



Strip Cropping in the Willamette Valley, Oregon

Implementation at Stahlbush Island Farms

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LandWISE Inc

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Introduction

This visit was made in conjunction with a trip to the Western United States in August 2002 to investigate irrigation auditing procedures, training and certification. This visit was made possible by agreement with the Sustainable Farming Fund, Hawke's Bay Regional Council and Dr John Luna from Oregon State University in Corvallis, Oregon.

The purpose of the trip was to view techniques being implemented by cropping farmers in Oregon, as numerous similarities were apparent between conditions there and in Hawke's Bay and wider New Zealand. Strip tillage has been extensively studied and trailed in the Willamette Valley, Corvallis.

Dr John Luna provides science input to the Willamette Valley Farm Improvement Association through his extension position at Oregon State University. This is a group similar in many ways to LandWISE, but it is much larger and financially stronger. In addition, they are several years further into strip tillage cropping than we are in Hawke's Bay through the LandWISE project.

Stahlbush Island Farming is owned by the Chambers family. It is a key member of the Willamette VFIA, and an example of excellent practice! Owner with his wife of the operation, Bill Chambers, attended Lincoln University for a year as an exchange student while completing his Agriculture degree. He takes an active role in all aspects. While very busy, he was very happy to take time to talk with me and tell me about the farm and their practices.

The farm manager is Rob Heater who completed most of an engineering degree before deciding he wanted to be a grower. He left university to manage an orchard, then was head-hunted by Bill. As well as managing field operations, he designs and manages construction of machinery for both the farming and food processing aspects of Stahlbush. Like Bill, he was very keen to discuss strip tillage and related aspects with me, even though the factory started processing sweetcorn the day I was there.

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Strip Tillage Cropping: Stahlbush Island Farming

Overview

Stahlbush Island Farming is a large operation started about 20 years ago. The home farm includes 700 acres of process cropping, but also houses a processing factory. The operation now includes two other farms, one south near Eureka, Oregon and one in Central Washington near where I was working.

Initially Stahlbush had two crops, corn and grass seed, then also grew pumpkins for seed. Seeking a market for the ‘waste’ pumpkin flesh they found they could sell frozen pumpkin pulp to pie manufacturers. Over time, the processing plant grew, and then started sourcing produce for contract growers as well. They now also process IQF corn, broccoli and other crops.

Over the last five years, the farm has converted almost entirely to strip tillage for main crops, particularly in Spring. There have been a number of motivators including a desire to reduce soil impact and increase soil health, time and energy savings, better yields and reduced erosion risk.

They currently use four 170hp John Deere tractors that are fitted with tracks [fig 1]. Two track widths are used; 18” early in the season when soils are moist and subject to compaction, and 12” later when soil condition has firmed and crop growth would result in damage from the wider tracks.



Fig 1. Tracked John Deere – narrow track width, fert tank on front, GPS equipment on roof

There has been a conscious effort to reduce pesticide risk to staff and the environment. This is evident in the avoidance of residual herbicides such as triazines, and organophosphate insecticides. Local waterways, including one flowing alongside Stahlbush Island Farm, have been found to have traces of such chemicals, and Stahlbush

refuses to be a potential contributor to that. In addition, they actively seek bio-control of pests and therefore seek a balanced ecology rather than 'OP sterilisation'.

The use of cover crops is a key component of their farming system. This is seen as essential for soil quality through structural improvement and bulk organic matter accumulation, and also to absorb nitrates that would otherwise be leached.

Cover crops are a mixture of a grass and a legume. Typically the legume is vetch, and the grass triticale or wheat. While lupins could be used, these tend to suffer diseases in Oregon and are not considered reliable. Other mixes, including ryegrass, are used depending on circumstance, and the ratios are also varied.

The ground preparation process in spring begins when cover crops are sprayed with a low rate of glyphosate. Depending on cover crop bulk, this may be in mid to late winter, to ensure that organic bulk is not excessive. Experience has shown that growth can easily be too much for machinery to handle if not managed.

Soil Preparation

The move to strip tillage by the Willamette farmers has been subject to all the same problems as we have found during LandWISE trials. However, being several seasons ahead, they have overcome many of these. Their current practices are similar to those being proposed by LandWISE for the coming season, in that they cultivate as a separate operation to planting. However there are some very significant differences.

While initial trials used a one-pass cultivation prior to planting, this did not provide sufficient fines to assure good emergence for many crops, including sweetcorn. Rob is adamant that there is plenty of research that shows seedbed fines are very closely correlated to yield, and this has been their experience as well.

The equipment they use allows better timeliness of operations in spring. It can work ground as soon as it could be ploughed or cultivated with other means, but requires only two passes at around 5-7 mph, and leaves 2/3 of soil uncultivated.

The strip till machines they have built are very solid and strong [see photos]. There are two machines used to prepare strips, a primary knife and disk system that is a bigger version of Hugh Ritchie's mole-knife system, and a five row rotary hoe.

