Impacts of crop diversification with legumes to food and nutrition security in Africa

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The Problem/Challenges

- Climate change
- Low agricultural productivity (eg maize <1.5 t/ha), rainfed systems
- Poor market incentives (small, scattered and diverse farms)

The Solutions

- Sustainable Agriculture Intensification (SAI) using Agroecological (AE) practices

- **SAIs refers to innovative solutions that integrates technologies with extensions (F2FE, PIP) and institutional approach (MAPs)**
- Maize-Legume cropping systems
- Millet/Sorghum-Legume cropping systems

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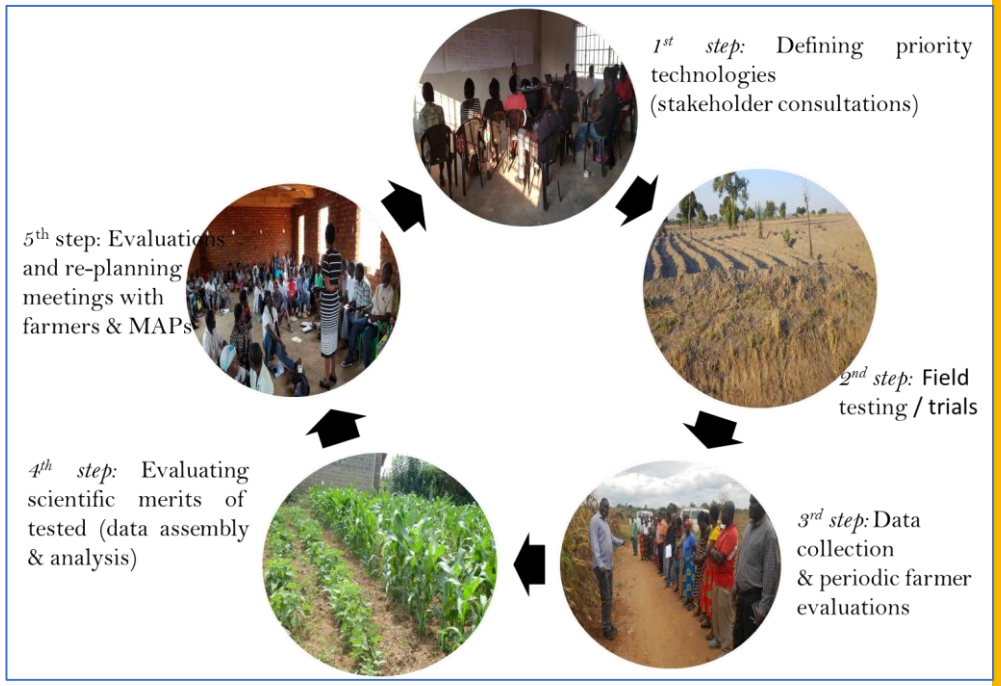
Objective/s

- Test/validate improved maize/millet/sorghum varieties intercropped with different types of legumes using farmer-led experimentation, backed by innovative Extension and Advisory Services (EASs) and Institutional Approaches (IIAs)

Methodology/Approach

Farmer led field experiments testing maize/millet/ sorghums intercrops and rotations established in

1. Malawi (Mzimba and Dedza districts)
2. Ethiopia (Eastern Ethiopia)
3. South Africa (Qwaqwa homeland)



Key Results/Outputs:

- A total of **250** farms directly engaged in SAI (cereal-legume) trials across the four countries
- Total number of farmers reached by 2020 with cereal-legume SAIs are about 40,000
- MAPs, F2FE and field trials were key mobilizing factors for upscaling SAIs

Country	No. of farmers	
	Engaged	Reached
S. Africa	70	8000
Ethiopia	35	2000
Malawi	145	30000
Total	**250**	**40,000**

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Key Results/Outputs: *Maize/millet/sorghum × Legumes trials (ground nuts, pigeon peas, bambara nuts, soyabeans, common beans) : Malawi*

