Clients and Methods Matter: The relationship between Breeders, Non industrial Farmers and emerging sweetpotato systems

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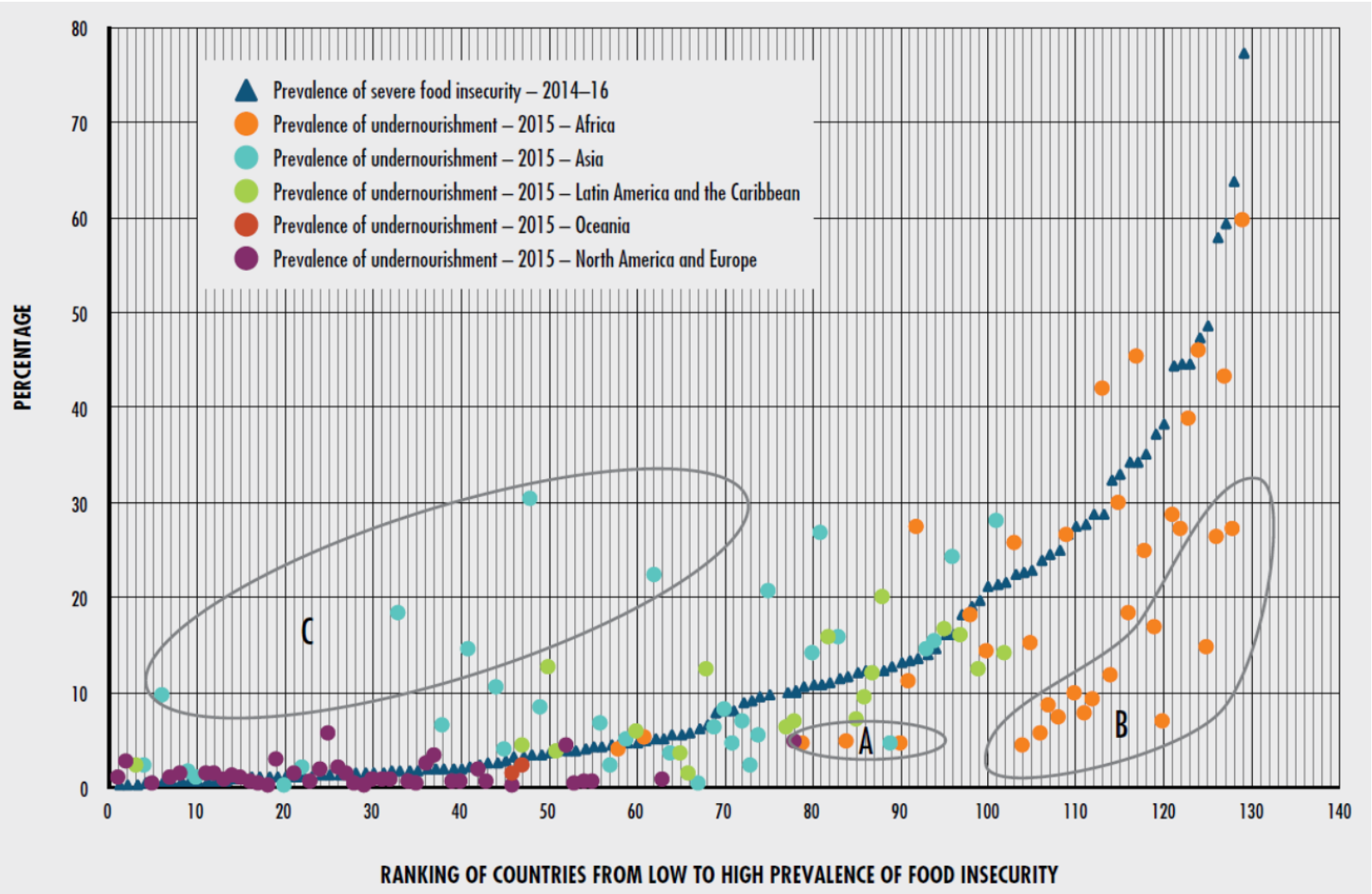
The State of Food security and Nutrition in the world (FAO report 2017)

