

Cover Cropping

Colin Seis

Winona

Myself and son Nick

2000 acres (840 Ha)

300 km NW of Sydney

- **Granite soil, Ph 5.5-6.0**

- **600 mm annual Rainfall**

- **Central Tablelands NSW**



Winona Enterprises 2016

Cattle trading



500 acres of Crops
Wheat, oats, rye. (pasture crop)



Working Kelpie Dogs



4000 Merino Sheep wool & meat production



Merino Stud ram sales



Native Grass Seed



What is Cover Cropping??

Sowing an annual crop between periods of regular crop production with the main purpose being to create thick mulch,
into which the following cash crop is planted using zero till planting methods.

But it is more than that!!!!

Cover Cropping can be either:

Annual Cover Cropping
or
Perennial Cover Cropping

‘Pasture Cropping’ is
perennial cover cropping

- Cover Cropping uses an annual crop to create mulch, control weeds and improve soil health.
- 'Pasture Cropping' uses perennial grass to create mulch, control weeds and improve soil health.



Single species cover crops only address some of the problems.

Multispecies cover crops address many problems

- It is important to include:
Cereals, Brassica and Legumes in the mix.

Why grow a multi species Cover Crop?

- Prevent soil erosion.
- Improve soil structure (*better water holding capacity*)
- Nutrient scavenging. (*less fertiliser*)
- Weed control (*less herbicides*)
- Control pest and disease (*less pesticides*)
- Increase Nitrogen (*Legume addition*)
- Increase Carbon (*Increased nutrients & water*)
- Prepare soil/paddock for following crop
- Quality stock feed (*healthy stock faster weight gains*)
- More profit.



Soil Erosion

**Around the world,
10 ton of soil is lost
for every ton of
grain produced**

Multi Species Cover Cropping *Soil Structure*

- Plants like radish, turnip, swede, are excellent ‘biological sub-soilers’, breaking plough pans and aerating poor structured soil.
- Improved water infiltration



Multi Species Cover Cropping *Weed Control*

Including plants like forage
brassica, radish & cereal rye.

- Some plants produce chemical exudates that can inhibit weed growth. (Allelopathy.)
- Weeds can be controlled. by shading and competition.
- Creating ground cover with plants and litter will control weeds



Multi Species Cover Cropping *Nutrients*

Soil nutrients can be made available:

Deep rooted plants like radish, turnips, can scavenge nutrients from depth and make them available to plants.

Legumes in the mix will produce Nitrogen



Having a C:N ratio of 24:1 will produce Nitrogen

Nutrients

- **Use high C:N ratio crops of 30:1 or greater to increase Soil Organic Matter**

Contributes directly to nutrient cycling, nutrient availability, nutrient holding capacity, and water holding capacity.

- Plays a significant role in the formation of water stable aggregates which affects infiltration, aeration, drainage and bulk density.
- Provides carbon and energy for soil organisms that are essential for maintaining a healthy soil.

Multi Species cover cropping

Nutrients

- Carbon to Nitrogen ratio.
- Having a multi species crop with the correct C:N ratio can supply N and other nutrients and /or maintain ground cover
- **Ideal microbial diet 24:1**
- Cereal Rye straw 82:1
- Oat Straw 70:1
- Annual vetch 11:1
- Forage Brassica 12:1
- Annual Ryegrass 20:1
- Clover 21:1
- Daikon Radish 19:1
- Millet 42:1

Recycling of nutrients by Oilseed radish

David Brandt Iowa USA

Nutrient	(lbs/acre)
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Nitrogen	265
Phosphorus	23
Potassium	230
Sulfur	60
Calcium	150
Magnesium	20



Multi Species Cover Cropping

Soil Health - Soil Carbon



A mix of species helps form water stable aggregates which affects infiltration, aeration, drainage and soil bulk density.

Provides root exudates and energy for soil organisms that are essential for maintaining a healthy soil and increasing soil carbon.