- Among the 3 cereals grown in the two districts maize produced the highest grain yield compared to finger millet and sorghum (Fig. 1)

- Similarly total system productivity was highest for maize compared to millet and sorghum (Fig. 2)

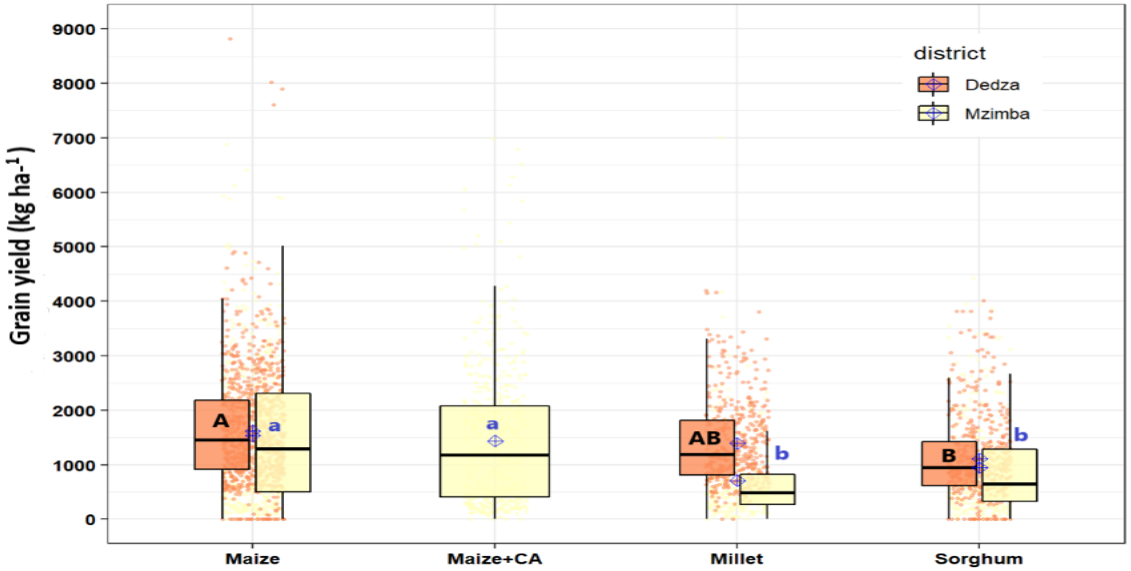

FIG 1. Grain yield productivity for cereals over three seasons in Malawi

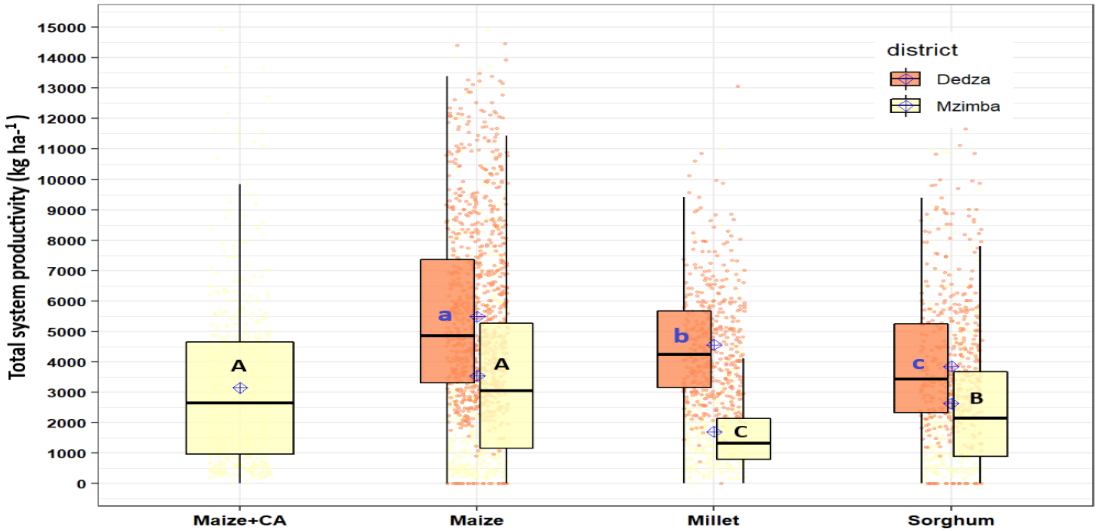

FIG 2. Total system productivity (grain + biomass) for cereals over three seasons in Malawi

