Harvesting 'pasture cropped' oats on 'Winona' with summer perennial grass emerging beneath the crop

Pasture Cropping

Profitable Regenerative Agriculture

Colin Seis

Concerns about declining profitability, increased input costs, poor soil structure, dry-land salinity, soil acidification and increasing numbers of herbicide resistance weeds have prompted over 2000 farmers throughout eastern, southern and Western Australia to adopt 'Pasture Cropping'.
The year-round ground cover created by using 'pasture cropping' techniques results in reduced wind and water erosion, improved soil structure, reduced weed numbers, increased nutrient availability and increased levels of soil organic carbon. The soil health benefits from plant root exudates and a large increase in organic matter derived from a mix of shallow rooted crops and deep-rooted perennial pastures are numerous and include large improvements of soil microbiology.
In an era when dryland salinity, soil acidification and loss of soil carbon are having increasing impacts on the productivity and profitability of farming enterprises, pasture cropping is providing an option for addressing these issues.

Colin Seis and his son Nicholas own and run the 840 ha (2000-acre) farm "Winona" which is situated north of Gulgong on the central slopes of NSW Australia.
The Seis family is one of the early pioneering families in the Gulgong district and has been farming and grazing there since the 1860s**.**
Winona runs around four thousand, fine wool merino sheep, which includes a 60 year old Merino Stud and "Pasture crops" around 200 ha (500 acres) annually to oats, wheat and cereal rye.
Winona also runs one of the largest 'kelpie working dog' studs in the world and sells dogs and pups to many countries in North and South America, Europe and Scandinavia as well as all states of Australia.
Colin has a published book on training working dogs ("Working Dogs"), which is sold internationally. He has also conducted dog training clinics internationally in the USA, Norway and Sweden and in most states of Australia.

Colin is the pioneer - developer of “Pasture Cropping” which is a method of sowing cereal crops directly into perennial pastures. It combines grazing and cropping into a single land use method where each one benefits the other economically, environmentally and ecologically.

Colin Seis and Daryl Cluff pioneered “pasture cropping” in 1993 and since that time, on his farm “Winona”, Colin Seis has spent much of his time perfecting this technique and due to this it is now possible to grow many different types of winter and summer growing crops, without destroying the perennial pasture base.

It may appear that ‘Pasture Cropping’ is simply a cropping technique. It is much more than that. ‘Pasture Cropping’ is the combining of cropping and grazing into one land management method where each one benefits the other. The potential for profit and environmental health, including increasing soil carbon are enormous and a lot of farmers in many regions of Australia are showing this to be the case. There are now over 2000 farmers “pasture cropping” cereal crops into summer (C4) and winter (C3) perennial native grass in NSW, South Australia, Victoria Queensland, West Australia and Tasmania as well as other areas around the world.

The original concept in 1993, of sowing crops into a dormant stand of summer growing (C4) native grass, like red grass (bothriochloa macra) was thought to be a very inexpensive method of sowing oats for stock feed. This certainly turned out to be true**,** but it was quickly learnt that there were many side benefits and that it was only touching the surface of a land management technique that is proving to be revolutionary. The grazing crops performed so well that it was obvious that good grain yields could be achieved as well.

It was also learnt that sowing a crop in this manner stimulated perennial grass seedlings to grow in numbers and diversity. This produces more stock feed after the crop is harvested and totally eliminates the need to re-sow pastures. Conventional cropping methods require that all vegetation is killed prior to sowing the crop and while the crop is growing.

From a farm economic point of view the potential for good profit is excellent because the cost of growing crops in this manner is much less than conventional cropping methods. The added benefit in a mixed farm situation is that up to six months extra grazing is achieved with “Pasture Cropping” compared with the loss of grazing due to ground preparation and weed control required in traditional cropping methods.

Other benefits include large recruitment of perennial plant numbers and diversity of the pasture following the crop. This means that there is no need to re-sow pastures, which can cost from $100 to $150 per hectare.
The technique is also being used to restore native grasslands over much of Australia.
There is growing evidence, anecdotal and scientific, to support improvement in soil health, improved water use efficiency and general improvement in ecosystem function.
By retaining perennial grass in grazing and cropping systems and having 100% ground cover 100% of the time, large increase in plant biomass can be achieved when compared to conventional methods. This biomass when combined with plant root exudates and soil microbes has been shown to dramatically increase soil carbon levels and improve the soil food web.

