Africa's Compelling Case for a Different Mode of Partnership in Agricultural Research and Development

Tsedeke Abate, Founder & Leader
Homegrown Vision
tsedeke@homegrownvision.org
www.homegrownvision.org
Addis Ababa, Ethiopia

Presented at PlantLink
Hosted by Swedish University of Agricultural Sciences, Alnarp, Sweden
14:00-15:15 CET, 9 February 2021

HGV
HOMEGROWN VISION
ሐገር በቀል ዕይታ

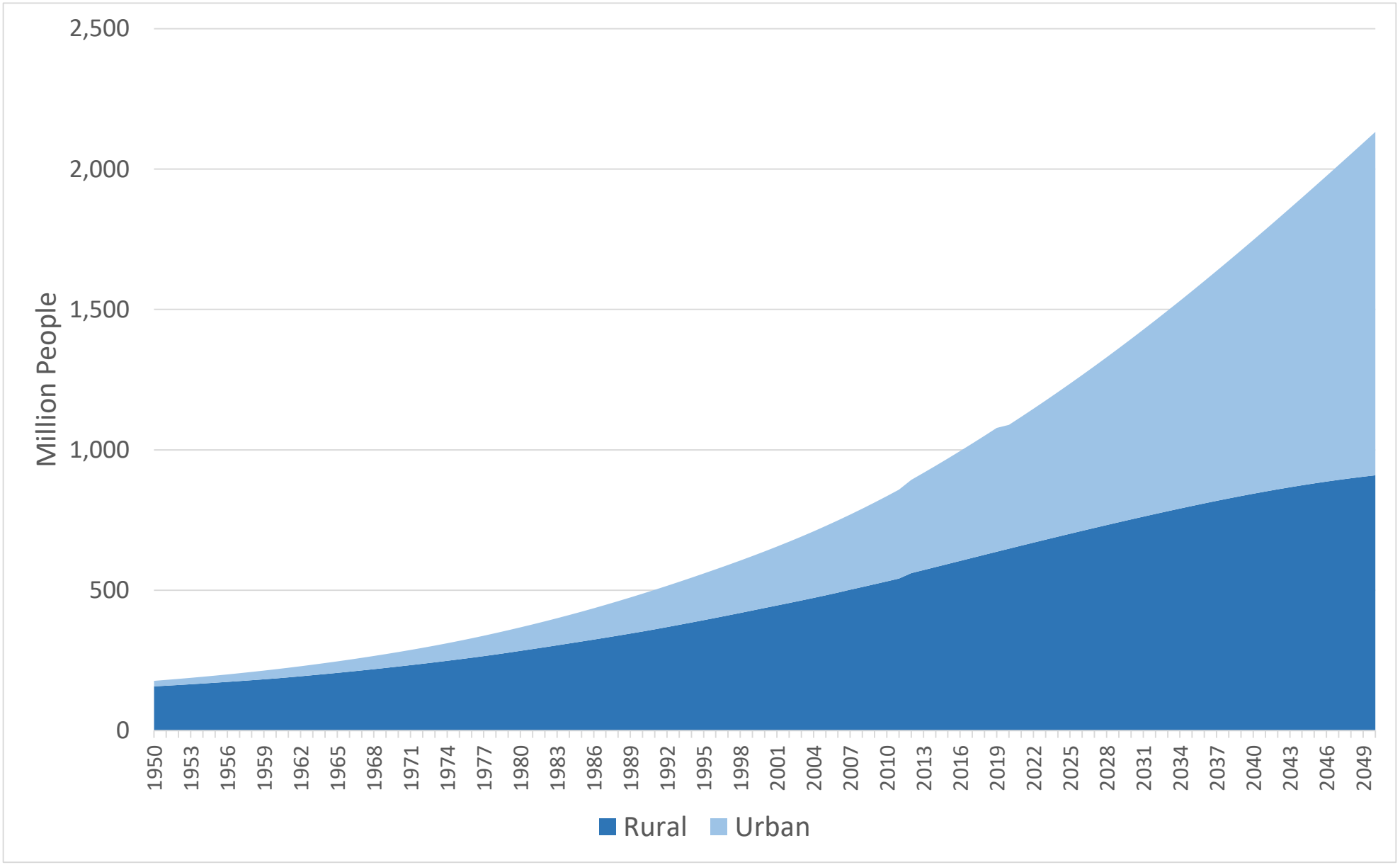
Outline

- Part One: Background
- Part Two: Recent Development Initiatives and How They Fared
  - National
  - Tropical Legumes II (TL – II): CIAT, ICRISAT, IITA
  - Drought Tolerant Maize for Africa (DTMA/STMA): CIMMYT, IITA
- Part Three: Unintended/Undesired Consequences
- Part Four: Summary & Conclusions

Agriculture is Life for Africa

- Food & nutrition security
- Export earnings
- Import substitution
- Raw material for local industry

Rapid Growth of AOS Population (constructed by the author from FAOSTAT)

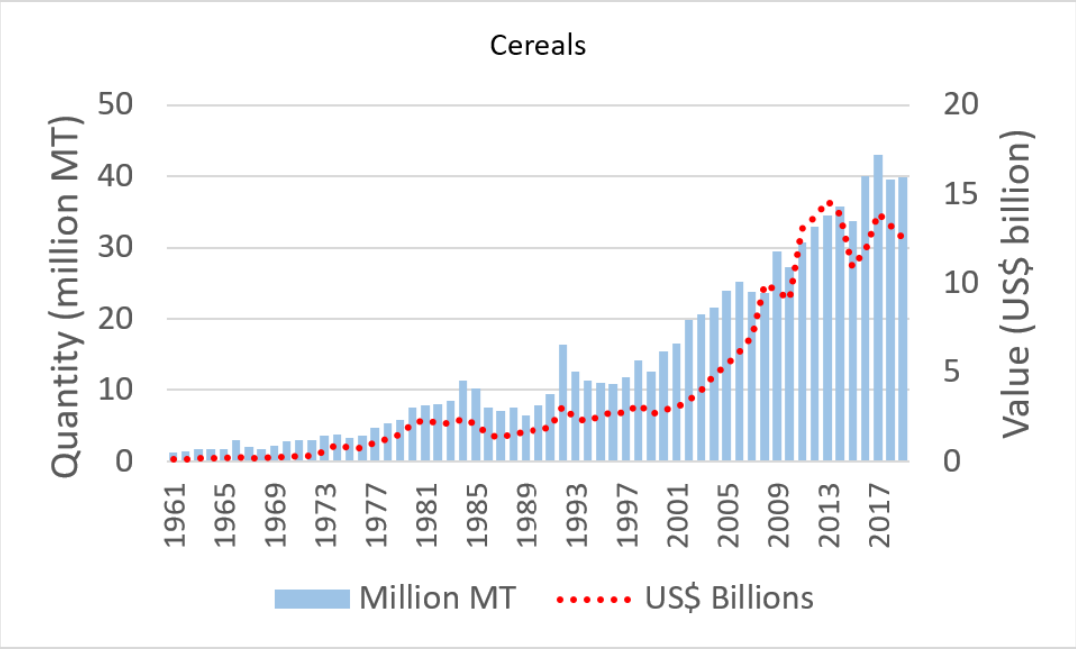


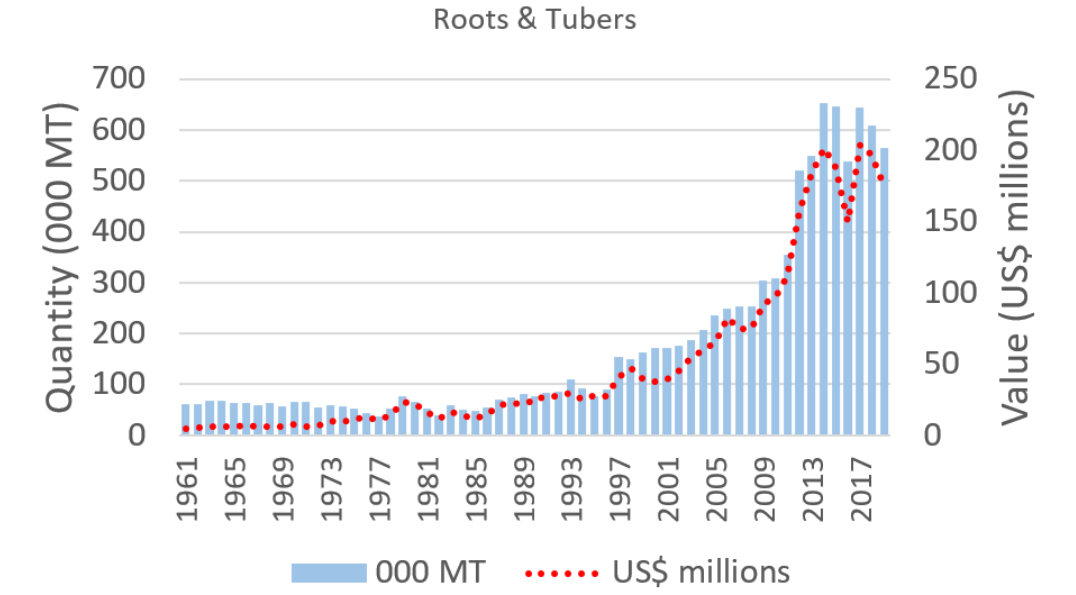
Millions
1950 - 177
2000 - 638
2050 – 2,133

Percent urban
1950 – 11
2000 – 32
2050 – 57

Challenge: Food & nutrition security (in addition to economic well being) while maintaining the resource base

