Feeds and feeding of dairy cattle: Climate effects on fodder production, quality and milk yields; Realizing the value of forage quality in African dairy

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Outline

- Univ of Florida
- How much longer?
- Scare them Gbola!
- Feed / forage; the most important pillar
- Climate change stunts forages and animals
- Realizing the African white revolution
  - Rewrite the rulebooks
  - Catch the foxes
  - Burn the fences:
  - Pull up yourselves by your bootstraps
  - Roll out the incentives
- Local private sector-led ag transformation

How much longer?

Farming in the Global North

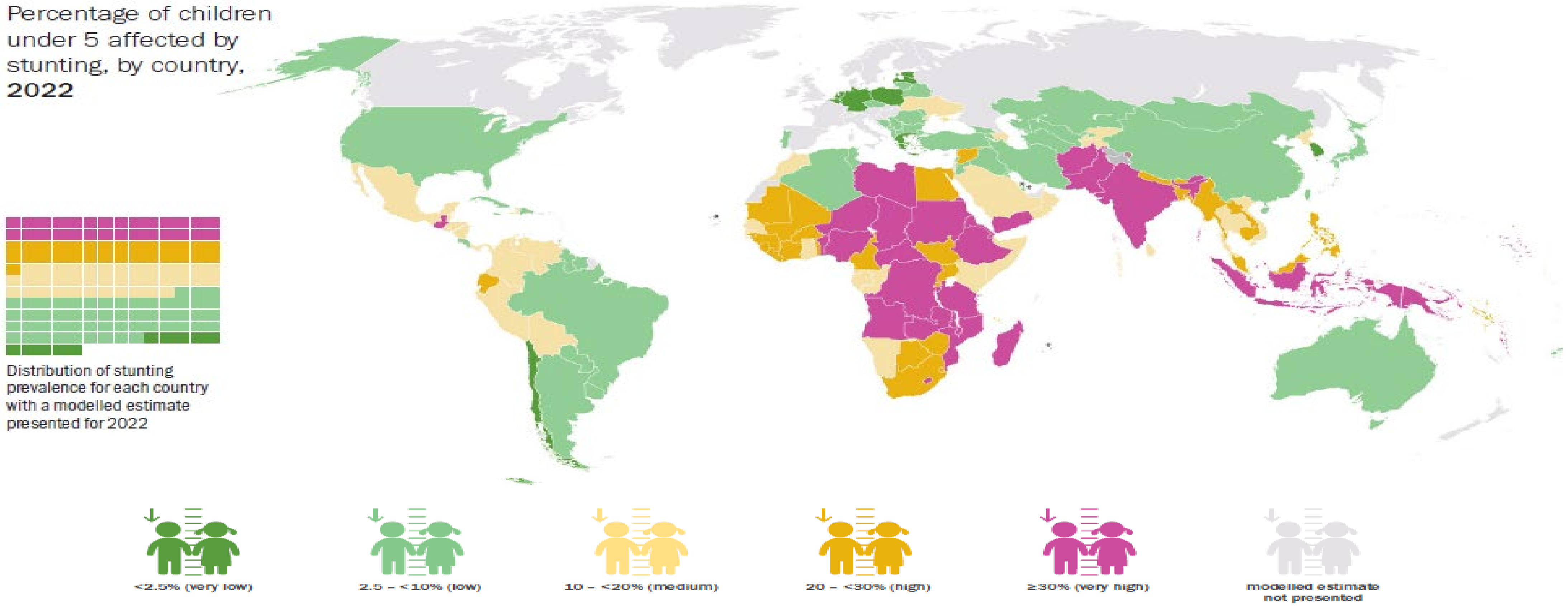
- Stara sprayer with ONE SMART technology

Burks/ABE

Li/ABE

Farming in the Global South

Global prevalence of stunting, %



1 in 3 children was stunted in sub-Saharan Africa and South Asia

Risk of child mortality is **eight times** greater in African than Europe (WHO, 2016)

(UNICEF, WHO, World bank, 2023)

Kenya school feeding study

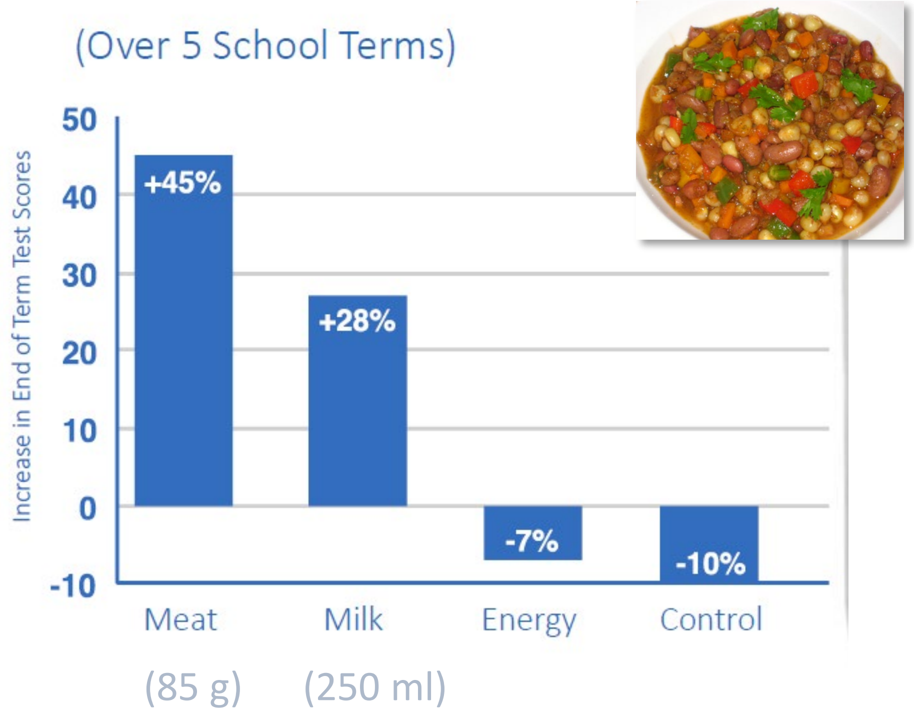
Embu Kenya, 2 years; 7–10-year-olds; n=554.

Meat improved:

- Cognitive performance (Raven's, math)
- School test scores
- Physical activity, initiative and leadership
- Arm muscle mass, B12 status

Milk improved:

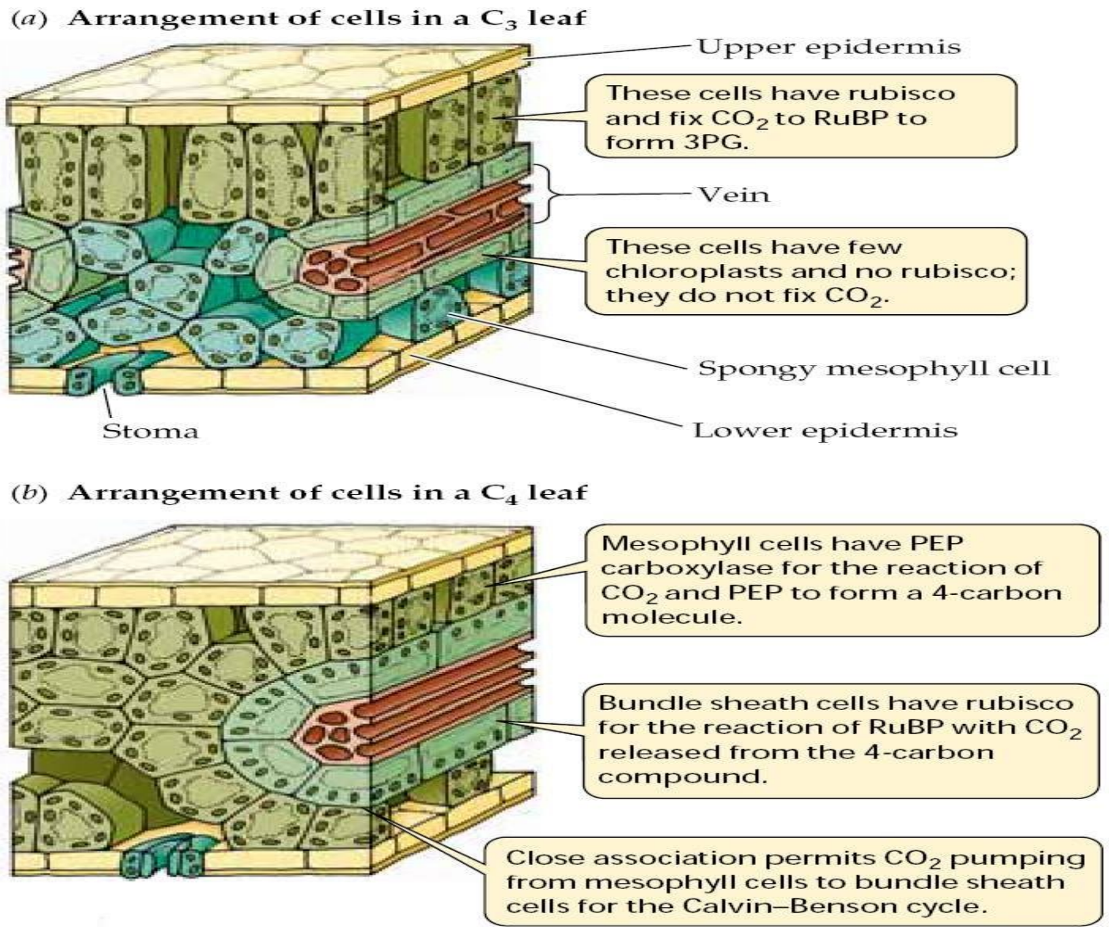
- Linear growth if stunted
- B12 status



Neuman et al., 1997; Hullet et al., 2014

Climatic stressors stunt forages and livestock

C4 vs C3 plant anatomy

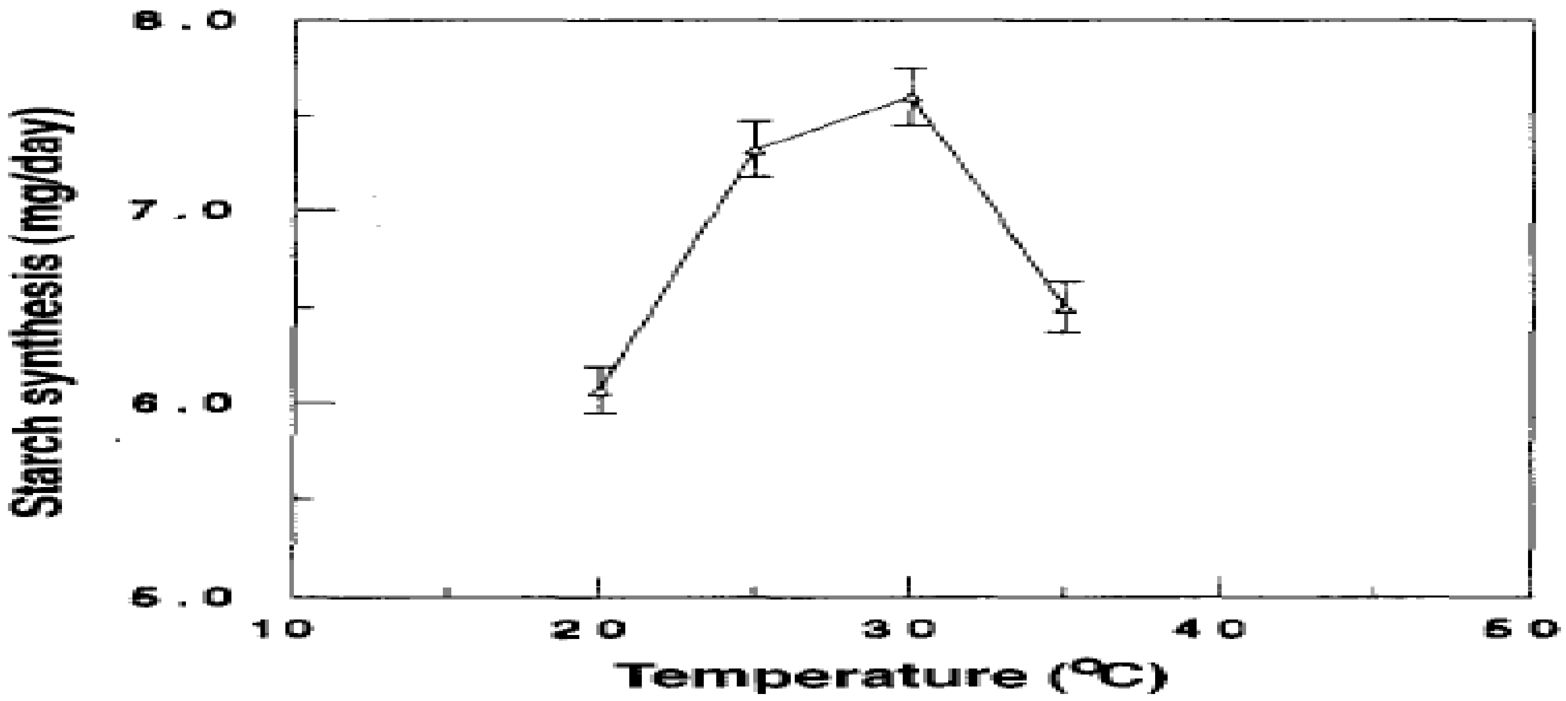


Leaf Anatomy of C_3 and C_4 Plants Carbon dioxide fixation occurs in different organelles and cells of the leaves in (*a*) C_3 and (*b*) C_4 plants.

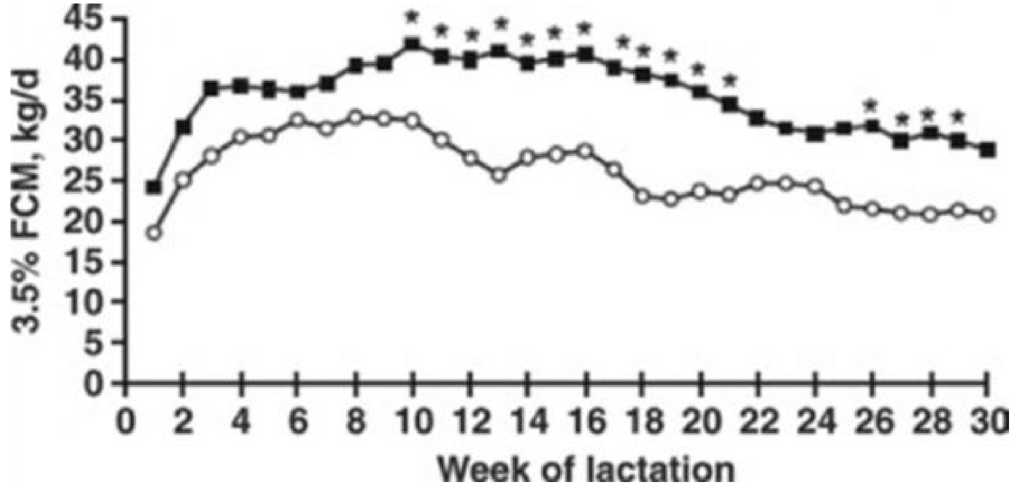
Corn growth under different temperatures

Walne and Reddy, 2022

Starch synthesis rate in maize endosperm at various temperatures (Keeling, 1994).



Cooling exotic cows is critical



(Do Amaral et al., 2009)

Climate effects on livestock

Impact Type	Observed Impacts	Major Influential Factors
Direct Impact	Reduced feed intake	Increased temperature (heat stress)
	Decline in animal milk and meat production	
	Decreased reproductive performance	
	Negatively affected immune functions	
	Increased mortality	
Indirect Impact	Changes in forage crop yields	Elevated CO_2 level
	Changes in pasture composition and forage production	
	Changes in forage quality	Increased temperature and elevated CO_2 level
	Shrinking water availability and increasing water use	Increased temperature
	Larger seasonal variation in resource availability	More frequent extreme climate events
	Increased disease, pest, and parasite stress	Increased temperature and changes in the precipitation pattern

(Cheng et al., 2022)

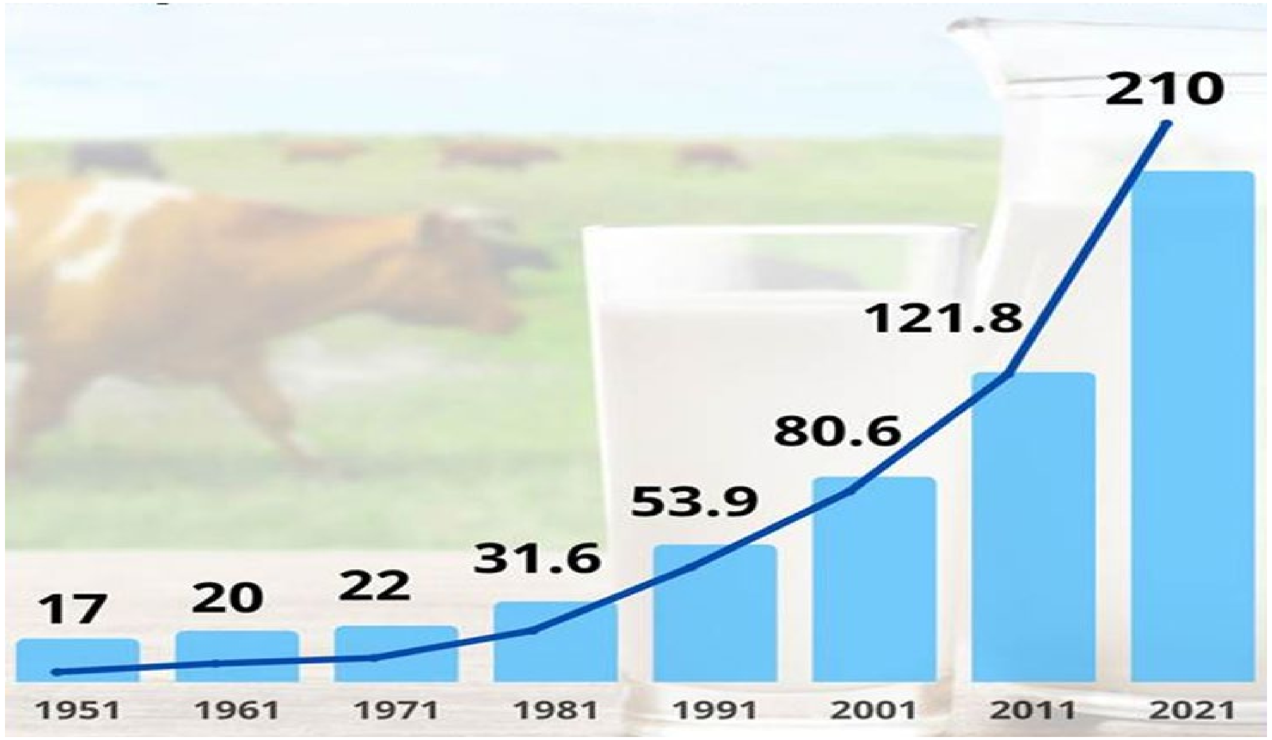

https://www.deccanchronicle.com/


The Baltimore Sun

Achieving the African white revolution

The Indian white revolution

MILK PRODUCTION IN INDIA
(MILLION TONNES)



(PIB, 2023)

Dairy production in Africa:

OPPORTUNITIES AND CHALLENGES

Challenges

- Inadequate water and feeding
- Low producing breeds
- Poor management (e.g. record keeping)
- Inadequate housing, small herds/acreages
- Weak disease prevention /control
- Large informal sector; food safety issues
- Low culling rates
- Poor transport, cooling and storage infrastructure
- Low skill levels / extension support
- Cultural norms inhibiting consumption

Opportunities

- High appreciation for livestock
- Need to improve nutrition, health and livelihoods
- Youth and women engagement potential
- Rapidly rising demand due to
  - Population growth,
  - Rising incomes
  - Urbanization
- Relatively cheap labor