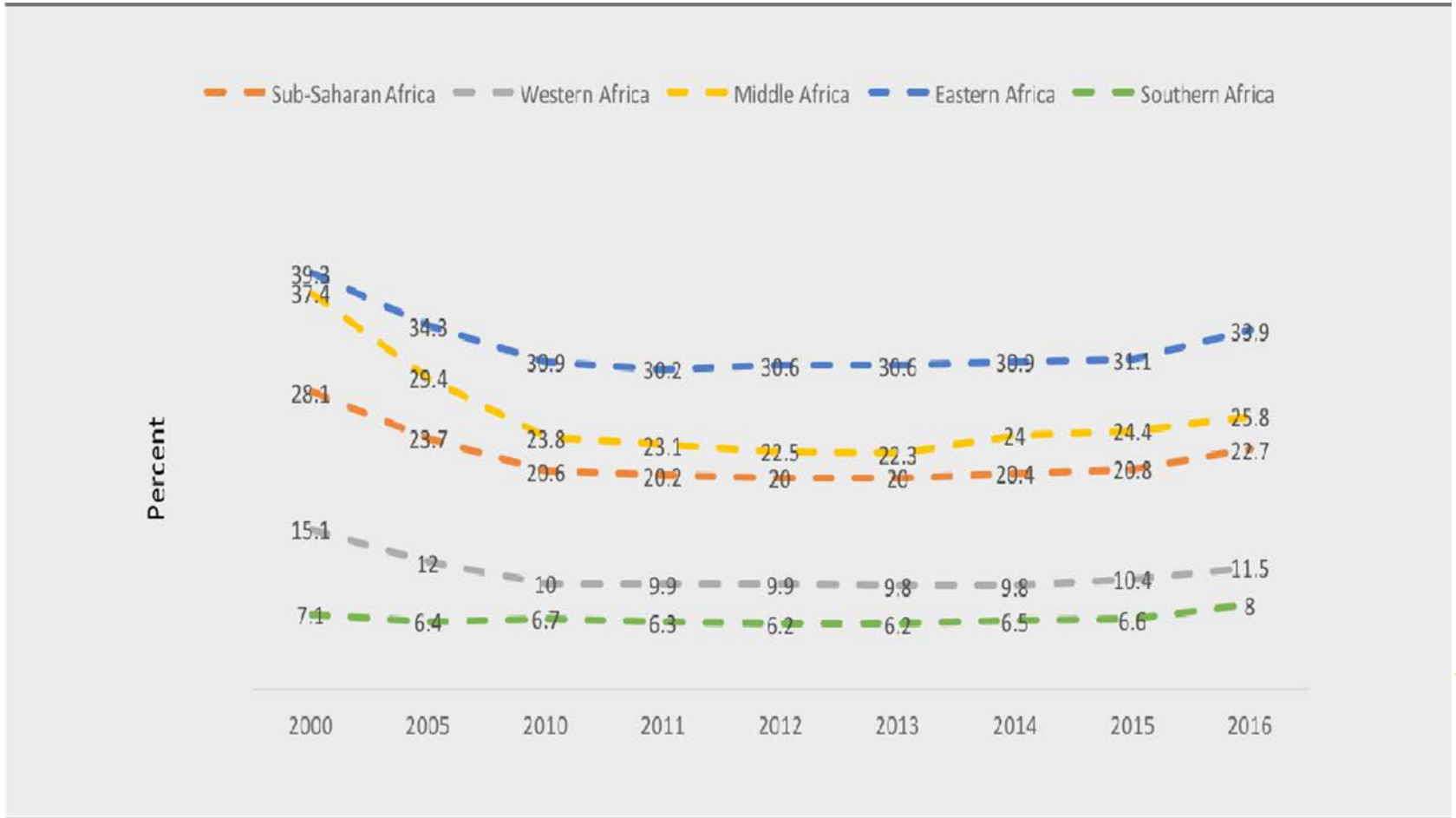


NOTE: Comparison between the prevalence of undernourishment in 2015 (dots) and the prevalence of severe food insecurity (triangles) in 2014–16. Horizontal axis is the ranking of countries by prevalence of severe food insecurity.
SOURCE: FAO.

➔ After a prolonged decline, world hunger appears to be on the rise again. The estimated number of undernourished people increased to 815 million in 2016, up from 777 million in 2015.

➔ This report sends a clear warning signal that the ambition of a world without hunger and malnutrition by 2030 will be challenging – achieving it will require renewed efforts through new ways of working.

Prevalence of undernourishment in SSA and sub-regions in 2000- 2016



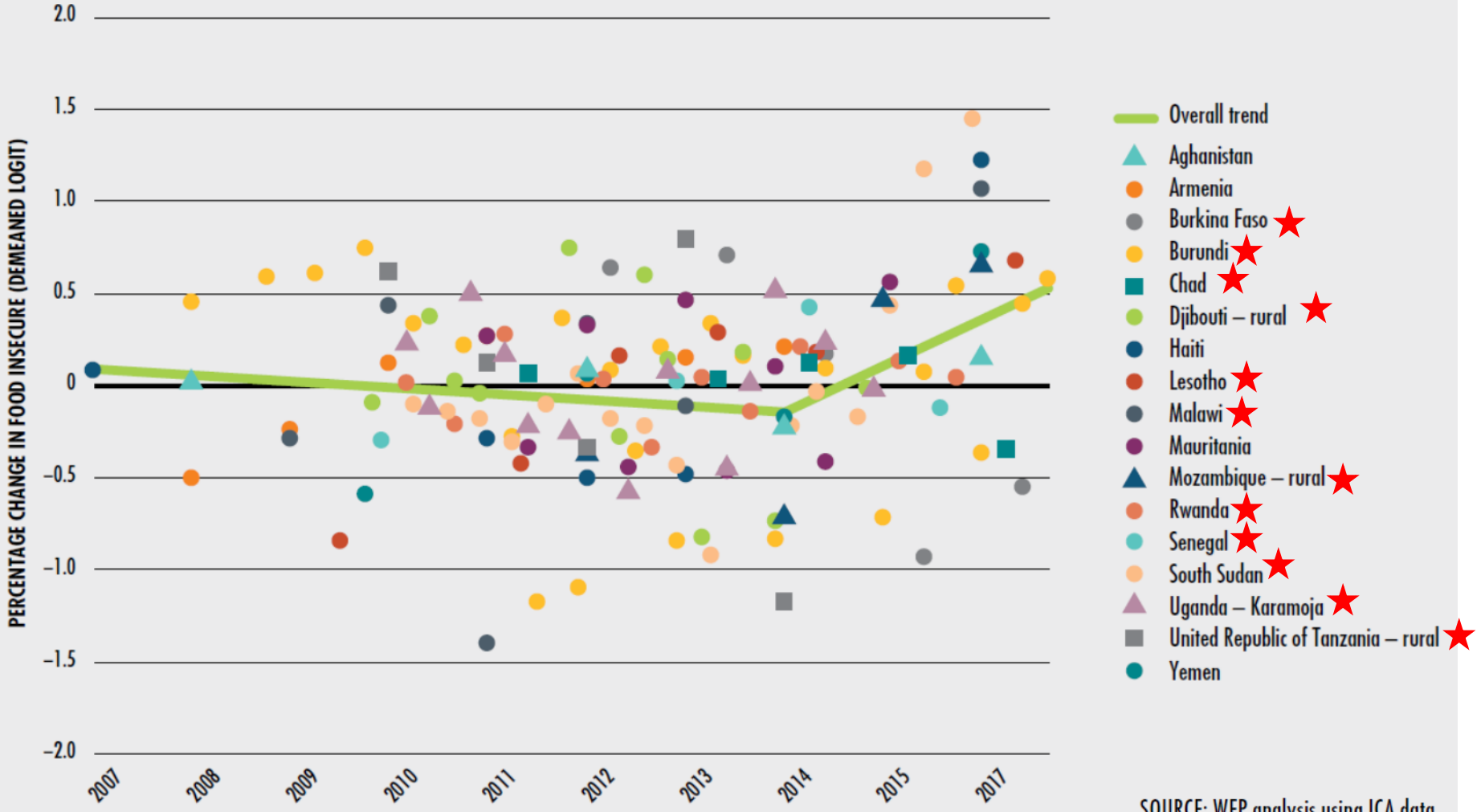
➔ Even in some peaceful settings, food security has deteriorated as economic slowdowns challenge access to food for the poor.

➔ Much of the recent increase in food insecurity can be traced to the greater number of conflicts, often exacerbated by climate-related shocks.

➔ Multiple forms of malnutrition are coexisting, with countries experiencing simultaneously high rates of child undernutrition and adult obesity.

Source: FAO

MARKED INCREASES IN FOOD INSECURITY STARTING IN MID-2014 ARE OBSERVED AS A STATISTICALLY SIGNIFICANT STRUCTURAL BREAK IN THE TREND



SOURCE: WFP analysis using ICA data.

