

# **Managing Biodiversity in Cropping Systems with Reference to Symbiotic Microbes and Their Host Plants**

**Felix D. Dakora**

**Botany Department**

**University of Cape Town**

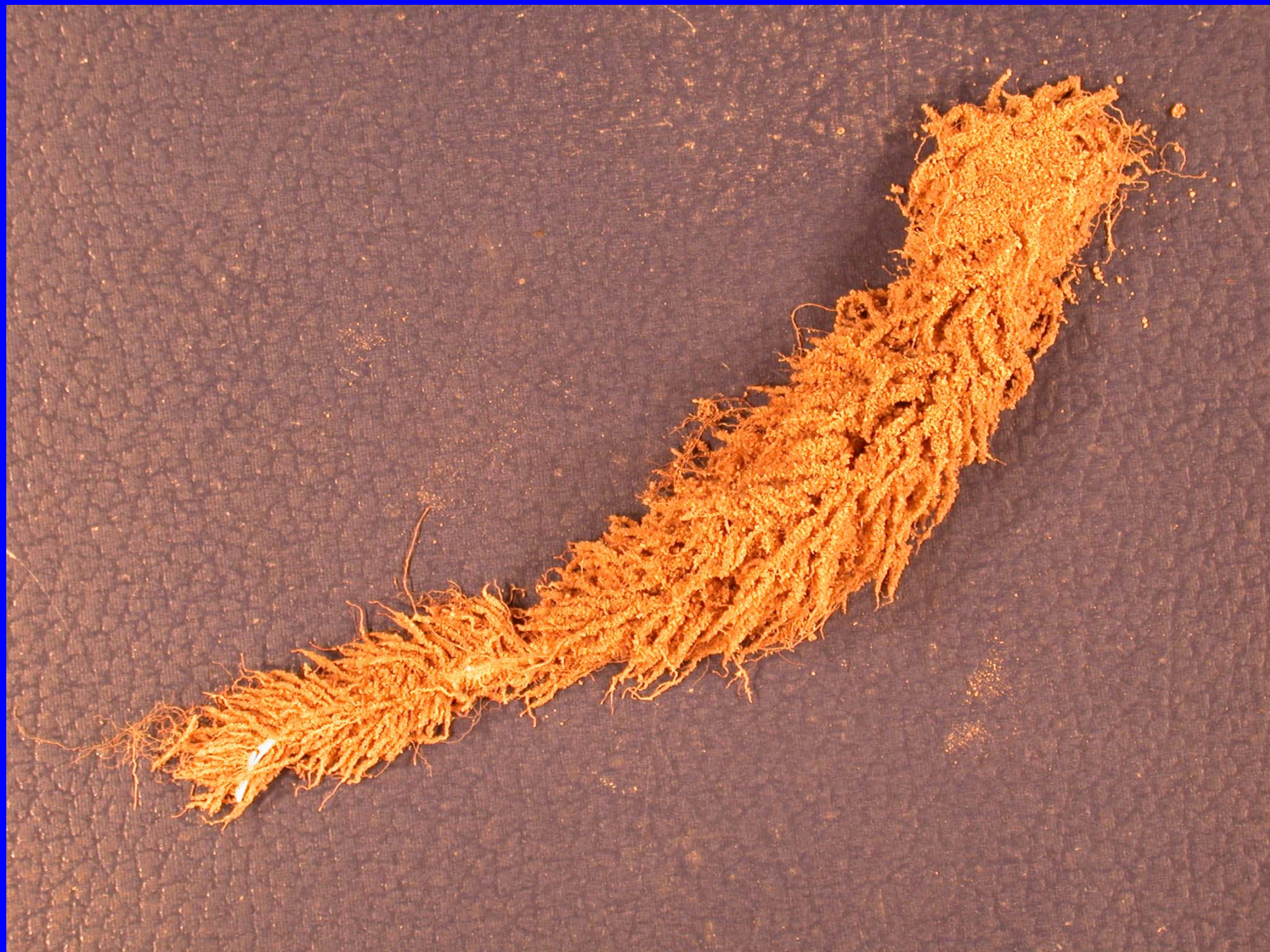
**Private Bag, Rondebosch 7701**

**South Africa**

# Outline

- Exploiting Legume/Rhizobia Symbioses  
for N Nutrition
- Legume Roles Outside N<sub>2</sub> Fixation
- Rhizobial Roles Outside N<sub>2</sub> Fixation
- Enhancing Nutrient Availability in Cropping  
Systems
- Need to Conserve Rhizobial Biodiversity
- Conclusion









# Nodulated Legumes and Nutrient Availability in Cropping Systems

- Symbiotic N nutrition and N release in crop rotations
- Mycorrhizae-enhanced nutrient uptake
- Cluster-root-mediated nutrient uptake

# Enhancing Nutrient Availability in Cropping Systems

- Tripartite symbiosis
- Cluster root-forming tripartite symbiosis



Table3. Rhizosphere pH changes and nutrient availability in soils of Honeybush tea plants (*Cyclopia genistoides*) at Rhondeberg, South Africa (Dakora *et al.* 2000). Mean  $\pm$  SD

Chemical parameter	Level	
	Rhizosphere soil	Non-rhizosphere soil
pH (KCl)	5.0 $\pm$ 0.2	4.4 $\pm$ 0.1
P (mg.kg <sup>-1</sup> )	4.8 $\pm$ 0.9	3.3 $\pm$ 0.9
K (mg.kg <sup>-1</sup> )	33.0 $\pm$ 11.3	15.8 $\pm$ 3.3
Ca (me%)	3.3 $\pm$ 1.0	1.5 $\pm$ 0.4
Mg (me%)	1.3 $\pm$ 0.4	0.4 $\pm$ 0.1
B (mg.kg <sup>-1</sup> )	0.7 $\pm$ 0.3	0.2 $\pm$ 0.02

Table 7. Phosphorus concentration (mg P.kg<sup>-1</sup>) of soil associated with the rhizosphere and cluster roots of *A. linearis* relative to bulk soil from three fields. Values followed by different letters are significant at  $P < 0.05$ .

Soil sample	Farm		
	Wilgerbos	Jakkalsvlei	KrommeVal
Cluster root rhizoplane	11.2 a	6.9 a	27.6 a
Cluster root	8.7 b	6.1 a	23.7 b
Rhizosphere	7.8 bc	4.1 c	9.2 c
Bulk	6.3 c	5.4 b	8.7 c

Table 11. Effect of nodule proximity to cluster roots on nodule concentration of P and N in *Aspalathus linearis*. Values are Mean  $\pm$  S.E.

Nodule type	P (%)	N (%)	$\delta^{15}\text{N}$ value (‰)
Non-cluster root nodules	0.23 $\pm$ 0.00	4.8 $\pm$ 0.5	6.5 $\pm$ 0.0
Intermediate cluster root nodules	0.34 $\pm$ 0.02	5.9 $\pm$ 0.75	5.5 $\pm$ 1.1
Cluster root nodules	0.44 $\pm$ 0.17	7.5 $\pm$ 0.19	7.0 $\pm$ 0.59