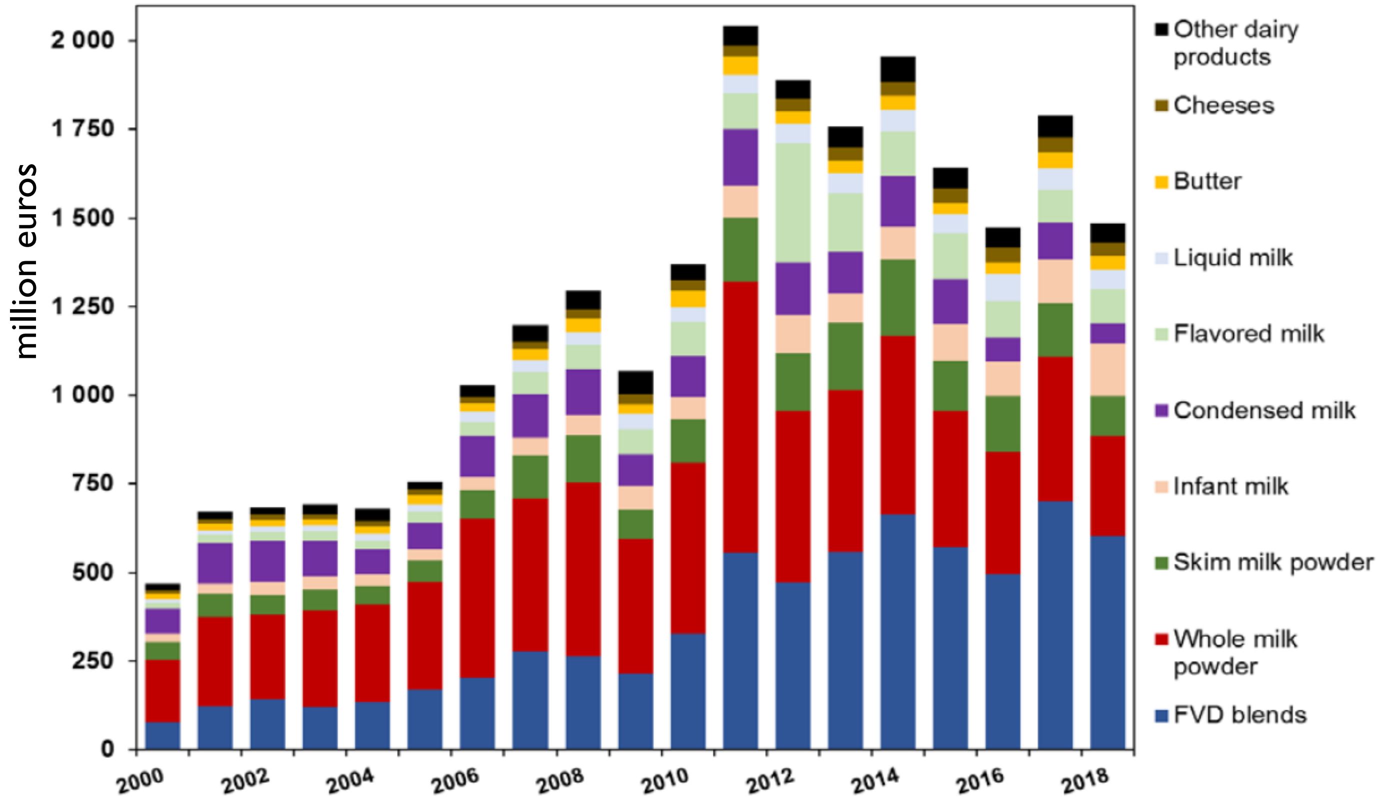
Focal areas to improve in African dairying

1. Improving dairy trade and investment policies
2. Sustainable intensification
3. Highlighting the importance of milk/dairy for growth, health and cognition
4. Supporting commercial dairy producers
5. Plugging smallholders into the supply chain; providing them with affordable feed
6. Keeping milk safe
7. The future dairy professional: training, education and extension

(Van der et al., 2014; Westebrink et al., 2019)

Stop the dumping

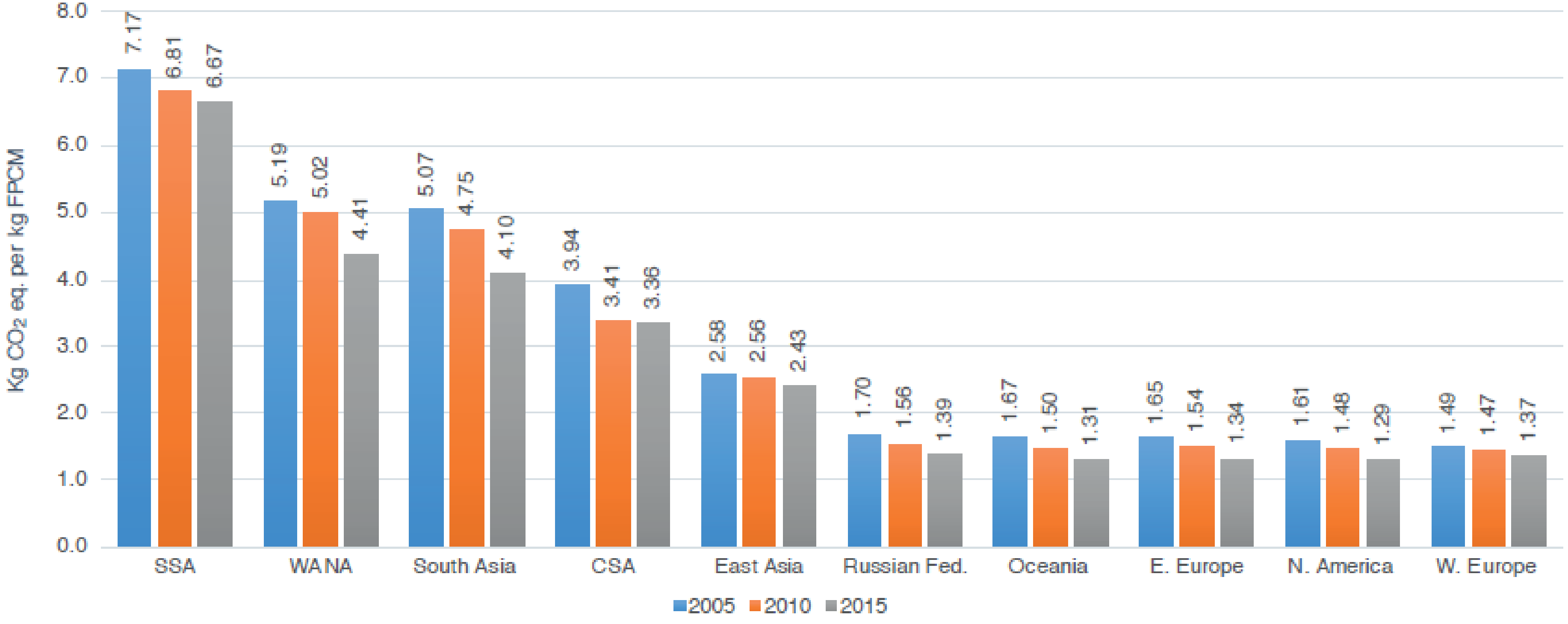
W. African imports of EU dairy products



"My milk is local" campaign in W. Africa

(Duteurtre et al., 2021; BACI/INRA, 2021) https://oxfamnovibacademy

Emissions intensity trend by region



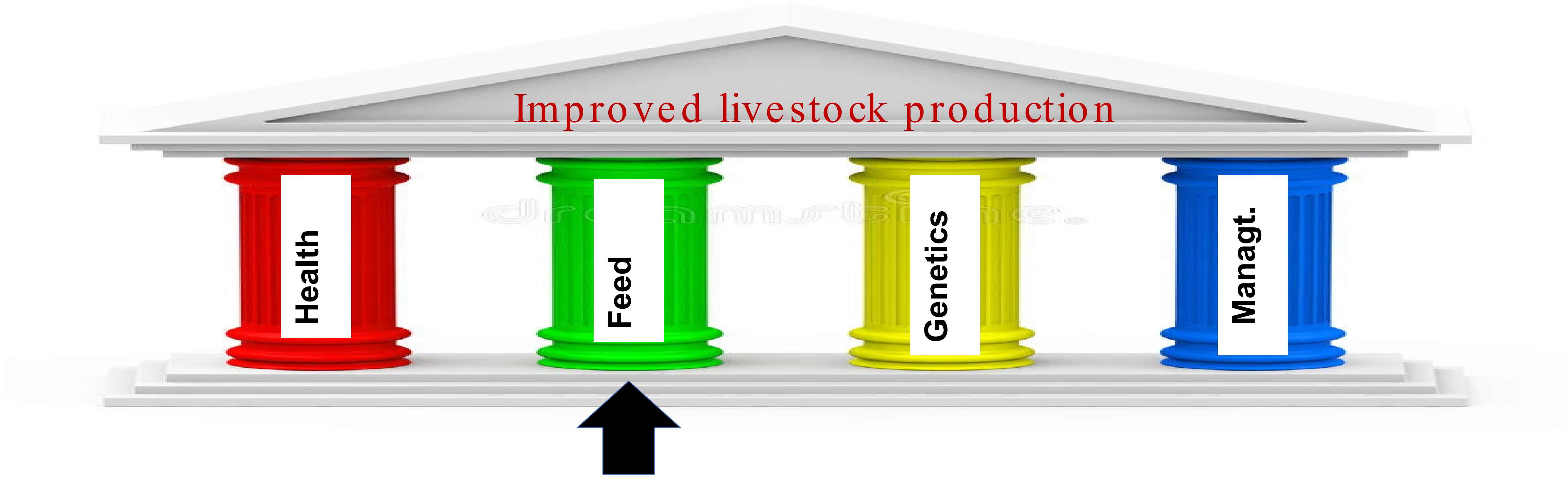
(FAO, GDP, 2019)

Sustainable intensification

"Focus more on increasing productivity per cow than cow numbers to improve milk production"

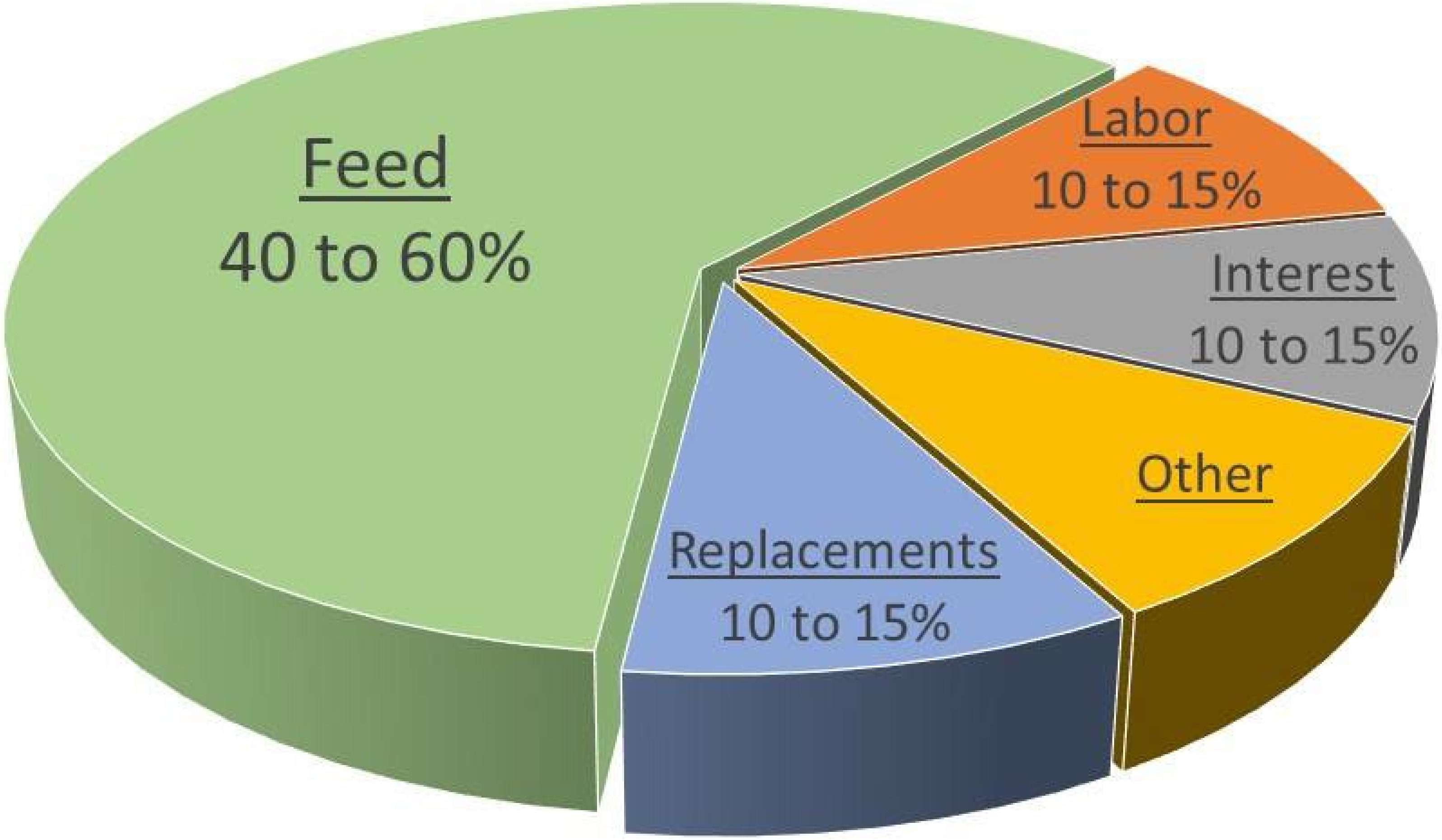
what is the greatest constraint to improved asf production and consumption?

(Six-developing-country-survey)



Unanimous answer

Cost of Production



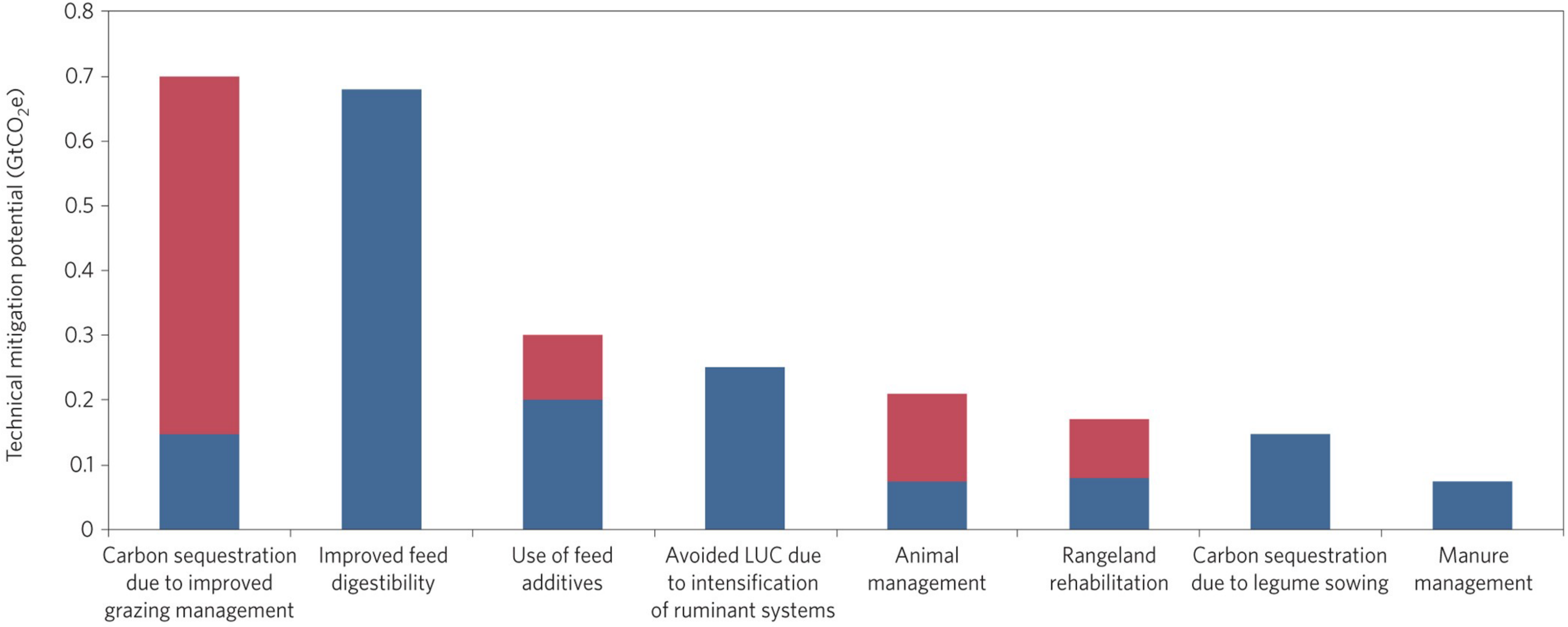
FEED is the foundation and priority

FEED
- Up to 75% of livestock production costs
- Best target for mitigating livestock GHG emissions

FEED
- Best driver of livestock productivity and hence incomes
- Best target for women's empowerment

FEED
- Fundamental requirement for health and health interventions
- Fundamental requirement for achieving genetic merit

GHG mitigation potentials in the livestock sector

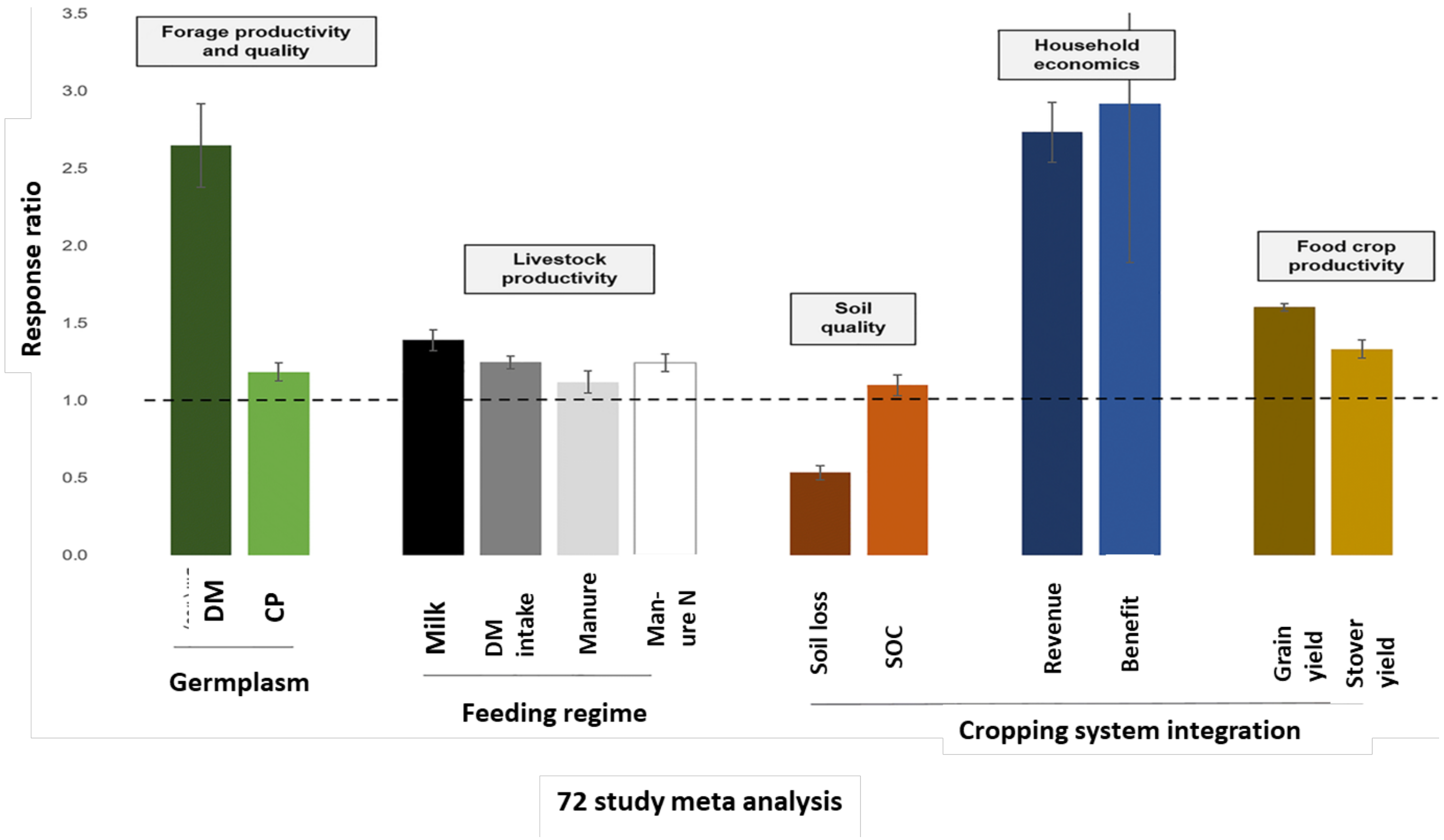


Herrero et al., 2016

Red represents the range for each practice, where available.

