



# Below and aboveground pigeonpea productivity in a novel doubled-up legume cropping system across three agro-ecologies in central Malawi



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## Background

- The doubled-up technology is a new innovation which involves intercropping two compatible grain legume crops
- The system is hinged on the initial slow growth of one of the legumes facilitating growth of companion crops as if sole cropped
- Pigeonpea, a semi-perennial legume is suitable for doubled-up cropping systems (Figures 1 and 2)
- The shrubby legume is a key component for nutrient cycling mainly because of its deep roots
- Despite past research on grain legumes in Africa, empirical data on root and shoot biomass additions through shrubby legumes has largely remained scarce



Figure 1.  
Pigeonpea and maize cropping system



Figure 2.  
Pigeonpea and groundnut doubled-up cropping system



Figure 3.  
Aboveground and belowground biomass determination methods

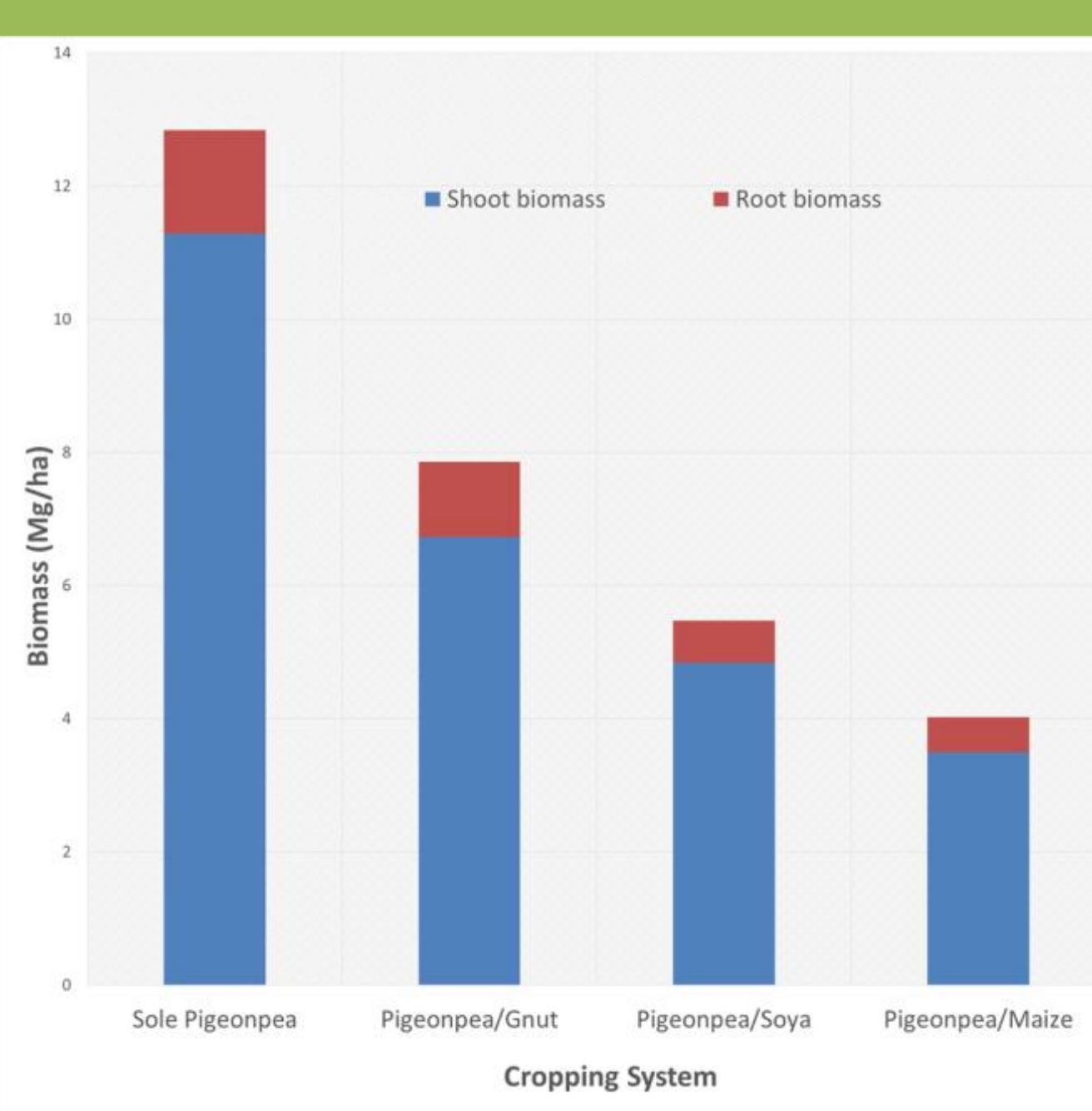


Figure 4.  
Shoot and root biomass of pigeonpea in four cropping systems

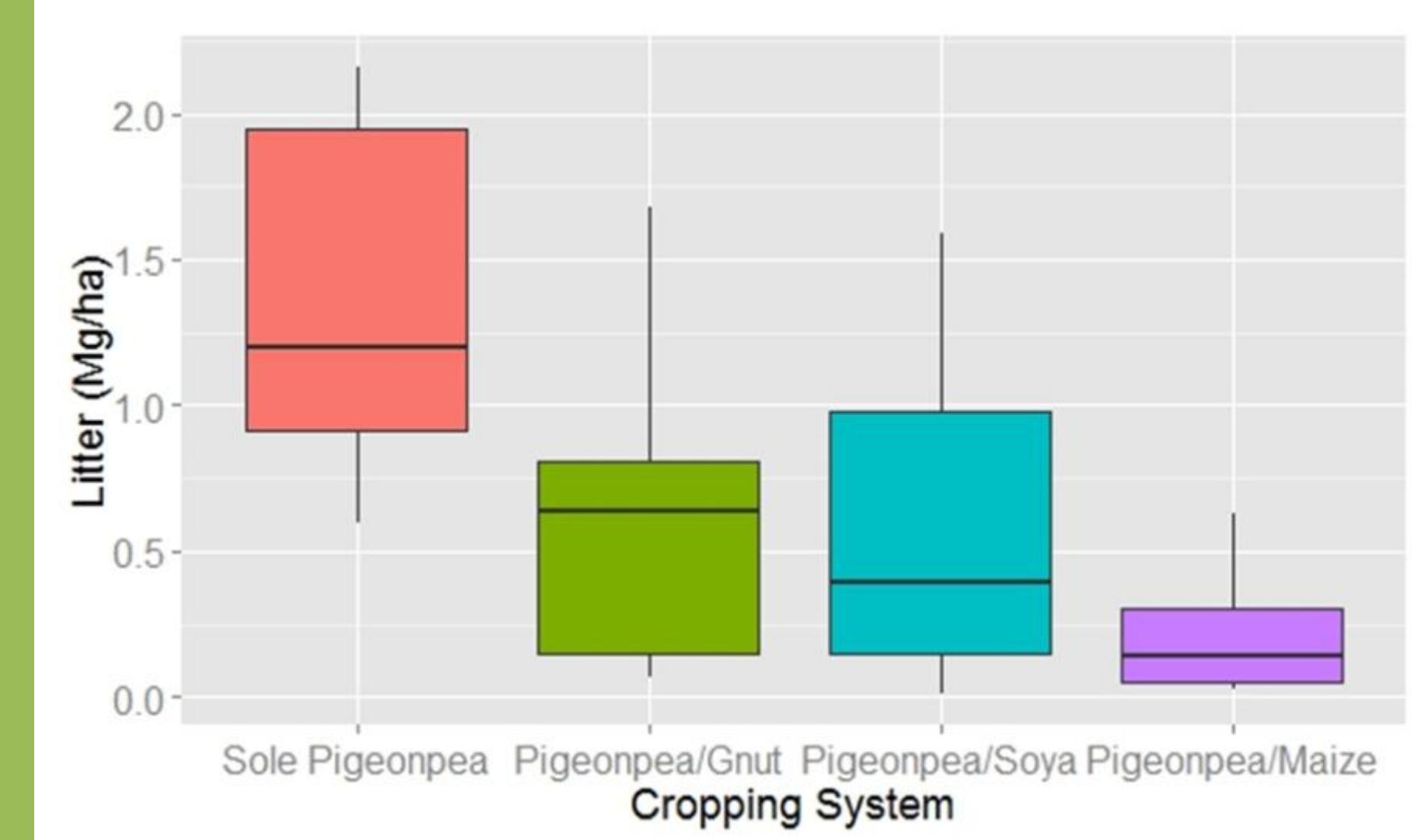


Figure 5.  
Total litter of pigeonpea in four cropping systems throughout the growing season