Key Results/Outputs: *Maize/millet/sorghum × Legumes trials (ground nuts, pigeon peas, bambara nuts, soyabeans, common beans) :*
Malawi

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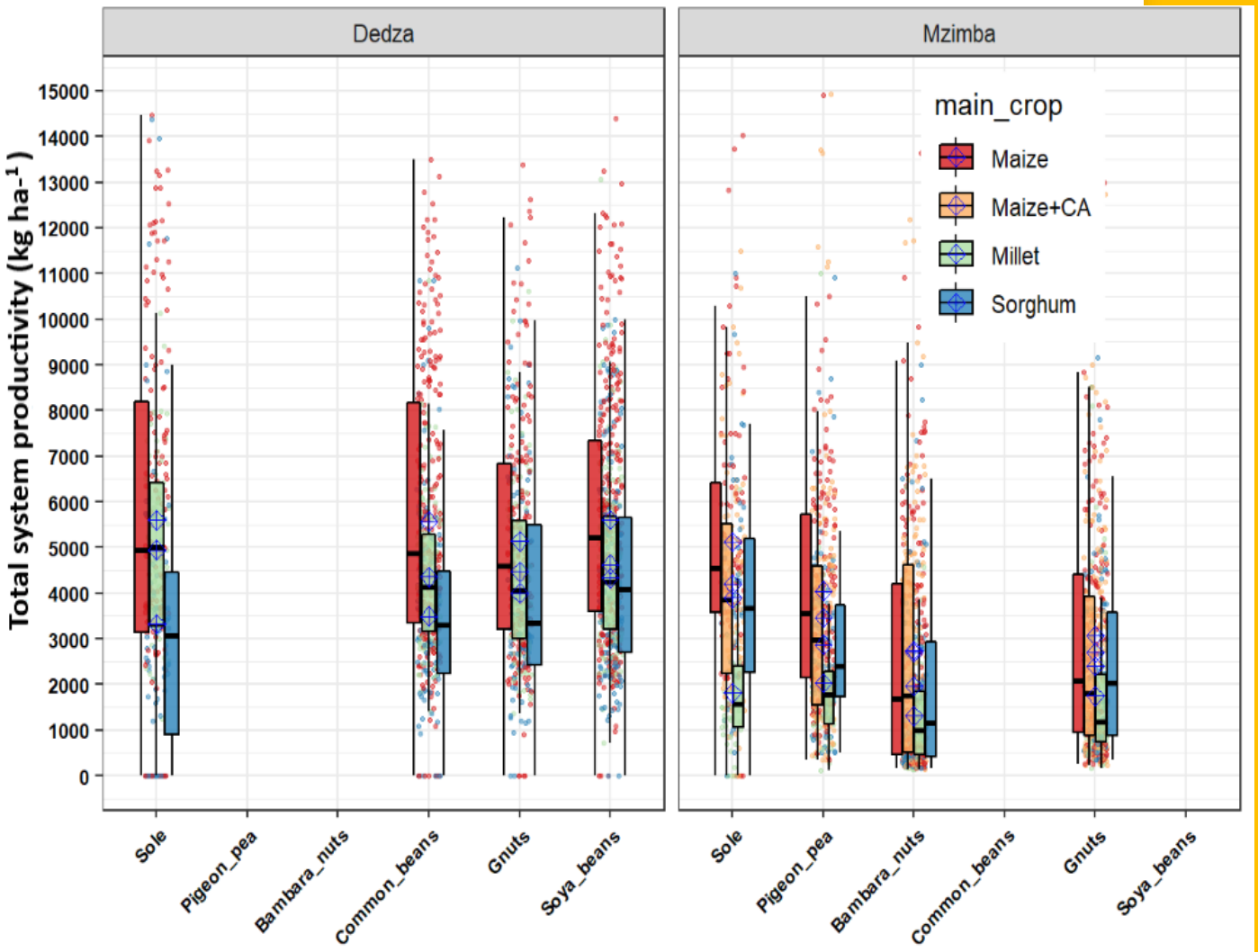
Sole cereals particularly maize tended to have the highest system productivity in both locations.

