A short commentary: Millet bringing climate resilience for food and nutrition

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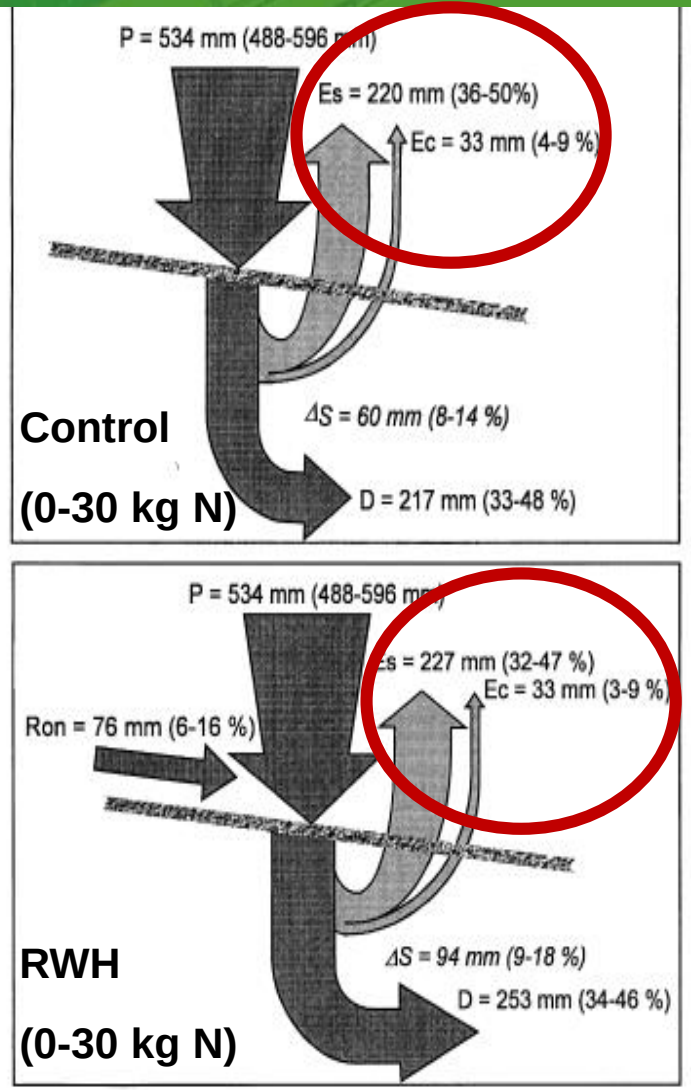
Millet onfarm experiment Niger 1994, testing N-dosing and in situ RWH/SWC

