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Infection Control Consultants LLC

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The use of Path-Away® in stored grain preservation.

Contamination of seed and grain with fungal organisms may result in poor germination, seedling vigor or grain quality. Storage fungi usually invade grain or seed during storage and are generally not present in large quantities before harvest in the field. The most common storage fungi are species of Aspergillus and Penicillium.

These fungi are widely distributed and almost always present. Contamination occurs through small quantities of spores contaminating the grain as it is going into storage from the harvest, in handling and storage equipment or from spores already in the storage structures. Under high temperatures and moisture this small amount of inoculum can increase rapidly.

Grain spoilage causes poor germination, loss of weight, loss of nutritive value, poor milling quality and deterioration in flavor and color of the rice. While the losses from spoilage may be of greater economic significance, they are less dangerous than the presence of mycotoxins. Mycotoxins are poisonous chemical compounds produced by certain fungal species that infect crops. While these fungi are not common in rice, they have been isolated from rice. They are common in corn, wheat, barley and in beans stored for any length of time.

Contaminated grain problems for workers:

Grain storage depot workers suffer from different respiratory problems after getting the exposure to storage grain dust. Which is a mixture of pesticides, fungi, silica, bacteria, spores, storage mites, animal hairs, pollens etc. The present study was undertaken to evaluate the fungal spore concentration in summer and winter season as well as the pulmonary function status of the workers; studies are limited in our country. In summer and winter seasons, air sampling was done to measure the airborne fungal spore concentration inside the grain storage locations in Iowa, USA by viable and non-viable samplers.

Aspergilus, Alternaria, Drechslera, Epicoccum, Nigrospora, Periconia were very much common and found higher in winter compared to summer. The respiratory functional status was assessed in two groups of workers of the same storage grain depot (total n=316) in summer (n=136) and in winter (n=180). List of the workers was collected from the authority and randomly selected every alternate worker and divide them for the studies in summer and winter seasons. Slow Vital Capacity (SVC), Forced Vital Capacity (FVC), and Peak Expiratory Flow Rate (PEFR) were recorded and Forced Expiratory Volume in one second (FEV1), FEV1% and different flow rates were calculated. The Immunoglobulin- E (IgE) level in the blood serum was assessed on post shift pulmonary function tests (PFT) decreased workers. The age, height and

weight of the same categories of workers of both studies are highly comparable. Mean PFT values in summer found higher than winter.

A gradual decrement of values were found as age was increased but not with duration of exposure. Post-shift PFT was carried in 21.8% (69) workers of which 46.4% (32) workers showed the decrement of values. The serum IgE level of the post-shift PFT decreased subjects was found more than 250 IU/ml in 53.1% (17) workers. Restrictive, obstructive and combined types of respiratory impairments were noticed among the workers. Presence of different spores in varying concentration in the working atmosphere may be responsible for the post shift decrement of PFT, allergic symptoms, high IgE level and respiratory impairments among the workers.

Fungi cause two distinct problems in storage grains.

•These are grain spoilage from fungal growth or molds and

• The production of poisonous mycotoxins.

The development of fungi is influenced by the:

•Moisture content of the stored grain

•Temperature

•Condition of the grain going into storage

•Length of time the is grain stored and

•Amount of insect and mite activity in the grain.

Grain damage by fungi will be reduced when grain and/or seed is:

1. Stored at moisture contents below 13-14%. It is important to be aware that there is variation in moisture content through a grain mass and fungi will grow where moisture is suitable and not according to the average moisture content of the grain stack

2. Stored at temperatures below 20oC and above 40oC.

3. Not cracked and broken kernels or contain large amount of foreign material - broken or cracked kernels are more likely to be contaminated going into storage and more likely to be invaded once they are in storage than whole kernels.

4. Free from fungi coming into store. Grains moderately invaded by storage fungi develop damage at lower moisture content, at a lower temperature and in a shorter time period than grain free or almost free of storage fungi.

5. Stored for a shorter period. Grain that is to be stored for only a few weeks before processing can be stored safely with a higher moisture content and more extensive invasion by storage fungi and can be kept at a higher temperature than grain that is to be stored for months or years.

6. Free from insect and mites. Insects and mites can carry fungal spores on their bodies thus introducing storage fungi into the grain mass. Insect activity in a grain mass leads to an increase in both the temperature and moisture content of the grain surrounding the insect infestation. In these 'hot spots' conditions may be favorable for mold growth.