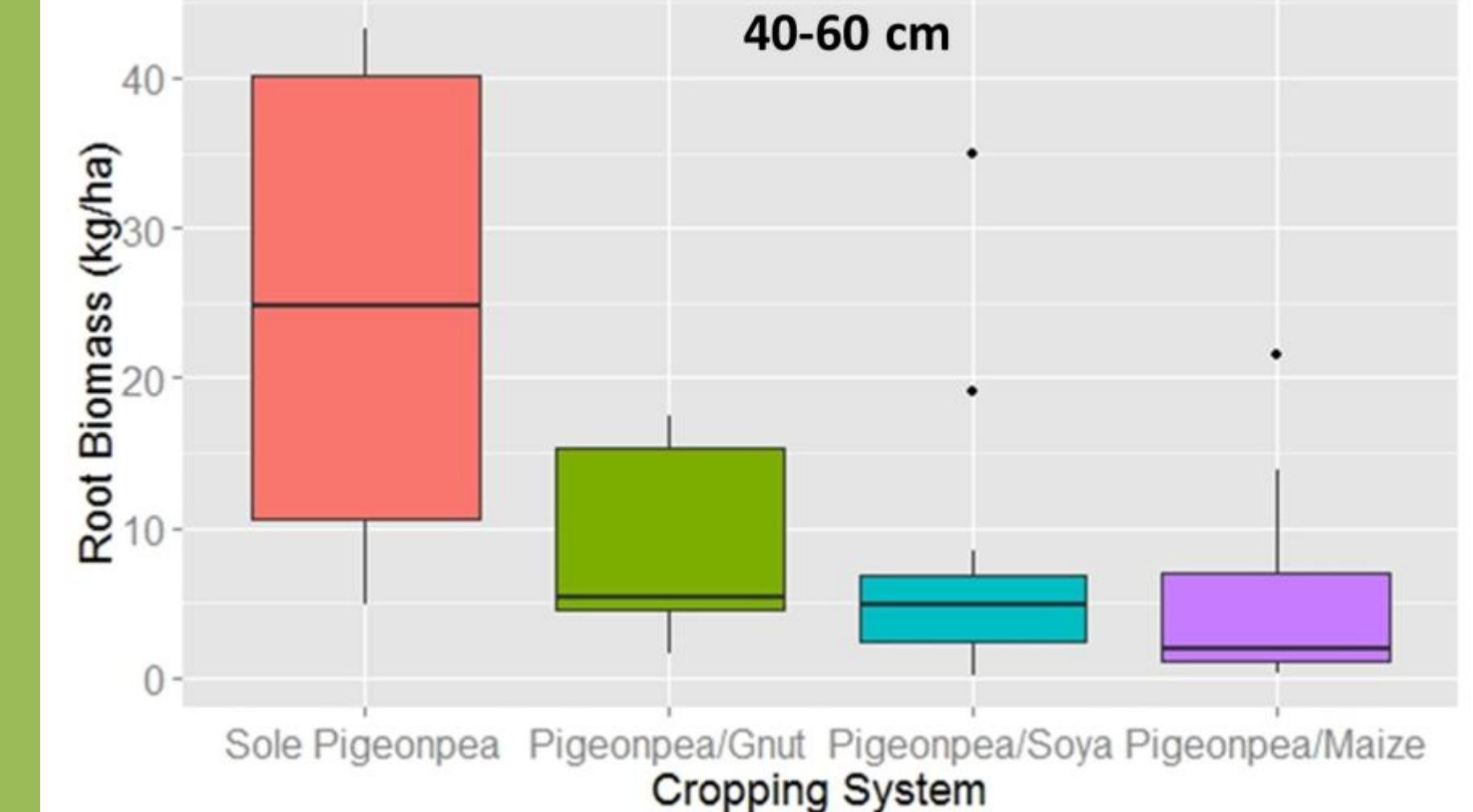