Field water balance mostly 'losses' for biomass production



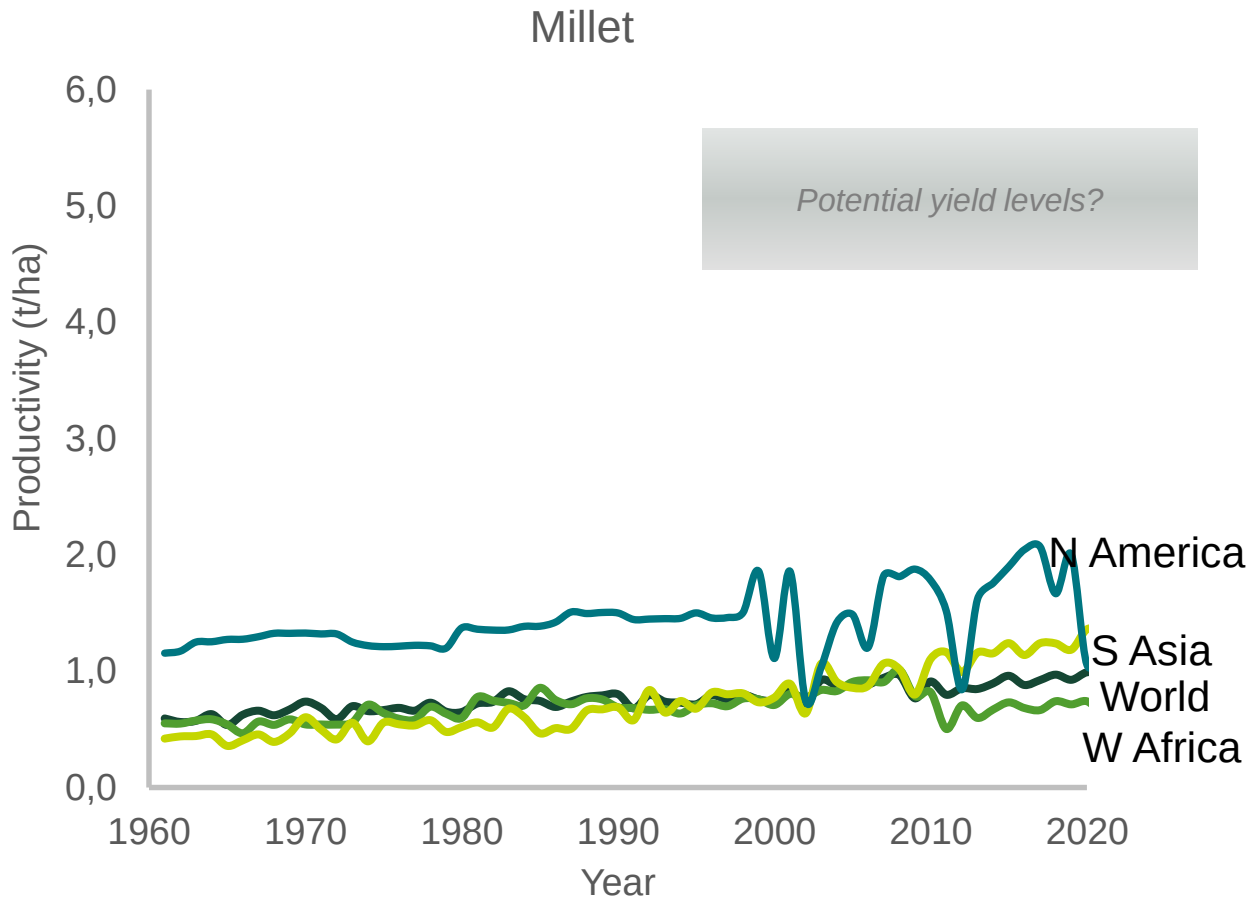
	0 kg N	30 kg N
Grain yield (kg/ha)	370-430	530-700
Total Above-ground Biomass (kg /ha)	1 680-2 010	2 890-3 500
WUE_{et} (m^3 ton^{-1}) WUE_{et} (kg ha^{-1} mm^{-1})	5 600-8 300 1.2-1.8	3 900-6 600 1.5-2.5

Rockström, Jansson & Barron, 1998

30 yrs later: Millet yield development (t/ha)

FAO Stat , last accessed Sep 2023

- Rainfed systems dominate
- Estimated/reported yield levels far from potential and >1 t/ha West Africa
- N America double other regions
- S Asia double over time (< 1t/ha)

