



Kichawi Kill, a new biological herbicide in Kenya

Peter Lüth
Toothpick Company Ltd.

Striga hermonthica on Maize and Sorghum



The nice lilac blooming plants cause high yield losses!

Striga hermonthica on Maize and Sorghum



Control of Striga using *Fusarium oxysporum*

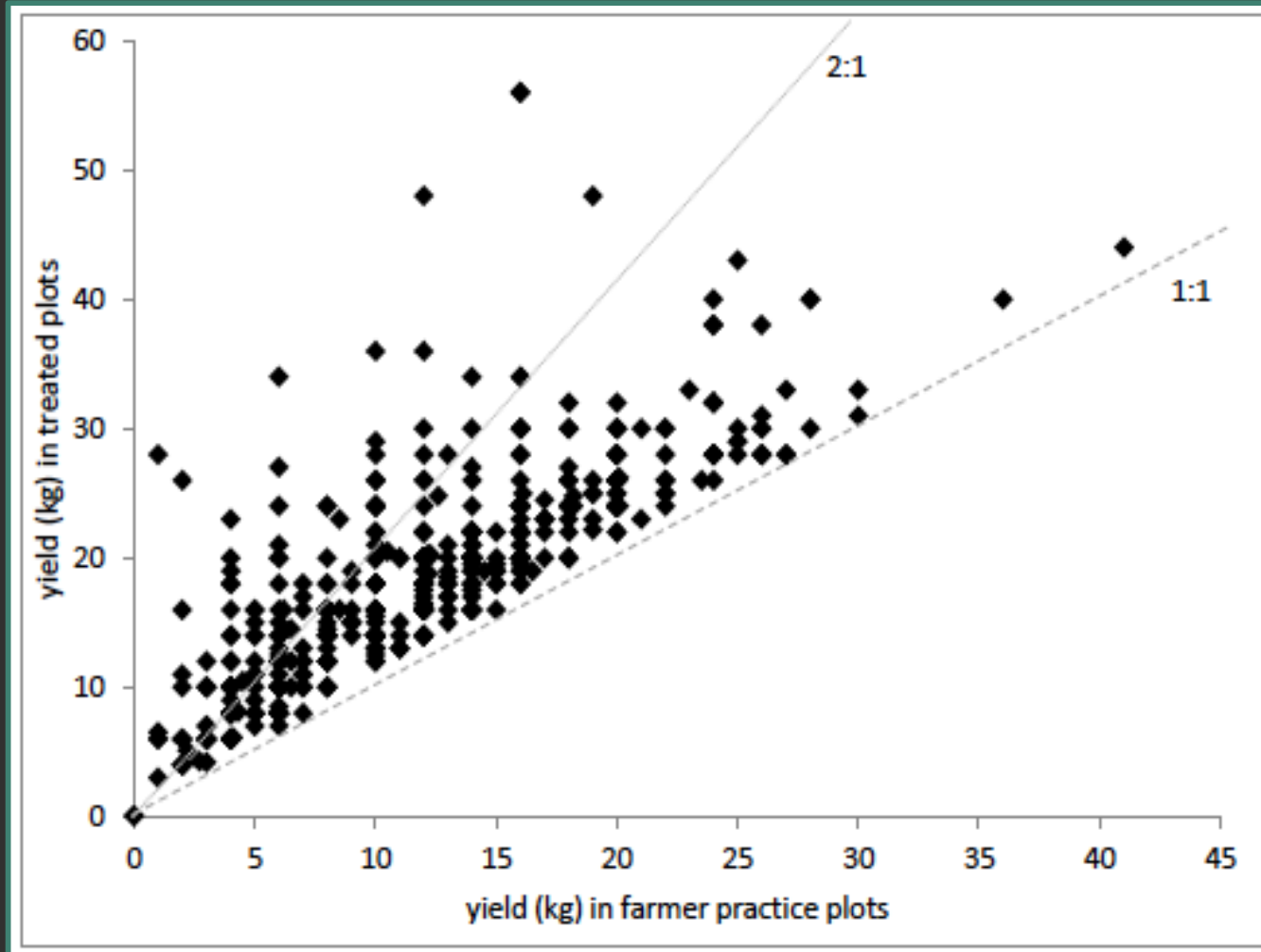


Farmers are putting *F. oxysporum* infested rice into the planting holes.