Despite high variability across farms and seasons, Total System Productivity (cereal+legumes) was generally higher in Dedza than Mzimba.

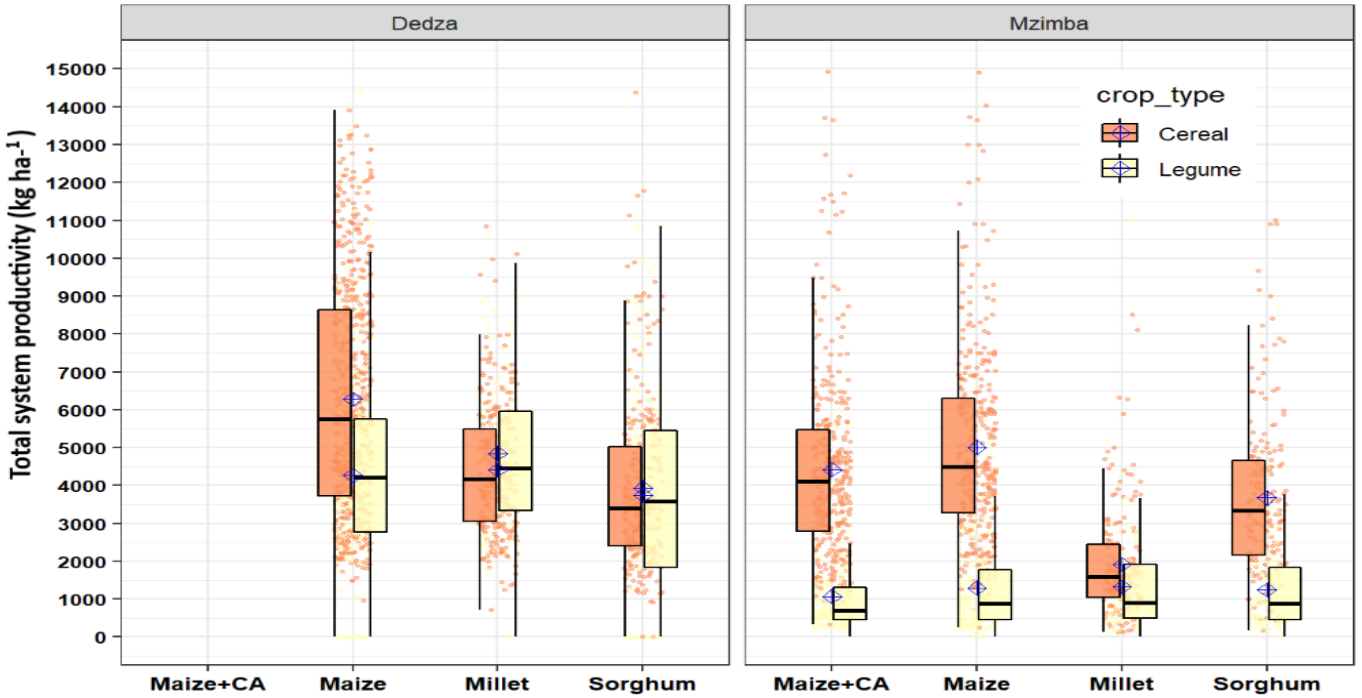
The high variability is suggestive of diversity among farmers and rainfall seasons