The primary cultivator is based on technologies developed in Milwaukee. However, Stahlbush found their first machine broke too often. The current one was designed to accommodate high stresses and can handle large rocks that are found in the soil profile. It does require large tractors, mainly to handle its weight, though the drawbar pull needed is around 25hp per row. Key aspects to note with this machine include, heavy fabrication (3/8" wall square section), spring-loaded pop-outs on all soil engaged components, disks set to a slight angle to direct more till into the cultivated strip, a cultivated strip width of 12" and a row spacing of 36" [figs 2-5].



Fig 2. Primary cultivator for strip tillage showing disc arrangement and rear cage rollers



Fig 3. Primary cultivator for strip tillage showing disc arrangement and heavy mole knife



Figs 4&5. Primary cultivator for strip tillage showing disc arrangement and cage roller with fert nozzle

The secondary cultivation is provided by a five row rotary hoe that was also built on property [figs 6 - 9].



Fig 6. Secondary cultivator for strip tillage showing 5 shrouded rows of blades



Fig 7. Secondary cultivator for strip tillage showing full width rear roller and rubber shields

Notable on this machine is its robustness, the rubber shields, steel side-guards and the straight blades. The main shaft is very solid to accommodate twist forces. The rubber shields are large and designed to facilitate rapid simple clearing (large boot) [fig 8]. The side-guards retain soil in the cultivated strip. L-shape blades have been avoided because

of potential smearing and compacting problems, and the straight blades have been demonstrated effective [fig 9].



Figs 8&9. Secondary cultivator showing shields, fert nozzle & straight shrouded blades

The 36” row spacing used by Stahlbush is wider than normal in the area, where 30” rows are more common. Because Stahlbush also harvest crops grown on contract, they have two sets of equipment to accommodate the different row spacings.

John Luna notes that while farmers will cultivate “20 times” in conventional practice, they tend to want to use only one pass when they shift to minimum tillage. He stresses that the appropriate seedbed remains absolutely essential if maximum yield potential is to be achieved. Again, the strong scientific evidence that supports this was raised.

Precision Technology

While the Stahlbush cultivation machinery is five rows, planting and harvesting is by six row equipment. The use of RTK-GPS and auto-steer allows this with no overlap problems. The equipment is the same as that sought for trials by LandWISE with support from Trimble [fig 10].



Fig 10. RTK GPS equipment mounted on tractor roof

Using precision agriculture technology like this means strips are kept within one or two centimetres of target, and seeds are planted in the very centre of the rows. This is seen as important for high yields. It has also allowed Stahlbush to greatly increase tractor efficiency and use less skilled operators.

The decision to move into GPS and auto-steer was made when the area under cultivation increased significantly. Previously they used six large tractors, and were faced with buying three or four more. By using the precision technology they have instead reduced tractor investment to only four tractors.

An additional factor was the difficulty in marking strips or following marker lines when large amounts of cover crop were present. None of the mechanical marking methods allowed the precision required to achieve the row matching and planting tolerances required.

The technology is independent of daylight, and operator skill level needs not be as high. Therefore at field preparation and planting times, students are employed to operate tractors that work 24 hours per day. They are told to bring a book to work as their main duties are to turn the tractor at the end of the row and refill hoppers etc, both of which are prompted by machine alarms[fig 11].



Fig 11. Precision ag screens in tractor cab, steering wheel folded away

The cost of the GPS equipment is comparable to that indicated in New Zealand. The costs were US\$25,000 per tractor for GPS and radios, US\$25,000 per tractor for steering, and US\$20,000 per base station.

Currently they have one base station per tractor, and set up for each field as they go. Their farming operation is extensive, and one base was not thought sufficient. Where a number of fields in close proximity are used, one base station should be able to serve a number of tractors. However, the family also has interests in communications, and intends providing a base station service across the entire valley. This will make the ground station data available to anyone in the area by subscription, and will do away with the need for individuals to have and maintain their own bases.

Fertiliser

Starter fertilisers are applied at cultivation depending on soil test results. The use of cover crops both retains nutrients over winter and fixes nitrogen, and fertiliser additions are reduced accordingly.

Side dressings are made as with conventional crops. The use of 300mm strips allows conventional side dressers to be used, and this is preferred because of the additional weed control that is gained.

The main fertilisers are in liquid form. Large holding tanks on the property allow considerable storage, and purchases are often made in winter to take advantage of significant discounting that is offered. Fertiliser tanks mounted on the front of tractors also helps counterweight the heavy tillage equipment [fig 1].

Weed Control

The weed management programme relies on both herbicides and mechanical methods. First herbicide applications are made in winter largely to control cover crop growth, and to begin reducing vegetative bulk and strength prior to cultivation. This kills most, but not all the plants present.

Following cultivation the strips are left fallow for at least three weeks. This has been found important to assist in pest management and to encourage weed germination following cultivation.