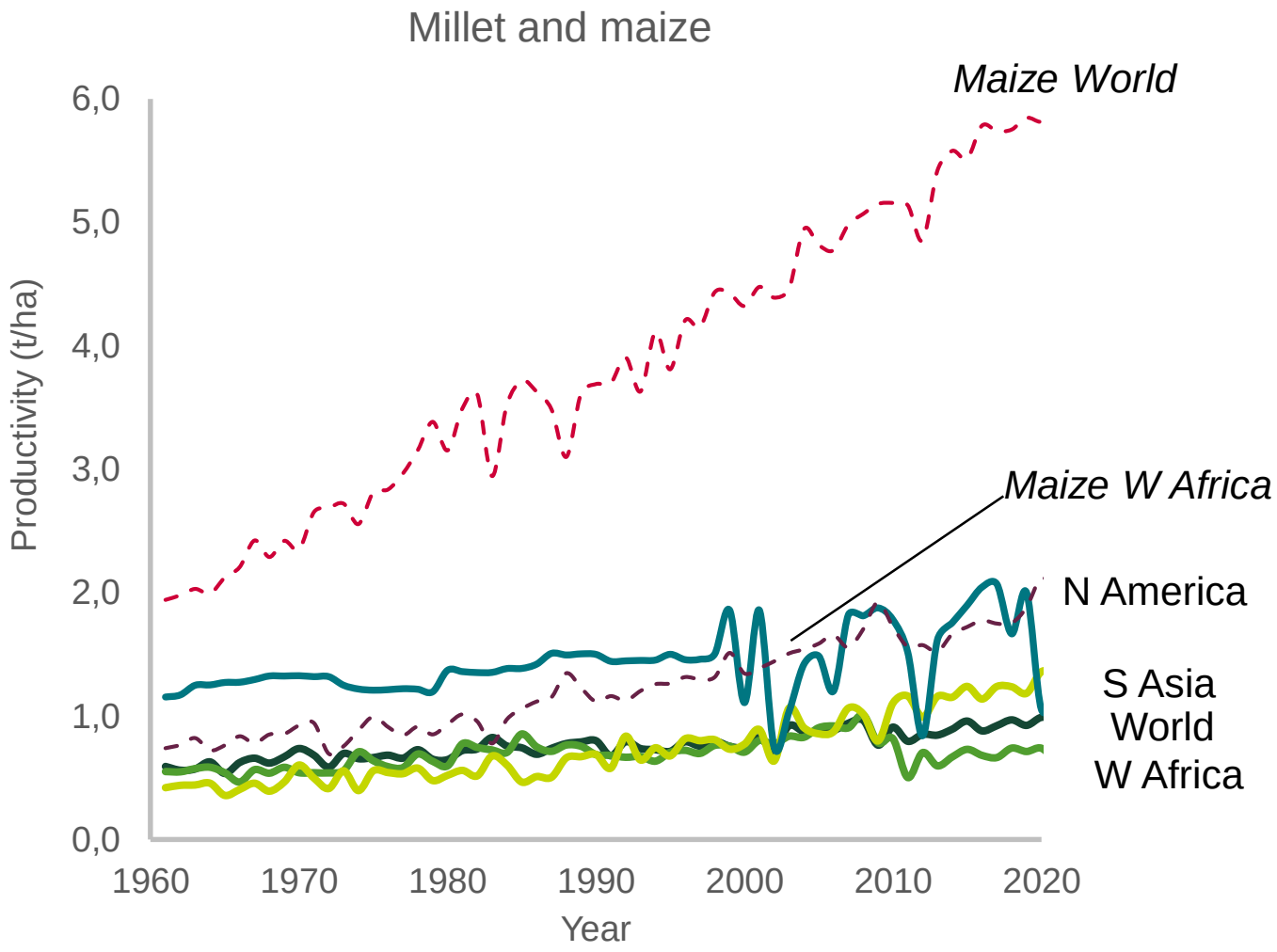


Millet yield development (t/ha)

