Chicken litter

alternative fertiliser & way to increase soil C

LISA WARN

AG CONSULTING

E: l.warn@iinet.net.au

Grasslands Society of Southern Australia Inc

Questions ?

If use as alternative to inorganic, granular fertiliser what is effect on:

- Pasture production, composition, quality
- Soil carbon
- Soil biology

Cost of nutrients

Research sites : 2009-2012

Glenaroua – near Seymour

- Sedimentary hills
- Sirosa phalaris & Trikkala sub

Pastoria - near Kyneton

- Granite hills

Litter Composition – dry matter basis

Dry matter %	Carbon %	C:N ratio	N %	P %	K %	S %	Moly mg/kg	Cu mg/kg	Zn mg/kg	B mg/kg
70-90	34-50	10:1	2.5-4.5	0.8-1.4	1.2-2.4	0.4-0.6	3.5	127	385	31

Photo courtesy of David Williams

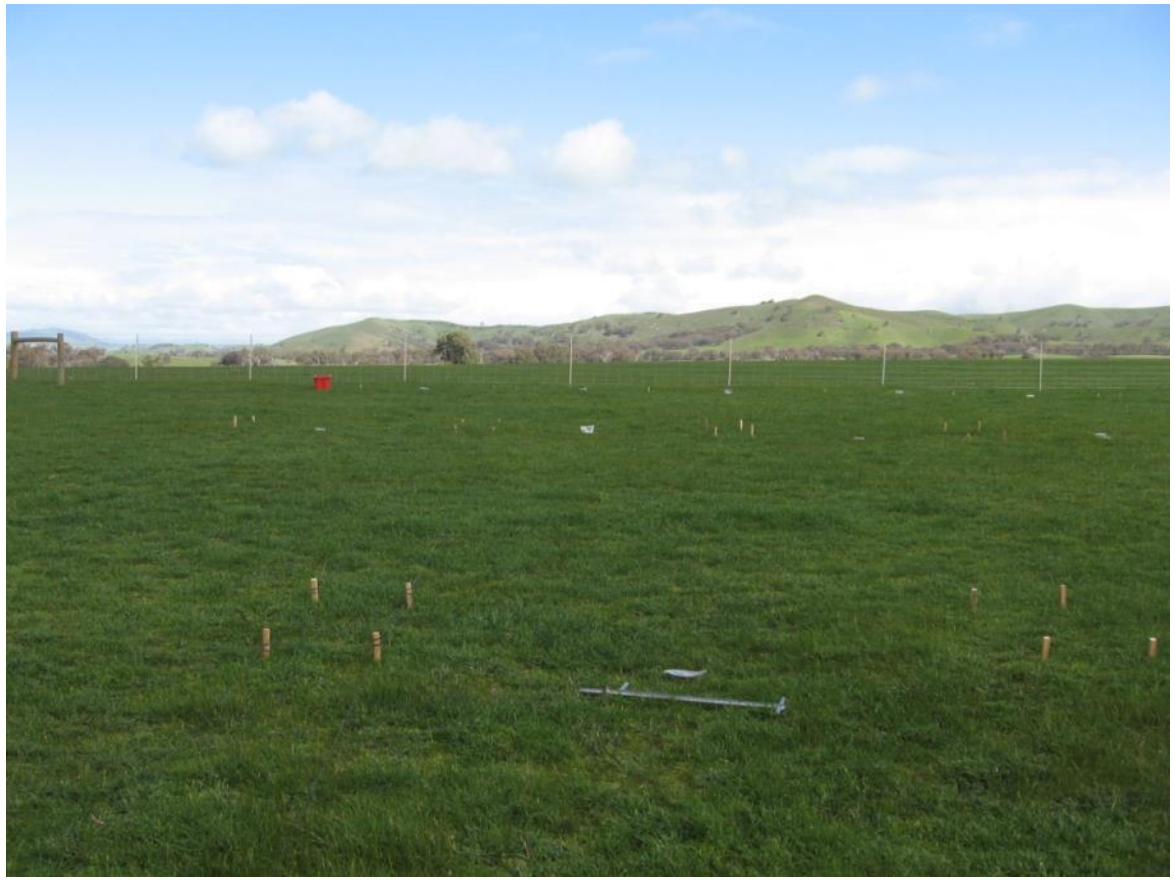
Nutrients in Chicken litter - 1 t (wet)

