A rapid food waste valorisation into organic fertilizer using a so called disruptive technology

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My talk will cover:

- Short description of the equipment
- Environmental Performance from its Use
- Plant nutrient properties of the product derived from foodwaste
- Growing trial using grass as a model crop and comparison with composted biowaste and composted green waste
- Emphasis on nutrient content and release over 5 + months with emphasis on N, P and K
- Residual nutrient level in the soil after cropping
- Conclusion

Harp’s Bio-Technology

How It Works

The Harp Bio-Digester’s on-board processor controls the internal parameters, such as temperature, pH, moisture, oxidation, and surface area, for optimum organic breakdown, achieving a decomposition phase within 24 Hours.

Weight & Volume Reductions

70-85%

Processing Time

24 Hours

1 Kg Food Waste

After 24 Hours

+- 250g Biofertiliz er

Harp’s Bio-Technology

End-Product

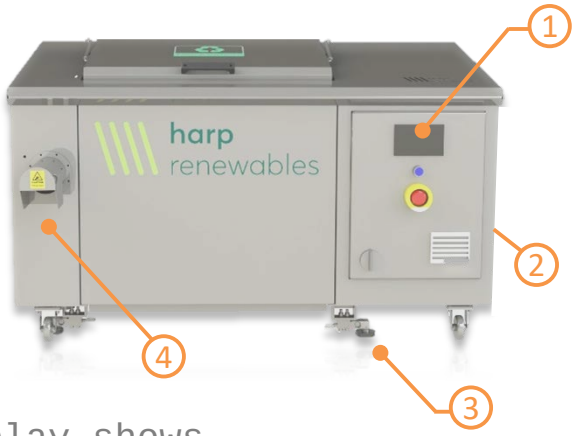
Weight & Volume Reductions

70-85%

Processing Time

24 Hours

Harp’s Bio-Technology
Features



1 Touch Screen Computerised Control

An easy-to-use on-board touch screen display shows the status, history and performance of the Bio-Digester

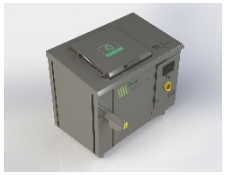
2 Active Carbon Filtration System

Harp’s Filtration System treats all potential environmental pollutants by ensuring they are below 1 part per million

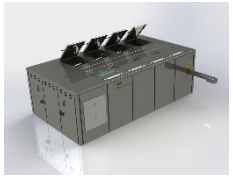
3 Load Cells for Automatic Waste Reporting

Door and Weight Sensors track and record times, dates, volumes and weights onto a downloadable CSV file

Bio-Digester™ Product Line





System	CX1	CX2	CX5	CX10	CX20	CX50
Daily Weight Input Capacity [3] (Metric and US.)	**Up to 71kg**	**Up to 143kg**	**357kg**	**714kg**	**1429kg**	**3572kg**
Monthly Input Capacity [1,3]	**2.16 Tonnes**	**4.33 Tonnes**	**10.8 Tonnes**	**21.7 Tonnes**	**43.3 Tonnes**	**108.3 Tonnes**
Monthly Bio-Product Production [2,4]	**0.65 Tonnes**	**1.3 Tonnes**	**3.25 Tonnes**	**6.5 Tonnes**	**13 Tonnes**	**32.5 Tonnes**
Equipment Footprint (Length/Width/Height)	**1.3 x 1.1 x 1.2 metres**	**1.9 x 1.3 x 1.2 metres**	**3.7 x 1.7 x 1.5 metres**	**5 x 1.78 x 1.88 metres**	**5.7 x 2.2 x 2.15 metres**	**8 x 5.2 x 2.5 metres**

[1] 30-day month
[2] Assumes 75% conversion; 25% residual material by weight
[3] Assumes Bulk Density of 0.4818 Kg/L
[4] Assumes Bulk Density of 0.5980 Kg/L

Environmental Performance

Emissions

- ✓ **VOC <0.278 mg/m3**
- ✓ **Respiratory Dust <0.5 mg/m3**
- ✓ **Hydrogen Sulphide < 0.1ppm**
- ✓ **Ammonia <0.1 ppm**

Air Quality Certificate of Analysis

SAL Reference: 621411
Customer Reference: HARP RENEWABLES

Filter+PUF IOM Analysed as Filter+PUF IOM
Miscellaneous

					SAL Reference	621411 002	621411 004
					Customer Sample Reference	1. DIGESTOS FILTER+FOAM	2.BLANK FILTER+FOAM
					Test Sample	AR	AR
Determinand	**Method**	**LOD**	**Units**	**Symbol**			
Total inhalable dust	Grav (5 Dec)	0.10	mg	U		<0.10	<0.10

SAL Reference: 621411
Customer Reference: HARP RENEWABLES

Filter IOM Analysed as Filter IOM
Miscellaneous

					SAL Reference	621411 001	621411 003
					Customer Sample Reference	1. DIGESTOS FILTER+FOAM	2.BLANK FILTER+FOAM
					Test Sample	AR	AR
Determinand	**Method**	**LOD**	**Units**	**Symbol**			
Respirable Dust	Grav (5 Dec)	0.05	mg	U		0.15	<0.05

SAL Reference: 621411
Customer Reference: HARP RENEWABLES

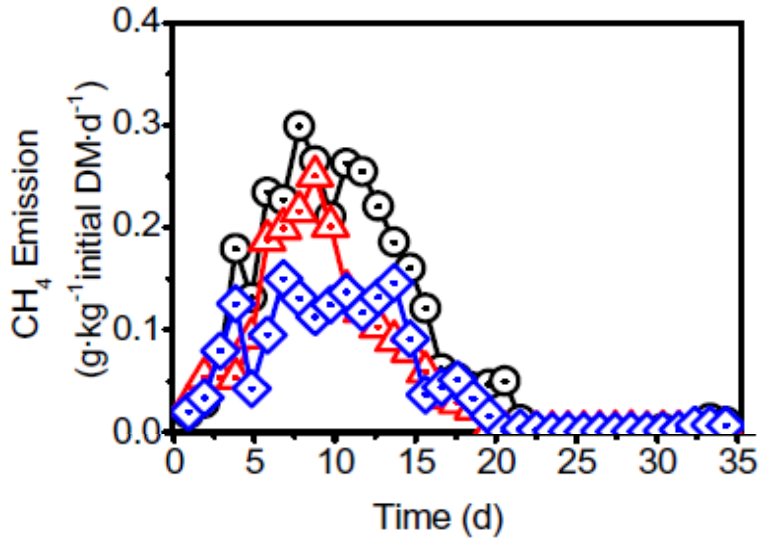
Tube (Charcoal 226-09) Analysed as Tube (Charcoal 226-09)
Top 10 screen

