

Stored Grain

Department of Entomology

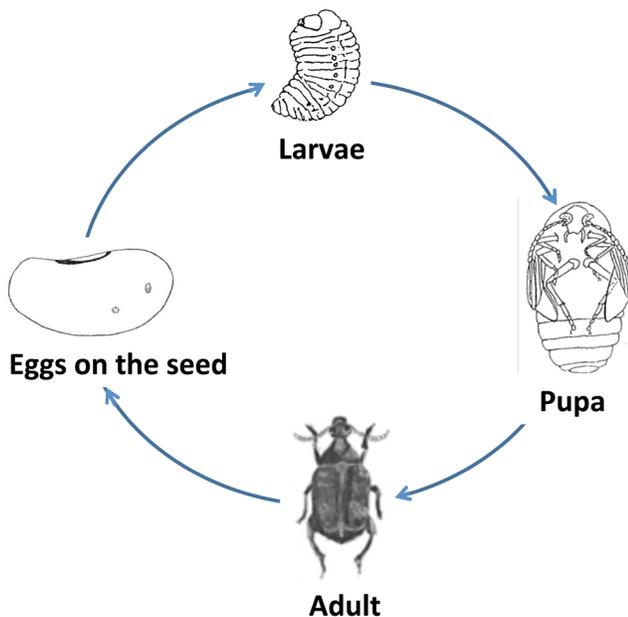
PURDUE IMPROVED COWPEA STORAGE (PICS) TECHNOLOGY

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Cowpea Storage: What Is The Problem?

Cowpea grain stored after harvest is the favorite food of insects called bruchids. Adult cowpea bruchids are often known as cowpea weevils. Infestation of cowpea grain starts in the field at a low level. In the granary, the female lays her eggs on cowpeas. The eggs hatch in about a week. Each tiny grub-like larva bores through the bottom of its egg and into the seed. There it feeds, grows and develops, passing through four larval and one pupal stage. This takes about four weeks. As soon as an adult female emerges from the seed, she finds a male and mates. She then begins laying her eggs on other cowpeas. About 30 days later the new generation of adults appears, popping out of their seeds and leaving a little round hole. Each pair of adults then begins its own new generation. Each female is prolific, producing some 100 offspring (half males, half females) after only a month.

After two or three months of storage, a granary of cowpea grain that initially had only a few cowpea bruchids can contain thousands. Since each new adult leaves a hole in the cowpea grain in which it developed, the entire store of grain is riddled after a few months. In this way cowpea weevils can turn a high-value, virtually insect-free store of cowpea grain into smelly and worthless powder within a short span of time.



Life cycle of the cowpea bruchid (*Callosobruchus maculatus*)



Cowpeas stored in PICS bags



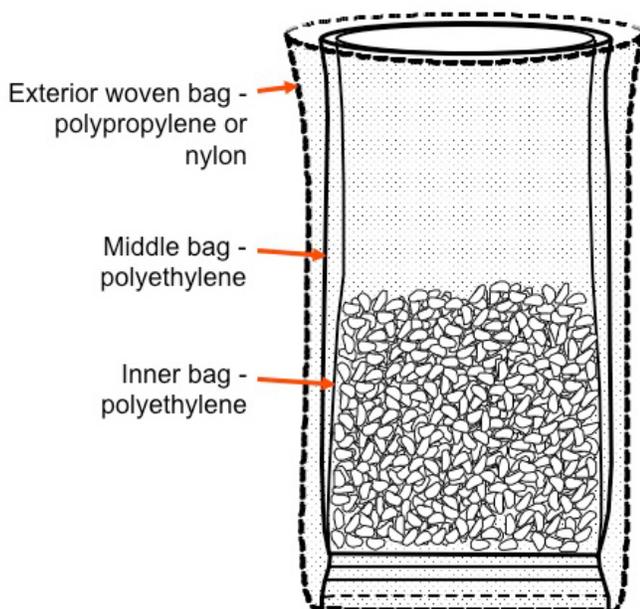
Cowpeas NOT stored in PICS bags

In Sub-Saharan Africa, farmers use a variety of commercial and traditional methods to control bruchids. Many of these have limited use because of their high cost, labor required and potential toxicity. As a result, most low-resource cowpea farmers often sell their grain at harvest – when the price is at its low point for the year – because they know bruchids will destroy if they try to store it.

