Effectiveness of Kenyan Rhizobia Strains on Soybean

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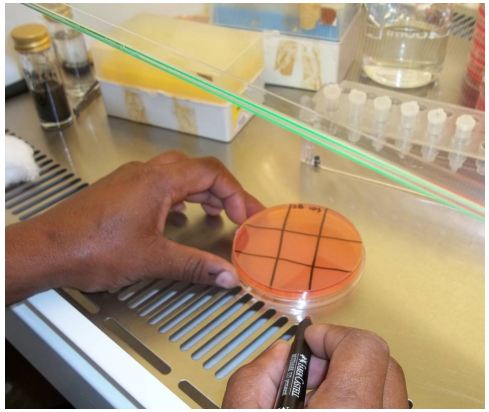
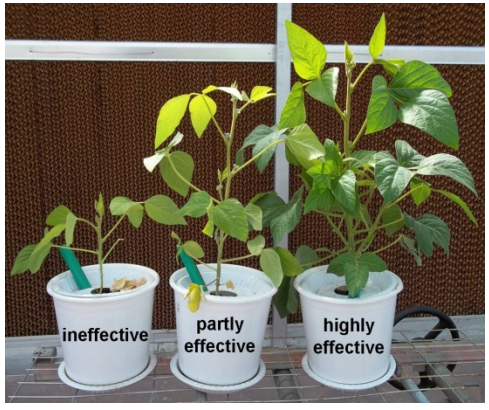


putting rhizobia

to work for

Kenyan smallholders farmers



Justification

Biodiversity and economic potential of African rhizobia is largely unexplored

Potential exists for native rhizobia to outperform exotic commercial strains

Objectives

Identify elite native rhizobia for soybean

Compare these rhizobia to standard industry strains

Steps in establishing rhizobia as elite strains

Bio-prospecting and isolation — ***208 isolates***

↓

Authentication and preliminary screening — ***186 isolates***

↓

Effectiveness testing under greenhouse conditions — ***100 isolates***

↓

Competitive abilities in potted soil — ***24 isolates***

↓

Field testing — ***6 isolates***

Greenhouse growth systems employed in this study

Leonard jars with sand media → ***non-quantitative, abandoned as unnecessary***

↓

Three liter pots with rhizobia-free vermiculite → ***clean controls, quantitative separation of isolates***

↓

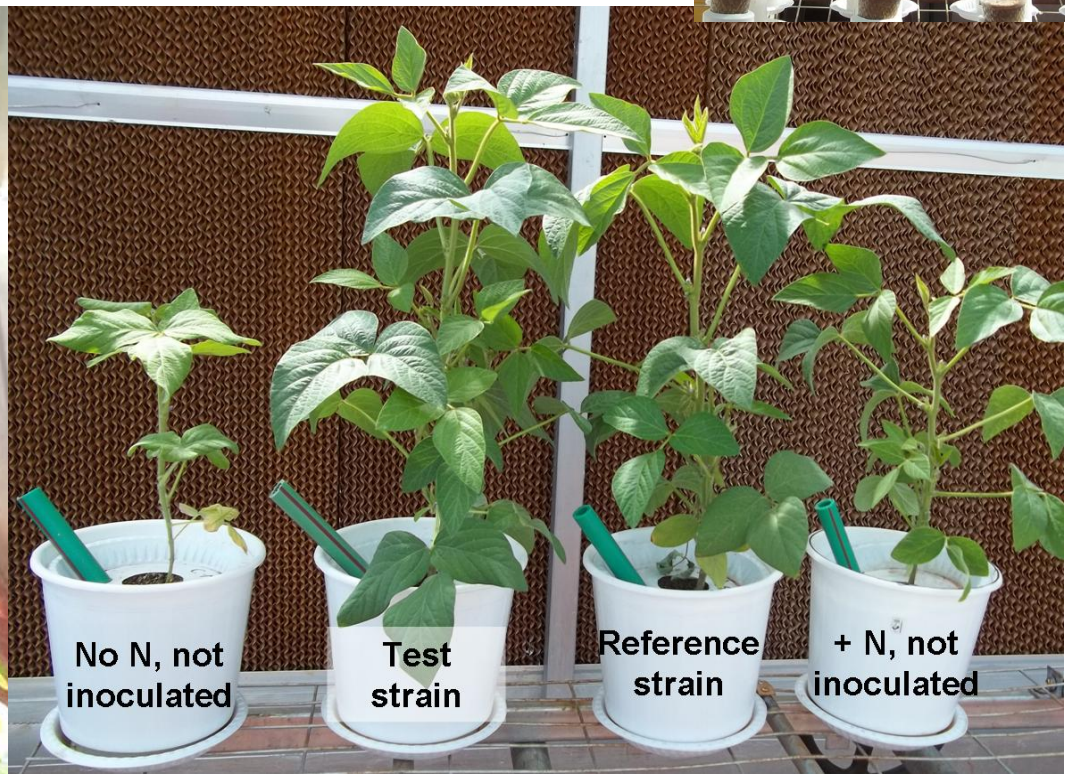
Growth pouches for MPN → ***rapid estimation of native populations***

