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## **Future Agriculture: Change of Attitude, Change in Latitude**

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*[Submitted Paper]*

Sustainable Agriculture on a broadscale is a fashionable expression used regularly by individuals and research organisations to describe new, often unproven systems for land use.

In Western Australia, millions of hectares of cleared agricultural and naturally vegetated land is affected by waterlogging, salinity, acidification and loss of topsoil through wind and water erosion. While the exact area of land lost to production is uncertain, what is certain, is the potential to lose many more hectares if we continue with our existing farming systems and the communities expectation of an even higher standard of living.

The changing uses of land and the impact it has on communities and social infrastructure, are rarely ever considered by Governments or economic rationalists. Every essential food producing hectare taken out of production by alternative unproductive land use, such as real estate or even worse land degradation, means another hectare has to produce twice as much to compensate. While it is acknowledged that vegetation within our landscape has economic, social and environmental benefits in the short term, a monoculture of any species could have detrimental long term affects.

This paper looks at "Alley Farming", the integration of trees and higher water use crops and pastures into our farming systems. Alley farming is the strategic placement of trees or shrubs in single or multiple rows with bays (determined widths) of untreed land between each replication. The trees play a multipurpose role in providing water table and possibly salinity reduction, improved microclimate, environmental benefits and potential timber production. The bays allow unlimited opportunities according to position in landscape and rainfall, varying from crops, grazing pastures, fodder and horticulture. The system described in this paper, was designed to maintain production from flat, waterlogged and milolu saline land.

While the earth's crust is in continual evolution and changing over millions of years to establish new latitudes, we as its inhabitants have brought about changes in only

decades. If we are to be fed and clothed from our soil, we will need to adopt rapid changes in attitude as to the way we use our land.

The level of acceptance of broadscale sustainability in agriculture will always be determined by two factors.

- Current economic and social status (Producer).
- Expected economic and social status (Consumer).

Producers in Australia are having great difficulty maintaining a dignified economic and social status.

It is often a case of living to survive because our fragmented farming systems are not profitable enough to repay the soil for its yield and producer for their toil.

Consumers, meanwhile, have the expectation of a greater economic and social status. Expenditure on leisure and recreation takes precedence over paying the true cost of food and fibre. Without this debt to our agricultural land being met the health of our natural resources used for conservation and recreation will continue to rapidly decline. These two examples highlight the extremes of reality and expectation.

The reality is that our natural resources cannot cope with our current farming systems. We need to develop integrated Australian farming systems to cope with our environment, not expect our environment to cope with alien systems.

Society's expectation of greater affluence and better quality produce will be entirely determined by the health status of our soil and water.

Alley farming is one component of a farming system which offers soil rehabilitation, economic return, conservation and social benefits.

An initial area of 11.18 hectares of a mildly saline and waterlogged paddock was planted in 1992. The treed belts consist of 3 rows, 3 metres apart with seedlings 2 metres apart, because of the duplex soils (sand over hard clay). The tree lines were deep ripped with a bulldozer (connected to a savannah plough) to provide an unsaturated seedling bed. Cuts from the plough discs act as drains for excess water. These 3-row tree belts were replicated across the paddock, leaving pasture bays of 60, 40 and 30 metres (250, 375 and 500 trees/ha respectively).

Tree species were selected using a hand held EM38 (Electromagnetic Induction Instrument) which measures soil salt storage to 1.5 metres. Because soil salinity ranged from 25 to 220 milliSiemens per metre (mS/m), several tree species with multipurpose benefits were planted (refer to Table 1). Areas with an EM38 reading of >150 mS/m were planted to salt bush (*Altriplex Amnicola*, *Undulata*, *Cinerea* and *Semibaccata*).

To generate income from pasture bays while the trees were too young to graze (3 years) some bays were sown to pure Balansa Clover, at 5 kg/ha, and others to Balansa and oats at 5 kg/ha and 20 kg/ha respectively. Prior to establishment, this paddock produced less than 1 ton/ha of barley grass and other low value grasses.

