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

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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
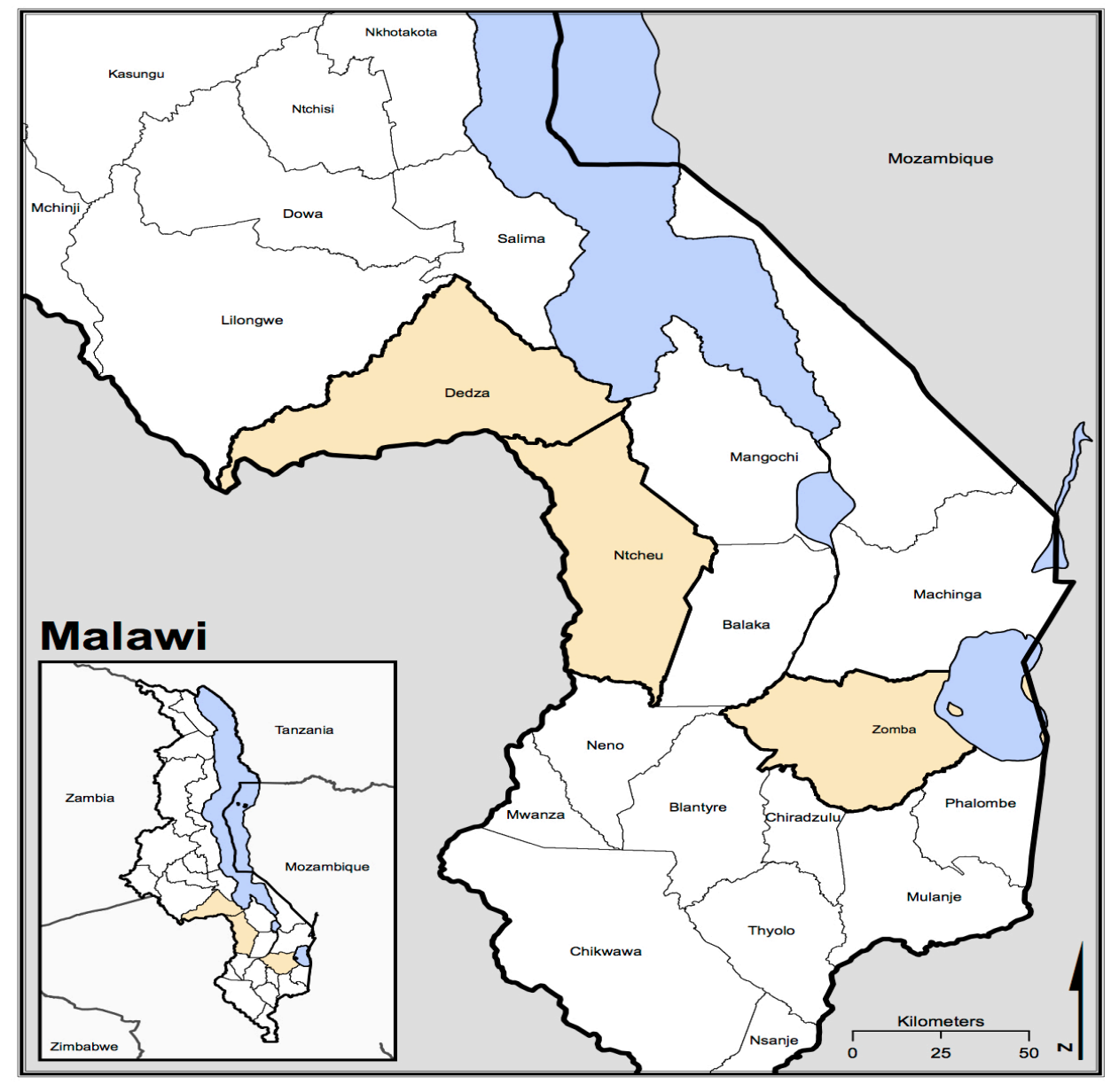
Malawi

