



# African, Caribbean and Pacific Group of States

## ACP Science and Technology Programme

### Optimisation of Pesticidal-plants: Technology Innovation, Outreach & Networks. (OPTIONS)

*Growing and Using Pesticidal Plants Training Workshop  
at World Agroforestry Centre, Nairobi, Kenya  
28-30<sup>th</sup> October 2014*

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## **SUMMARY and OBJECTIVES of ACP S&T**

The ACP Science and Technology Programme

- launched in June 2008
- open to 79 member states of the ACP group of states, 28 member states of (EU), EU candidate countries (5) and member states of the European FTA of EEA (3)

### **Overall objective ACP S&T**

Support ACP countries in formulating and implementing science and technology (S&T) policies that can lead to sustainable development and to poverty reduction through economic growth and progressive integration in the world economy

The programme originates from a need for joint ACP-EU approaches in support of Science, Technology and Innovation (STI)





## SUMMARY and OBJECTIVES of ACP S&T

**Purpose** is to strengthen internal S&T capacity of ACP countries to support research, development and innovation in the ACP region at three levels:

1. Institutional, administrative and policy making
2. Academic research and technology
3. Business and civil society

The Programme promotes interdisciplinary approaches to sustainable development along three main axes:

1. Co-ordination and networking in applied research
2. Instruments for collaborative research
3. Management of research activities & reinforcement of research



## ACP S&T 1<sup>st</sup> Call aimed at

1. Targeting poverty eradication – emphasis on MDGs
2. Building S&T capacities to support research, development and innovation
3. Enabling the activities, processes and policies critical to sustainable development





## ACP S&T 2<sup>nd</sup> Call Aims to

1. Apply **Science and Technology** to promote **innovation**
2. Develop **appropriate technologies** - that can be **effectively deployed** within the context of **local needs and resources** (affordable – accessible – relevant - sustainable)
3. Contribute to **improvement of living conditions**
4. **Boost family and business incomes** by raising competitiveness or developing commercial opportunities
5. Technologies that contribute to strengthening resilience to internal and external shocks

Energy shortages

Climate change

**Food insecurity**





## ACP S&T 2 Aims

ACP countries must

1. **Build capacity to find, absorb, use existing technologies**
2. **Strengthen own knowledge generation capacities**

Create appropriate **policies and incentives**, building technical, vocational, engineering, **entrepreneurial**, managerial, and **scientific capacities**

ACP S&T II support for Science and Technology (S&T) (and innovation) for development

**Promote a scientific culture**

**Bolster national and regional capacities** to formulate, manage, monitor, **evaluate and disseminate S&T activities** within and across ACP countries



# PROGRAMME OBJECTIVES AND PRIORITY ISSUES

## Global objectives of call:

1. Address S&T divide between ACP states and industrialised countries.
2. Strengthen STI in ACP countries (enable creation, update and use).
3. Use STI as enabler for poverty reduction, growth and socio-economic development.

The **specific objective** : Contribute to building and strengthening capacities in STI in ACP countries

**Result 1** – STI goals and priorities are identified, formulated and mainstreamed in the national and regional strategies of ACP countries

**Result 2** – National and regional capacities to devise, manage, monitor, evaluate and disseminate STI programmes and their results are improved

**Result 3** – Importance of STI for development acknowledged by decision-makers, mechanisms of innovation understood by policy-makers and a culture of science promoted among the general public



