

Supplementary online supporting material

Rhizobium survival and inoculation of beans in response to different pre-planting water availability with additions of pyrolyzed and non-pyrolyzed sugarcane bagasse

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Table S1. Experimental design schematic. Each treatment was replicated five times.

	Soil (%)				
	0	25	50	75	100
	Sand (%)				
	100	75	50	25	0
Inoculant application at planting (WP)	Biochar	Biochar	Biochar	Biochar	Biochar
	Bagasse	Bagasse	Bagasse	Bagasse	Bagasse
	Control	Control	Control	Control	Control
Inoculant application after 4 weeks of drying (WD1)	Biochar	Biochar	Biochar	Biochar	Biochar
	Bagasse	Bagasse	Bagasse	Bagasse	Bagasse
	Control	Control	Control	Control	Control
Inoculant application after 4 weeks of alternate wetting/drying (WD4)	Biochar	Biochar	Biochar	Biochar	Biochar
	Bagasse	Bagasse	Bagasse	Bagasse	Bagasse
	Control	Control	Control	Control	Control

Table S2. Soil and sand weights in the mixtures, and the weights of inoculant carrier material as well as their weight proportions (volumes of carriers added were equivalent; biochar and bagasse added at 15 t ha⁻¹).

	Soil (%)				
	0	25	50	75	100
	Sand (%)				
	100	75	50	25	0
Soil weight (g)	0.0	492.6	985.2	1477.8	0.0
Sand weight (g)	3246.1	2434.6	1623.1	811.5	1970.4
Mixture weight (g)	3246.1	2927.2	2608.3	2289.3	1970.4
Bagasse and Biochar (g pot ⁻¹)	33	33	33	33	33
Bagasse and Biochar (% w/w)	1.0	1.1	1.3	1.4	1.7
Soil/sand carrier (g pot ⁻¹)	263.7	236.5	209.2	182.0	154.8
Soil/sand carrier (% w/w)	8.1	8.1	8.0	8.0	7.9

Table S3. Bean mean nodule weight in response to biochar, bagasse, and control inoculant amendments and the proportion of sand mixed to soil. Treatments include inoculant addition to soil adjusted to field capacity at planting: WP; drying for 8 weeks between inoculant addition and planting: WD1; alternate wetting and drying between inoculant addition and planting: WD4. Different letters indicate significant differences, no letters are shown when main effect is not significant (Tukey's HSD, $P < 0.05$, $n = 5$).

Soil (%)	Sand (%)	Inoculant carrier material	Watering regime		
			WP	WD1	WD4
			Mean nodule weight (mg pot ⁻¹)		
100	0	Bagasse	4.12 a	2.44 a	2.85
		Biochar	0.00 b	0.00 b	4.24
		Control	0.00 b	0.00 b	0.00
75	25	Bagasse	9.81	1.52 a	2.06
		Biochar	4.38	0.00 b	1.86
		Control	0.00	0.00 b	0.00
50	50	Bagasse	7.07	0	2.15
		Biochar	0.00	0	12.82
		Control	3.22	0	0.00
25	75	Bagasse	7.33	5.92 a	3.94
		Biochar	5.38	0.00 b	6.86
		Control	10.00	0.00 b	0.00
0	100	Bagasse	8.30 a	0	1.01
		Biochar	5.96 a	0	0.00
		Control	1.25 b	0	0.00

Table S4. Bean shoot, root, and nodule weight, and the number of root nodules in response to biochar and bagasse inoculant amendments and the proportion of sand mixed to soil. Inoculant added at planting to soil watered to field capacity (WP). Different letters indicate significant differences, no letters are shown when main effect is not significant (Tukey's HSD, $P < 0.05$, $n = 5$).

		Soil (%)				
		0	25	50	75	100
		Sand (%)				
		100	75	50	25	0
Shoot weight (g)	Biochar	0.38 A	0.30 A	0.54 A	0.43 A	0.58 A
	Bagasse	0.17 B	0.41 A	0.47 A	0.44 A	0.55 A
	Control	0.20 B	0.33 A	0.78 A	0.74 A	0.77 A
	P-value	0.003	0.4323	0.1669	0.0335	0.1441
Root weight (g)	Biochar	0.07 A	0.04 A	0.12 B	0.14 A	0.14 A
	Bagasse	0.08 A	0.06 A	0.10 B	0.14 A	0.06 A
	Control	0.04 A	0.19 A	0.34 A	0.14 A	0.13 A
	P-value	0.59	0.1996	<0.0001	0.2196	0.0452
Nodule number	Biochar	28 A	1 B	0 B	1 B	0 B
	Bagasse	10 B	48 A	24 A	23 A	42 A
	Control	1 B	6 AB	4 B	0 B	0 B
	P-value	0.0005	0.0222	0.0045	0.0007	0.0032
Nodule dry weight (mg)	Biochar	4.88 A	0.26 A	0.00 A	0.06 B	0.00 B
	Bagasse	1.20 B	7.16 A	4.82 A	8.22 A	10.04 A
	Control	0.16 B	0.13 A	1.30 A	0.00 B	0.00 B
	P-value	0.0006	0.1493	0.0697	0.0158	0.0001