HGV
HOMEGROWN VISION
ሓገር በቀል ዕይታ



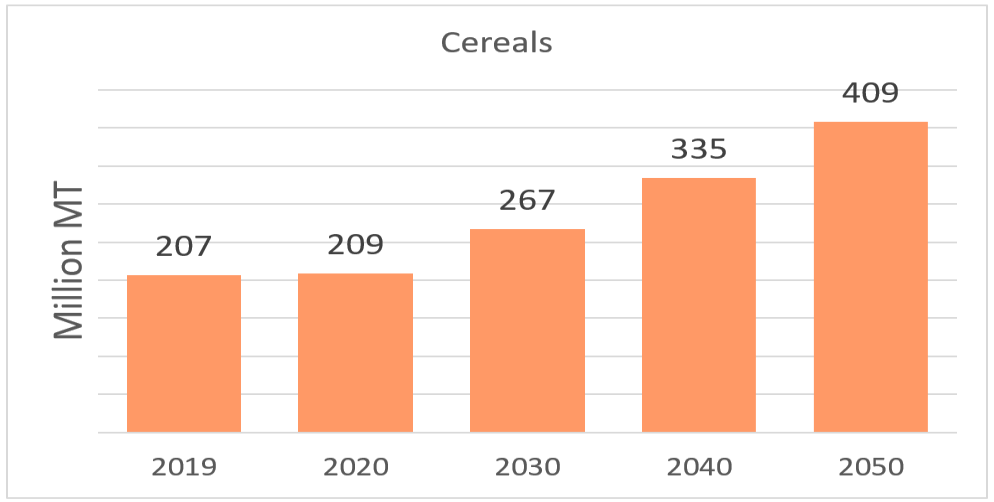


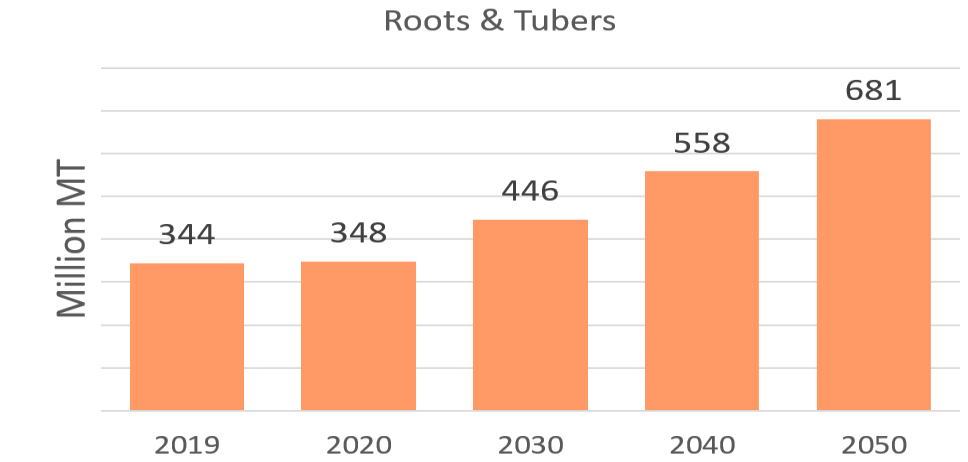
Quantity and value of staple crop imports are rapidly growing in Africa

Cereals (2015-19 avg.)
Quantity: 39 Million MT
Value: US$12 billion

Roots & Tubers (2015-19 avg.)
Quantity: 600,000 MT
Value: US$ 183 million

Minimum requirements (million MT) – major staples





Source: 2019 actual (FAOSTAT); rest own calculations

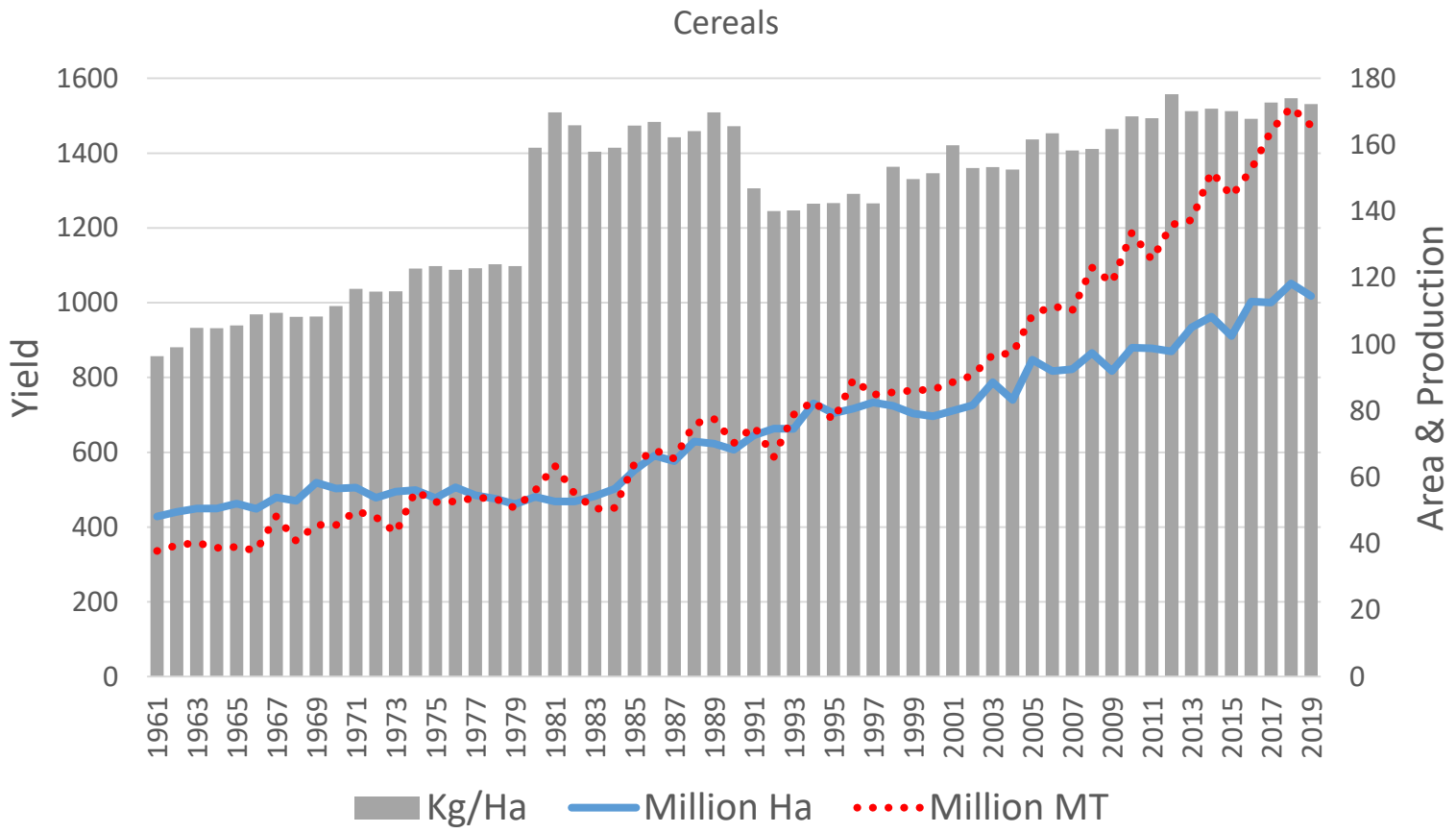
Million MT (2019)

Crop	Production	Import	Total	% Import
Maize	74	4	78	5
Rice	32	15	47	32
Sorghum	28	1	29	3
Millet	14	<1	14	<1
Wheat	8	21	29	71
Others	6	0	6	0
Barley	3	<1	3	2
Total	166	41	207	20

Crop	Production	Import	Total	% Import
Cassava	192	NA	192	NA
Yam	72	NA	72	NA
Sweet pot	28	<1	28	<1
Plantain	27	<1	27	<1
Potato	14	<1	14	3
Taro	7	NA	7	NA
Others	4	1	4	<1
Total	344	1	345	<1

Rapidly growing African populations drive high and growing consumption of cereals, 20% of which was imported in 2019. Meanwhile, African countries are almost self-sufficient in roots and tubers (prominently cassava), though increasing population requirements may put a strain on production.