↓

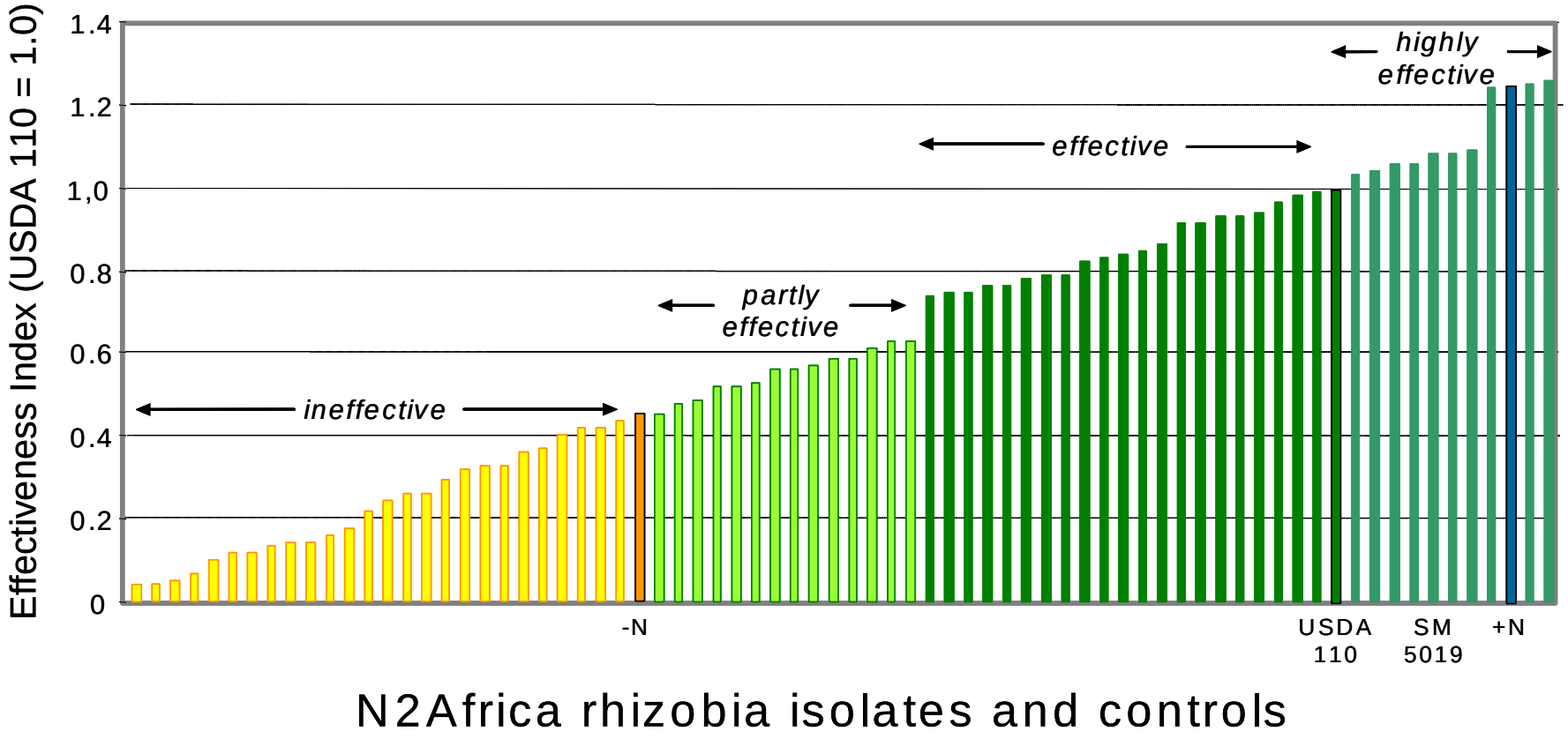
Three liter pots with site soils → ***effective isolates tested for competitive abilities***