Crop residues should not dominate diets

Feed Improved forages



(Paul et al., 2020)

Strive for quality forage production

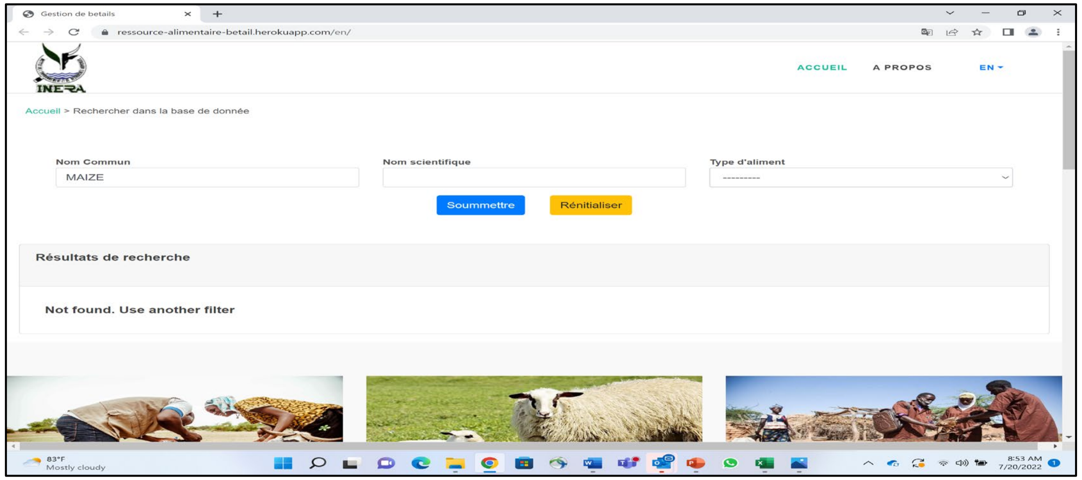
- *Hybrid selection*
- *Growing the crop*
- *Predicting harvest dates*
- *Chopping*
- *Packing/ensiling*
- *Sealing*
- *Feedout*

Every link in the silage-making 'chain' must strive for excellence

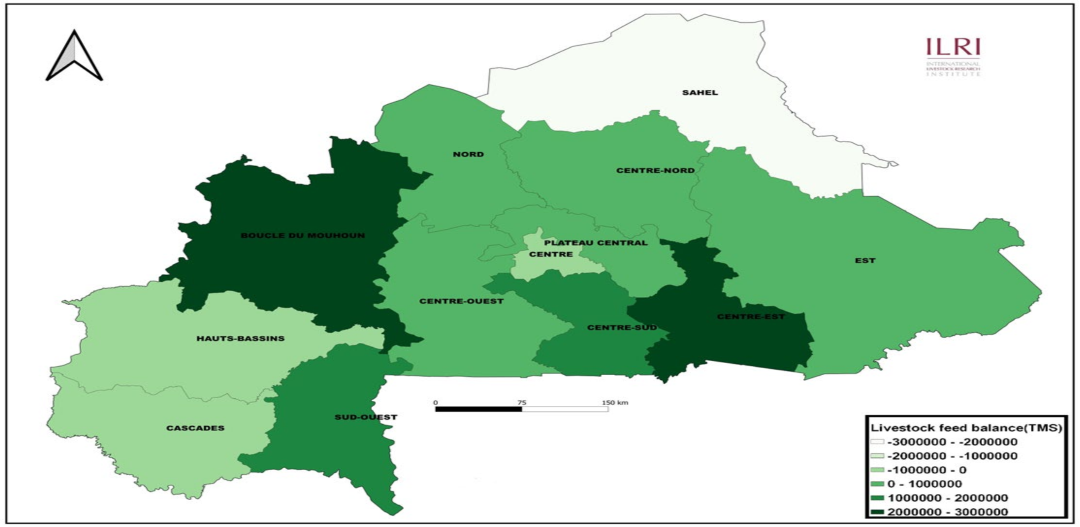
Feed Landscape Analysis

- Approximately 8000 new feed entries made into new (BF) and existing (ET) feed databases.

Item	ET	BF
Total entries in the feed database	4433	3857



- Mapped the feed supply-demand scenario across BF
- Showed 6 million tons surplus feed produced for BF but a 2-ton deficiency in the north (Sahel zone)



Improved fodder development

Exported improved forage legumes, cereals, and grasses from Brazil and Florida to....	• Burkina Faso • Niger • Ethiopia
Validated their potential over several years and sites in each country.	Several have now been registered and released by the governments.

Yield improvement over local varieties:

Sorghum SEPON-82

Forage : 17%

grains : 63%

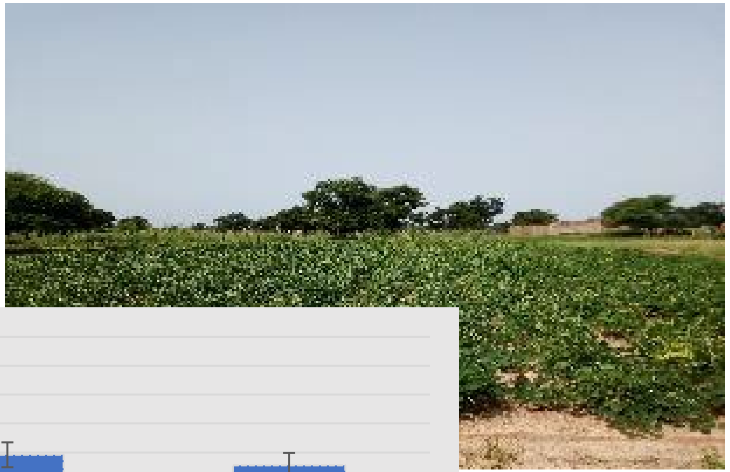
Millet

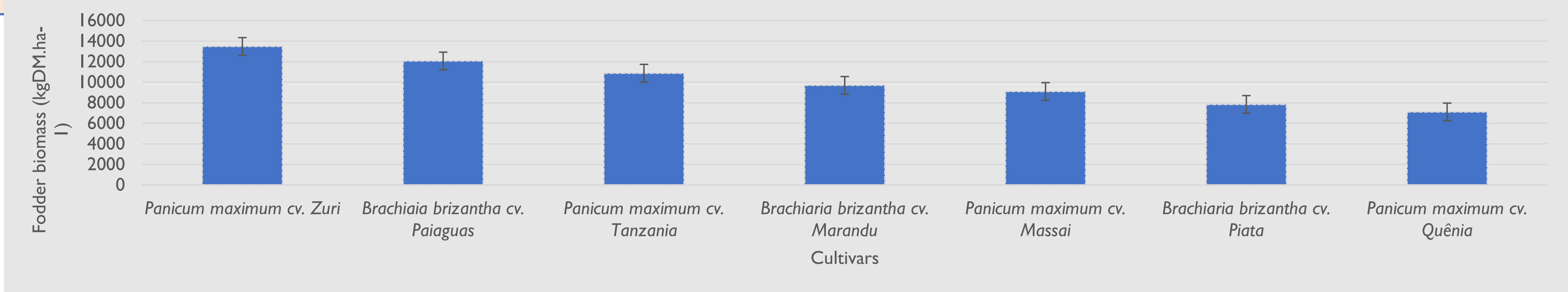
Forage: 78%

Cowpea KVX 745-11P

Forage : 125%

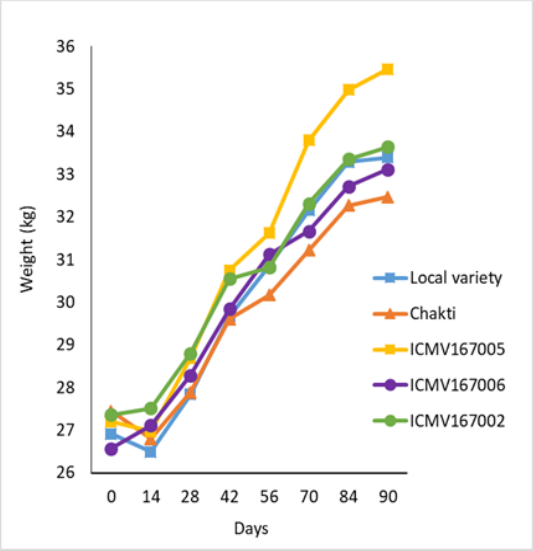
Crude protein :40%





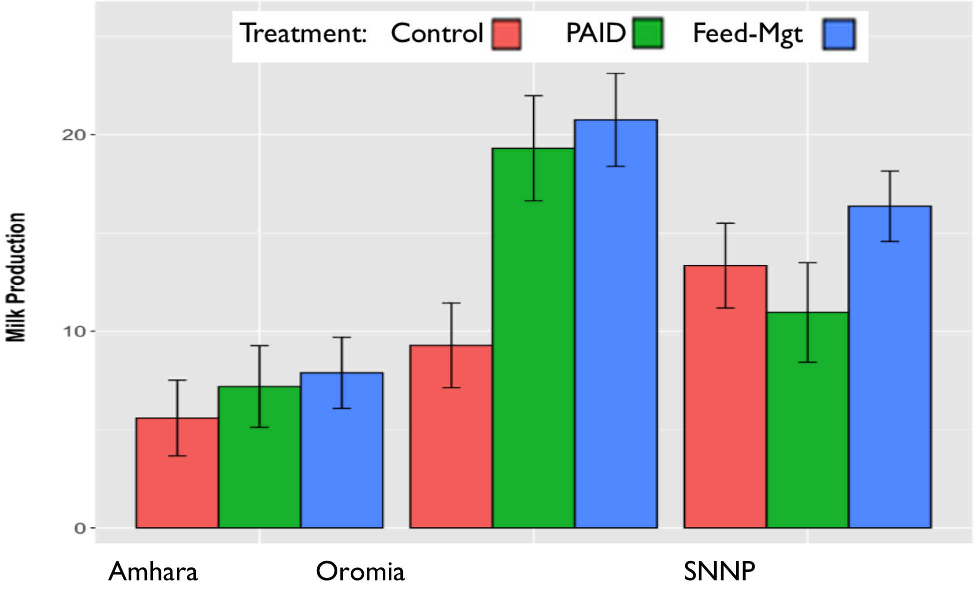
Increased livestock productivity

Niger



Increased sheep growth with improved forages

ETHIOPIA

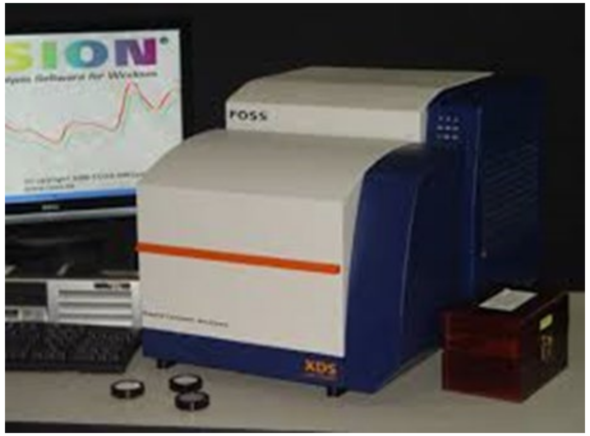


Increased milk production by 50% by better feeding and management

Built local capacity to analyze feeds

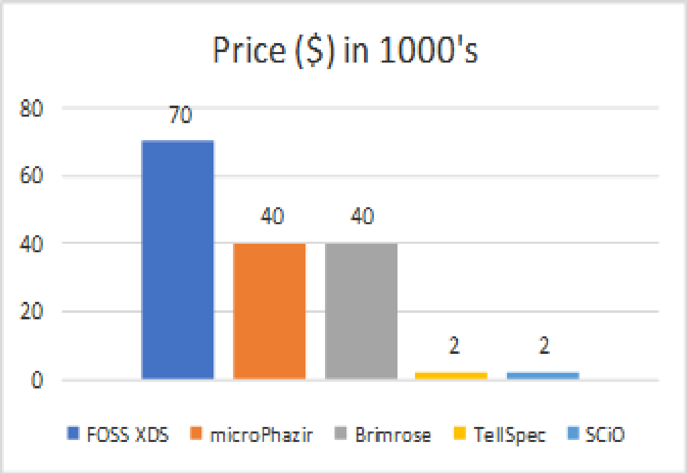
- Introduced desktop and mobile NIRS systems costing 3% of the cost of desktop systems
- Showed they are as accurate for feed analysis
- **Established thriving locally-led Public Private Partnerships in BF and ET**

- Creates opportunities for:
  - Feed analysis
  - Feeding balanced rations,
  - Improved livestock productivity
  - Lower emissions.
  - Labelling of feeds
  - Toxin detection

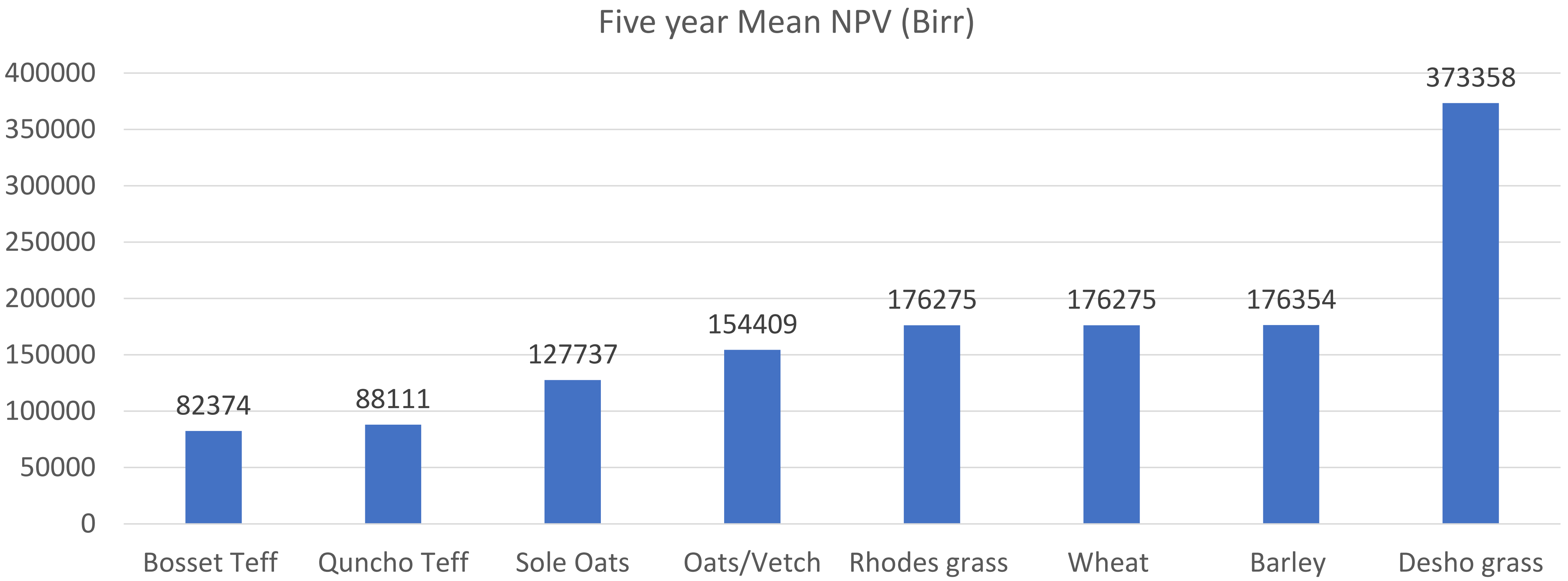


>US$ 70,000

<US$2,000



Proved forages are more profitable than food crops



Showed that most farmers are willing to pay for forages in Burkina Faso

Variable	Tobit double censorship statistics for WTP for cultivated forage (ll = 0. ul = 200)		
	Coefficient	t	P>t
Cotton cake prices 2017	0.056429***	5.62	0.00
Crop residue expenditures	-0.0001111	-0.46	0.646
Trans-boundary trans-humance	-111.79**	-2.49	0.014
Ethnic group	-69.41114*	-1.89	0.06
Practice of fattening	-28.10858	-0.81	0.422
Number of years of experience	0.990793	0.73	0.465
Knowledge of forage crops	137.89***	3.05	0.003
Practice of grazing	-47.17054	-0.65	0.516
Practice mowing and conservation	-9.985132	-0.28	0.778
Livestock number	0.0024388	0.03	0.978


Photo credit: V. Bado

Aggregate demand, increase market access to increase incomes

Niger

- We expanded market access for feed traders by linking them with livestock keepers 800 km away.

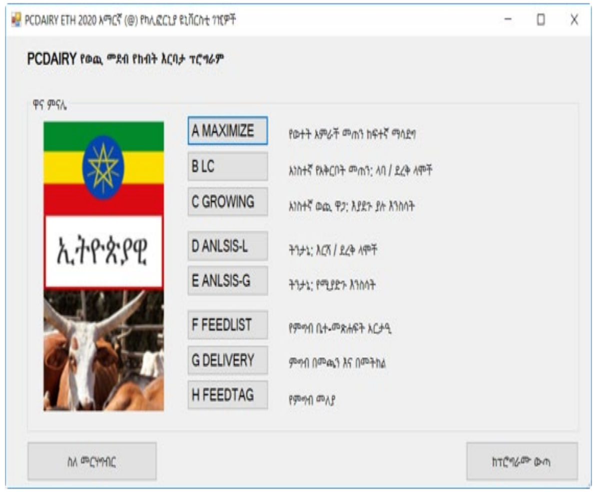
- Feed costs were reduced by **30%**

  12.6 tons of feed sold in 4 months **($3,600)**

- Ramana Doni earned **33%** more money from sales of her (well-fed) sheep.

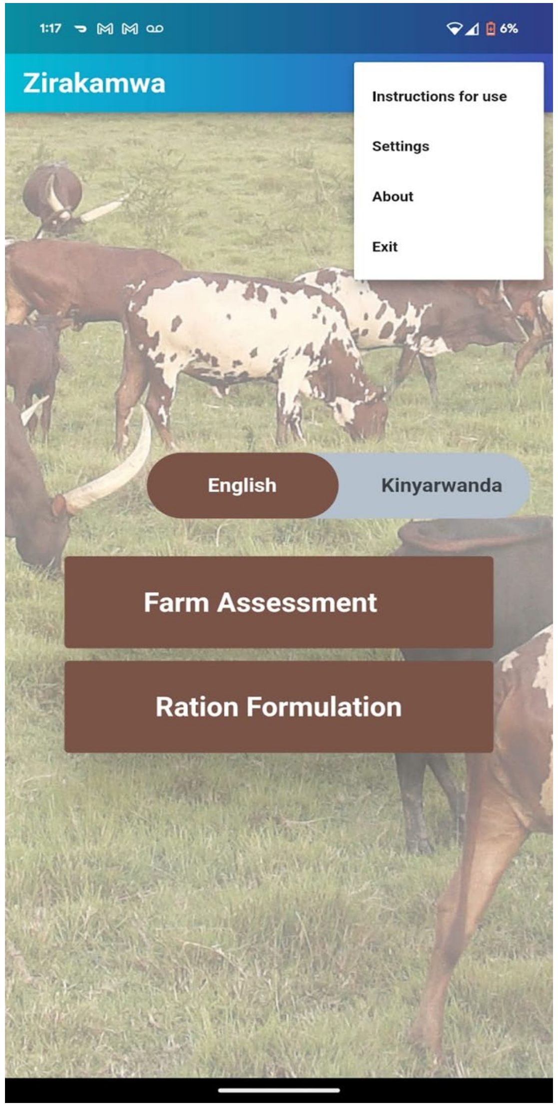
Developed and disseminated apps for better feeding, tech for measuring GHG emissions

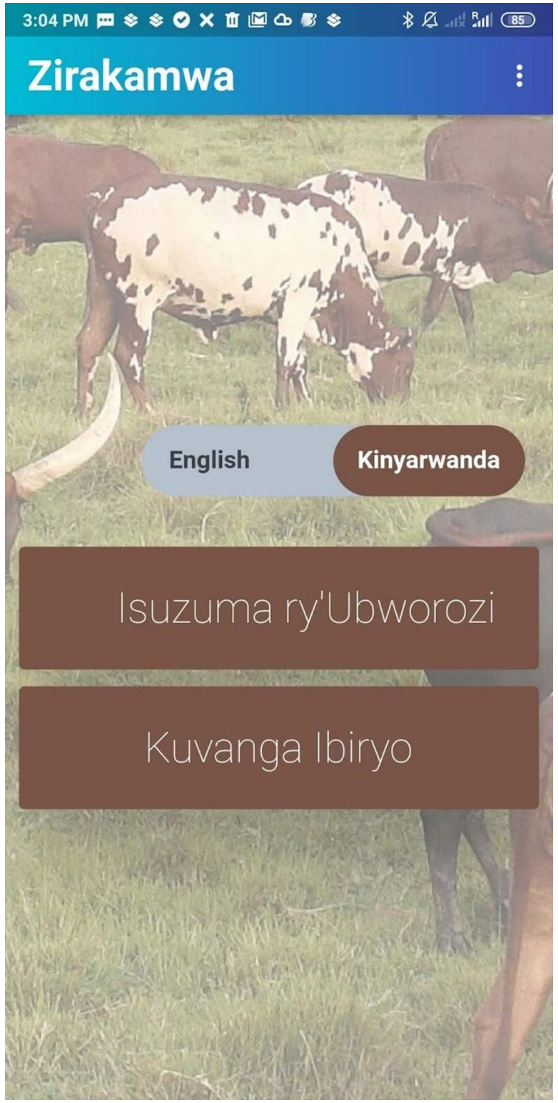
- Introduced state of the art green feed machines to ET & BF for precise emissions measurements
- Trained technicians, researchers, farmers private sector, extensionists to use them
- Creates business opportunities for entrepreneurs



Zirakamwa app for dairy management:

Assisting Rwanda dairy producers to produce more!





