



# A showcase of the bio-rodenticide development in Amhara, Ethiopia

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# Introduction of the bio-rodenticide development pathway

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## SECTION 1

# Overwhelming damage vs lack of action








## Total (world)

(Excluding United States, Canada and Australia)

**69 Million** of cereals gained (all types, e.g. wheat, rice.)

**278.8 Million** of extra people nourished

**34%** of undernourished benefiting

	 Million t of cereals gained	 Million of extra nourished people	 % of undernourished benefiting
 <b>Asia</b>	53.32	217.3	39
 <b>Latin America</b>	7.84	31.3	60
 <b>Africa</b>	5.68	22.7	11
 <b>Europe</b>	1.89	7.5	-

Source: Meerburg et al (2008). Data derived from FAOSTAT



WATER  
CONSERVATION  
MEASURES → RAT  
ABUNDANCE



INDIVIDUAL  
MANAGEMENT =  
INSUFFICIENT

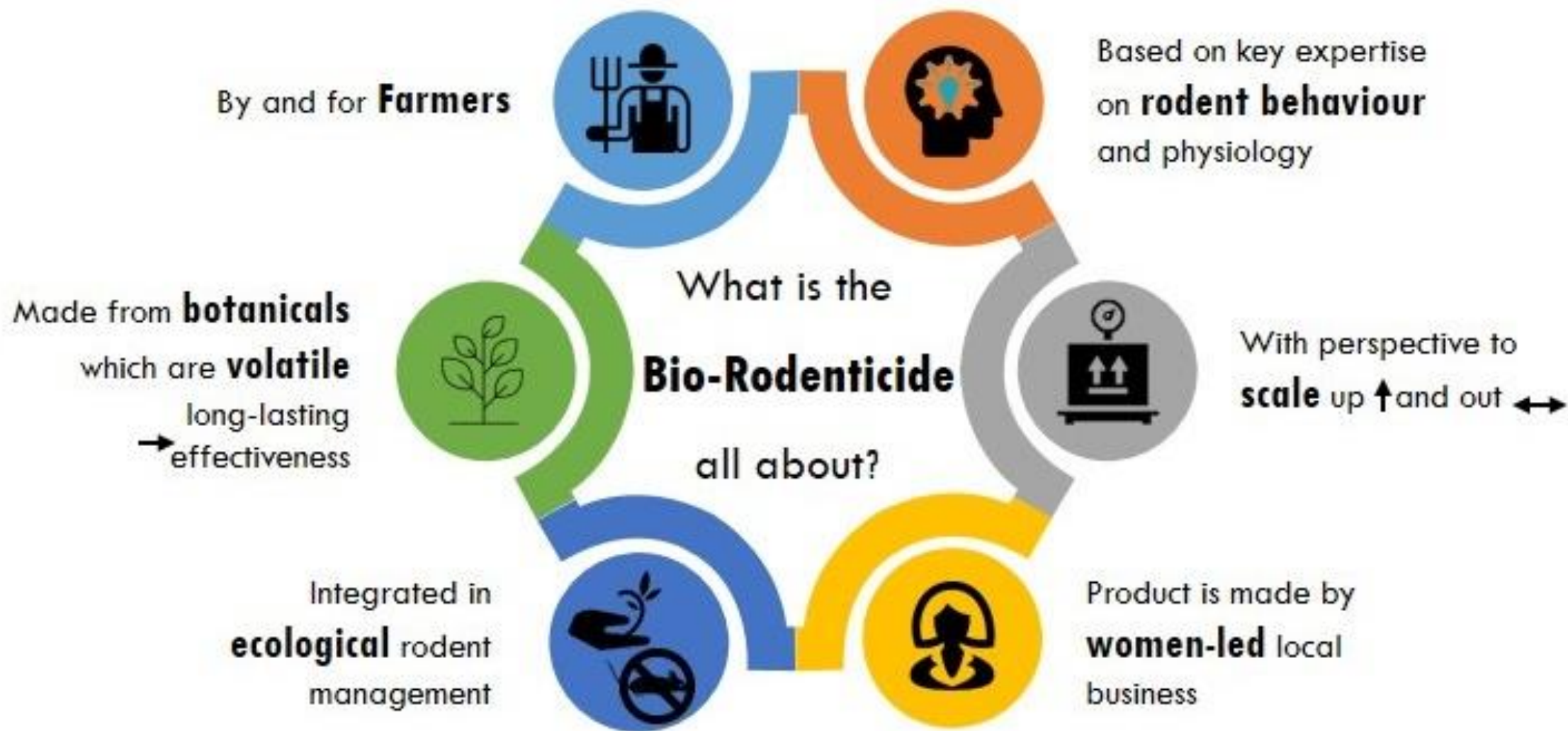


EXISTING  
CHEMICALS NO  
LONGER EFFECTIVE



LACK OF NEW  
PRODUCT  
DEVELOPMENT

Urgency for  
bio-based  
rodent  
control



# Development pathway

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FIELD TRIALS



LAB TRIALS



SOCIAL BUSINESS  
MODEL



PATENTING



OFF-THE-SHELF  
PRODUCT



## MetaMeta Research

- Project lead
- Coordinate R&D
- Establishment of Rodent Green company
- Developing EBRM package
- Upscaling to other countries

## Amhara Bureau of Agriculture (govt)

- Large scale EBRM trainings and campaigns
- Setting up women SMEs for BR production
- Testing and monitoring with farmers in the field

## Mekelle University

- Rodent center of excellence
- Lab research
- Support to field testing
- Quality control

## Debre Tabor University

- Field testing
- Sustainable cultivation of botanical resources
- Co-learning with farmers
- Technical trainings to SMEs

## MetaMeta Ethiopia

- Training on business aspects to women SMEs
- Support to licensing



# Research and Development Biological Rodenticide

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## SECTION 2



# Outline:

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1. The innovation and process
2. Challenges and mitigation
3. What makes the innovation unique, why should buy it?
4. Who are the customers and end-users?



# Integrated in: Ecologically-Based Rodent Management

- EBRM coined ~ 20 years ago