Greenhouse effectiveness testing of 100 isolates in 3 liter pots with rhizobia-free vermiculite

Clockwise: early N response (top), sterile irrigation system (upper right), effectiveness differences (lower right) and experimental overview (lower left).



Effectiveness testing under greenhouse conditions



Strains were compared by Effective Index and then assigned to four categories (< -N control, < 0.75 USDA 110, < USDA 110 and > USDA 110)

The best “candidate elite strains” emerging for greenhouse effectiveness testing

isolate	EI	Host	Source AEZ
NAK 176	1.26	Cowpea	Coastal plain
NAK 179	1.25	*Eriosema* sp.	Coastal plain
NAK 96	1.24	Soybean	Semi-arid upland
NAK 149	1.09	Cowpea	Coastal plain
NAK 115	1.08	soybean	Sub-humid midland
NAK 128	1.06	soybean	Sub-humid midland
USDA 110	1.00		USA (Industry standard)

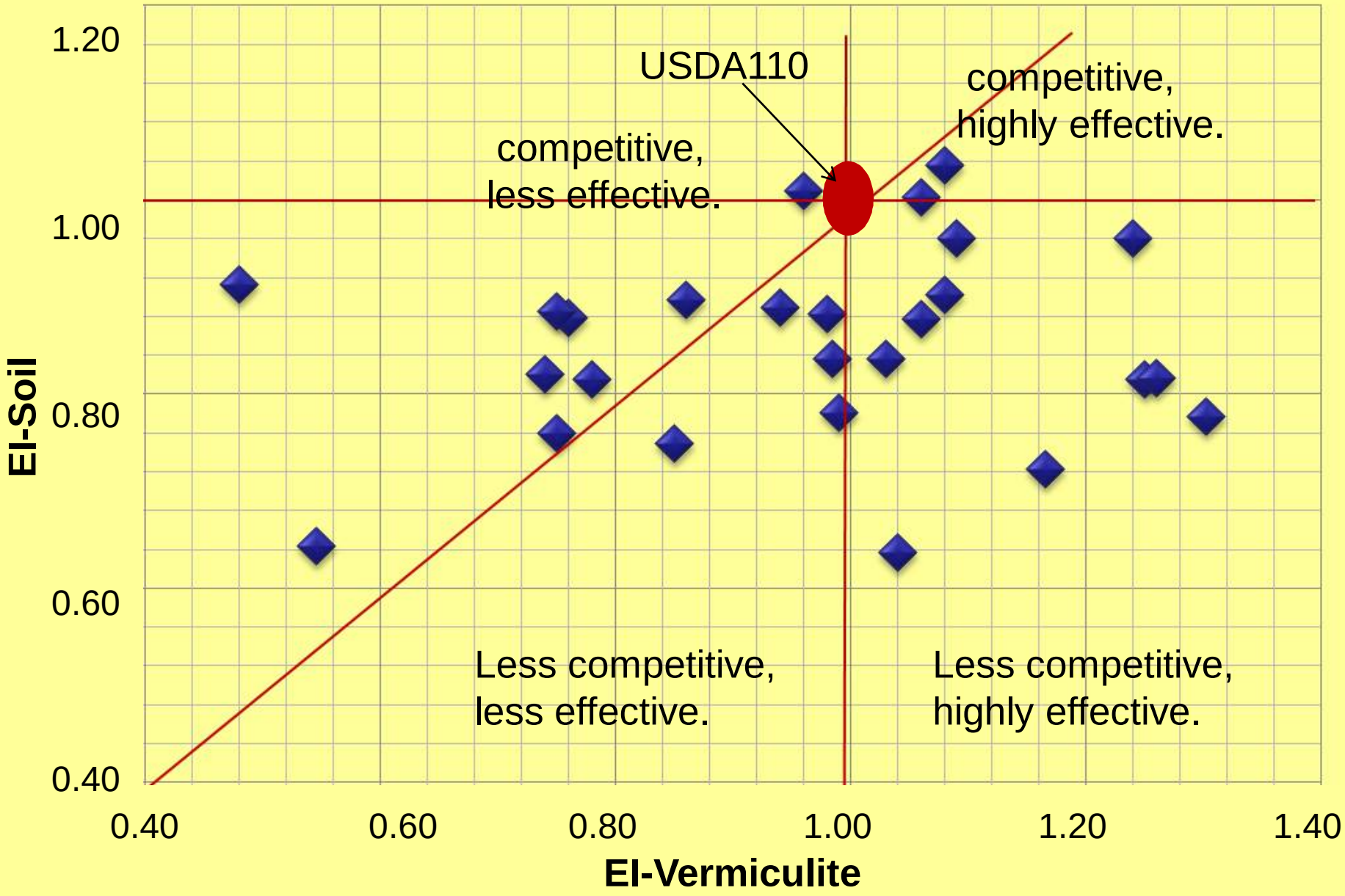
Greenhouse competitiveness testing of 24 isolates in 3 litre pots with soil

Clockwise: experimental overview (top right), MPN (lower left)and nodulation of test strain (lower right).

The best promising elite strains emerging for greenhouse competitive ability testing

Isolates	EI	Host	Source AEZ
NAK128	1.00	Soybean	Semi-arid upland
NAK135	1.01	Soybean	Semi-arid upland
NAK89	0.78	Soybean	Semi-arid upland
