RHIZOBIA STRAIN SELECTION AND SYMBIOTIC COMPATIBILITY WITH DIFFERENT CULTIVARS OF COWPEA (*VIGNA UNGUICULATA* L.) WALP) IN BRAZIL

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INTRODUCTION

Cowpea [*Vigna unguiculata* (L.) Walp] is a major pulse on tropical regions of the world, including North and Northeastern Brazil and Africa. It may be cultivated under adverse soil and climate conditions, and may nodulate and fix nitrogen with a wide range of rhizobia.

Most breeding programs do not take this bacterial symbiont biodiversity into account, but rely on native bacteria of the experimental field for nodulation and nitrogen supply, or use relatively low nitrogen doses. This may lead to cowpea cultivars with preferential nodulation with rhizobial strains from the region where the cultivar will be recommended.

Under Brazilian legislation, though, rhizobial inoculants must use rhizobial strains nationally recommended. This may lead to strains from one origin being used on crops on widely differing agroecosystems. For crops such as soybean, with relatively low rhizobial biodiversity, this likely does not lead to nodulation incompatibility, but it might be a problem for crops such as cowpea.

A continual search for new bacterial strains is important to select more efficient and adaptable associations, and a better evaluation of symbiotic stability may contribute to strain recommendation. The symbiotic compatibility and efficiency of strains from soils of the semiarid region of Pernambuco, and the recommended strain BR 3262, and their symbiotic stability with BR 17 Gurguéia, IPA 206 and BRS Novaera cultivars was estimated.

MATERIAL AND METHODS

Greenhouse

✓BR 17 Gurguéia, IPA 206, BRS Novaera recommended for different growing regions
✓25 isolates from Semiarid soils
✓Recommended strain BR 3262
✓Uninoculated treatments with and without N

- Shoot
- Root and nodule dry matters
- Nodule number
- Specific nodule mass
- Shoot N by nodule dry mass unit
- Relative efficiency of inoculated strains in relation to the currently recommended strain

Eberhart and Russell stability analysis was performed when there was interaction between variety and strain.

$Y_{ij} = \mu_i + \beta_i I_j + \delta_{ij}$.

Y_{ij} – genotype i average on enviroment j;
μ_i – general genotype i average;
β_i - genotype i regression coefficient to the environments
I_j – enfironmental index
δ_{ij} – deviation from the regression of genotype i on environment j

RESULTS

Sixteen isolates nodulated as much as BR 3262, and 20 isolates did not differ from BR 3262 for specific nodule mass, and 18 for shoot nitrogen per nodule dry matter mg. Strain by cultivar interactions were observed for relative efficiency estimates on a shoot dry matter and fixed nitrogen basis, indicating potential for selection of more efficient symbiotic pairs. Strains G7.85 and BR 3262 had the highest stabilities and adaptabilities to cultivars with higher nitrogen fixation potential.

Table 1 – Nodule dry mass (NDM, mg), nodule number, specific nodule mass (mg/nodule) and shoot nitrogen per specific nodule mass (SNNM (mg N/nodule mg) of three cowpea cultivars recommended for different Brazilian regions inoculated with rhizobial strains isolated from semiarid soils.