Field trial results

Yield of maize on 500 trial locations either treated or not treated with Foxy 2014 (long) season

Treated with Foxy T14



Not treated with Foxy T14



On any location above this line = greater yield in the treated plot

Average yield increase: 56.5%

Reason for the success

→ The special *Fusarium oxysporum* strain used

→ It does not only attack *Striga hermonthica*.

→ It has particularly selected to also excrete high amounts of amino acids into the soil. The amino acids are working additionally as a herbicide.

The Toothpick Company

Foundation of the Toothpick Company took place on November 16th, 2017

Shareholder

- Prof. David Sands
- German Foundation Welthungerhilfe
- Claire Baker
- Peter Lüth
- Winifred Ohrstrom Nichols
- Florence Oyosi (LIN)

Managing Director

- Newton Kisala



The Toothpick Company

Objective of our work in Kenya

Building up a sustainable system of

- Financing
- Producing, and
- Distribution of the product “Kichawi Kill”

Way to reach the objectives

- Getting the registration
- . . .
- . . .

GEP Trial (Fanon Company Ltd.) Long Season 2018

Results of a GEP trial, yield as average of 3 locations
with 3 replications each (plot size 18.75 sqm)

Table 11: Effect of Kichawi Kill on grain yield and yield parameters

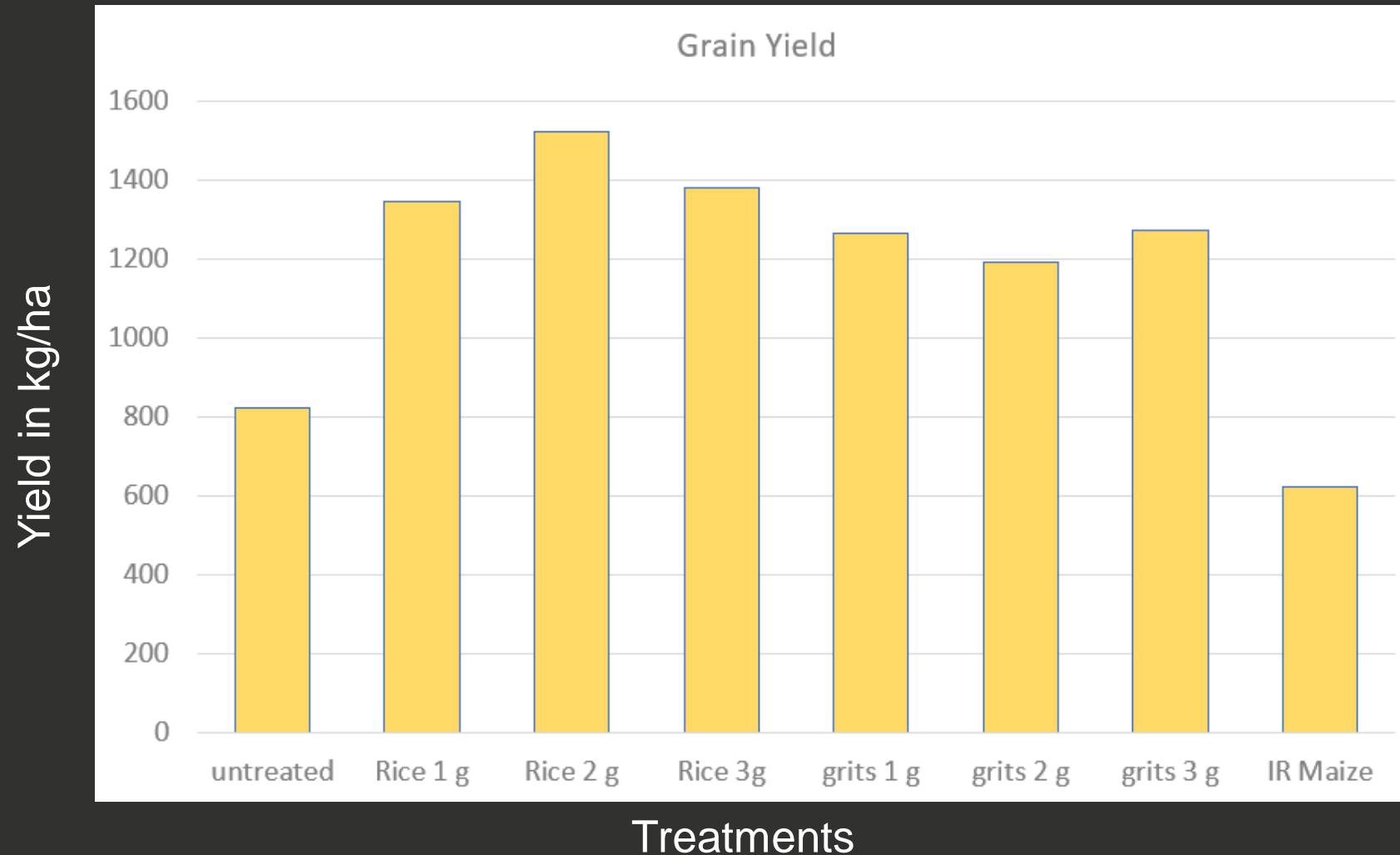
Treatment	Rate of Inoculum	Means			% Increase Over Control		
		No. of Harvested Cobs/Plot	Weight of Cobs/plot (g)	Grain Yield (Kg/ha)	No. of Harvested Ears/Plot	Weight of Cobs/plot	Grain Yield (Kg/ha)
Rice substrate	1.00g	34.00a	2232.00ab	5300.00cd	100.00	140.78	81.69
Rice substrate	2.00g	42.00a	4677.00a	12733.00a	147.06	404.53	336.51
Rice substrate	3.00g	41.33a	3882.00a	9317.00ab	143.12	318.77	219.40
Maize cob grit substrate	1.00g	42.33a	4377.00a	10761.00ab	149.00	372.17	268.91
Maize cob grit substrate	2.00g	35.33a	3870.00a	6506.00bc	107.82	317.48	123.04
Maize cob grit substrate	3.00g	35.67a	3162.00ab	6826.00bc	109.82	241.10	134.01
IR maize	-	36.33a	3252.00ab	7706.00ab	113.71	250.80	164.18
Untreated	-	17.00b	927.00b	2917.00d	-	-	-
C.V (%)		25.50	42.70	40.10	-	-	-
L.S.D (0.05)		15.86	2464.28	5447.53	-	-	-

