IOWA STATE UNIVERSITY
Department of Agricultural and Biosystems Engineering

Periodic Physical Disturbance: An Alternative Method for Controlling Insect Infestation During Storage

Tanzania Post-harvest Management Platform (TPMP) Post-harvest Management Conference:

"Reducing post-harvest losses for food security and industrialization"

Ministry of Agriculture

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Embassy of Switzerland to Tanzania and Zambia

Swiss Agency for Development and Cooperation SDC

HELVETAS Swiss Intercooperation TANZANI

ANSAF Agricultural Non State Actors Forum

UDSM-Department of Agricultural Economics and Business

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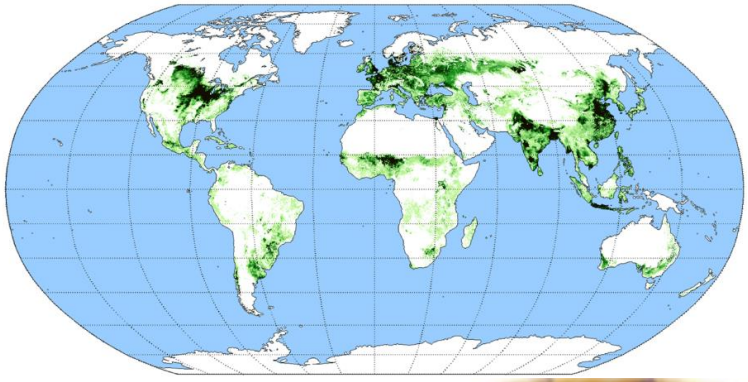
Outline

- Introduction
- Objective
- Study area & sampling
- Materials and methods
- Results and discussion
- Conclusions

Introduction



Global forecast 2016/17

Maize	Wheat	Rice
↑	↓	↑
993*	717*	495*

*Million metric tons

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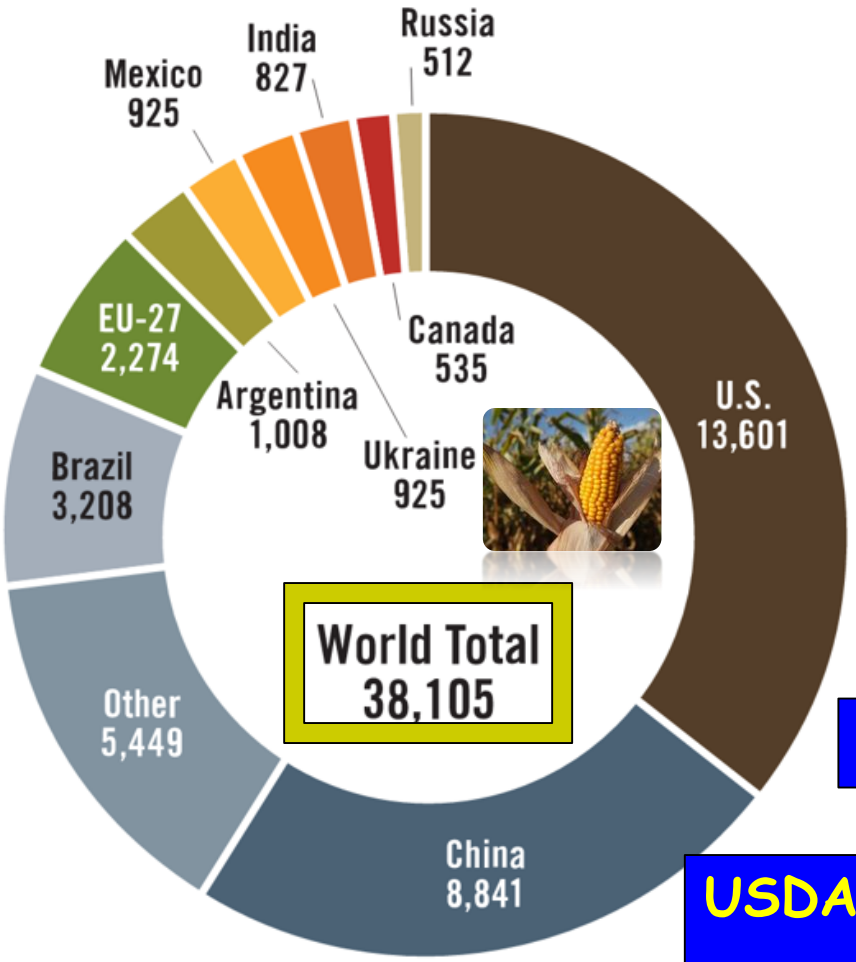
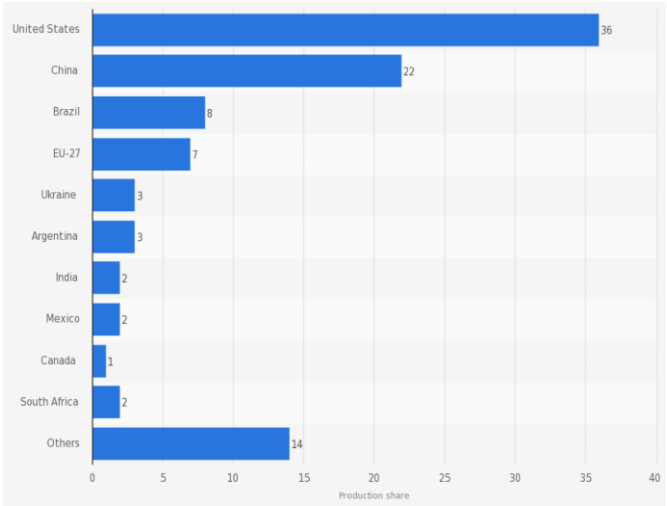
Source: FAO Cereal supply & demand, 2016 ; USDA, 2015; IGC, 2016