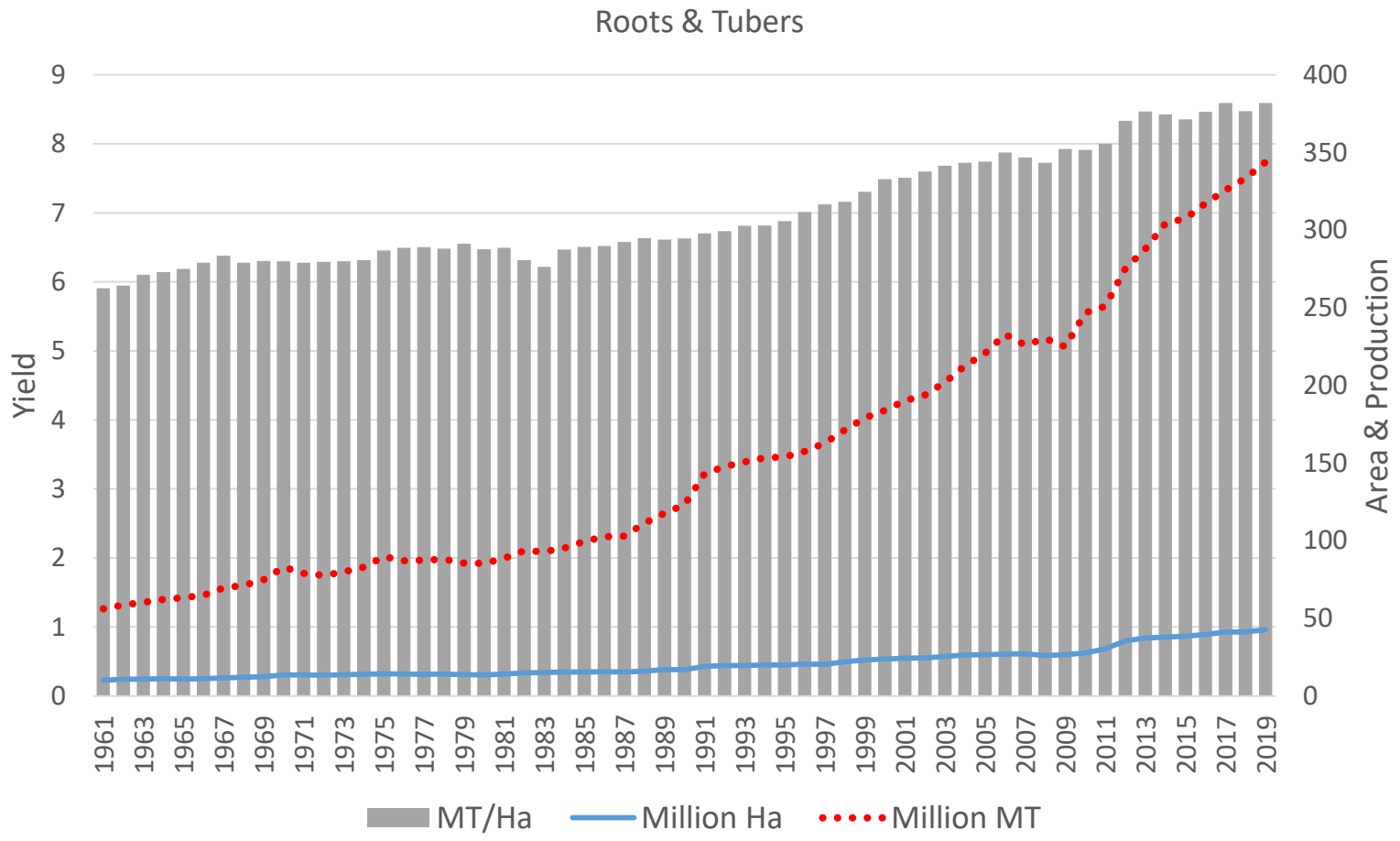
Indicators for major cereals in Africa



Production of major cereals has grown by an annual rate of 3.71% in Africa between 2000 and 2019. However, much of the gain was driven by expanding areas under production, with yields growing by <1% per year and remaining below 1600 kg/ha.

Source: Constructed by the author from FAOSTAT (accessed 13 Jan 2021)

Indicators for roots & tubers in Africa



Production of major starchy crops has grown by an annual rate of 3.43% in Africa over the last 20 years, with much of the gain driven by expanding areas under production, with yields growing by <1% per year and remaining below 9 MT/ha.

Source: Constructed by the author from FAOSTAT (accessed 13 Jan 2021)

HGV
HOMEGROWN VISION
ሐገር በቀል ዕይታ

Groundnut farmer in Asebot, near Mieso, eastern Ethiopia

Photo: Tsedeke Abate (Oct 2005)

The farmer is the ultimate judge for the success of your interventions.

This farmer was full of praises for researchers during a field day occasion in the 2005 main crop season – first time he grew an improved groundnut variety.

When asked how he could be so thankful when he has not seen the benefit of the new tech yet. His answer was “These are the only people who have acknowledged that I even existed”, meaning, he has never been visited by development agencies in the past.

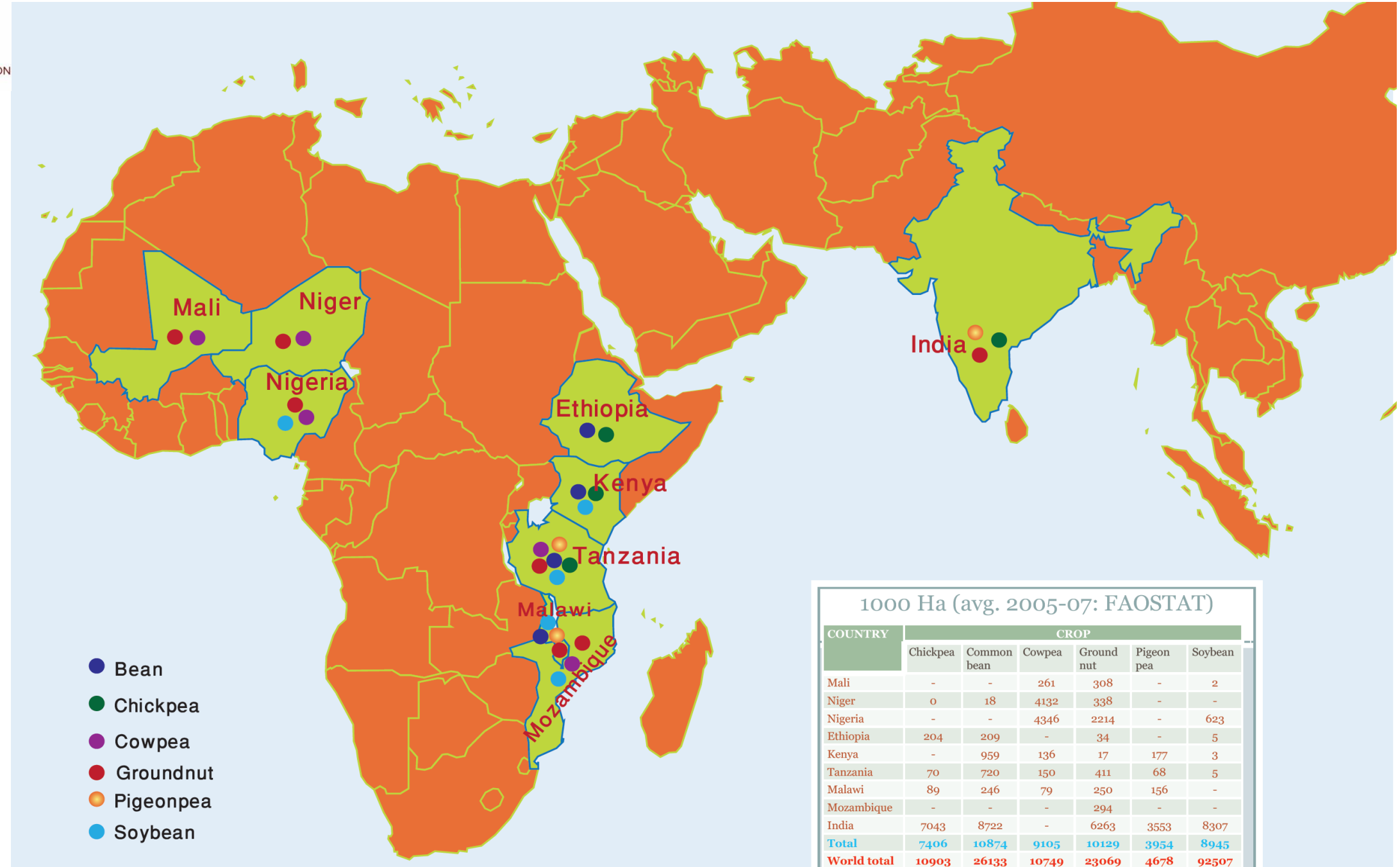
Initiatives to Improve African Agriculture

- Research/Extension Systems Established
  - Varying levels of competence/effectiveness
    - Funding
    - Capacity
- “Partnerships” Formed – TL-II, DTMA, …
  - What are the outcomes?
  - Which countries did well?
    - Who takes credit for the success?

Methods/Metrics (Measuring Change)

- Timeline 20 years: 2000 - 2019
- Source: FAOSTAT
- Yield gain
  - Computed the linear regression using the annual crop mean yield as a dependent variable and production year as an independent variable. The resulting regression coefficient was taken as an annual rate of yield gain.
- Annual rate of growth (ROG) for area, yield and production
  - Contribution of area expansion and yield to the change in production calculated
- Graphics/illustrations (1961 – 2019)
- Others have used adoption rate – but challenged

