

RESEARCH FOR DEVELOPMENT

CSIR - CROPS RESEARCH INSTITUTE



**National Tomato Breeding Programme:
Past, Present and the Future**

PRESENTATION AT WACCI, UNIV. OF GHANA

BY

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Outline of Presentation



Tomato

**Background of Tomato Breeding in Ghana
1960-mid 1980s**

**Current Breeding Programmes
Mid 1990s to present**

The Future of Tomato Breeding in Ghana

Background

- **Tomato was introduced into the West African sub region by the Portuguese between the 16th and 17th Century**
- **The crop has since its introduction become an important food item in the sub region.**
- **In Ghana, it is now the number one vegetable consumed and most of our food preparations have grown around it.**



- **Production has always lagged behind leading to a huge short fall which always has to be imported**
- **Research work has concentrated on agronomy, physiology and protection with very little being on breeding**
- **Development of the crop in terms of breeding new varieties has not been systematic**

- **The Govt. in the 1960s promoting industrialization in Ghana built dams and irrigation projects key areas to promote tomato**
- **By 1968 processing industries were set up to process tomato at Pwalugu and Wenchi and Nsawam.**
- **Tomato breeding actively started in the country major research institutions (CSIR-CRI and UG) to support the industry.**
- **The breeding work led to the development of the following varieties.**

- **The OK and MH series through crosses between local and exotic lines like (Kumasi x Oxheart) and (Manpong x Hawaii) produced new cultivars like the (McEwen 1961; Doku 1963).**
- **The Wosowoso a vigorous material tolerant to nematode infestation and high rainfall (Sinnaduari and Doku, 1976).**

1974



1978



Agble working from CSIR-CRI also made various crosses b'tween *L. Pimpinellifolium* and some commercial lines

He also was successful in getting the non ripening gene (nor^A) into some of his breeding materials .

Though a lot of success were made, the work was discontinued without any releases of varieties

- **By the mid 1980's the tomato factories stopped producing due poor management**
- **This led to a slow down in active research in breeding . Few in the academic institutions.**
- **However farmers went ahead and did their own selections on their fields and came out with lines like...**

1

Power

2

Power Rano

Farmer selected lines

Pectofake

4

Tyre

3

Current Breeding Programmes

Mid 1990s to present



Tomato Research work at CSIR-CRI

- ❑ Collections and Characterization**
- ❑ Field evaluations & Genetic diversity**
- ❑ Generation of crosses/cross combination**
- ❑ Development of high yielding tomato fruits using pureline selection**
- ❑ Some bit of molecular work on tomato**

Germplasm collection and Characterization

- ❑ In 1995 under NARP and AgSSIP, tomato germplasm were collected all over the country
- ❑ In 2012 under KAFACI, tomato germplasm were assembled from Korea, Burkina Faso, Taiwan and Ghana
- ❑ A semi structured questionnaire from CSIR-PGRRI are usually administered to obtain some passport data for the collected germplasm



Germplasm collection

Activity a. Collection of tomato germplasm from RDA & AVRDC via postal mail

Activity b. Collection of tomato germplasm in Burkina Faso & selected growing areas in the Agro ecological zones of Ghana