Means within columns followed by the same letter are not significantly different (P<0.05)

IR maize = Imazapyr resistant

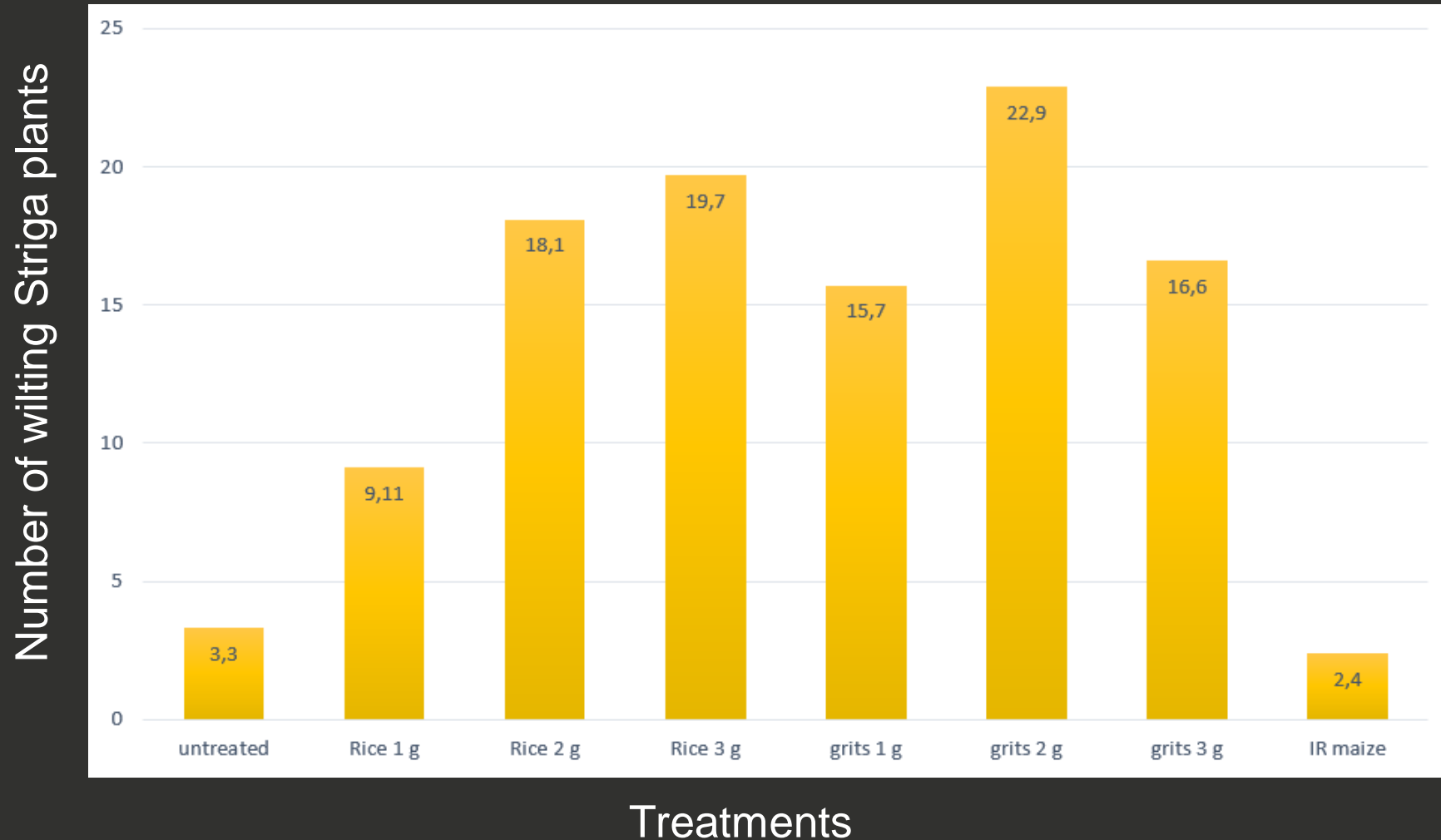
GEP Trial (SGS) Long Season 2019

Results of a GEP trial, yield as average of 3 locations with 3 replications each (plot size 18.75 sqm)



GEP Trial (SGS) Long Season 2019

Results of a GEP trial, number of wilting *Striga* plants per plot as average of 3 locations with 3 replications each (plot size 18.75 sqm)



