

Supplementary Material

Biochar enriched compost elevates mungbean (*Vigna radiata* L.) yield under different salt stresses

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Biochar was produced from sawdust in a slow pyrolysis biochar kiln for 10 hr at ~ 400°C (Mia et al., 2015). The freshly prepared biochar was activated following a biological method using microorganisms collected from soil and nutrient solution. Soil microorganisms were collected from three different soils (i.e., grasslands, crop field and forest) by shaking at 120 rpm with water (1:10, m/v) while a nutrient solutions was prepared using macro and micro-nutrients (Table S1). Additionally, we used labile organic carbon source to promote microbial growth. After inoculation and addition of nutrient solution (60% moisture content), the mixture was incubated for 15 day in a climate chamber (GC-300TL, Korea) at two different temperatures cycle (40°C and 25°C for 12 hr). The relative humidity of the chamber was at 90% while 12 hr light/dark period were also maintained. At the end of incubation, the pH of biochar was adjusted to the pH freshly prepared biochar (6.50). Next, this biochar slurry was washed thoroughly with DI water to remove excess salts and then dried at 105 °C.

Table S1. Nutrient addition for activation of biochar

Nutrients	Concentration (mg L⁻¹)
CaCl ₂	375
CuSO ₄	60
Na ₂ HPO ₄	70
MgSO ₄	240
ZnSO ₄	60
NH ₃ SO ₄	480
NH ₃ SO ₄	480
MnSO ₄	480
Dextrose	95.606

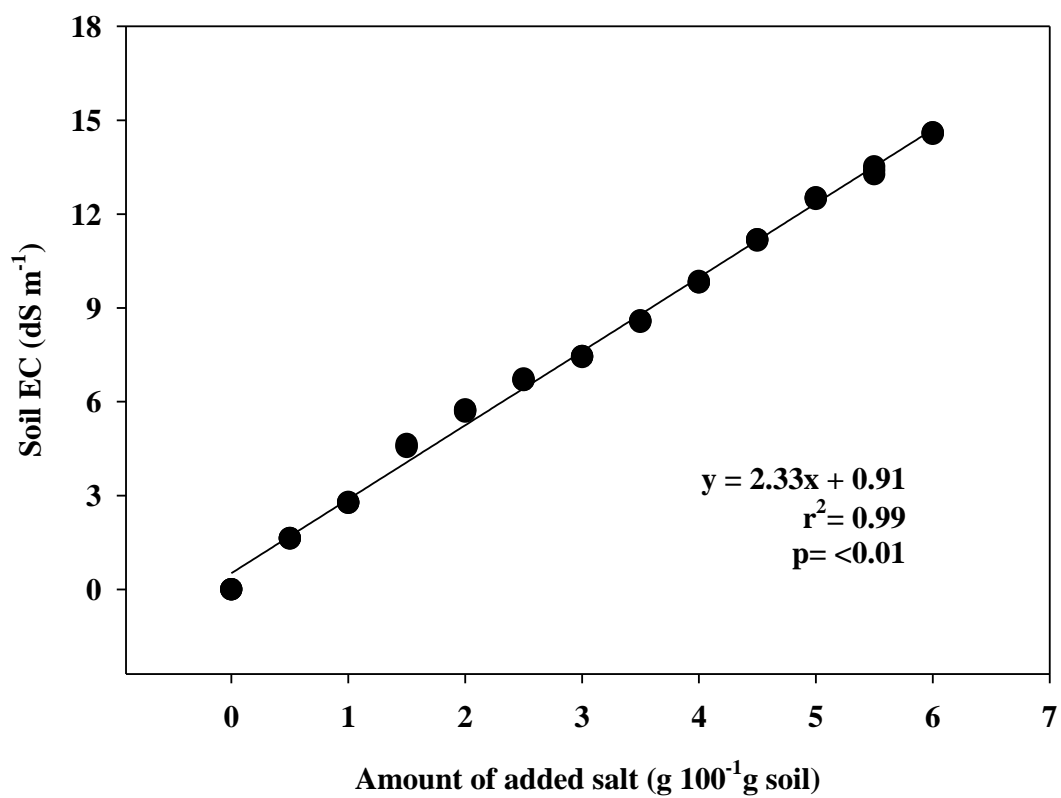


Fig. S1.The relationship between salt addition and electrical conductivity development in soil



Fig. S2. Experimental units with different biochar-compost application rates.