Introduction

- Maize (corn) is the third most important cereal in the world



World Maize Production (2015- 2016)

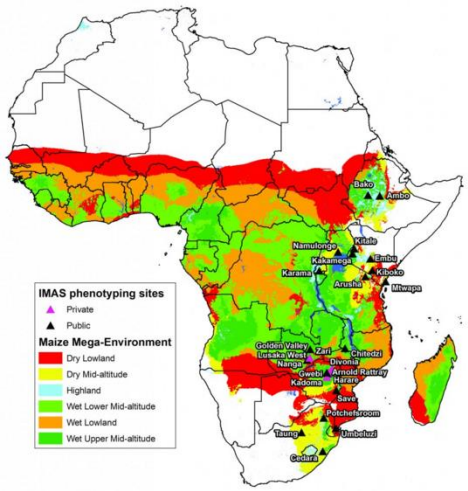


Million bushels*

USDA, FAS Grain (2016)

*1 bu= 25.40kg

Introduction



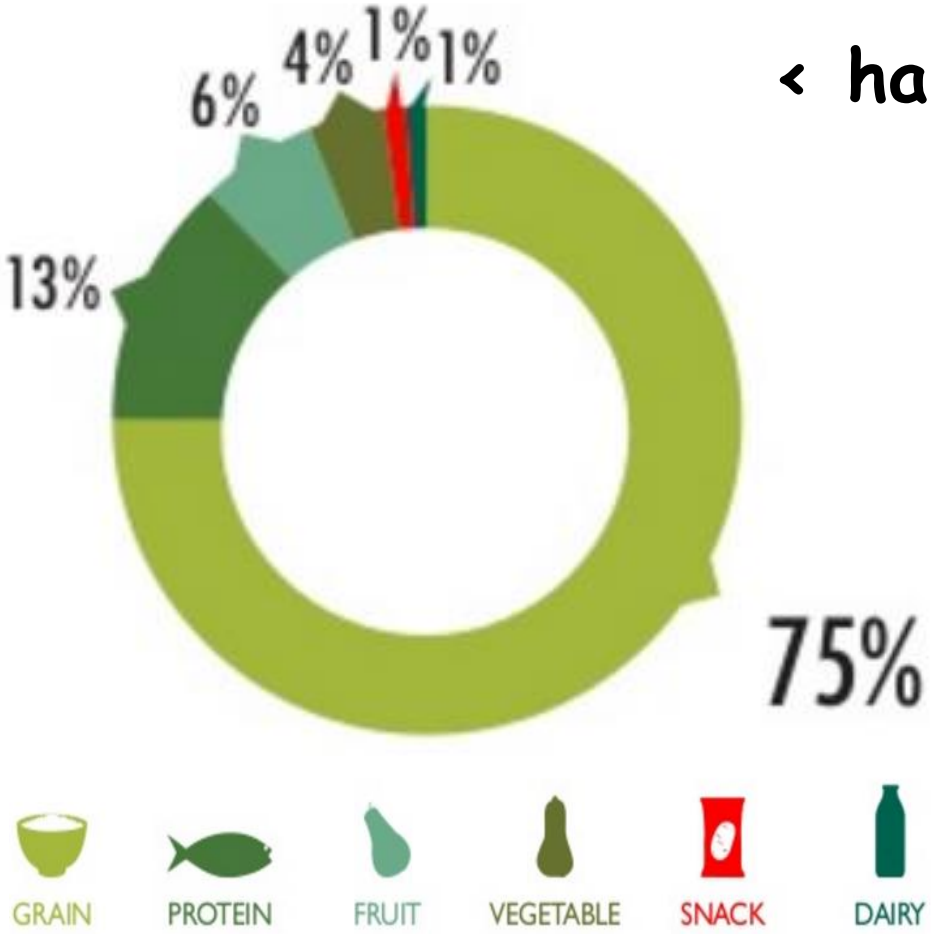
> One billion

People in SSA*

(IITA, 2009)

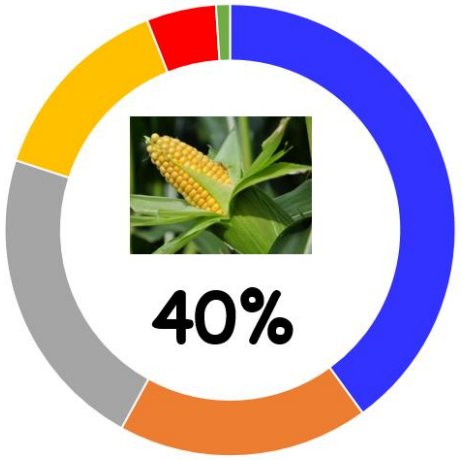
*Sub-Saharan Africa (SSA)