Strain	NDM	NN	SNM	SNNDM
G7.14	118.6a	57.9a	1.9a	0.2b
G7.118	86.4a	45.8a	1.6a	0.3b
G7.18	5.6b	1.9b	0.7a	0.5b
G7.79	1.0b	0.6b	0.2b	0.9a
G7.99	91.6a	54.5a	1.7a	0.4b
G7.12	41.9a	25.2a	1.2a	0.4b
G7.68	108.7a	53.5a	2.0a	0.2b
G7.45	0.9b	0.4b	0.2b	0.8a
G7.103	9.6b	5.6b	0.7a	0.5b
G1.62	1.4b	1.1b	0.3b	0.7a
G7.77	142.9a	54.5a	2.4a	0.3b
G7.102	76.7a	81.8a	1.1a	0.3b
G1.1	8.9b	5.5b	0.5a	0.6a
G7.32	145.8a	75.0a	1.9a	0.3b
G7.109	119.9a	77.9a	1.5a	0.3b
G7.64	25.3a	14.4a	1.1a	0.4b
G7.85	91.6a	56.7a	1.6a	0.3b
G7.25	1.0b	0.6b	0.2b	0.7a
G7.7	91.7a	44.6a	1.9a	0.2b
G7.23	58.6a	40.5a	1.2a	0.4b
G7.13	95.2a	55.9a	1.6a	0.3b
G1.99	9.9b	5.6b	0.7a	0.5b
G1.2	108.7a	62.5a	1.6a	0.2b
G7.69	2.1b	2.2b	0.2a	0.7a
G7.3	2.9b	1.6b	0.4b	0.7a
BR3262	146.4a	64.2a	2.1a	0.2b
0N.SI	0b	0b	0b	-
CN.SI	0b	0b	0b	-
CV (%)	49.3	45.2	36.1	26.3

Table 2 – Eberhardt & Russel (1966) adaptability and stability parameters for shoot dry mass (SDM) and shoot nitrogen content (SNC) of rhizobial strains considering cowpea cultivars as enviironments

Strain	SDM			SNC		
	Average	β_{1i}	σ^2_{di}	Average	β_{1i}	σ^2_{di}
G7.14	5.88	-1.04*	0.07*	168.34	-0.77*	0.63^{ns}
G7.118	4.80	-1.06*	0.08*	167.39	-1.64*	1.16^{ns}
G7.18	1.40	-0.92*	0.06*	43.11	-0.57*	0.57^{ns}
G7.79	1.44	-0.99*	0.01*	26.60	-0.82*	0.13*
G7.99	4.92	-1.03*	0.06*	150.11	-1.65*	1.50^{ns}
G7.12	4.96	-0.98*	0.14*	129.84	2.01*	3.05^{ns}
G7.68	5.13	-1.11*	0.06*	156.54	0.25*	0.67^{ns}
G7.45	1.31	-1.01*	0.01*	23.74	-0.88*	0.14*
G7.103	2.81	-0.96*	0.10*	75.86	-1.78*	1.59^{ns}
G1.62	1.54	-1.01*	0.03*	34.29	-0.78*	0.33*
G7.77	5.36	-1.04*	0.09*	155.81	-2.00*	1.38^{ns}
G7.102	5.10	-1.07*	0.06*	171.97	0.72*	0.55^{ns}
G1.1	2.09	-0.97*	0.05*	55.25	-2.55*	0.54*
G7.32	5.03	-0.92*	0.10*	161.76	0.29*	1.28^{ns}
G7.109	5.39	-1.02*	0.08*	163.22	-0.01*	1.16^{ns}
G7.64	3.41	-0.93*	0.10*	90.40	-1.65*	2.55^{ns}
G7.85	4.63	-0.91*	0.11*	150.60	2.64*	1.78^{ns}
G7.25	1.31	-1.01*	0.01*	24.48	-0.86*	0.10*
G7.7	4.63	-1.08*	0.08*	143.06	2.36*	1.64^{ns}
G7.23	5.60	-1.02*	0.08*	141.82	1.98*	1.79^{ns}
G7.13	4.41	-1.04*	0.08*	132.48	1.62*	1.82^{ns}
G1.99	2.62	-1.12*	0.10*	70.05	-0.71*	1.59^{ns}
G1.2	5.30	-1.10*	0.08*	185.96	-0.94*	0.80*
G7.69	1.68	-0.96*	0.03*	35.66	-0.71*	0.25*
G7.3	1.56	-1.04*	0.02*	34.14	-0.95*	0.25*
BR3262	4.90	-0.95*	0.12*	174.91	0.11*	1.13^{ns}
Average	3.10			109.22		

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