Integrated Soil Fertility Management (ISFM) and Contribution to Productivity and Soil Carbon

Upendra Singh, Vice President Research, IFDC

Muscle Shoals, Alabama

www.ifc.org

With contributions from:

Sampson Agyin-Birikorang , Latha Nagarajan, Andre Bationo, Henk Breman, and John Wendt

IFDC Background

- Nonprofit research for development organization
- HQ in Muscle Shoals – Pilot Plants, Laboratories, Greenhouses, and Offices
- Provides solutions to food security, sustainable agricultural intensification, soil health and soil nutrition improvements, reducing environmental impact, strengthening market systems and economic development
- IFDC Strategy 2020 – 2030
  - Develop better technologies and advanced fertilizer products
  - Catalyze farm productivity
  - Strengthen markets
  - Enable impact
- Focus area – Global research, Africa and South Asia

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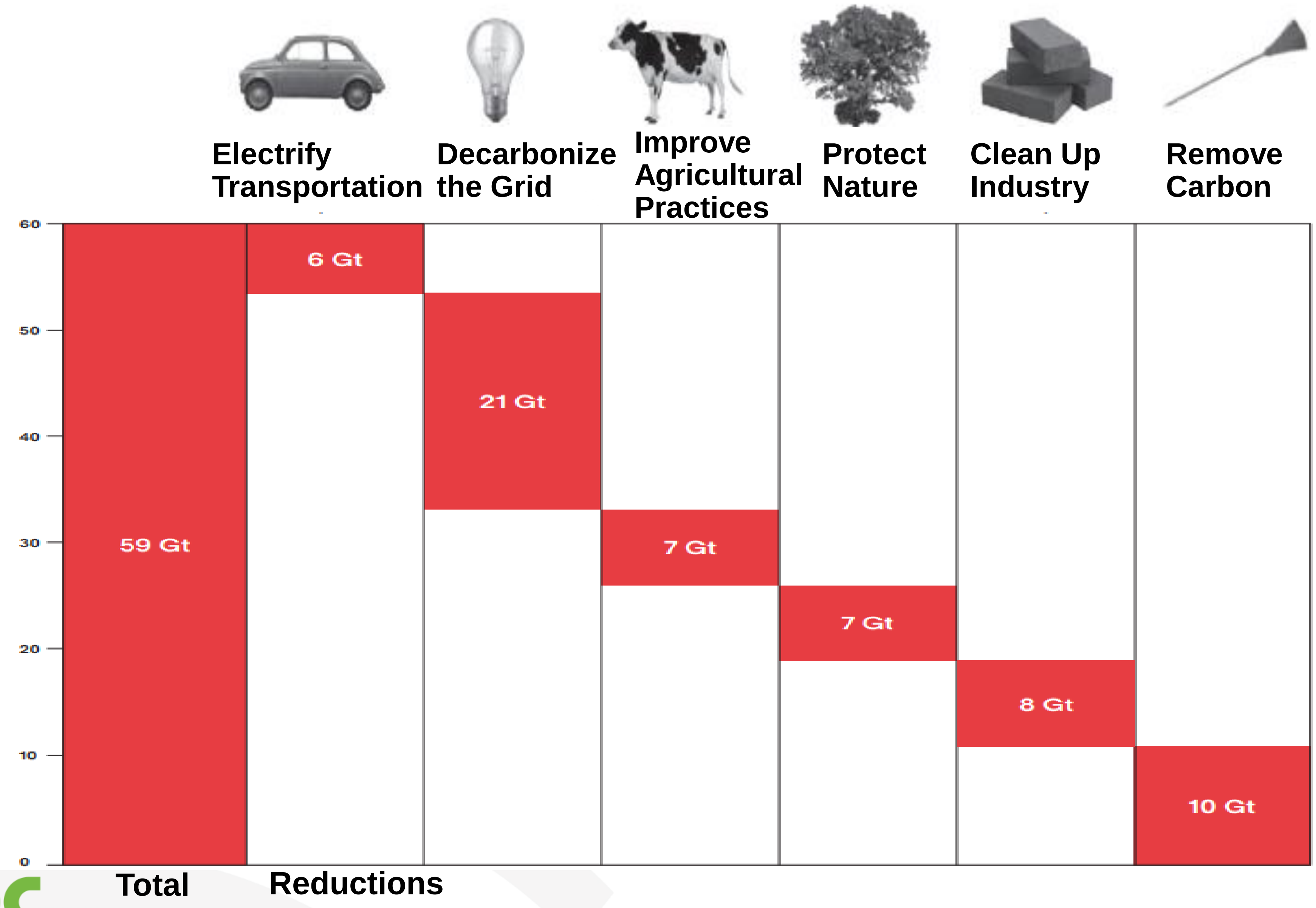
Net Zero by 2050



ISFM Impact on Productivity, Soil Fertility and Soil Carbon

- **Increasing Productivity (Fertilizer use efficiency)**:
  - Profitability
  - Higher yield and biomass production
  - Reduced risk (greater climatic resilience)
- **Increasing Soil Organic Matter:**
  - Increase nutrient availability to crops, thus increase yield, income, and food security
  - Improve water and nutrient use efficiency – reduces losses and environmental pollution
  - Provide a sink for carbon, removing it from the atmosphere and storing it in the soil, thus help reduce atmospheric CO_2 and global warming