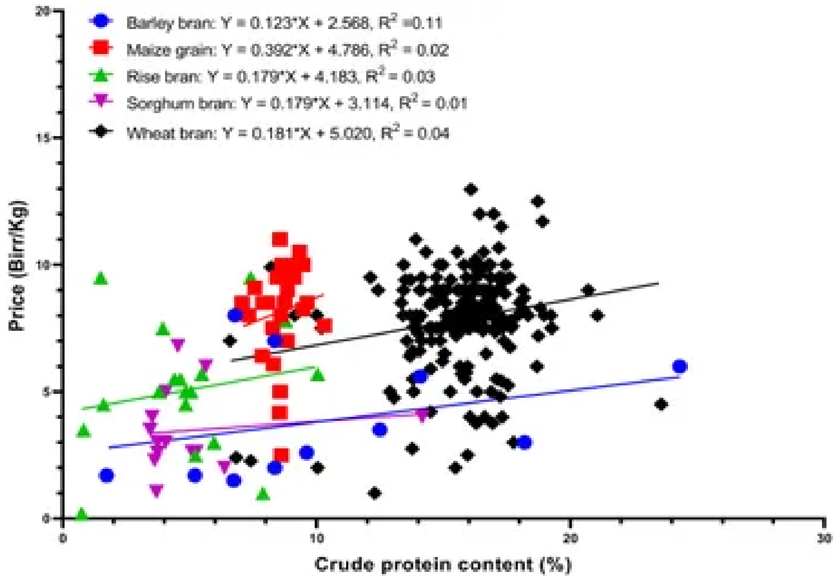
Achieving the African white revolution

No cybertrucks please, improve genetics wisely

Rewrite the rulebooks

- **Support <u>commercial</u> forage and dairy production**
- Demand –led dairy/forage production
- Aggregate demand, strengthen markets
- Introduce quality-based pricing
- Forage quality first;   Upgrade crop residues,
- Sunset dual-purpose forages. AFIA
- Capacitate, promote, support women
- Introduce novel forages
- Introduce feed additives

No price – quality relationship in forage markets



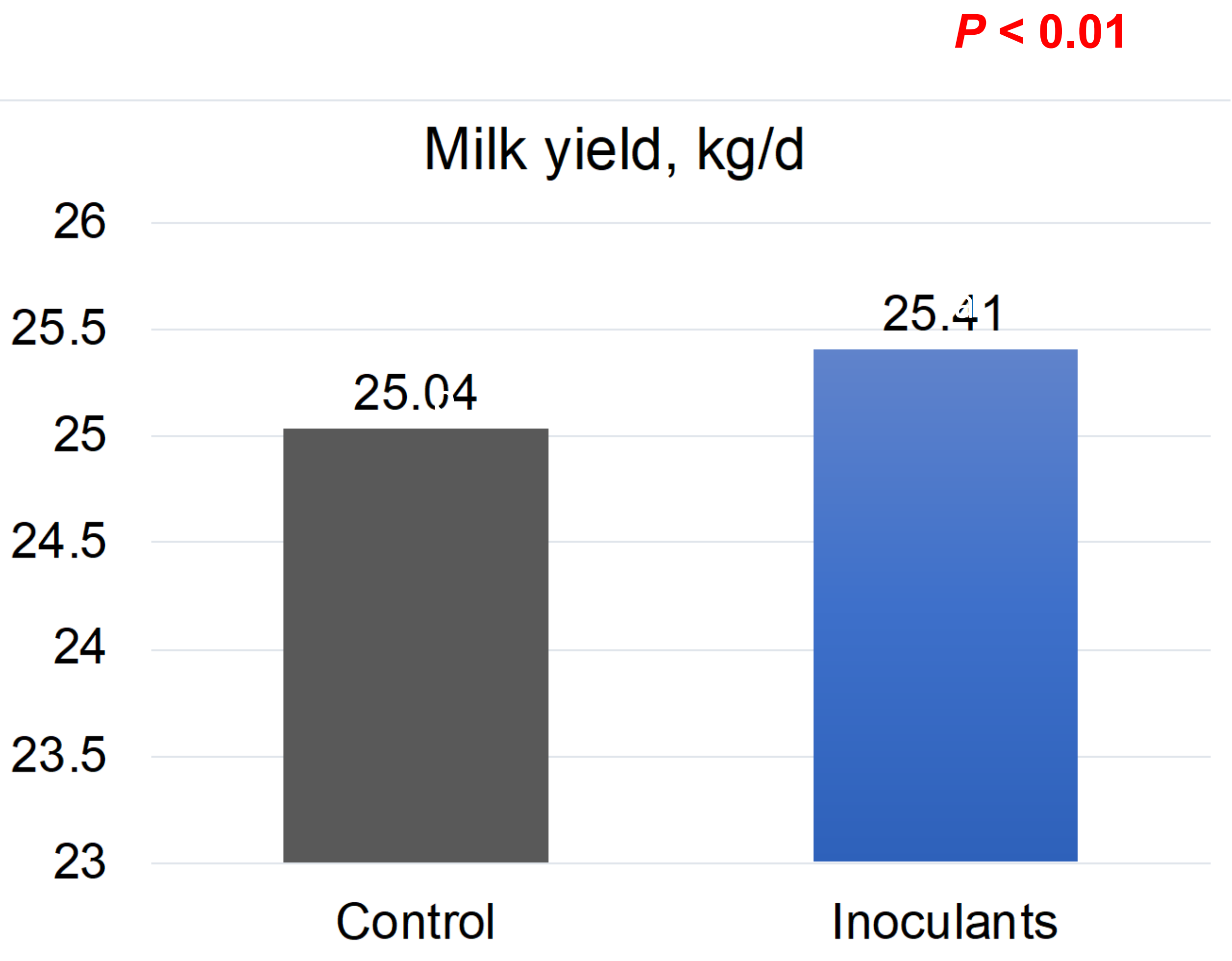
Catch the foxes

- Learn from **GIRINKA**
- Limit free fertilizer campaigns
- Limit free seed campaigns
- Stop the per diem for attendance requirement
- Ban / regulate imported milk powder,
- Question social media messages / influencers / authorities

Go, cool, and get the milk!

Use validated feed additives

- Oliveira et al., 2017
-
- Homofermentative inoculants
- 38 comparisons
- Inoculation increased milk yield when application rate was at least 10^5 cfu/g



How silage inoculants affect milk production

Feed inoculated silage

↓

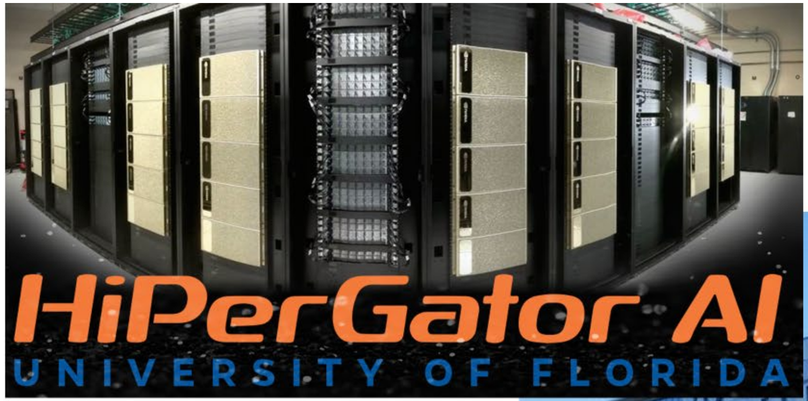
- Intake
- Digestibility
- Rumen function and microbial growth
- Inhibiting spoilage
- Inhibiting pathogens

↓

Milk production

Burn the fences

- Town and gown divide; Ivory towers;
- Extension divorced from research
- Industry alienated from research



The Visionary Private Sector Partners

M.D. Abubakar
President Commercial Dairy Ranchers Association Of Nigeria (CODARAN)

Founder/CEO L&Z INTEGRATED FARMS

Ayoola Oduntan
National President,
Feed Industry Practitioners Association of Nigeria (FIPAN)
GMD. Amo Group

Tony Jibunoh
CEO Milkin Barn Limited

Ope Agbato,
E.D. Technical and Husbandry operations, Animal Care Services Konsult (Nig.) Ltd

The UF (Gator) Profs

How much longer?

……. till the last hoe is dropped.

……. till our last child is well nourished.

WHAT ARE WE/YOU GOING TO DO?

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Conclusions

1. The rising demand for meat and milk in LMIC should be met with fewer more efficient livestock
2. A systems lens should be used to evaluate the promise of climate smart strategies and appropriate universal indicators should be developed
3. Attention should shift to promote adoption of validated best-bet mitigation **and** adaptation technologies
4. Sustainable production intensification should be a prime goal for LMIC
5. More research is needed to develop effective and appropriate strategies for LMIC systems; Food security and environmental stewardship goals must be simultaneously addressed.

Climate-smart livestock production practices

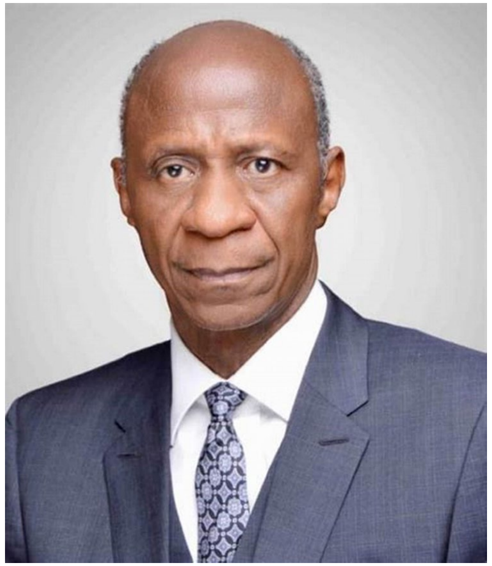
	Food security	Adaptation potential	Mitigation potential	Main constraints to adoption
Supplementary feeding	+	+	++	easy to implement, but costly
Grazing management	+/-	+	++	lack of technical information and capacities, especially in extensive systems
Animal breeding	+	++	++	technical, economic, institutional: especially in developing countries
Animal and herd management	+	++	+	technical, institutional: especially in developing countries
Animal disease and health	++	++	+	technical, institutional: especially in developing countries
Vaccines against rumen archaea	++		+	not immediately available, may have low acceptability in some countries
Warning systems	++	+		technical, institutional: especially in developing countries
Weather-indexed insurance		+		technical, economic, institutional: especially in developing countries
Agroforestry practices	++	++	++	technical and economic

(FAO, 2013)

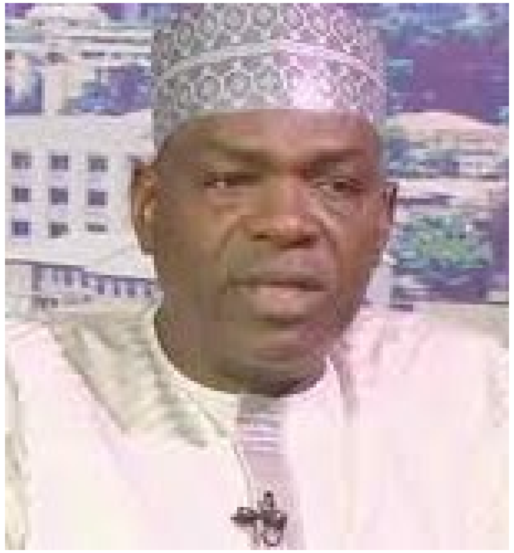
Co-strategists

The Mentors

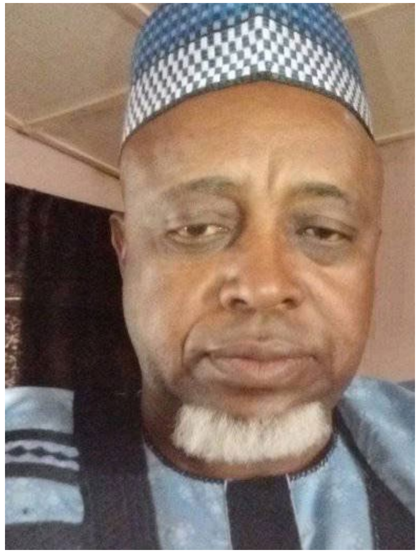
Prof
Junaidu Maina



Prof Elias
Bogoro



Alhaji Baba
Ngelzarma



Alhaji
Hussaini Bosso

Livestock Management & Emerging Technologies: Demonstration Hackathon

AI COLLECTIVE

FEDERAL MINISTRY OF COMMUNICATIONS, INNOVATION & DIGITAL ECONOMY

CONCEPT NOTE

Background

Livestock management plays a critical role in Nigeria's agricultural sector, contributing approximately 5% to the nation's Gross Domestic Product (GDP) and serving as a vital source of food security, employment, and economic growth. With an estimated livestock population of over 18 million cattle, 34 million sheep and goats, and 7 million pigs, the sector supports millions of Nigerians (FAO, 2020). However, despite its significance, the livestock industry faces persistent challenges, including inefficient grazing practices, resource misallocation, supply chain inefficiencies, and frequent conflicts between farmers and herders

M.D. Abubakar l and z dairy - G
The XX International Silage Con

conference.ifas.ufl.edu/silage/

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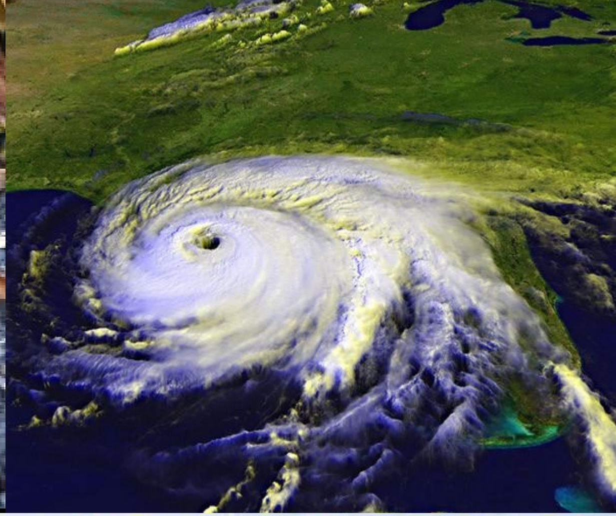
LALLEMAND bonsilage novonesis

Stressors predispose to mycotoxin production

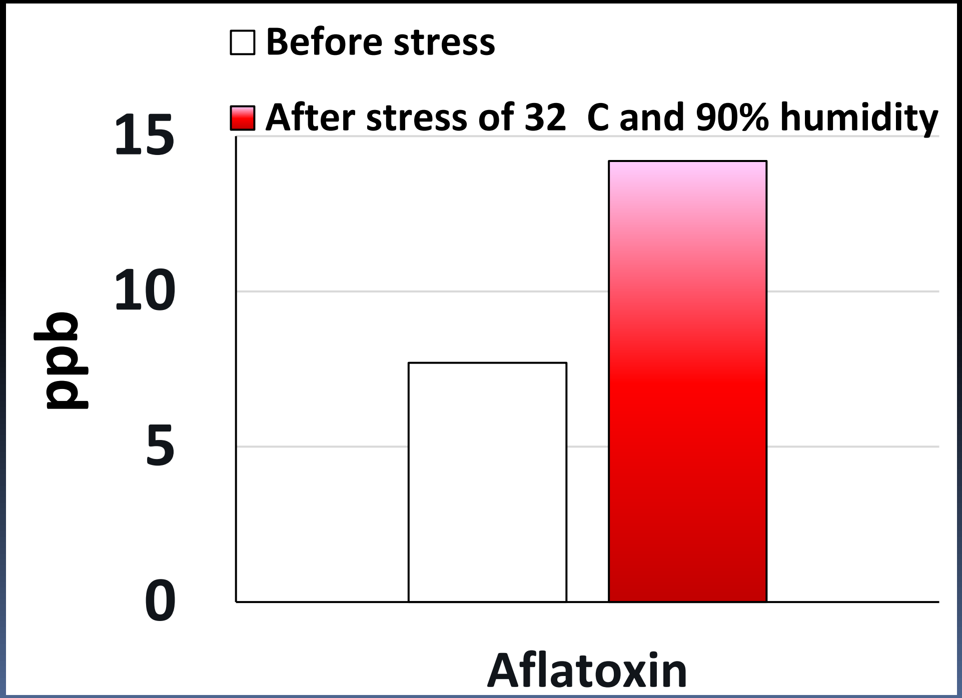
- Temperature
- Water activity
- Drought
- Insect activity
- Plant disease
- Hail storms






Stressors

Stressors predispose plants to greater aflatoxin contamination



Russell et al., J. Anim. Sci. 69:5-12.

Mitigation approaches

Beauchemin et al., 2022, based on FAO, 2022

- Reviewed 30 mitigation approaches.
- Many options exist (mostly for intensive systems) but adoption has been low.
- Affordability needs to be prioritized.
- Incentives needed for approaches that don't increase performance.
- Production intensification is the most immediate and universally applicable means of decreasing CH_4 intensity

Production intensification (improved feeding and management)

Dietary Manipulation (Supplementation and processing of concentrates and lipids, management of forage and pastures),

Rumen Manipulation (3-nitrooxypropanol, macroalgae, nitrates, etc.),

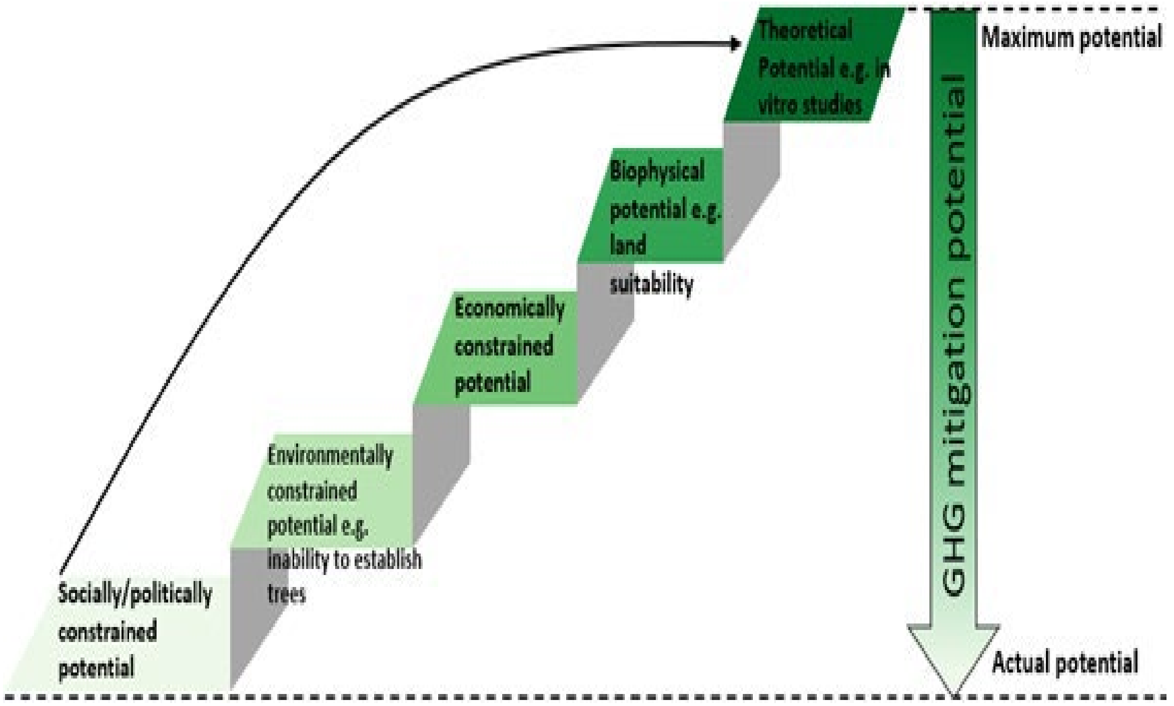
Selection of low-CH_4-producing animals.