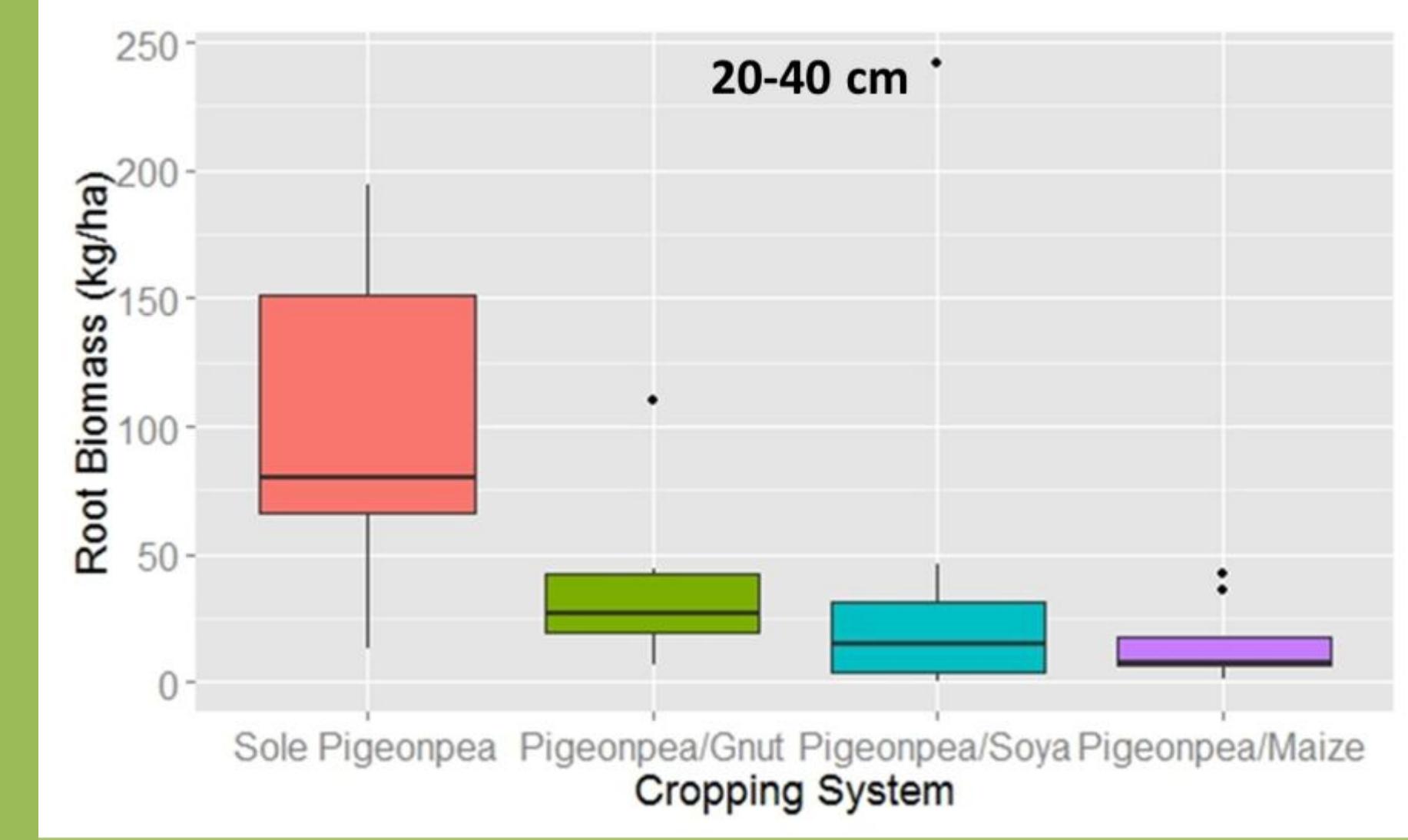