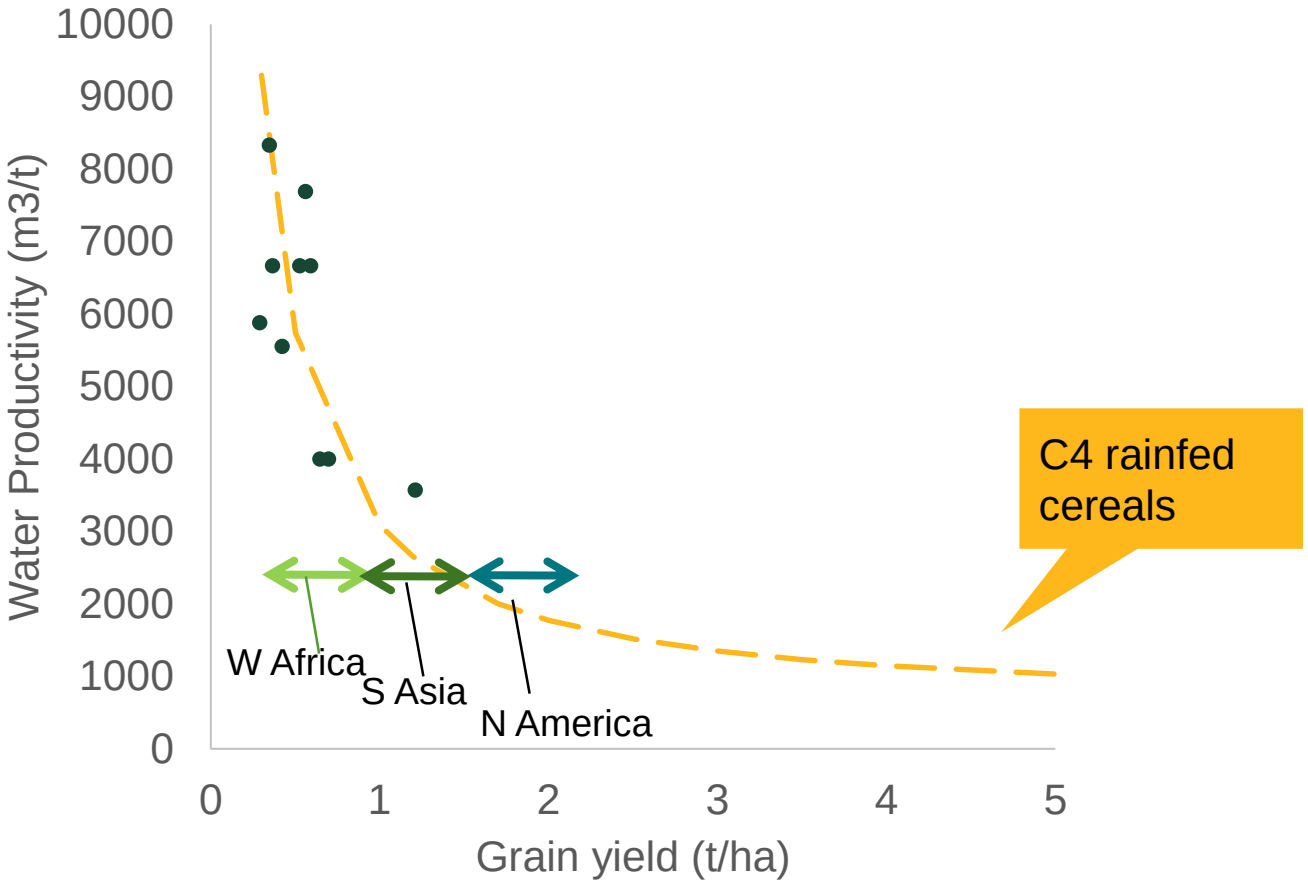
FAO Stat , last accessed Sep 2023

- Rainfed systems dominate
- Estimated/reported yield levels far from potential
- N America double other regions,
- S Asia double over time

- *Compare with maize: triple global yield; e.g. W Africa almost double …*



Millet Water Productivity (WP; m^3 t^{-1})