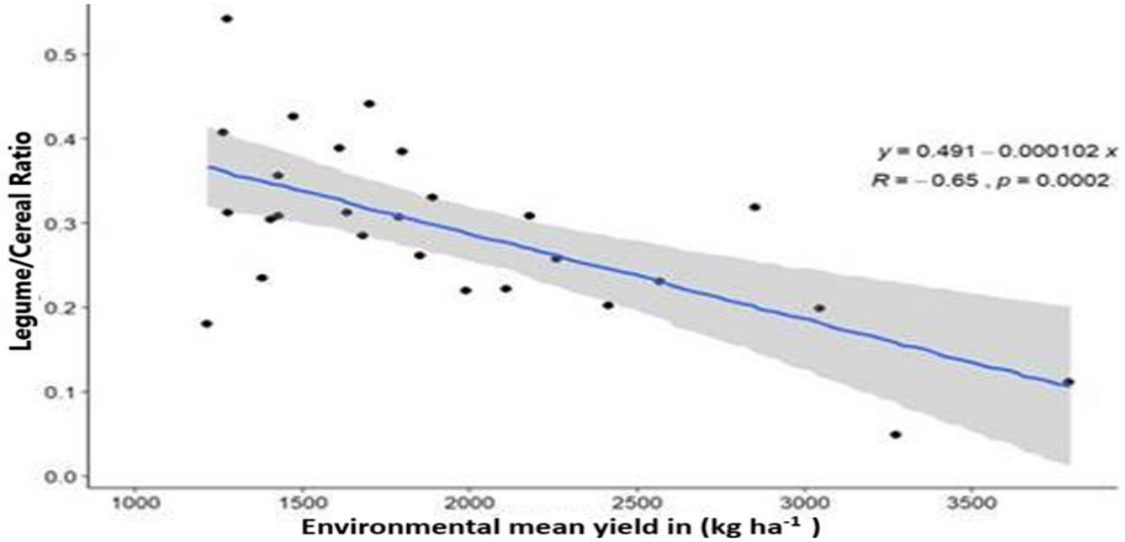
For Mzimba, Bambara systems had the lowest yields



Yield merits of intercrops Malawi

- Among the intercropped cereals, maize still dominated the systems in both districts
- Legume performance was not influenced much by the cereal crop type
- In Mzimba, result from two seasons suggest that in more favourable crop growth environments the legume/cereal yield ratio drops while in less favourable environments the legumes perform relatively better.
- The cereals are most affected by moisture competition. Thus the cereal yield is compromised in low rainfall seasons and vice versa





