

## **Food & Nutrition Solutions Ltd**

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#### **Refractance Window Drying Technology Outreach and dissemination carried** out by FONUS



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Ministry of Trade, Industry and Cooperatives





# **About FONUS**

- Based at the School of Food Technology Nutrition and Bioengineering, Makerere University, FONUS provides consulting services in the fields of
  - Food value addition
  - community nutrition,
  - food handling and hygiene,
  - post harvest handling of foodstuffs,
  - facilitation of farmer group learning processes and project evaluations.
- FONUS delivers services in the agriculture, nutrition and health sectors providing crucial information for start-up companies, community based projects and capacity building in nutrition.





- Many small-scale farmers in Uganda produce a variety of fruits and vegetables which are sold with minimum value addition hence low monetary returns.
- Seasonality, high post-harvest losses and low access to market are major challenges that have greatly contributed to the low monetary returns.
- This calls for the need for development and adaptation of appropriate technologies that reduce post-harvest losses and enhance farmer incomes through processing and preservation.

# Preamble



- FONUS under BioInnovate Africa phase II programme supported by partners spearheaded a bio-innovation in the form of refractance window drying technology (RWDT) for the production of superior quality dried products from perishable agricultural produce such as fruits, vegetables and nutraceutical herbs.
- Reduction in postharvest losses can contribute greatly to increasing farmer incomes and enhance industrialization by prolonging product shelf life (Wakholi et al., 2015).
- Fruits that can be dried include; Pineapples, mangoes, jackfruit, passion fruit, and bananas which were processed into flakes, powders, dices & sheets with funding under The BioInnovate Africa Programme Phase II



# FONUS' part in the Bioinnovate Project

- The main purpose of FONUS' engagement with the project was to promote uptake of the RWD technologies among end users
- This was done through a series of engagements with groups like farmers, small- medium agroprocessors, and processors that utilise the RWD products and ingredients in foods
- Before any engagement was made, surveys were carried out to asses the current drying technologies and people's perceptions about them



# Situational analysis: Potential utilization of the Refractory Window Drier Technology in Food Value Addition.

#### **Research questions**

- In an effort to assess the performance of the fruit value chains, the following questions were addressed to make sense out of the information gathered.
- a) What practices at production, transporting, processing and exporting impact positively or negatively on the performance of the fruit value chains?
- b) What is the financial position of the producer, middleman/trader, processor and exporter in the fruit value chains operate?
- c) What enterprising traits are shown by actors in the fruit value chains?

This gave the team an insight of the market players, products, dryers, production regions and other market dynamics



## Engagement with small scale processors: Production of quality dried fruit products

- These are the processors that processed between 1-30 Kg of dried products a day using conventional drying technologies
- The commonest drying technology was open solar drying and use of Box dryer
- The most small scale agroprocessors doubled too as farmers
- Most of the construction an repair of these technologies was done locally
- The commonest limitation to their technology was the dependance on solar energy for production.
- At this point, only the Miniature and full scale RWD were available for full operation



# Steps necessary taken while drying fruit

# Slicing thickness examin

# Training feedback





# Feedback

- The technology was appreciated
- Drying through out the year would be was commended
- Temperature monitoring and control
- Price was relatively affordable for individuals

# On the other hand;

- Dryer was too small
- Significantly high energy consumption rates

Feedback Good temperature monitoring and control Higher production rates On the other hand; • Too expensive Too complicated for the group Significantly high energy

Α



# Where is the middle ground??





# Training agroprocessors in the Use of the Hybrid RWD

- The same group was brough back to use the new Hybrid RWD and assess int's performance based on previous experiences.
- Almost all previous concerns were addressed;
- Production capacity
- Energy consumption
- Cost
- Usability





# Training of medium-Large agroprocessors in the use of RWDT in drying fruits and vegetables





1. To train the participants on the procedures of using the Hybrid RWD

Objectives

- 2. To appreciate the comparative advantages of the Hybrid RWD to other dryers
- 3. Demonstrate GMPs and procedures to produce quality dried products
- Get proposals on potential of 4. **RWDT** commercialisation
- Interest participants in acquiring 5. and using the RWDT equipment



# Training feedback





- The fruits over-dried and stuck to the Mylar.
- Suggestion: Incorporation of a material
- Browning of the products
  due to different sizes
- The thickness too small for international market



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### Techno Economic Analysis of Refractance Window Drying of Fruits: A Case of Small-Medium Scale Agro Processors in Uganda

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# Training on the use of RWDT products as ingredient and flavors in foods

- This was preceded by a market survey to understand the processors, products and prices on the market
- The focus was on Bakery and dairy products
- RWDT products were produced that were compared to other products on the market
- Recipe charts for incorporation of RWDT products were developed and shared including brochures

#### **The Biomass Operation**

In absence of electricity, the dryer uses biomass in form of firewood to heat water and dry fruit products. The Rocket Stove is a clean burning and fuel-efficient cooking stove which uses thin sticks as fuel and doesn't require constant fanning. This means that the Rocket Stove is more efficient than open fires since it uses less firewood therefore reduce long-term household expenditure.