Introduction



Macauley (2015)

< half of the calories in SSA



FAOSTAT, 2015

Maize Millet Sorghum Rice Wheat Barley

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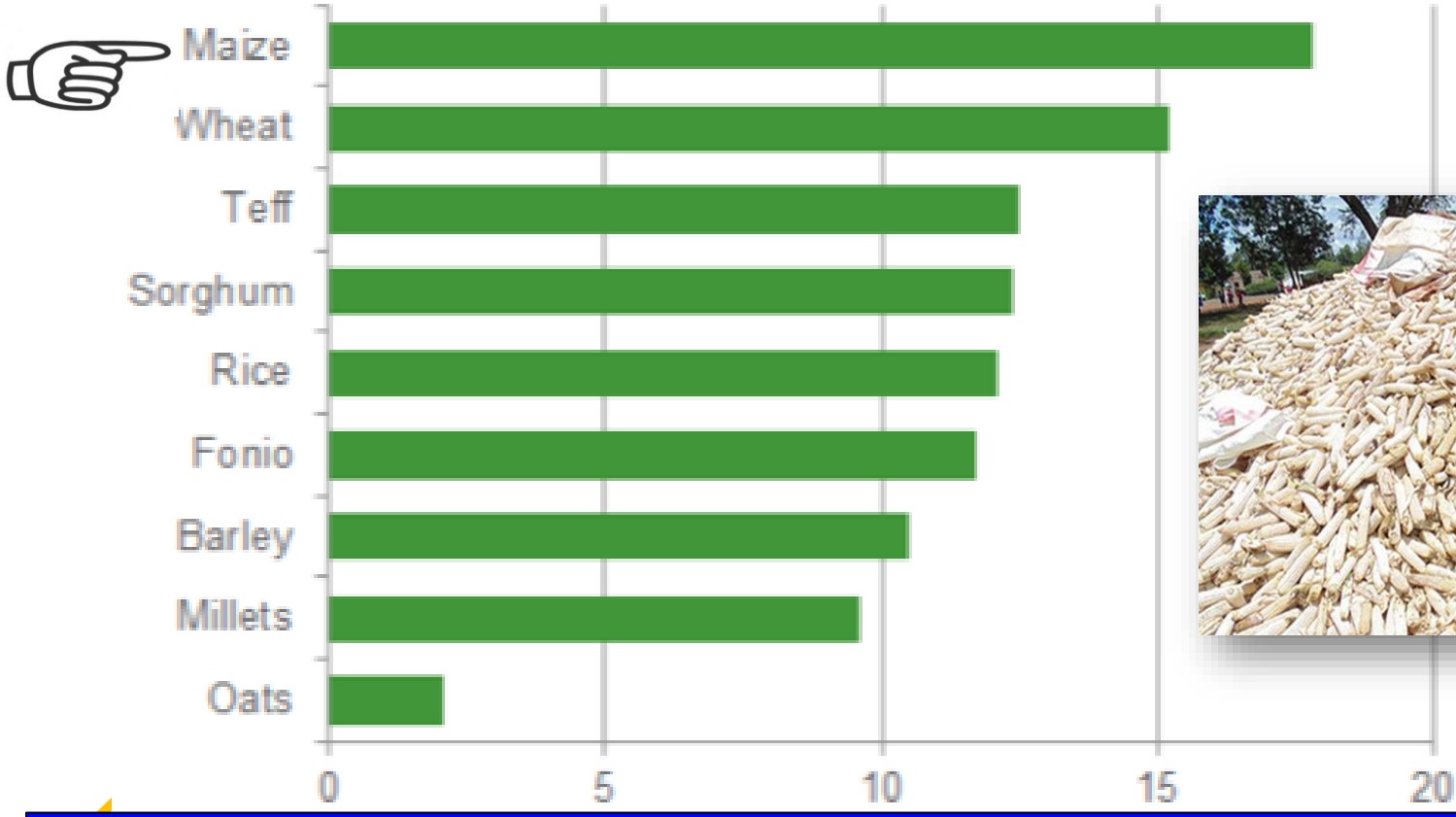
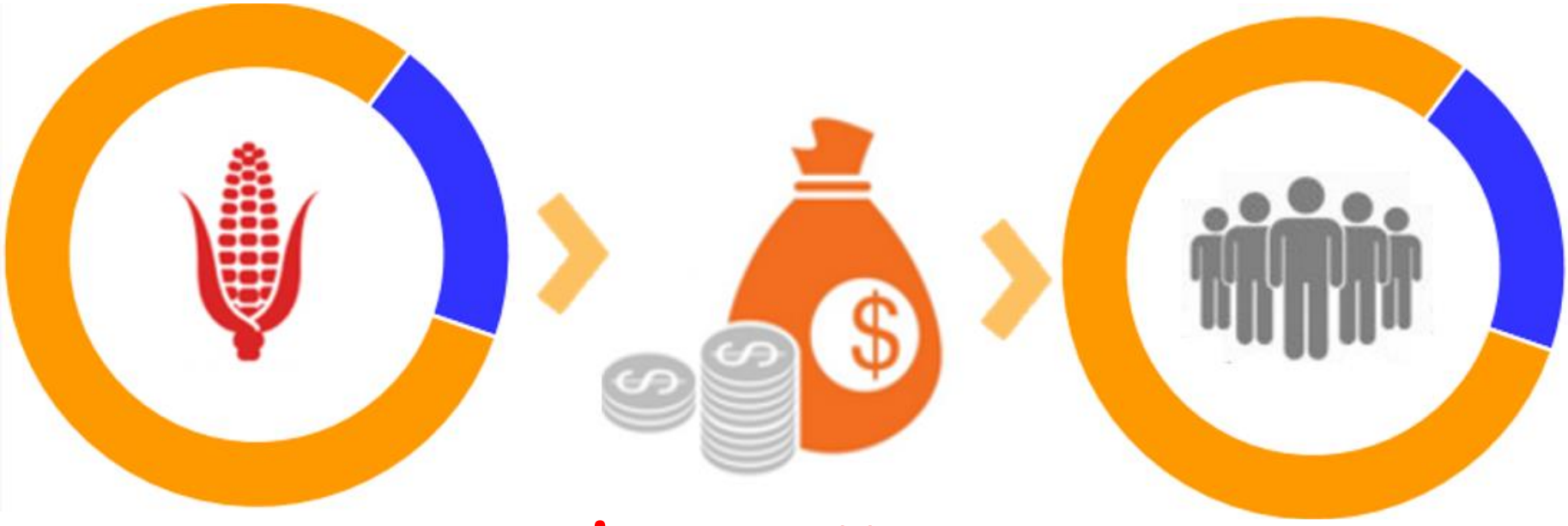
Introduction