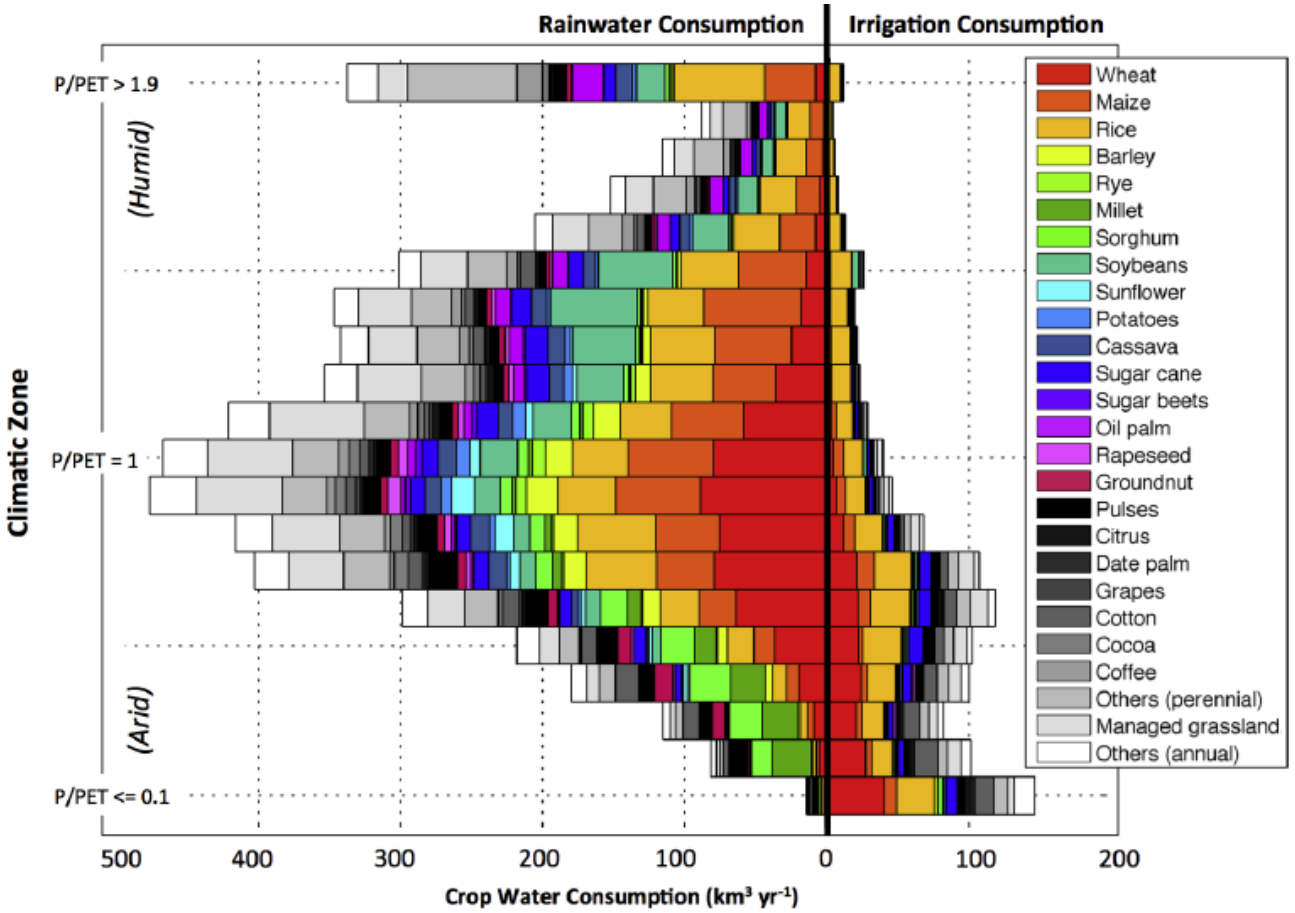


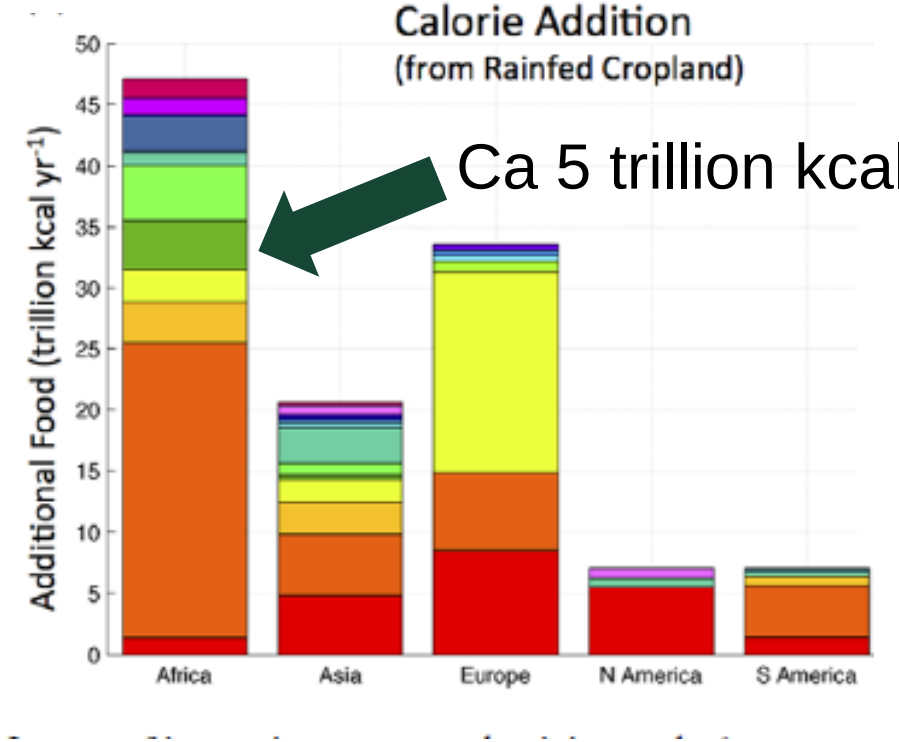
After Rockström & Barron, 2007

- Data points from 1980-1990s field trials millet Niger
- WP inefficient due to low yield levels