Diversity of sweetpotato in the world

All occurring naturally

What is plant breeding

- The art and science of changing the genetics of plants for the benefit of humankind

It is done to improve the genetic potential of plants and the process involves combining parental plants to obtain the next generation with the best characteristics

Breeders improve plants by selecting those with the greatest potential based on performance data, pedigree, and more sophisticated genetic information

Plants are improved for food, feed, fibre, fuel, shelter, landscaping, eco-systems services and a variety of other human activities

Robert Mwanga (CIP breeder) demonstrates how to do sweetpotato cross

Role of plant breeding

Breeding new crops is important for ensuring food security by developing new varieties that are higher-yielding, resistant to pests and diseases, drought-resistant or regionally adapted to different environments and growing conditions

Fast Facts: source FAO

Plant Breeding is responsible for about 50% of crop productivity increase over the last century, while the remainder of the yield increase comes from better crop management (e.g., fertilization, irrigation, weeding)

The sciences supporting Plant Breeding, e.g. molecular biology, are advancing rapidly and plant breeding will provide even greater contributions in the near future

Plant Breeding must be one of the highest priorities of government, policy makers, and donors to ensure food in quality and quantity available to an each day hungrier world

RETURN ON INVESTMENT IN PLANT BREEDING

Food security: developing varieties with higher productivity and better yield stability

Social benefits: developing more profitable varieties for poverty alleviation

Economic benefits: developing drought resistant varieties that help reduce production costs, improving viability in marginal agribusinesses. A more profitable agribusiness results in more revenues and higher gross domestic product

Environmental benefits: developing varieties less dependent on pesticides or more efficient in water and nutrient use.
Source: FAO