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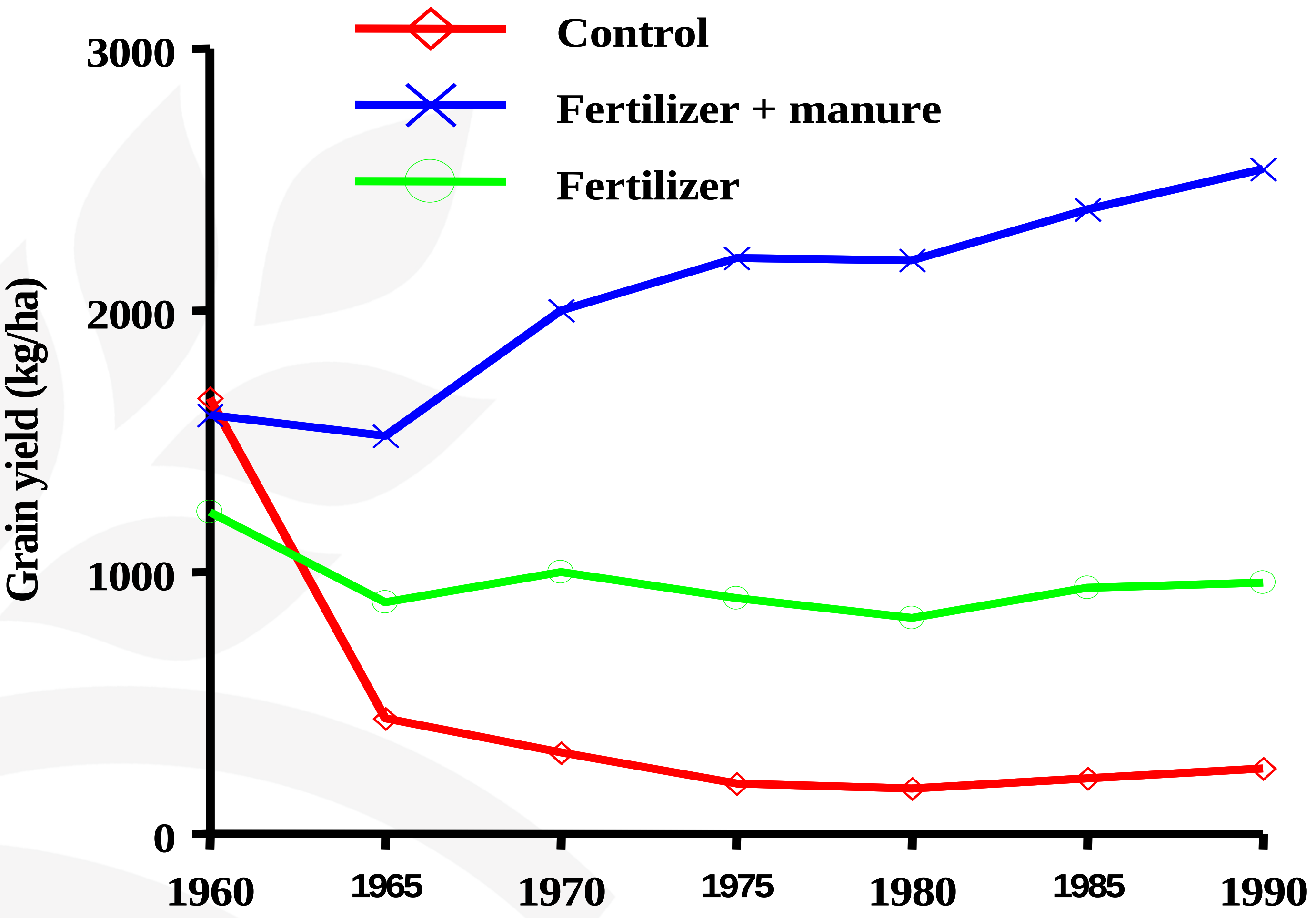
Organic Matter Effect on Fertilizer Use Efficiency

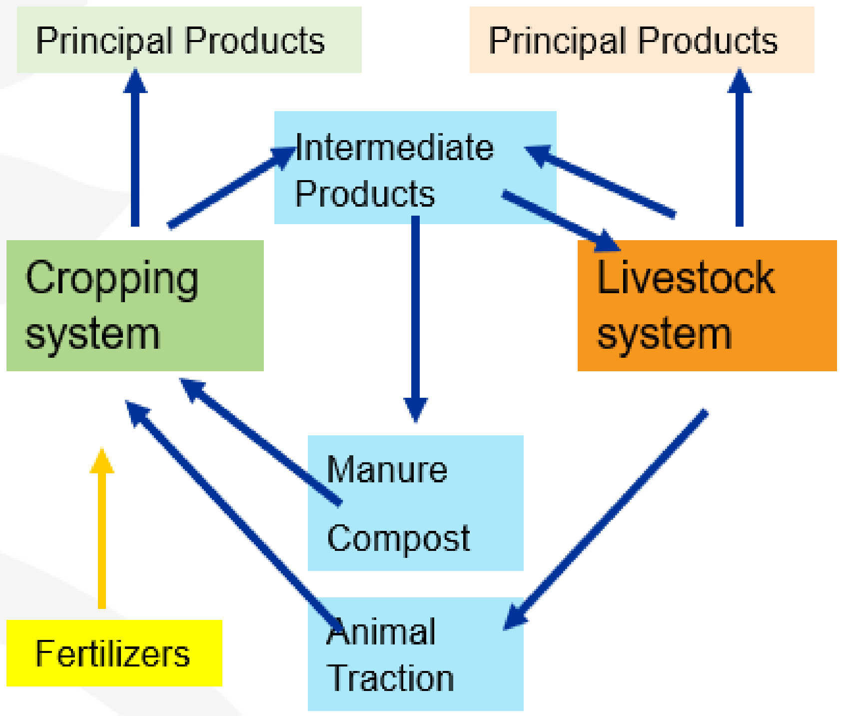
30-yr study in the Sudanian zone of Burkina Faso



