

Composted plant residue amendments in integration with *Trichoderma asperellum* suppresses above-ground diseases and improves the growth of cacao (*Theobroma cacao* L.)

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Cacao in Sulawesi, Indonesia

- ▶ Cacao, the source of chocolate, is a perennial tropical crop typically grown by smallholder farmers
- ▶ Currently, this crop suffers severe losses due to biotic and or abiotic stress factors
- ▶ Biotic factors, including plant diseases like vascular streak dieback (VSD) and Phytophthora pod rot (PPR)
- ▶ Abiotic factors such as high sunshine radiation and nutrient deficiency

The aim of research

- ▶ to characterize composted material with *Trichoderma* and
- ▶ evaluate its efficacy in controlling VSD and PPR diseases in the farm,
- ▶ improve nutrient uptake, reduce heavy metal, especially Ni uptake and increase cacao production

Why compost and Trichoderma

- ▶ Huge of plant residues around the cocoa farm
- ▶ Deficient soil nutrient content, N is around 0.13%, C-organic around 1.5%
- ▶ The tested compost is compatible with Trichoderma
- ▶ Trichoderma used is endophyte

Treatment

- ▶ First compost (gliricidia leaves, decayed empty stalks of oil palm, rice straw) + *Trichoderma asperellum*
- ▶ Second compost (gliricidia leaves, billygoat, rice straw) + *T. asperellum*
- ▶ Third compost (gliricidia leaves, coconut husk, rice straw)+ *T. asperellum*
- ▶ The compost applied was 10 kg/tree/year for cacao of 5-6 years old



Impact of treatment on vascular streak dieback (VSD)

Treatment and Control	Per cent of incidence, month post-treatment		
	1	3	5
Compost 1 + T. asperellum	16.6 ab	13.4 a	13.4 a
Compost 2 + T. asperellum	22.1 ab	18.7 a	15.9 a
Compost 3 + T. asperellum	13,6 a	13.6 a	13.7 a
Control	23,5 b	35.5 b	49.2 b

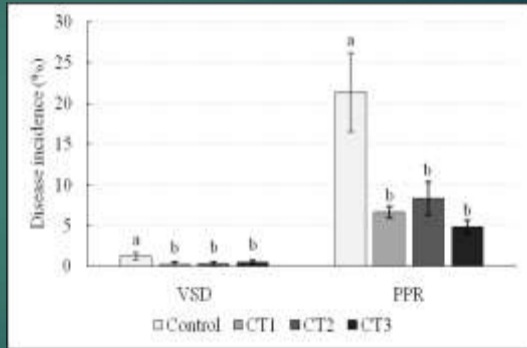


Impact of treatment on Phytophthora pod rot (PPR)

Treatment and Control	Per cent of incidence, month post-treatment			
	1	2	3	4
Compos 1 + <i>T. asperellum</i>	1.0 a	7.1 a	7.1 a	7.1 a
Compos 2 + <i>T. asperellum</i>	1.8 a	8.8 ab	9.8 ab	9.8 a
Compos 3 + <i>T. asperellum</i>	1.6 a	8.2 ab	8.6 ab	8.6 a
Control	3.1 a	14.1 b	17.2 b	20.1 b



Impact on VSD and PPR, two years post-treatment



Content of N, P, and K in leaves ten months after the first treatment

Treatment and control	Content of micro and macro elements in leaves			
	Ni (ppm)	N (%)	P (%)	K (%)
Compost 1 + T. asperellum	17.4 ab	0.86 b	0.07 a	0.36 b
Compost 2 + T. asperellum	13.0 a	0.82 b	0.06 a	0.38 b
Compost 3 + T. asperellum	16.1 ab	0.80 b	0.06 a	0.38 b
Control	21.3 b	0.72 a	0.06 a	0.30 a

Impact of treatment on pod production



Treatment and Control				Number of pod/tree
Compost <i>asperellum</i>	1	+	T.	33.9 a
Compost <i>asperellum</i>	2	+	T.	30.2 a
Compost <i>asperellum</i>	3	+	T.	28.3 a
Control				19,8 b

Conclusion and suggestion for application

- ▶ Composted plant residues with the right formula can react quickly to suppress disease and improve the growth of cocoa plants
- ▶ Compost application is mandatory due to soil nutrient depletion and global warming
- ▶ Observation in the field shows that routine application of compost by the farmers permits their farms to persist in diseases infestation, even with less shade coverage

Cocoa learning garden created by Cocoa Research Group (CRG)



Thanks you