Soil Salinity Range	Species Planted
100–150 mS/m	<i>E. Occidentalis</i> , <i>A. Saligna</i>
50–100 mS/m	<i>E. Camaldulensis</i> (4 Provenances), <i>E. Melliodora</i> , <i>E. Cladocalyx</i> , <i>E. Rudis</i> , <i>E. Microcarpa</i>
0–50 mS/m	<i>E. Maculata</i> , <i>E. Grandis</i> , <i>E. Botryoides</i> , <i>E. Cornuta</i>

**Table 1:** Allocation of species to salinity ranges

	% Dry Matter Digestibility	% Crude Protein
Pure Balansa	74.2	12.4
Balansa and oats	65.0	6.5

**Table 2:** Pasture bay nutrient yields

This change in agronomic systems produced up to 7 ton/ha of Balansa and oats with an average of 3.1 ton/ha.

Hay was cut from the bays during 1992, 1993 and 1994. Grazing took place during 1995. In 1996 the alley bays were sown to perennial grass.

Tall wheat grass ( <i>Agropyron Elongatum</i> )	10 kg/ha
Phalaris ( <i>Phalaris Aquatica+Holdfast</i> )	5 kg/ha
Puccinellia ( <i>Puccinellia Ciliata</i> )	2 kg/ha

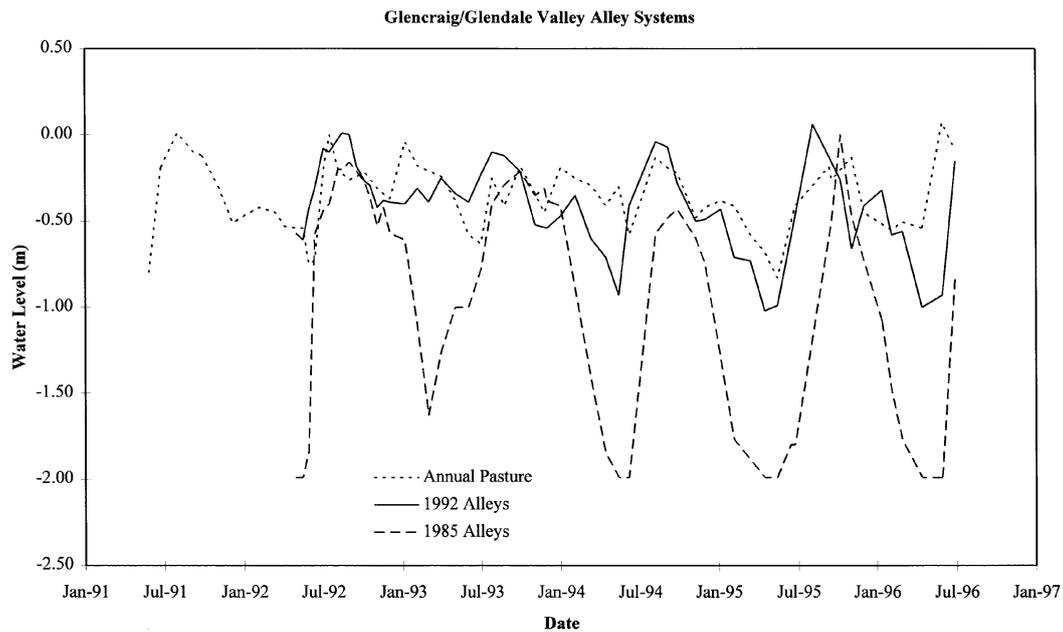
**Table 3:** Perennial grasses sown

The initial objective of this system was to generate enough income during the 3 years of hay production to pay for the cost of establishment and maintenance (see Table 4). The initial cost was \$324.00/ha and, after 3 years hay production and excluding grazing, there is only a \$34/ha deficit.

A transect of Piezometers in groups of 3 (8 metres - 6 metres - 3 metres) were drilled in 1992 by Dr Richard George and Mr Don Bennett from the Department of Agriculture, Bunbury. These are being jointly monitored on a monthly basis and results recorded on hydrographs (see Figure 1).

Future trends in water table draw down will help determine tree density and bay width. Current ground water quality varies between 1200 and 2600 mS/m with a general water table level at the end of summer. An adjacent planting of narrow alleys with bays 15 metres apart and single rows of trees was established by my father Loudon Cochrane in 1985 (now owned by Chris and Wendy Cochrane).