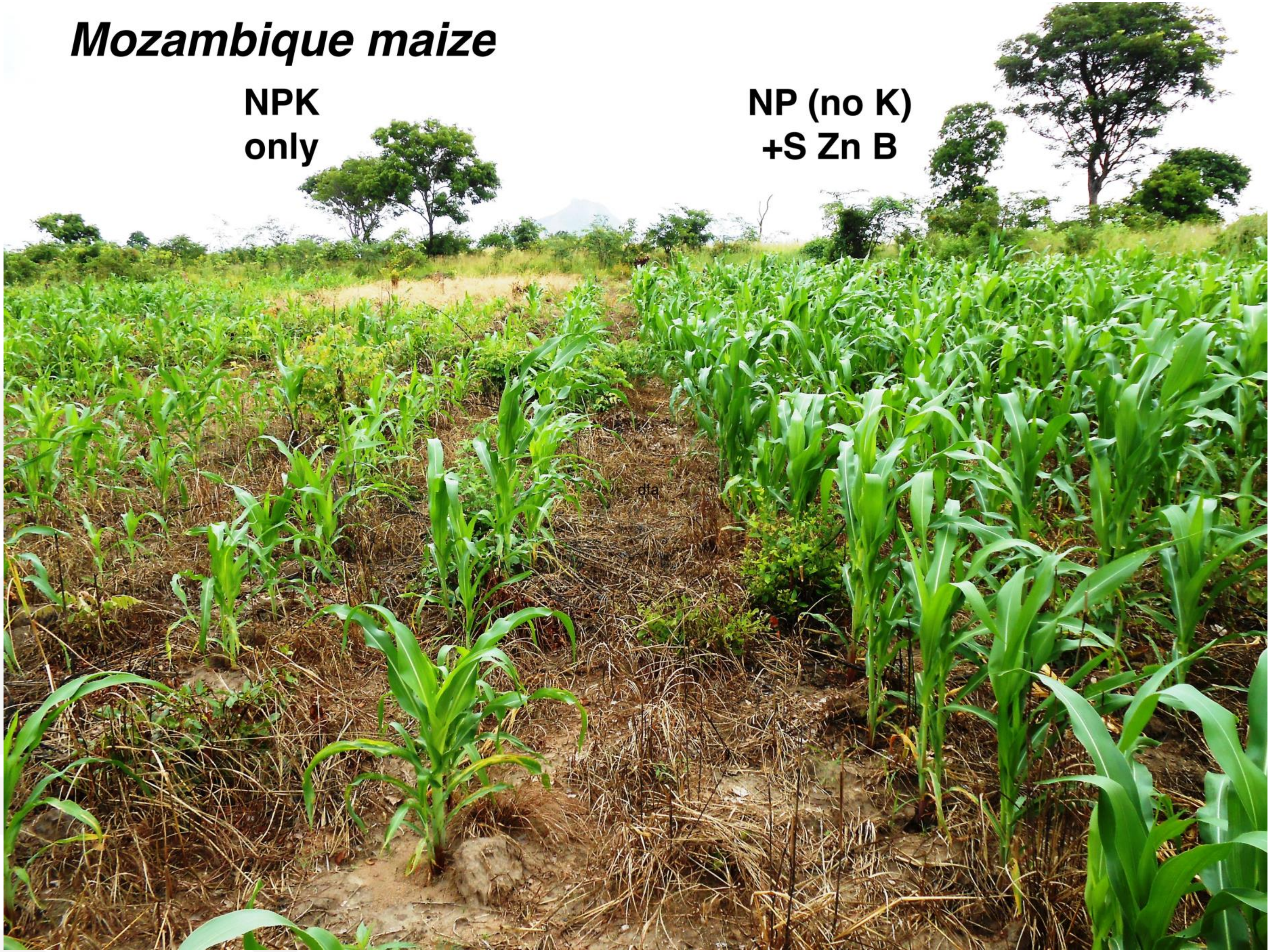
Lessons Learned on ISFM

- Availability, accessibility, and affordability of organic amendments major bottleneck
- Fertilizers critical component of ISFM for all agricultural intervention – crops, agroforestry, livestock integration
- Organic matter in the soil is a key condition for intensification using fertilizers
- Interventions needed
  - improve water infiltration,
  - increase absorption and storage of water
  - improve root system development.
- Stress-adapted crops and varieties