- Proponents: [Grant Singleton et al.](#)
- [Herwig Leirs](#), [Steven Belmain](#), [Rhodes Makundi](#), ...

EBRM developed for

- **Ecological** basis for management of rodent pests
- **Environmentally-sensitive** approaches
- Reduce reliance on **chemical rodenticides**





# 1. The innovation and process

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## Our approaches in developing BR

- **Select** potential plants with toxic, deterrent or repellent, ...
- Use proven **protocols** for lab and field testing
- **Test** acceptance, efficacy, shelf-life, non-target and environmental harm
- **Training** and ensure integration of BR in farmers' rodent management strategies



## i. Select plants

- Depend on
  - Wild and domestic
  - Traditional knowledge
  - Literature





## ii. Acceptance (palatability) test

- ▶ On 3 species:
  - ▶ *Mastomys awashensis*, *Arvicanthis niloticus* and *Rattus rattus*
- ▶ Lab testing using rapeseed and linseed
- ▶ Choice between a BR formulation and a standard diet
- ▶ Monitored using camera traps
- ▶ Results are usually expressed as the percentage of total bait consumption with respect to control diet



### iii. Efficacy test

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- Efficacy of tested both in the lab and field using proven protocols
- Different concentrations and mixes tested to come up with most effective **lethal dose**
- BR considered satisfactory
  - Minimum mortality of 90% of test animals
  - If at least 33% of the BR is consumed
  - When no more than 10% of control group died during the study



### iii. Efficacy test...

- Recorded **> 71.4% mortality rate**
- Average body weight loss **> 20g** (6.4-41g)
- **Post-mortem observations:** darkened liver, empty or partially filled stomach and intestine)
  - Distended bladder
  - Splenomegaly





## iv. Shelf-life determination

- Shelf-life tested by storing portions of the BR
- In labelled containers, to test for efficacy at fixed time intervals



## v. Non-target species and environmental harm

- Possible lethal or morbid effect on non-target population
- On domestic chicken and guinea pigs
- Same test procedure as that of the rats



## Field trials



- No established protocol for field testing.
- Developed this for the field trials in parallel to lab trials