Carbon kg	N kg	P kg	K kg	S kg	*Moly g*	*Cu g*	*Zn g*	*B g*
336	34	10	15	5	*3*	*101*	*308*	*25*

If Maintenance fertiliser rate is 10 kg P/ha
= 114 kg/ha superphosphate
= 1 t/ha litter

If SSP @ $350/t spread = $3.90/kg P
Litter @ $ 70/t spread= $6.80/kg P

Glenaroua site - spring 2009



Treatment
Control (nil)
Maintenance P,S fertiliser (100 kg/ha superphosphate)
Maint. P,S & Humic acid
Capital P,S (200 kg/ha super)
Maint. P,S + N,K fertiliser (super plus urea & potash)
Capital P,S + N,K
Maint. rate Chicken litter (1.0 - 1.6 t/ha fresh)
Capital rate Chicken litter (2.0 – 3.2 t/ha fresh)
High Carbon rate Chicken litter (5.0 t/ha – nutrients supplied varies)

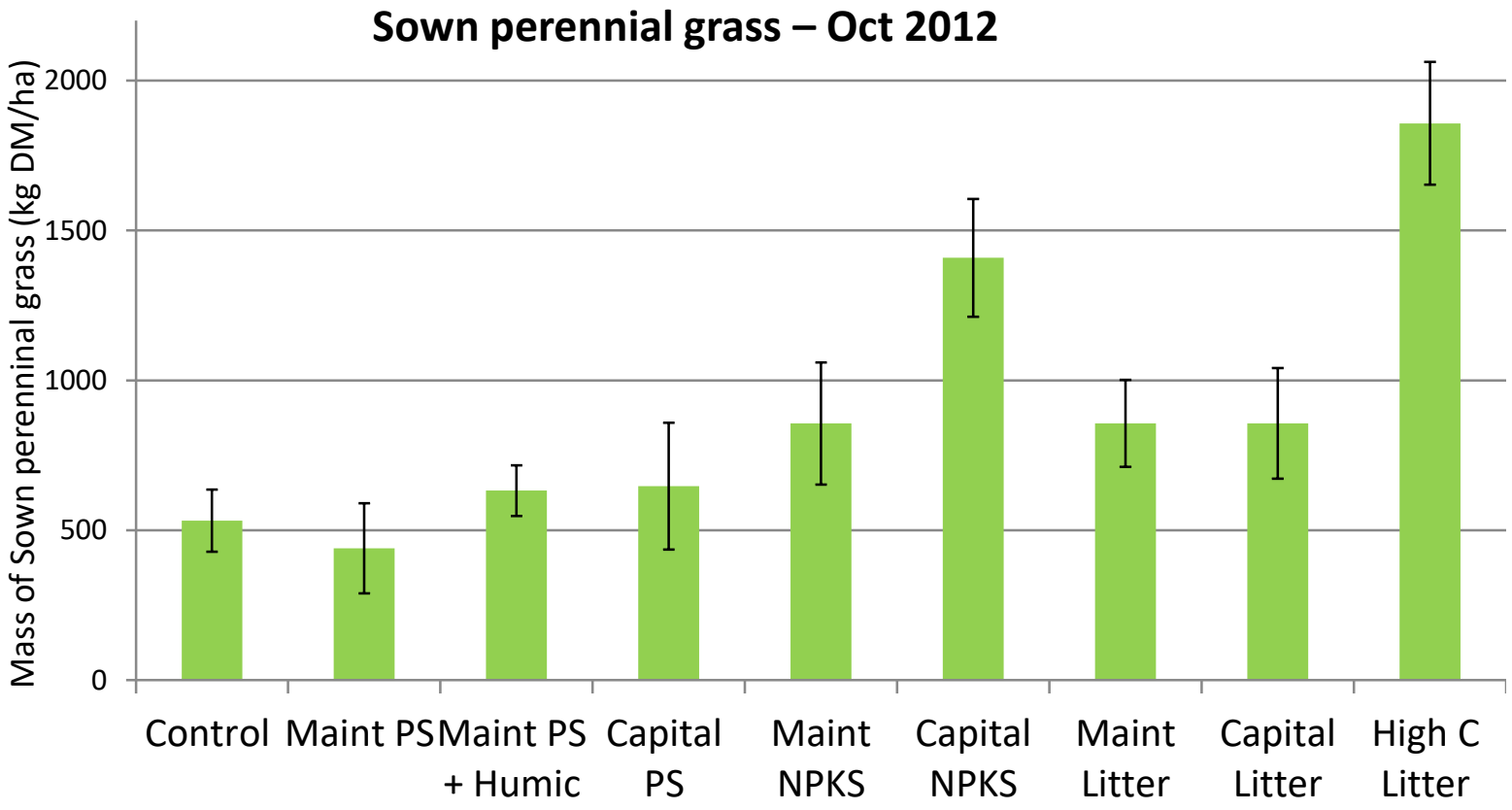
Pasture growth: Litter vs inorganics

- Short /medium term
  - If apply same nutrient rates => same pasture & soil response
  - no extra plant response

At Glenaroua – P,K,S good

- Mainly an N response from litter
- (but urea cheaper)
- low rates of litter, more variable N response cf urea