NAK84	0.84	Soybean	Semi-arid upland
NAK115	1.03	Soybean	Semi-arid upland
NAK117	0.89	Soybean	Semi-arid upland
USAD110	1.00		USA (Industry standard)

Competitive classes of native strains



Competitive, highly effective	Less competitive, highly effective	Competitive, less effective	Less competitive, less effective
NAK115	NAK9	NAK12	NAK10
NAK128	NAK83	NAK122	NAK30
	NAK89	NAK135	NAK84
	NAK96	NAK139	NAK117
	NAK127	NAK146	NAK144
	NAK149	NAK152	NAK176 (SCcv)
	NAK176 (SB19)	NAK160	NAK179 (SCcv)
	NAK179 (SB19)	NAK161	

Conclusion and recommendation

- For strains to be elite, they must be screened for genetic stability, satisfactory growth and survival under inoculant manufacturing conditions.
- Preliminary testing of promising native strains have been done and further testing continues at the field with six promising native isolates.
- Competitive, highly effective and less competitive, highly effective: field testing should be done in different soils and environment.
- Isolates NAK179 and NAK176 performed well on promiscuous but not on specific soybean: Different inoculants maybe required for different soybean genotypes.


- Nitrogen
Test strain
+ Nitrogen
Test strain

ACKNOWLEGEMENT

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THANK YOU