand snakes and also remove the cover partially. Keep it as such for two days for aeration.

Results

Development of Fumicover™:

After initial set of trials it was found that one tonne of food grain when stacked in a particular order saves the maximum space (Figure 1). The material selected for construction of Fumicover™ was Multi Layered Cross Laminated sheets (MLCL) as per Indian specifications IS-14611. The cover consists of 3 pieces, one rectangular piece of 6' x 12' size, which constitutes the roof of the tent like Fumicover™. The sides are made up of triangular sheets of 8' base and with a side length of 6' each. Such a cover can be used to fumigate 1 tonne of grain, i.e., 20 gunny bags of 50 kg each. Another rectangular sheet of 7' x 9' size was used as base on which the gunny bags were arranged in a particular manner. This sheet was also made of MLCL. A 10 cm (diameter) cylindrical structure made up of MLCL and filled with sand (sand snakes) was used to ensure the air tightness near the sides of the cover (Figure 11).

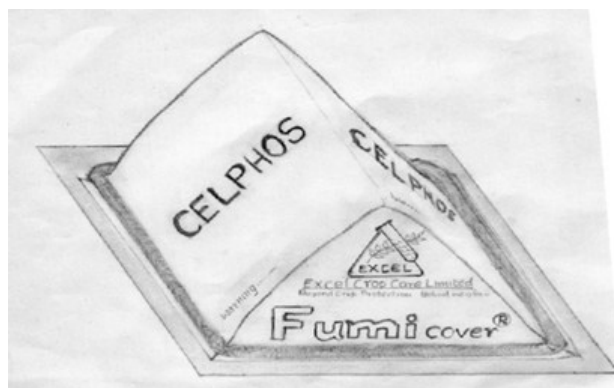


Figure 11. Schematic diagram of the Fumicover™.

Efficacy Trials

The trials conducted at FCI, and other locations across India proved to be very effective (upto 100 %), in the control of stored grain pests in various commodities.

Development trials

The Fumicovers were sent to our development teams in different zones across India, to test its effectiveness. The Efficacy of Fumicover™ along with Celphos pouch fumigation was tested in the states of Delhi, Madhya Pradesh, Gujarat, Karnataka, and Tamil Nadu, across India. It was tested in Paddy, Wheat, Mung, Jowar, Maize, Red Gram, Horse Gram and Ground nut. For fumigation of one tonne of grains one Celphos pouch of 10 gm AIP was used. The results that have come in from different parts of the country indicated a very high degree of efficacy and convenience, under various agroclimatic conditions (Figure 12). Fumicovers have also been sent to our overseas collaborators in Nigeria, Ghana and Ethiopia. Promising results are coming in from those parts of the world too.

Rice Weevils kept in two different experiments in beakers/bottles were all killed at the end of the Fumigation period. Trials not only at the farm levels but also at the exporter level proved very successful. Work done at one of the largest rice grain exporter namely KRBL, Delhi, produced excellent results. The company is an exporter of India Gate brand of Basmati Rice. All the Rice weevils that were present in the sacks were found dead.

The cost of Fumicover™ is approximately Rs. 500/- (INR) only, which makes it very economical.



Figure 12. Fumigation of one tonne of grain.

Cost Analysis:

Storage loss/ton = 70 kg

(Assuming 7 % loss due to insect pests).

(Anonymous, 2001)

Loss in Rupees = 70 x 10 = Rs. 700/-

Cost of the Fumicover™ = Rs. 500/-

Effective cost /tonne = Rs. 500/25 = Rs. 20/-

(Assuming that a cover can be used for 25 fumigations)

Cost of Celphos (10 Gram Pouch) = Rs.10/-

Total cost per fumigation = Rs. 20 + Rs. 10 = Rs. 30/-

Net gain per fumigation = Rs. 700 – Rs. 30 = Rs. 670/-

Cost benefit ratio = Rs. 30 /Rs. 670 = 1 : 22

(1 US \$ = Rs. 46/- Indian Rupees)

Promotion and Communication to the farmers

The important stage of the project was the introduction of the Fumicover™ to the farmers. This was achieved through demonstrations and training programs. For the various extension activities we appointed 25 Village Agricultural Practitioners (VAP), across the country in 250 villages, who are touring the remotest of villages and educating the farmers about the use of Fumicover™. We are using diverse means of promotion, like farmer-meetings and rallies, pamphlets, leaflets, to guide farmers in the use of Fumicover™.

Discussion

Different techniques for the control of various stored grain pests are available in developed countries. This effort was to develop an effective, yet economical technique for the developing countries where the land holdings of the farmers are generally small and the quantity of grains that they store is also small. The use of Fumicover has proved to be extremely successful and useful for Farm level usage in Developing countries where the average storage of the typical farmer is about 1 tonne. The use of Fumicover

with Celphos has been effective in controlling all kinds of stored grain pests, in different agricultural commodities, in various locations, in India and Africa. The cost of Fumicover™ (INR 500/-) makes it very economical. In the days to come we are confident that Fumicover™ will be popular among small farmers across India.

Conclusion

In a country like India, the innovation like 'Fumicover™' has greater significance. The 'Fumicover™' gives a perfect tool for conducting effective fumigation of grains stored in gunny bags. Its easiness to handle, cost effectiveness and durability makes it more user friendly. This will be our humble contribution towards helping the farmer who hold 70 % of the total grain storage. (Chadda et al., 2004).

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