- *Until yield levels (through agronomy,- through breeding) improves, rainfall not well utilised*

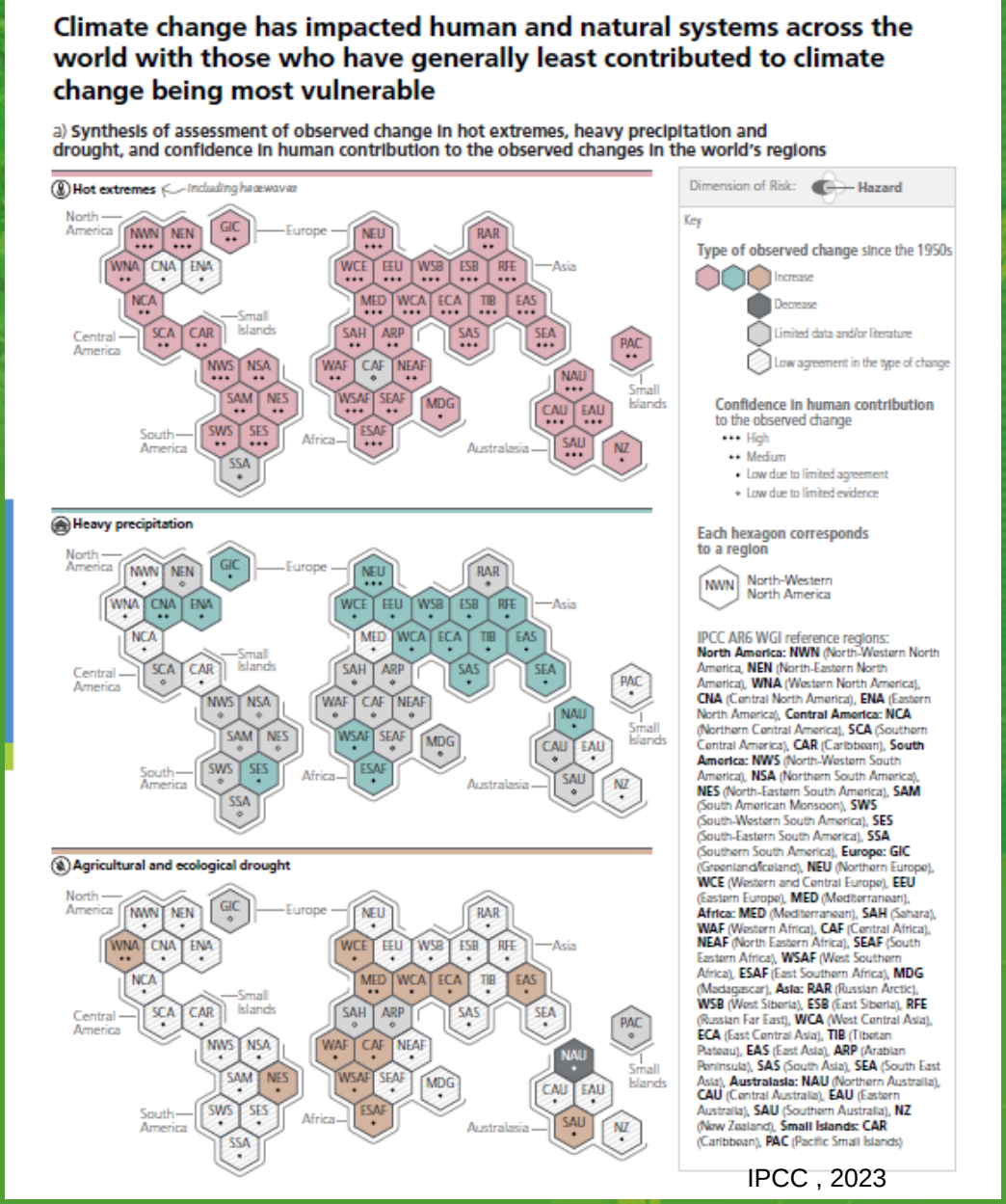
Millet essential in rainfed drylands, but still marginal for potential nutrition per drop?