Integration of Agriculture (cropping systems) and Livestock



Balanced Fertilization

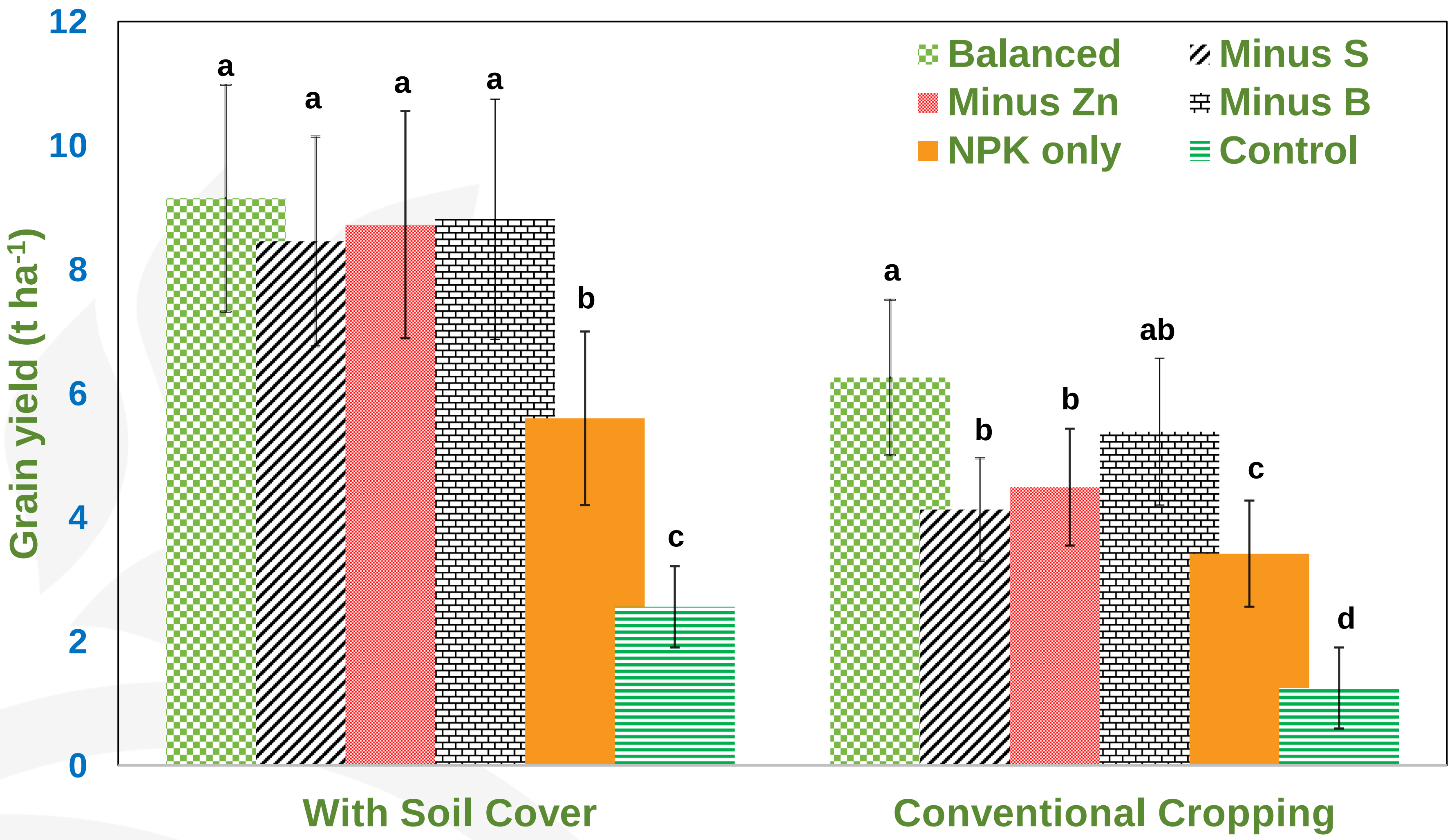


Balanced Fertilization on Maize: Nutrient recovery efficiency (Guinea Savanna AEZ)

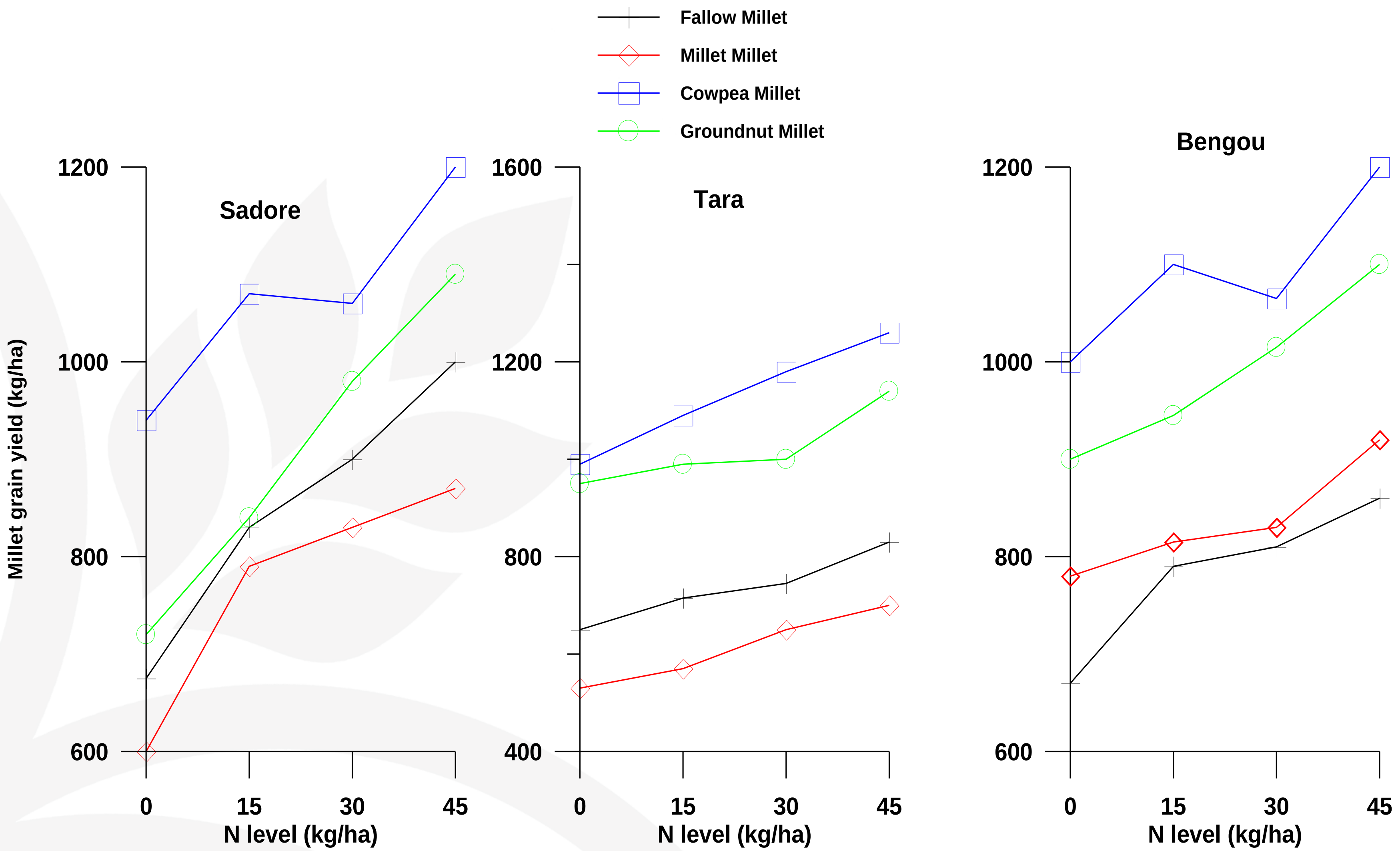
Treatment	Nitrogen (%)		Phosphorus (%)		Potassium (%)	
	2018	**2019**	**2018**	**2019**	**2018**	**2019**
Balanced	63.1a	66.2a	45.4a	48.4a	68.8a	70.4a
Minus-S	51.6b	53.8b	42.6ab	42.1b	58.3c	61.3b
Minus-Zn	53.9b	55.9b	40.8b	40.7b	60.4bc	62.0b
Minus-B	61.8a	64.5a	44.3ab	46.8a	64.8ab	68.8a
NPK-only	33.4c	35.9c	22.7c	23.2c	46.4d	45.2c

