

LASER PULSE

Long-term Assistance and Services for Research (LASER) Partners for University-Led Solutions Engine (PULSE)

Guidebook 2: Post-Harvest Inputs for Youth Resellers

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ABOUT LASER PULSE

LASER (Long-term Assistance and Services for Research) PULSE (Partners for University-Led Solutions Engine) is a \$70M program funded through USAID's Innovation, Technology, and Research Hub, that delivers research-driven solutions to field-sourced development challenges in USAID partner countries.

A consortium led by Purdue University, with core partners Catholic Relief Services, Indiana University, Makerere University, and the University of Notre Dame, implements the LASER PULSE program through a growing network of 3,000+ researchers and development practitioners in 74 countries.

LASER PULSE collaborates with USAID missions, bureaus, and independent offices, and other local stakeholders to identify research needs for critical development challenges, and funds and strengthens the capacity of researcher-practitioner teams to co-design solutions that translate into policy and practice.

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Acronyms

KALRO	Kenya Agriculture and Livestock Organization
MC	Moisture Content
NCPB	National Cereals and Product Board
PICS	Purdue Improved Crop Storage
PPE	Personal Protective Equipment
RH	Relative Humidity
USAID	United States Agency for International Development

Project Summary

Providing youth with access to economic opportunities is a major challenge across the developing world. At the same time, linking rural smallholder farmers to the agricultural input supply chain is another challenge in Sub-Saharan Africa (SSA) and elsewhere in the developing world. The overall project goal was to develop sustainable and resilient supply chains by having rural youth in the Eastern Kenyan Counties of Machakos, Makueni and Kitui counties sell agricultural inputs to farmers who lack market access in Kenya. This pilot project took place during 2021-2022 and was a partnership between Purdue University, The Kenya Agricultural and Livestock Research Organization (KALRO), Bell Industries, local agro-dealers and rural youth between 18-35 years old in the focus counties. Kenya is the appropriate place to implement this pilot project because of its high population density and because many farmers still lack access to modern inputs despite a relatively vibrant input supply chain. This pilot project provides useful lessons learned for others who want to implement projects with rural youth in East Africa and beyond. More details on the project can be found [here](#) and [here](#).

Intended Use and Audience for this Guidebook

This guidebook is based on the practical training that youth who participated in the project received before they sold agricultural inputs. It provides practical training on how to use post-harvest inputs. It is intended to be used with the complementary guidebook that provides training on business concepts, sales techniques and gender considerations. The trainer should have a background in post-harvest management and a proven ability to lead training sessions. In total the two guidebooks make up a one-day training that combines classroom learning with hands-on activities. This guidebook is intended for an audience of rural youth in low and middle income countries who may have limited formal education and little knowledge of business, sales and gender issues.

Guidebook Introduction

The Guidebook will serve as a resource for the project team containing all the material used to train the youth resellers and partnered agrodealers on the fundamentals of the post-harvest inputs utilized in this study. The trainers who utilize this guidebook should understand basic post-harvest handling principles and have a proven ability to lead training programs. The guidebook is compartmentalized into specific training modules, which were provided to trainees a part of the one-day training session. The modules include:

- Module 1: COVID-19 Guidelines
- Module 2: Moisture Measurements
- Module 3: PICS Bags

The guidebook was developed specifically to support the trainers within the project and the material is targeted for rural youth looking to gain basic understanding of the post-harvest inputs. This guidebook contains materials that have been directly drawn or adapted from other sources. Source material is cited throughout the document and in the references section.

Module 1: COVID-19 Guidelines

Module Overview

This module covers the necessary COVID-19 Guidelines necessary to complete the following training in safe manner in accordance with the Kenyan Ministry of Health.

Learning Objectives

- Learn the symptoms of COVID-19 and what to do if they are experiencing symptoms or have been exposed to COVID-19
- Understand training requirements for Personal Protective Equipment (PPE) to protect from COVID-19
- Understand training requirements for hygiene and social distancing to protect from COVID-19.