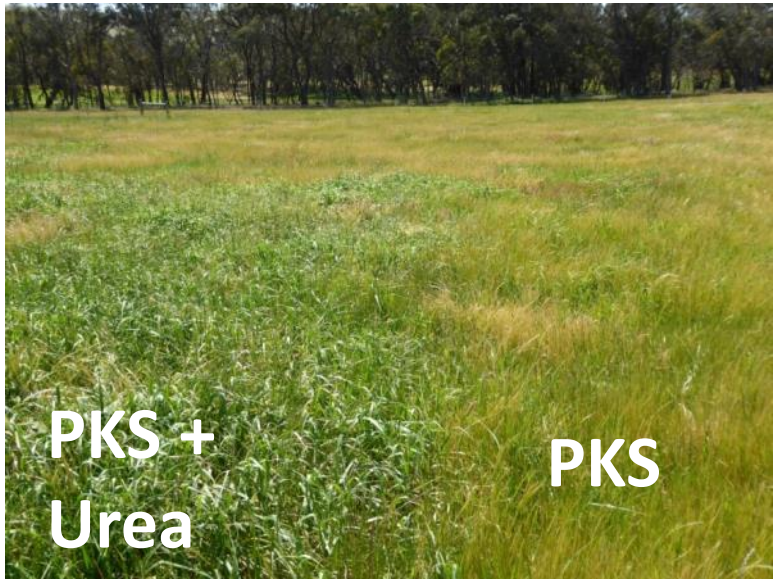
Effect on composition



Pasture composition

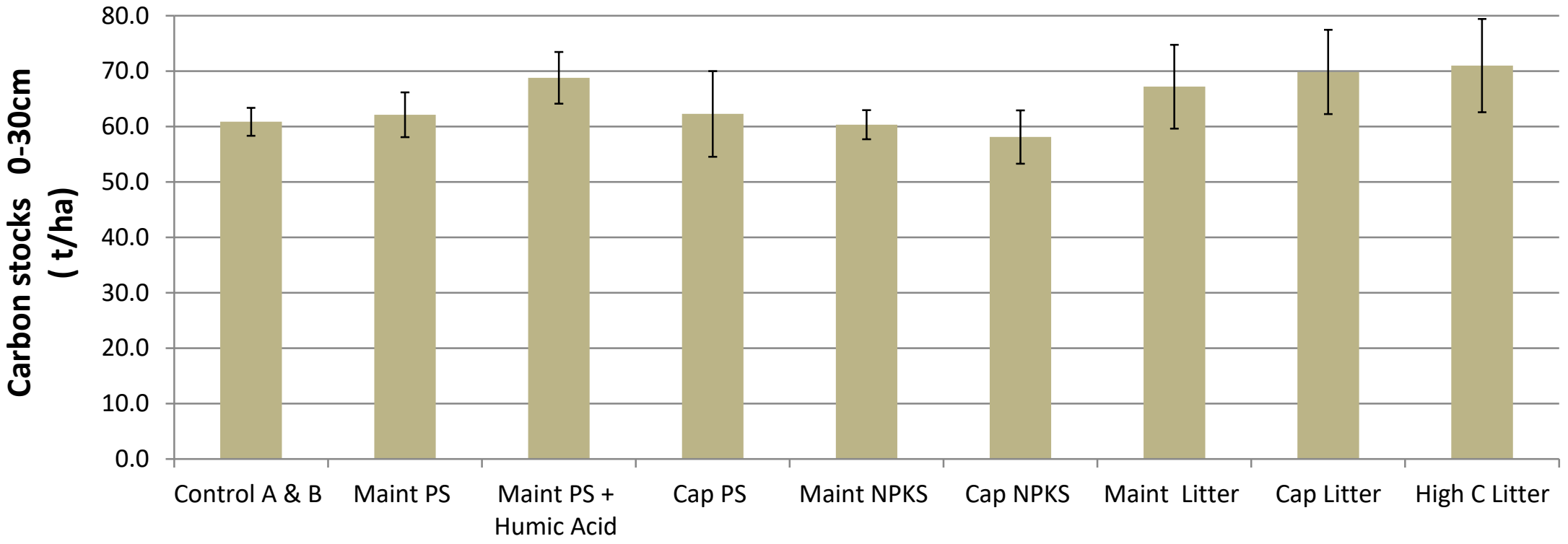
Control

Capital rate chicken Litter

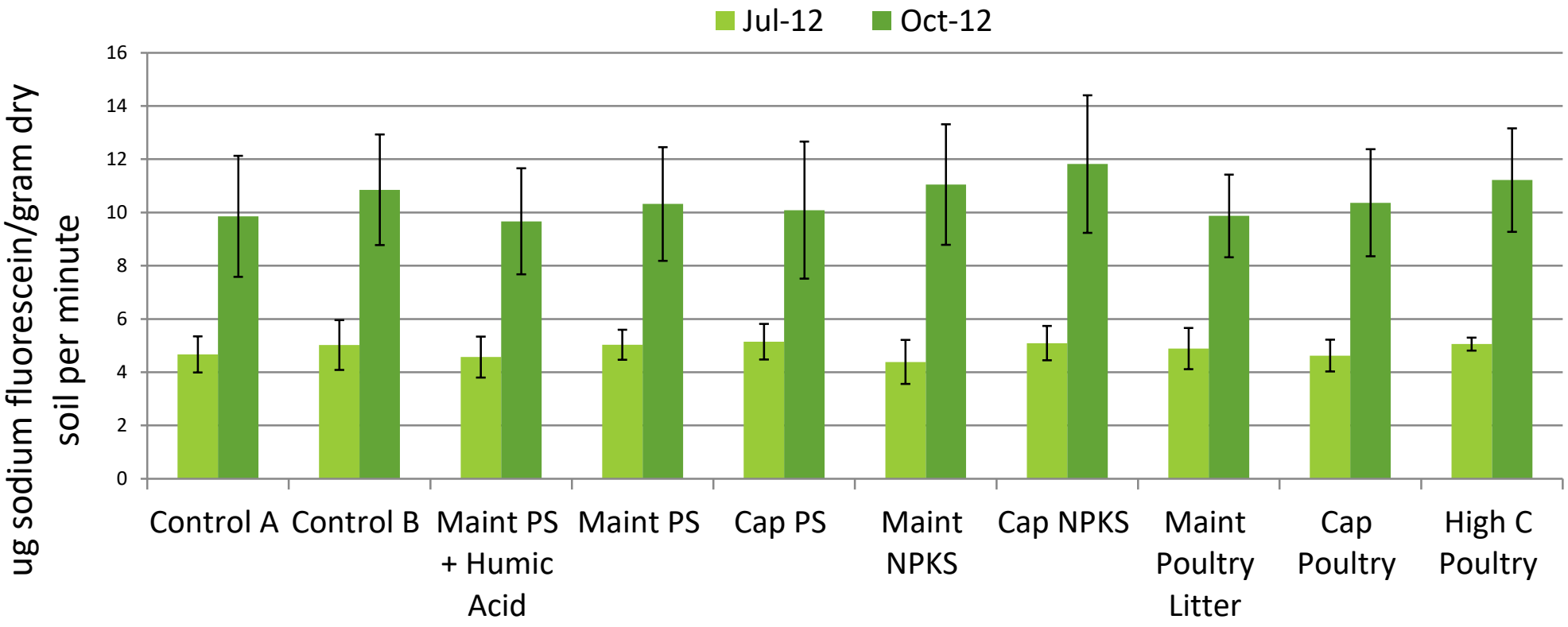


Carbon stocks – spring 2012

(POC, HOC,ROC also measured)



Soil biology



Potential issues with organic materials

Cost of transport

Nutrient variability

Nutrient availability

N loss (up to 20-50% ..warm/dry)

Heavy metals

Pathogens (if non-composted)

- Fence off stock pile
- Apply in late summer/aut – stock off 4 weeks

Using organic products: litters, manures, composts

Does product supply nutrients you need at least cost?

- What does your soil need ?
  - Soil test (& leaf analysis)
- Composition of product ?
  - Get it analysed (1kg sample $90)
- Cost $/ kg nutrient ?

Acknowledgments

RIRDC - Chicken Meat Group

Host producers - Thomsons & O'Sullivans

David Williams – Seymour Organic Fertilisers

Grasslands Society

GBCMA

RURAL INDUSTRIES
Research & Development Corporation

Conclusion

Chicken litter, manures, composts

- Can be cost-effective, alternative fertilisers
  - Price, transport cost, nutrients required
- High rates can build soil carbon but may not be economic
- Short /medium term
  - nutrient response
  - no extra plant response

Monitor soil fertility (incl Cu & Zn)

- to select suitable product/s & rates

Cost comparison - $/kg nutrient

Superphosphate

8.8% P & 11% S

Cost $/t spread	Cost $/kg P
300	3.40
400	4.50
500	5.60

Litter

- 4% N, 1.2 % P, 1.8% K, 0.6%S
- 85% DM

Cost $/t (fresh) Spread	Cost $/kg P
40	3.90
70	6.80
100	9.80

Issues with using manures/litters/composts

Variable composition
- (nutrients, DM%, bulk density) but same cost $/m^3

Cartage /spreading

Animal health
- stock pile (meat meal) => fence off from livestock
- potential pathogens in non-composted material
  => Apply litter late summer/early autumn
  4 weeks before graze (UV light, heat)
  => Avoid grazing with young stock

Is fertiliser/lime needed? How much?

