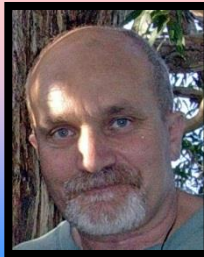




**Ko "Thomas Harrison" te waka  
My ship is Thomas Harrison (1842)  
Nelson**

**Ko Don Graves ahau  
My name is Don Graves**



**Ko Motueka toku papakainga  
My place is Motueka**



**Ko Taranaki te maunga  
Taranaki is my mountain**



**Ko Whanganui te awa  
Whanganui is my river**



**Ko Pākeha te iwi, My tribe is Ngati Pākeha.**

**Ko Keswick, ko Cumberland o te rohe a ngā roto  
o Ingarani, ko Tiamana ngā hapū i te taha a  
tooku papa.**

**My father's father's ancestors' & clans came  
from the Lakes District England & from  
Germany. My mother's peoples were Otago  
whalers, sealers & shipping workers from  
Scotland (Kōtorana).**

**Waiata mai "Non Je Ne Regrette Rien"**

**My song is "No Regrets" by Edith Piaf**



# Transforming waste products into by-products? & or crises into opportunities?

危機 wēijī

(n.) lit. "crisis" or "critical moment"; from risk 危 and opportunity 機, the idea that there can be a positive result in a wisely handled risk



# Farming within Nitrogen Limits: Cow urination ... crisis ? & or opportunity?

*Has anyone else  
peed here already?  
How often? How many?  
How long? How come?*

*How Come? ...  
the “solution to pollution is dilution*





# Freshwater Algal Bloom & Fisheries Risks





# Community Shared Goals: Freshwater Quality Protection



# **Farming within Nitrogen Limits:**

**Proposal to apply biochar into dairy pasture  
root zones**

**AIM 1: (on site) within dairy pasture soils & crop root zones. “Nutrient capture & re-use” (or ‘closed-loop’) dairying. Retain soluble nutrients derived from cow urine patches and fertilizer inputs.**

Refs. Clough & Condon *et al* (2013);

Cayuela *et al* (2013) Joseph & Lehmann (2015);

# **Farming within Nitrogen Limits:**

**Proposal to apply biochar into dairy pasture  
root zones**

**AIM 2: (off site) in surface waters & ground  
water aquifers. N mitigation - Dairy Farming.**

**Avoid, Remedy or Mitigate effects of dairy  
pasture nutrient losses on water quality**

Refs. Clough & Condon *et al* (2013);

Cayuela *et al* (2013); Joseph & Lehmann (2015);



**Proposed method**  
uses no-tillage direct  
seed drills to place  
biochar slurry into  
dairy pasture soils in  
close proximity to  
plant root zones and  
mycorrhizal soil  
fungal zones.



*Mycorrhizal Symbiosis*  
S.E. Smith & D.J. Read (1997)

Smith & Read (1997)



Preliminary research has shown that no-tillage or direct drilling can effectively apply biochar into pasture root zones.



**Refs:** Blackwell *et al* (2009).; Baker *et al* (1996); Rikihana *et al* (2012); Bishop *et al* (2013)  
Graves *et al* (2013); Graves (2013); Lehmann J & Joseph S (2015)

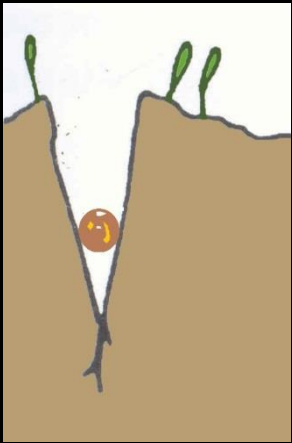
# What is *biochar*?

**“*Biochar*”** is a modern name for **charcoal used in soils** in a manner derived from ancient gardening practices to amend the physical, biological and nutrient availability qualities of soils, ... or to capture leachate lost from composts, kitchen & toilet wastes or fertilisers.