Effect of Soil Cover and Balanced Fertilization on Maize Grain Yield

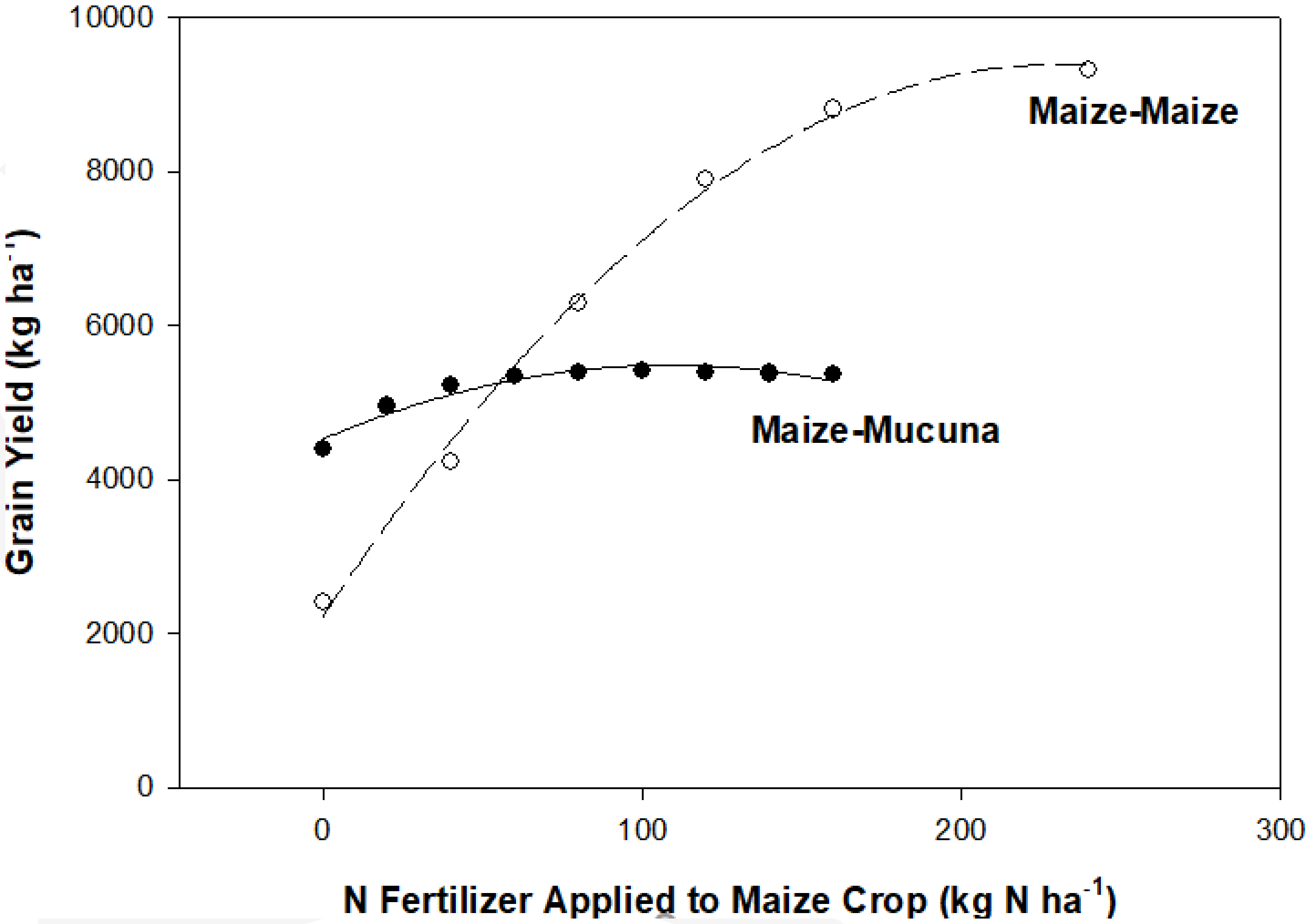
Effect of Soil Cover and Balanced Fertilization on Corn Grain Yield