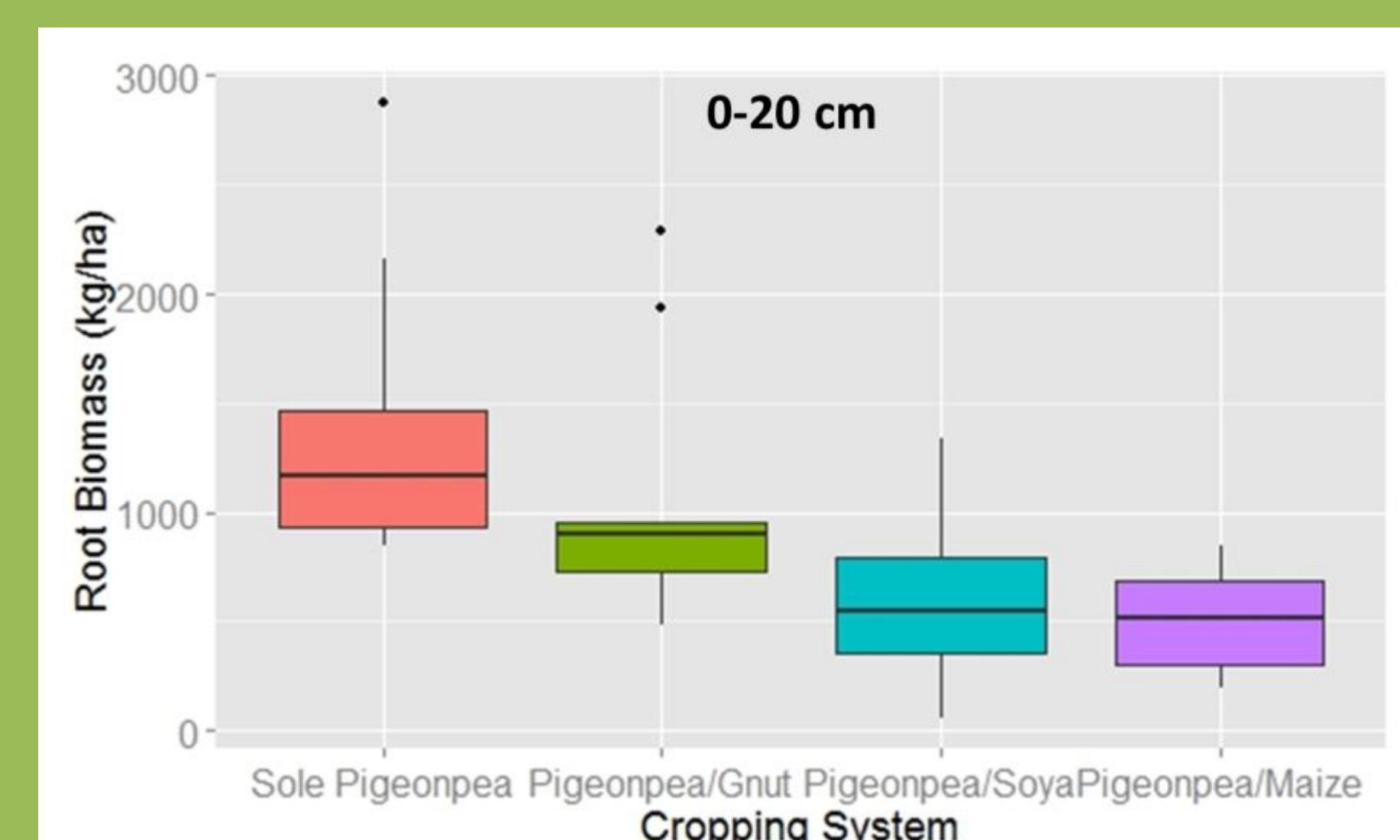