On “Winona” soil carbon levels have increased by over 200% during a 10 - year period.
Independent studies at Winona on have found that “pasture cropping” is 20% more profitable than conventional agricultural practices, this is coupled with great environment and ecological benefits that will improve the soil and regenerate landscapes.

Australia’s main scientific and research organization (CSIRO) have also taken ‘Pasture Cropping’ seriously investing in a three-year trial project that was conducted by Dr Sarah

Bruce on ‘Winona’. The project investigated many aspects of ‘Pasture Cropping’ and documented a wide range of positive outcomes, including increased water use efficiency, improved nitrogen use efficiency and improved plant biomass. The CSIRO have also been involved in soil carbon testing on ‘Winona’ which also showed very large increases in soil carbon.
On farm trials have been conducted in NSW, Queensland, Victoria, Tasmania, South Australia and Western Australia.
In these areas good crop yields have been achieved while stimulating perennial species, improving soil health and increasing plant biomass, which will increase soil organic carbon levels over time.

Until recently “Pasture Cropping” has been practiced with the use of chemicals to control weeds, and conventional fertilizers to manage soil chemistry. But over time, as “Pasture Cropping” stimulates improvement in soil health, with increase in soil organic carbon levels and improvement in ground cover, many crops are now being sown without these inputs.
Once complete ground cover is achieved, the “Pasture Cropping” technique can be used to grow organic crops. This can be done without using a plough or herbicide to destroy the existing pasture.

Soil and Pasture changes on ‘Winona’:

After 50 years of high input agriculture, Colin Seis’ 2000 acre farm “Winona”, had become degraded, dependant on high inputs and lacking production and profit as well as having ongoing problems of insect attack and fungal disease in crops. The granite soil on “Winona” had become compacted, lacking structure, acidic, high in aluminum and had organic carbon levels below 1.5%. The top soil had declined to less that 100 mm (4 inches) deep and the sub soil had become sodic. The poor structured soil allowed very little water to infiltrate and consequently very little nutrient cycling.
Small saline areas were first noticed on Winona in the 1920’s and by the 1970’s the saline area had expanded to cover over 100 acres.
Over a 50 year period, introduced pastures like sub clover and rye grass, were sown annually in an effort to maintain production. These pastures were maintained with increasing amounts of fertiliser to a point where 125 kg/ha of superphosphate (112 lbs/acre) was applied to pastures annually and 100 kg/ha of DAP applied to annual crops like wheat and oats. The advice in 1970 to apply 200 kg/ha of superphosphate to pastures was thankfully, not adopted.
From the early 1990s Colin Seis started to look for other ways of farming and grazing on “Winona”, that did not require high levels of fertiliser and pesticides to maintain, and would restore the farm to a regenerative grassland. The restoration of Winona was achieved with a combination of “pasture cropping” “time control grazing” and reduction of fertilizers, fungicides and insecticides.
“Pasture Cropping” combined with “time control grazing” changed “Winona” from a farm dominated by annual plants that required high levels of fertiliser to maintain, to a grassland dominated by native perennial plants that improved soil structure, increased organic carbon levels and increased soil nutrient cycling.

The data and photo below are the result of using these techniques

The University of Sydney, Australia, conducted the following research on ‘Winona’ and a neighbors adjoining paddock to evaluate the effects of different land management techniques on soil and ecosystem function. The “Winona” paddock was “pasture cropped” in 2000 (wheat), 2004 (oats) and 2009 (cereal rye). A large mob of merino ewes is time control grazed on the area with a graze period of 2-3 days and allowed to recover from the graze for 90 – 120 days before re-grazing. This grazing technique has been used over all of ‘Winona’ for over 20 years. The large mob of sheep was also used to prepare the paddock pre “pasture cropping” by mulching and manuring the grass.

The Neighboring paddock was sown to oats in 2000, 2004 and 2009, using traditional disc ploughing, scarifying once and cultivating twice. The sheep are grazed using traditional 'set stock' grazing (no rotation).
The only fertiliser applied to either of the paddocks during the last 10 years has been with the crops. 40 kg/ha DAP on Winona and 60 kg/ha DAP on the neighboring farm.
No lime has been applied to either farm.