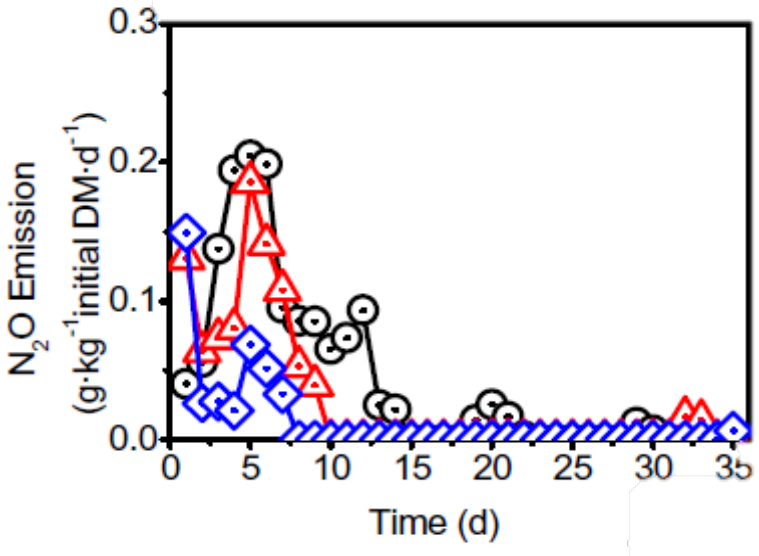
					SAL Reference	621411 005	621411 006
					Customer Sample Reference	3. DIGESTOS VOC	4. BLANK VOC
					Test Sample	AR	AR
Determinand	**Method**	**LOD**	**Units**	**Symbol**			
Number of additional significant peaks	Calc			N		N.D.	N.D.
VOC (Total excluding targets)	GC/MS	1	µg	N		2	<1
Volatile Organic Compounds (Top 10 Screen)	GC/MS	10	µg	N		<10	<10

Corporate social responsibility

Unknown On-site Emissions and Foul Odours(brown bin,EU)

Academic research on composting, concludes that over 80% of the CH4 and N2O is produced during this active phase





Growing Trial

- **Application Rate** : The three materials (Harp/Bionova, CGW, CBW . Brown bin)) applied on volume basis at 4 rates:

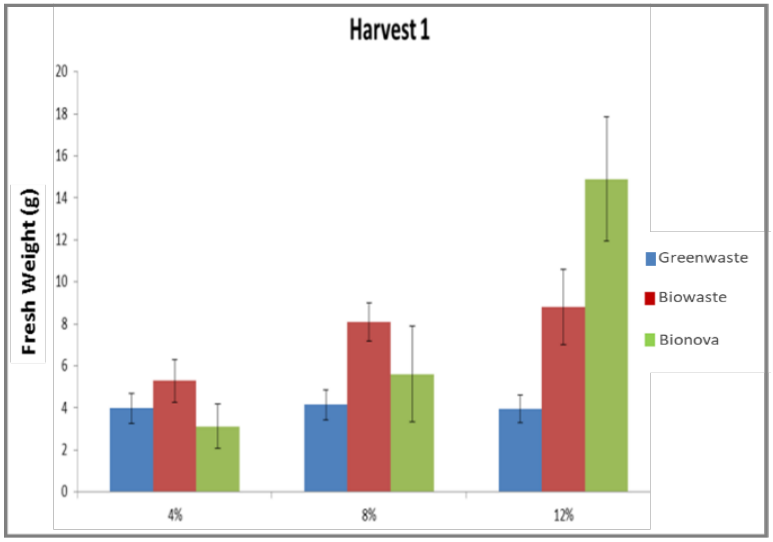
1. 0% (Control),
2. 4%,
3. 8%,
4. 12%

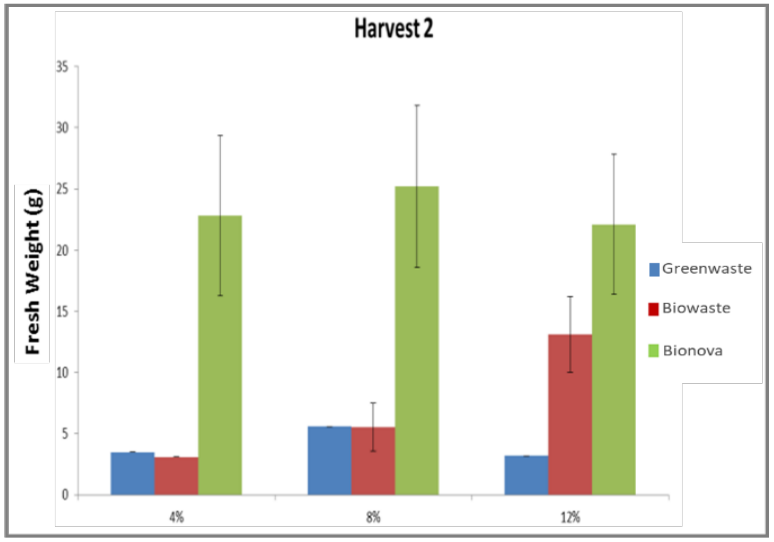
- **Crop** : Grass used as a model crop grown for 160 days (5+ Months)
- **Parameter** : 4 Harvests, Fresh matter yield, Dry matter yield ,N , P and K (and other macronutrients) analysed.
- **Nutrient Uptake** : calculated with emphasis on N.P and K
- **Residual Nutrients** : Soil after 4 harvests analysed for residual total N, available P and available K (Mehlich extract)

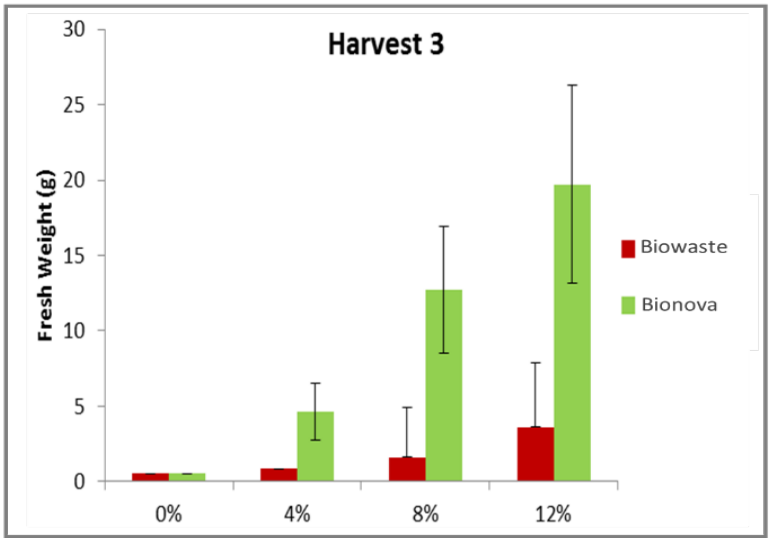
Some physical and chemical characteristics of the material tested