7. Treated with an anti-pathogenic natural based solution capable of efficacy against a wide variety of pathogens including the broad spectrum of fungal pathogens endemic to grain storage.

Grain treatment:

Infected seeds can be treated by either physical or chemical treatments, or a combination of both methods. Seed borne bacteria can be treated by dry heat at 65oC for 6 days or dipping in hot water treatment at 52-55oC. Seeds can also be treatment with anti-pathogenic solutions such as Path-Away®, www.path-awaycom, to eradicate infestation if the seeds and or grain are not beyond an edible stage.

Options for preventing fungal growth in stored grain:

Product	Advantages	Disadvantages
Drying	Controls mites. Grain not killed. Long term protection.	Capital cost of heated air-drying. High utility costs to run on a long term basis.
Airtight	Grain rolled for feed does not need dampening.	Grain is killed and only usable for animal feed. Carbon dioxide hazard potential. Air entry during unloading may cause deterioration.
Caustic soda	Digestibility may be improved.	Grain I killed and only usable for animal feed. Corrosive; - safety measures required.
Organic high acids	Saves cost of drying	Grain killed and only suitable for animal feed. Corrosive – safety measures required.
Path-Away®	Plant based and natural Alcohol free No added chemicals long term protection. Does not kill grain. Does not change edibility. Efficacy on all grain pathogens.	Must be supplied as finished product rather than mixed on-site to ensure proper concentrations.

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Application process:

Path-Away® solution should be applied by micro-vaporization fogging on grain as it is being stored. This can be done by automatic equipment installed in the storage location(s). The micro-vaporization is done during this time so that as grain is "layered" in storage a protection layer of Path-Away® is applied. This will protect covered areas within the storage mass to retain the ability to fight harmful fungi.

Prior to storage the interior surface son the storage location should be fogged at 10-15 microns with Path-Away® solution. This is particularly critical if the storage location has porous interior surfaces where fungal reservoirs can grow and flourish.

Transport vehicles should also be fogged at 10-15 microns to prevent cross contamination of clean facilities by contaminated product entering at the time of product transfer.

Summary:

Long term storage of grain and the protection of the grain are possible with pre-planning. In existing storage facilities a simple on site review of the facility can be made to either ensure compliance with good practice or put in place upgrades to bring it into compliance. Different product application equipment may be needed based on facility size, layout, and geographic and/or climatic conditions.

Careful consideration and choice of a tested, proven and approves product that will be effective against the wide range of fungi attacking crop storage should be done by a manufacturer with expertise in not only product but also overall building design. This will enhance the implementation of the project to ensure success to the end user.

Path-Away® Anti Pathogenic Solution is a broad spectrum anti-pathogenic solution derived from natural sources with no added chemicals, drugs or alcohol. It is synthesized from all naturally occurring substances. It is an extremely potent and effective anti-pathogen that acts as a bactericide, fungicide, anti-viral and anti-parasitic compound. Path-Away® Anti Pathogenic Solution is environmentally safe with extremely low toxicity to humans, plants, animals and the environment. It is presently the natural prophylactic with the broadest spectrum action against diseases that attack animals and plants.

Path-Away® Anti Pathogenic Solution is biodegradable according to the "Standard Test Methods for Determining the Anaerobic Biodegradation Potential of Organic Chemicals", ASTM Standards, Section 11, Water and Environmental Technology, Procedure E 1196-2, pp. 879-901, 1993 even though it contains no added chemicals.

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As a “Homeopathic Solution” it is exempt from USA EPA as well as US FDA regulations. It has been registered under the New Zealand EPA under Section 28A(2)(b) and has registration numbers HSR100548 and HSR100549. Path-Away® Anti-Pathogenic Solution has been tested in laboratories in the USA and numerous foreign countries. All base products are manufactured in a sterilized environment using food grade, non-GMO components. Path-Away® is a Halal Certified product and contains no carcinogenic agents. Path-Away® Anti Pathogenic Solution has also been approved by the New Zealand Food Safety Authority.

The manufacturing company’s headquarters are in South Carolina, USA with manufacturing operations in the USA, S.E. Asia, New Zealand, Malaysia and the Middle East.

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