

Third-Party Validation

The following consists of a recent series of crop growth experiments carried out at Massachusetts Institute of Technology (MIT) in collaboration with the Media Laboratory. The results are currently being prepared in a scientific manuscript, but we have received the authors' permission to share these results.

This is the first time that the Takachar process has been tested with wheat crop. The test was carried out in pots as shown below in Figure 1. The control (samples 1-3) consisted of regular soil with fertilizer. The other experiments include two types of biomass residues: pine shavings and rice husks. For each type of biomass, three types of configurations were applied to the soil: untreated (raw) biomass (i.e. organic mulching), biomass processed with the Takachar process under two different chemical conditions: lightly torrefied, and biomass heavily torrefied.

Type of biomass	Pine shavings	Rice husks
Untreated	Samples 4-6	Samples 13-15
Lightly torrefied	Samples 7-9	Samples 16-18
Heavily torrefied	Samples 10-12	Samples 19-21

The samples were grown outdoors for 3 months in the summer. Twice a week, each pot was fed with 500 mL of water. Then, the order of the pots (samples 1-21) were randomized using numbers generated from an online random number generator, to eliminate any potential biases originating from the location or position of the pots.

Results: As can be see in Table 1, the crop yield results from the various Takachar outputs show improvement, in many cases even superior to the organic mulching process. For rice husks, an average improvement of as much as 55% from the baseline (control) has been observed.

Figure 1. Pot experiments for testing effect of various torrefied biomass samples on soil



Table 1. Crop yield results for all 21 samples at start, middle, and end of the experiment

	Sample No.	Mass of grains after harvest (g)	Average mass of grains (g)	Percent yield change from control
Control	1	14.0	13.2 ± 1.1	-
	2	13.5		
	3	12.2		
Untreated pine shavings (mulching)	4	15.0	15.7 ± 1.2	18% ± 2%
	5	16.2		
	6	15.8		
Lightly torrefied pine shavings	7	17.1	14.8 ± 1.1	11% ± 3%
	8	13.2		
	9	14.1		
Heavily torrefied pine shavings	10	15.5	16.2 ± 1.2	22% ± 3%
	11	16.8		
	12	16.2		
Untreated rice husks (mulching)	13	15.0	15.0 ± 1.1	14% ± 2%
	14	14.6		
	15	15.5		
Lightly torrefied rice husks	16	15.8	15.7 ± 1.2	19% ± 3%
	17	17.1		
	18	14.3		
Heavily torrefied rice husks	19	21.4	20.5 ± 1.5	55% ± 7%
	20	19.6		
	21	20.5		