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**Sustainable Intensification and Farmer Preferences for Crop System Attributes:
Evidence from Malawi's Central and Southern Regions**

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Sustainable Intensification and Farmer Preferences for Crop System Attributes: Evidence from Malawi's Central and Southern Regions



David L. Ortega*, Kurt B. Waldman†, Robert B. Richardson, Daniel C. Clay, and Sieglinde Snapp

Introduction

Maize is the dominant staple crop in Southern Africa; grown by 97% of households and comprising 66% of total caloric consumption. Despite its contributions to food security there are numerous limitations to intensive maize cultivation. Maize is very sensitive to environmental deficiencies, has high erosivity factors, and lacks amino acids, proteins and vitamin A. In Malawi, a country with high population density and soil nutrient deficiency, continuous maize cultivation can contribute to declining soil fertility.

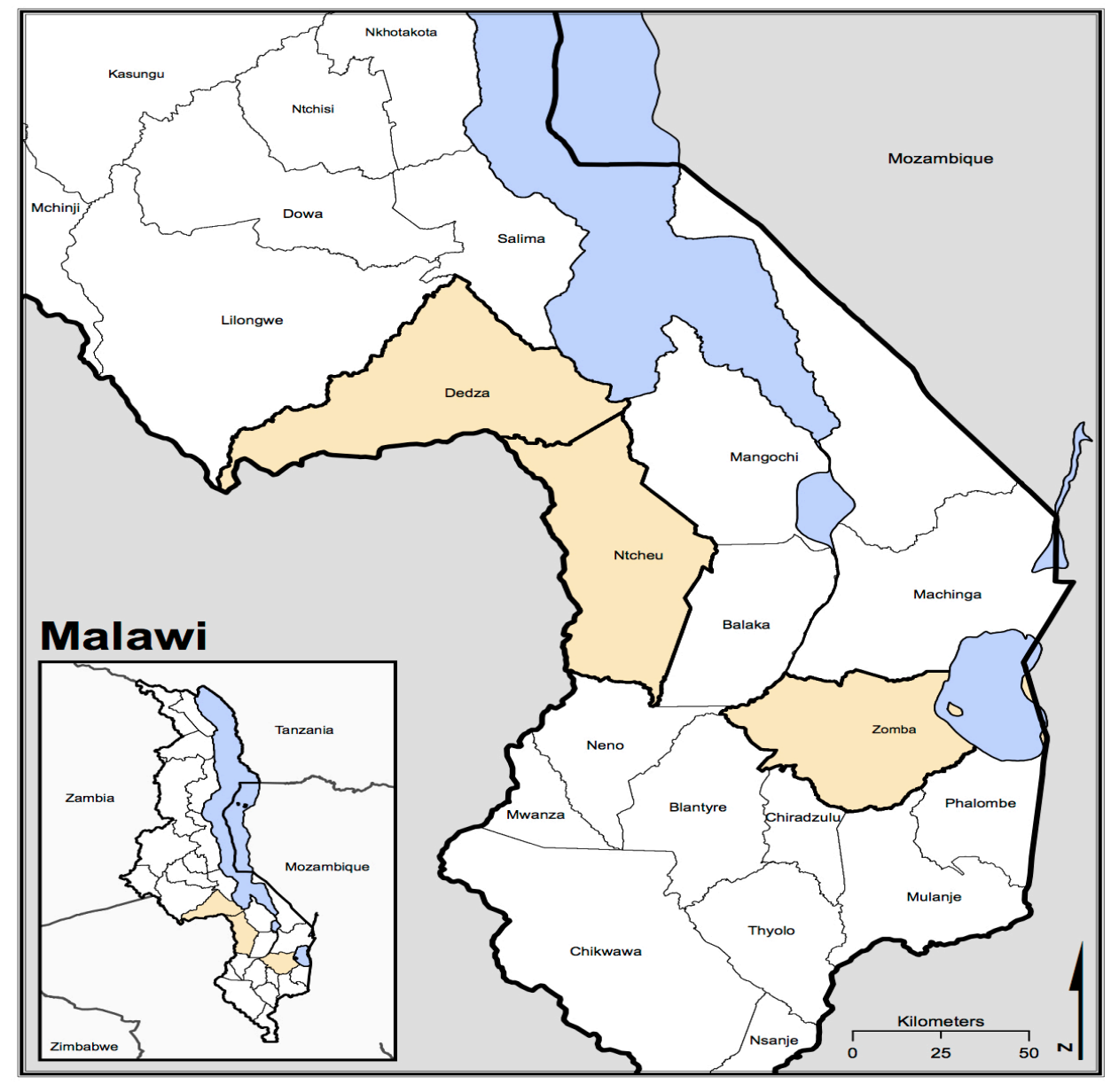
Nitrogen cycling leguminous crops like groundnut, soybean, and pigeon pea have the potential to reverse the deleterious effects of maize but adoption is slow. Shorter duration legumes like groundnuts and soybean have higher yield but contribute less to soil enhancement. Longer duration legume crops like pigeon pea crops more efficient at fixing N, enhancing K and boosting maize yields.