Variety creation process

Parental selection

OFSP

X

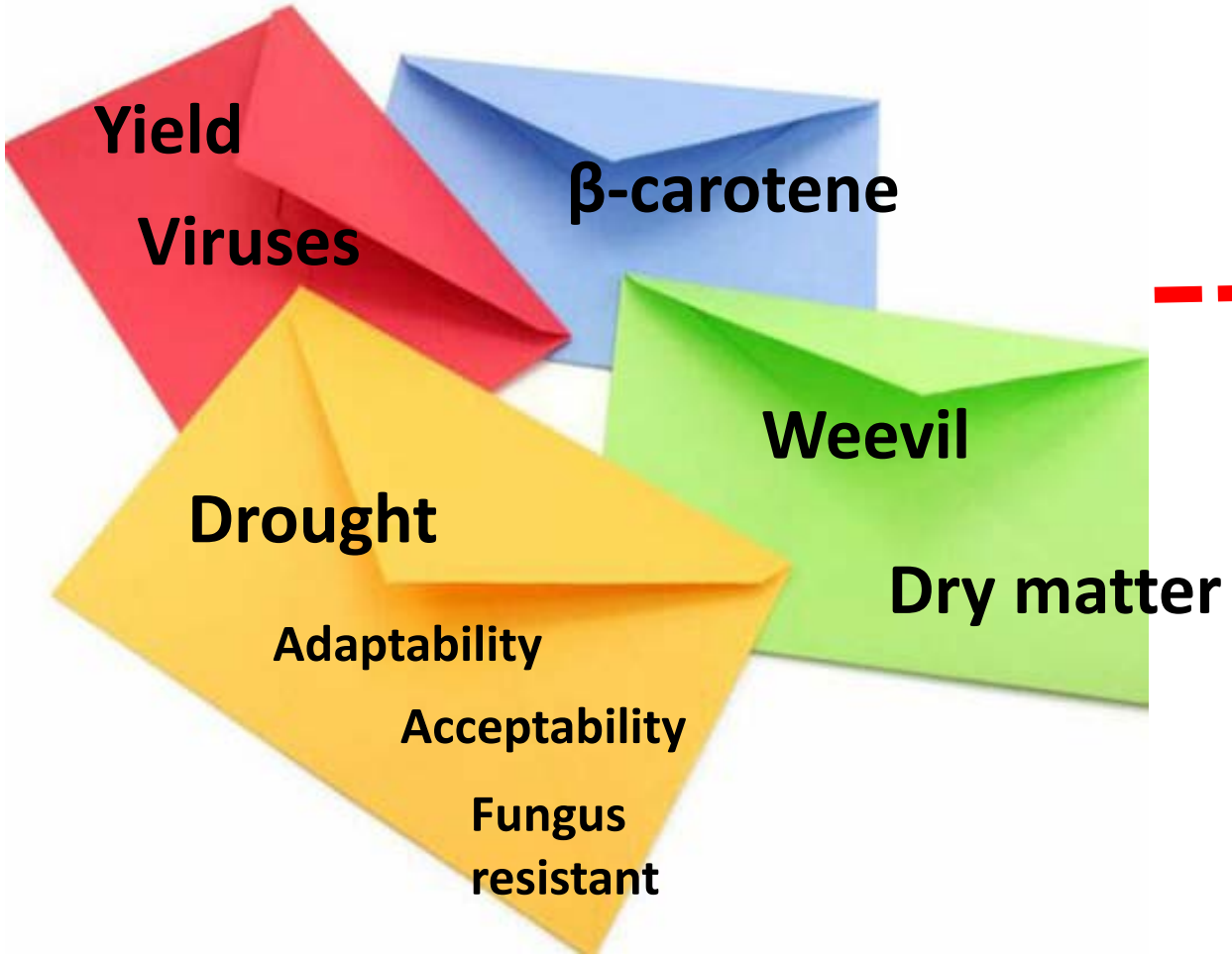
white

Production of seeds and multiplication of clones

Field evaluations

Dr. Mercy Kitavi own drawing

The breeders goals vs marketing, processors and utilization wish list

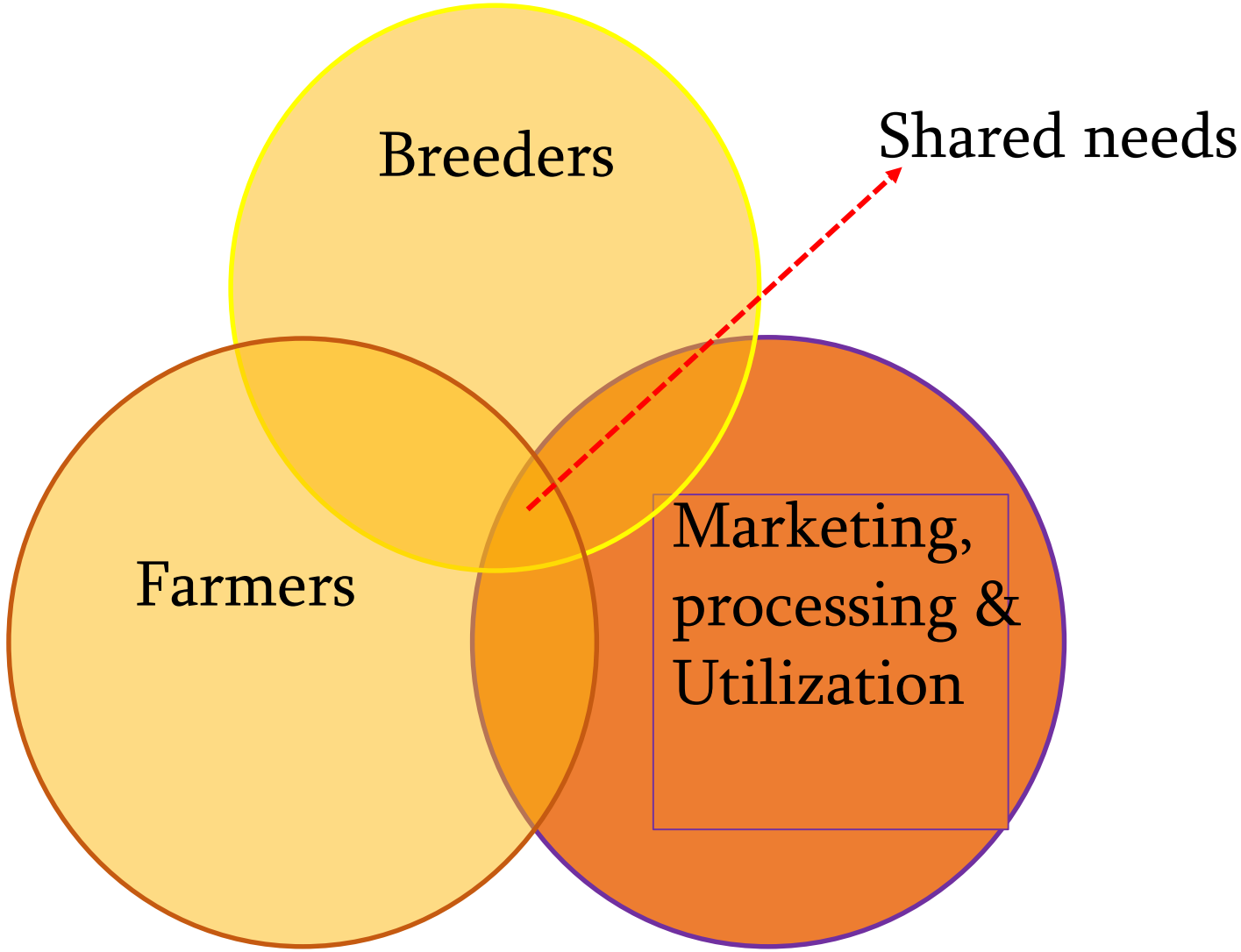


- High β carotene
- Storability
- Dry matter content
- Shape
- Chipping qualities
- Size
- Good flavor, texture
- Easy to peel
- Easy to wash
- High tolerance to heat
- Taste
- Different maturing period
- Frying qualities
- Water absorption
- Not browning

What can be done

- Active networking and steady exchange of information and knowledge
  - creating synergies
  - making outcomes more accessible to end-users

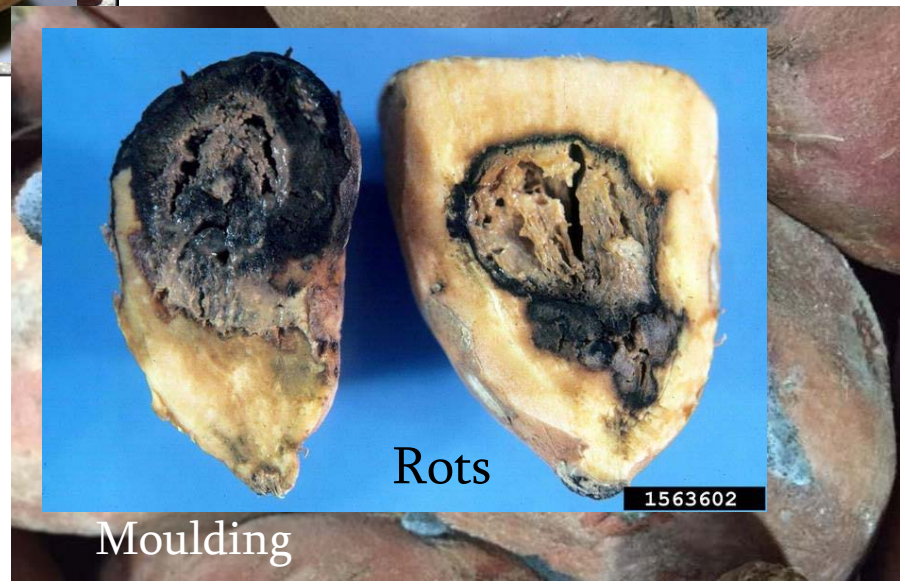
- Leads to
  - Better coordination offer opportunities for innovation
  - building on shared needs
  - achieve economies of scale while avoiding overlaps



Processing Challenges

Lack of raw materials due to overreliance to rain-fed OFSP farming

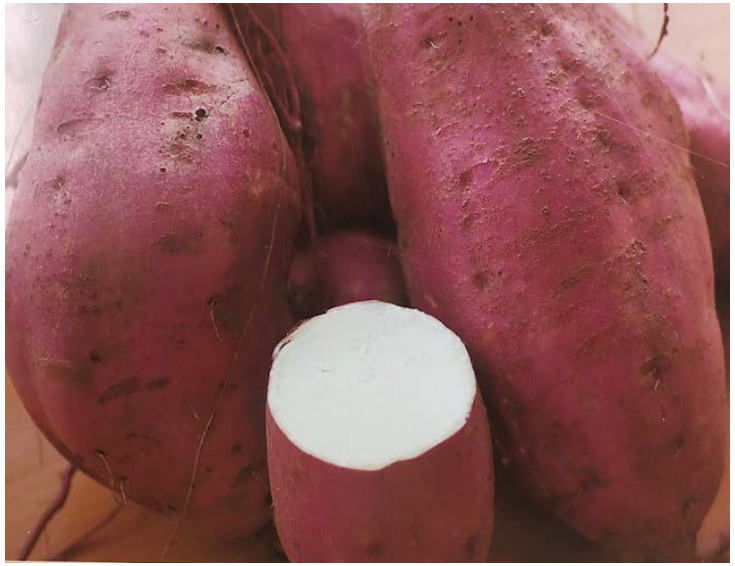
Poor quality processing roots root geometry is long tapering - which makes it susceptible to injuries during harvest, packaging, and transport (Aditya *et al.*, 2016)