# Field trials...



## EBRM + BR community campaign

Region	Amhara
Report Weredas	Farta, Wadla and Guna Begiemider
No. of watersheds	12
No. of households	3380 (average of 5 per household, equivalent to 16,900 people)
35% of households	Keep houses and compound clean, use improved storage, no open food nor garbage, and plugging of entry holes or hiding places for rats with solid material
1,259 cats	Kept domestic cats, widely used against rats
147 hermetic bags	Used by farmers, while another 1,200 are requested
On 389 ha	Rat shelters destroyed by digging, deep ploughing, flooding, ...
191 km	Stone bunds devoid of grasses and vegetation aiming to expose rats to predators
100 birr/day	Penalty when missing community campaigns, and 10 Birr for late comers: community bylaw
15,285	Estimated to have been eliminated individually and collectively

## 2. Challenges and mitigation

- No priori knowledge about the plants' properties
- Active ingredients of plants and synergetic effect
- Species-specific **formulations** to avoid non-target harm
- Identification of **bio-active compounds** (active ingredients)
- Ethical permit: on domestic animals – chicken and guinea pig
- No established field protocol
- **Field application** challenges = to many parameters to control in the fields
- Wild sourcing of one of the plants



### 3. What makes the innovation unique, why buy it?

Made from locally sourced botanical material

No industrial processing, low carbon footprint, low production cost, and low environmental impact

Non-persistent, quick degradable

No significant harm to non-target species

More effective against bait-shyness and long-term resistance

Produced by women SMEs to support sustainable entrepreneurship, local economies

From farmers to farmers

Enhance working together as a community

Allow close monitoring

## 4. Who are the customers and end-users?

- \* Smallholder farmers
  - BR, user manual, training and awareness
- ❖ Large scale farming
- ❖ Large scale storage (warehouses)
- ❖ Urban/suburban rodent control
- ❖ **WASH**
  - BR, consultancy, inspection, action, user manual, training and awareness



- We are trying to develop similar BR in Niger, Senegal, Morocco, Turkey



# The value of the Bio-Rodenticide product and EBRM service

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## SECTION 3



# What happened in Amhara before 2018?

- In the past decade impressive mobilization on NRCM and land management took place
- All segments of the population from all corners of the region participated
- The mobilization was successful in controlling soil erosion and improving soil fertility



# Leading to: high rodent infestation

- But creating favorable conditions for rodents cause various damages.
  - **Changes in landscape** ecology (more land under cultivation, multi-cropping, less natural enemies),
  - **Bunds for SWC** harbours rodents



# The damage caused by rodents in Amhara region

- Unsustainable natural resource conservation
- Estimated 9-44% pre-harvest yield loss of most for Amhara
- In selected project areas of Amhara respondents mentioned that **a realistic 25% crop loss** (field and storage); the worst 100% damage
- Causing damage to household items and;
- Human health through their feeding, discomforting, contaminating and disease transmission



# Why do the farmers need a bio-rodenticide?



- No effective treatment nor systematic promotion of rodent control in spite of the magnitude of the problem;
- BR is rather a proven effective, low cost, eco-friendly and easy to apply
- BR is an alternative 100% biological product
- From locally available botanical ingredients
- Produced locally by organized SMEs




# The value to smallholder farmers

- Land size is 0.5-0.75 Ha; a constrained resource, 90% depend fully on own land, need to optimize it's usage.
- Direct impact on food security; each Quintal matters; crop loss reduction is crucial.



# Why this product

- Product is environmentally friendly and easy to produce
- Linked to farmers innovative indigenous knowledge and experience; increased confidence
- Low-cost made from locally available botanicals, easily accepted by the farmers
- Enable controlling rodents in an integrated and sustainable way
  - Can be integrated with EBRM mobilization,
  - Improved storage
- The methods of application are easy and comprehensible to farmers

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# Feedback from farmers

- Farmers are very positive and indicate the BR has worked more than they expected
- The main improvements made are:
  - Crop stand has improved
  - Patches hit hard by rodent damage before have revived
  - Initiation of tillers greatly improved



# Impact

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- Monitoring data (30 farmers, 1 growing season) has shown that **10-15% loss can be reduced** as a result of applying the BR; “without it we may lose 50% yield, some even 100%”
- Collective EBRM campaigns further increase the impact, **communal- and grazing lands** have greatly revived.
- Rodent green products and services already **change the outlook of fields and farmers**, and are foreseen to make a lasting change.
- Claim that damage due to rodents reduced by ~ 50%
  - ✓ For example: in watershed A: DAMAGE reduced from >20% to ~ 10%
  - ✓ In watershed B: Damage reduced from >15% to ~ 9%