# Synthetic pesticides present serious problems for farmers, particularly in developing countries



Health & Safety

Environmental impact



Adulteration

Resistance



Cost



Labelling & Literacy

redundant chemicals



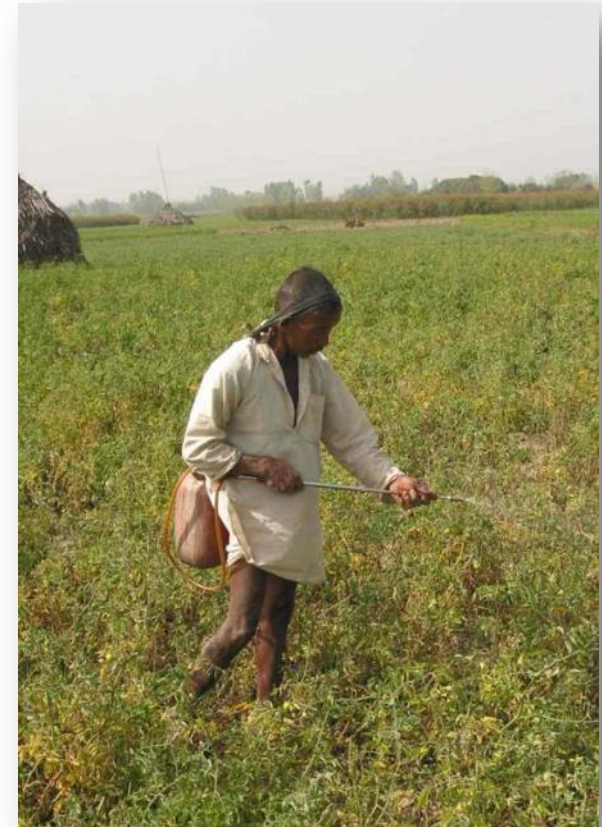
Access & transport



# Pesticidal plants

## Why do we need them?

- 🌀 Constraints associated with use of commercial pesticides, fungicides, veterinary products
  - 🌀 Effectiveness questionable (adulterated products)
  - 🌀 Expensive
  - 🌀 Limited availability – inconsistent efficacy
  - 🌀 Pesticide resistance - poor efficacy
  - 🌀 Incorrect application - poor efficacy
  - 🌀 Human, mammalian & environmental health & safety fears associated with commercial products



# Pesticidal plants

## Why do we need them?

🌿 Management and control of insect pests is arguably the most important issue of crop production and storage

🌿 Damage to crop fields and yield

🌿 Transmit disease

🌿 Reduce harvestable product

🌿 Damage stored product





# Pesticidal plants

## Why do we need them?

 Livestock

 Ticks

 Mites



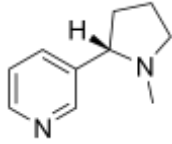
 Fungal, bacterial, viral diseases?





# Safety

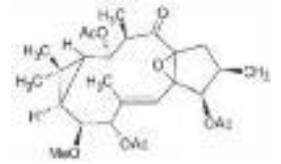
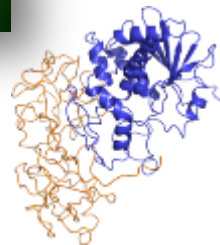
PPs seen as natural and low cost  
But natural doesn't always = safe



nicotine in *Nicotiana tabacum*



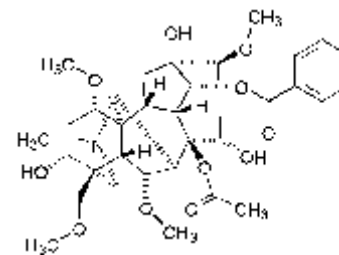
Ricin in *Ricinus communis*



tirucalicine in *Euphorbia tirucalli*



Aconitine in *Aconitum* spp.



# Pesticidal plants

- 🌿 Unprocessed plant materials, rudimentary preparation
- 🌿 Appropriate for small scale, low profit farming
- 🌿 Cannot be adulterated (if harvested by farmer) and cost effective
- 🌿 Toxicity and persistence is low
- 🌿 But...
- 🌿 Efficacy can vary across seasons or locations
- 🌿 Application needs optimising
- 🌿 Availability?



Discussing plant materials with farmers under a Neem tree



# Why Grow your own?

- ♻️ Sustainable and reliable supply
- ♻️ Source material can be selected as elite
- ♻️ Regulatory approval not required
- ♻️ Free and effective





# Botanical pesticides vs. pesticidal plants

- ♻️ Botanical pesticides are refined and formulated to be sold like a synthetic product
  - ♻️ Targeting wealthy households
- ♻️ Pesticidal plants are generally unprocessed plant materials requiring rudimentary preparation
  - ♻️ Highly suited to small scale farmers

Isman, 2006. *Ann Rev Entomol*

Isman, 2008. *Pest Management Science*



# Botanical pesticides: Two perspectives

## Industrialized Countries

- ♻️ Pesticides highly regulated
- ♻️ Quality control required
- ♻️ Many conventional products available/affordable
- ♻️ Efficacy expectations
- ♻️ High premium on human safety, environmental protection
- ♻️ Consumer demand and premium prices paid for organic produce

## Developing Countries

- ♻️ High plant biodiversity
- ♻️ Little or no pesticide regulation
- ♻️ Conventional products often unaffordable
- ♻️ Many cases of human poisoning from pesticides
- ♻️ Lower efficacy still valuable
- ♻️ Absolute food production (and stored product protection) is paramount

# Development of pesticidal plants

🌿 Scientific literature since 1980 has exploded

- 🌿 Hundreds of plant extracts
- 🌿 Isolated plant compounds
- 🌿 Feeding deterrent reports
- 🌿 Toxic effects

Isman, M.B. et al. (2014) Botanical insecticide research: many publications, limited useful data. *Trends in Plant Science* 19(3):140 – 145.