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Range of fruits dried by the Hybrid RWDT

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#### Introducing The Hybrid RWD

The RWD is a new type of dryer where liquid foods, purees and slices are dried on one side of a thin plastic film using hot water.

#### **Main Components**

Electric components: Consists of electric immersion heaters that raise the temperature of water in a trough. The trough is covered by a drying belt onto which fresh fruit products are placed. A hood to carry out moist air, a water reservoir, an electrical water heater and a temperature control system.



#### **Performance Parameters**

Parameter	Quantity
A. Drying time	Slices 1.5 – 3 Hours
	Pulp 30 Mins – 1.5 Hours
B. Temperature	95°C -120°C
C. Moisture content	3% - 7%
D. Throughput	0.75 Kg/hr
E. Loading capacity	Pulp- 1.5 Kg/ <u>hr</u>
	whole pineapple per batc 30Kg of

#### RWD Comparative Advantages

#### Weather susceptibility

The dryer is not susceptible to weather changes since it uses both electricity and biomass

#### **Moisture content**

Can achieve relatively low moisture content of up to about 3-7%

#### **Product quality**



Produces high quality products with respect to appearance, flavour and microbial load

#### Nutrition

High retention of bioactive compounds

#### **Drying time**

Relatively shorter drying time

#### **Product variety**

A variety of product forms can be produced; powders, flakes, slices, dices and fruit leather.



#### Schematic diagram for flavouring bread using RWDT dried pineapple dices

#### Recipe

240g of sugar 90g of Fat 20g of salt 20g of yeast 5g of Calcium 1800g of wheat flour 200g of RWDT pineapple

## BioInnovate Africa





African Insect Science for Food and Health





Schematic diagram for flavouring yoghurt using RWDT dried pineapple powder

#### Recipe

Pineapple 2.5% per liter of boiled cool water

#### OR

Mango 2% per liter of boiled cool water

#### OR

Passion fruit 1.5% per liter of boiled cool water

BioInnovate Africa



African Insect Science for Food and Health



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#### **ADAPTATION AND PROMOTION OF REFRACTANCE** WINDOW DRYING TECHNOLOGY FOR **PRODUCTION OF HIGH-QUALITY BIOPRODUCTS**

Use of RWDT products as ingredients in flavoring yoghurt and juice.

#### **Recipes and Procedures**











BioInnovate

#### ADAPTATION AND PROMOTION OF REFRACTANCE WINDOW DRYING TECHNOLOGY FOR PRODUCTION **OF HIGH-QUALITY BIOPRODUCTS**

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#### **Use of RWDT Products as Ingredients in Flavouring Bread and Cakes**

**Recipes and Procedures** 

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# **RWDT Product market testing**



## **Objectives**:

- i. Establish the expected demand volumes for ingredients and ready to eat RWDT products
- ii. Establish the acceptable prices for RWDT products

iii. Describe the available forms and products in regards to pricing/ demand/ competition (market segmentation)

iv. Identify and describe the nutritional and techno functional properties of RWD products and substitutes.

# Remarks



- The RWDT presents a viable solution to the perishability of fruits and vegetables in Uganda
- The trainings revealed that incubatees were more ready to adopt the technology compared to already established processors
- More research needs to be done in RWDT energy efficiency if the RWDT products are to have competitive process on the market
- Collaboration with government funding bodies will go along way to increase the technology uptake since individuals and small processor groups may not easily afford the technology



## The FONUS Team that worked on Bioinnovate Project

- 1. Dr. Gaston Ampe
- 2. Dr. Faith Namayengo
- 3. Jackie Nshemerirwe
- 4. Mutumba Raymond
- 5. Joan Nampiima
- 6. Speciyoza Aywek
- 7. Wasswa Joseph
- 8. Alex Aliga

# Thank you for Listening