- Postharvest losses (PHL) of maize –in SSA are very high – 5- 20% (*APHLIS, 2013)



*APHLIS (African Postharvest Losses Information System) - 2013

Introduction



20% $4 billion >20 million

THE WORLD BANK

LABORATORY

Natural Resources Institute

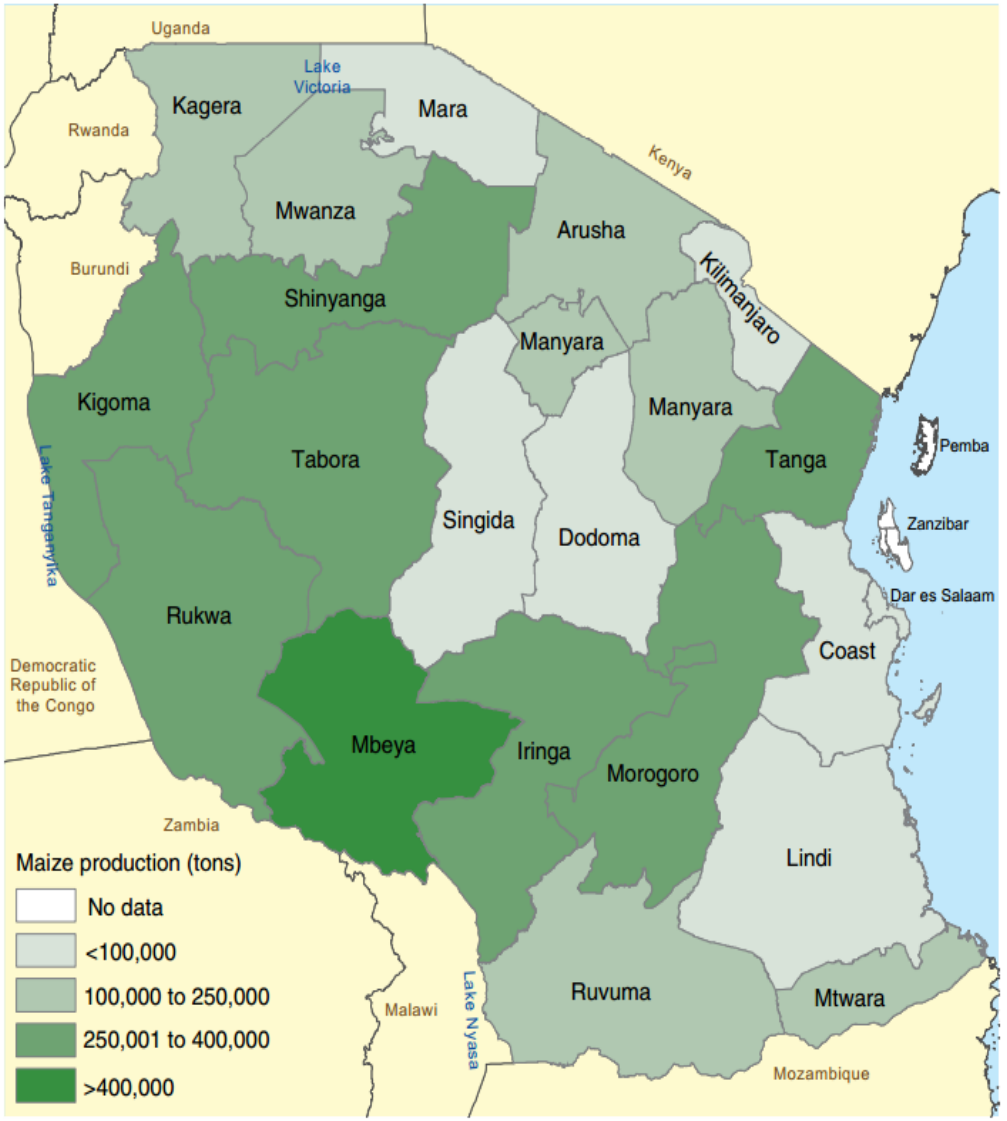
Introduction

- Tanzania is a major maize producer - E/Africa
- Cultivated area - > 4.9 million ha (45%)
- A national average yield 1.0 - 1.5 t/ha
- Current postharvest losses of maize ≈ *9%