***Source**: Overall Mzimba, Malawi 2017/18 to 18/19, all cereals and legumes*

Key Results/Outputs: Maize × Dry beans demo trials
South-Africa case

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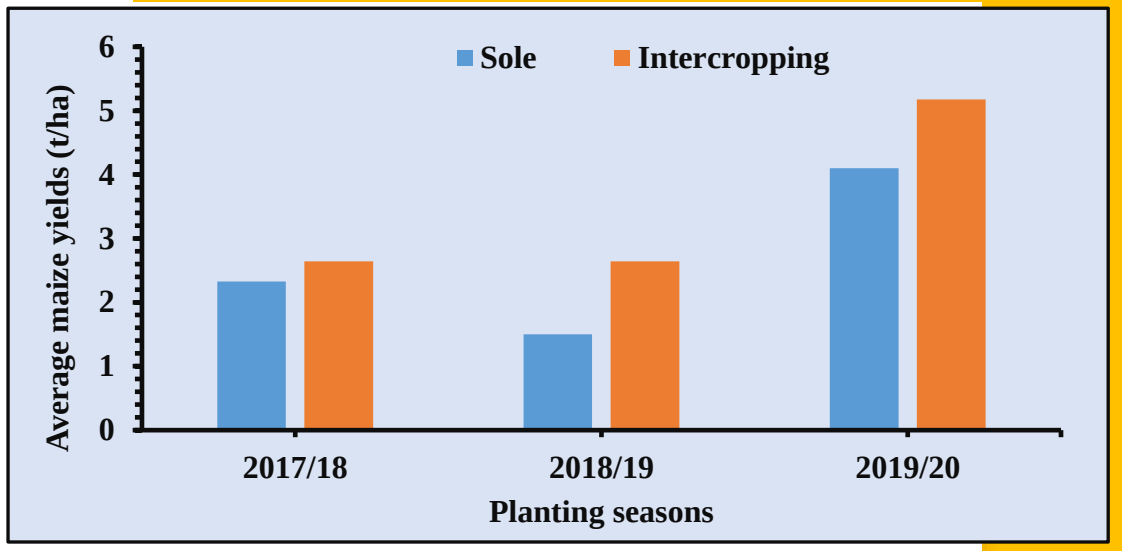
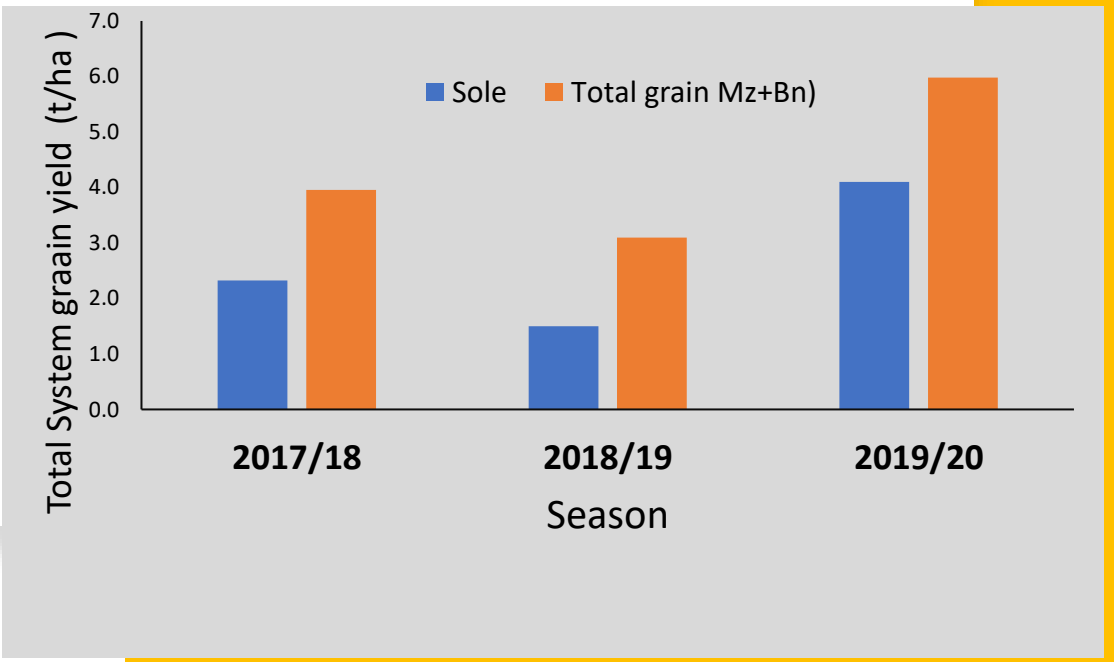
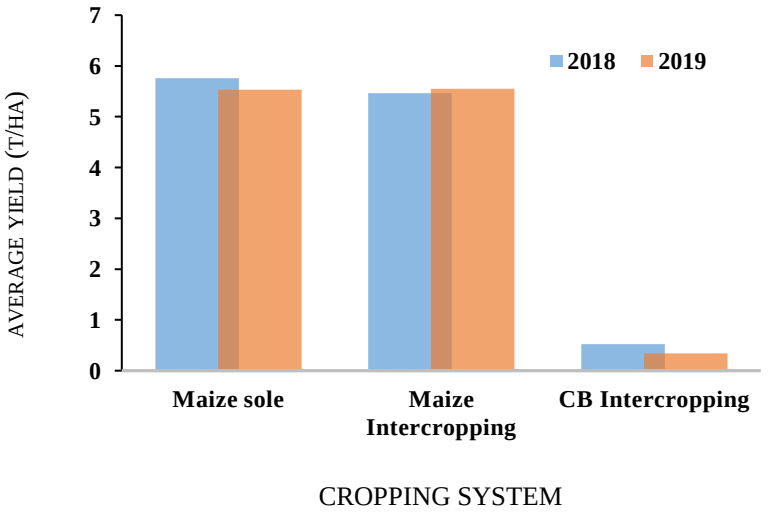
- Intercropping + improved seed varieties increased maize and dry beans yields by over 36% than conventional practices
- Land equivalent ratios ranged between 0.9 to 2.1
- Overall intercrops had higher total system grain productivity in all seasons
- Experimental maize yields were 49% higher than the local district averages in 2019/20 season.
- High potential for improving maize-beans productivity, profitability and nutritional benefits through diet diversification