Materials Adapted From:

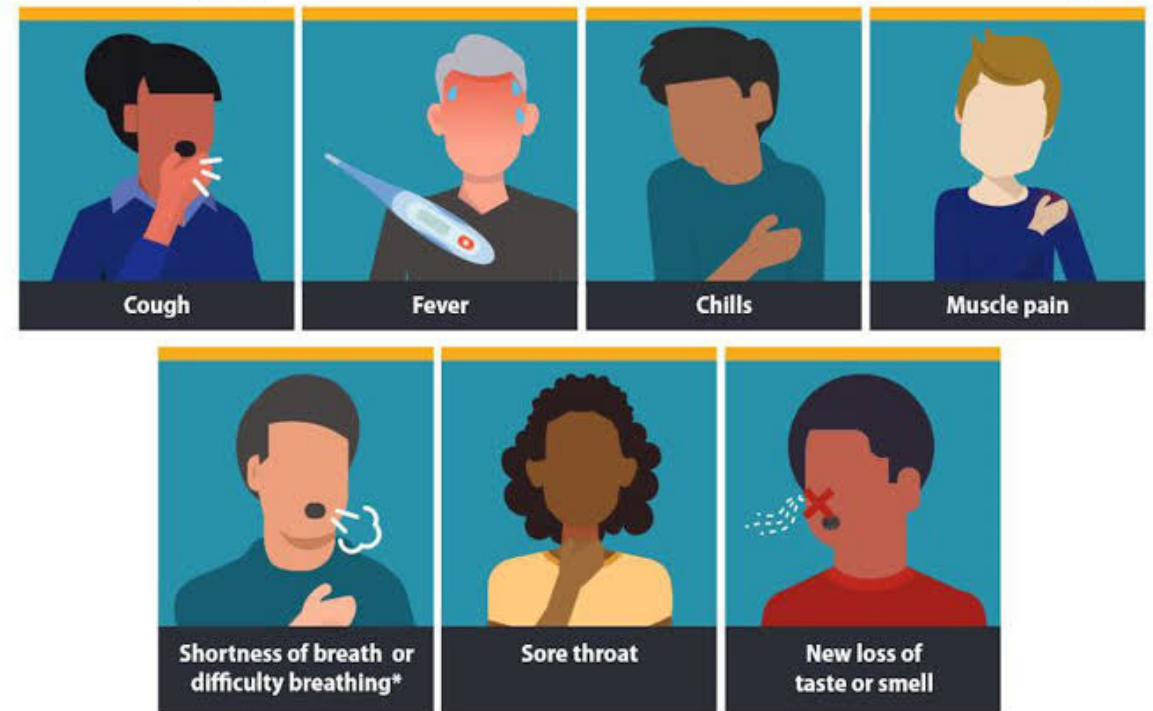
Interim guidance for public use of face masks to reduce droplet transmission for COVID-19. Kenya Ministry of Health. April 10, 2020. Accessed at:

<https://mman.co.ke/sites/default/files/corona/MOH%20GUIDANCE%20ON%20USE%20OF%20FACE%20MASKS.pdf>

Interim Guidelines on Management of COVID-19 in Kenya. Kenya Ministry of Health. Accessed at: <https://kma.co.ke/Documents/Case%20management%20protocol.pdf>

Symptoms of COVID-19

- Fever
- Experiencing dizziness
- Persistent coughing
- Difficulty in breathing
- Tiredness
- Runny or Stuffy Noses
- Body Aches
- Chills
- Diarrhea
- Vomiting



PPE Requirements

Training participants will be required to use PPE (facial coverings, masks, etc.) for all interpersonal interactions

Properly Wearing Masks

The masks/face covering should:

- Cover the mouth AND Nose
- Fit your face well and have no gaps on the side
- Be secured with ties or ear loops
- Allow for breathing without restriction
- Be able to laundered and dried without damage or change to shape
- Be disposed of properly and not loitered

PREVENTION

TIPS TO AVOID CONTAMINATION: CORONAVIRUS (COVID-19)

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WASH YOUR HANDS
REGULARLY WITH
SOAP/SANITIZER FOR AT
LEAST 20 SECONDS.