Wilting Striga plants



Effect of the Kichawi Kill application

The Toothpick Company

Objective of our work in Kenya

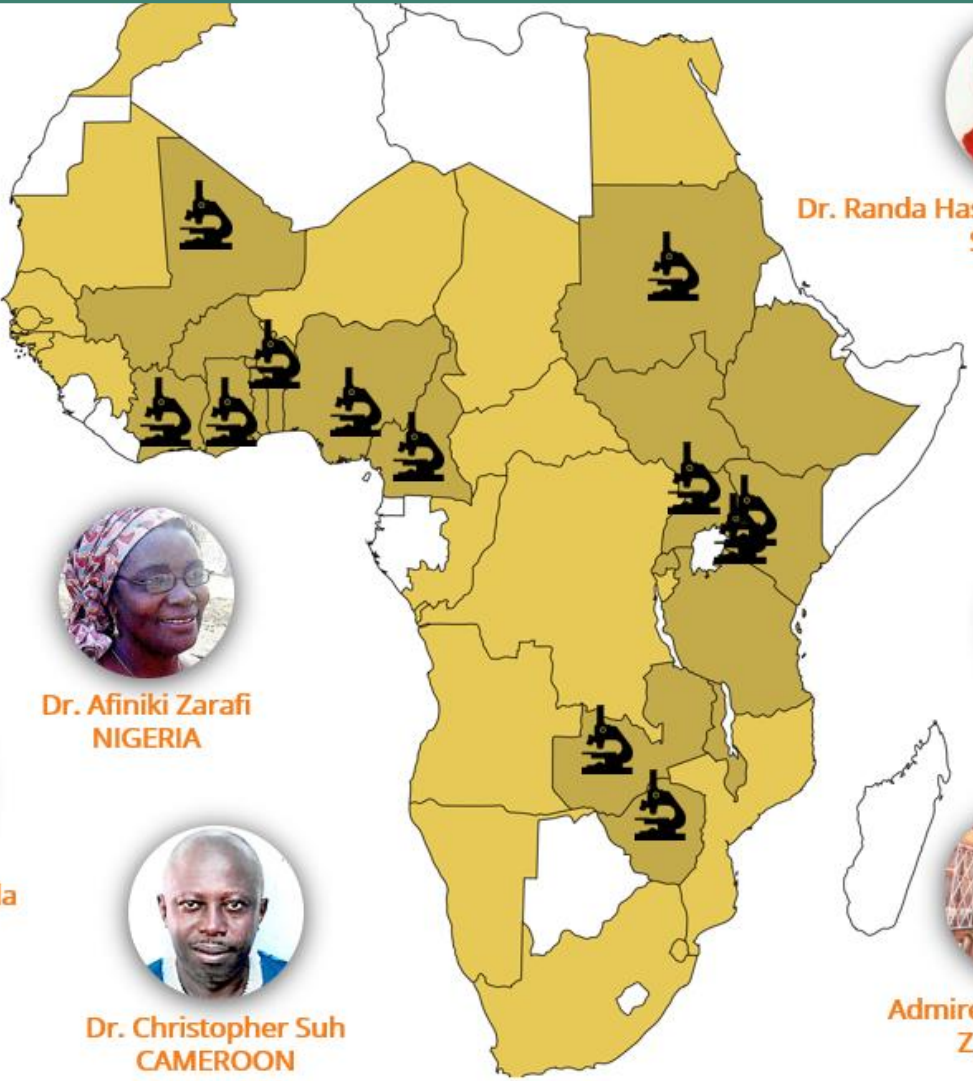
Building up a sustainable system of

- Financing
- Producing, and
- Distribution of the product “Kichawi Kill”

Way to reach the objectives

- Getting the registration (2021)
- Organizing of the inoculum production ✓
- Building up of a franchise system responsible for the production and distribution of “Kichawi Kill” → 52 producers
- Financing the producers (VIPs) ✓
- Organizing the extension work ???
- Exporting the successful system to other countries → 12

Exporting of the project to other countries



A map of the African continent is shown in a light yellow color, with black outlines of the countries. Several black microscope icons are placed on the map, indicating the locations where the project has been implemented or is being implemented. The icons are located in Mali, Cote d'Ivoire, Ghana, Benin, Cameroon, Nigeria, Sudan, Uganda, Zambia, Zimbabwe, and Tanzania.