In the late 1980's Purdue entomologists working with African collaborators devised a simple, low-cost and effective way to stop losses to cowpea bruchids without insecticides or other chemicals – hermetic storage in triple layer plastic bags (Murdock et al., 1997, Murdock et al., 2003). This Purdue Improved Cowpea Storage (PICS) technology is already benefitting millions of cowpea growers and consumers in West and Central Africa.

What Is The PICS Technology Or PICS Bag?

The PICS bag is a triple-layer plastic bag that serves as an air-tight (hermetic) way to store cowpea grain. Two high-density polyethylene (HDPE) inner bags fit inside an outer sack composed of woven polypropylene (PP). The inner HDPE liners have a wall thickness of 80 microns. They greatly hinder the movement of oxygen across the wall of the bag. The tough outer woven bag enables the bag to be easily handled.



How Do PICS Bags Work?

Sealed PICS bags deprive insects of oxygen. The bags work – as do other hermetic storage containers such as sealed steel drums (Seck et al., 1996) – because insects respire aerobically, i.e., they use oxygen to generate energy from their food. They need energy to grow, develop and reproduce. Feeding and growing larvae burn up the oxygen in the airtight container while raising the carbon dioxide level. When the oxygen level in the container falls low enough, the insects cease feeding and become inactive (Murdock et al., 2012). Growth, development and reproduction is arrested. The bruchid population stops growing. Thanks to the oxygen deficit-caused inactivity and population arrest, damage to the stored cowpea also stops. The insects begin drying up and dying of desiccation; early stage larvae and pupae appear to be particularly vulnerable. Research conducted at Purdue and at the National Agricultural Research Institute (INRAN) of Niger, together with field observations show that PICS bags preserve the quality of cowpea. Even after several months of storage the quality of the grain is as good as when it was first put into the bag.



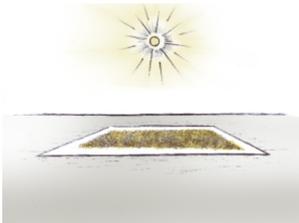
A PICS bag used to store cowpeas

How Do I Use PICS Bags?

The PICS technology is simple to use:



1. Buy PICS bags from approved merchants. Take the three PICS bags apart and check the two inner bags for holes and tears. Do not use a bag that has holes or tears.



2. Ensure that your cowpea is completely dry and clean (no debris).



3. Pour a small amount of cowpea into the inner bag, starting gently. Make sure there are no air pockets at the bottom.



4. Put the three bags together. Fold the top of the bags inside-out. Continue to fill the bags with cowpea. Make sure no grain gets between the bags.



5. Fill the bag far enough so that a lip remains for tying. Pack the grain tightly to remove air.



6. Twist the lip of the first bag tightly shut. Fold it over and tie firmly with string at the base of the twist and over the folded twist.



7. Pull the middle bag up over the first one so that it completely surrounds it. Twist the lip shut, fold over and tie, as before. Follow the same steps for the outer/woven bag.



8. PICS technology is easy, simple and effective. A demonstration video is available at: <http://www.ag.purdue.edu/ipia/pics/pages/Video.aspx>.

Why Are PICS Bags So Useful?

- They prevent losses to bruchids (weevils).
- No insecticide or other chemicals are needed.
- They are convenient for small-scale farmers and organic grain producers to use.
- They are reusable as long as they don't have holes.
- They cost little compared many other storage methods and are thus affordable.
- Investment in PICS bags pays high returns – their use is profitable.
- The PICS technology is easy to learn and use.
- Cowpea grain can be stored safely in PICS bags for a year or more.

References

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October 2013

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