COVER YOUR NOSE AND
MOUTH WITH A TISSUE
WHEN SNEEZING OR
COUGHING. IF NO TISSUE,
COUGH INTO YOUR ELBOW.



STAY AT HOME WHEN
YOU ARE SICK.



AVOID TOUCHING YOUR
EYES, NOSE OR MOUTH.



AVOID CLOSE CONTACT
WITH ANYONE WHO IS
SICK. KEEP HYDRATED TO
FLUSH YOUR SYSTEM.



KEEP OBJECTS AND
SURFACES CLEAN.

Other Requirements

- Training participants should clean hands with soap and water or hand sanitizer
- Disposable masks should not be washed and re-used

Other Requirements

- Social distancing (6 feet) shall be maintained in all possible instances
- Avoid being crowded or clustered together in large groups

Module 2: Moisture Measurement (Hygrometer)

Module Overview

Storing grain at the proper moisture content (MC) is essential for maintaining the quality and longevity of the grain and ensuring that it remains safe and suitable for consumption or sale. This module will cover the fundamentals of moisture content and teach how to properly use the hygrometer to measure moisture content.

Learning Objectives

- Understand grain moisture content and how it is calculated
- Understand why storing grain at the correct moisture content is important
- Understand what a hygrometer is and how it is used to measure moisture content (MC)
- Know how to read a moisture table to convert relative humidity (RH) to moisture content

Activities

Using the Hygrometer

The facilitator will take the trainees through an example of using the hygrometer. This training should be done with maize of two different moisture levels (too wet, and dry maize) to allow trainees to see the difference. Follow the steps outlined below to properly teach participants how to use the hygrometer.

1. Teach trainees how to obtain a representative sample of the maize.
2. Place maize sample and hygrometer into a small sealable plastic bag, or into a hygrometer jar depending on the hygrometer available. Seal the plastic bag or jar.
3. Wait 15 -30 minutes to allow relative humidity to equilibrate.
4. Read the relative humidity measurement on the hygrometer.
5. Teach trainees how to use the hygrometer reading and the moisture table to calculate moisture content.

Moisture Management

Moisture Content



Grain Moisture Content (MC)