Cropping System Effect on Fertilizer Use Efficiency



Maize Grain Yield for Maize-Maize and Maize- Mucuna, Davie, Togo



On-Farm Reality

Southern Togo

- Yields of 3-4 t/ha (maize-mucuna)
- On average between 0.4 and 1 t/ha maize yield for long-season
- Eradicates weed (Imperata)

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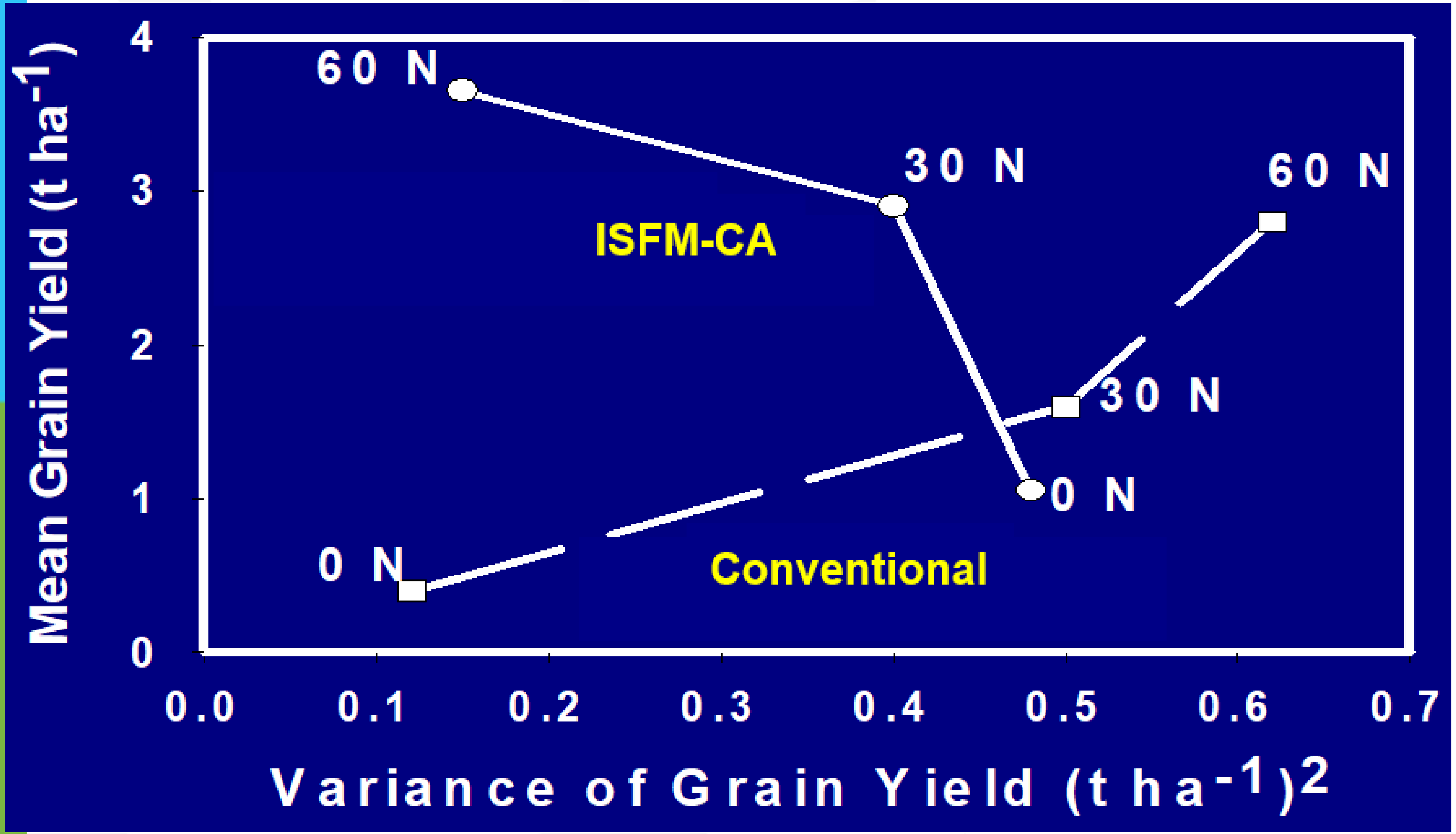
Early Specific variety
Dual purpose variety