Key Results/Outputs: Maize × Common Bean Demo trials: Ethiopia case

- Average experimental maize grain yields were very high ranging between 5-6t/ha
- Maize yields in intercropped systems were similar to sole maize systems in two seasons.
- Common bean yield in the intercrops were below 0.5t/ha
- Advantages of intercrops lie in improved diversification, higher protein yield and caloric energy thereby enhancing food and nutritional security



Key Results/Outputs: Maize × Common Bean Demo trials:
Some exciting innovations that emerged

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- New planting configurations allowing legumes to access sunlight in intercrops eg back to back

- Bokash manure (compost ready in 11 days tested in Mzimba, Malawi)
- New hybrid orange maize variety (MH43A) Malawi

- Precision planting in Dedza, Malawi using sticks to pre-mark planting stations

Key Outcomes/Impacts

Ecological impacts : *Increase in crop yields (up to 3.5 t/ha) and soil organic carbon (1.15 - 3.4%) with increases relative to the sole crop systems of up to 28% in pigeonpea cereal intercrops in Malawi*

FNS impacts : *Improved food security (up to 86%) and household nutrition particularly protein, vitamin A and iron eg 2019 in Malawi.*

Socio-economic impacts: *Increased awareness and adoption of technologies, increased income (74 – 155%) and improved livelihood*

Pathways of Upscaling SAI (e.g. AE practices)

- Provide conducive policy environment for private sector and seed producer cooperatives' growth and investment in seed sector.
- Institutionalization and upscaling of Village Knowledge Centre (VKC), Integrated Farm Planning (PIP) and crop diversification
- Promote government subsidy intervention beyond maize to encourage crop diversification

Main Risks/Challenges

- Covid-19 Pandemic. Reduced field visits and monitoring
- Small grains such as sorghums and millets are highly susceptible to bird attack despite their resilience to droughts
- Flood events in SA affected bean crop
- Long dry spells were experienced in Malawi, Mzimba
- FAW affected maize on most sites in the region

Measures

- Remote interactions though virtual meetings, etc.
- Better variety selections and timing of planting alleviated the challenges in Malawi
- Intercropping helped to suppress FAW attacks on maize and sorghum

Lessons learned for practice

- Diversified crop mixtures involving cereals and legumes are popular with farmers and key drivers for improved food and nutritional security=> need to be promoted by research and development institutions

- Nutrient dense maize varieties such as QPMs in Ethiopia and Orange maize in Malawi eg MH43A (CIMMYT) can contribute to improved nutrition in maize based systems

- Farmer linkages to private sector driven markets can improve s.h.f market participation and drive productivity eg NASFAM in Malawi

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Thank You

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