The results of this management technique are:

- Winona's paddock is dominated by 82.9% native perennial grass species. *(82.9% compared to 11% on the neighbors)*
- The neighboring paddock is dominated by 88.1% annual weed species.
- Improved ecosystem and landscape function on Winona.
- Production has increased, (double) with the number of sheep carried on Winona at 8 dse /ha compared with 3.7dse/ha on the adjoining paddock.
- Crop yields on both areas are similar
- Improved water infiltration
- Improved nutrient cycling.
- Almost double soil nitrogen
- Soil microbial counts showed that the Winona soil had significantly higher counts of Fungi *(46% increase)* and actinomycetes bacteria *(over 100% increase)*

Note: The above data is the result of a "communities in landscape" project by Peter Ampt, Rebecca Cross, and Sarah Doornbos from the University of Sydney NSW in 2010.

The soil photo and samples (below) were taken 15 meters apart and a half meter (500mm) deep on 28th September 2010 The soil on the left is from Colin Seis farm "Winona" the other sample from the neighboring farm. (Fence line comparison) *(The same paddocks as the data above)*
The following increases in soil minerals have occurred on Winona:
Calcium 227%, magnesium 138%, potassium 146%, sulphur 157%, phosphorus 151%, zinc 186%, iron 122%, copper 202%, boron 156%, molybdenum 151%, cobalt 179% and selenium 117%

The average increase in total nutrients in the Winona soil is 162 %
E.g. Calcium: 12768 kg/ha on Winona and 4602 kg/ ha on the neighboring farm (277% change)
Phosphorus: 837kg/ha on Winona and 554 kg/ha on the neighboring farm (151% change)

Soil organic carbon has increased by 203.5% over the 10 year period. There is 90.1 ton/Ha on Winona, and 43.41ton/Ha on the neighboring farm which is equivalent to 168.5tonnes of CO2/Ha sequestered to a depth of half a meter of which 78% of the newly sequestered carbon is in the non labile (humic) fraction of the soil.

Top soil has increased from 100mm (4inches) to almost a half meter (about 18 inches) and water holding capacity increased by 200% or 360,000 lt/ha

Pasture Cropped ***Traditional Crop***

Gross Margins

For many years agriculture has concentrated on production as a measure of the amount of money made. Although production or the amount of product produced is important, it is not necessarily an indication of profit. When our farms start to function in an ecologically sound manner a lot of inputs that have previously been seen as necessary like insecticides and fungicides and excessively high rates of fertiliser can be reduced and in some instances can be eliminated altogether.

When these inputs are reduced there does not need to be a reduction in profit or production, but it is important not to reduce inputs until farms and individual paddocks are functioning well other wise production and profit can be compromised.
The chart shows the difference in money spent today compared to 20 – 30 years previously when Winona was being managed with a high input agricultural system.
The costs have been converted to Australian 2011 values

	1960 -1992	1993- 2011	Difference
Superphosphate on pasture	$51,000	0	$51,000
Sheep veterinary costs	$12000	$7000	$5000
Pasture seed and pasture establishment	$5500	nil	$5,500
Cropping Expenses 200 ha (500 acres)	$40,000	$20,000	$20,000
Dollars saved on Winona annually (2000 acres)			**$81,500**

The cost of production on ‘Winona’ (sheep, wool and grain) is $81,500 less annually for inputs like fertilizer, pesticides and veterinary expenses. Combined with less expenses ‘Winona’ is generating more income, run more livestock, crop grain yield is similar, while increasing soil carbon and soil minerals. This is all being achieved while the grassland on ‘Winona’ is being regenerated and generating more income from the sale of native grass seed.

The benefits of pasture cropping are way beyond the short-term crop yields. They contribute to the development of vitally needed topsoil, water management, stabilizing the many forms of soil erosion, controlling weeds, increasing pasture plant numbers and diversity as well as great potential for increasing soil carbon levels and improving soil health. It gives farmers and graziers a tool to effectively manage their farms whilst individually contributing to a healthier environment.

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