To make rational decisions

Need soil tests

- Land-class /soil type
- Or Paddock
- Take every 3-5 years

Leaf analysis – trace elements

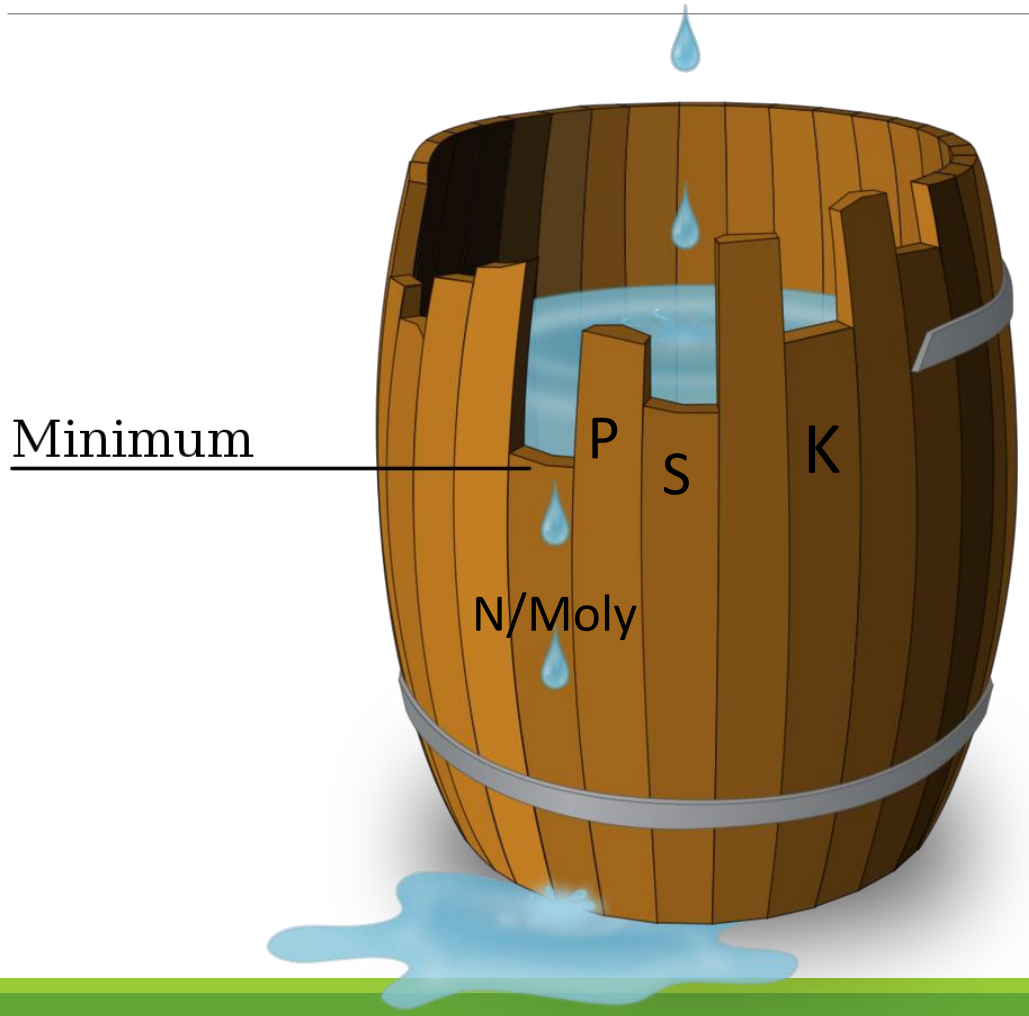
Soil tests

- Soil test (0-10cm)
  - ✓ Chemical (macro nutrients, pH, C, salt)
  - ✓ Physical (soil type, OM, Na)
  - ○ *Biology (not measured directly)*

- Autumn vs Spring
- Depth critical
- Test poor sections of pdks (ID diff soil type/low K)

- look at Soil profile (root growth, pH/Al)
- fert test strips

Soil fertility – Liebigs's Law of the Minimum



"yield is proportional to the amount of the most limiting nutrient, whichever nutrient it may be" Justus von Liebig

Need to correct all nutrient deficiencies

N deficiency – eg. paddocks where P,K,S is high

Animal manures, litter, compost *(Organic/recycled materials)*

Alternatives to inorganic fertilisers ?

- Main benefit => supply nutrients
- Need to supply at same/lower cost than inorganics
- Need a local & reliable source

Organic matter & soil carbon ?

Soil biology ?