Objectives

1. Understand preferences for maize-legume system intercrops
2. Identify adoption drivers and barriers to adoption of various legume cropping systems
3. Quantify tradeoffs involved in farmer decision-making

Data: Multistage sampling

- 3 districts with different market access and land holding size
- Randomly chose 4 Extension Planning Areas (EPAs) per district
- Randomly selected 2 villages from each EPA
- Randomly recruited 20 farmers from each villages through extension officers
- Total N= 488 village households



Acknowledgements

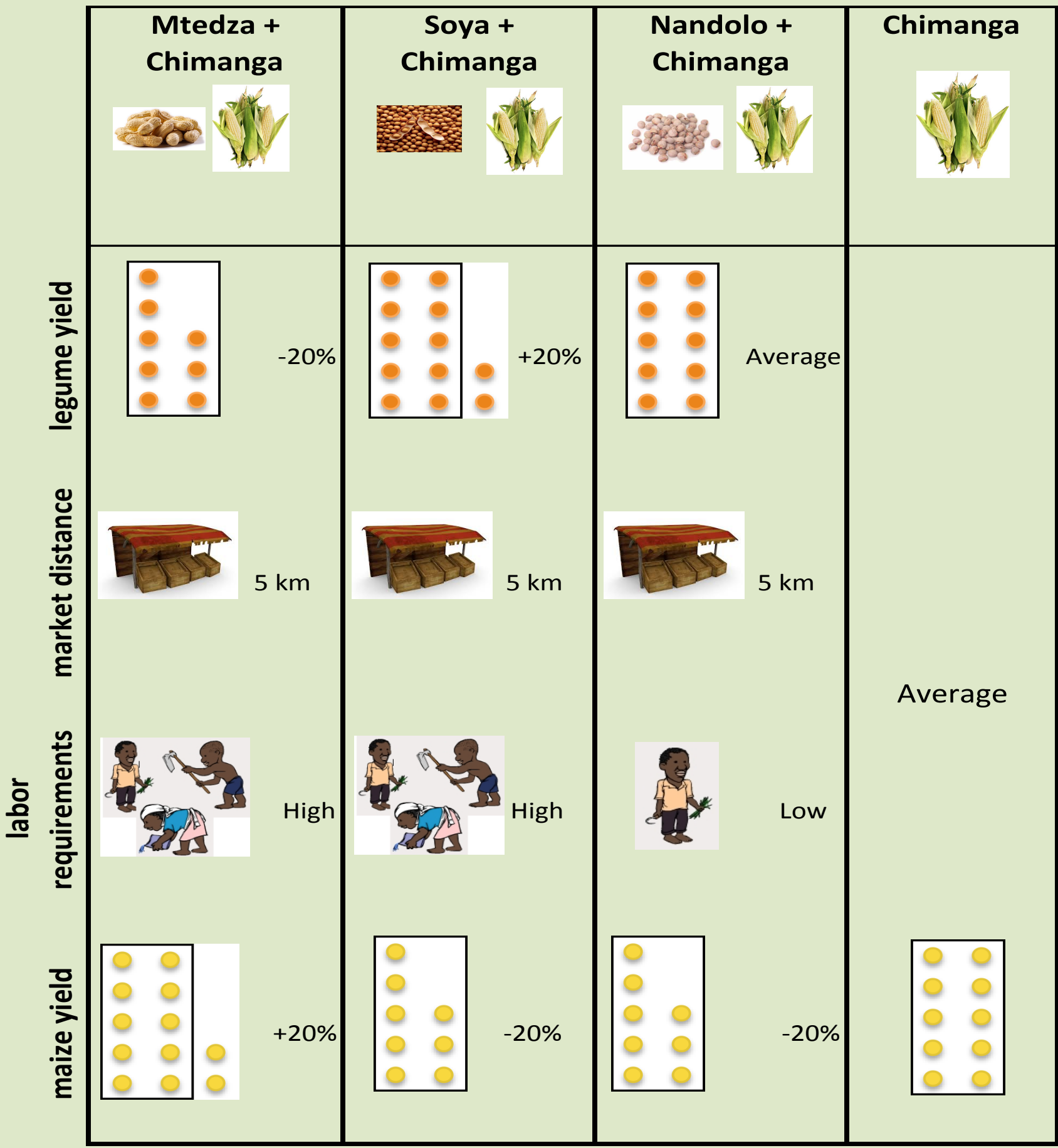
Funding for this research came from the USAID funded “Integrating Nutrition in Value Chains” and the Bill and Melinda Gates Foundation “Perennial Grains for Africa” project.