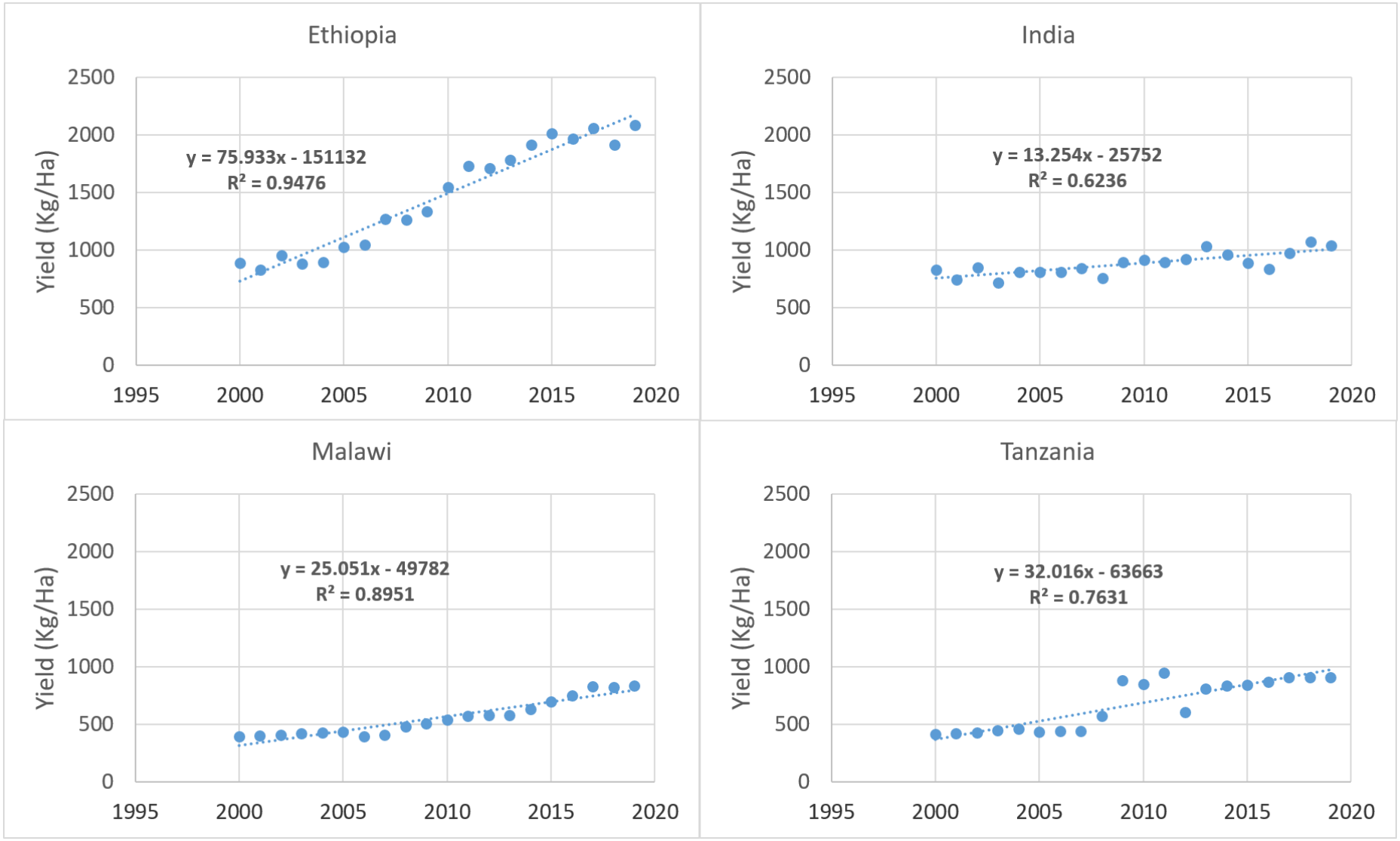
HGV
HOMEGROWN VISION
ሓገር በቀል ዕይታ



1000 Ha (avg. 2005-07: FAOSTAT)

COUNTRY	CROP					
	Chickpea	Common bean	Cowpea	Ground nut	Pigeon pea	Soybean
Mali	-	-	261	308	-	2
Niger	0	18	4132	338	-	-
Nigeria	-	-	4346	2214	-	623
Ethiopia	204	209	-	34	-	5
Kenya	-	959	136	17	177	3
Tanzania	70	720	150	411	68	5
Malawi	89	246	79	250	156	-
Mozambique	-	-	-	294	-	-
India	7043	8722	-	6263	3553	8307
Total	**7406**	**10874**	**9105**	**10129**	**3954**	**8945**
World total	**10903**	**26133**	**10749**	**23069**	**4678**	**92507**
% of world	**67.9**	**41.6**	**84.7**	**43.9**	**84.5**	**9.7**

Yield gains in chickpea



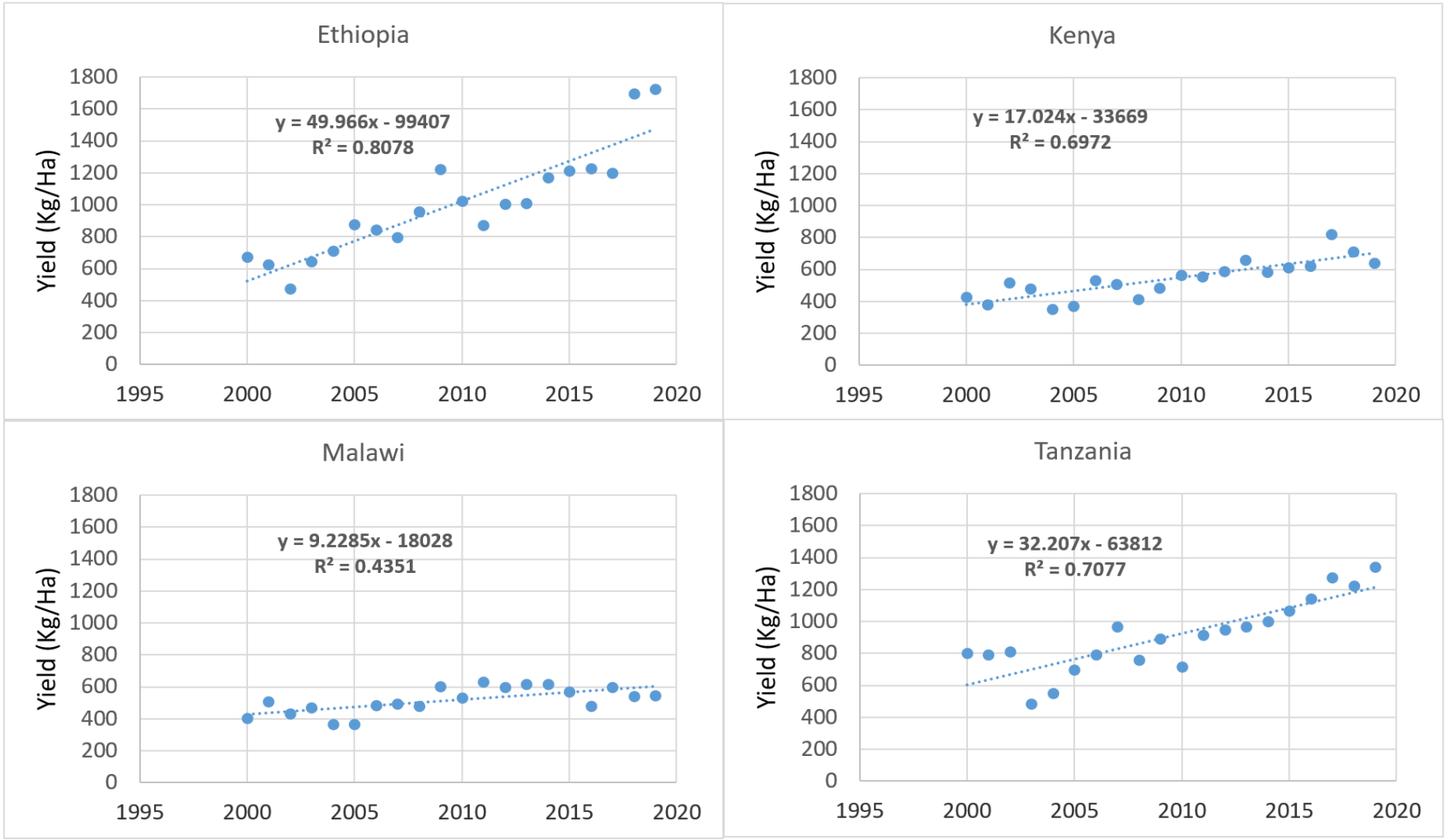
Source: Constructed by the author from FAOSTAT (accessed 16 Jan 2021)

The regression coefficient (b-value) represents the yield gain (kg/ha/yr). Thus:
Ethiopia = 76
Tanzania = 32
Malawi = 25
India =13

Note that the yields were >2000 kg/ha only for Ethiopia while the rest were near or below 1000 kg/ha

Also note the variations in the R-square values

Yield gains in common bean



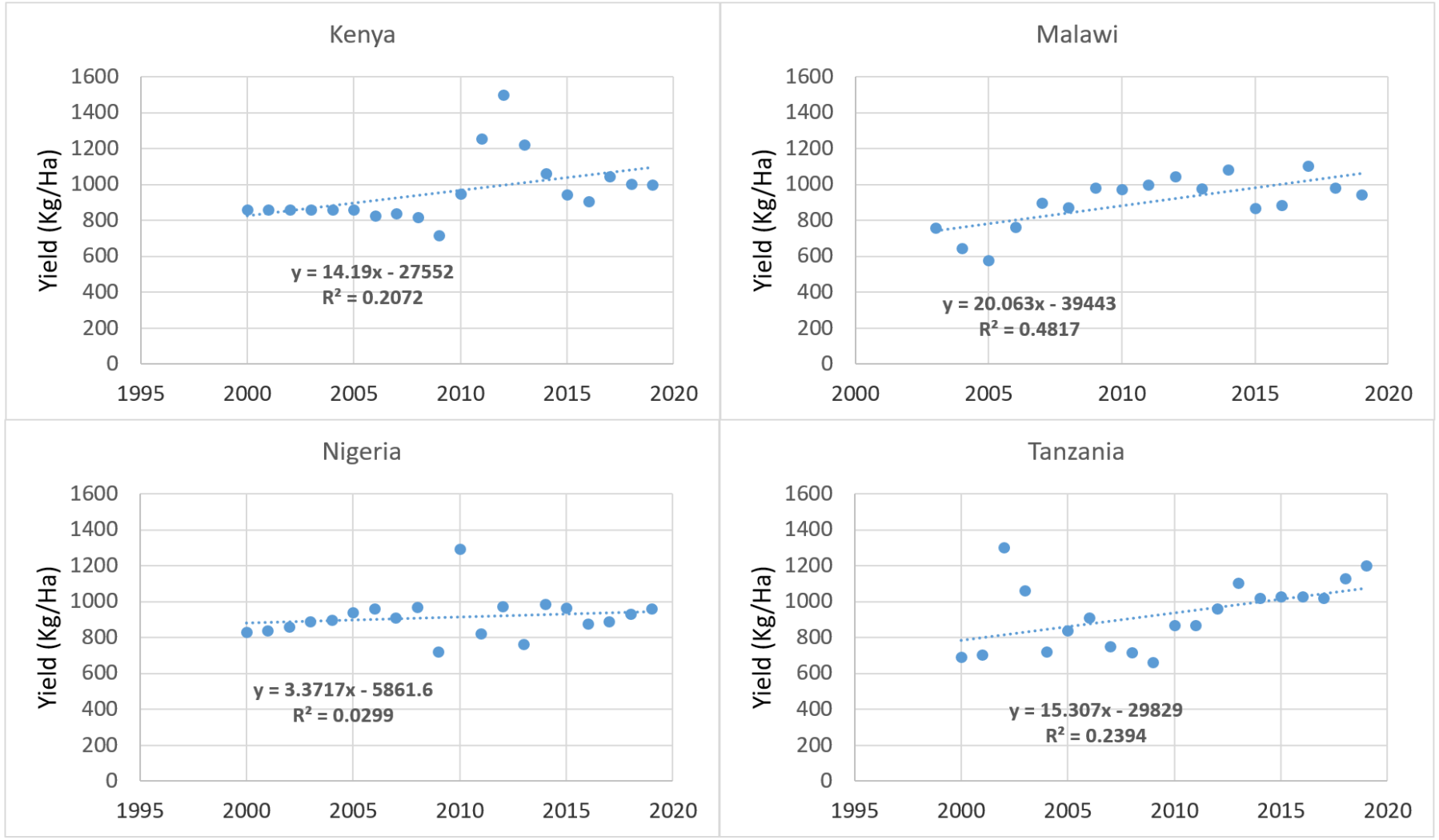
Source: Constructed by the author from FAOSTAT (accessed 16 Jan 2021)