Insect Control

**Reduce crop
insect damage
with beneficial
insects,
by including
flowering plants**



Multi Species Cover Cropping

Insect Control



Disease control

In balanced soil ecosystems disease is controlled by their natural enemies

A diversity of soil microbes will interrupt and control many fungal and bacterial crop diseases.

Suppress nematode populations.



Increasing plant diversity

Total fungi increase 862%
Total bacteria increase 350%
Total protozoa increase 640%
Total nematode increase over 1000%

Having healthy soil with large numbers and large diversity of soil microbes will control plant disease.

Multi Species Cover Cropping

Improved Grazing /Better diet

- **Healthy animals**
- **Faster fattening**
- **Faster growth rates**
- **More feed**

Selecting Multi Species Crops

Different combinations of plants can be used for:

- Forage.
- Prepare soil for a following crop.
- Increase in soil organic matter. (C:N ratio)
- Increase nitrogen. (C:N ratio)
- Nitrogen fixation – legumes.
- Capture, recycle, redistribute nutrients
- Weed suppression.
- Reduce soil compaction.
- Attract beneficial insects.
- Disease control.



Selecting Multi Species Crops

Winter Multi Species Crops

Cereals	Legumes	Brassica	Other
Oats	Field pea	Forage Brassica	Ryegrass
Wheat	vetch	Radish	
Barley	Lupin	Turnip	
Triticale	Clover	Swede	
Cereal rye	Lentil	Kale	

Multi Species Crops

Cereal Crops

- **Winter: Multi Species Crops**
- Oats, Wheat, Barley, Triticale, Cereal Rye can form the basis of a winter multi species mix.

Multi Species Crops

Winter Legumes

- **Annual vetch**
- Is excellent stock feed.
- Can fix large amounts of N
- Makes soil phosphorus more available.

Provides excellent habitat for beneficial insects.



Multi Species Crops

Winter Legumes

Field Peas are excellent stock feed and capable of fixing large amounts of Nitrogen.



Multi species crops

Forage Brassica



- **Winter: Multi Species Crops**
- Forage brassica are high protein, and highly digestible feed.
- Swede, turnip and newer varieties, e.g. Winfred is a cross between turnip and kale.
- Varieties like daiken radish and turnip can be used as "biological sub-soilers".

How do costs compare with single species crop??

- The overall cost of seed is more expensive but the seed rates are usually sown at 25% - 50% of recommended rates for single species crops.



Winter Multi species mix

	Kg per Ha	Price per Kg	Price per Ha
Oats	50	.50	\$25
Forage brassica	1-2	10	\$10-20
Tillage radish	1-2	10	\$10-20
Annual vetch	5-10	2	\$10-20
Field pea	5-10	2	\$10-20
Turnip	0.5 - 1	5	\$ 2.5-5
Total			\$70 - \$100

Summer multi-species cover crop



Summer Multi Species Crops

Millet

Summer: Multi Species Crops.

- Millet is an ideal base for a multi species summer crop.
- Heat and drought tolerance.
- Low cost seed.



Summer Multi Species Crops

Forage sorghum:

Productive and fast growing.

Heat and drought tolerant.

- Good weed control.



Summer Multi Species Crops

Cow Pea

Cowpea:

- Excellent stock feed.
- Legume that fixes lots of N
- Provides food and habitat for beneficial insects.
- Rapidly shades out weeds.
- Tolerant of hot, dry conditions.



Summer Multi Species Crops Lablab



- Lablab is a viny, summer growing annual legume.
- Excellent stock feed.
- Good supplier of soil N.

Summer Multi species crops Sunflower

- Good stock feed.
- Sunflowers are deep rooted summer growing broad leaf annual plants.
- Very good at 'mining' mobile nutrients deep in the soil profile and making them available other plants.