Table S2. Nutrients status of soil

Nutrients	Concentration
pH	7.5
EC	6.34 dS m ⁻¹
Organic matter	1.42%
Total N	0.071%
P	8.49 µg g ⁻¹ Soil
K	0.8 Meq 100g ⁻¹ soil
S	13.40 µg g ⁻¹ Soil
B	0.59 µg g ⁻¹ Soil

Calculation of relative performance

Relative performance was calculated as follows-

$$\text{Relative performance (\%)} = \frac{(\text{Treatment value} - \text{Control value})}{\text{Control value}} \times 100$$

Table S3. Soil properties after harvesting of rice

Treatment	pH	EC (dS m⁻¹)	NH₄⁺ (mg kg⁻¹ soil)	NO₃⁻ (mg kg⁻¹ soil)	Phosphorus (mg kg⁻¹ soil)	Organic matter (%)	Aromatic organic matter (%)	Total organic matter (%)
Control	7.80±0.015d	0.15±0.002e	29.77±0.32e	18.60±0.56e	1.63±0.09f	4.18±0.27	2.29±0.14b	6.48±0.22c
Cow-urine	8.32±0.028a	0.32±0.01a	30.68±0.43e	22.72±0.49d	2.59±0.08e	4.20±0.25	2.60±0.15ab	6.81±0.31abc
Compost	8.01±0.047c	0.19±0.003d	32.57±0.24d	30.52±0.55c	3.58±0.12d	4.41±0.27	2.77±0.16ab	7.19±0.39ab
Biochar compost	7.89±0.034d	0.17±0.005de	34.49±0.93c	31.75±0.26bc	4.25±0.04c	4.50±0.31	2.85±0.15a	7.35±0.37a
Compost with cow urine	8.12±0.023b	0.24±0.006b	40.30±0.39b	32.73±0.28ab	4.69±0.06b	3.92±0.22	2.66±0.17ab	6.59±0.34bc
Biochar compost with cow urine	8.09±0.006bc	0.21±0.006c	44.92±0.70a	34.64±0.26a	5.65±0.10a	3.84±0.21	2.76±0.11ab	6.61±0.20bc
<i>P</i> value	<0.01	<0.01	<0.01	<0.01	<0.01	0.154	0.05	0.041

Table S4. Biochar-compost application rates affects plant performance (mean \pm SE)

Biochar compost (%)	Plant height (cm)	No. of leaf plant⁻¹	Dry weight of plant (g)	Soil pH	Soil EC (dS m⁻¹)	Evapotranspiration rate day⁻¹ (ml)
0	6.90 \pm 0.57c	5.25 \pm 0.48c	1.17 \pm 0.10d	7.71 \pm 0.15d	1.82 \pm 0.27a	16.6 \pm 1.2a
1	7.18 \pm 0.61c	5.55 \pm 0.55c	1.22 \pm 0.10c	7.84 \pm 0.13c	1.64 \pm 0.16b	13.0 \pm 0.7b
2	7.76 \pm 0.62b	6.15 \pm 0.53b	1.32 \pm 0.11b	7.97 \pm 0.12b	1.56 \pm 0.11c	10.4 \pm 0.5c
3	8.52 \pm 0.83a	6.80 \pm 0.71a	1.45 \pm 0.14a	8.07 \pm 0.12a	1.51 \pm 0.08c	6.8 \pm 0.5d
<i>P</i> Value	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Table S1. Effect of salt addition

Salt addition (dS m ⁻¹)	Plant height (cm)	No. of leaf plant⁻¹	Dry weight of Plant (g)	Soil pH	Soil EC (dS m ⁻¹)	Evapotranspiration rate day⁻¹ (ml)
0	12.26±0.47a	9.88±0.42a	2.08±0.08a	6.98±0.05e	0.93±0.06e	15.81±1.32a
2	8.76±0.13b	7.00±0.16b	1.49±0.02b	7.64±0.07d	1.23±0.02d	14.06±1.21b
4	7.08±0.11c	5.63±0.13c	1.20±0.02c	8.03±0.01c	1.39±0.01c	11.88±0.89c
8	5.86±0.12d	4.50±0.13d	1.00±0.02d	8.23±0.03b	1.76±0.05b	9.19±0.75d
12	3.97±0.13e	2.69±0.15e	0.67±0.02e	8.62±0.02a	2.87±0.18a	7.50±0.67e
<i>P</i> Value	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Table S6. Residual effect of different organic amendments on growth and yield related attributes of mungbean (BARI Mung 6)