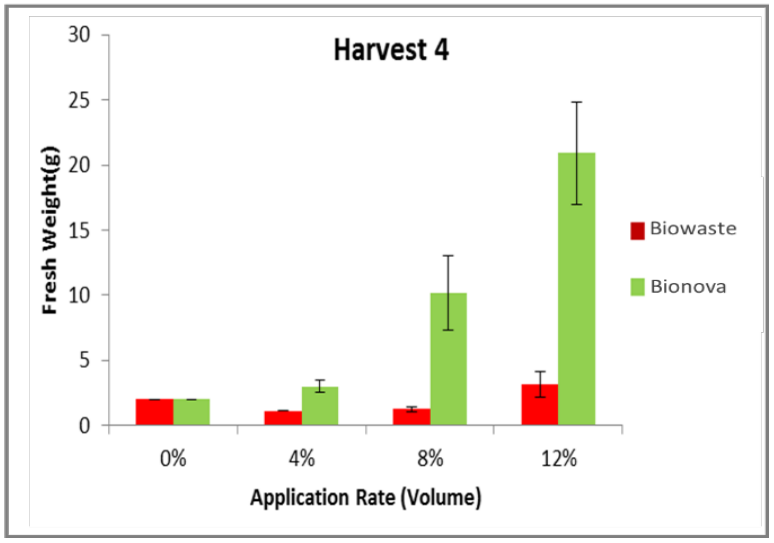
Material	Bulk Density (g/L)	Organic C (%)	TKN (%)	CAT NH4-N (g/L)	CAT NO3-N (g/L)	Ava.N	CAT -P (g/L)	CAT-K (g/L)
BioNova	570	52	3.09	0.4274	0.1038	0.5312	1.224	12.008
Green waste	577	26.5	2.33	0.079	0.1225	0.2015	8.442	8.442
Biowaste	620	13.4	1.86	0.227	0.2115	0.429	2.471	2.471

Comparative fresh weight recovery for composts and BioNova material over 4 harvest periods