Figure 6.  
Root biomass of pigeonpea in four cropping systems from 0-20 cm, 20-40cm and 40-60 cm depths. Please note that the scale is different

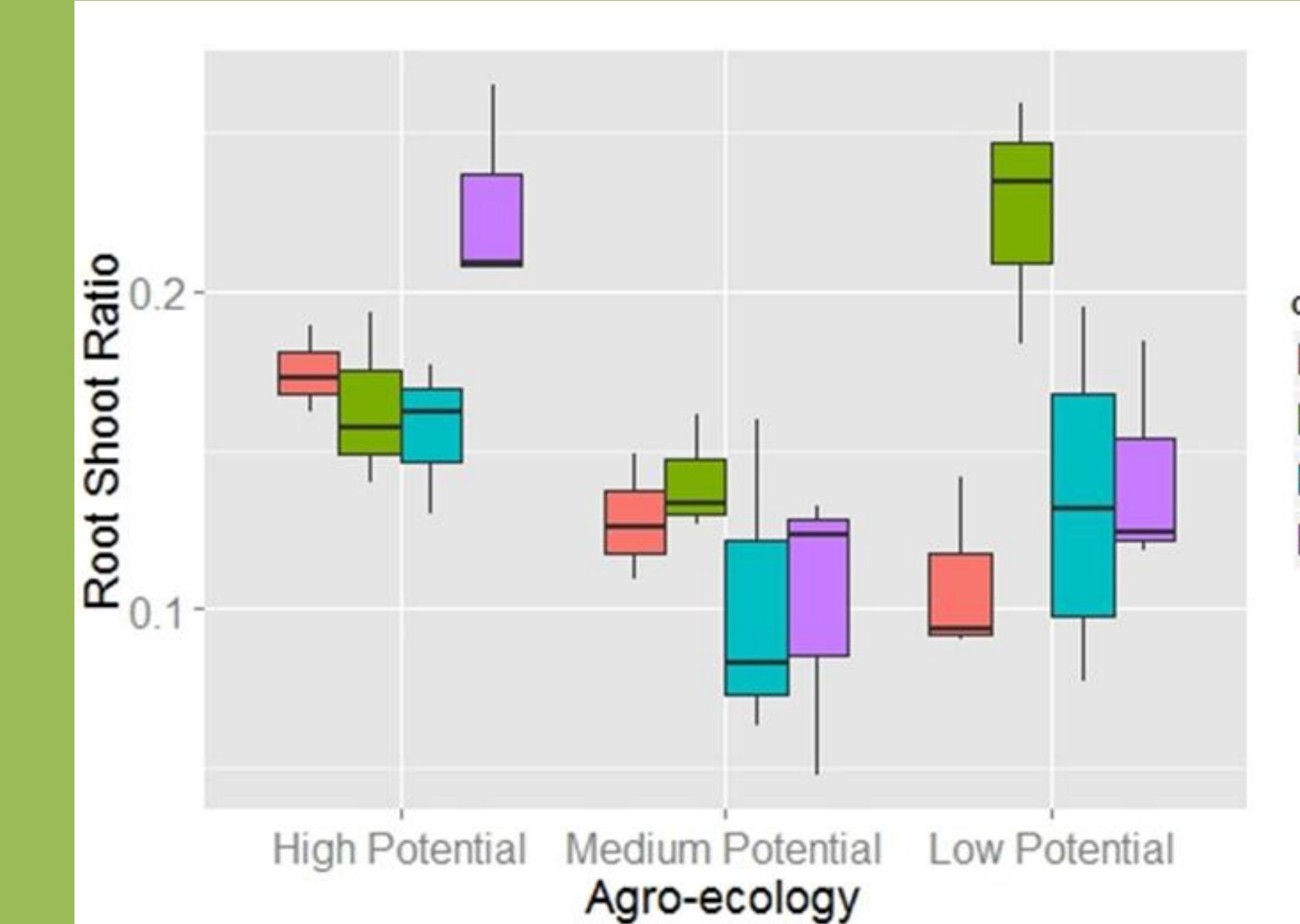


Figure 7.  
Root to shoot ratios of pigeonpea in three agro-ecologies and cropping systems

## Results

- Across sites, pigeonpea above ground biomass was largest for sole pigeonpea and lowest for the pigeonpea/maize intercrop (Figure 4)
- Leaf litter was highest for sole pigeonpea and lowest for the pigeonpea/maize intercrop (Figure 5)
- Root biomass was largely confined in the 0-20 cm layer, with trends similar to that for shoot biomass (Figure 6)
- At below the 20 cm depth, fine pigeonpea roots were dominant (Figure 6)
- Root shoot ratios varied with agro-ecologies and cropping systems (Figure 7)

## Conclusions

- Intra-specific competition in a well fertilized pigeonpea and maize intercropping system is rather large
  - Pigeonpea productivity in a pigeonpea/groundnut system is comparable to sole cropped pigeonpea, with additional grain benefits.
  - The Africa RISING program is promoting the doubled-up legume system for enhanced land productivity on smallholder farms.
- Further thoughts/questions:
- What are the nutrient budgets of the different pigeonpea based doubled-up cropping systems?

## Acknowledgements

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