The amount of water inside a kernel



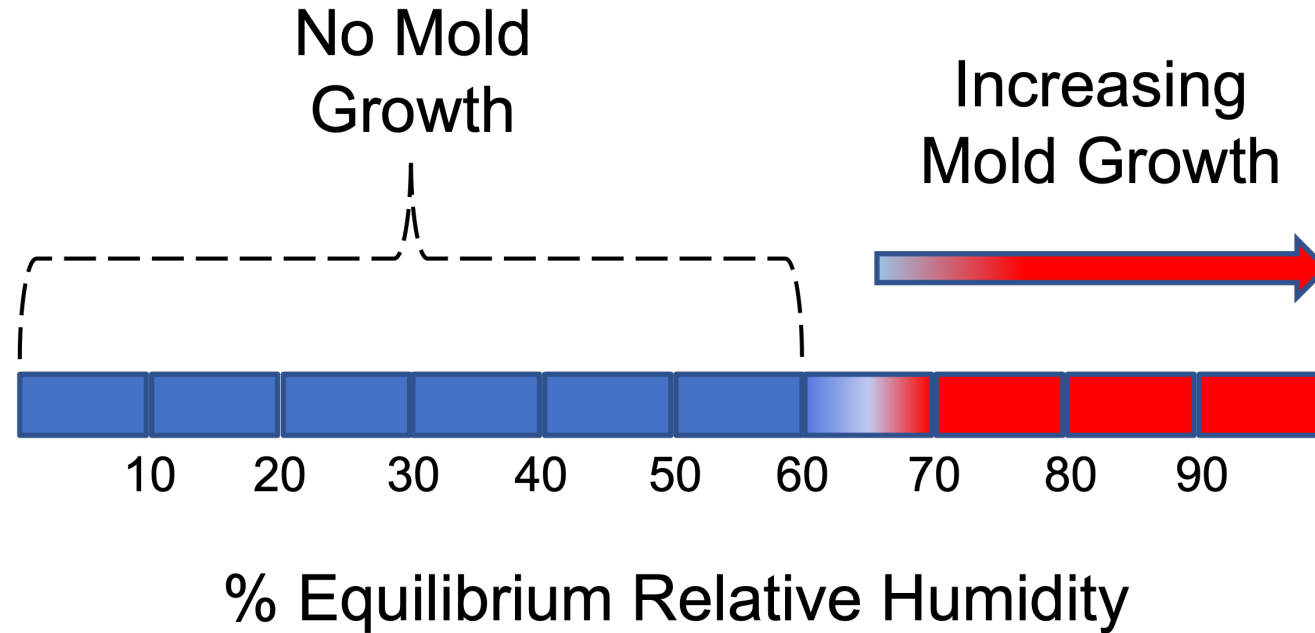
20% MC = 20 KG of water

14% MC = 14 KG of water

Motivation: why are moisture meters important?

- Grain stored in wet conditions allows mold to grow. Food safety risk.
- Economic issues:
 - Moisture not fully observable without meter
 - Kenyan cereal board (NCPB) purchases only if moisture content is below 13%
- Moisture meters, used in developed world are expensive (> US \$150)
 - Unattainable and unavailable for most smallholders and small-scale traders





65% is best for storage



Measurement of Grain Moisture with Hygrometer



- Place handful of maize in small sealable bag with hygrometer.
- Push air out and seal bag.
- Place bag in shaded area.



Read relative humidity after 15-30 minutes.