Dr. Katile Seriba
MALI

Dr. Daouda Kone
COTE d'IVOIRE

Dr. Nelson Opoku
GHANA

Dr. Leonard Afouda
BENIN

Dr. Christopher Suh
CAMEROON

Dr. Afiniki Zarafi
NIGERIA

Dr. Randa Hassan Elsalahi Osman
SUDAN

Henry Sila Nzioki
KENYA

Dr. Julius Sserumaga
UGANDA

Dr. Suha Hassan Elhag
SUDAN

Dr. Juliet Akello
ZAMBIA

Rueben Mulamila
TANZANIA

Admire Shayanowako
ZIMBABWE

THE toothpick PROJECT

Wooden dowels to be used as a Fusarium inoculum

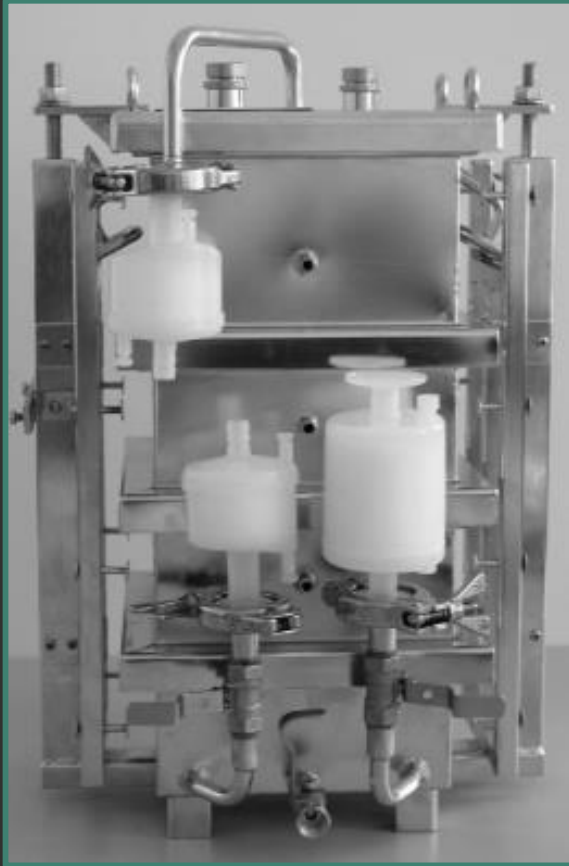


Wooden dowels used in the furniture industry



1,000,000 wooden dowels delivered to the KALRO lab

Wooden dowels to be used as a Fusarium inoculum



Solid-state fermenter donated
by Bayer CropScience Biologics GmbH



Fermenter filled with the wooden
dowels

Wooden dowels to be used as a *Fusarium* inoculum



Dowels after fermentation, covered with the mycelium of *Fusarium oxysporum*



Mycelium of *Fusarium oxysporum* growing from a wooden dowel pin

Inoculation bottle



Inoculation bottl

Inoculation bottle

How to manufacture the final product (Kichawi Kill)?



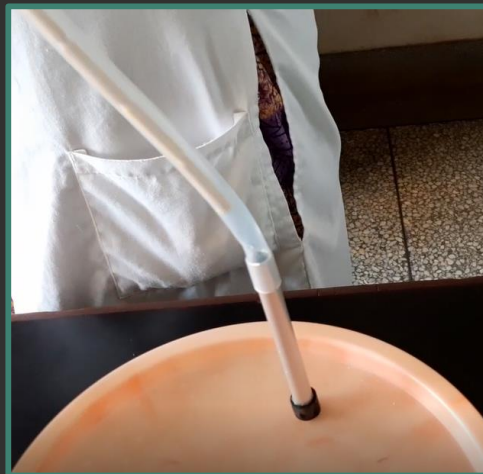
Cooking of the rice



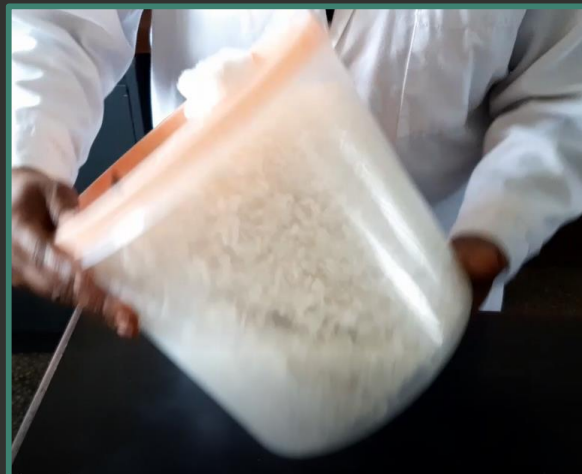
Cleaning of the bucket



Filling of the bucket



Inoculation



shaking of the bucket



Colour of the rice after 3 days

Control of Striga using *Fusarium oxysporum*



Farmers are putting *F. oxysporum* infested rice into the planting holes.