Other mitigation strategies at earlier stages

Factors limiting attainment of theoretical GHG mitigation potential

- Scientific soundness of the approach
- Magnitude and persistence of the approach's potential
- Economic feasibility of the application/approach
- Adoptability
- Other environmental impacts
- Consumer acceptance of the approach

Knapp et al. 2011



Harrison et al., 2021

The economic potential of mitigation approaches is less than 10% of what is technically possible because of adoption constraints, costs and numerous trade-offs (Herrero et al., 2016)

Evaluating approaches with a systems lens

- Harrison et al., 2021
- Reviewed 54 mitigation strategies
- Accounted for mitigation as well as
  - **Economics** (productivity, profit, opportunity cost)
  - **Environment** (air, water, land)
  - **Social aspects** (availability, social license, adoption capacity, acceptance)
- Only 16 approaches had
  - medium–high mitigation potential and
  - triple-bottom line benefit (Econs, Envirn, and Social)

	Co-benefits and trade-offs				
Intervention	Type	Mitig	Econ	Envirn	Social
1. Animal management or genetics					
Genetic selection (residual feed intake) for low CH_4 production	ER	●	↑	↑	↓
Improved animal health	ER	●	↑	↑	↑
Reduced adult and juvenile mortality at birth	ER	●	↑	↑	↑
2. Feed additives and feeding management					
Nitrate feeding in rangeland environments	ER	●	↓	↓	↓
Nitrification inhibitors	ER	●●	↕	↓	↓
Tannins	ER	●	↓	↑	↓
Chemical inhibitors (3-nitrooxypropanol)	ER	●●●	?	↓	↓
Concentrates, e.g. grains (highly digestible feeds)	ER	●●	↑	↓	↕

Climate smart approaches for LMIC based on the systems approach

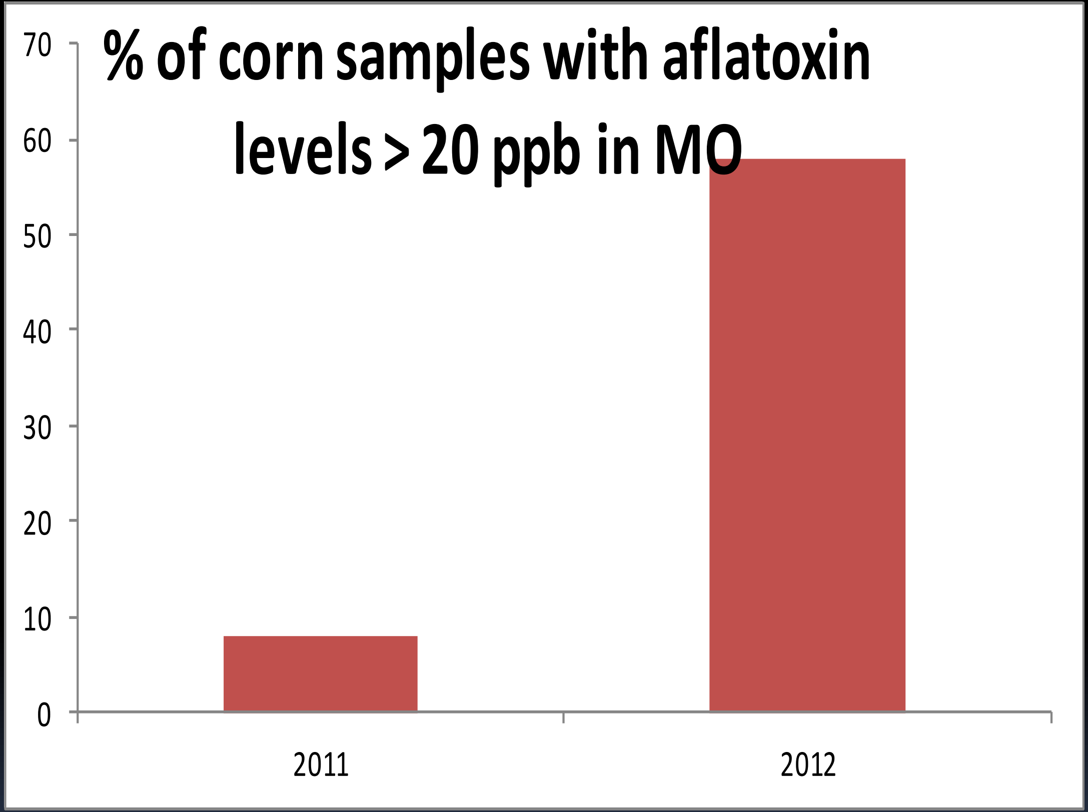
Appropriate approaches for LMIC with
- triple-bottom line benefit and
- medium–high mitigation potential.

1. Concentrate supplementation
2. Improved animal health
3. Improving animal management
4. Pasture management
5. Agroforestry
6. Manure management

(Harrison et al., 2021)

2012 drought increased plant poison levels

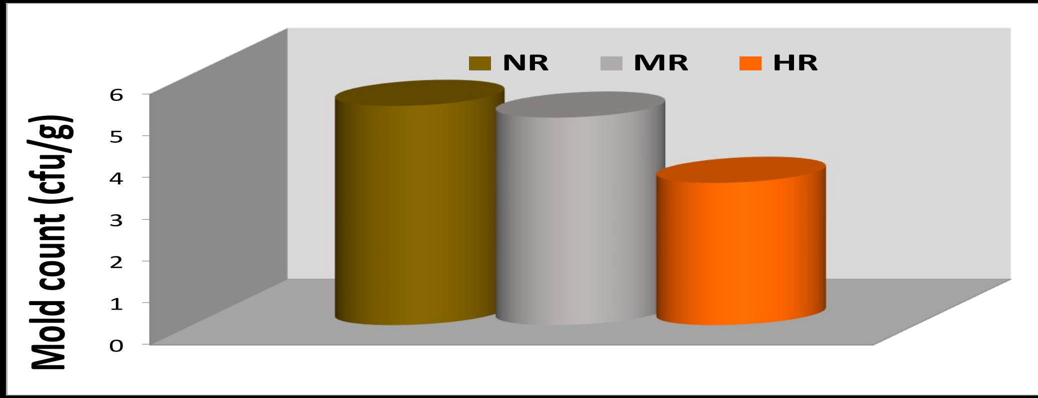
Aspergillus infested corn

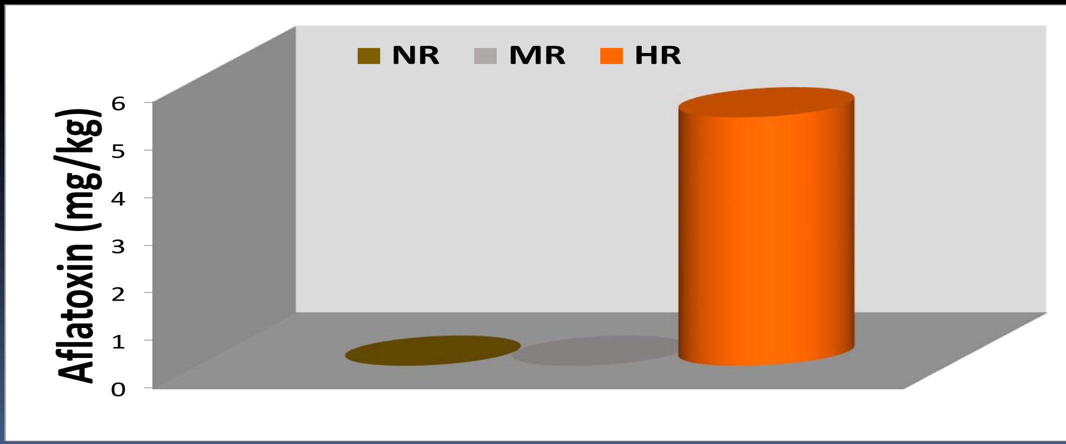


Scientific American

Rust disease effects on aflatoxin

No rust (NR) | Medium rust | High rust





Risk of mycotoxin associated with Hail damaged corn

White mold characteristic of Fusarium ear rot associated with wounds caused by hail

Powdery olive green mold characteristic of Aspergillus ear rot associated with insect damage

https://crops.extension.iastate.edu/cropnews/2009/08/risk-mycotoxins-associated-hail-damaged-corn

Misconceptions about aflatoxin M1 contamination of milk: global ramifications

Stark differences in global milk consumption by region/country (kg per person /year)

1	<30	30 to 150	>150	>300
DR Congo	Most of sub-Saharan Africa & East & Southeast Asia	India, Iran, Japan, Kenya, Mexico, Mongolia, New Zealand, North and Southern Africa, most of the Near East, Latin America and the Caribbean	Argentina, Armenia, Australia, Costa Rica, Europe, Israel, Kyrgyzstan, North America, and Pakistan	Sweden Finland

(Adapted from FAO, 2019)

Average daily dose of aflatoxin M1 (AFM1) in global regions

Region	AFM1 (ng/kg body weight/day)
Africa	0.02-0.8
North America	No data
Latin America	0.01-2.6
Eastern Mediterranean	0.1-1
Southeast Asia	0.03-0.6
Western Pacific	0-0.09
Europe	0-0.2

Adapted from Saha Turna et al. 2022

AA

Milk AFM1 standards have caused milk avoidance, dumping and related challenges

- **Balkans –** High milk AFM1 levels led to widespread dumping of milk, closure of dairies
- **Ethiopia-** Social media article about milk AFM1 nearly crippled the nascent dairy industry
- **Nepal –** Milk holidays (dumping) are common despite huge neighboring markets
- **Kenya-** if aflatoxin standards were strictly enforced, 3,400,000 Kenyans would be deprived of milk (Sirma et al, 2018).

Nation	Allowable aflatoxin in food (μg/kg)
Canada	15
China	20
European Union (EU)	4/10
Ghana	No regulation
Guatemala	20
India	30
Kenya	20
United Arab Emirates	No regulation
USA	20

>100 nations worldwide have aflatoxin regulations

Nation	Allowable aflatoxin in food (μg/kg)
Canada	15
China	20
European Union (EU)	4/10
Ghana	No regulation
Guatemala	20
India	30
Kenya	20
United Arab Emirates	No regulation
USA	20

AFM1 causes 13-32 liver cancer cases/year: 0.0003% of all cases

- Most nations would have no AFM1-related liver cancer cases

Nation	AFM1-related HCC cases/yr
Brazil	0.5 - 7
India	4 – 9
Indonesia	0.2 – 5.6
Mexico	3 – 5.4
Pakistan	1.6 - 4

(Wu, 2022)

Should this change regulations?
If so, why?

- "It was the age of **wisdom**, it was the age of **foolishness**." – Charles Dickens, *A Tale of Two Cities*
    - "Wisdom" – analytical advances → detect ever-tinier traces of chemicals
    - "Foolishness" – thinking this should be the basis of regulations
- Base regulations on HEALTH RISK, not limit of detection.

- Yet we currently stand here:
    - **AFB1 causes 800-12,000 times more cancer cases than AFM1.**
    - … but US regulation of AFM1 is **40 times stricter** than its regulation of "total aflatoxins" (AFB1 + AFB2 + AFG1 + AFG2).
    - EU regulation of AFM1 is **80-200 times stricter** than for total aflatoxins.

(Wu, 2022)

We made a mountain out of a molehill

Our research suggests only 13 to 32 cases of global liver cancer can be attributed to milk aflatoxin M1.

Saha Turna et al. 2022. Amer. J. Clin. Nutr..

Corn silage quality in tropical areas

A. T. 'Gbola' Adesogan

Department of Animal Sciences,
University of Florida

International Silage Conference, Madison, WI

Outline

- Defining the tropics
- Tropical silage production systems
- Challenges of tropical silage production
  - Forage factors
  - Climatic factors
  - Pests & diseases
  - Socioeconomic & infrastructure factors
- Solutions

Outline

- *Whole plant and kernel yield*
- *Kernel hardness, starch concentration and availability*
- Nutritive value of silage hybrids
- Effects on ensiling characteristics
- Spoilage potential and pathogenicity of silage
- Effects of diseases and storage pests
- Temperate versus tropical corn hybrids.
- Summary and implications

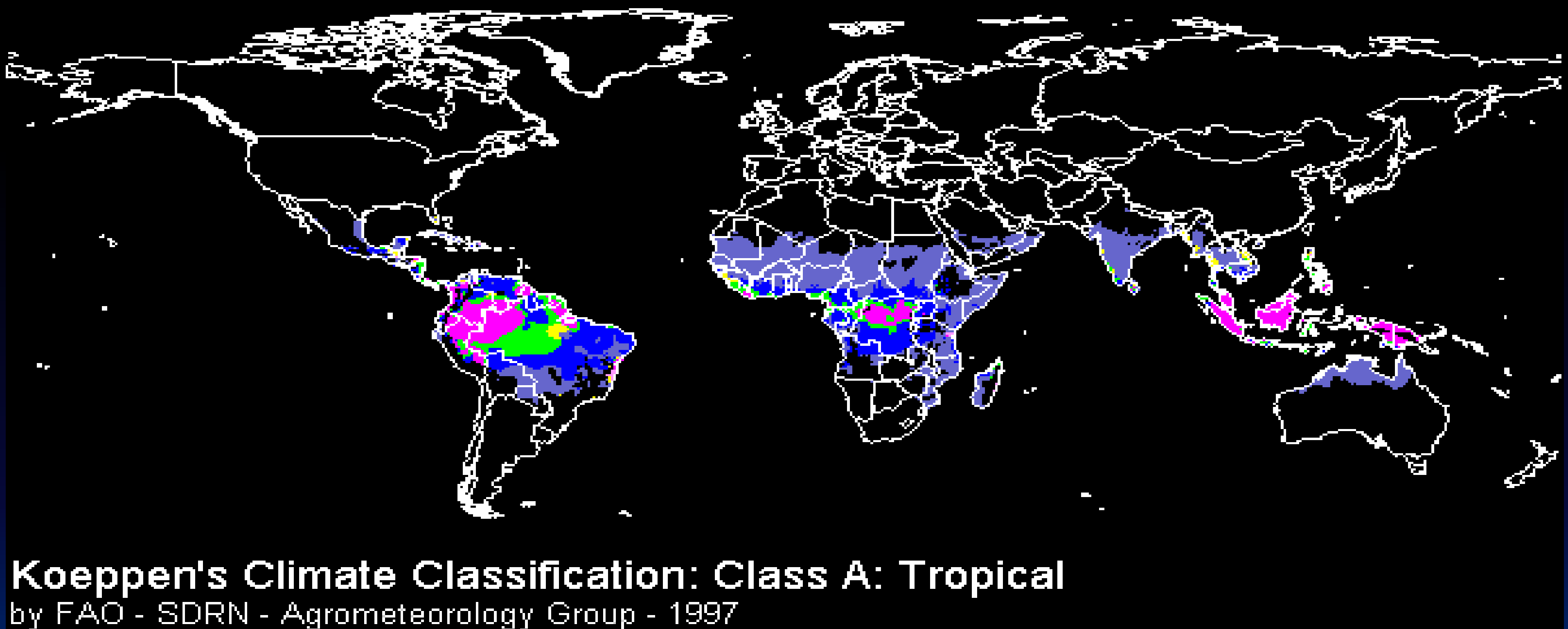
Definitions

Tropics:

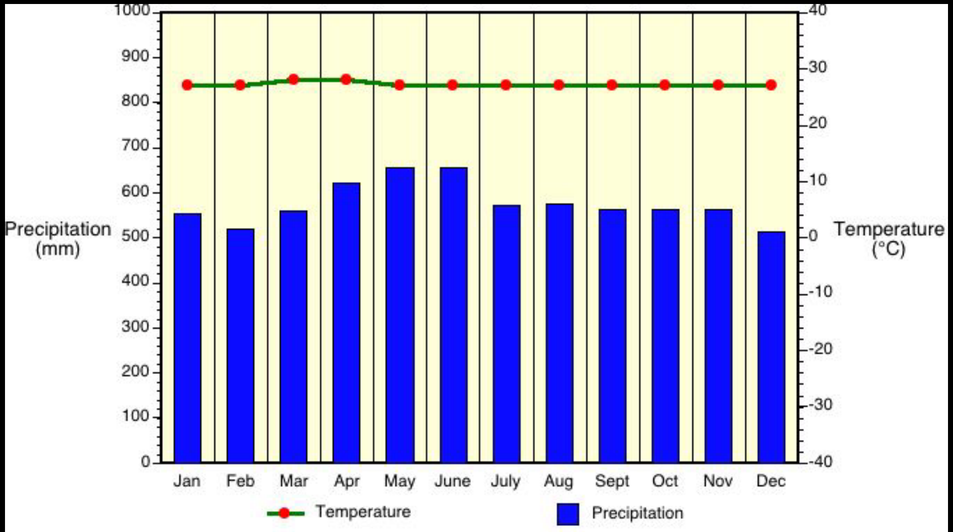
- Areas between latitude 23.5°N and 23.5°S
- Warm, humid, frost-free; Av. monthly temp. ≥ 18°C

Subtropics:

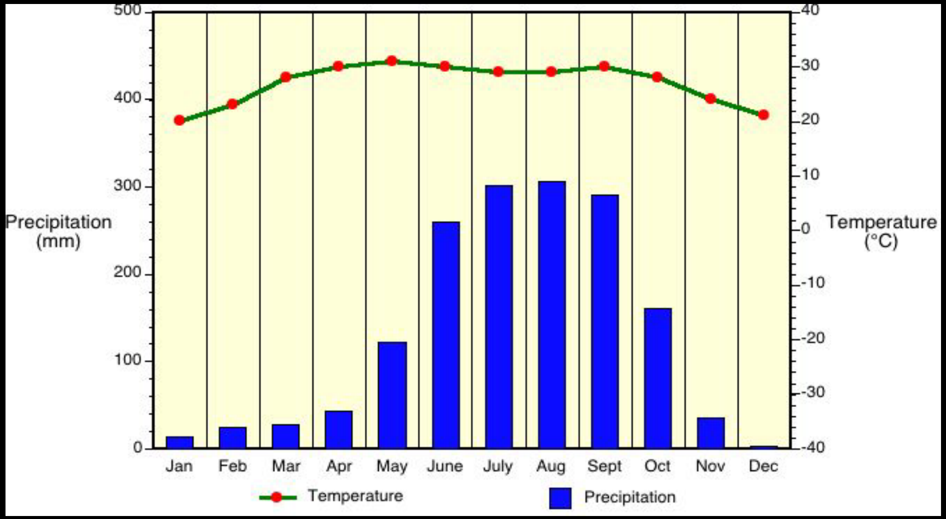
Areas north /south of tropics within latitudes 30° N & S