Selecting Summer Multi species crops

Crop	Legume	Broadleaf	Other
Japanese Millet	Cow Pea	Sunflower	Brassica
Pearl millet	Lablab Bean	Buckwheat	
Shiroie Millet	Soy bean		
Forage Sorghum	Sunnhemp		
Maize			

Sowing Multi Species Crops



Seed drills for (Zero till or direct drill)



Sowing: Multi Species Seed Mix

A mix of seeds can be more difficult to sow

- Larger seeds like oats, cow peas, field peas can be sown with the normal seed box, as a mix.
- Smaller seeds like forage brassica, turnip, millet etc can be sown with a pasture box. (small seed)



- Seeds can be mixed together with disc seeders because they usually do not place the seed deep.

Weed Control

Pre Sowing//

If weeds are not going to effect the growth of the cover crop, they may not require controlling, and can become part of the cover crop mix.

Weed control with herbicide may be necessary if weeds are going to effect crop establishment and growth



Multi Species Cover Cropping

In crop weed control

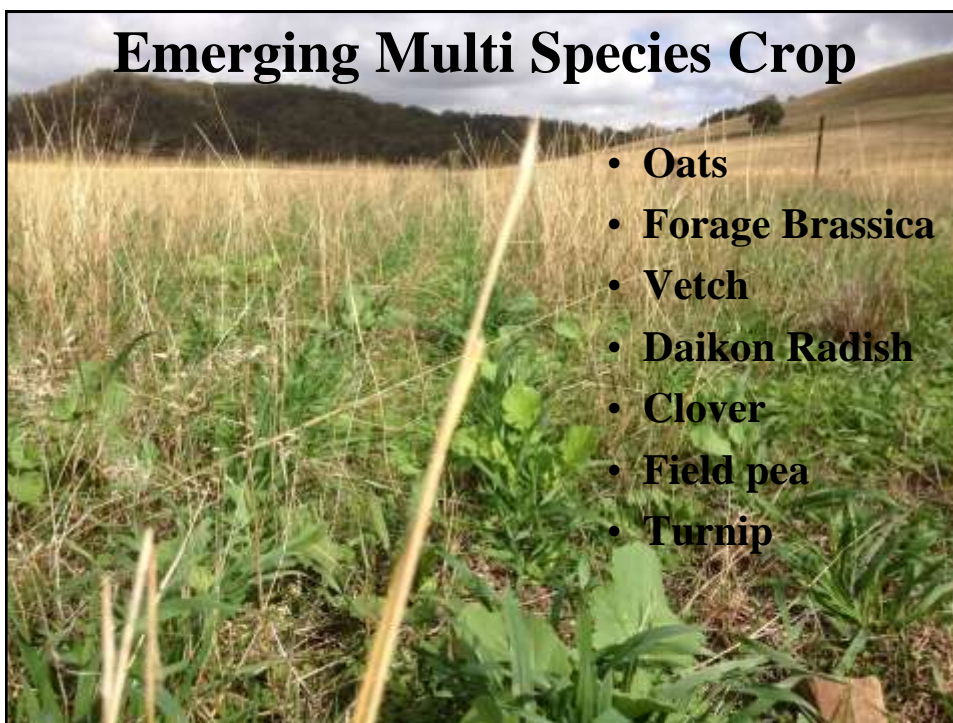
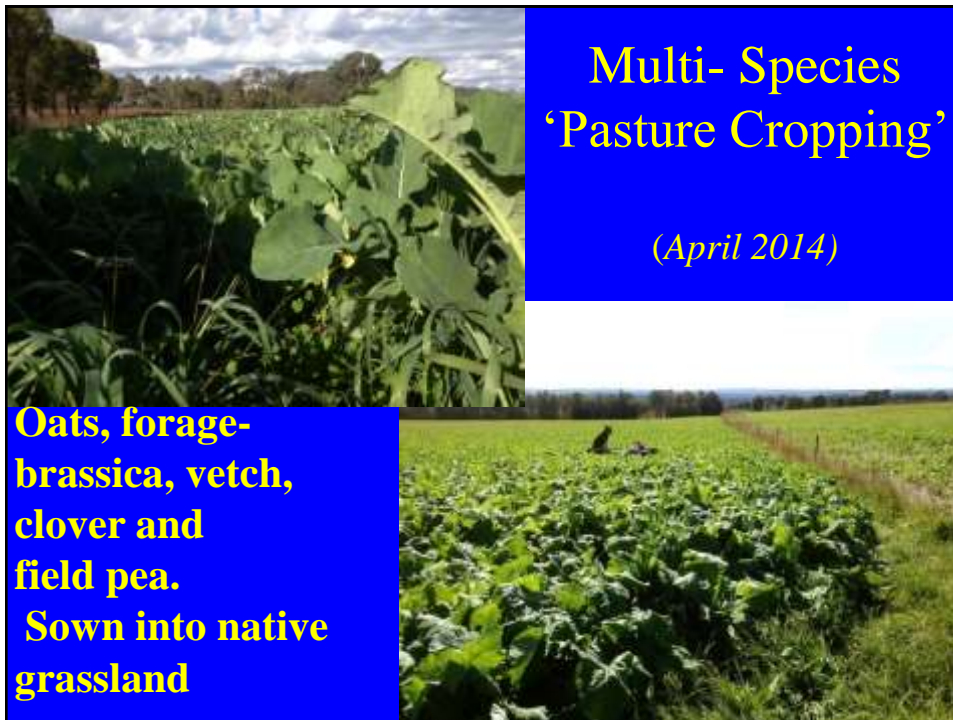
- Herbicide use with Multi Species crop is normally not possible without killing crop species.
- Some weed control is possible with fast growing canopy closure providing a weed smothering effect and allelopathic properties from plants.