# The meaning to women SME members

Job creation is priority agenda of the government

- But most jobs depend on existing jobs in a competitive way,
  - Not supported by new innovation
- 
- ✓ BR is innovative business opportunity, with no competition in the market
  - ✓ Women develop skills and can add source of income for their families
  - ✓ Production of BR is considered easy to do
  - ✓ Providing important service to their community
  - ✓ Huge demand for the future
  - ✓ Hoping for further expansion and becoming a large company



# The challenges and how they were overcome

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- COVID 19, war and instability interrupt the continuation of testing final product, and SME training, coaching and follow up.
- The botanical production in a nursery was not effective, no experience and research available.
  - ✓ Experimental research
  - ✓ Sustainable sourcing through watersheds
- The testing process at Mekele university interrupted before the final result, which was required for licensing.
  - ✓ We started working with AAU to do final quality testing of the BR produced by SMEs

# The challenges and how they were overcome

- During COVID\_19 not possible to organize EBRM campaigns with watershed committees
  - ✓ Worked through trained ToTs in the watersheds to train others, in this way 65 new watersheds were reached out to
- Product licensing process was slow. No experience before how to issue license for BR in the country
  - ✓ Agree with the local government to facilitate market linkage until production license is issued.
  - ✓ Retargeting and rearrangement of SME members permanently displaced due to the war
  - ✓ Propose to conduct further assessment and research to fill gaps of findings interrupted during the war and COVID\_19





# Cooperation and plans

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## SECTION 4

# The rodent problems is huge, hardly recognized but there are good ecological solutions

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## Agriculture crop loss

- On field (16% in Africa)
- Storage (8%)

## Public health

- Villages (Village EBRM – needs to be part of WASH)
- Urban areas (enormous public health risk but largely unknown)

**The need is high and comes down hardest on those most vulnerable**

**We need to urgently scale!**

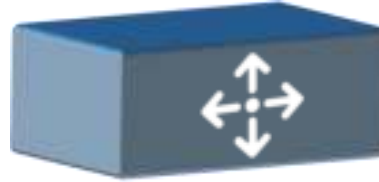
# Pathway to scale

## Food Security Facilitation



- Continental Service Provider
- National Partnerships
- Tailored Programs

## Roll-out



- National Enterprise
- New Stakeholders and Capacity Building
- Self Financing

## Scaling



- Scaled Field Application
- Production/ Sales/ License Model
- Central Business Unit

## Prototype



- Bio-rodenticide
- Collective EBRM Campaigns
- Business Case

## Feasibility



- Understanding Rodent Problem
- Initial Testing

# Our plan

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Introduce ecologically based rodent management globally – beyond Ethiopia, work with poor and rich customers

- Addressing food security
- Changing regulations

Centre of practical learning and working methods

Work with large partners (WHO, FAO, WFP, national and regional governments)

Building up the sector

- Effective and safe control
- Jobs and employment
- Conducive regulation
- Capacity building

# Besides - some immediate follow up

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Green Future Farming (Ikea Foundation): integrating rodent management in rural circular economy

Med4Pest (EU): starting with EBRM and BR in four countries in Mediterranean, developing sensors

SCARIA (Belmont Foundation): urban rodent management in four countries in Africa

FAO West Africa – translating EBRM guidelines



# Vehicle: Rodent Green BV

Service Provider in:

- implementing EBRM campaigns in different contexts
- support sector development
- improving methods of EBRM (practice, research)
- doing surveys, inspection, monitoring, awareness, agenda setting
- Improve storage and warehouse management



# Vehicle: Rodent Green BV

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## Business model

- commercial clients
- small farmers/ local public health (cross subsidized from commercial clients, grants and others)

## Scientific board

# Our hope from this meeting

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- Raise attention to relevance of bio-based rodent control
- Make linkage to health / hygiene / WASH programs
- Integrate Green Rodent Management into common agricultural practices
- Suggestions and connections
- Openings for further collaboration

# Opportunities with Olam

- Transformational impacts within global agriculture
- Working with internal teams Olam on number of value chains
- Re-imagine global food systems





**አመሰግናለሁ**  
**Thank you !!!!**



**አማራ ክልል ግብርና ቢሮ**  
**AMHARA BUREAU OF AGRICULTURE**

**ግብርና ከማምረት በላይ ነው**  
**Agriculture is Beyond Production !!!!**