The regression coefficient (b-value) represents the yield gain (kg/ha/yr). Thus:
Ethiopia = 50
Tanzania = 32
Kenya =17
Malawi = 9

Note that the yields for Kenya and Malawi are below 1000 kg/ha

Also note the variations in the R-square values

Yield gains in soybean

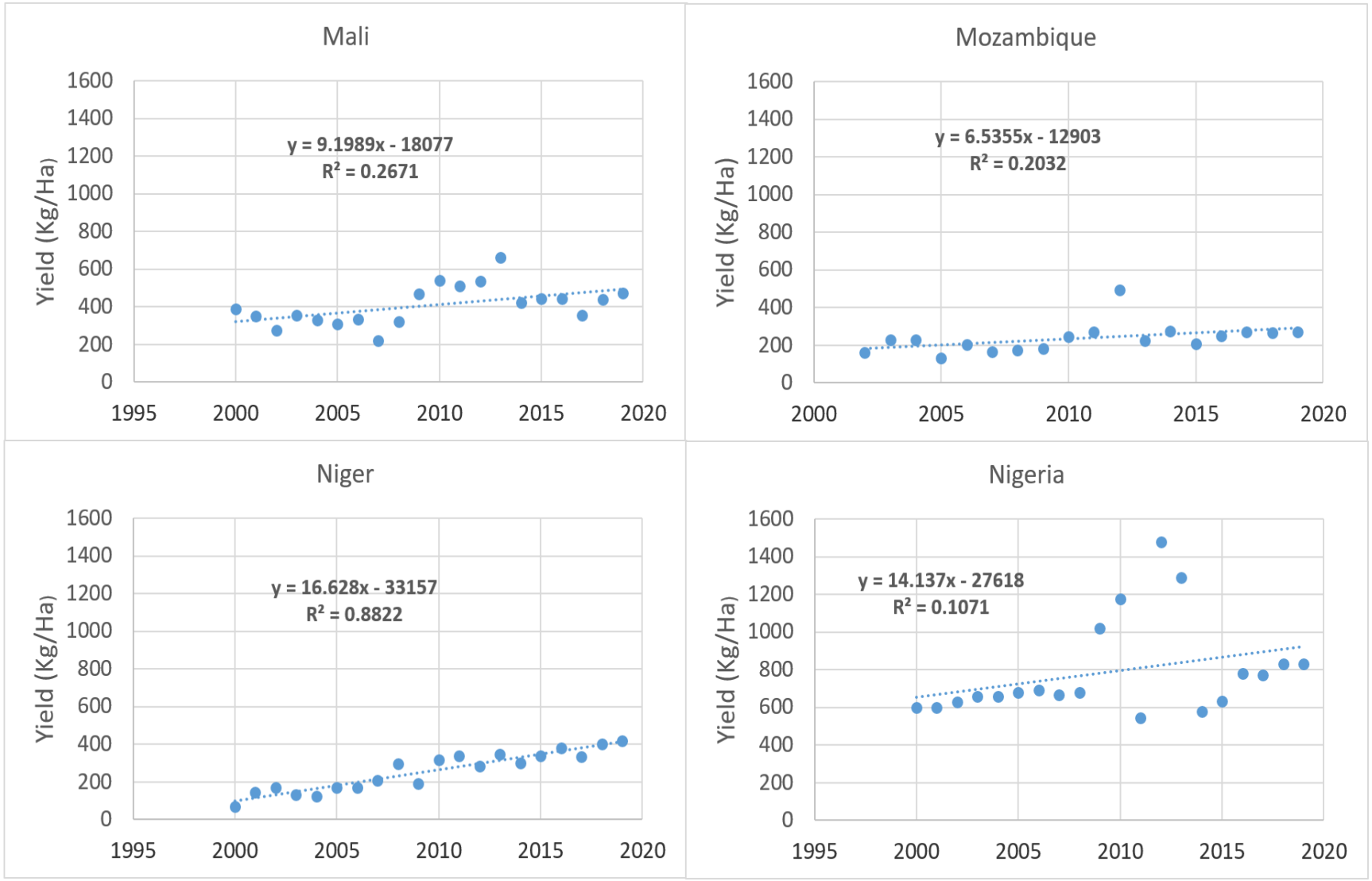


The regression coefficient (b-value) represents the yield gain (kg/ha/yr). Thus:
Malawi = 20
Tanzania = 15
Kenya =14
Nigeria = 3

Marginal differences; non-significant

Source: Constructed by the author from FAOSTAT (accessed 23 Jan 2020). Malawi data start from 2003

Yield gains in cowpea

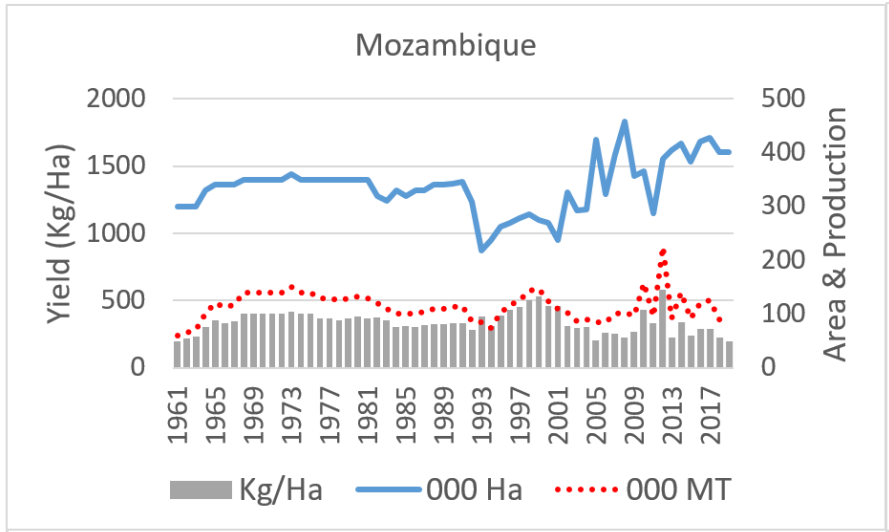


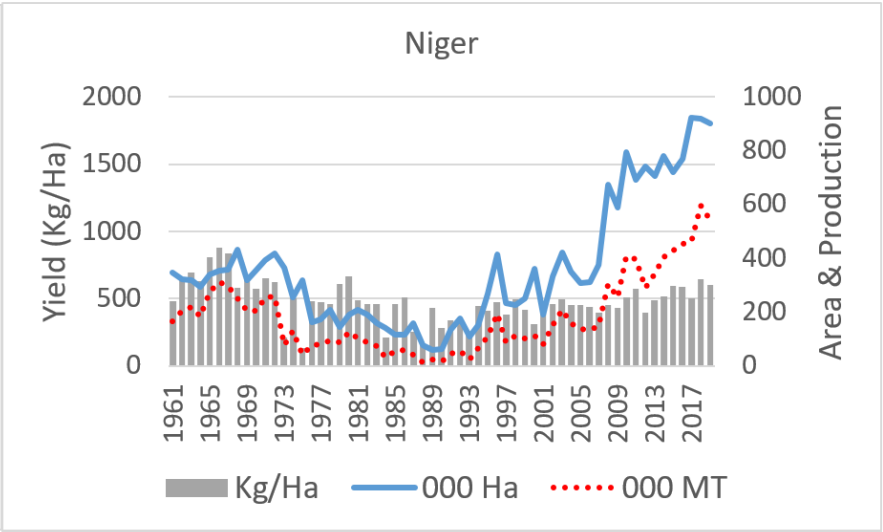
Dismally low yields in Mali, Mozambique, and Niger; so much fluctuation in Nigeria

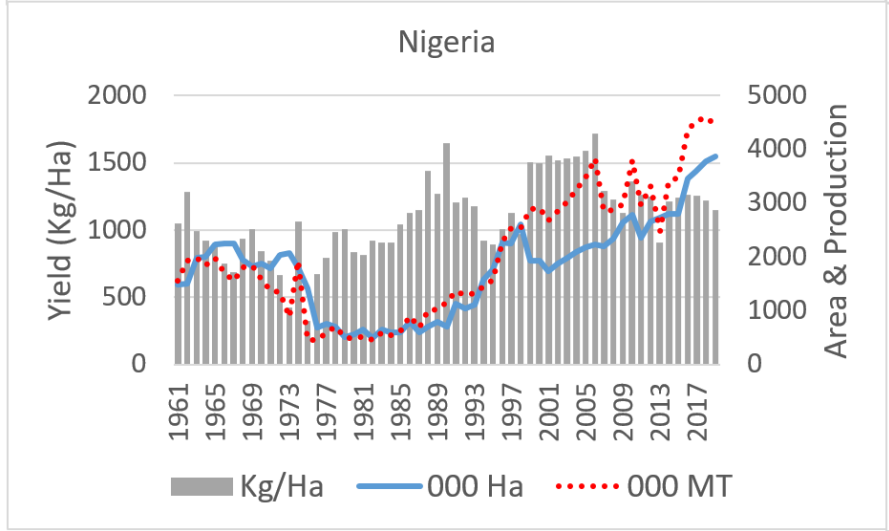
No country has made meaningful and significant progress with cowpea in Africa