Organic amendments	Plant height (cm)	No. of leaf plant⁻¹	No. of pod plant⁻¹	No. of seed pod⁻¹	No. of seed plant⁻¹	Wt. of seed plant⁻¹ (g)	Dry wt. of plant (g)	No. of nodule plant⁻¹
T₁	29.78±0.85 bc	14.78±0.43 d	11.11±0.87 c	4.67±0.37	53.56±6.81 e	1.95±0.25 e	3.37±0.32 bc	11.22±1.20
T₂	33.05±2.26 abc	15.67±0.33 cd	11.88±0.75 bc	5.00±0.28	60.44±5.98 d	2.31±0.23 d	4.83±0.67 ab	7.11±0.99
T₃	31.27±1.64 abc	16.22±0.43 bcd	13.00±0.72 abc	5.11±0.30	66.33±5.09 cd	2.64±0.21 c	3.94±0.62 abc	11.78±2.18
T₄	29.00±1.05 c	17.11±0.65 abc	13.88±0.51 ab	5.11±0.26	70.89±4.30 cd	2.92±0.18 b	3.08±0.39 c	10.00±1.33
T₅	34.35±1.07 a	17.89±0.65 ab	14.33±0.52 a	5.33±0.23	76.33±4.09 ab	3.24±0.18 a	5.09±0.40 a	11.00±1.50
T₆	33.78±1.61 a	18.56±0.66 a	15.00±0.40 a	5.44±0.24	81.44±3.69 a	3.50±0.16 a	4.87±0.61 a	10.11±1.38
P value	0.0024	<0.01	<0.01	0.19	<0.01	<0.01	0.03	0.11

T₁- Control, T₂- Cow urine, T₃- Compost, T₄- Compost with cow urine, T₅- Biochar compost, T₆- Biochar compost with cow urine

Table S7: Effect of different salinity treatments on growth and yield related attributes of mungbean (BARI Mung 6)

Salinity (dS m⁻¹)	Plant height (cm)	No. of leaf plant⁻¹	No. of pod plant⁻¹	No. of seed pod⁻¹	No. of seed plant⁻¹	Wt. of seed plant⁻¹ (g)	Dry wt. of plant (g)	No. of nodule Plant⁻¹
0	34.45±0.95 a	17.56±0.41 a	14.44±0.37 a	5.61±0.11 a	80.72±2.06 a	3.29±0.12 a	11.94±0.95 a	5.12±0.36 a
3	33.61±0.76 a	17.11±0.52 a	13.72±0.40 a	5.44±0.14 a	74.05±1.82 b	3.07±0.10 b	11.67±1.17 a	4.81±0.29 a
6	27.56±0.84 b	15.44±0.35 b	11.44±0.58 b	4.27±0.17 b	49.72±3.68 c	1.99±0.17 c	7.00±0.55 b	2.66±0.25 b
P value	<0.01	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Table S8: Partial correlation of different variables

Traits	Plant height	No. of Leaf	SPAD value	No. of pod plant ⁻¹	No. of seed Pod ⁻¹	No. of Seed Plant ⁻¹	No. of nodule plant ⁻¹	Dry wt. of plant	Soil EC	Soil pH	Na	K	Na:K	P	Wt. of seeds plant ⁻¹
Plant height	.														
No. of Leaf	-0.13*														
SPAD value	-0.16*	0.20*													
No. of pod plant⁻¹	-0.24*	-0.08*	-0.17*												
No. of seed Pod⁻¹	-0.21*	-0.14*	-0.13*	-0.97*											
No. of Seed Plant⁻¹	-0.24*	-0.32*	0.04*	0.50*	0.49*										
No. of nodule plant⁻¹	0.07	0.04	-0.09*	0.09	0.11*	0.01*									
Dry wt. of plant	0.98*	0.16*	0.15*	0.24*	0.21*	0.26*	-0.09								
Soil EC	0.17*	0.05*	0.21	0.32*	0.28*	-0.09*	0.10	-0.18*							
Soil pH	-0.12	-0.24*	0.09*	0.06*	0.03	-0.59	-0.11	0.13	-0.12						
Na	-0.09*	0.16*	-0.52*	0.28*	0.31*	-0.12*	-0.05*	0.08*	-0.14*	0.38					
K	-0.17*	-0.32*	0.30*	-0.24*	-0.30*	-0.24*	0.14	0.17*	0.26*	-0.07*	0.45*				
Na:K	-0.19*	-0.25*	0.29*	-0.59*	-0.59*	0.08*	0.12*	0.21*	0.41*	-0.32	0.83*	-0.54*			
P	-0.24*	-0.03*	0.07*	-0.01*	-0.01*	-0.30*	0.16*	0.29*	-0.14*	-0.21*	-0.29*	0.24*	0.10*		
Wt. of seeds plant⁻¹	0.37*	0.44*	0.03*	-0.01*	0.01*	0.85*	-0.05*	-0.40*	-0.03*	0.68*	-0.05*	0.45*	0.22*	0.36*	.