Apparent Drought



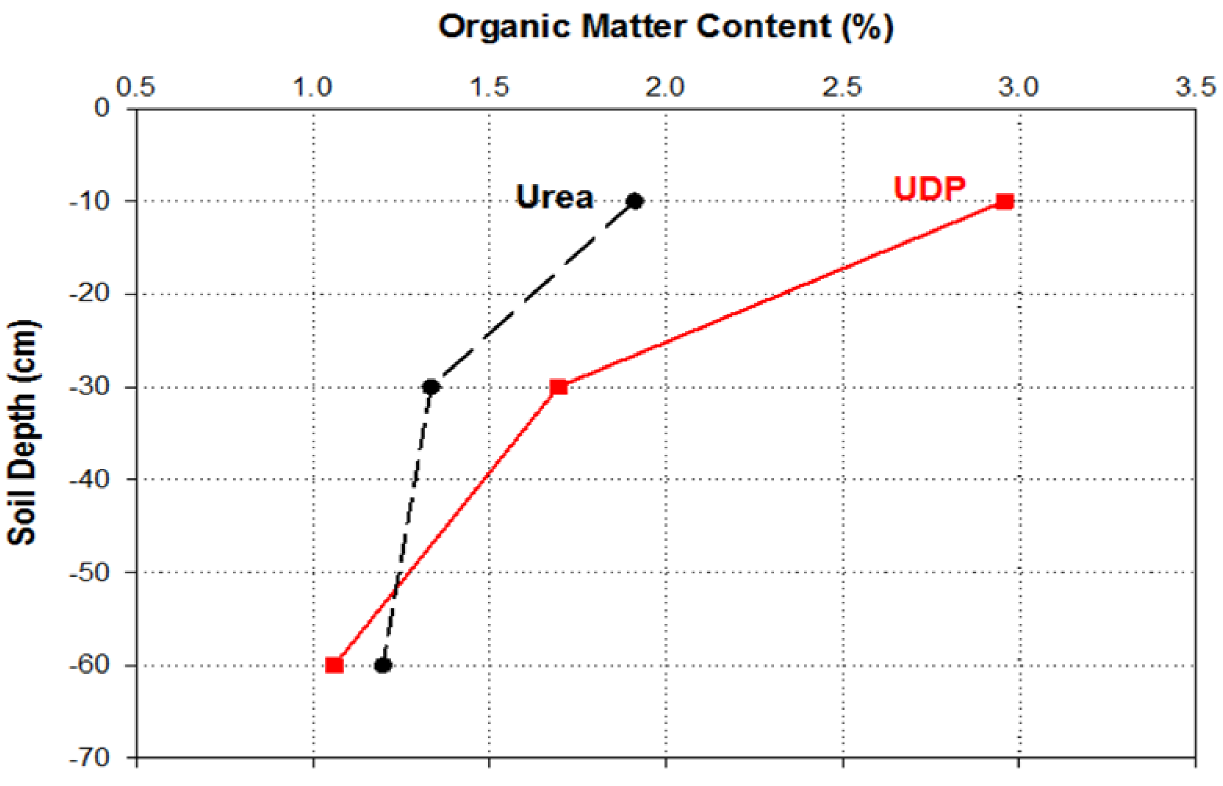
Correcting Soil Acidity – Resource Poor Farmers

Local Amendments and Crop:

- Lime: to limit amount used instead of broadcast incorporation:
  - Band application of lime
  - Mix lime in the planting hole or plant bed
- Organic amendments
- Phosphate rock as a soil acidity amendment and source of P
- Gypsum on weathered soils – calcium effect
- Acid tolerant crops and varieties

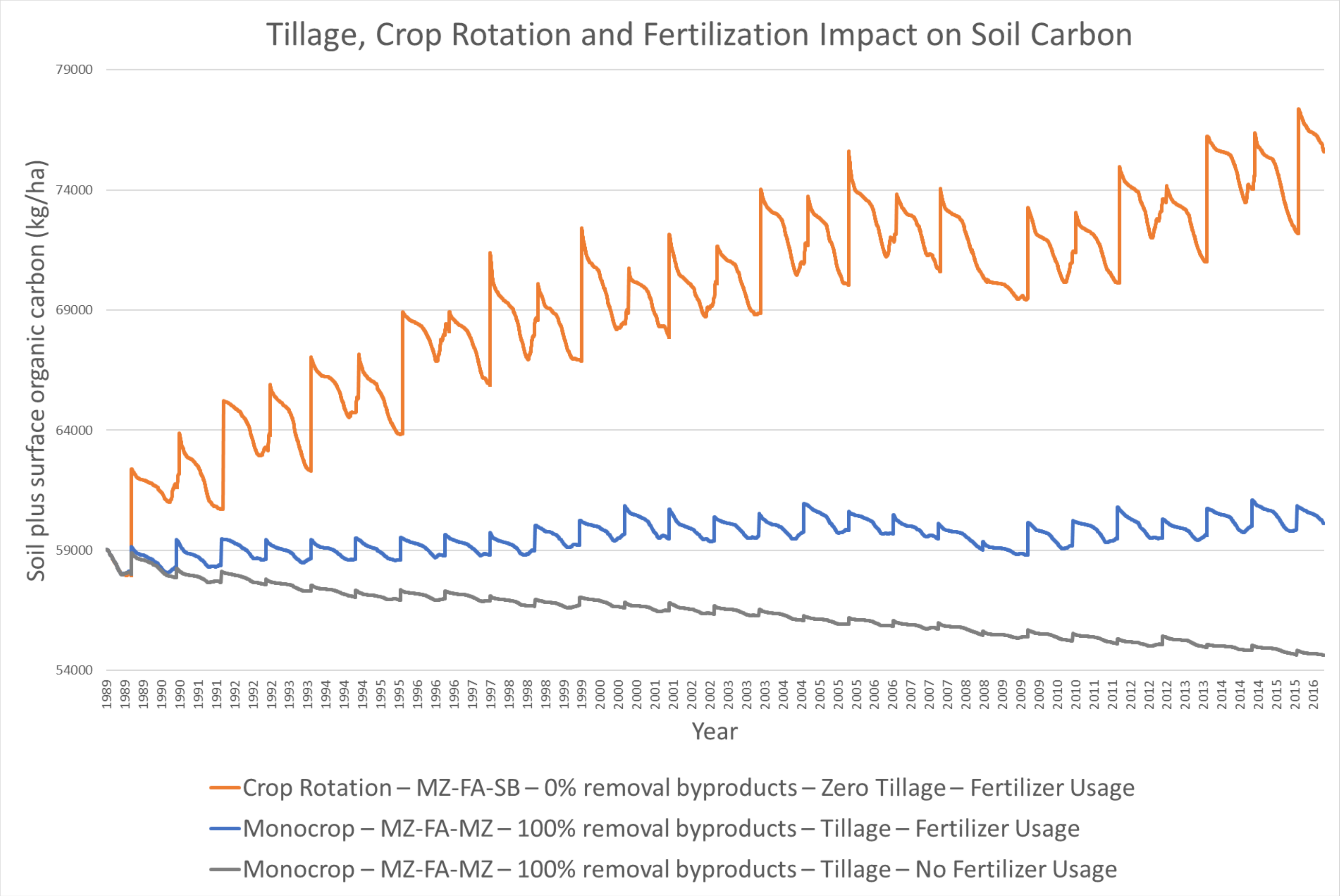
Courtesy:
CIAT-CIMMYT

Long-Term Effect of Urea Deep Placement on Soil Health



Comparison of Organic Matter Content with UDP and Urea

Productive and Sustainable Agriculture ➔ Carbon Sequestration



Simulated response based on soils and weather from Kellogg Farm, Michigan State University.