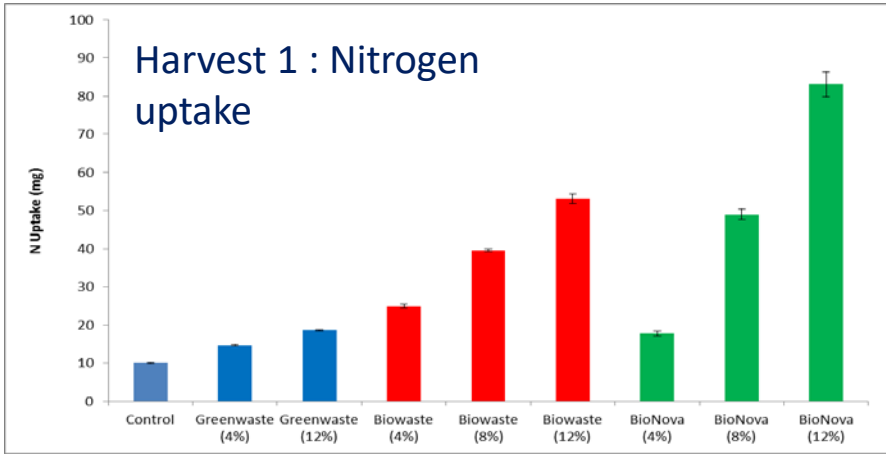


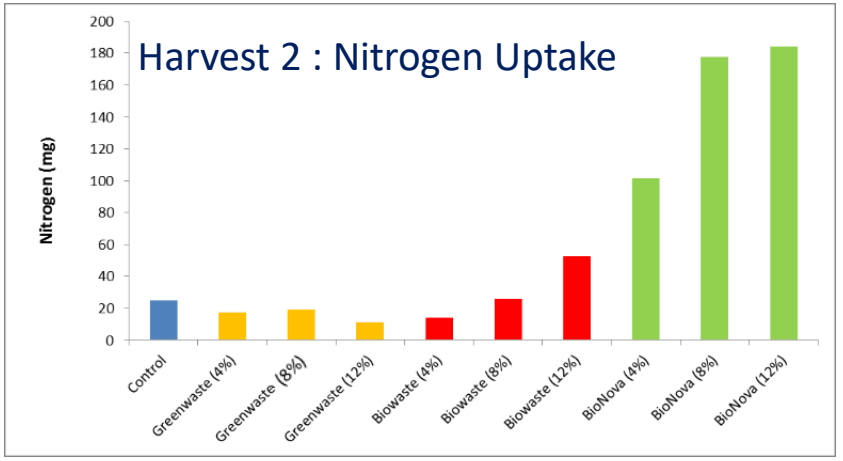


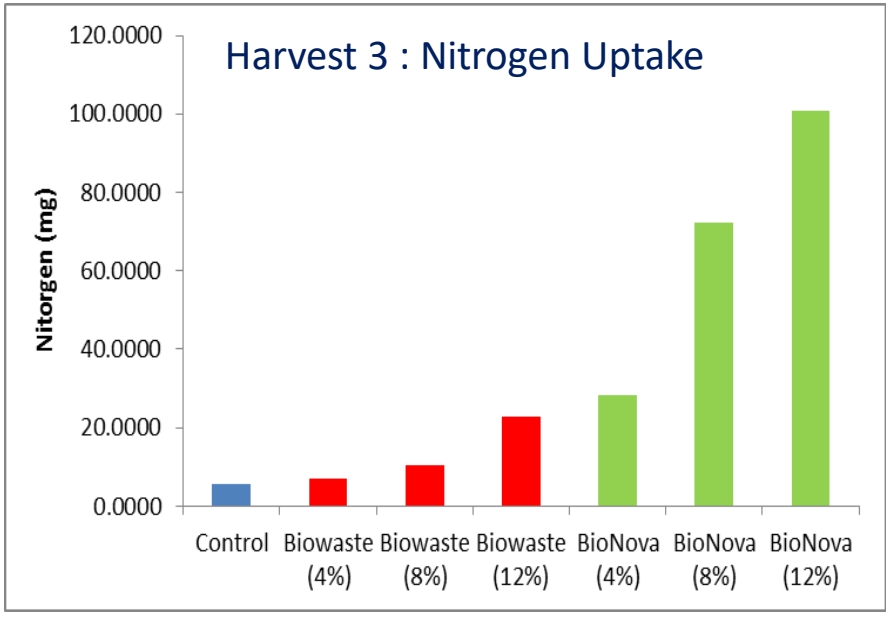


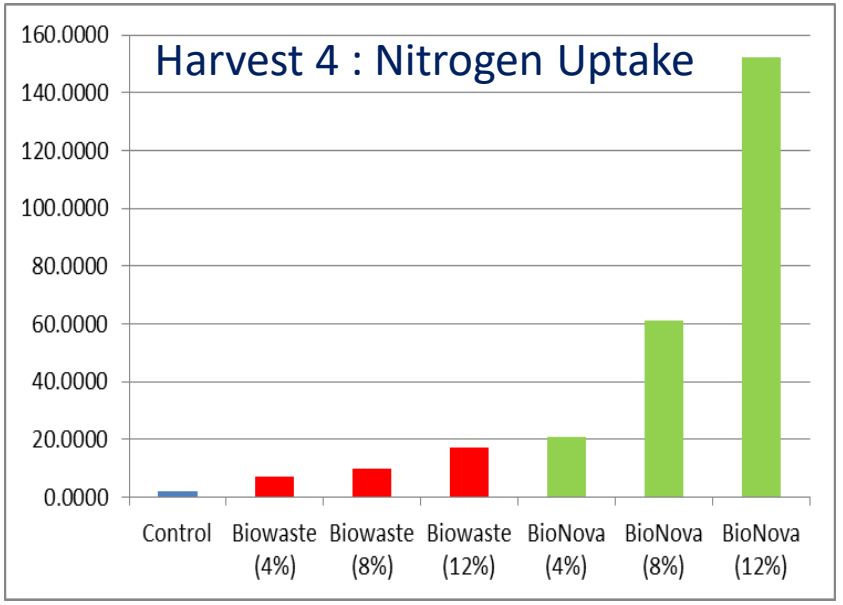


Nitrogen uptake from various materials over 4 harvests