Multispecies Pasture Cropping

- Perennial Cover Cropping
- Perennial grass is the cover.
- Zero till into dormant Summer grass.







Oats, vetch, radish, pea, turnip, clover, forage brassica sown into grassland. (September 2015)

Harvest multi species crop for grain.



November 2015



Grain from Multi species Harvest



The difference in land management techniques

Adjoining Paddocks March 2010



**Pasture Cropped and
plan Grazed**



**Conventional grazing
and cropping**

Grazing Multispecies crops

- First graze should not start until all plant species are well established.
- Better quality feed and less dietary problems.
- First graze should not start until all plant species are well established.
- Allow plants time to recover from the initial graze before re- grazing. (3-4 grazings are possible)

Terminating the cover crop

- Grazing
- Crimp rolling
- Herbicide

Phil Lyn

Glen Innes NSW



102.7 t carbon/Ha

43.4 t carbon/Ha

- Winona's soil now has over 200% more organic carbon.
- Has sequestered 59.3 t /Ha of carbon
(213 ton/Ha of carbon dioxide)
- Holds over 200% more water.

All of the soil nutrients including trace elements have increased by an average of 172%

e.g. Calcium increase of 8166 kg/ha or 277%

- Ph has changed from 5.2 - 6.01



Soil Nutrients

	<i>Avail</i>	<i>Total</i>
Ca	234%	277%
Mg	110%	152%
Zn	250%	195%
Cu	185%	215%
B	150%	161%
Si	116%	113%
N	103%	151%
P	102%	155%
K	198%	150%
S	92%	159%
Fe	87%	130%
Na	45%	88%
Al	28%	140%

Soil Carbon and soil water storage

- An increase in soil organic carbon level of 1% to a depth of 30 cm (1 ft) can increase the water holding capacity of soil by an extra 168,000 liters/Ha. **On every rainfall event.**

The Two previous paddocks:

- Winona (Pasture Cropped)
360,000 lt/Ha
- Adjoining (conventional)
188,000 lt/Ha
- Difference 172,000 lt/Ha of extra water holding capacity on every rainfall event



360,000 lt/Ha

188,000 lt/Ha



*Don Murray.
Orange. NSW.*