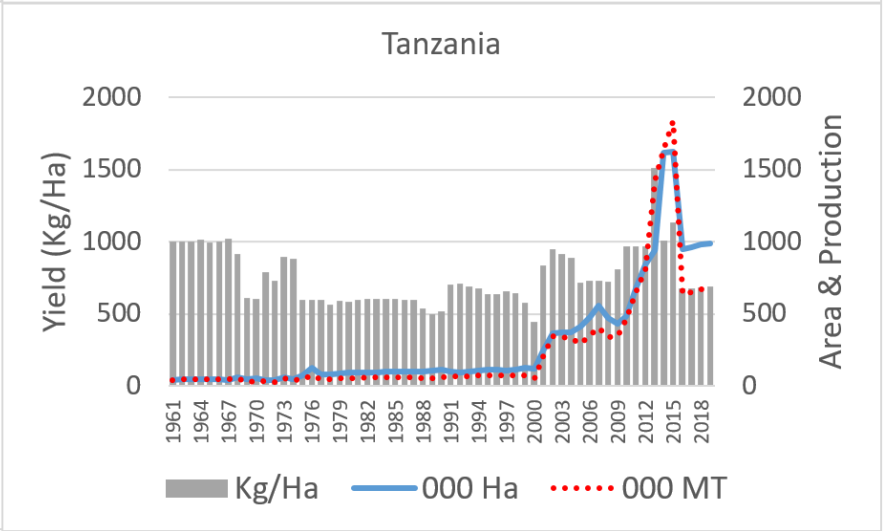
Source: Constructed by the author from FAOSTAT (accessed 23 Jan 2021)

Groundnut trends in selected TL-II countries









Source: Constructed by the author from FAOSTAT (accessed 23 Jan 2021)

No evidence that the interventions are making any positive change

Yields declined in Mozambique, Nigeria, and Tanzania. Remained same in Niger

Note the rapid area expansion

HGV
HOMEGROWN VISION
ሐገር በቀል ዕይታ
Outlook on **AGRICULTURE** Vol 40, No 3, 2011, pp 213–220 doi: 10.5367/oa.2011.0048

A systems and partnership approach to agricultural research for development

Lessons from Ethiopia

Tsedeke Abate, Bekele Shiferaw, Setegn Gebeyehu, Berhanu Amsalu, Kassaye Negash, Kebebew Assefa, Million Eshete, Sherif Aliye and Jürgen Hagmann

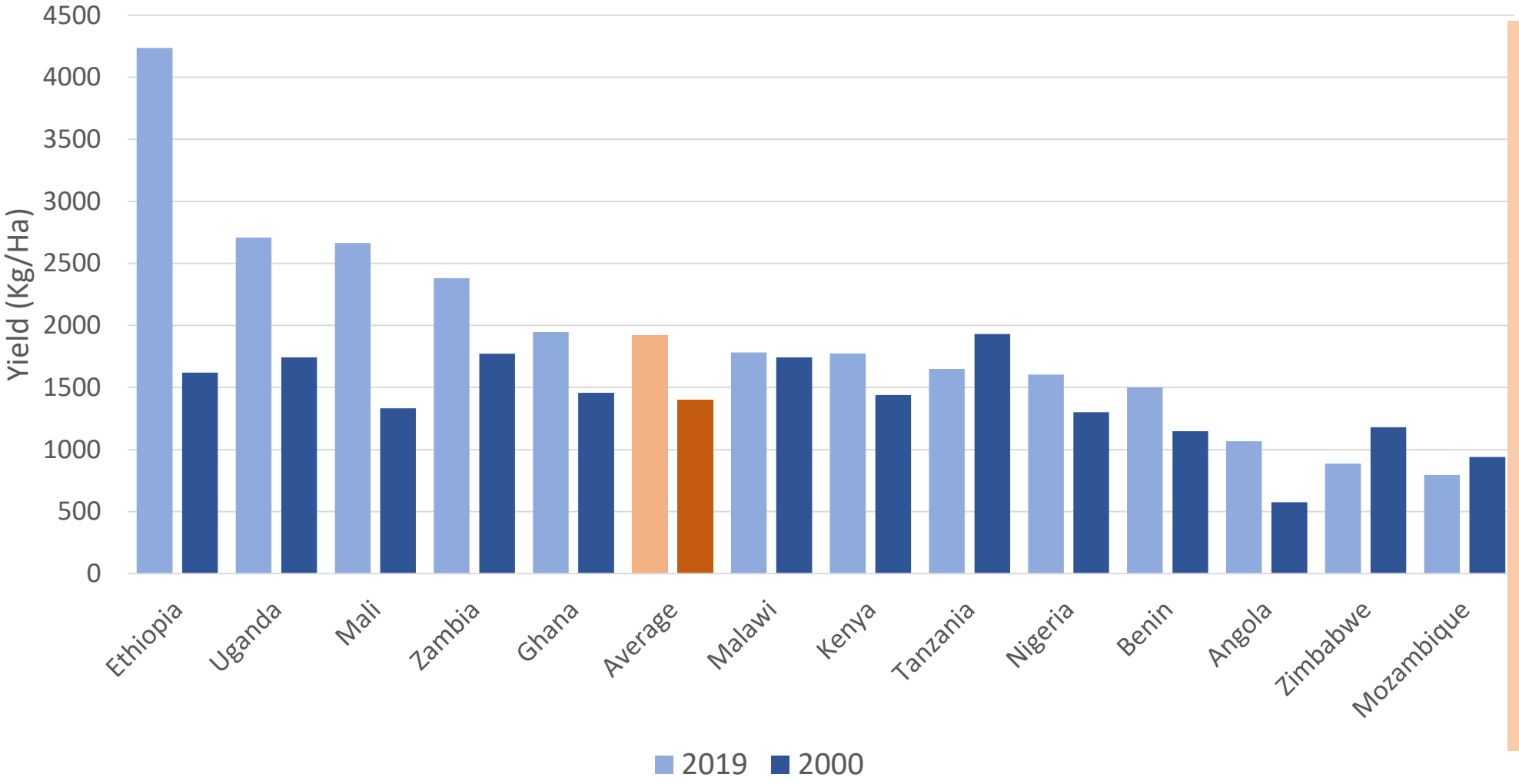
Improved crop management key to improving productivity

HGV
HOMEGROWN VISION
ሓገር በቀል ዕይታ

DTMA Countries

HGV
HOMEGROWN VISION
ሐገር በቀል ዕይታ

Maize yield in DTMA countries during 2 years



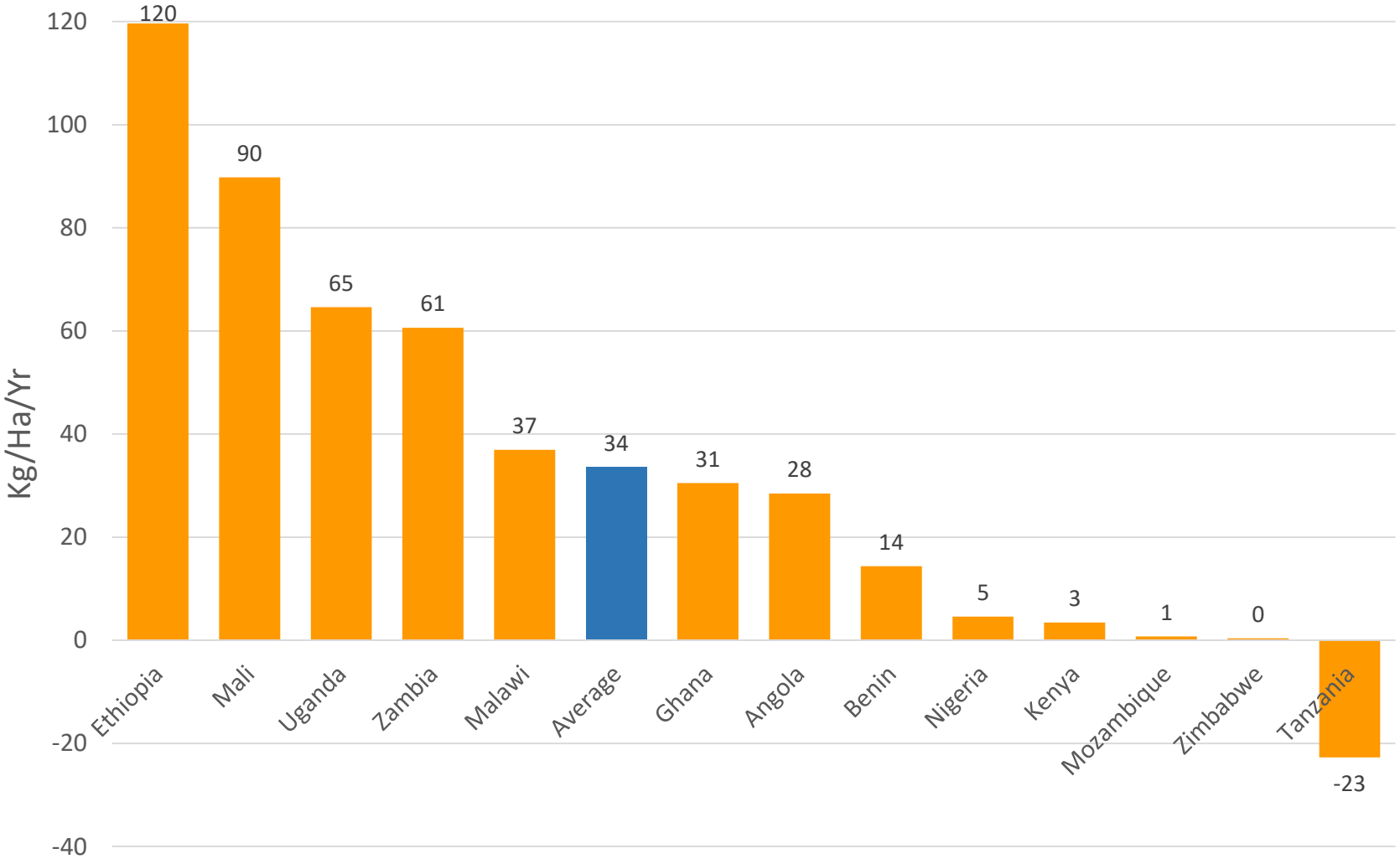
Only limited countries (Ethiopia, Uganda, Mali, Zambia) made substantial progress.