🌿 Despite 100s of papers on entotoxic/deterrent plants as potential products – only 5 commercialised

- 🌿 *Tanacetum* spp. (pyrethrum),
- 🌿 *Derris* spp. (cube resin – rotenone)
- 🌿 *Azadirachta indica* (Neem)
- 🌿 *Nicotiana* (nicotine)
- 🌿 Lamiaceae (essential oils)



*Tanacetum cinerariifolium*



# Why are there so few botanical insecticides?

- 🌀 Most existing botanical insecticides are neurotoxins or muscle poisons
- 🌀 Conventional chemical screening is focused on **acute toxicity**. We tend to select substances that are the most potent and have rapid action.
- 🌀 In contrast, insect-plant chemical interactions in nature **are more subtle**. Most plant defensive chemicals **discourage insect herbivory**, rather than killing outright.

# Optimisation of Pesticidal-plants: Technology Innovation, Outreach & Networks: OPTIONS



€1 million from European Development Fund

Jan 2014 to Dec 2016

## Main Partners

University of Zimbabwe

Sokoine University of Agriculture

Mzuzu University

World Agroforestry Centre

National Museums of Kenya

Sustainable Global Gardens

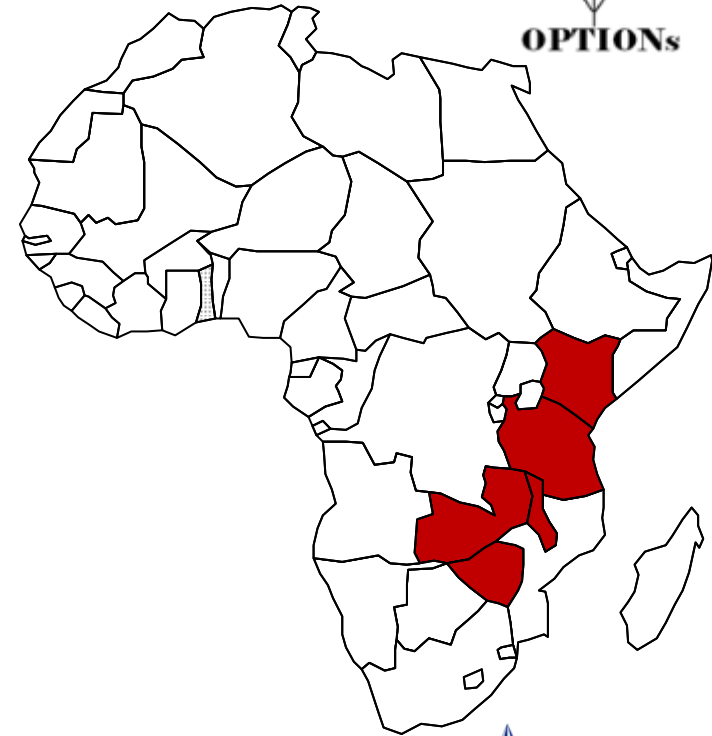
Royal Botanic Gardens Kew

Natural Resources Institute, University of Greenwich

Associates from a wide range of other institutions



OPTIONS



UNIVERSITY  
of  
GREENWICH

Natural Resources Institute

# OPTIONS

## Overall objective

Promote and facilitate uptake of pesticidal plant technologies for improved food security that are deployed effectively

and

Capacities of stakeholder institutions enabled to promote STI

- 🔄 Formulating and revising **policies** in STI
- 🔄 Enable effective **outreach** of plant materials in pest management and food security





# OPTIONS

## Specific objectives

- 🔄 Consolidate existing partnership of stakeholders from farmers to ministries to exploit STI in the use of pesticidal plants
- 🔄 Provide a forum for raising awareness about pesticidal plant use, particularly the livelihood benefits to poor farmers and potential for commercial exploitation
- 🔄 Create environment for cross-training & skill-transfer through demonstration workshops on propagation and optimised application of plant pesticides (incl. building individual and institutional capacity)
- 🔄 Develop policy guidelines and trial/validate innovations to support marketing and promotion of safe and effective plant-based pesticides

# OPTIONS



- 🔄 Create environment for cross-training & skill-transfer through demonstration workshops on propagation and optimised application of plant pesticides (incl. building individual and institutional capacity)

# What do we want to achieve at this workshop?

- ♻️ Support environmentally benign, safe and effective pest control using plants
- ♻️ Training in propagation, use and application of plants for pest control
- ♻️ Improved production and storage of agricultural produce





# What do we want to achieve at this workshop?

Discuss and share current experiences



Learn about new approaches to pest control



Develop innovations for up-scaling and outreach

Provide you with the skills to train farmers on growing and using PPs

**Thank you**