*APHLIS- African Postharvest Losses Information systems (2016)

Introduction

- It is grown in all regions
- **Over 85% by smallholder farmers**
- It is grown as staple food and cash crop



Maize production area in Tanzania (Cochrane & D'Souza, 2015).

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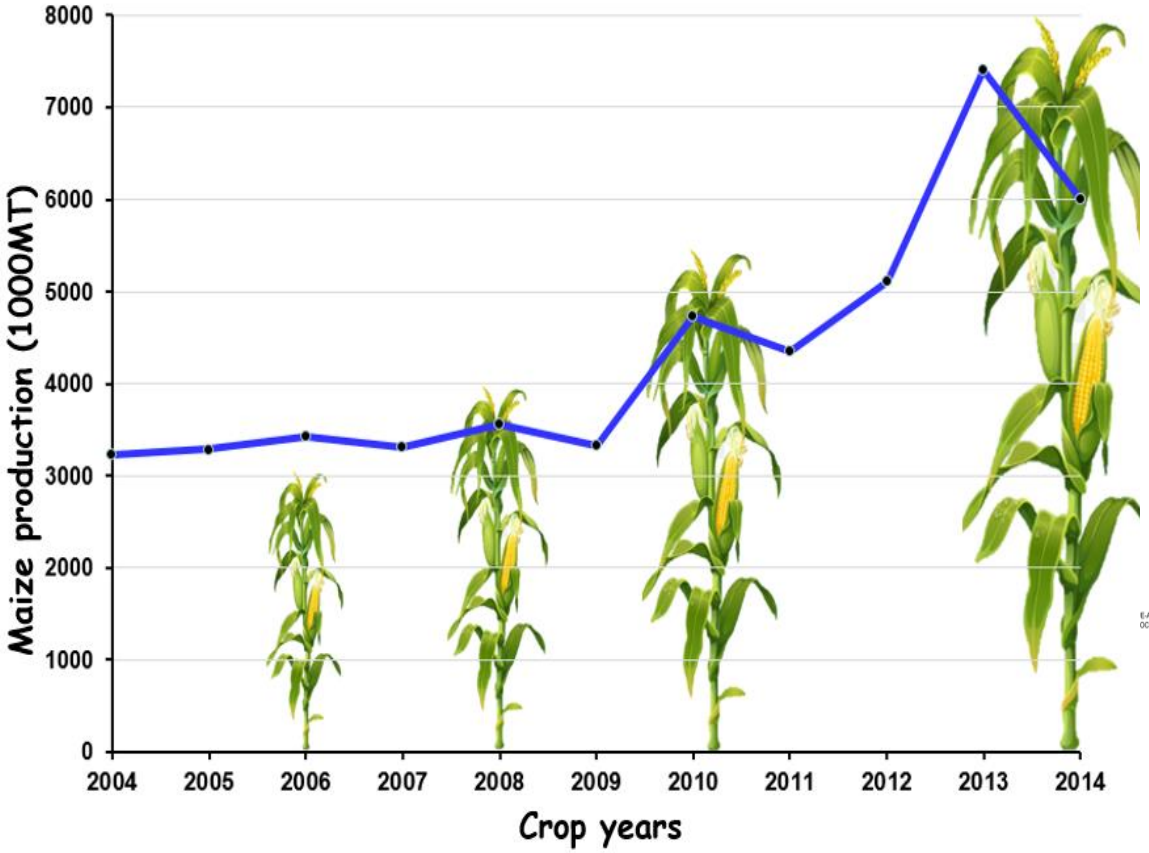
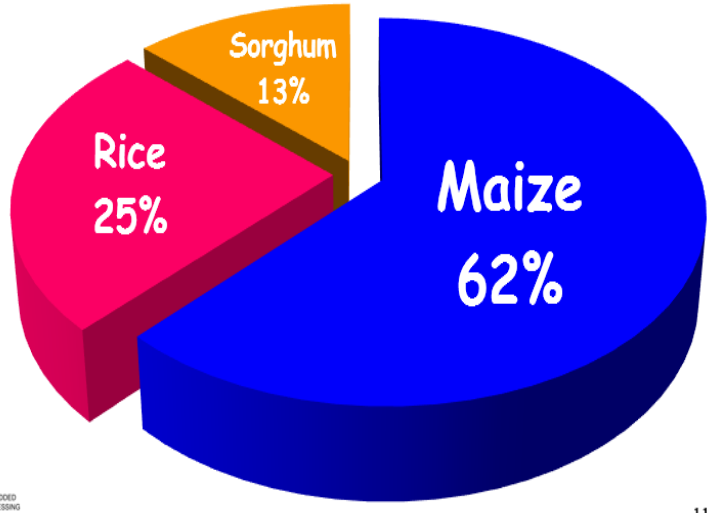
Introduction