Collections from Guinea , Sudan savannah and part of semi deciduous zones





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Germplasm collections

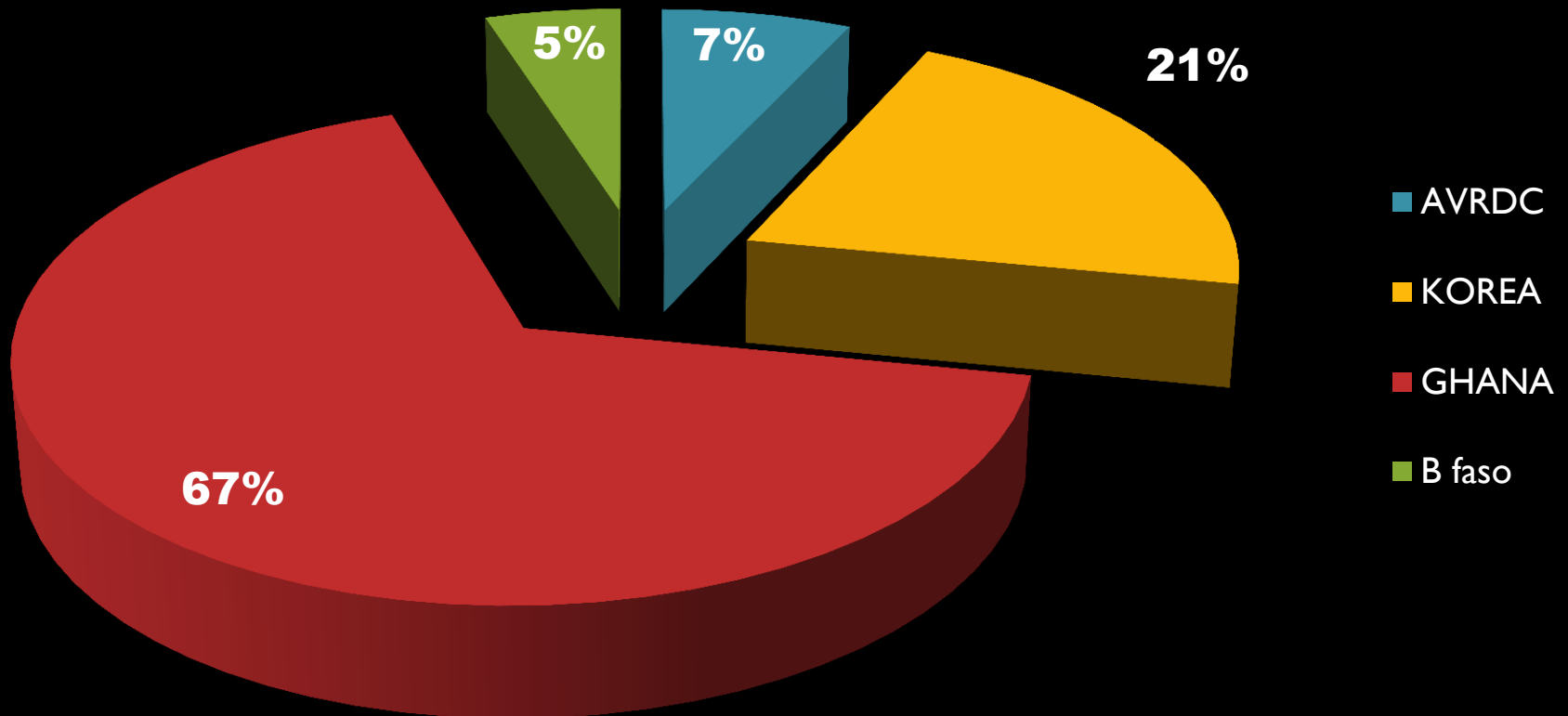


Fig. 1 Germplasm assembled from different countries

Collections from Ghana

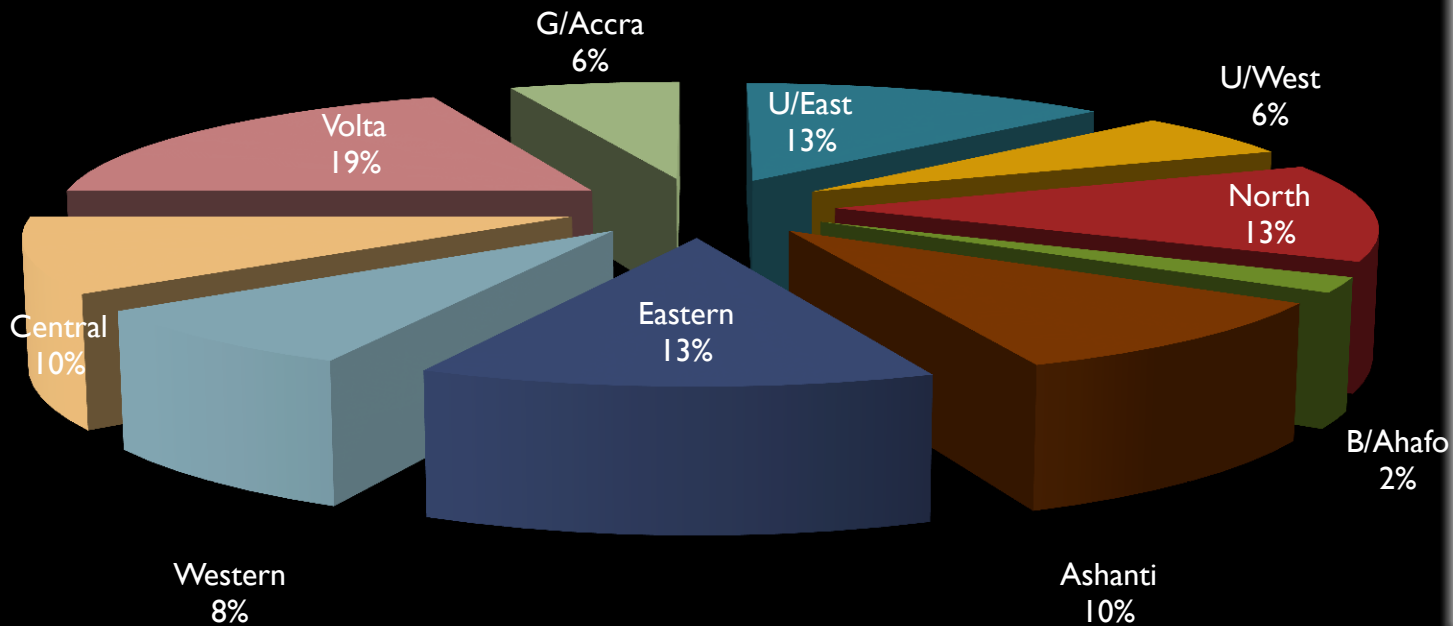


Fig. 2a Germplasm assembled from Ghana

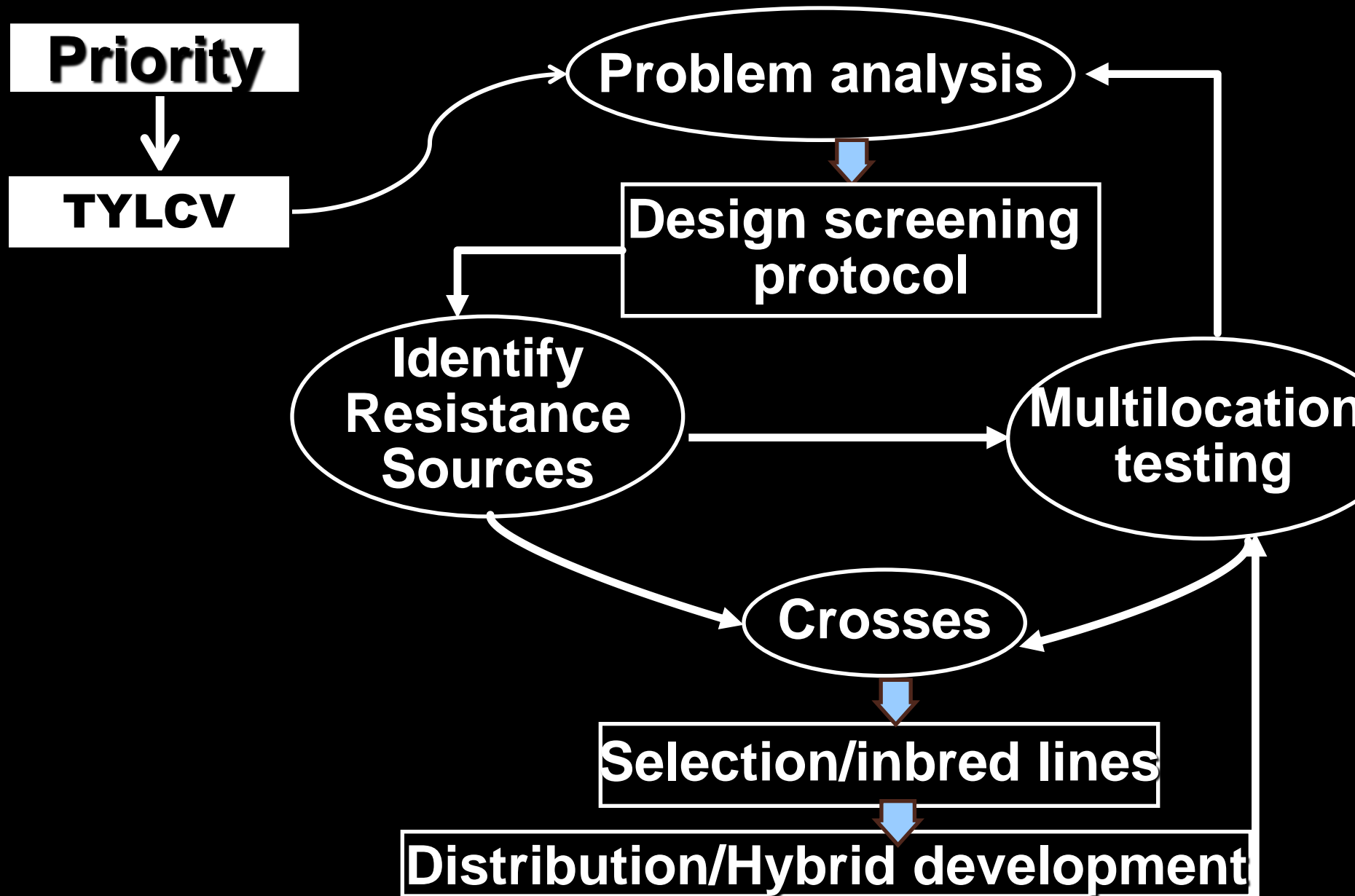


Fig. 2b Agro ecological zones in Ghana

Breeding programme at CSIR-CRI

- **Our breeding programme is geared towards the following:**
 - ✓ Breeding for disease resistance (TYLCV)
 - ✓ Breeding for good horticultural characteristics such fruit shape, size, colour etc
 - ✓ Development of high yielding tomato varieties using pureline selection method
 - ✓ Breeding for processing qualities, high brix, shelf life
 - ✓ Breeding mini tomato for export market
 - ✓ Breeding for heat tolerance tomato (climate change)