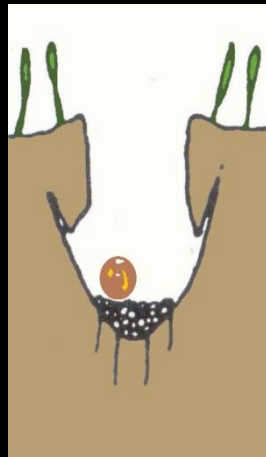
***“Biochar binds onto nutrients etc ... in a way similar to how Velcro attracts fluff”***



# No-tillage seedbed or 'slot' shape & seed drill options:



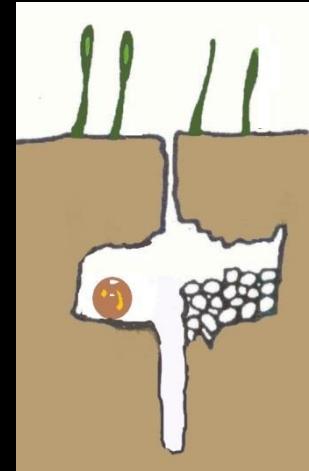
“V” or “Y”  
shaped slots  
derived from  
“double-disc”  
or “triple disc”  
seed drill  
blades



“U” shaped  
slot derived  
from a “U”  
shaped seed  
drill coulter  
blade



“inverted T”  
or “⊥”  
shaped slot  
derived from  
“Baker Boot”  
seed drill

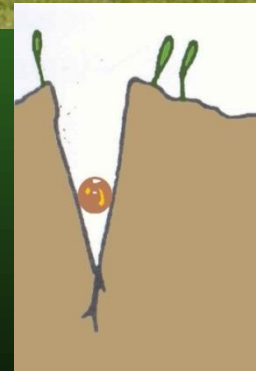


“+” shaped  
slot derived  
from “Cross  
Slot”™ seed  
drill

# No-tillage seed drill options: Double Disc & Triple Disc Seed Drills



“V” or “Y”  
shaped slots  
derived from  
“double-disc”  
or “triple disc”  
seed drill  
blades





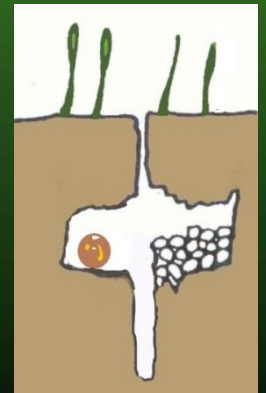
# No-tillage seed drill options:

## Cross Slot™ ultra low disturbance seed drill

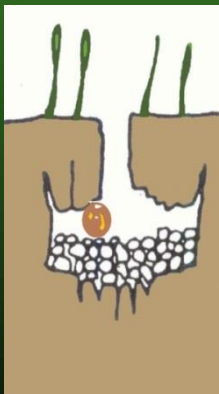
[www.crossslot.com](http://www.crossslot.com)



• “†” shaped slot  
derived from “Cross  
Slot”™ seed drill



# No-tillage seed drill options: “*Baker Boot*” minimum tillage direct seed drill / slurry injector



• “inverted T” or “⊥”  
shaped slot derived from  
“Baker Boot” seed drill



# Charcoal production / purchase options: Cool Planet Energy

**CoolTerra™**  
A product of Cool Planet



<http://www.coolplanet.com/>

# Charcoal production / purchase options:

**KILNZ** Kowhai International Ltd **NZ**, Rotorua,  
[pari@wastetransformation.co.nz](mailto:pari@wastetransformation.co.nz)





- It is envisaged to **share** or “piggyback” the **effort and costs of applying biochar** into pasture or crop soils **alongside the practice of under-sowing with crop or pasture seeds.**

- Further economic opportunities for farmers that may result from a successful outcome of this method, include the possibility to **reduce the quantities of fertilizer inputs** required and thereby **lower future production costs.**

# Further possible biochar applications in dairy farming

1. Making biochar from manures
2. Biochar nutrient capture & recycling from dairy shed washings & effluent holding ponds
3. Mixing biochar with supplementary feed
  - Manure + biochar for earthworms to mix into soils
4. Greenhouse gas (GHG) mitigation
  - Denitrification inhibition in soils
  - Soil Carbon sequestration



## References & Acknowledgements

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- Pari Rikihana, & Dr Colin Knox, KILNZ Bioenergy, Rotorua (2012), for their help & practical advice re biochar used in no-tillage trials. Jean-Paul Praat, for loan of his single opener seed drill; & Dr C. John Baker, Thierry Stokkermanns, Dave Robinson, Baker No-Tillage Ltd, Fielding; (2012) for expert advice, practical skills re seed drilling, flow dynamics & agricultural engineering & design.
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- Trevor Richards, AllBlackEarth <http://soilcarbon.org.nz/> Sincere thanks for travel expenses to & from Rotorua