



CHARACTERISATION RUSTICA BUILDING BLOCKS

Final report on lab-scale fertiliser ingredient characterisation

SHORT SUMMARY FOR PRACTITIONERS

EN version

The RUSTICA technologies will result in the production of several building blocks (microbial biomass, insect biomass and chitin, mineral concentrate, insect frass, biochar, compost), with a composition that is linked to the regional inputs from which they are produced. Each ingredient has specific fertiliser characteristics: for instance microbial biomass provides mainly N and P, and is slow-release; insect biomass is besides N, P and K rich in micronutrients and is also slow-release; insect chitin is a polymer with known biopesticide properties; mineral concentrate contains relatively pure nutrients in their mineral/inorganic form and are readily plant available; insect frass is mainly composed of insect faeces and contains both macronutrients and micronutrients and stabilised organic matter; biochar is mainly a soil amendment poor in nitrogen and stabilised carbon with a known beneficial effect on the water holding capacity of soils, but also prevents nutrient leaching; compost finally is a known soil amendment with slow nutrient release and stabilised organic matter, improving soil quality in water holding capacity and biodiversity. These different building blocks will be specific blended after the formulation based on regional customer wish, as defined by the regional multi-actor networks.

SHORT SUMMARY FOR PRACTITIONERS

NATIVE version

De RUSTICA-technologieën zullen resulteren in de productie van verschillende bouwstenen (microbiële biomassa, insectenbiomassa en chitine, mineralenconcentraat, insectenfrass, biochar, compost), met een samenstelling die is gekoppeld aan de regionale inputs waaruit ze worden geproduceerd. Elk ingrediënt heeft specifieke eigenschappen van meststoffen: zo levert microbiële biomassa voornamelijk N en P, en komt het langzaam vrij; insectenbiomassa is naast N, P en K rijk aan micronutriënten en komt ook langzaam vrij; insectenchitine is een polymeer met bekende biopesticide-eigenschappen; mineralenconcentraat bevat relatief zuivere voedingsstoffen in hun minerale/anorganische vorm en is direct plantbaar; insectenfrass bestaat voornamelijk uit insectenpoep en bevat zowel macronutriënten als micronutriënten en gestabiliseerde organische stof; biochar is voornamelijk een bodemverbeteraar arm aan stikstof en gestabiliseerde koolstof met een bekend gunstig effect op het waterhoudend vermogen van bodems, maar voorkomt ook uitspoeling van voedingsstoffen; compost tot slot is een bekende bodemverbeteraar met een langzame afgifte van voedingsstoffen en gestabiliseerd organisch materiaal, waardoor de bodemkwaliteit wat betreft het waterhoudend vermogen en de biodiversiteit verbetert. Deze verschillende bouwstenen zullen na de formulering specifiek worden gemengd op basis van de regionale klantwens, zoals gedefinieerd door de regionale multi-actornetwerken.



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CONTEXT

RUSTICA's ambition to develop circular plant-based fertilisers must be implemented in the 5 regions. The regional customer wishes about soil functioning because of RUSTICA fertiliser must be linked to the characterisation of the building blocks, and translated to measurable soil functionalities.

PROBLEM

Ranking the building blocks according to their nutritional value, or their contribution to soil biological activity (soil resilience, crop protection and mineralisation), or their impact on physical soil parameters.

APPROACH

The final results of characterisation of the building blocks are translated into nutritional value (= N:P:K availability for the crop), the EOM (remaining organic matter after 1 year) number as an indicator for soil structure improvement and the degree of biodegradability of the building blocks as indicator for biological activity.

OUTCOME

1. Biochar, preferentially produced from woody materials at 650°C, is not relevant for its nutritional value, however being valuable as a soil amendment for improvement of physical soil characteristics
2. Mineral concentrates is a liquid building block containing only mineral nutrients serving direct crop needs
3. Insect frass is a rather easy biodegradable building block suitable as a booster of soil life but also containing moderate levels of crop available nutrients, however rather rich in potassium
4. Insect biomass is an easy biodegradable building block suitable as a booster of soil life and supplying high levels of nitrogen to agricultural crops, potassium level is lower than in insect frass and phosphate is similar
5. Microbial biomass is a very easy biodegradable building block serving as a soil life booster, but at the same time containing high level of easily available nitrogen, phosphate and potassium.

PRACTICAL RECOMMENDATIONS

RBBF is an integral fertiliser, applied during and after a transition to a cultivation without or low input of mineral fertilisers. This transition basically involves:

- Building a "soil-inclusive" cultivation; namely, making use of the potential of the soil to feed and protect the crop itself (wholly or partly)
- Maintaining an acceptable harvest level (economy)



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EFFECTS OF RUSTICA BUILDING BLOCKS ON SOIL PROPERTIES

	Soil organic matter content (SOM)			Mineral availability	Activation of bioactivity
	Easy	Medium	Recalcitrant		
Biochar		+	++	-	-
Mineral concentrate	-	-		+	-
Microbial biomass	+/-	-	-	-	+
Insect frass	+	+/-		+/-	+
Insect biomass /chitin	+	+/-		+/-	+
Compost	++	+		+	+

Easy: biodegradable within 2 years;
Medium: biodegradable 2 > years > 5;
Recalcitrant: biodegradable >5 years

CORRELATION MATRIX SOIL PROPERTIES AND SOIL FUNCTIONALITIES

Soil functionalities	Higher mineralisation	Higher resilience	Change in plant available nutrients	Higher water holding capacity	Lower erosion sensitivity + CO ₂ capture
Soil properties					
Biological activity	+	+	+/-	-	-
Easy biodegradable SOM	+	+	+/-	-	-
Medium biodegradable SOM	+	+	-	+/-	+/-
Recalcitrant SOM	-	-	-	+	+
"Free" minerals	-	-	+	-	-

SOM: Soil Organic Matter
Easy biodegradable within 1 year
Medium biodegradable 1-2 years
Recalcitrant biodegradable >3 years
+: there is a correlation
+/-: there could be a correlation
-: there is no correlation