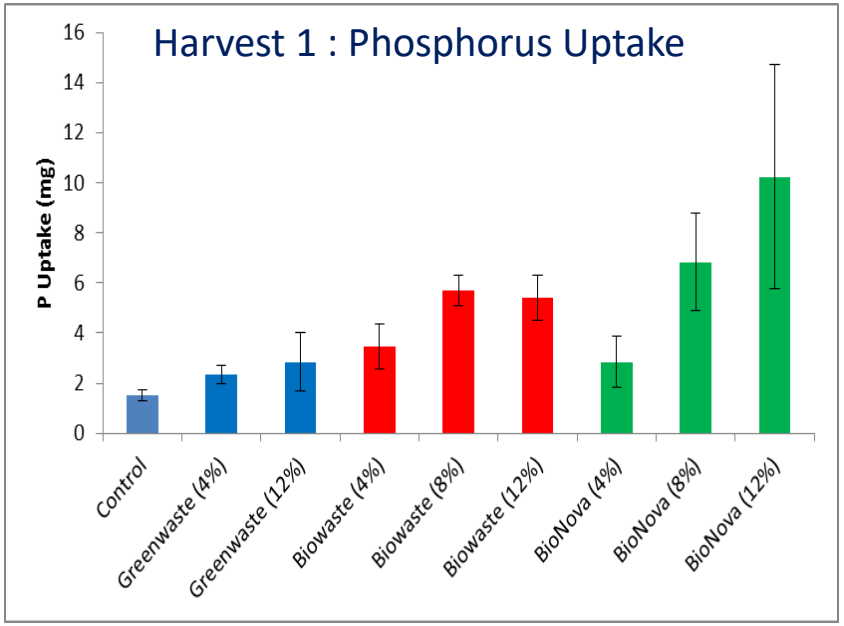


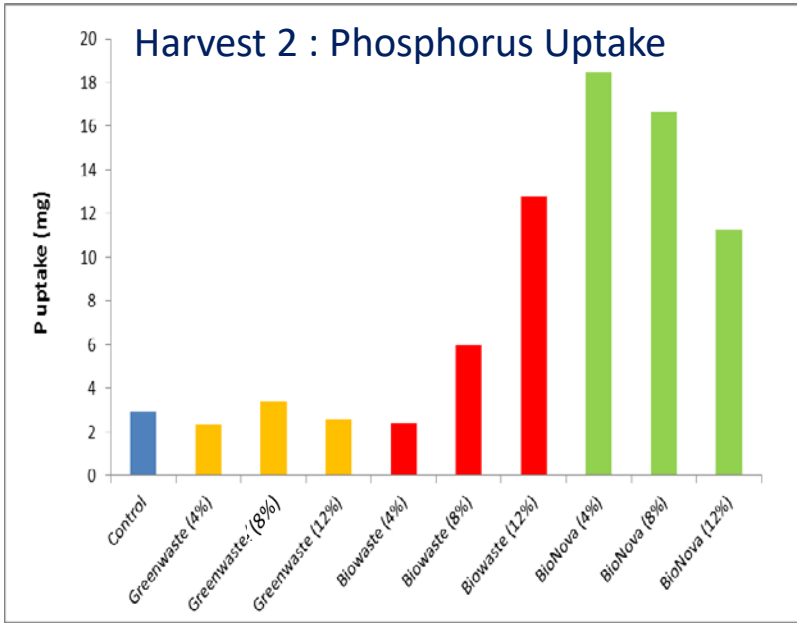


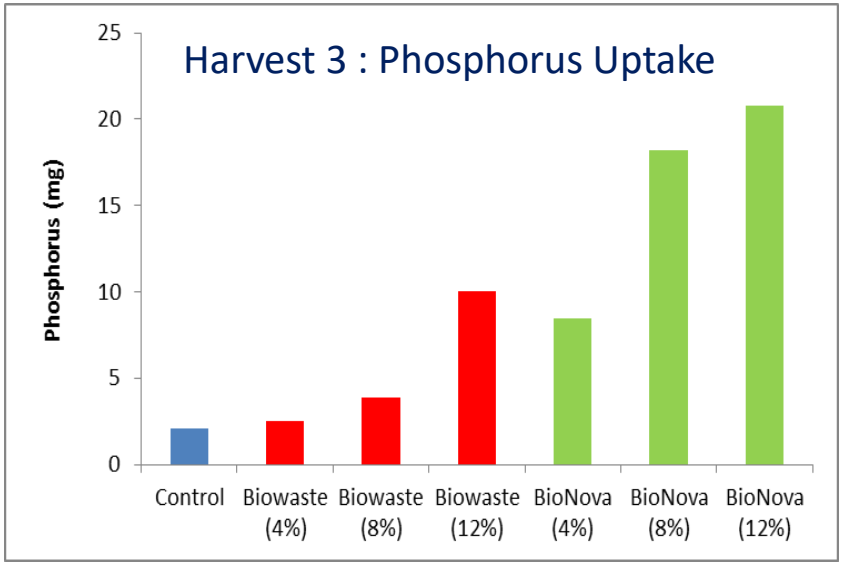


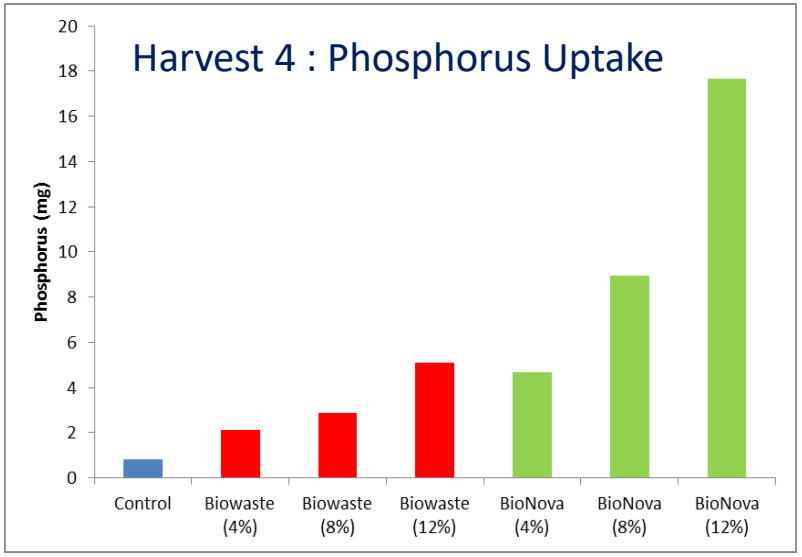


Phosphorus uptake from various materials over 4 harvests