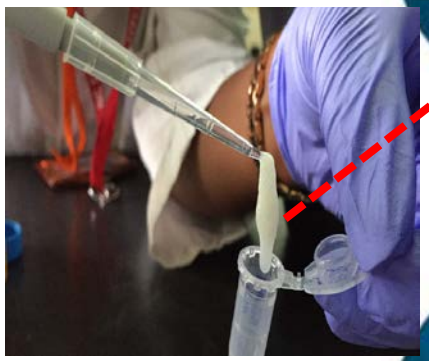


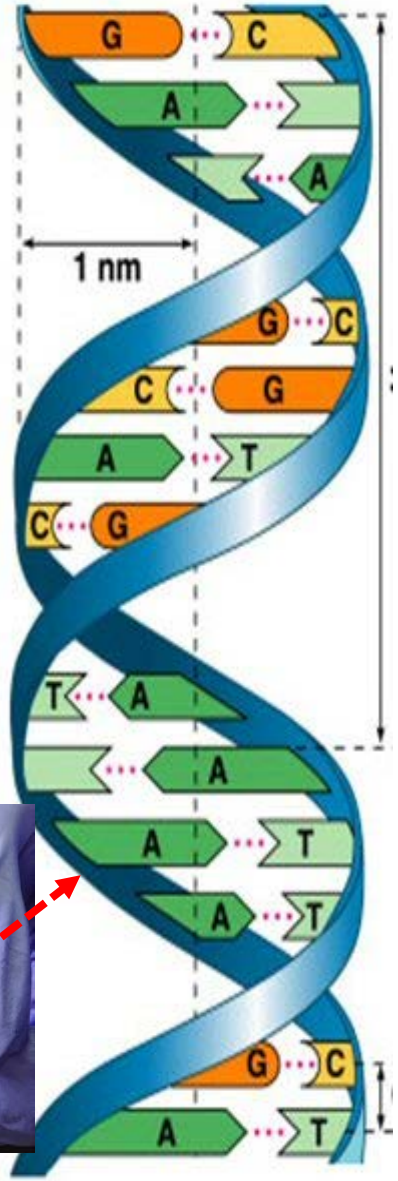
Post harvest/storage challenges


JUST KEEP
SWIMMING,
SWIM,SWIM,SWIM.

The breeding perspective



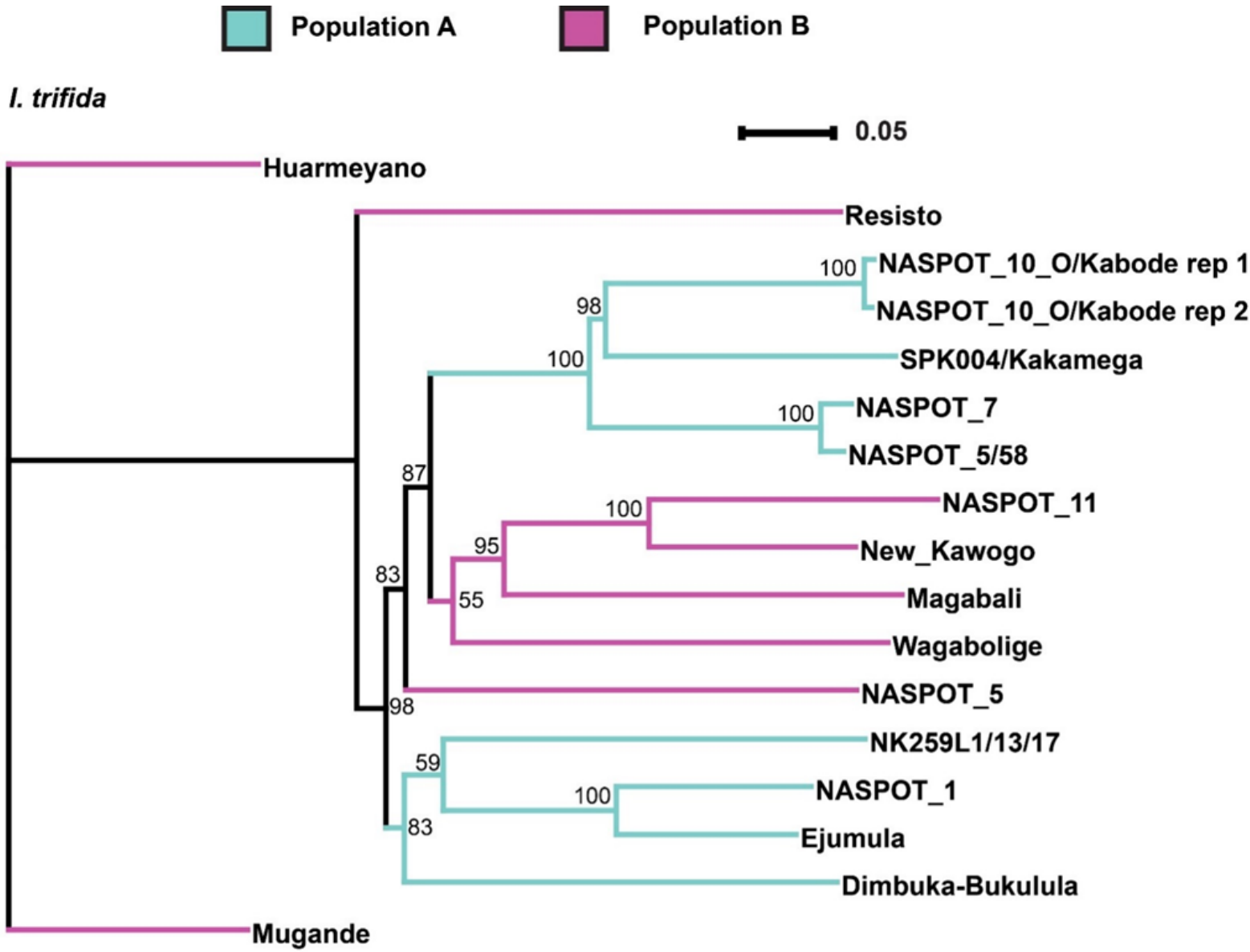




(a) Key features of DNA structure

Knowing the genetic relationship of parental materials before making crosses

CIP breeders are now utilizing heterosis (combining ability and performance of different parental materials)