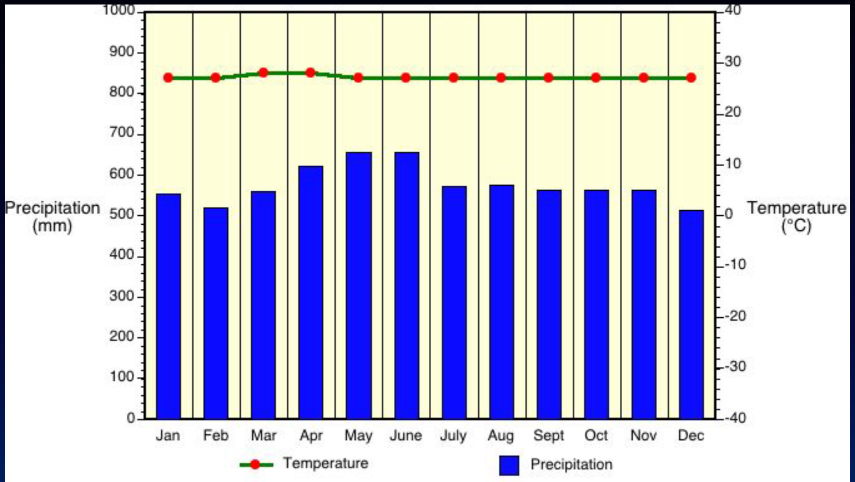
Tropical wet/rainforest
Andagoya, Columbia, 5° N



Tropical Monsooon Calcutta, India, 22.5°

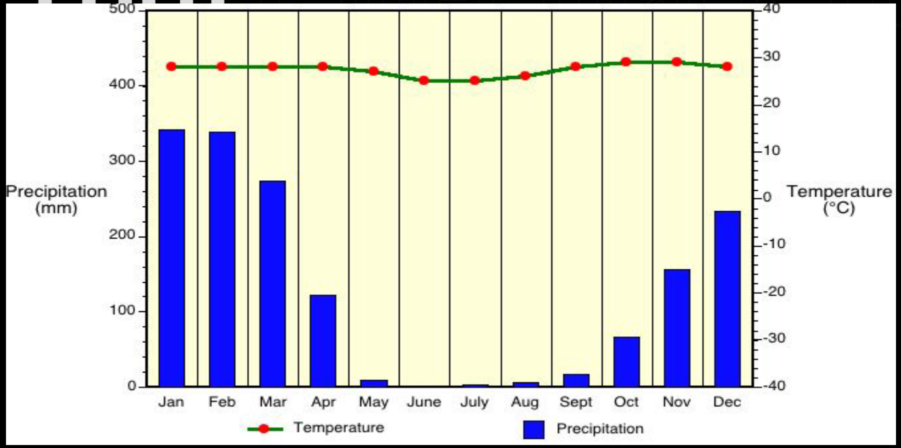


Tropical Savannah
Darwin, Australia 12.5° S



Origins and spread of corn Chief Black Hawk

- The m

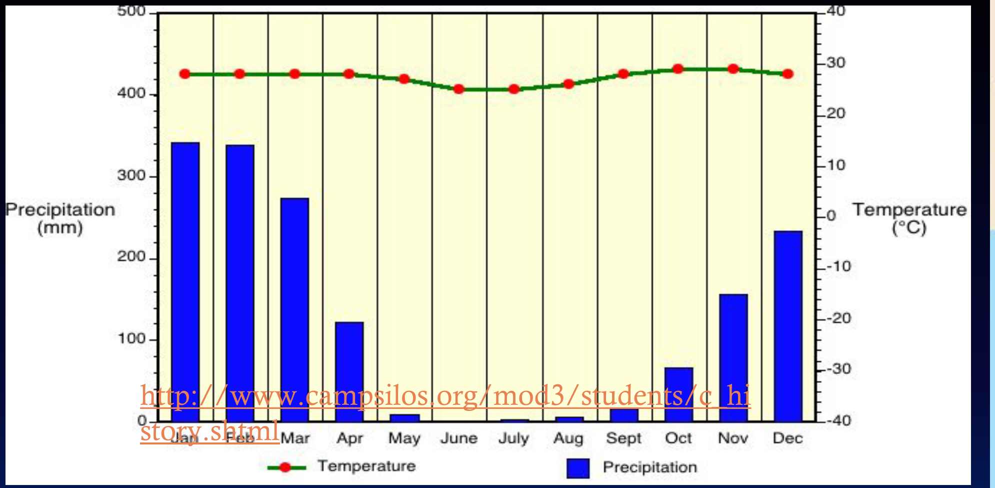


Chief Black Hawk

Origin of corn

http://www.nsf.gov/news/news_images.jsp?cntn_id=104207&org=DEB

Domesticated from teosinte > 6,000 years ago in the Tehuacan valley, Mexico



http://www.campsilos.org/mod3/students/c_history.shtml

Why corn silage

- High yields ($\leq$ 25 tons DM/ha)
- High energy value (starch 31%; ME 11 MJ/kg DM)
- High effective fiber
  - Ruminal buffering
  - Milk fat stimulation
- No wilting required
- Relatively easy to ensile and store

Importance of Corn Silage

- Corn production in the US increased from zero 3000 years ago to 13.2 billion bushels in 2009 (Troyer, 2004)

- US corn silage yield in 2009 was estimated at 44 metric tonnes/ha from about 2.3 million ha

- Perhaps the most commonly used forage for intensive/ confinement dairy production

Ideal conditions for corn

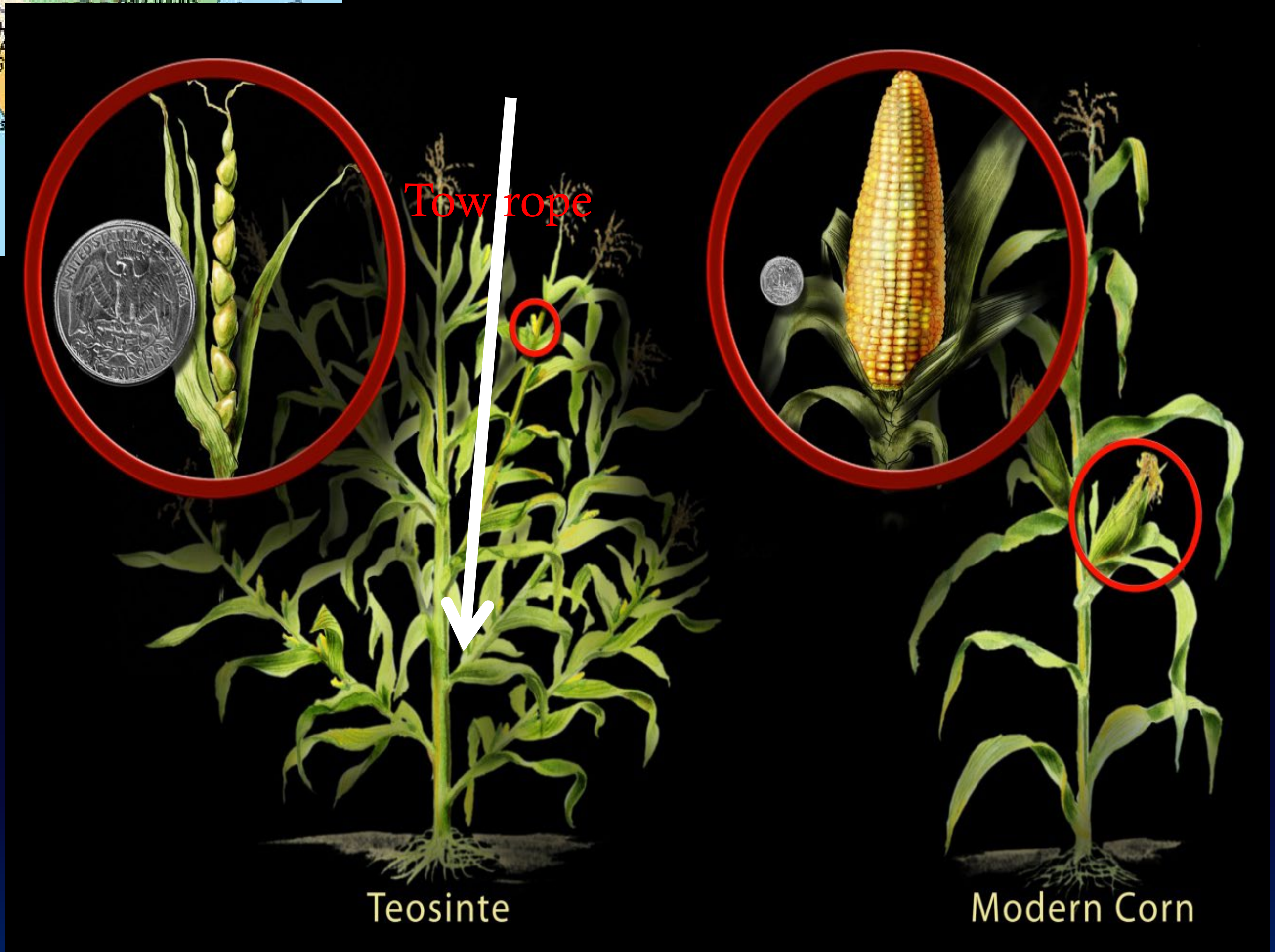
- 600 to 1500 mm rainfall
- Soil temp. > 10^{o}C
- 18 to 33^{o}C
- No frosts or droughts
- Adequate sunlight

But weather influences the anatomy and composition of corn plants.

Effects of temperature on corn anatomy

Corn forage yield and nutritive value

Alternative use of choppers

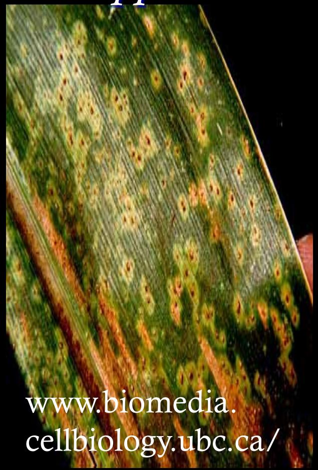


Southern rust

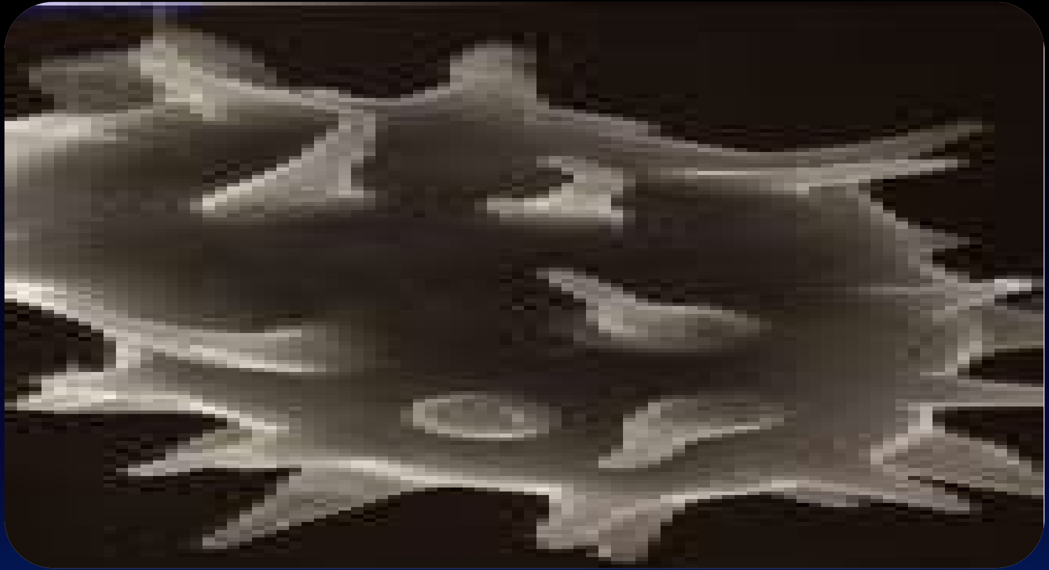

pdc.unl.edu


http://www.microscopyu.com/

Puccinia spp.


www.biomedia.
cellbiology.ubc.ca/


www.ipm.iastate.edu



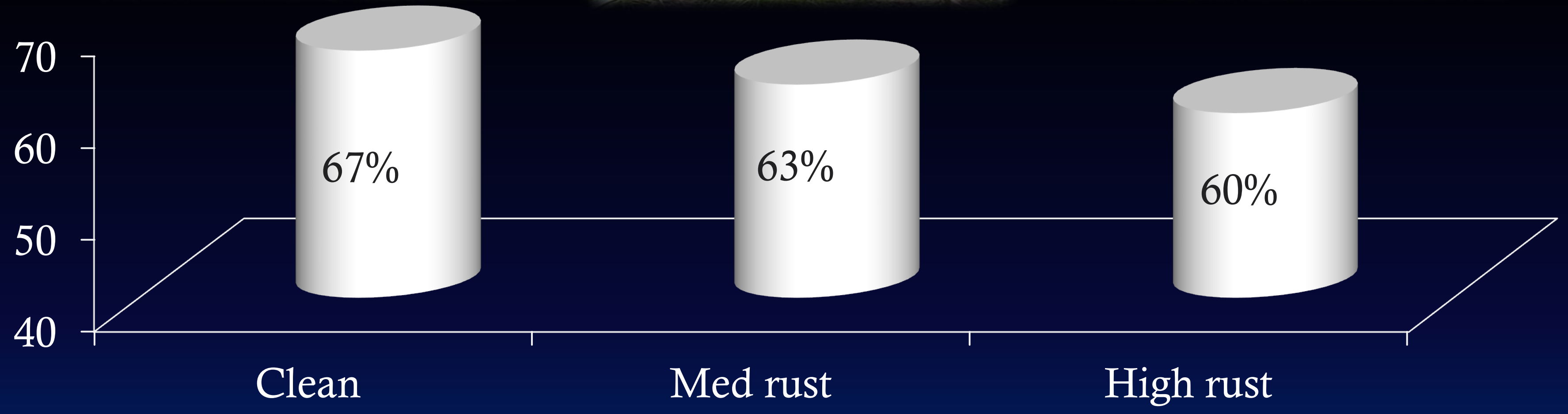
Rust levels of summer (2nd planting) corn in FL