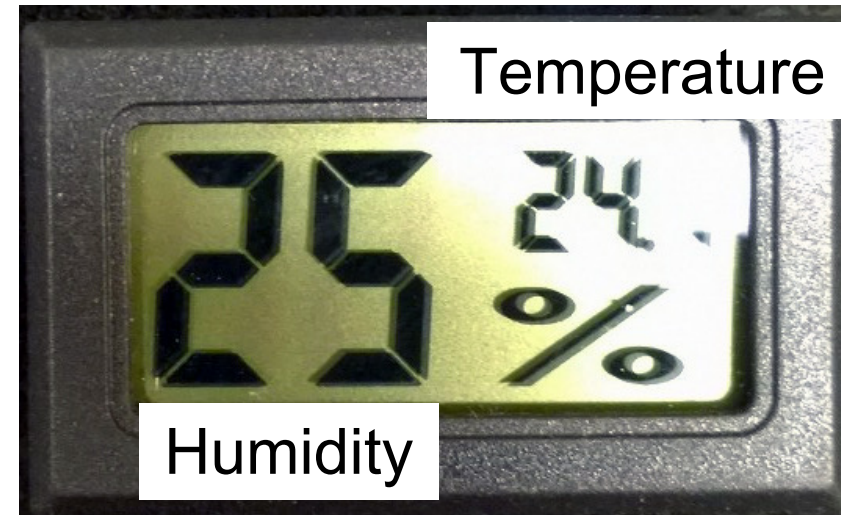
If above 65%, Too Wet

OR

If below 65%,
good for storage

OR

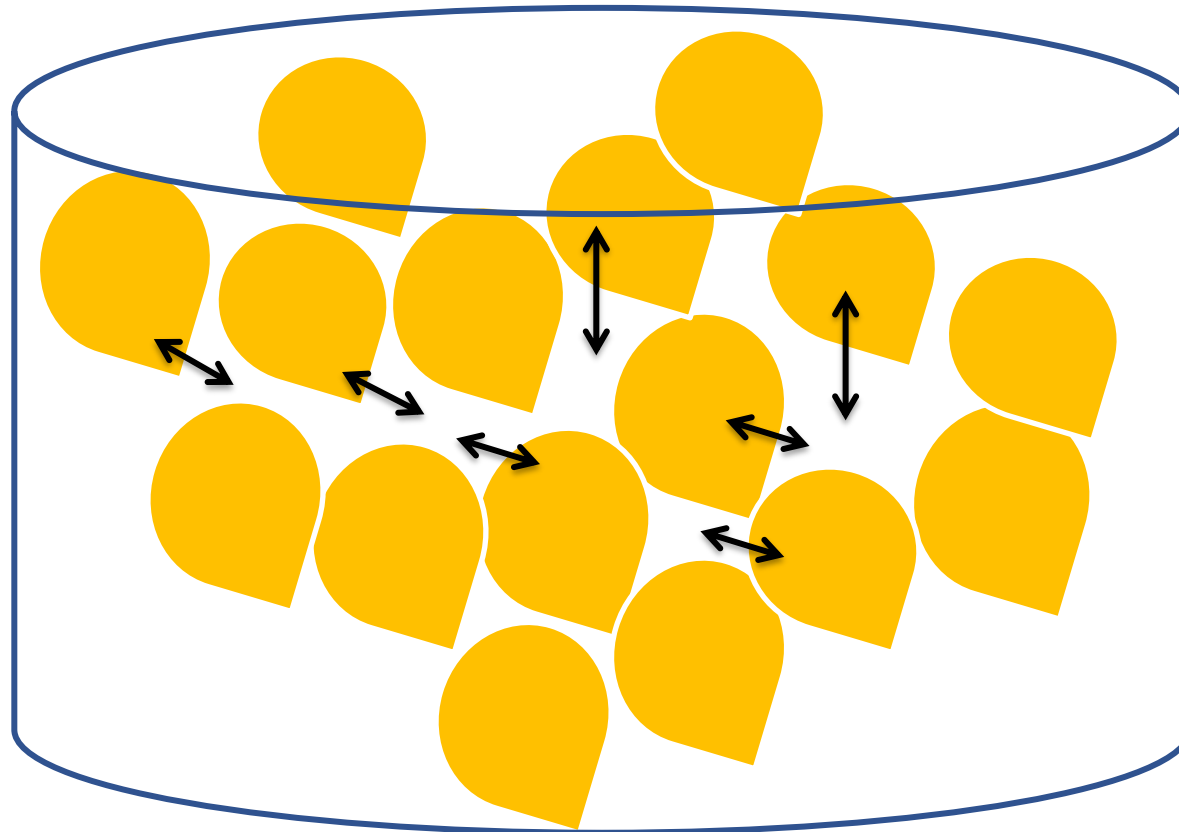
If below 60%,
good for market



Temperature

Humidity

