The effect of Cricket Frass fertilizer on the growth of Canola (c.v. Westar)

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Background:

- ❖ Insects, in particular crickets (cricket meal), Gryllodes Sigillatus, are being hailed as the animal protein of the future due to their sustainability and environmental friendliness (livestock feed, pet feed, human protein).
- ❖ A by-product of this protein production is cricket frass (mixture of insect manure and shed exoskeletons) which has shown promising evidence of being an effective, clean fertilizer.
- ❖ A pot study was conducted to test the impact of cricket frass on soil health indicators, as well as growth and seed yield of canola grown under the controlled environmental condition.

Methods:

- ❖ Canola (c.v. Westar) were grown with 4 different rates of frass within the two soils, one with a high level and one with a low level of organic matter and nutrients, over 82 days.
- ❖ These rates were 0% mix (control), 2.5% mix, 5% mix, and 7.5% mix (percentages based on soil volume). All treatments were arranged in a randomized complete block design (RCBD) with 4 replicates.
- ❖ Yield was measured in dry seed weight, and soil and plant material were analyzed for total nitrogen, nutrient content, and water retention.
- ❖ All pots were watered daily to maintain soil water content at optimal level for crop growth. Pots were kept in the University of Manitoba's temperature controlled greenhouse.

Seed yield being weighed

Canola being grown in GH

Raw frass before mix with soil

Results and Discussion:

- ❖ Canola seed yield was significantly larger in plants treated with frass, especially the 2.5% and 5% mix. 2.5% and 5% in both soil types showed at minimum a 3200% mean increase in seed weight compared to control groups. Weight is measured in grams. Control groups showed almost no yield, with some producing zero seeds.

seed yield						Soil 2	Control	2.5	5	7.5
							0	1.5	5.67	0.75
Soil 1	Control	2.5	5	7.5			0.15	4.87	2.15	1.8
	0	2.77	0.69	0.28			0.24	4.56	1.42	0
	0	0.56	3.11	1.3			0	3.05	3.75	2.74
	0	1.8	4.11	0.44		Mean	0.0975	3.495	3.2475	1.3225
	0.07	0.48	3.77	0.92		SAS	c	a	a	ab
Mean	0.0175	1.4025	2.92	0.735		p=0.008				
SAS	c	ab	a	b						
p=0.012										

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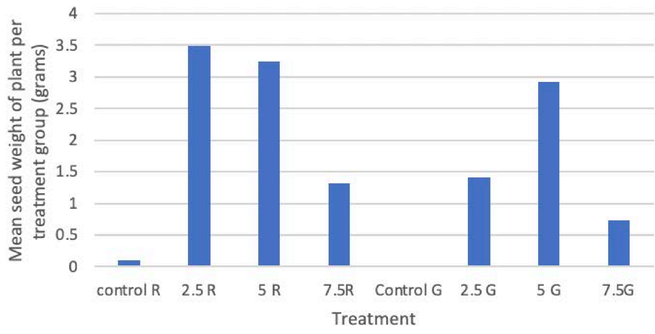
Results and Discussion:

- ❖ Soil Nitrate saw a significant increase in 2.5 (up 275%) and 5 (up 220%) levels, while seeing a smaller increase in the 7.5 (up 55%) level (compared to control).
- ❖ Soil K displayed an increasing trend, with a gradual increase from control to 7.5 level.
- ❖ Soil Biocarb-P showed an interesting consistent increase from control to 7.5 as well.
- ❖ Nutrient analysis in above ground plant tissue was recorded and found promising increases in S across all levels, and increases in TKN across all levels except for 0.06% drop from control to 2.5% in soil G.

Nutrient analysis in above-ground plant tissue

	TKN	P	K	S	Mg	Ca	Fe	Mn	Cu	Zn	B
	----------%----------						----------ppm----------				
Soil R											
Control	0.76	0.26	1.88	0.37	0.27	1.00	143	3.0	3.6	45.6	21.4
2.5	0.78	0.25	2.15	0.68	0.32	1.30	46	4.0	2.8	49.5	27.0
5	1.40	0.37	2.43	0.81	0.36	1.07	61	10.1	4.2	52.0	25.7
7.5	2.14	0.48	2.65	0.83	0.34	0.86	57	17.7	4.0	55.9	25.5
Soil G											
Control	1.13	0.24	1.85	0.56	0.36	2.00	137	11.7	4.5	47.8	34.3
2.5	1.07	0.29	2.13	0.67	0.26	1.53	101	6.5	3.6	28.7	31.0
5	1.35	0.31	2.01	0.79	0.23	1.33	151	23.4	3.7	94.6	32.3
7.5	1.96	0.36	1.97	0.79	0.26	1.15	193	34.1	4.0	43.0	27.2
ANOVA											
Soil type (S)	0.315	0.253	**0.045**	0.640	**0.031**	**<0.001**	**<0.001**	**0.009**	0.533	0.852	**0.036**
Frass rate (F)	**<0.001**	**0.006**	0.135	**0.004**	0.890	**0.005**	0.054	**0.001**	0.425	0.363	0.885
S x F	0.207	0.374	0.219	0.581	**0.012**	**0.040**	0.055	0.510	0.663	0.396	0.603



Soil Nitrate				
Soil1	Control	2.5	5	7.5
	2.5	10	20	5.5
	2.4	14	10	11
	3.3	18	4.1	2.7
	6.2	12	12	4.2
Mean	3.6	13.5	11.525	5.85
SAS	b	a	ab	ab
p=0.019				

Soil K				
Soil1	Control	2.5	5	7.5
	64	58	77	78
	57	65	73	98
	61	73	73	84
	57	59	70	110
Mean	59.75	63.75	73.25	92.5
SAS	b	b	b	a
p=0.006				

Soil Biocarb-P				
Soil1	Control	2.5	5	7.5
	6.4	24	87	85
	4.8	19	52	85
	4.2	39	60	94
	4.4	23	46	100
Mean	4.95	26.25	61.25	91
SAS	d	c	b	a
p<0.001				

Implications:

1) This study shows that the use of frass as a fertilizer is effective to improve soil nutrient availability and canola productivity.
2) Frass is produced in a sustainable and environmentally friendly manner, while being a chemical free, clean, organic fertilizer (tested fertilizer is not organic, as the feed fed to the insects contained GMOs, but organic frass is easily accessible). There is a bright future for frass in the upcoming age of clean agriculture.