Little change in Malawi

Declines in Tanzania, Zimbabwe, Mozambique

Yield below 2 MT/Ha unacceptable

Yield gain in maize in DTMA countries (2000 – 2019)



Source: Constructed by the author from FAOSTAT (accessed 13 Jan 2021)

Yield gains varied among countries, owing to different factors – investment, capacity, input use, government policy, etc.

HGV
HOMEGROWN VISION
ሐገር በቀል ዕይታ

Food Sec. (2015) 7:965–981
DOI 10.1007/s12571-015-0488-z

ORIGINAL PAPER

Factors that transformed maize productivity in Ethiopia

Tsedeke Abate[1] · Bekele Shiferaw[2] · Abebe Menkir[3] · Dagne Wegary[4] · Yilma Kebede[5] · Kindie Tesfaye[4] · Menale Kassie[1] · Gezahegn Bogale[6] · Berhanu Tadesse[6] · Tolera Keno[6]

Maize agriculture in Ethiopia has changed the narrative about African agriculture

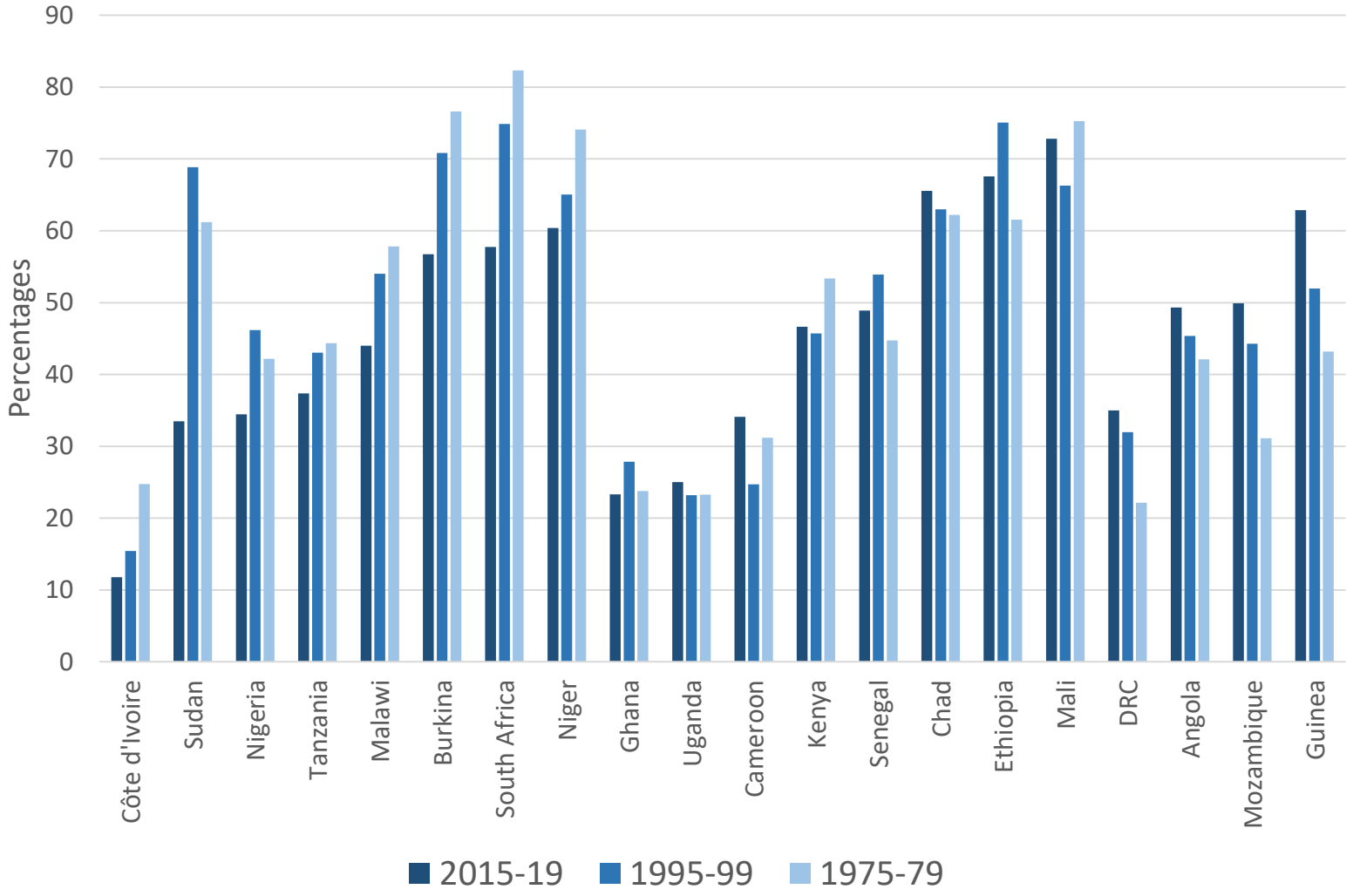
- Improved varieties
- Increased fertilizer use
- Increased extension coverage
  - Ethiopia – 1:476
  - Kenya – 1:1000
  - Malawi – 1:1603
  - Tanzania – 1:2500
- Government policy
- Homegrown approach

HGV
HOMEGROWN VISION
ሐገር በቀል ዕይታ

Unintended/Undesirable Consequences

- Crop diversification not given due attention
  - Too much emphasis on limited cereals (maize, rice, wheat)
- Potential of indigenous crops not fully exploited in spite of their superior traits – productivity, nutrition, versatility, sustainability, etc. (the *enset* example in Ethiopia)
- Unrealistic promises/expectations

Proportions of cereals to all other crops in the top 20 producing countries of Africa



Reduced: Cote d'Ivoire, Sudan, Nigeria, Tanzania, Malawi, Burkina Faso, South Africa, Niger

Little/no change: Ghana, Uganda, Cameroon, Kenya, Senegal, Chad, Ethiopia, Mali

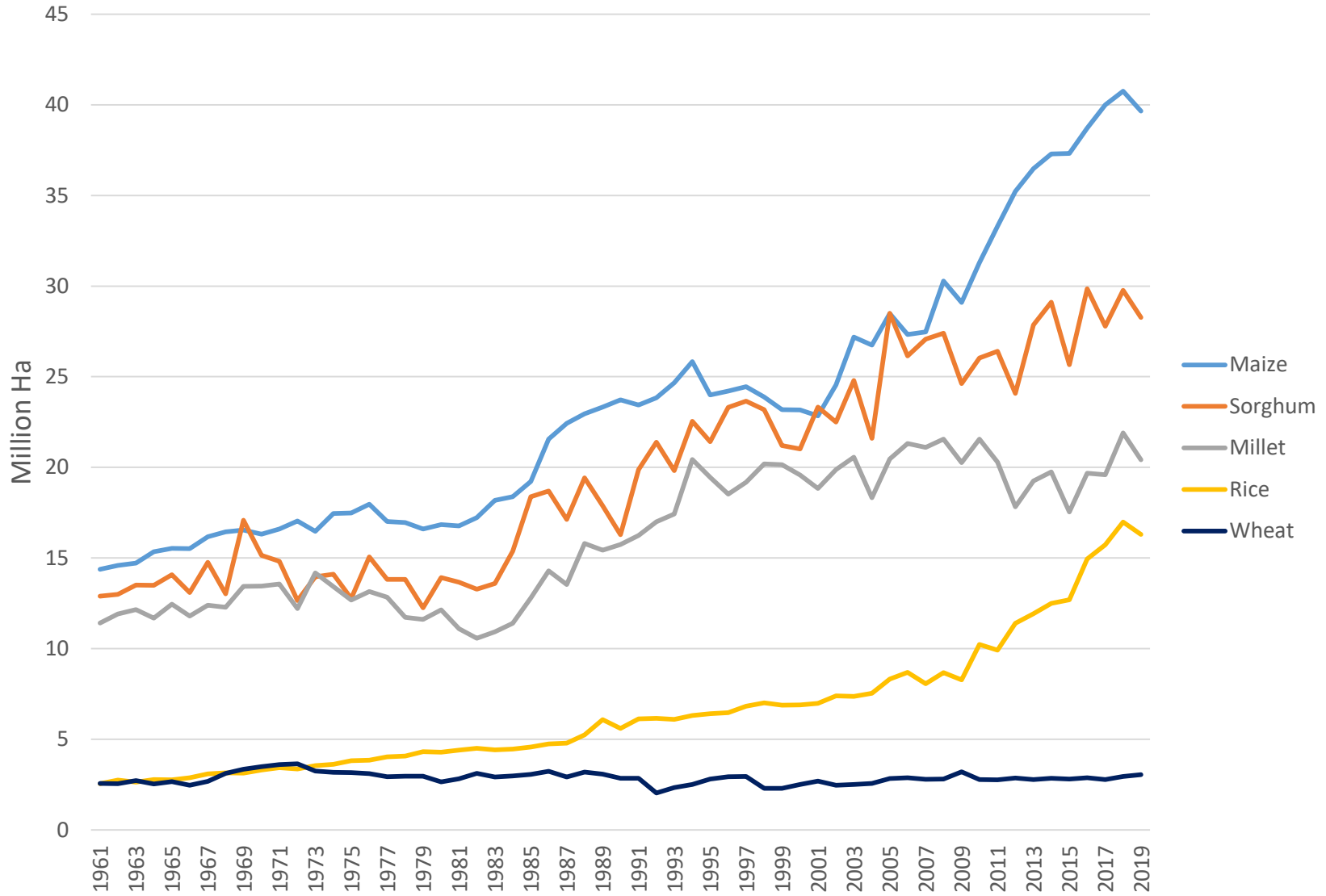
Increased: DRC, Angola, Mozambique, Guinea

Many countries did not take crop diversification very seriously

Source: Constructed by the author from FAOSTAT (accessed 21 Jan 2021)

HGV
HOMEGROWN VISION
ሐገር በቀል ዕይታ

Area harvested of major cereals in Africa



Source: Constructed by the author from FAOSTAT (accessed 22 Jan 2021)