Equilibrium Moisture Content Equilibrium Relative Humidity

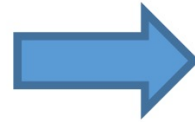


Water in grain
equilibrates
with the air
between kernel

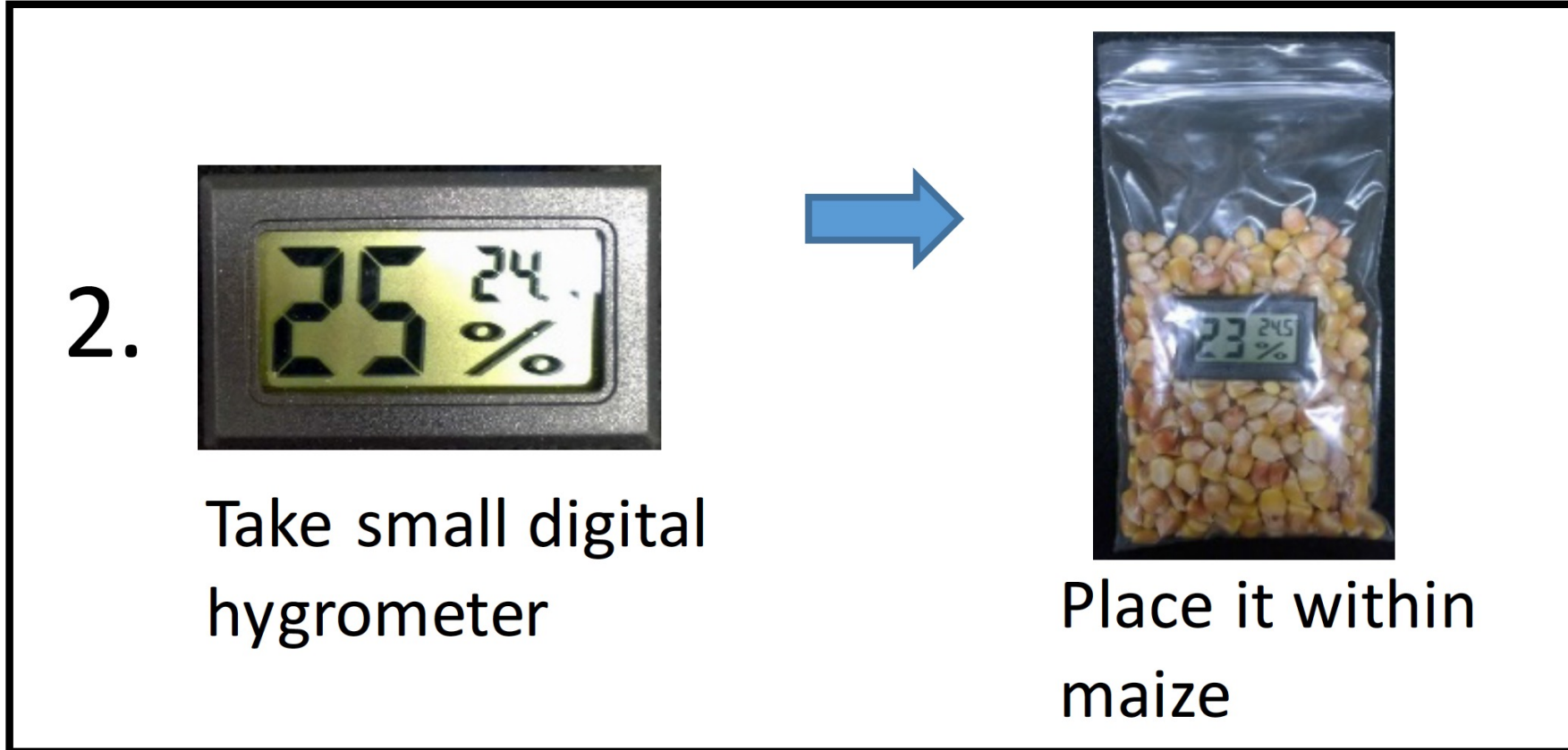
1.