Phylogenetic tree based on ~10,000 SNPs does not recapitulate populations A and B
Allelic expression for the 8x8 to be done using RNAseq data

The value of genetic relationships

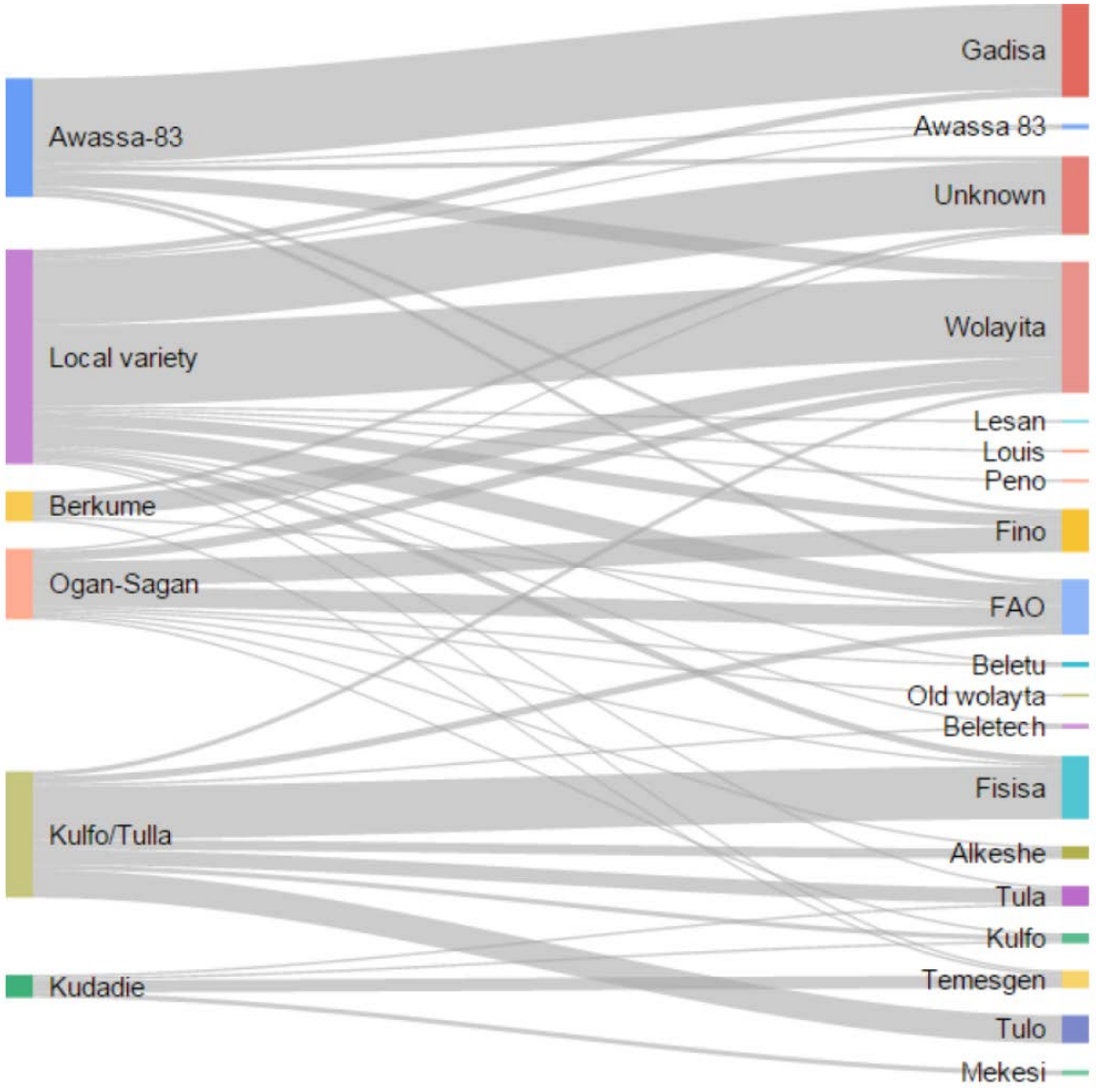


Figure 3. Sankey diagram capturing the relationship between sweetpotato varieties identified through DNA fingerprinting and sweetpotato variety names given by farmers. The bars indicate percentage of total varieties while lines describe the relationship

What can we do for the breeders?

Varietal identification

- Parental selection
- Help breeders keep track of landraces and released varieties through DNA fingerprinting

Kosmowski et al 2016

Multi environment evaluation of populations

Uganda

- Different agroecological zones are evaluated- Some phenotypes/characteristics are only expressed in certain environmental conditions e.g disease and pest resistance, drought
- Faster discovery of traits controlled by many genes

Using genetics to know where the genes for quality processing traits are located and use them for selection of varieties