Composition – dry matter basis

Product	Dry matter %	Carbon %	C:N ratio	N %	P %	K %	S %	Moly mg/kg	Cu mg/kg	Zn mg/kg	B mg/kg
Chicken litter	70-90	34-50	10:1	2.5-4.5	0.8-1.4	1.2-2.4	0.4-0.6	3.5	127	385	31
"Revive" Compost	80	10-15	11:1	0.9-1.2	0.4	0.4-0.7	0.2-0.3	1.4	42	190	15
Mushroom compost	56	22	10:1	2.2	0.7	1.3	3.5	4.7	85	260	28

Value of nutrients

Cost of product spread	N $/kg	P $/kg	K $/kg	S $/kg
Chicken litter @ $28/m^3 ($ 88/t dry)	2.05	6.80	4.55	13.66
Urea @ $600/t	1.30	-	-	-
Single Super @ $400/t (+ moly 0.05% @ 450/t)	-	4.55	-	3.64
Muriate of Potash @ $740/t	-	-	-	1.48

Value of nutrients

Nutrient in litter	Kg nutrient /t fresh litter	Value $
N	34.0	44.20
P	10.0	45.40 (51.30 + moly)
K	15.3	22.60
S	5.0	*not valued*

Cost $70/ha…. ….. .over $100 worth of nutrients in 1 t of litter

Initial soil test results - Glenaroua

Test	Aug 09	*Target*
Olsen **P** (mg/kg)	13	*12 - 15*
Colwell **K** (mg/kg)	216	*160* *clay loam*
KCl40 **S** (mg/kg)	8	*8*
pH (water)	5.2	*5.3 – 5.5*
Organic carbon %	4	*3 - 5*

Effect on soil fertility

Where similar macro nutrient inputs

- similar increase in soil P,K,S

With increasing rate of litter

- trace elements in soil & leaf increased

Effect on total cations (CEC) & Carbon

Very high rates of litter (5t/ha per yr over 4 yrs)

- CEC increased (6.5 => 8.0 meq/100g)
- C % increased by 0.9% in topsoil (3.5% => 4.4 %)