The tree species are predominantly *E. Occidentalis* and *E. Camaldulensi*. Hydrographs from bores recorded since 1992 show a draw down of water tables of 1.00 to 1.50 metres at the end of autumn. This significant reduction allows a greater time span for pasture development before winter water logging.



**Figure 1:** Water table hydrograph

This system of farming could be adapted with modification to all land forms and rainfall zones. It allows unlimited options for future land use within the bays while benefiting from the multipurpose effects of trees such as shade, shelter, microclimate, water use, aesthetics, flora and fauna habitat and timber production.

The recent favour of placing a monoculture of trees over entire farms may have great benefit in lowering water tables for salinity control, but denies future land use options. On-going research and integrated agriculture offer the only long term hope for a sustainable future. To achieve this goal, we need to change our attitude towards land use and accept that the soil is a living organism.

Finally. Real change will not come until we all look to the land. We all come from the land, and when we look to it, we look into ourselves where we find the power to change.

The sowing rate used was Balansa 5 kg/ha and Oats 15 kg/ha. The area was sprayed (Sprayseed<sup>®</sup> and Rogor<sup>®</sup> mix) scarified, and then drilled with 200 kg/ha of 3:2 super potash before sowing in early May. The seed was dripped on the surface and covered with trailing harrows.

Germination would have been improved if the area had been rolled after sowing. Spraying for Red Legged Mite was repeated in June using Le-mat.

## Acknowledgments

Rarely do people ever achieve goals entirely on their own. I would like to thank my father (Louden Cochrane) who had the foresight to plant the 1985 agroforestry. Richard George, Don Bennett, and also Tom Smith for their technical and physical support in the 1992 alley farming. Without their advice and encouragement, the paddock today would probably be nothing more than alleys of saltbush and puccinellia. Geraldine Capp for the use of the last paragraph which she wrote in earth

<b>Cochrane's Alley-Farming – Summary Of Costs</b>				
<b>1992</b>	Trees	Growing 8,500 trees	\$ 454.00	
		Site Preparation:		
		Ripping	\$ 1210.00	
		Drains	\$ 66.00	
		Mounding	\$ 405.00	
		Fencing	\$ 450.00	
	Pastures	Pasture Sowing:		
			Distillate	\$ 60.50
			Herbicide & Pesticide (Red Mite)	\$ 150.00
			Seed (Balansa and Oats)	\$ 118.00
			Fertiliser (Super/potash 3:2)	\$ 459.00
			Hay Making (792 bales):	
			Distillate (26 hours)	\$ 144.50
	Bailing sundries (twine)	\$ 100.00		
Margins	Total tree and pasture establishment costs (\$324/ha)	\$ 3620.00		
	Hay sales income (\$2.50 per bale)	\$ 1980.00		
	<b>Deficit (\$149/ha)</b>	<b>\$1640.00</b>		
<b>1993</b>	Margins	Total pasture establishment costs	\$ 937.00	
		Hay sales income (614 bales @ \$2.50)	\$ 1535.00	
		Profit (\$55/ha)	\$ 598.00	
		<b>Deficit 1992 and 1993 (\$94/ha)</b>	<b>\$1042.00</b>	
<b>1994</b>	Margins	Establishments Costs	\$ 950.00	
		Hay Making Costs (contract)	\$ 252.00	
		Hay sales income (620 bales @ \$3.00)	\$ 1860.00	
		Profit 1994 (\$59/ha)	\$ 656.00	
		<b>Deficit 1992, 1993 and 1994 (\$34/ha)</b>	<b>\$ 386.00</b>	

**Table 4:** Summary of costs (Total paddock area = 11.18 ha, Hay area = 7.14 ha)

2,000, West Australian Newspapers 13 November 1995, and Colin and Sue Stock for their typing skills.

Donald Cochrane has owned his farm since 1974. Since 1989 have been involved with the Lake Towerrinning Landcare Group. We initiated a plan to divert fresher water 12Kl to fill and flush the lake to reduce its salt bed. This was the social and environmental half of our plan. The other was to get involved with scientists and develop new farming systems to reduce salinity and other degradation on agricultural land. This has been very successful and hopefully will be ongoing. The landcare group won the prestigious 1993 State and 1994 National Australia Landcare Awards for its work.