Breeding for disease resistance



Breeding for good horticultural characteristics:

Cross Combinations

<u>Male</u>	x	<u>Female</u>
202		191
042		083
087		186
106		188
070		005
083		042
097		213
042		209
070		191/083
083		042
042		083
106		188
213		079

<u>Accession no.</u>	<u>Name</u>	<u>Source</u>	<u>Desirable trait</u>
202	AVTO 0102	AVRDC	Fruit shape
042	local tomato	V/R	Fruit shape
087	5K	SARI	Fruit shape, colour
106	local tomato	Bolga (U/E)	High yielding
070	local tomato	Bunlung (N/R)	Fruit shape, fruit size
083	6(A)	SARI	Plant height/yield
097	local tomato	Binduri (U/E)	Fruit shape
042	local tomato	V/R	TYLCV resistant
213	AVTO 0102	AVRDC	Virus tolerant
191	Dyune	Korea	TYLCV resistant, brix
188	Madiso	Korea	Shelf life, TYLCV resi.
005	Petomech	E/R	High yielding
209	AVTO 01020	AVRDC	Brix, fruit size
079	local tomato	Bontanga (N/R)	Fruit size, shape

F₁ generation

2014

Advance F₁ to F₂

2015

F₂-F₃-F₄

Development of high yielding tomato using pureline selection

3080

▪ **101 tomato lines were selected (from 3080 plants) in 2011**
Fruits were harvested separately and seeds extracted separately

101

▪ **In 2012, planting involved growing progeny rows from individual tomato lines (101) selected for observation**

12

▪ **In 2013, 12 tomato lines selected from the previous lines (101) were evaluated on-station**

Kwadaso station

- ❖ **Date of Nursery: 14th March 2013**
- ❖ **Date of Transplanting: 9th April 2013**
- ❖ **Size of land : 0.1 ha (39m x 22m)**
- ❖ **Plant spacing : 100cm x 50cm**
- ❖ **Design : RCBD with three blocks**

Fertilizer

- 1. YaraMila winner (150kg/ha)**
- 2. YaraLiva nitrabor (125kg/ha)**
- 3. Krista K (50kg/ha)**



KWADASO STATION





**Segregating
fruits**



- drastic reduction was made
- diseases plants & defects were eliminated
- 12 tomato lines were selected



KWADASO STATION





**Student from
KNUST**



Breeding mini tomato to feed Ghanaian local market

Objective

- To develop tomatoes that can stand high rainfall conditions
- To feed the expanding expatriate community in Ghana



Mini tomato growing in the middle of the rainy season with no fungal problems. No fungicide have been applied yet.

Fruits of mini tomatoes



Plum Shape



Heart Shape



Round Shape

Farmers from Western region who visited CSIR-CRI during our open day and saw it fruiting during the middle of the rainy season are already requesting for seed.

Crosses between mini tomato and cultivated tomato



Mini -tomato X commercial large types

F4 – Increased shelf life (in some cases up to 50+ days)

Increased fruit size over the mini-types

Good brix (between 4-6)

Improved fruit no /truss

Improved fruit shapes

Molecular work on tomato at CSIR-CRI

- ❖ **Molecular characterization of tomato germplasm**
- ❖ **Molecular screening for TYLCV resistance**

- Two to three young tender leaves are plugged into plastic envelopes, labeled and stored on ice
- These are taken to the molecular laboratory
- The extraction process was carried out using Egnin *et al.*, (2000) protocol with modifications by the laboratory



The Future of Tomato Breeding in Ghana

The golden age for tomato breeding

- ❑ Demand of tomato and tomato products increasing.
- ❑ The population becoming more and more critical in choice of products
- ❑ Production technologies changing ... introduction of protected cultivation ...

Looks at developing of tomato to meet the following demands



- ❑ Breeding for heat tolerance tomato
- ❑ Breeding for tomato varieties adaptable in greenhouse
- ❑ Breeding for processing qualities, high brix, shelf life
- ❑ Poor storage condition for breeder seeds of vegetables
- ❑ Breeding for disease resistance (bacterial wilt & nematode)

some challenges need addressing

- ❑ Funding for research in vegetable is limited
- ❑ Capacity building (long term training) in vegetable breeding) is limited

THANK YOU