Good agronomic management (crop residue retained), crop rotation (maize-soybean), and fertilization can:

- Build soil carbon

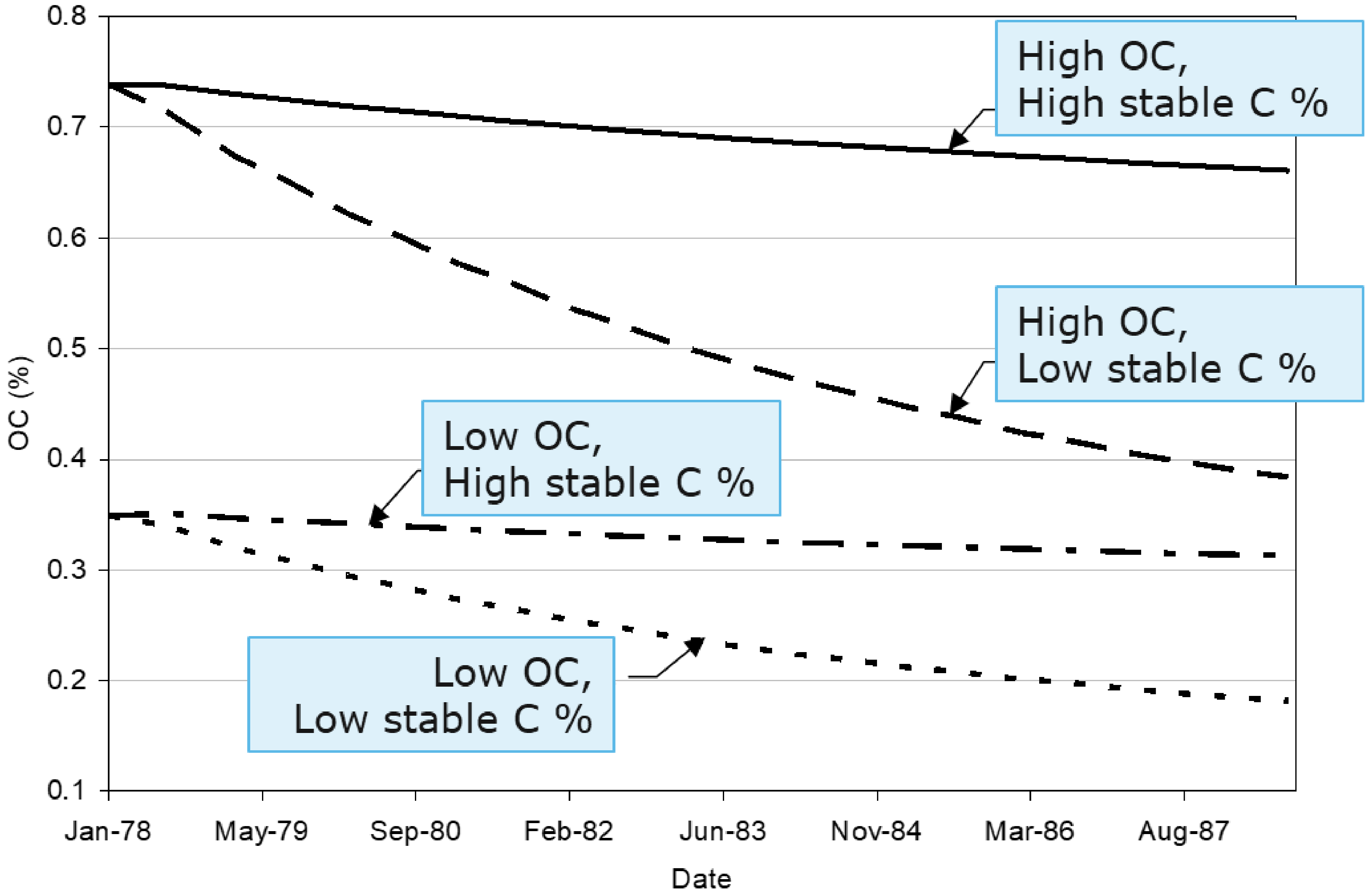
Good agronomic practice with fertilizers but removing residues, forgoing zero tillage and crop rotation can:

- Retain soil carbon

Unfortunately, not using fertilizer combined with poor agronomic management will:

- Deplete soil carbon

Soil C Effect on Decomposition of Organic Matter



Innovations with Soils in Mind

- Harness soil ecosystem services
- Improve soil health – greater bio-diversity and resilience (soils and crops)
- Improve efficiency – synchrony with crop demand
- Reduce losses

Fertilizers and Amendments that:

- Improve soil health (add soil C),
- Create/promote more productive and sustainable crop production systems by harnessing (and identifying) soil microbiome’s capability to produce and/or release nutrients,
- Increase nutrient bioavailability, and
- Improve plant resilience to environmental stress and disease.

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