Table S5. Bean shoot, root, and nodule weight, and the number of root nodules in response to biochar and bagasse inoculant amendments and the proportion of sand mixed to soil. Inoculants added to soil eight weeks before planting with continuous drying (WD1). Different letters indicate significant differences, no letters are shown when main effect is not significant (Tukey's HSD, $P < 0.05$, $n = 5$).

		Soil (%)				
		0	25	50	75	100
		Sand (%)				
		100	75	50	25	0
Shoot weight (g)	Biochar	0.13 A	0.32 A	0.38 B	0.75 A	0.79 A
	Bagasse	0.11 A	0.25 A	0.37 B	0.86 A	0.46 A
	Control	0.08 A	0.33 A	0.65 A	0.68 A	0.60 A
	P-value	0.2227	0.4117	0.0218	0.5607	0.1125
Root weight (g)	Biochar	0.02 AB	0.02 A	0.06 A	0.15 A	0.15 A
	Bagasse	0.03 A	0.05 A	0.09 A	0.11 A	0.10 A
	Control	0 B	0.04 A	0.13 A	0.09 A	0.09 A
	P-value	0.0343	0.1652	0.0622	0.2938	0.5517
Nodule number	Biochar	0	0 B	0 B	0 B	0 B
	Bagasse	0	25 A	20 A	79 A	53 A
	Control	0	0 B	0 B	0 B	0 B
	P-value	NA	0.0009	0.0002	0.0012	0.0003
Nodule weight (mg)	Biochar	0.00	0.00 B	0.00 B	0.00 B	0.00 B
	Bagasse	0.00	7.14 A	0.73 A	50.72 A	25.63 A
	Control	0.00	0.00 B	0.00 B	0.00 B	0.00 B
	P-value	NA	0.0252	<0.0001	<0.0001	0.0030

Table S6. Bean shoot, root, and nodule weight, and the number of root nodules in response to biochar and bagasse inoculant amendments and the proportion of sand mixed to soil. Inoculants added to soil eight weeks before planting with alternate drying and wetting to field capacity (WD4). Different letters indicate significant differences, no letters are shown when main effect is not significant (Tukey's HSD, $P < 0.05$, $n = 5$).

		Soil (%)				
		0	25	50	75	100
		Sand (%)				
		100	75	50	25	0
Shoot weight (g)	Biochar	0.12 A	0.34 A	0.82 A	0.79 A	1.18 A
	Bagasse	0.32 A	0.38 A	0.53 A	0.44 B	0.51 B
	Control	0.14 A	0.32 A	0.63 A	0.53 AB	0.46 B
	<i>p</i>-value	0.2207	0.7863	0.0748	0.0305	<0.0001
Root weight (g)	Biochar	0.03	0.05 A	0.15 AB	0.14 A	0.21 A
	Bagasse	0.05	0.07 A	0.08	0.05 B	0.08 B
	Control	0.06	0.06 A	0.16 A	0.13 A	0.10 B
	<i>p</i>-value	0.1836	0.6573	0.0391	0.0051	0.0014
Nodule number	Biochar	0 A	2.4 B	7 AB	7 B	6 B
	Bagasse	10 A	46 A	60 A	35 A	59 A
	Control	0 A	0 B	0 B	0 B	0 B
	<i>p</i>-value	0.2492	0.0046	0.0248	0.0008	0.0068
Nodule weight (mg)	Biochar	0.00 A	0.07 B	0.59 B	0.77 B	0.30 B
	Bagasse	3.47 A	13.21 A	24.73 A	17.78 A	20.09 A
	Control	0.00 A	0.00 B	0.00 B	0.00 B	0.00 B
	<i>p</i>-value	0.1660	0.0025	0.0001	<0.0001	<0.0001