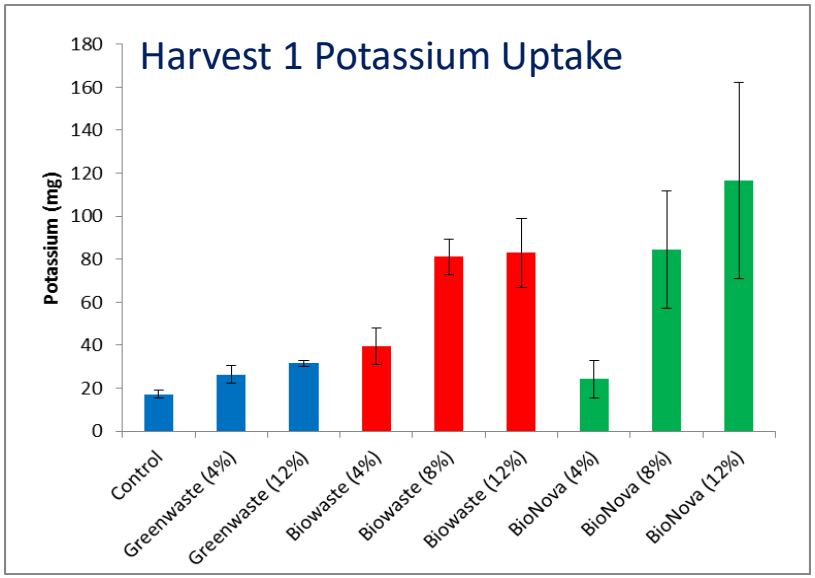


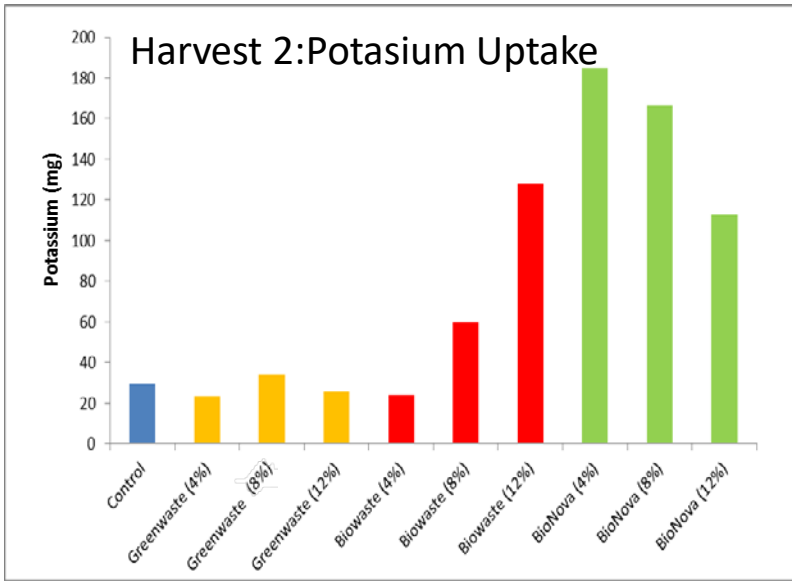


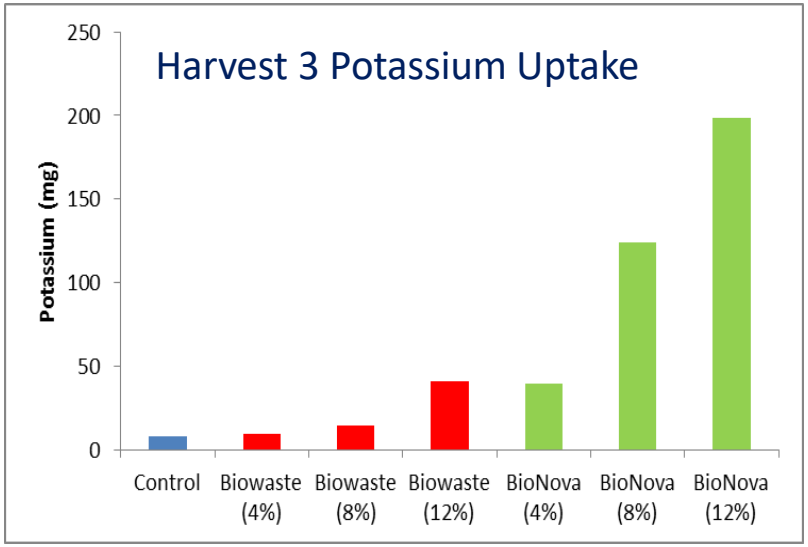


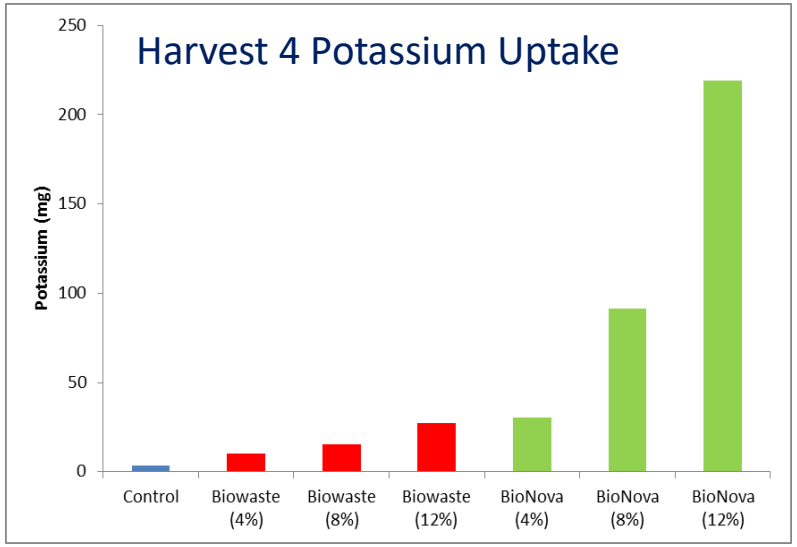