Take a large handful of maize

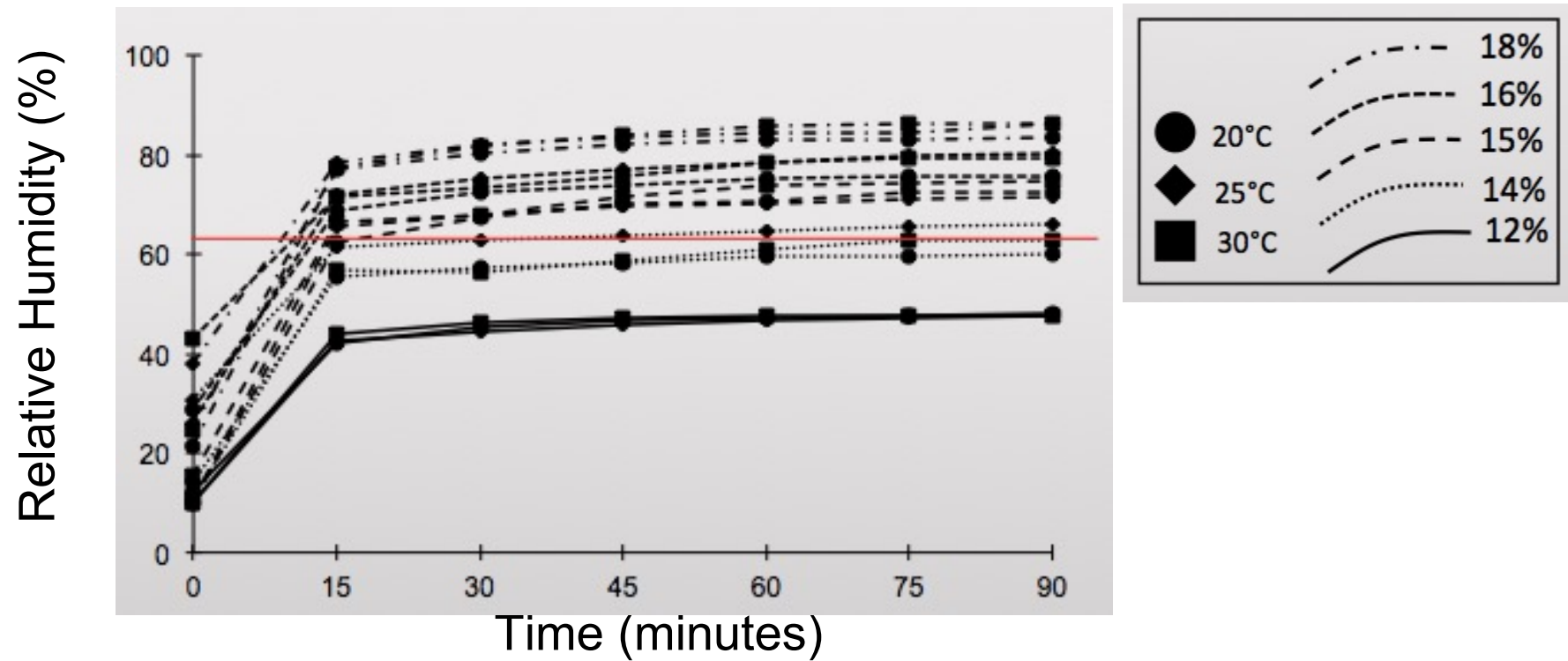


Place in small sealable bag



Push air out and seal bag
Place bag in shaded area

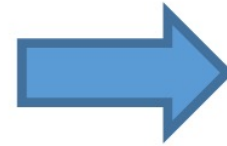
Equilibrium takes about 15 -30 minutes



3.



Read relative humidity after 15-30 minutes



If above 65%, Too Wet

Or

If below 65%, good for storage

Or

If below 60%, good for market

Moisture Table for Maize

		Relative Humidity (%)						
		50	55	60	65	70	75	80
Temperature (C)	15	11.9	12.6	13.3	14.1	14.9	15.8	16.8
	18	11.6	12.3	13.0	14.6		15.5	16.6
	21	11.4	12.0	12.8	13.5	14.3	15.3	16.3
	24	11.1	11.8	12.5	13.3	14.1	15.0	16.1
	27	10.8	11.5	12.3	13.0	13.9	14.8	15.9
	30					13.6	14.6	15.6
	33	10.4	11.1	11.8	12.6	13.4	14.4	15.4
	36	10.2	10.9	11.6	12.4	13.2	14.2	15.2

Module 3: Hermetic Storage (PICS Bags)