Brauman et al 2013

Climate change

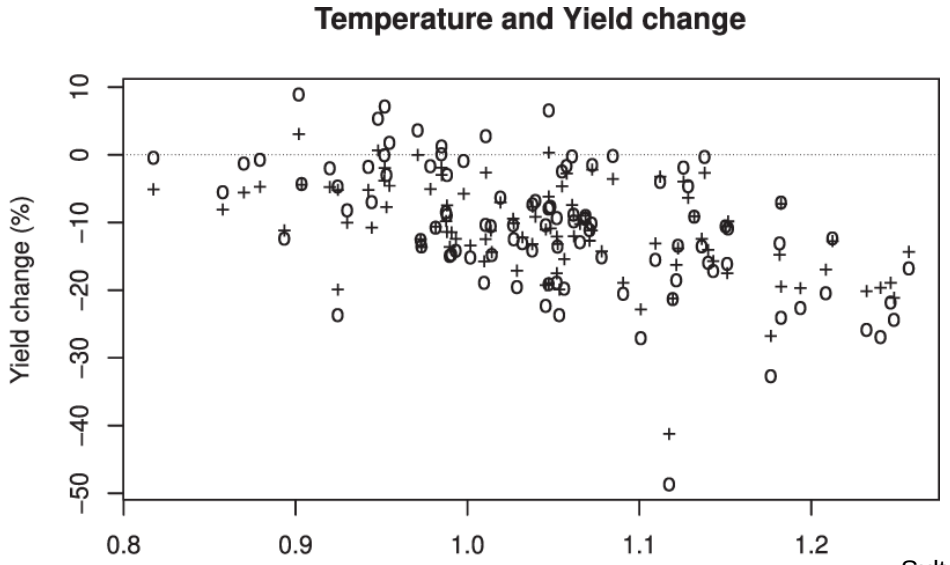


IPCC , 2023

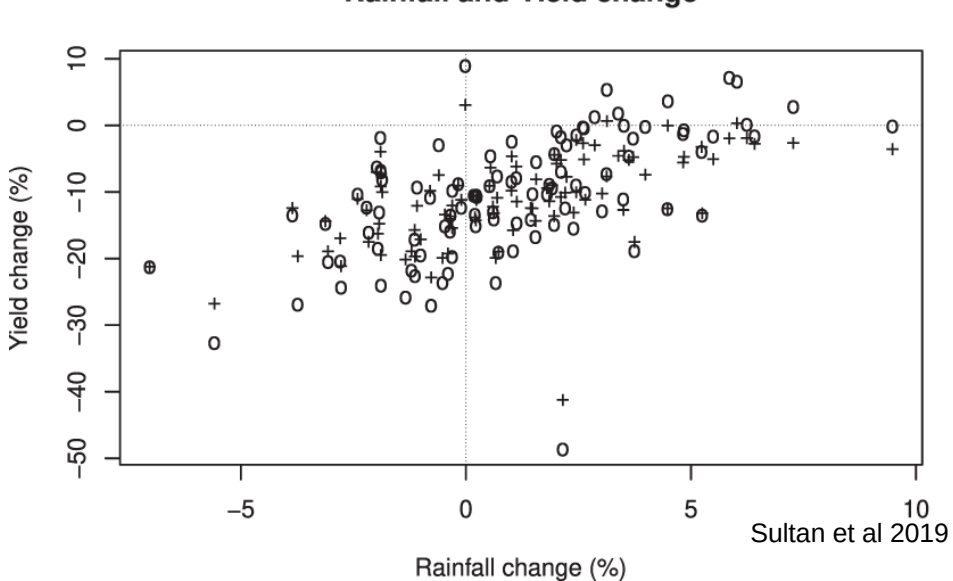
Climate change already affect millet?