Clean

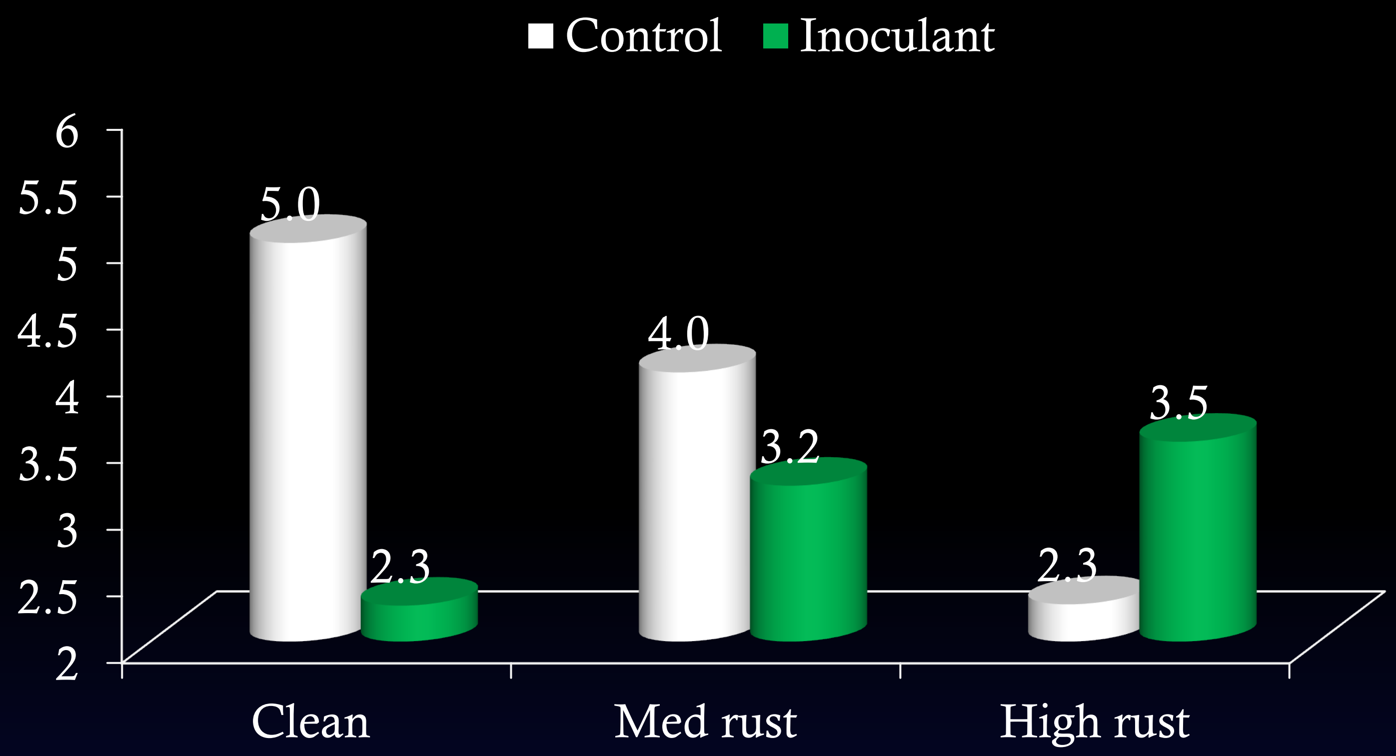
Medium rust

High rust

Rust effects on DM digestibility, %



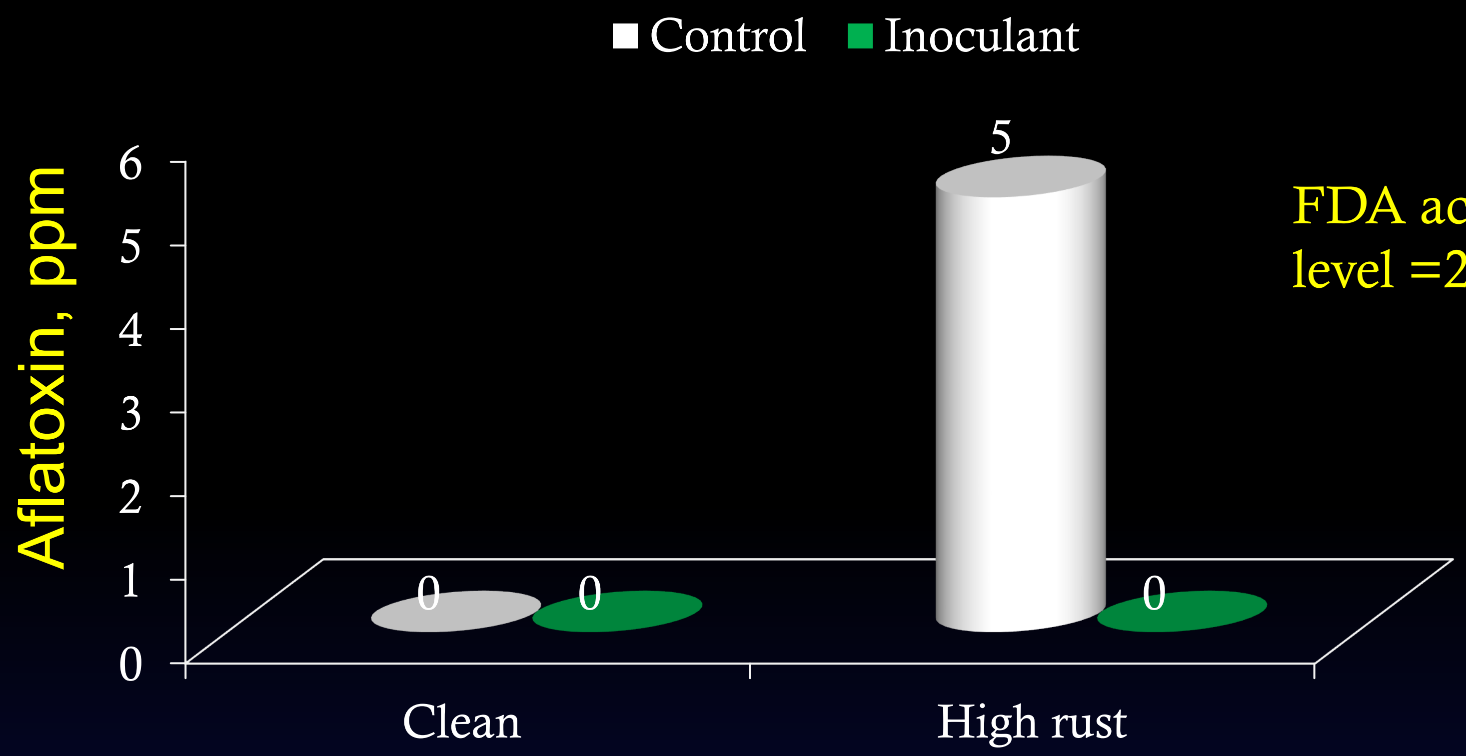
Treatment effects on **Lactate %**



<u>Effects:</u>
Rust level **
Inoculant : ***
Interaction: ***

Lactate decreased by rust; reversed by inoc

Treatment effects on aflatoxin, ppm

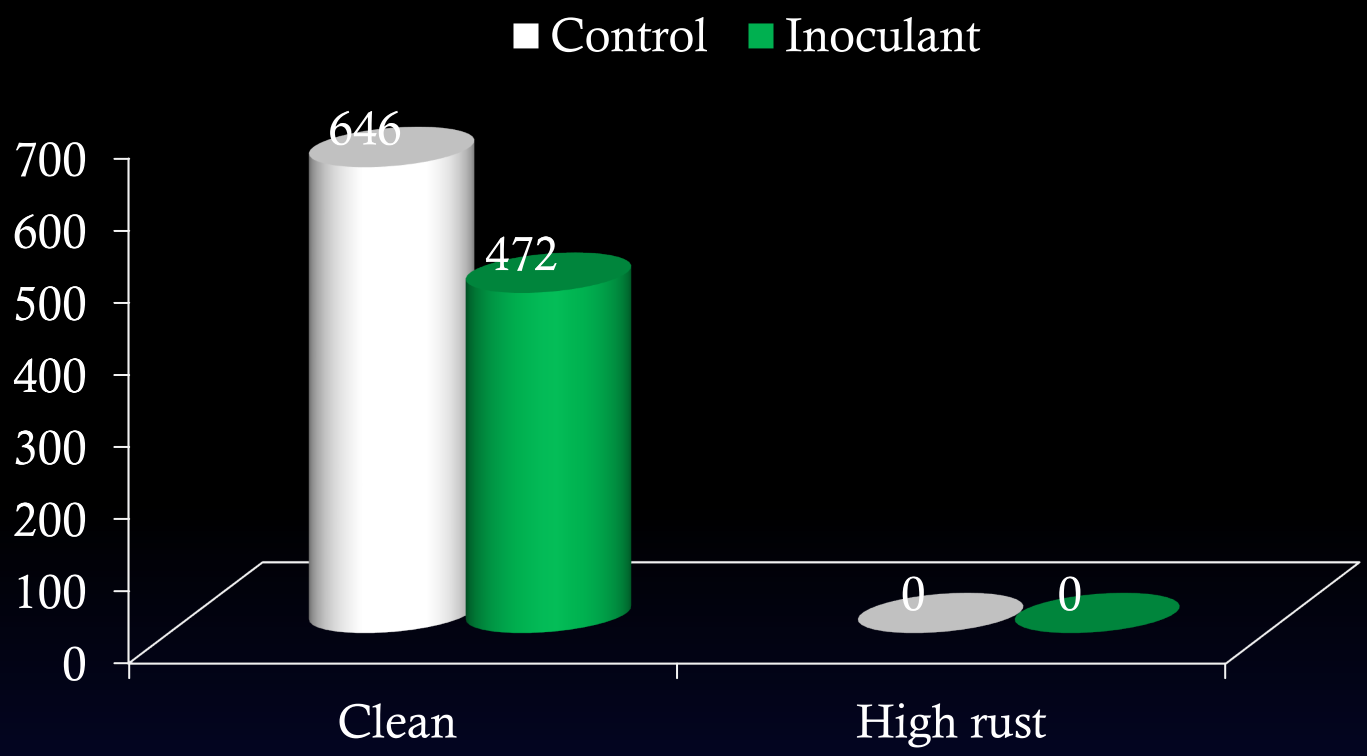


FDA action level =20 ppb

Effects:
Rust level X
Inoculant : X
Interaction: X

High-rust corn was unsafe to feed

Treatment effects on zearalenone, ppm



Effects:
Rust level ***
Inoculant : ns
Interaction: ns

Zearalenone was detected in clean corn

Low input system characteristics

- Limited silage making know-how
- Advanced equipment is unavailable / unaffordable
- Hence, basic implements are used

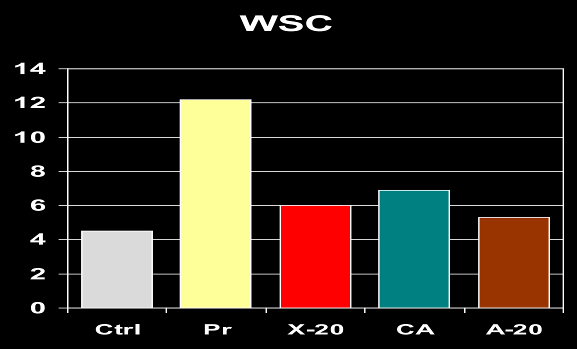
Consequences for silage production in low input systems

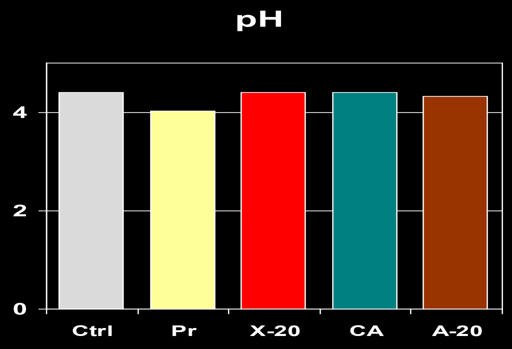
- Silage is poorly made
  - Poorly chopped, compacted, unstable; often contaminated with sand
- Very laborious process
- Slow throughput
- Perceived to give low return on investment
- Discouraged by some

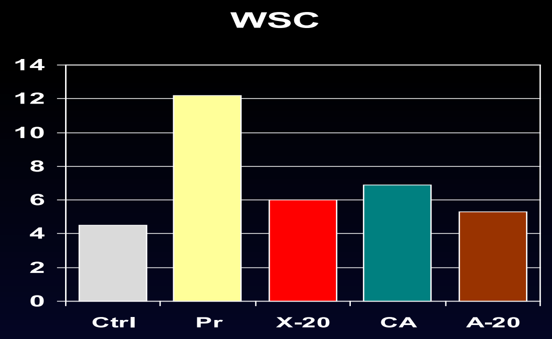
Enhancing tropical silage quality

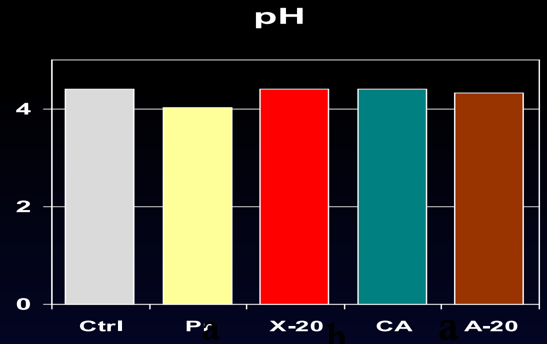
- Strategic wilting
- Add WSC
- Strategic use of additives
- Improving management

Adding enzymes









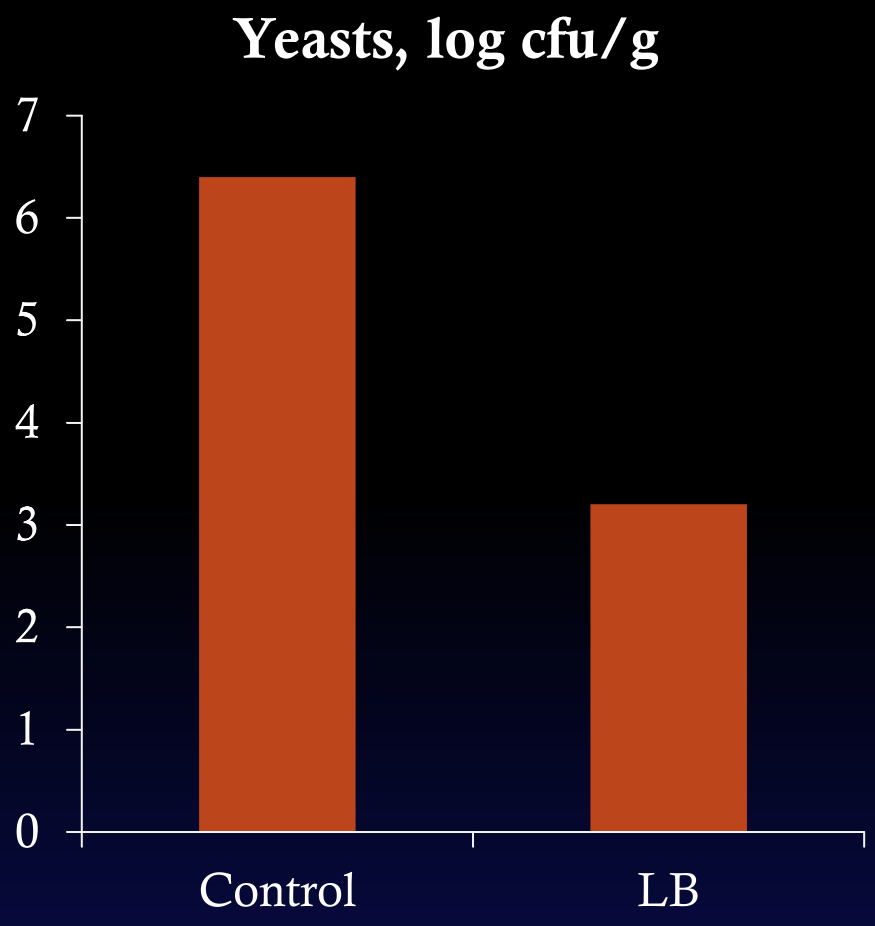
a b a a a

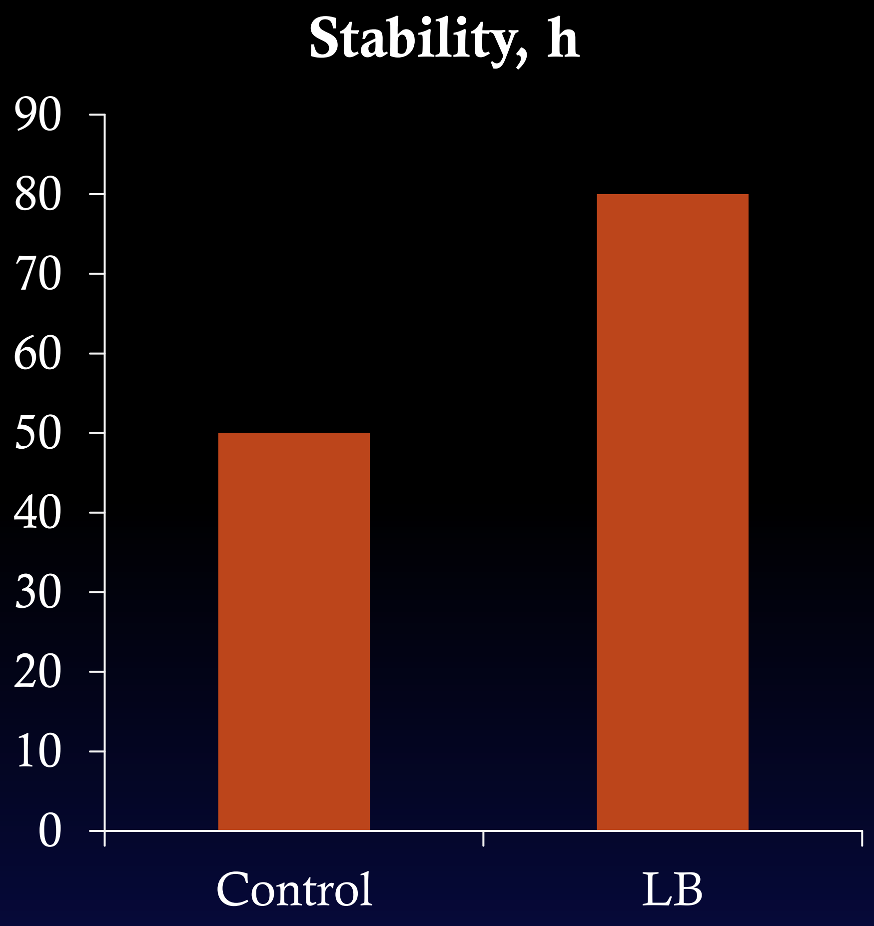
c a bc b c

(Bermudagrass silage; Dean et al., 2005)

Adding inoculants

Don’t add sugar sources to corn unless, sugars are < 5% DM





(Sugarcane silage; Pedroso et al., 2007)

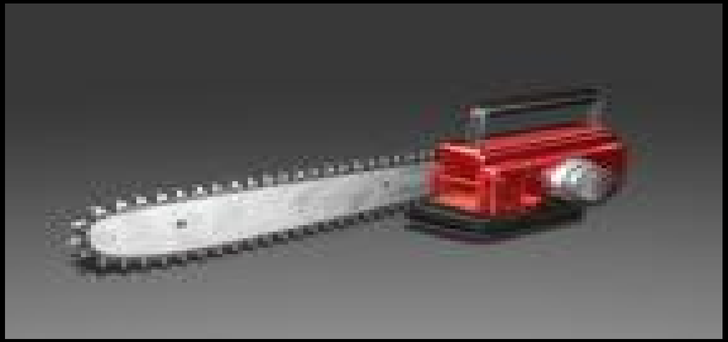
Adding fermentation inhibitors

- Acids, alkalis
- Effective but:
  - Hazardous
  - Costly
  - Distribution issues
  - Toxic products (NH3)

Improve management:

Every link in the silage-making 'chain' must strive for excellence

- Hybrid selection
- Growing the crop
- Predicting harvest dates
- Chopping
- Packing
- Sealing
- Feedout



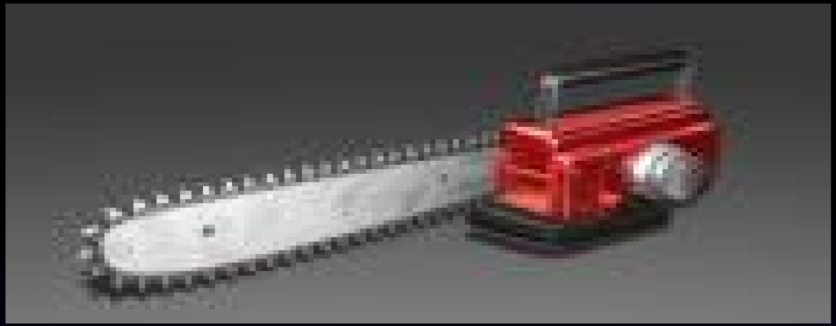
Every link in the silage-making 'chain' must strive for excellence

Improving silage production in 'low input' systems

- Develop low cost, alternative ensiling technologies
- Use small / alternative bales
- Form cooperatives to increase buying power
- Educate producers about:
  - Best silage management principles
  - Financial & performance benefits of quality silage

Conclusions

'Deck stacked' against silage production in the tropics



Can't get away with foul-ups

Detailed attention to each 'step' required for quality silage production in the tropics

Tropical versus temperate corn hybrids

Breeding targets for temperate & tropical corn

Temperate

- Longer daylengths,
- Cooler minimum temperatures,
- Drought,
- Short growing season

Tropical

- Short days,
- High temperatures,
- High humidity
- Disease resistant
- Insect resistant
- Long growing season

(Lilly et al.,

Attributes of temperate vs. tropical hybrids

- Tropical hybrids have:
- More fiber
- Greater yields
- Less starch
- Fiber digestibiitility may be greater

- Above depend on growth conditions.

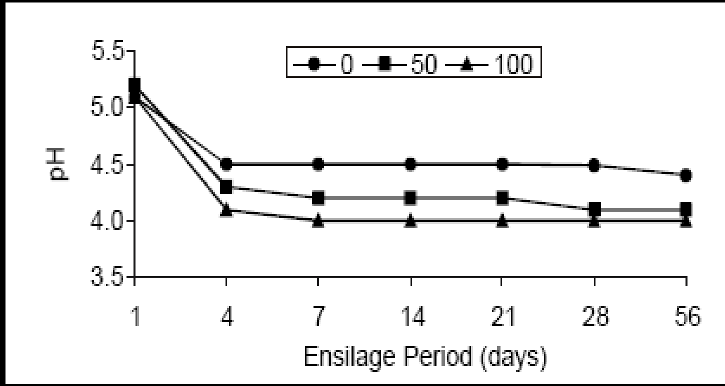
Adding WSC

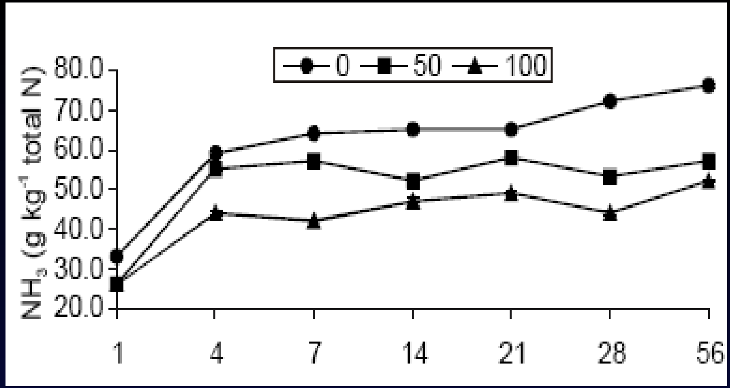
Molasses (M, kg/ton)

	pH	NH_3-N (g/kg TN)
Unwilted control	4.75	221
Wilt + No M	4.87	454
Wilt + 20 M	3.93	172
Wilt + 40 M	3.76	189
LSD[1] (P<0.05)	0.13	58

(Kikuyugrass silage; Piltz et al., 1999)

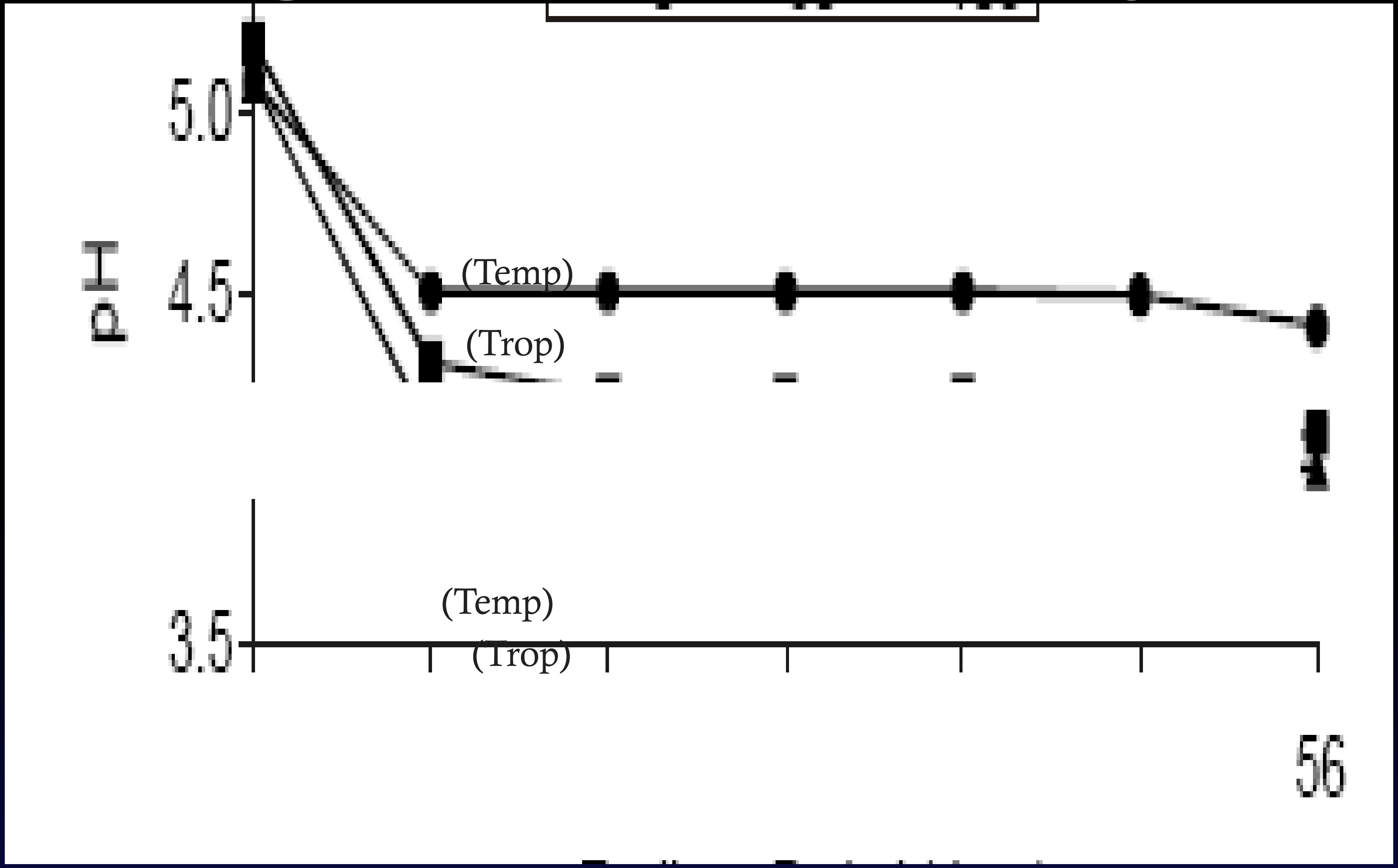
Citrus pulp (g/kg)