Potassium uptake from various materials over 4 harvests

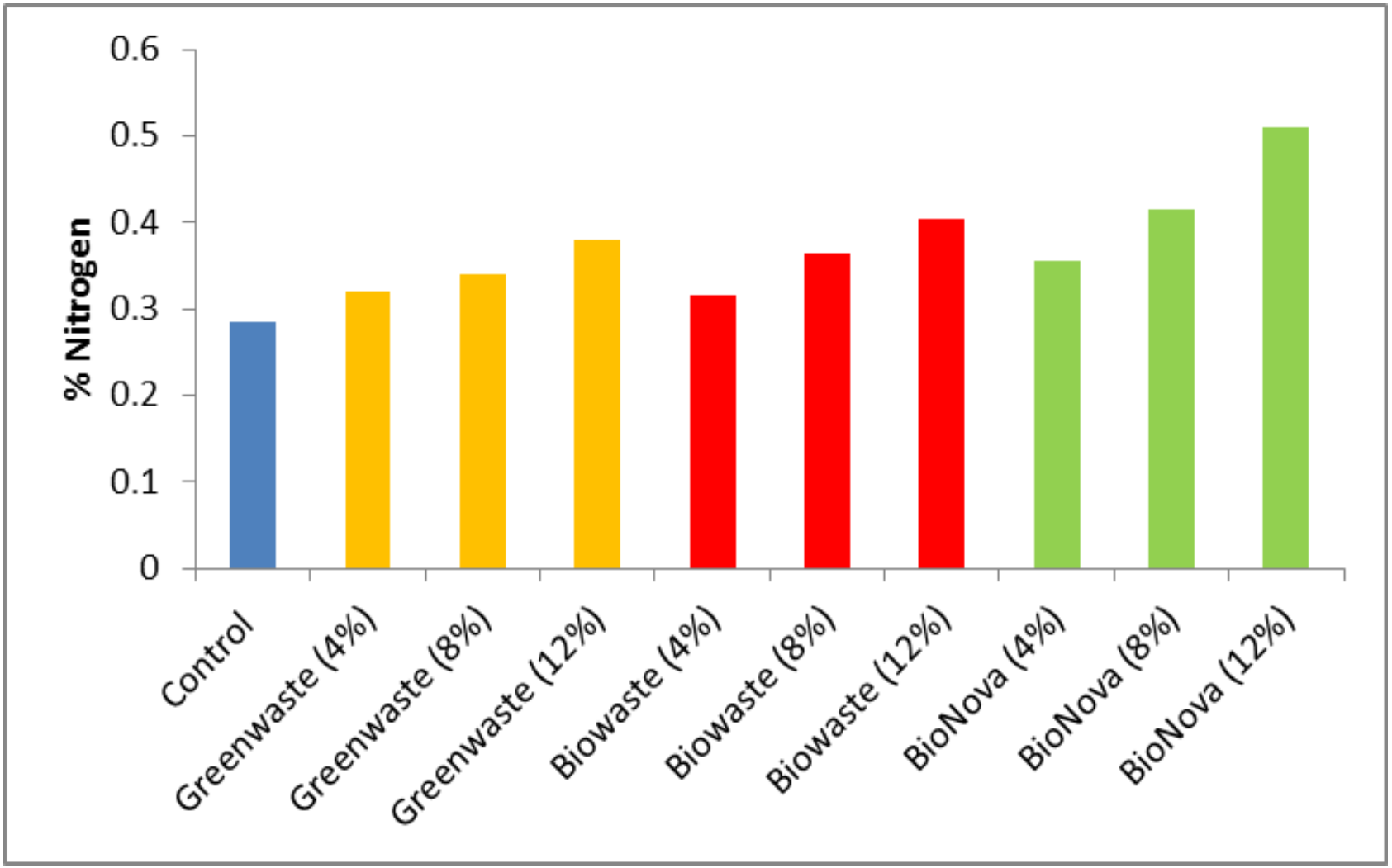




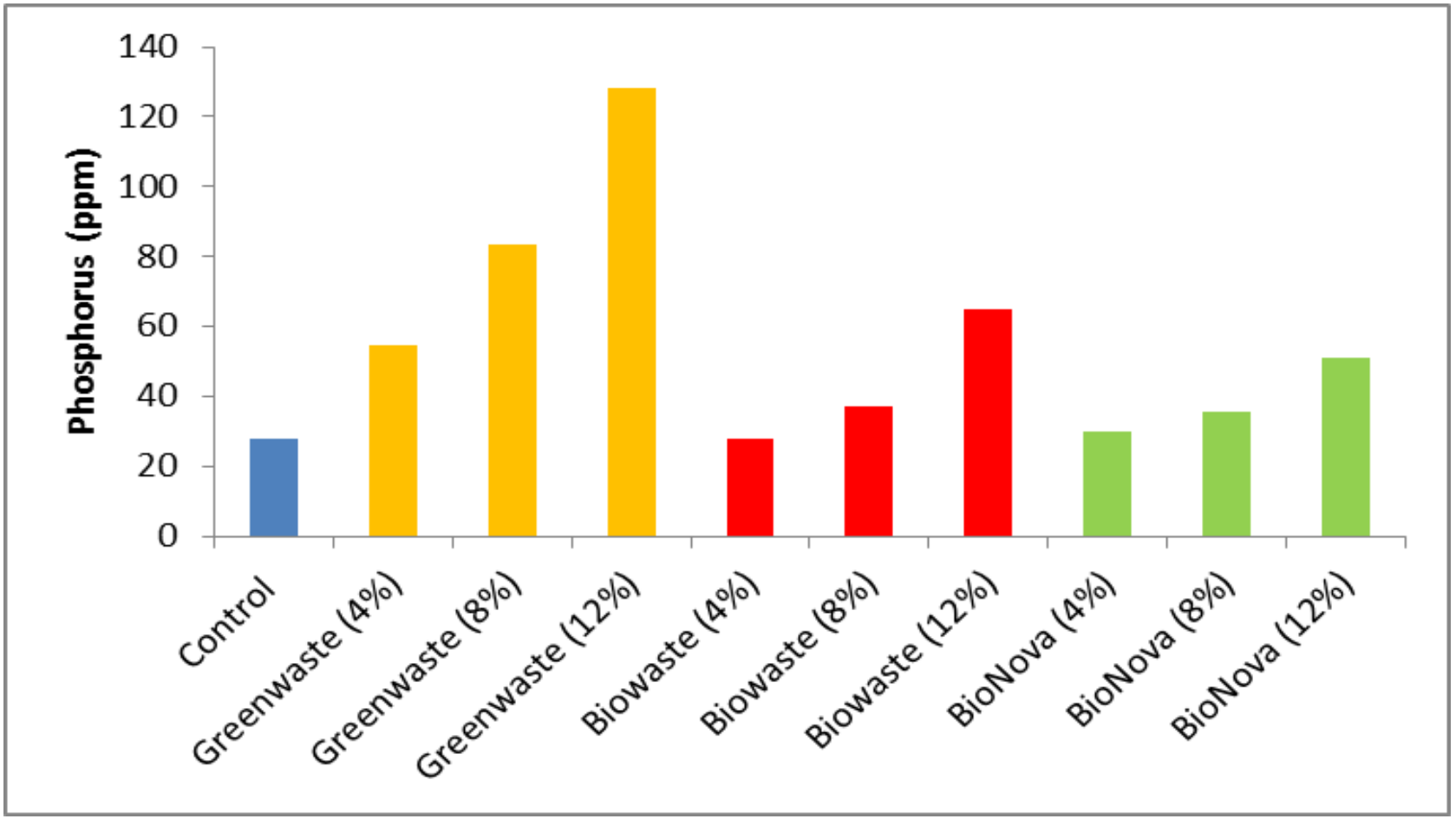




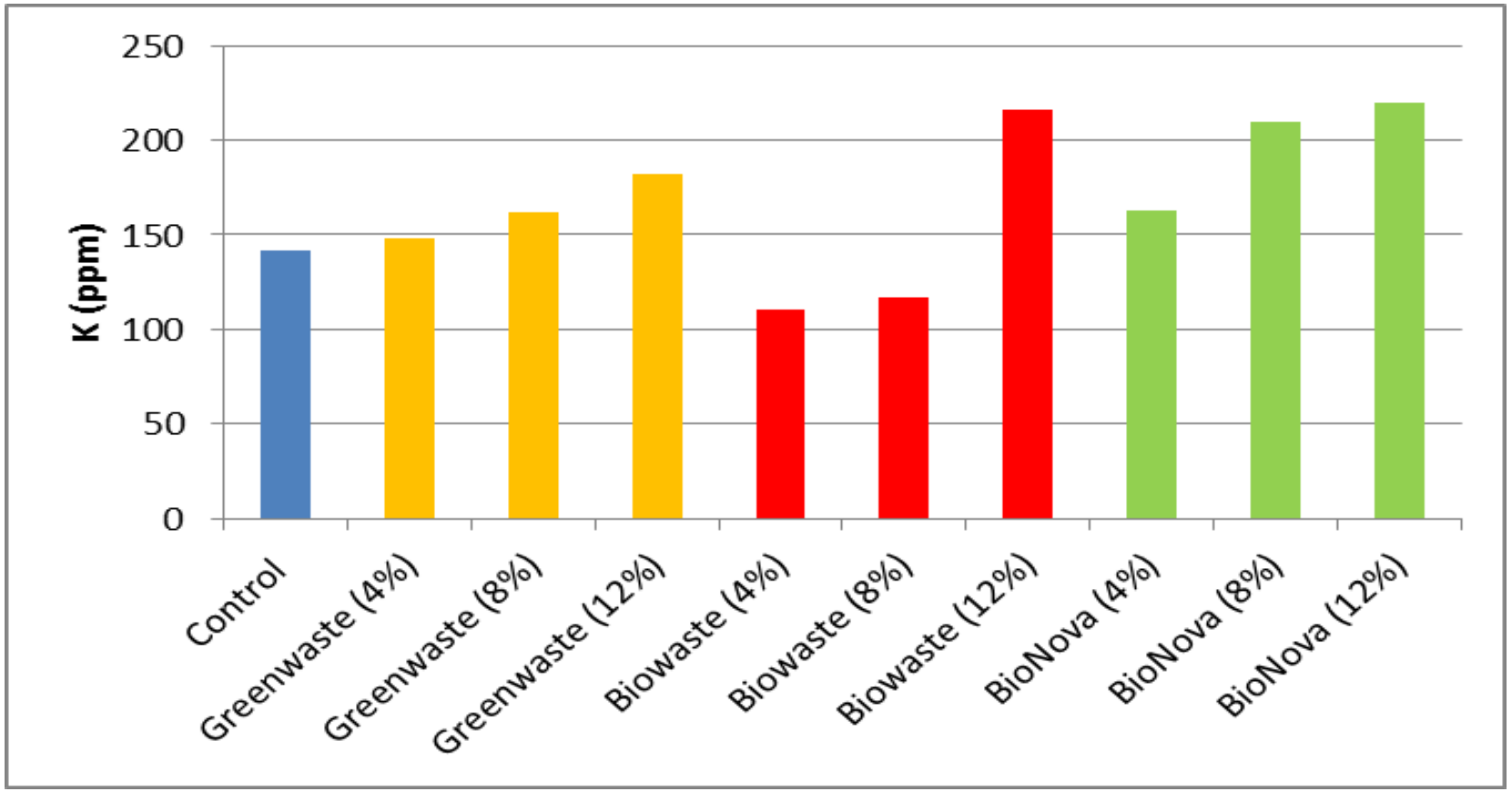
Soil Analysis: Post Experiment: Nitrogen