Acknowledgements

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
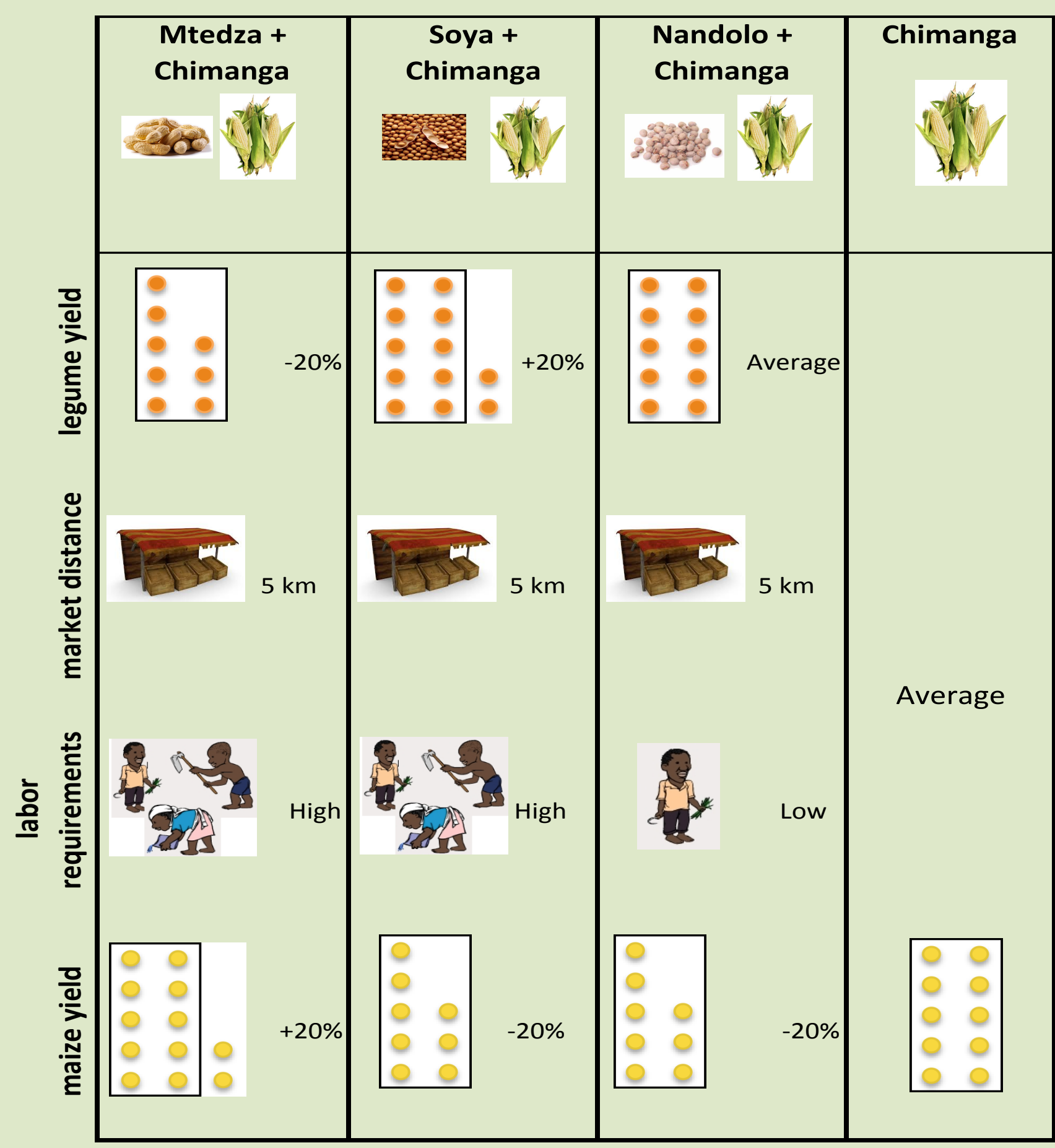
Results

	RPL		WTP-Space	
Random parameter means	Coeff.	Std. Error	Coeff.	Std. Error
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 ***		
Alternative-specific parameters				
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 ***
Random parameter standard deviations				
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.
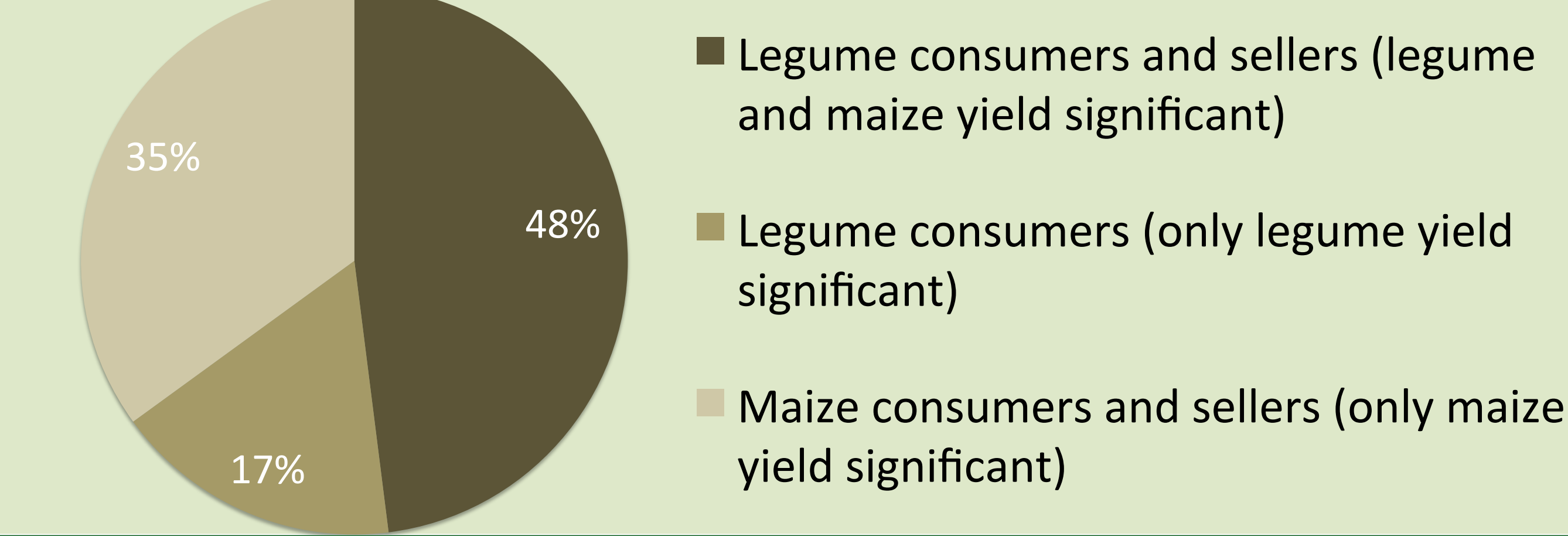
Results: Random Parameters Logit

- ➤ 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

- ■ Legume consumers and sellers (legume and maize yield significant)
- ■ Legume consumers (only legume yield significant)
- ■ Maize consumers and sellers (only maize yield significant)

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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