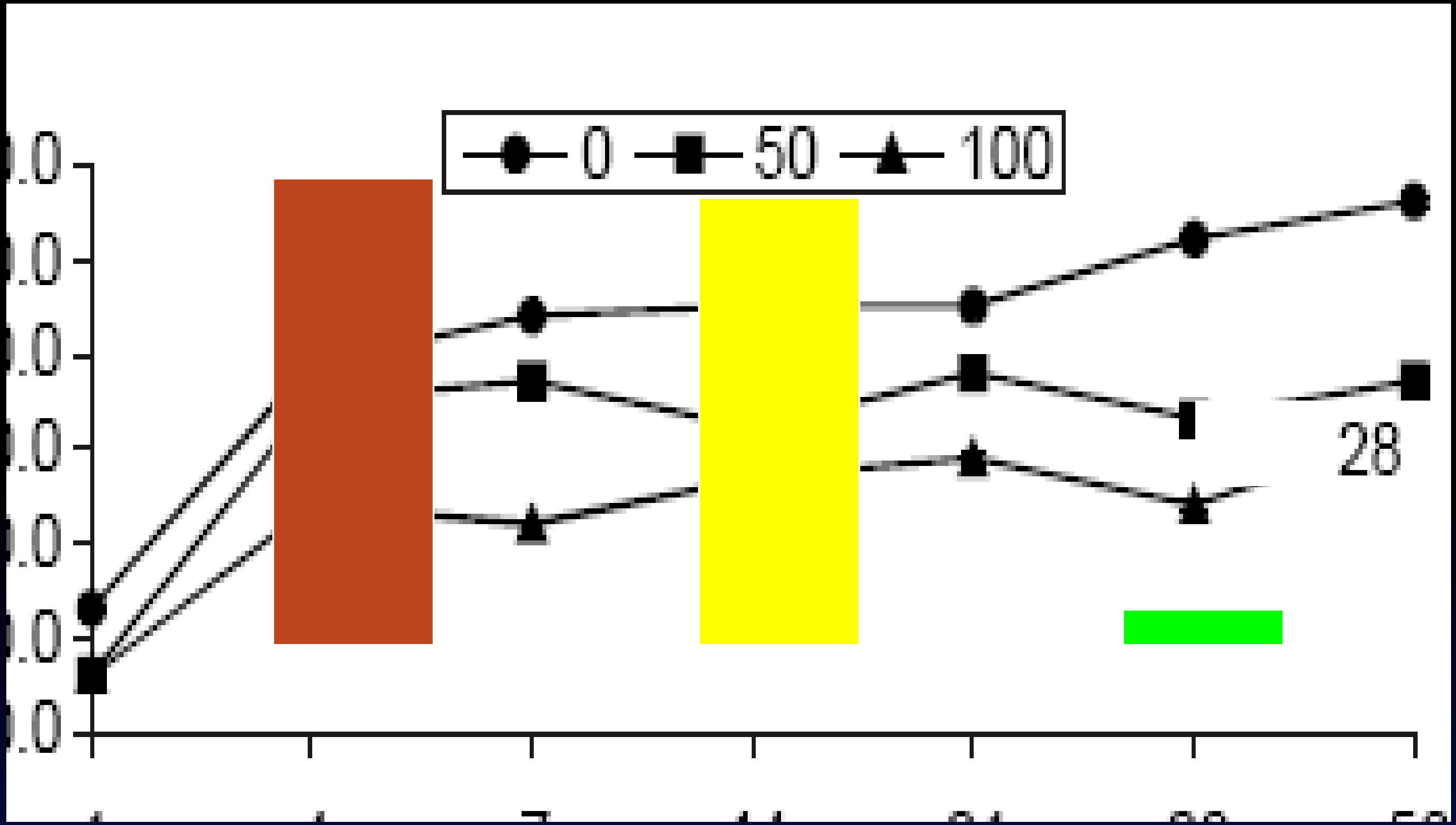


(Marandugrass silage; Bernardes et al., 2005)

Planting date effects on corn yields



Disease pressure on different corn hybrids



Wiatrak et al. (2004)

Table 1. Maximum whole plant dry matter and grain yield by three corn cultivars affected by planting date.

Cultivar	Month of Planting: March	May	August
	---------------- Ton A⁻¹ ----------------		
Pioneer 3320	9.9	5.5	3.3
Pioneer X304C	8.5	7.6	3.8
FLOPUP	8.3	5.9	4.6
Average	8.9	6.3	3.9
	---------------- Bu A⁻¹ ----------------		
Pioneer 3320	207	93	64
Pioneer X304C	150	114	78
FLOPUP	114	86	78
Average	157	98	73

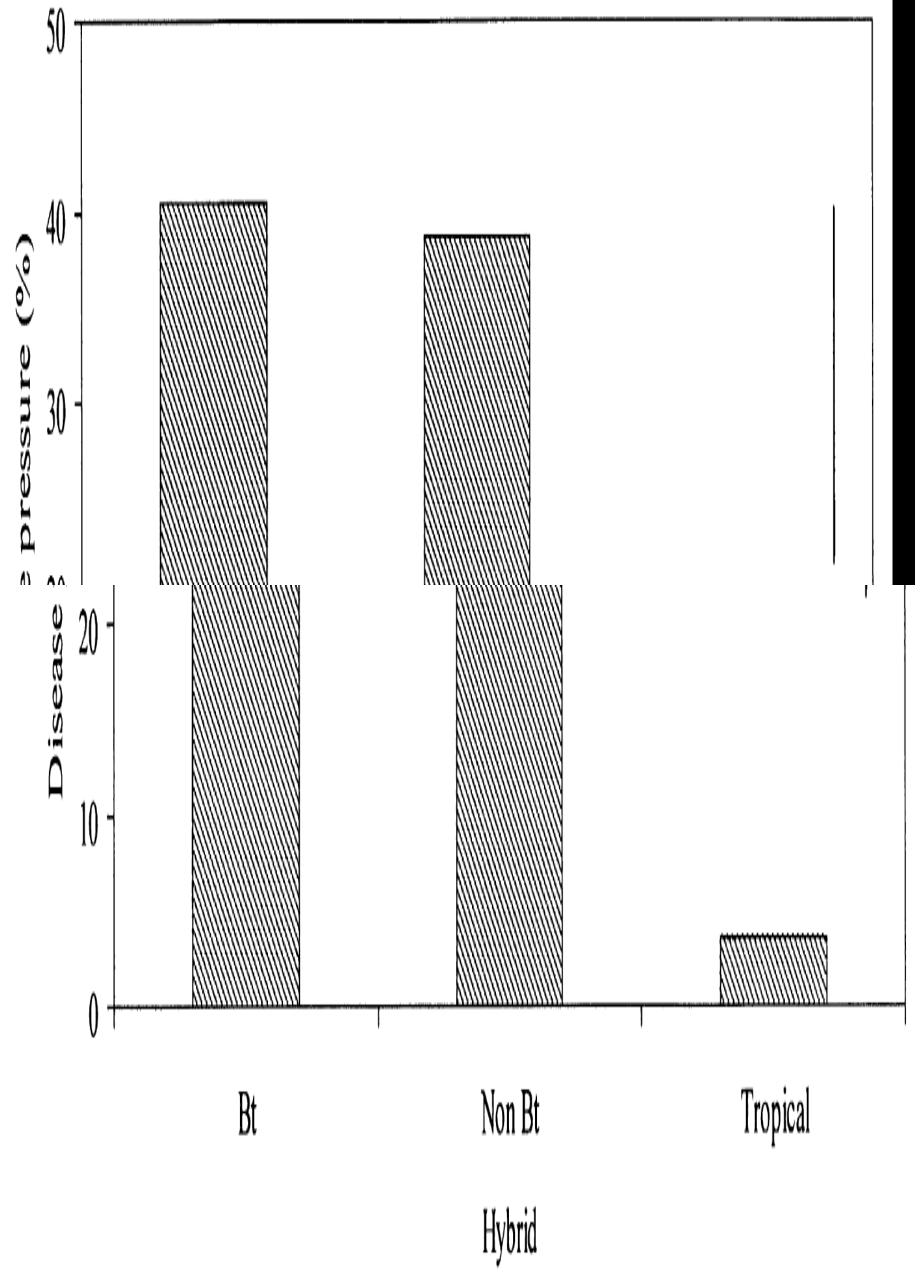
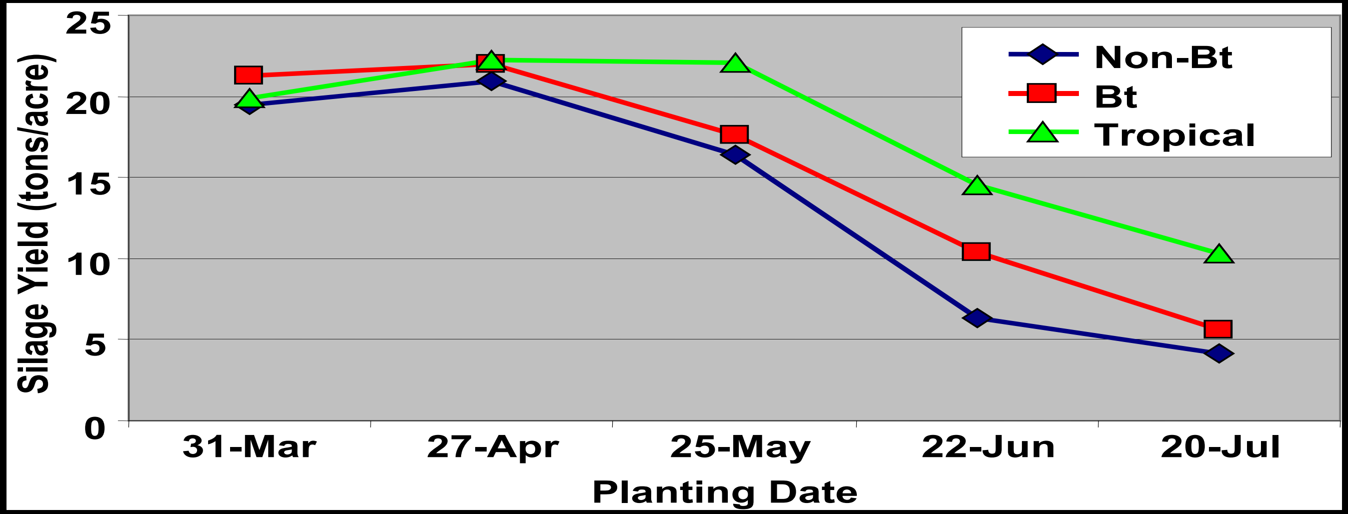
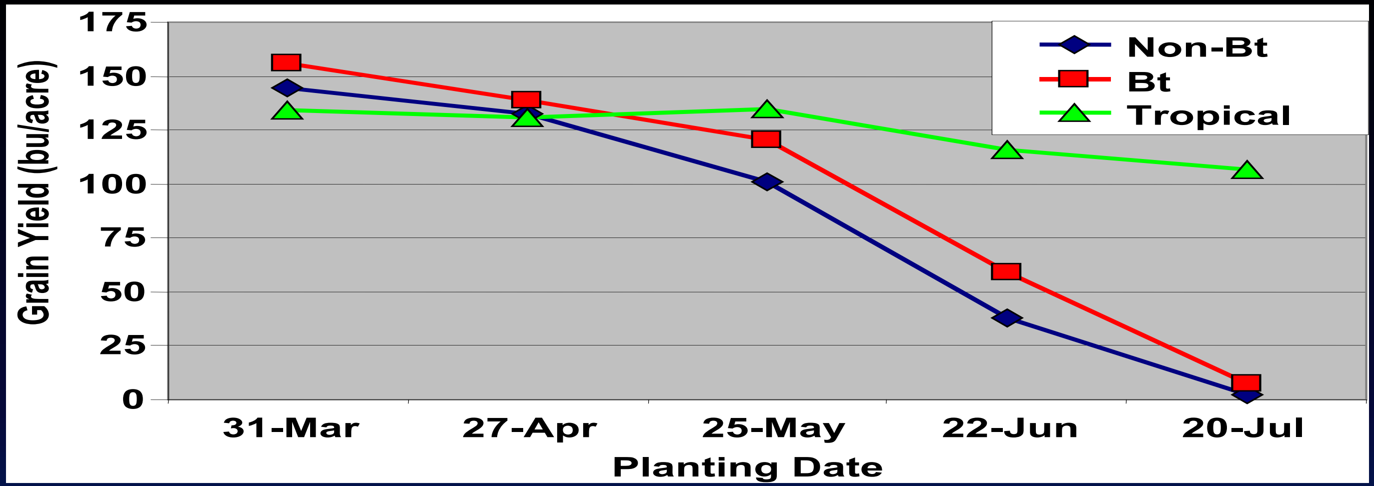


Fig. 6. Influence of corn hybrid on southern corn rust disease pressure. Vertical bar indicate the LSD (P = 0.05).

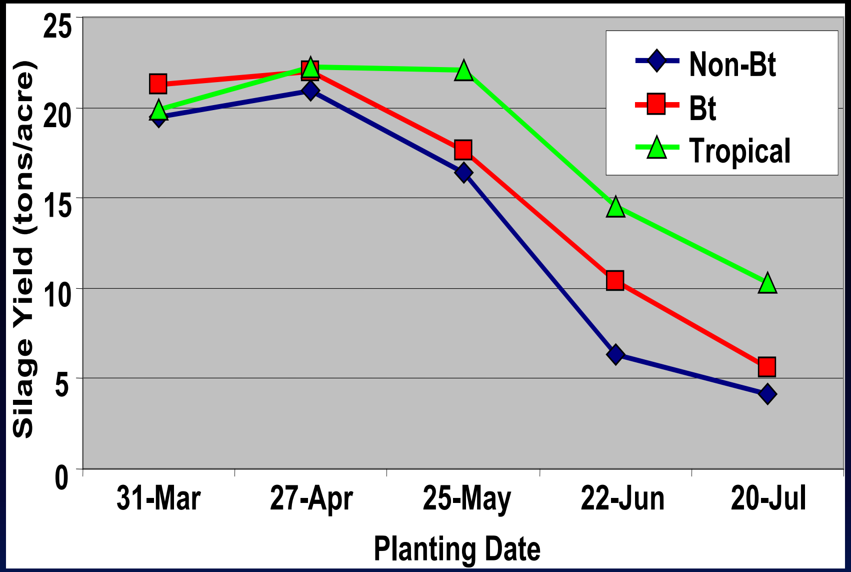
Yields of Temperate (Bt and non-Bt) and Tropical hybrids across planting dates

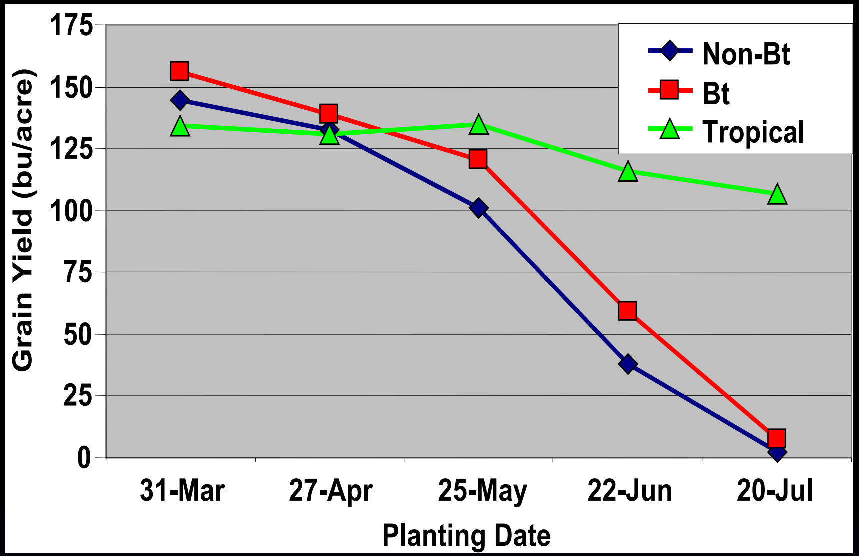




Wright, 2002

Insect damage of temperate (Bt and non-Bt) and tropical corn hybrids





Wright (2002)

Effects of tropical versus temperate hybrids on beef production

- Tropical hybrid doublecropped after Temperate:

- Relative performance of Tropical hybrid
  - 14 % more DM yield
  - 38% less grain
  - 8% more CP
  - 20% more NDF; 31 % more ADF

  - 17% lower DMI in steers
  - 18% lower ADG
  - No difference in Gain:feed

(Utley et al., 1997)

- The warm humid conditions in the tropics/subtropics may increase DM yields and crude protein concentrations of silage hybrids but they have several adverse effects on the nutritional quality of corn silage. These include reduced grain yields and starch concentration, increased fiber and lignin concentration, and decreased digestibility and energy value. In addition, tropical conditions may reduce the efficiency of fermentation of corn silage by making the fermentation more heterolactic, increasing proteolysis, and decreasing aerobic stability. Tropical conditions are also favorable to the growth of various pests and diseases and to contamination of corn with various mycotoxins. These challenges are the imperative for corn silage producers in the tropics to ensure excellent silage management practices. The following recommendations are critical for optimizing the quality of corn silage produced in tropical areas:

- Use tropical, pest and disease resistant hybrids
- Use proven hybrids from variety trials
- Hybrids chosen should also have adequate sugars ($\geq$ 5% of DM) to optimize the fermentation.
- Harvesting at appropriate maturity (about 35% DM).
- Chopping forages to correct lengths (2 cm for processed corn , 1 cm for unprocessed corn).
- Packing forages promptly to a density of about 240 kg of DM/m^3 in the silo.
- Use plastic lined walls and weighted plastic covers
- Silo design should minimize the size of the silo face
- Sealing the silo promptly (within 10 h of packing) and maintaining anaerobic conditions for the duration of ensiling.
- Strategically use inoculuants (with $\geq 10^5$ cfu/g of *L. plantarum, Pediococcus acidilacti, P. pentosaceous, or Enterococcus faecium*) for corn forage that is too dry / wet at harvest or frosted.
- Using additives to prolong the aerobic stability of corn silage. (10^5 cfu/g of *Lactobacillus buchneri*
- Using shavers to ensure smooth silo faces that
- Feeding silages out at rates that minimize the length of time the face is exposed to the air (at least 15 cm per day).
- Accounting for relatively low energy concentration, and low starch degradability of tropical silage hybrids by processing

Thanks

Corn silage trial

- CON = Control
- BB = Lallemand combo inoculant
- PN = Pioneer combo inoculant
- MOL = Molasses @ 3.5 % of DM

Take Home Messages

- Manage the silo face
  - Feedout quickly (6 inches/day)
  - The narrower the bunker, the better
  - Minimal disturbance
  - Heat loss = production volatilized

Take Home Messages

- Fill bunker promptly
- Pack, pack and pack again
- Seal immediately & properly + tires

Chop properly

- Use Sharp knives
- Unprocessed chop length (1/4 –3/8 inch)
- Processed chop length (3/4 inch)

Excel at packing (at least 14 lb/ ft^3)

Spread to depth of 6 inches at a time

Use heaviest tractor

Seal immediately & properly

Monitor bags/bunkers to prevent spoilage

Take Home Messages

- Harvest promptly – (35%DM or 1/3-2/3 milk line)

- Sharp knives, chop length
  - Unprocessed (1/4 –3/8 inch)
  - Processed (3/4 inch)

HYBRID CHOICE

Choices,
choices,
choices!