Maize production in Tanzania (2004-2014)





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Introduction

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Insects infestation

Poor postharvest handling

Poor storage structures

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Introduction

- Most important insect pests of stored products (maize) in SSA

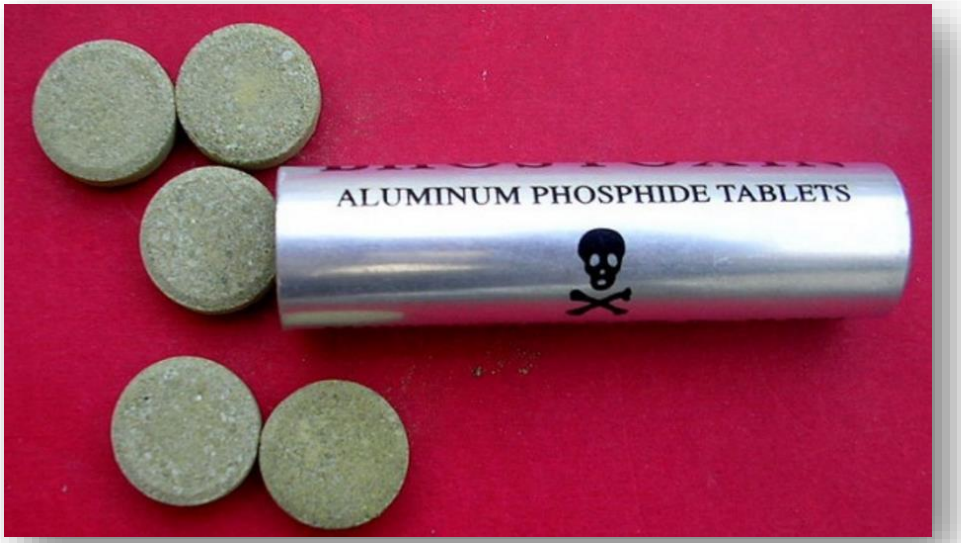
  - ***Sitophilus zeamais***
    (maize weevil)

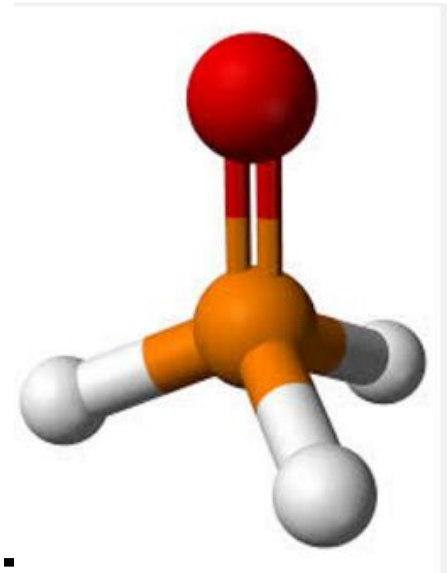
  - *Prostephanus truncatus*
    larger grain borer (Scania)

Introduction

- Chemical insecticides are commonly used to control insect pests of stored products

  - phosphine

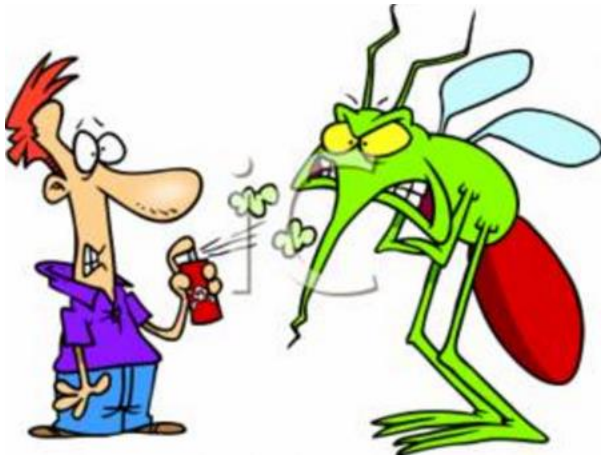




$$AlP + 3H_2O \text{ ------> } PH_3 + Al(OH)_3$$

Introduction

- Synthetic insecticides have resulted – numbers of drawbacks



- Insect resistant
- chemical residues in foodstuffs
- health consequences to human & animals

Introduction

Physical control methods

- Alternative methods to **prevent** & **control** stored product pests
  - based on the application of some kind of force
  - creates unfavorable conditions to pests
- It includes method like
  - heat, cold, inert gas,
  - **impact or physical disturbance** (Bbosa et al., 2014)

Objective

- The objective was to determine the practicability of **periodic physical disturbance** on ***S. zeamais***, the maize weevil **mortality** by substance farmers in developing countries