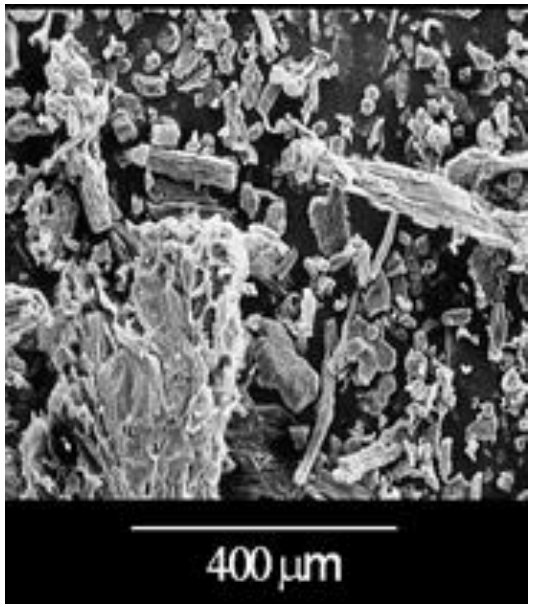
Soil organic matter - organic carbon

Key role in soil health

Physical – soil structure, water retention

Chemical - nutrients, cation exchange capacity

Biological – nutrients & habitat for organisms



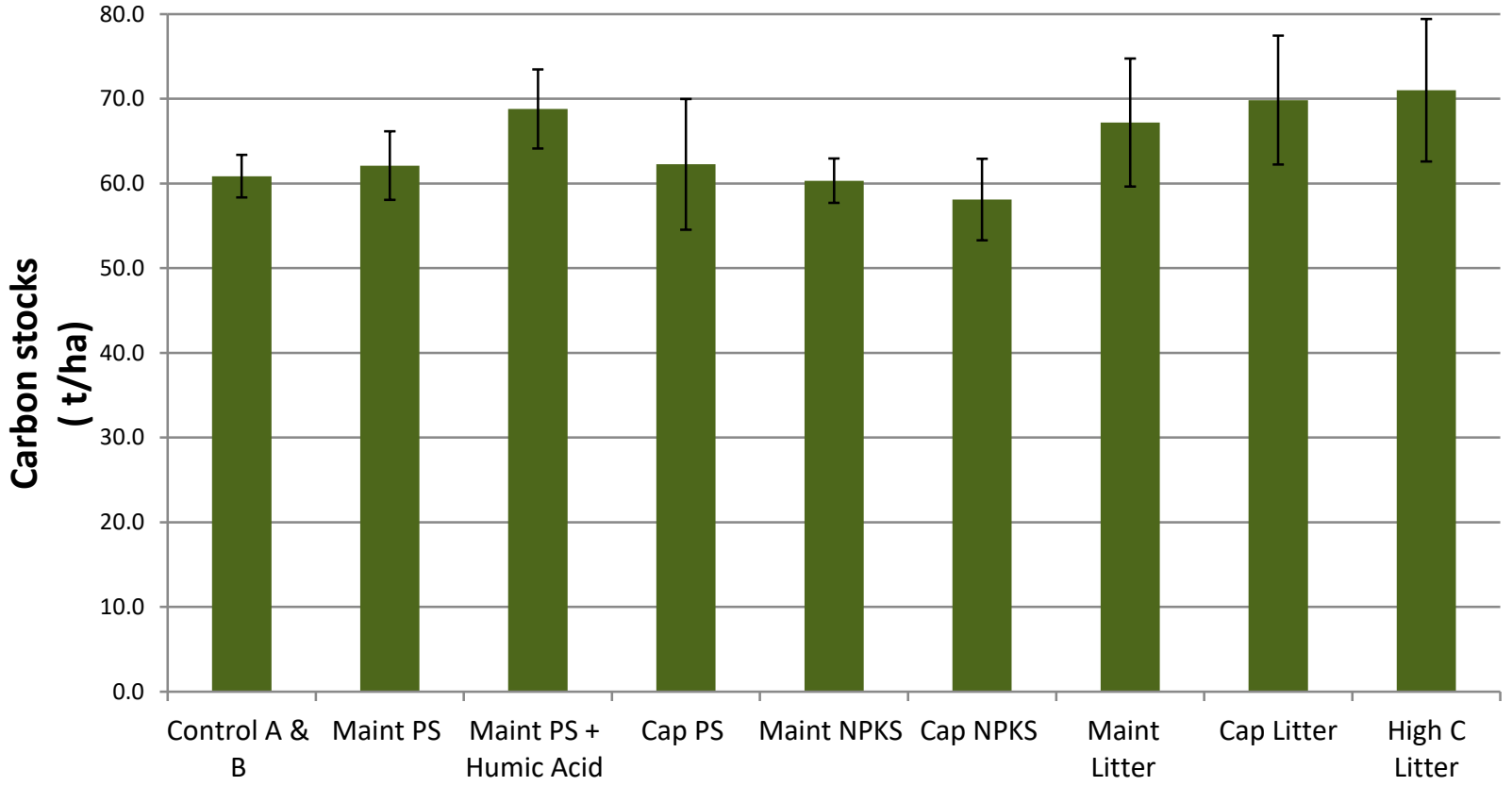
CSIRO

C sequestration

- Carbon tax =>Emission trading scheme
- forms of carbon important
  (recalcitrant, particulate OM, humus)

Soil tests for Carbon: 0-10cm & 10-30cm

Carbon stocks at Glenaroua – spring 2012



Value of organic matter in litter

High rate of litter (20t/ha over 4 yrs = $1400/ha)

Site	Additional carbon stored (t/ha in 0-30cm)	Additional Carbon (t CO_2 equivalents)	Value of carbon @ $24.15/t CO_2e	Value of carbon @ $15.00/t CO_2e
Pastoria (loam)	3.0	11.0	$ 266	$ 165
Glenaroua (clay loam)	10.0	36.6	$ 884	$ 549
Value of C in litter			$ 5-18/m^3	$ 3-11/m^3