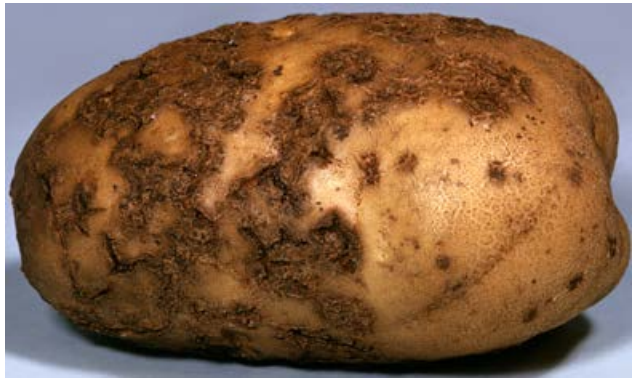
Beauregard

x

Tanzania

Credit: Dorcus Gemenet

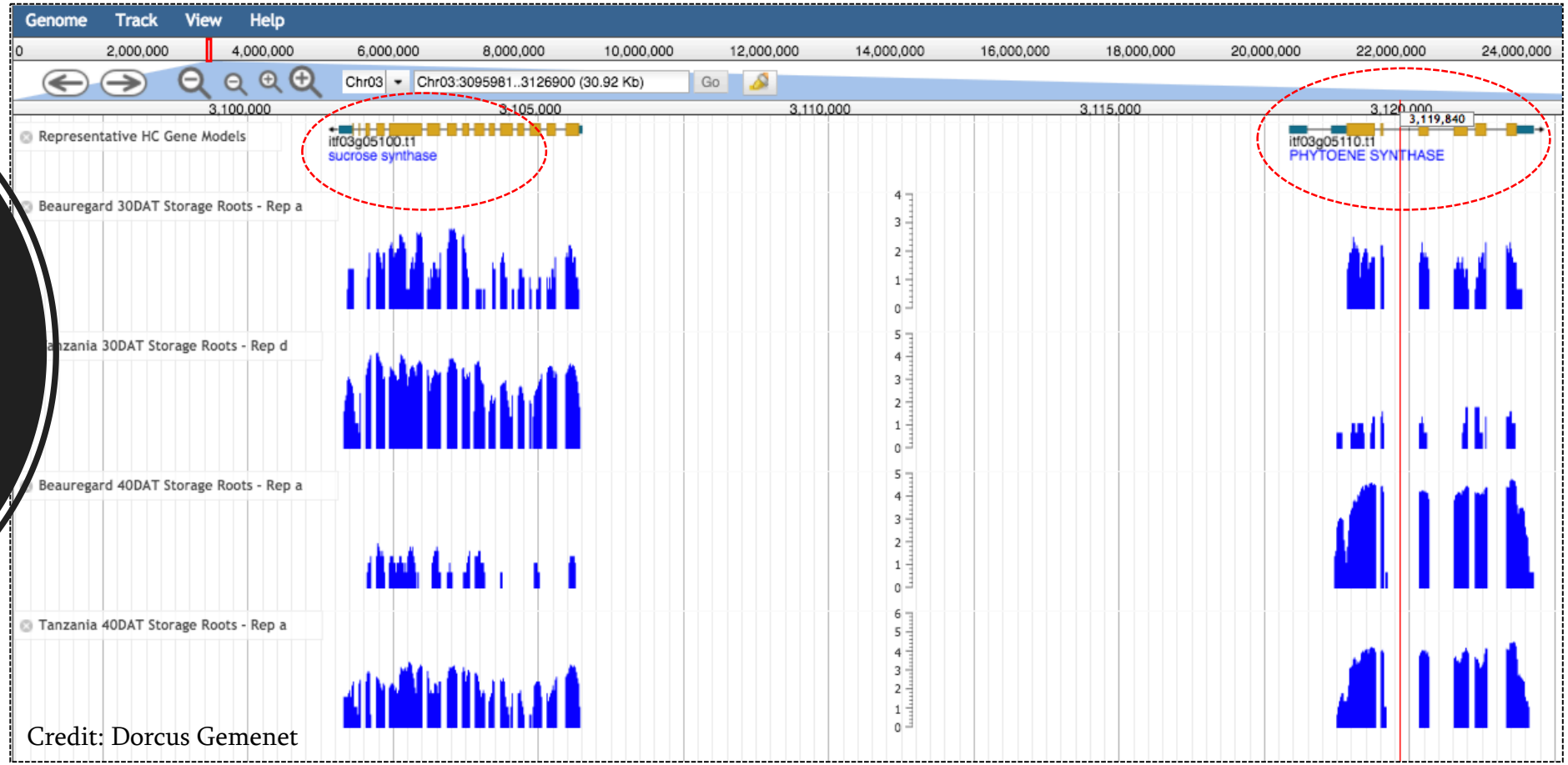
Sprouting



Weevil or nematode resistance

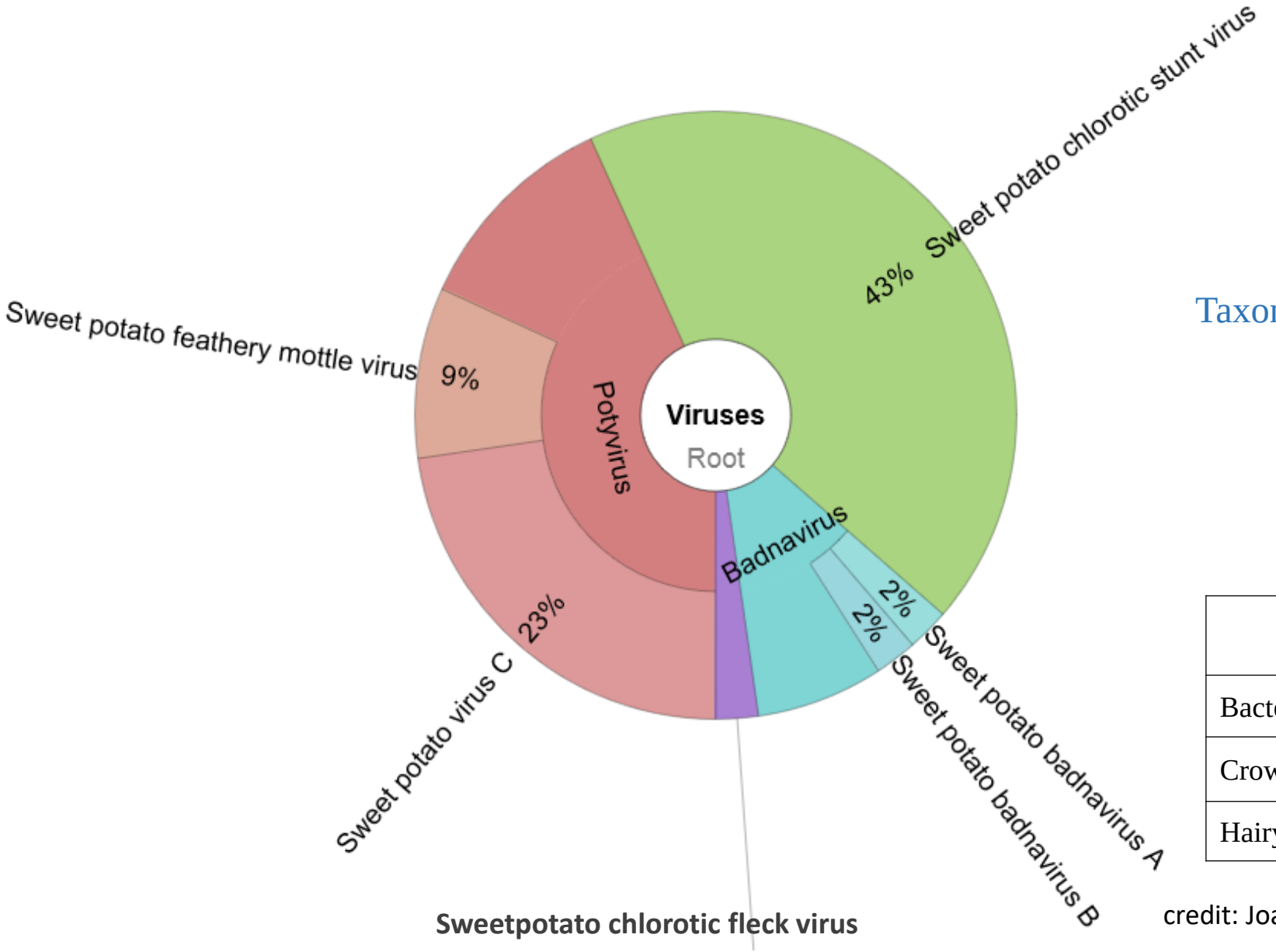
The negative correlation of Beta carotene and dry matter