Study area & sampling

Gallapo-village

- Two women
- One man

Ikowa -village

- All women

Mambwerembwere

- One women
- Two man

Population: 19,5

Total farmers = nine (9)

ation: 7,155

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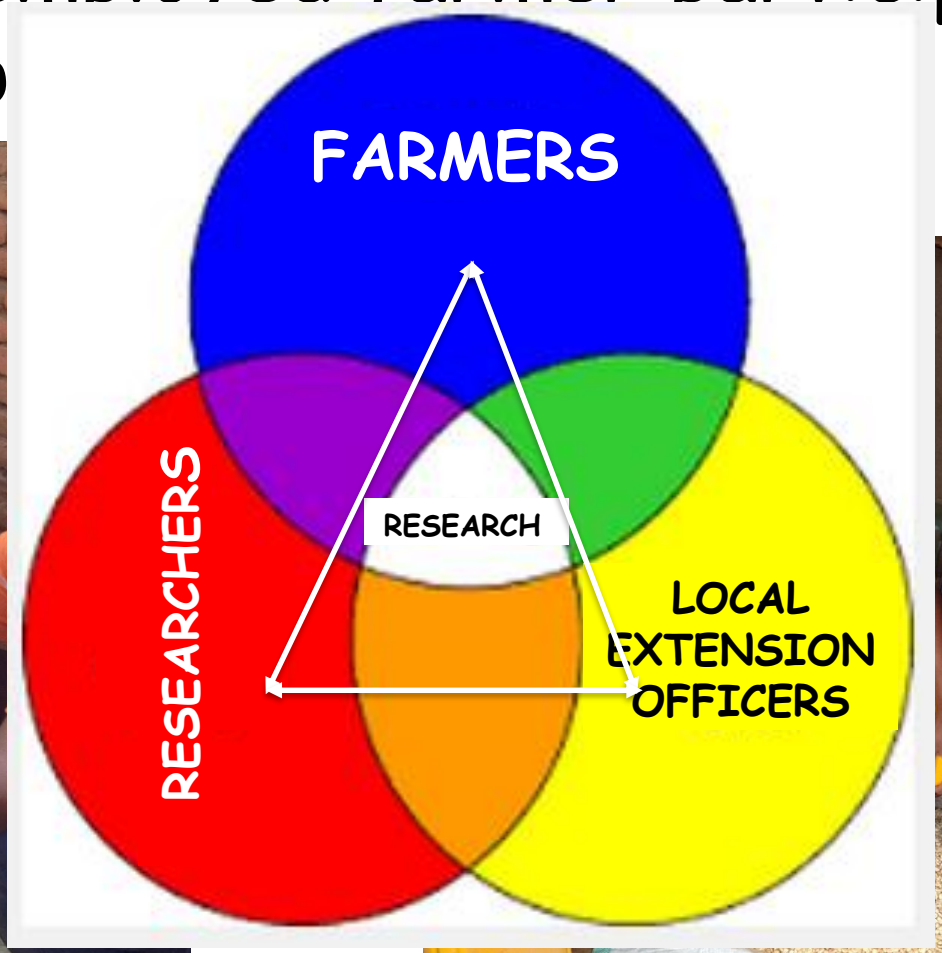
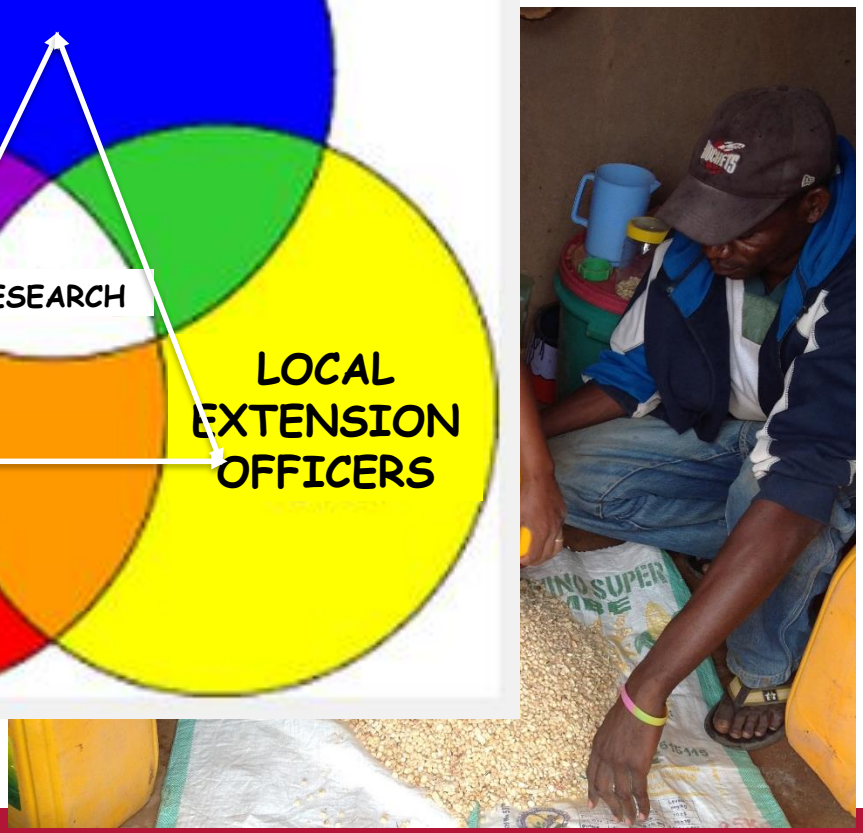
Materials & methods