- Recent global research points at soil/land ‘drying’ and +2oC

- W Africa model current and pre industrial climate for millet yield impact (e.g., Sultan et al ,2019)
- 10-20% millet yield decrease compared to pre history



Sultan et al 2019



Sultan et al 2019

Heat and water stress affects nutritional content

- Millet nutrition comparable to wheat, sorghum

- *“little to no nutrient penalty growing C4 plants under elevated CO_2”?*

- *“nutritional quality of C4 staples is generally not high due to poor protein digestibility rates, or low concentrations of eg lysine (Barbenhenn et al 2004)*

Contents	Crop			
	Pearl millet	Sorghum	Rice	Wheat
Carbohydrates (g)	61.8	67.7	78.2	64.7
Protein (g)	10.9	09.9	07.9	10.6
Fat (g)	5.43	1.73	0.52	1.47
Energy (Kcal)	347	334	356	321
Dietary fiber (g)	11.5	10.2	02.8	11.2
Calcium (mg)	27.4	27.6	07.5	39.4
Phosphorus (mg)	289	274	96	315
Magnesium (mg)	124	133	19	125
Zinc (mg)	2.7	1.9	1.2	2.8
Fe (mg)	6.4	3.9	0.6	3.9
Thiamine (mg)	0.25	0.35	0.05	0.46
Riboflavin (mg)	0.20	0.14	0.05	0.15
Niacin (mg)	0.9	2.1	1.7	2.7
Folic acid (µg)	36.1	39.4	9.32	30.1

Adapted from: NIN, Hyderabad, 2018.

SUMMARY/ Questions

- Understudied/There is great yield potential to close with agronomic practises:

Lack of understanding of combined agronomic practises for yield gains and nutritional gains?

- Direction (and speed) of climate change (heat , variable rainfall) may undermine progress in yield and nutrition gains.

Need better understanding of response /impact of compound events?

Elevated CO2 response in combination of heat/waterstress?

Niger, 2013

Fastest growing populations … youth existing nutrition challenges…..

Thank you for your attention!

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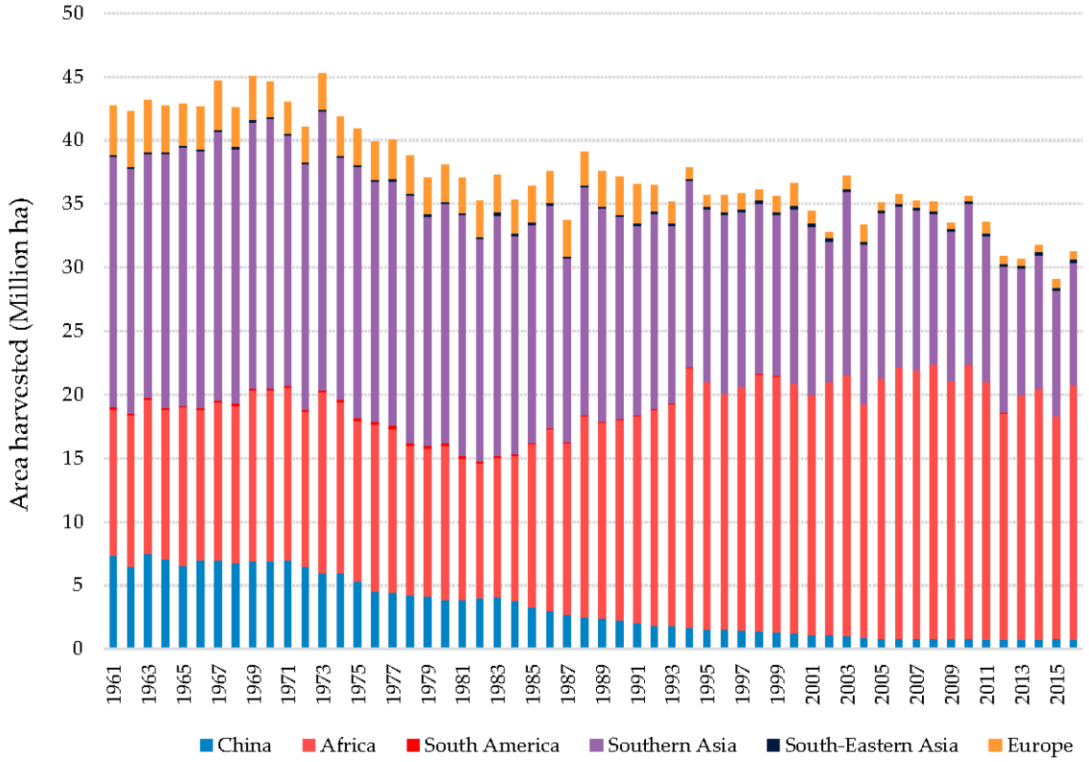

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