Soil Analysis: Post Experiment: Phosphorus



Soil Analysis: Post Experiment:Potassium

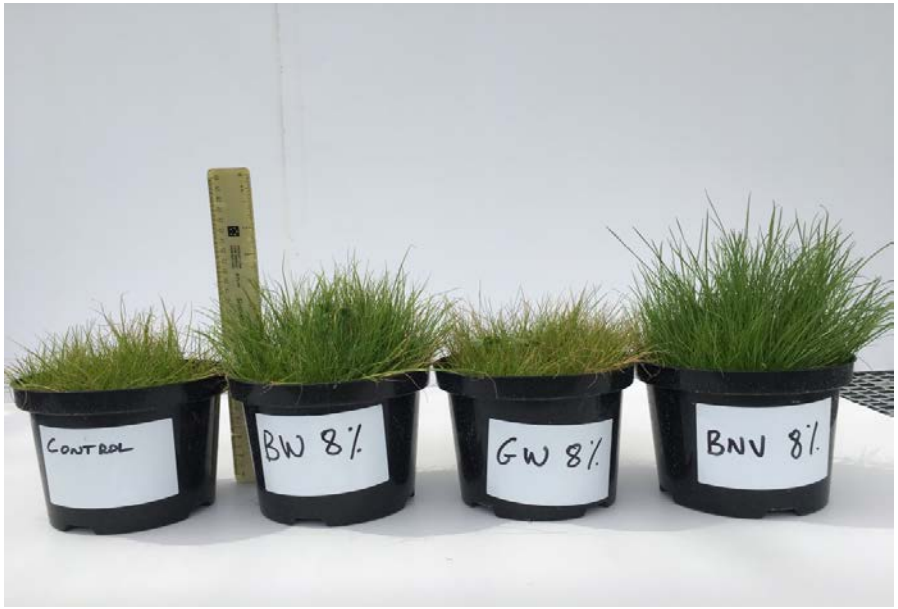


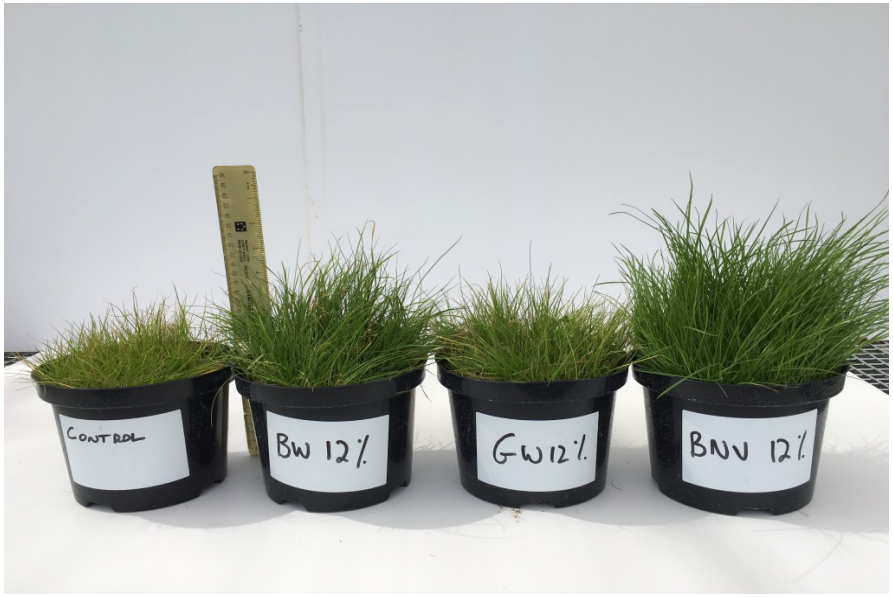
Conclusion

- Ideal for processing foodwaste, processed within **24 hours**
- High potential as a possible replacement for mineral N fertilizer and P fertilizer(Mineral N fertilizer production leads to high GHG emissions while P is considered as a critical raw material by the EU)
- Low in losses of GHG e.g. ammonia during processing and high Carbon content retained.
- Better Environmental Performance than Industrial food waste Composting?
- High nutrient availability and prolonged nutrient release
- Low moisture content and large volume reduction
- Fits in with the EU strong policy on Circular Economy
- Fits in also with new EU Fertilizer Regulations

Thank you for your attention, any questions?

Growing Trial





Comparison to Conventional Compost

Conventional Compost	Harp Organic Fertiliser
Microbes create self-generated heat	Microbes secrete potent hydrolytic enzymes - bio-catalysts for accelerated thermal process
Significant GHG emissions: CO_2 + N_2O + CH_4	Low GHG emissions. Binds carbon & nitrogen
Temperature 55 to 65 C for weeks to months.	Temperature >70 C; Pathogen free
Waste volume reduced 40-50%.	Waste volume reduced 75-80%
Requires structure. Suitable for woody material	Ideal for food waste
Open batch system; consumes space	Closed continuous system; small footprint
Open windrows carry risk of rodents etc.	No risk of rodents and other pests
Variable moisture. Sometimes wet & heavy.	Low moisture content; Light weight material.
Some odours present	Odor-free. Enzymatic process binds ammonia.
Lower & less consistent nutrient content	Higher & more consistent nutrient content.
Suitable as soil amendment	Suitable as soil amendment and fertiliser

Impact of Physical and Chemical Characteristics on application rates (Volume)

	Application Rate (Volume / ml)	Weight of Addition (g)	Dry Weight of Addition (g)
BioNova (4%)	80	45.6	39.31
BioNova (8%)	160	91.2	78.61
BioNova (12%)	320	136.8	117.92
Greenwaste (4%)	80	46.16	20.22
Greenwaste (8%)	160	92.32	40.44
Greenwaste (12%)	320	138.48	60.65
Biowaste (4%)	80	49.6	45.19
Biowaste (8%)	160	99.2	90.37
Biowaste (12%)	320	148.8	135.56