- The study employed farmer participatory research ap





Materials & methods

- Each farmer was given 12 plastic containers
  - Manyara region – 3 x12 = 36
  - Dodoma region – 3 x 12 = 36
  - Morogoro region – 3 x 12 = 36
  - **Total treatments = 108**

Experiment setup

- Three storage time
  30, 60, & 90 days

- Two treatment
  - turning
  - control

- Three replications

Experiment setup

- A10 kg of fresh white dent corn & 0.50 kg of maize infested with *S. zeamais*
- **Initial & final numbers** of *S. zeamais* was determined
- Turning treatments- **disturbed twice a day** (early in the morning and late in the evening)

Experiment setup

Control/stationary	Turning/ tumbling treatments			Storage time (d)
C_1	T_1	T_2	T_3	30
C_2	T_4	T_5	T_6	60
C_3	T_7	T_8	T_9	90

Experiment setup

- Controls - were **not disturbed or untouched** until the end of storage.

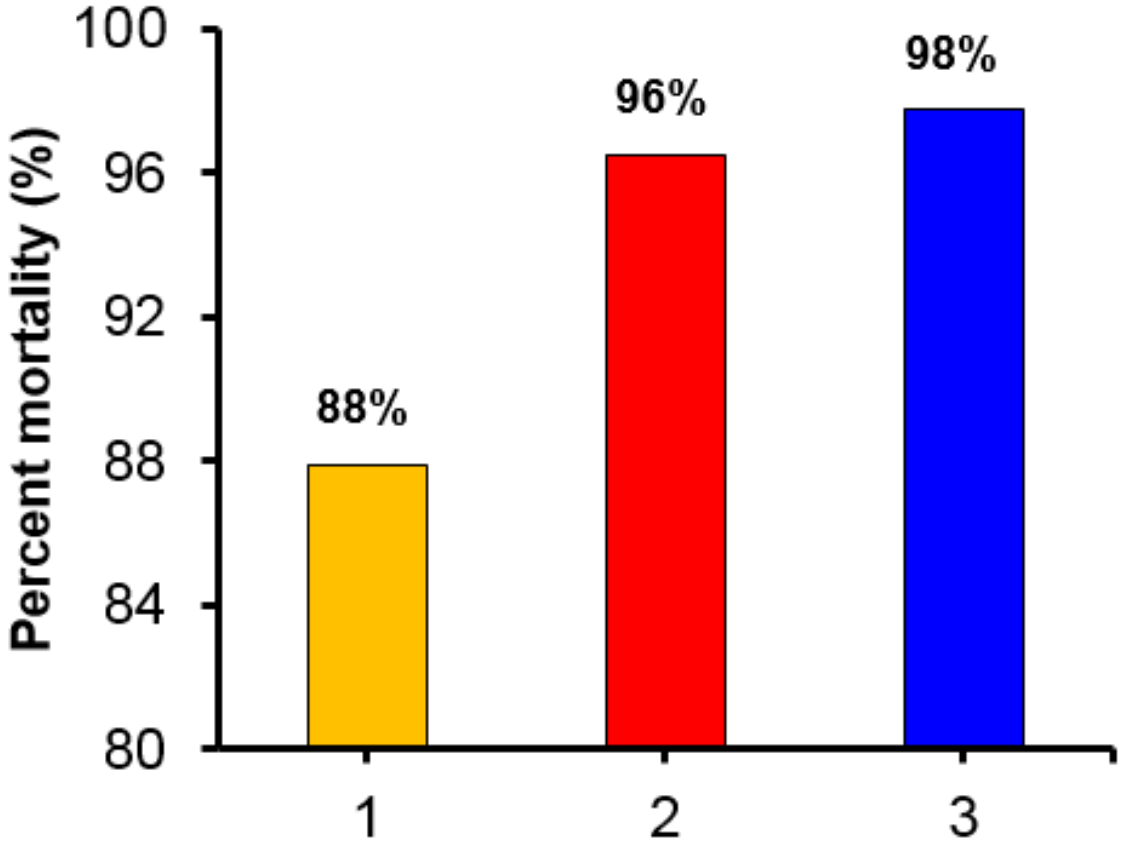
- **Percent mortality** was calculated by

$$\% \text{ Mortality} = \frac{\text{Number of dead insects}}{\text{Total number of insects}} \times 100$$

- Data were analyzed using SAS (version 9.4)

Results & discussion

- The overall percent mortality after 30, 60 & 90 days of storage were 88%, 96%,& 98%



Results & discussion

- Number of live *S. zeamais*

Storage time (days)	Control (Stationary)		Turning treatments	
	Dodoma	Manyara	Dodoma	Manyara
30	20 ± 8.33^{c}	12 ± 4.00^{c}	10 ± 2.31^{a}	3 ± 0.89^{a}
60	68 ± 31.24^{b}	77 ± 44.06^{b}	2 ± 1.39^{b}	0 ± 00^{b}
90	109 ± 22.03^{a}	152 ± 35.73^{a}	0 ± 00^{b}	0 ± 00^{b}

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Conclusions

- The study determined the practicability of periodic physical disturbance

- The study **shows potential** of physical disturbance
  - **feasible & effective**
  - **simple, affordable & safe**

- Can eliminate chemical contamination of maize

thank you!

Questions?