The Toothpick Spore Powder

- Very fine powder
- High spore concentration
- Very vigorous spores
- Spores germinate within one day
- Sufficient shelf life



Very vigorous Spores



Fusarium oxysporum colony after 24 hours

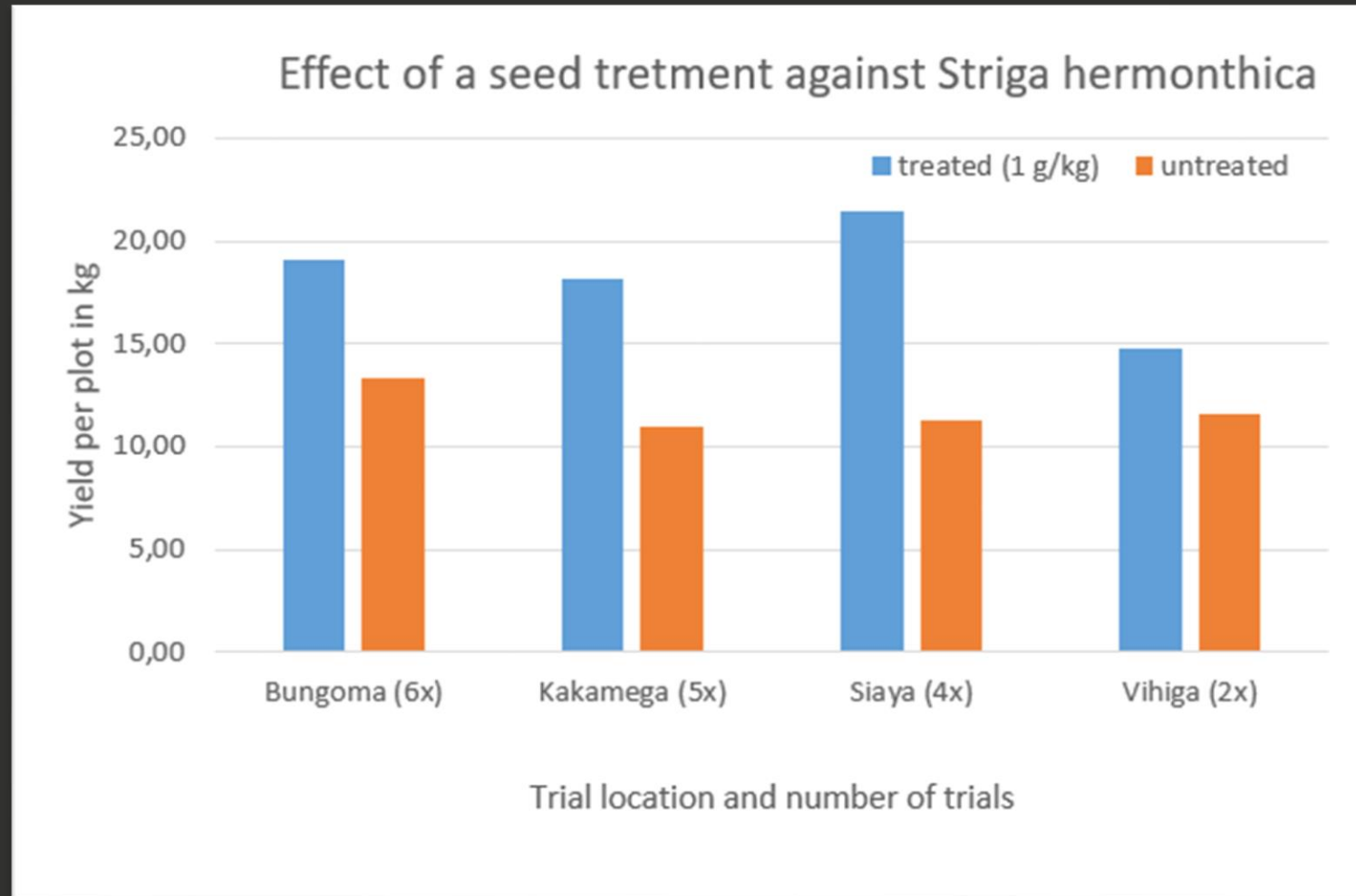


Fusarium oxysporum growing out of a maize grain

First trial results using a pilot batch

- **Trial was carried out in 4 counties**
 - Bungoma (6 farmers)
 - Kakamega (5 farmers)
 - Siaya (4 farmers)
 - Vihiga (2 farmers)
- **Each farmer set a treated and an untreated plot (10 x 10 m)**
- **The seed was treated with 1 g/kg spore powder**
- **As a result the yield per plot in kg was evaluated**

First trial results using a pilot batch



The differences in Bungoma, Kakamega and Siaya have been highly significant.



Thank you