Combining conventional breeding and genetics enables breeders to understand and speculate on undefined mechanisms for traits



Credit: Dorcus Gemenet

Knowledge on circulating viruses/pests and their distribution in each sweetpotato producing country

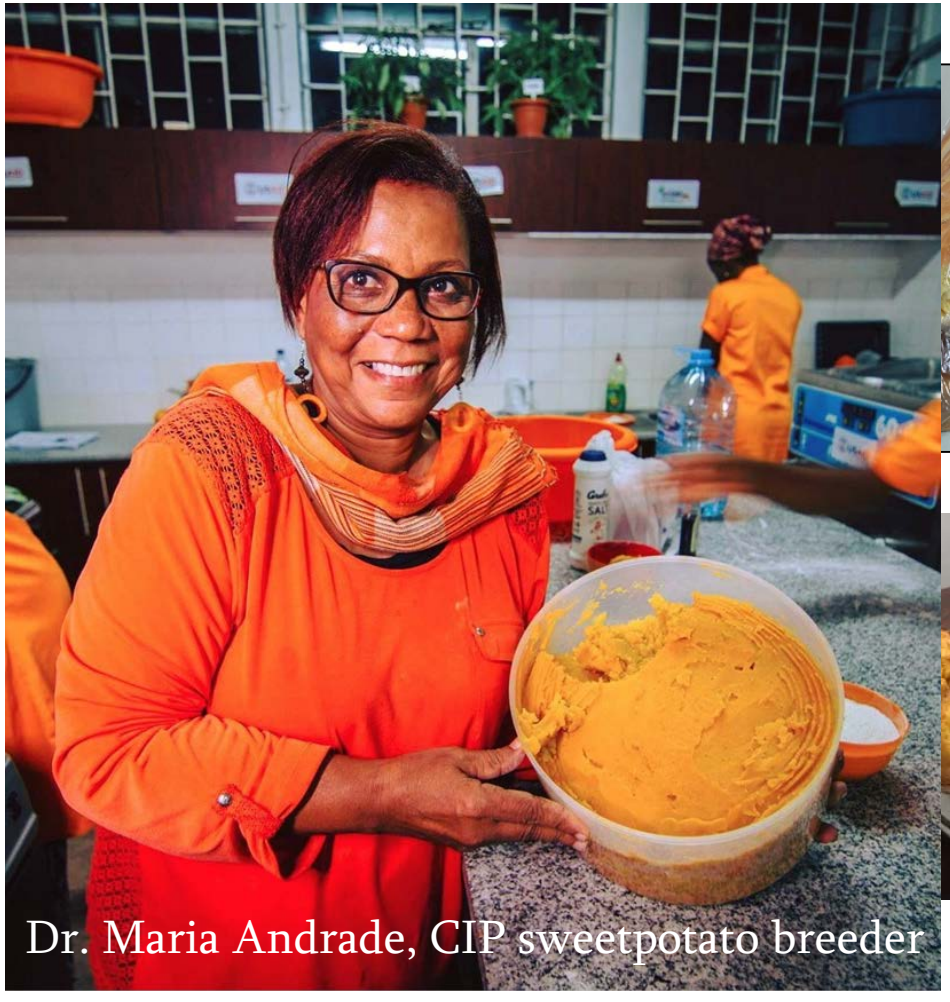


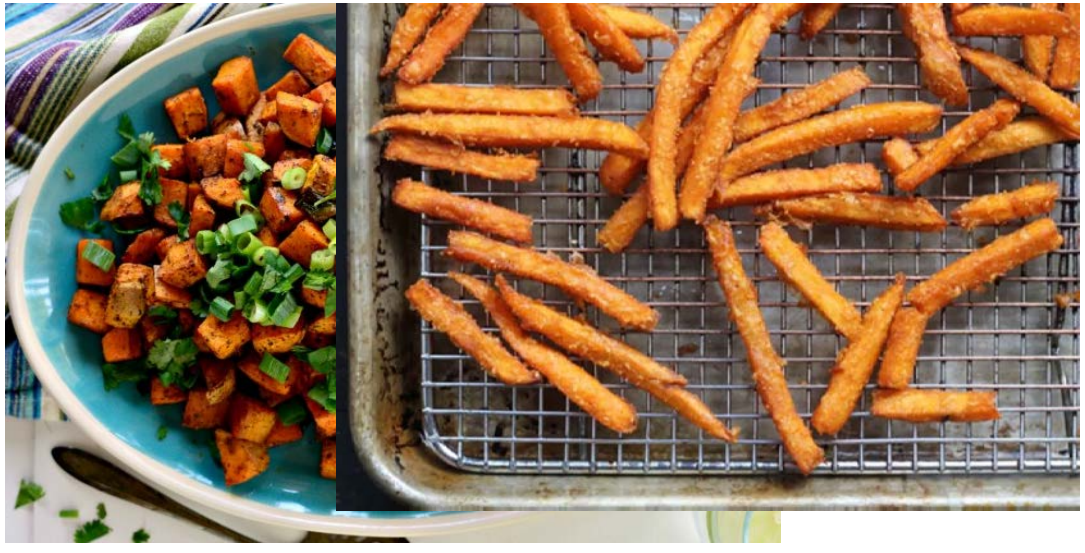
Taxonomic abundance of S.P viruses

Bacteria detected	
Bacterial wilt	*Ralstonia solanacearum*
Crown gall	Agrobacterium tumefaciens
Hairy roots	*Agrobacterium rhizogenes*

credit: Joanne Adero

<< Different OFSP varieties for different products>>





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Haiku

Genes, genetics, genomes
What a golden sweetpotato
Food, feed, health and wealth