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"Reconcile land system changes
with planetary health"

Functional diversification through crops that nourish: 'More is better' evidence from around the globe

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Abstract

Dryland farming requires a broad range of functional crop types that meet multifaceted requirements for livestock feed, soil fertility and nutritional security. Research that prioritises crops that nourish, with a systems perspective, could improve resilience and nutritional security, while staying within planetary boundaries. New plant forms are being explored that include dual use for crop-livestock, and perennial grains. These growth habits and traits promote microbial community function for soil nutrient cycling, and biofortification. Breeding approaches include farmer and gender-aware engagement, and assessing performance in mixed crop systems, and on marginal soils.

Emerging evidence will be presented on the broad diversity of function possible through expanding multifaceted traits in wheat, sorghum-pigeonpea and maize-groundnut systems. Wheat traits are being assessed in Ethiopia, Mexico and India, to include functions such as biological nitrification inhibition, zinc fortified grain, and performance in mixtures. The BNI trait has the potential to markedly reduce nitrogen losses, including emissions of the potent greenhouse gas nitrous oxide, for much improved management of nitrogen and environmentally-sound wheat production. Sorghum and pigeonpea traits include ratoon and branching functions, along with soil phosphorus solubilisation and drought tolerance for intercrops, relay crops and crop-livestock performance. Crop traits the promote longevity of growth have been rarely exploited, yet are key to provisioning of livestock feed and soil health. Groundnut traits include tolerance to shade, high feed quality stover and rhizo-microbiomes for nutrient cycling. Taken together, integration of more of these traits in crop varieties could provide options for farmers to 're-wire' nutrient cycles in a way that harnesses biology. Functionally mixed cropping systems require diversity that includes a broad range of traits, for plant combinations that enhance nutrient cycling, as well as provide nutritionally dense food products for livestock and communities.

A transdisciplinary approach to breeding that integrates knowledge of agricultural systems and nutritional performance is explored in this presentation. Examples are provided drawing on innovative research underway in farming systems of marginal drylands in the

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Americas, East Africa and South Asia. Expansion of multipurpose crops with hiqh nutrient quality vegetation and longevity of growth types could markedly expand resilience on smallholder farms.

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