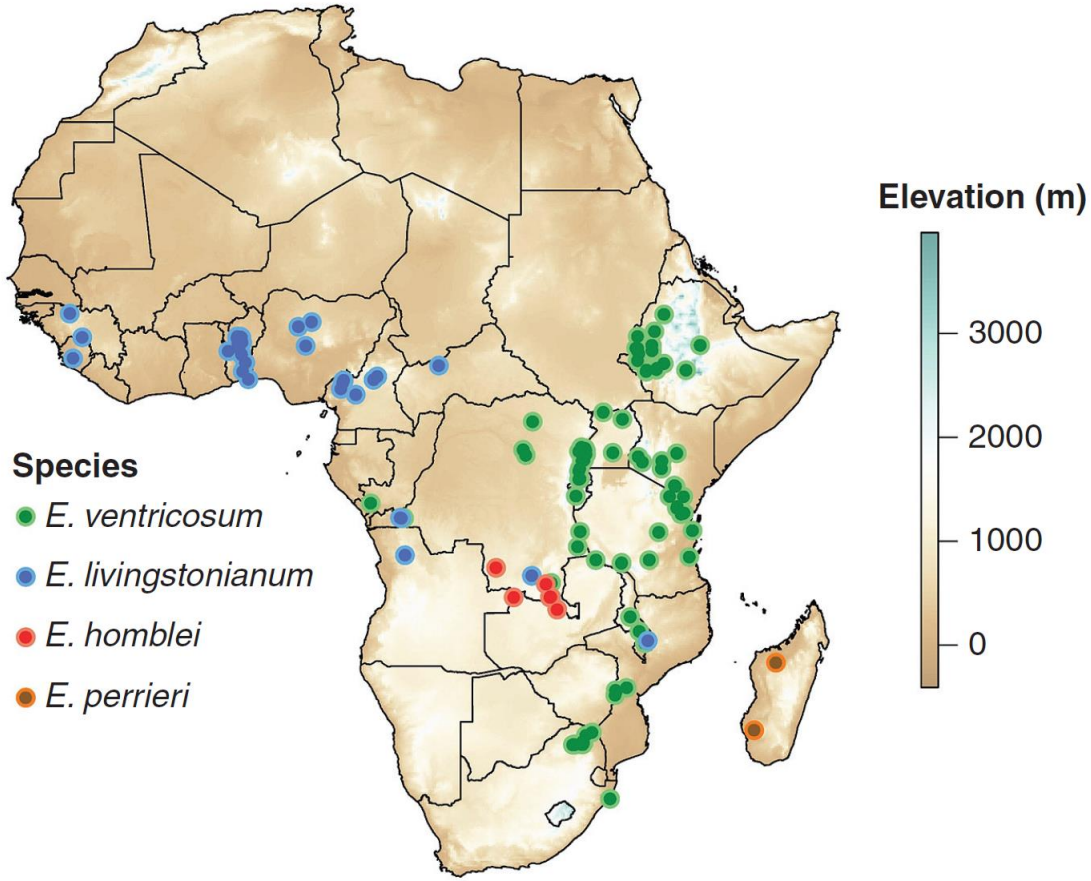
Maize is the major driver for area expansion of cereals in Africa; rice also growing fast.

Both at the expense of sorghum and millet, Africa's traditional cereals.

Wheat little change; mainly important in Ethiopia & S. Africa

HGV
HOMEGROWN VISION
ሐገር በቀል ዕይታ

Distribution of selected *enset* species in Africa*



Source: From Borrell et al (2019)

*Bezuneh (1996) recognizes 19 species

HGV
HOMEGROWN VISION
ሐገር በቀል ዕይታ

Comparative yields of *enset* (1969-71)

Crops	Fresh Weight (MT/Ha)	Dry Weight	
		MT/Ha	MT/Ha/Season
Cereals			
Maize	2.5	2.2	2.2
Rice	2.4	2.1	2.1
Wheat	1.6	1.4	1.4
Sorghum	1.2	1.1	1.1
Roots & Tubers			
Potato	13.7	3.0	3.0
Cassava	8.9	3.2	3.2
Sweet potato	8.1	2.3	2.3
Enset	49.0	21.6	4.4

Enset not only superior in yield but has several advantages:

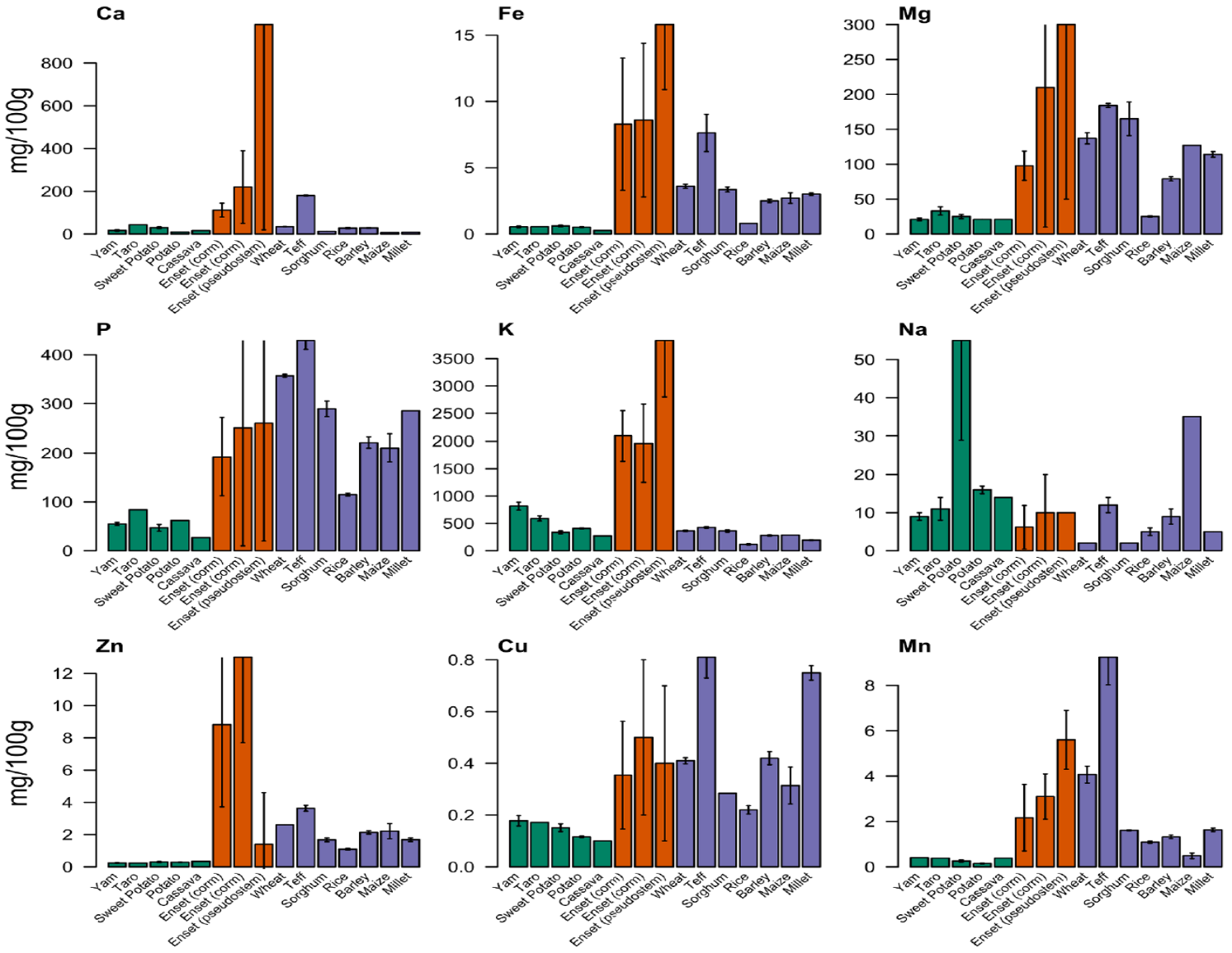
- Superior nutritive value
- Better resilience
- More versatility
- Longer storability (years)
- Soil protection (like forest)
- Sustainability

4.4 MT/Ha/Season dry wt. an under estimation because it assumes enset maturity to be 8 years whereas it can actually mature within 4-6 yrs.

Source: Adapted from Hibsch (1996)

Nutrition profile of enset, compared with other major staples in Ethiopia

S. Tamrat, et al. Food Research International 137 (2020) 109636



Enset is superior to all of the staples in Ethiopia in its calcium, iron, magnesium, potassium, and zinc contents.

Superior to all roots & tubers and similar to many cereals in phosphorus, copper, and manganese.

Similar to many roots & tubers other than sweet potato, and to cereals other than maize in sodium content

HGV
HOMEGROWN VISION
ሐገር በቀል ዕይታ

Enset-based farming system near Yirgachefe, southern Ethiopia

Photo: Tsedeke Abate (c. Sep 1992)

This is a sustainable indigenous system. To tamper with enset agriculture in Ethiopia would mean to mess with nature itself.

- We are aware that this system could be the future of African agriculture
- One decent initiative would be how to expand our understanding of the system and then how to expand enset in other parts of the country (and beyond) with similar agro-ecologies
- How to ensure sovereignty over germplasm?

Summary and Conclusions

- Food and nutrition security highest priority for Africa;
- AR&D infrastructure variable among countries, but many of the recent international development initiatives followed a similar model for all – mixed results (at best);
- Increases in production mostly from area expansion rather than productivity;
- Ethiopia showed relative success because it followed a “homegrown” approach (its R&D system not donor-dependent);
- Inadequate attention to indigenous crops/systems, crop diversification, nutrition;
- Partnerships have not been equitable:
  - Weak bargaining power of Africans
  - Unrealistic promises/expectations (“shortcuts and outsourcing”)
  - Africans have yet to take the leadership and be accountable for their development agenda
- So, there needs to be a well thought out dialogue between Africa and the international development community to jointly identify priorities and clearly define responsibilities.