Methods: Choice experiments

- Explore maize-legume yield tradeoff using maize as “currency”
- ❑ Cropping system attributes
 - Legume yield (% relative to previous year: -20, Average, +20, +40)
 - Market distance (5 km, 10km)
 - Labor requirements (low, high)
 - Maize yield (% relative to previous year: -40, -20, Average, +20)
 - Alternative specific constants for groundnut, pigeon pea, & soybean

Sample choice set

- 3 legume-maize intercrops and sole maize status quo
- Branded choices: Groundnut, soybean, pigeon pea, or maize
- 5 choice sets evaluated per farmer
- Efficient & nearly-orthogonal, blocked, labeled design
- Calibrated with actual maize-legume yield data



Results

	RPL			WTP-Space		
	Coeff.	Std. Error		Coeff.	Std. Error	
<u>Random parameter means</u>						
Legume yied	0.018	0.002	***	0.443	0.043	***
Market distance	-0.025	0.005	***	-0.599	0.122	***
Labor requirement	-0.355	0.066	***	-8.432	1.724	***
Maize yield	0.039	0.002	***			
<u>Alternative-specific parameters</u>						
Groudnut-maize	2.035	0.123	***	2.070	0.091	***
Soybean-maize	1.860	0.124	***	1.903	0.093	***
Pigeonpea-maize	1.667	0.126	***	1.721	0.093	***
<u>Random parameter standard deviations</u>						
Legume yied	0.015	0.003	***	0.340	0.059	***
Market distance	0.032	0.010	***	0.902	0.158	***
Labor requirement	0.591	0.118	***	12.349	2.636	***
Maize yield	0.029	0.002	***			
N	2419			2419		
No. of parameters	11			12		
Log-Likelihood	-2681			-2688		
Adjusted Pseudo R-squared	0.200			0.197		
AIC	5385			5401		

Note: ***, **, * represent statistical significance at 1%, 5% and 10% level, respectively.

Results: Random Parameters Logit

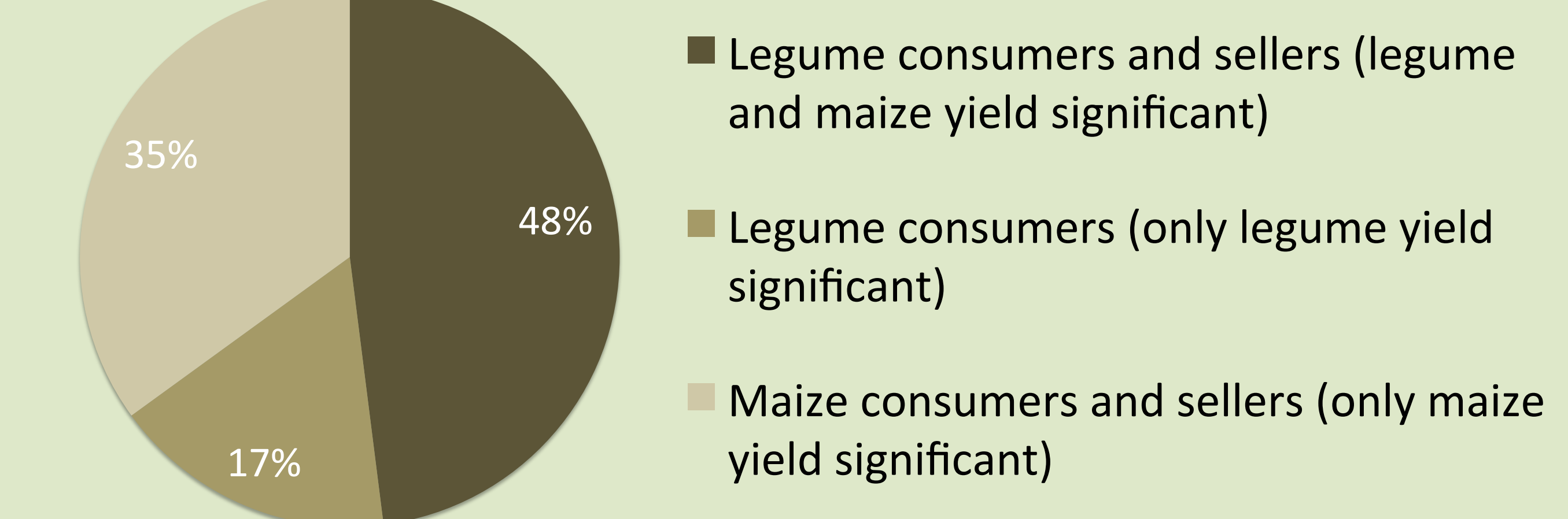
- Farmers are willing to trade a 0.44% increase in legume yield for a one percent increase in maize yield
- There is a large and significant tradeoff between maize yield and labor (-8.43)
- Market access constraints are large and significant (-0.60/km) (5.3km on average)

Results: Crop system preferences

Dedza	Ntcheu	Zomba
1. Groundnuts	1. Pigeonpea	1. Groundnuts
2. Pigeonpea	2. groundnuts	2. Soybean
3. Soybeans	3. Soybeans	3. Pigeonpea
4. Maize only	4. Maize only	4. Maize only

- Preferences for groundnut-maize dominate overall, followed by pigeon pea-maize, soybean-maize systems are the least favored legume intercrop, & sole maize is the least preferred system.

Results: Latent Class model



Conclusions

1. There is a substantial legume-maize yield tradeoff (about 2:1), which has implications for both breeders and extension efforts.
2. The differences in labor requirements between legume crops and labor saving technologies need to be explored further.
3. Extension efforts should consider market access & farm level net consumption and selling positions for each legume crop.

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