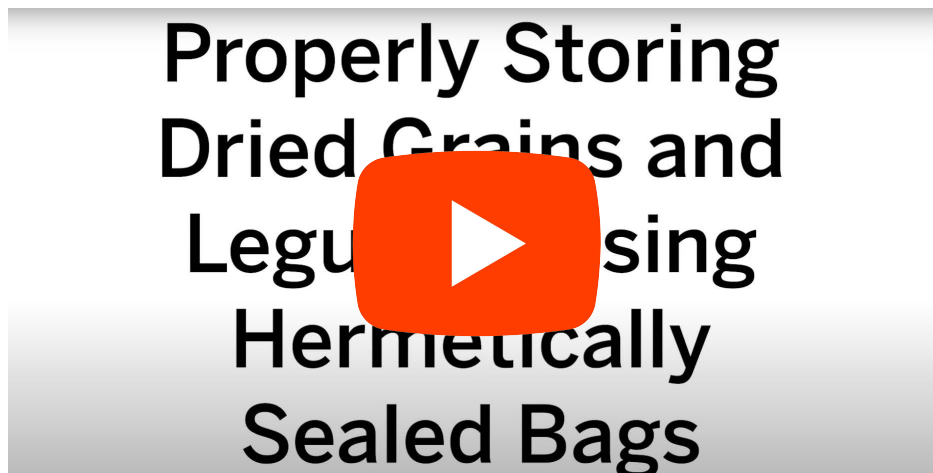
Module Overview

The Purdue Improved Crop Storage (PICS) Bags or hermetic storage bags are an important tool for improving the storage and preservation of grains. The triple layer plastic bag makes an airtight barrier which helps to prevent spoilage and insect infestation. This module will explain hermetic storage, why hermetic storage is important and how to properly use a PICS Bag.

Learning Objectives

- Understand what hermetic storage means
- Understand the benefits of hermetic storage
- Learn how to properly use a PICS Bag

Video



Activity

Using a PICS Bag

The facilitator will take the trainees through an example of using the PICS Bags. The training should have empty PICS Bags for the participants and have several filled bags to be used to show how to properly use the bag. Follow the steps outlined below to properly teach participants how to use the PICS Bags.

1. Show all participants an empty PICS Bag. Allow them to investigate the bag.
2. Break the participants into equal number of groups to practice closing the filled PICS Bags.
3. Teach the participants how to properly inspect the PICS Bags (grain quality, bag quality, tying ropes).
4. Practice closing the inner plastic layer, ensuring all participants understand how to make an airtight seal.
5. Practice tying off the outer layer.

Hermetic bags technology

- Problem: Insects damage stored grains leading to quality loss
- Excessive use of chemicals in storage of grains are linked to many causes of diseases
- Use of hermetic storage bags is presently recommended during storage
- Many brands in the market; PICS, AgroZ, Zero-fly, Elites etc
- It has many benefits
- It reduces aflatoxin risks during storage



Threats to grains during storage

1. Weevil



2. Grain Borer



3. Rats



4. Grain mold



5. Pets & others



Impacts

- Loss of grain
- Reduces farmers profits
- Household food security & Safety (Big 4 Agenda)

Hermetic storage (PICS) Solution

- Triple-layer bags that protect grain from insect damage without using chemicals
- The bags (PICS) have the potential to increase incomes, improve food security, and maintain food/seed/grain quality



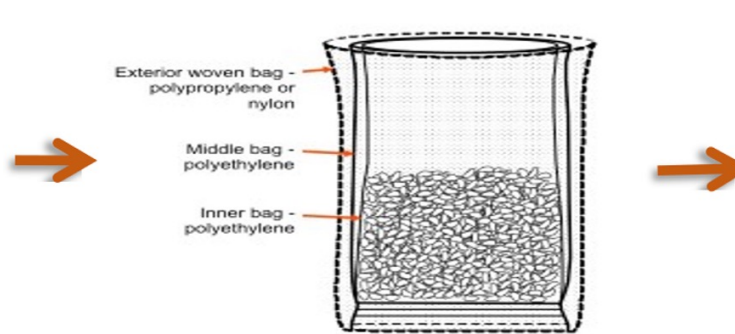
Use of hermetic bags

Key issues of consideration and procedures

- Inspection (Grains quality, bag (liners, damages), tying ropes, storage chemicals)
- How to safely close and uncloose
- Requirements for safe storage of hermetic bags (handling, warehouse)
- How to access grains in the hermetic bag for use



Hermetic (PICS) bags vs. traditional technology



Courtesy: Murdock et al., 2014

Economics for maize storage

- PICS bag costs ≈ \$2.50 for 100 kilogram
- Losses close to zero if used properly
- Preserves quality grain for sale later in year (hopefully at higher prices).
- Can use for 2-3 seasons

Economics for maize storage

- Regular bag costs ≈ \$0.50 for 100 kilogram
- No insect protection (7%, \$2.80 loss)
- Insecticides cost ≈ \$0.50 per application, apply 2 -3 times per year + labor
- Use for one season

⁵ PICS bag breaks even in one to two seasons for maize. Sooner for higher value crops. Plus health benefits.