A second glyphosate application is made three days before planting. This stale seedbed technique is the basis of weed control. Note that the glyphosate label sets a withholding period of no application within three days prior to planting. Thus a post-plant application as is used in NZ is not permitted.

Stahlbush accepts reduced rates of glyphosate may allow a number of escapes, but believes these are mostly controlled by mechanical weeding. The use of GPS has reduced the need for human labour for weed control, but not eliminated it. In corn crops, side dressing provides significant weed control.

For pumpkins and squash, a specialised mechanical weeder is used [fig 12]. This uses set tines to cultivate inter-rows, and a raisable blade to cultivate between plants [fig 13]. People sitting on the back of the machine control the in-row blades. They push a button that triggers a hydraulic ram to raise the blade [fig 14]. The comment was that school kids who place computer games can manage two rows at once, other people only one!



Fig 12. Mechanical weeder for squash and pumpkins



Fig 13. Detail of v-shape inter-row tine, discs, and raisable in-row weeding blade



Fig 14. Detail of in-row weeding blade, lifting ram and trigger unit

Selective chemicals may be used to give effective weed control as necessary. However they expect there will be some weeds present. Indeed, it was suggested that it is not possible to control all weeds in winter squash or pumpkins without using unregistered (= illegal) agrichemicals.

At the end of the main crop, a light general cultivation may be undertaken, largely as a method of physical weed control. Initially cover crops were direct drilled, but it was found that weeds were getting away especially around field edges. Cultivation controls these, and is preferred to more chemical applications.

Crop rotation and a mix of chemical and mechanical control methods allows effective weed management on Stahlbush Island Farms.

Seed Quality

Problems have been experienced with some seed-lines, especially supersweet corn seed. This season, Stahlbush had several supersweet seed-lines independently tested.

Testing seed certified as 85% showed only 78% viability, and 65% in the cold vigour test. Further research found that the rules allow companies to inflate results because of “testing variability”, and in the 70% range they can add 7% to the score. Thus 78% vigour, + 7% = 85% so the seed met the specification. However, poor germination meant they had to replant three ‘circles’ (centre-pivot irrigated fields). This cost US\$270/acre or US\$32,000 for seed.

Appendix 1: Climate Data for Corvallis (Willamette Valley) and Hastings (Heretaunga Plains)

CORVALLIS STATE UNIV, OREGON (351862)

Period of Record Monthly Climate Summary

Period of Record : 1/ 1/1890 to 12/31/2001

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Annual
Average Max. Temperature (C)	27.1	27.4	24.1	18.1	11.5	8.1	7.5	10.1	12.9	16.2	19.6	22.9	17.1
Average Min. Temperature (C)	10.7	10.6	8.7	5.7	3.3	1.4	0.6	1.7	2.8	4.3	6.6	9.2	5.4
Average Total Precipitation (mm)	10	14	38	81	163	177	169	133	110	65	50	31	1040
Average Total SnowFall (mm)	0	0	0	0	5	30	79	33	10	0	0	0	160

Source: Western Regional Climate Center via <http://www.wrcc.dri.edu/index.html>

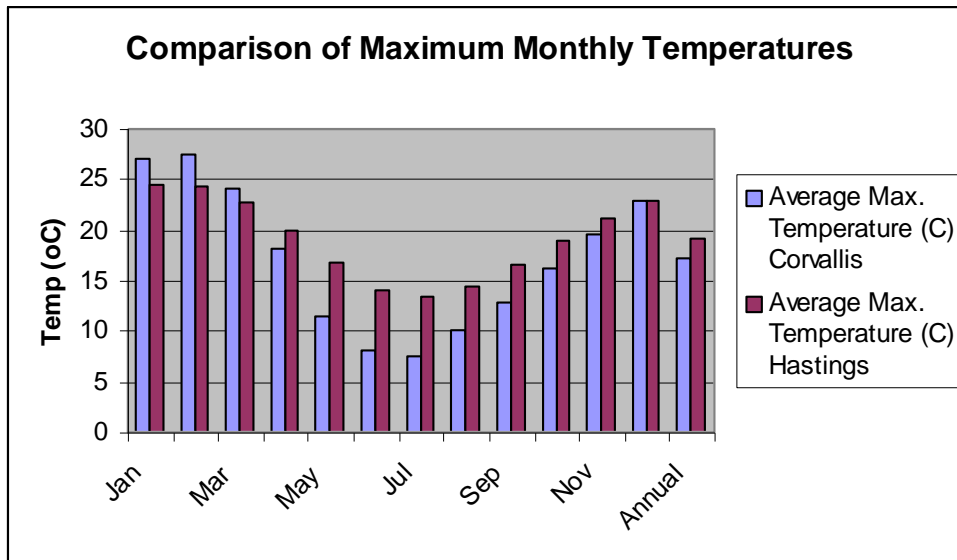
HASTINGS, NEW ZEALAND (D96681)

Period of Record Monthly Climate Summary

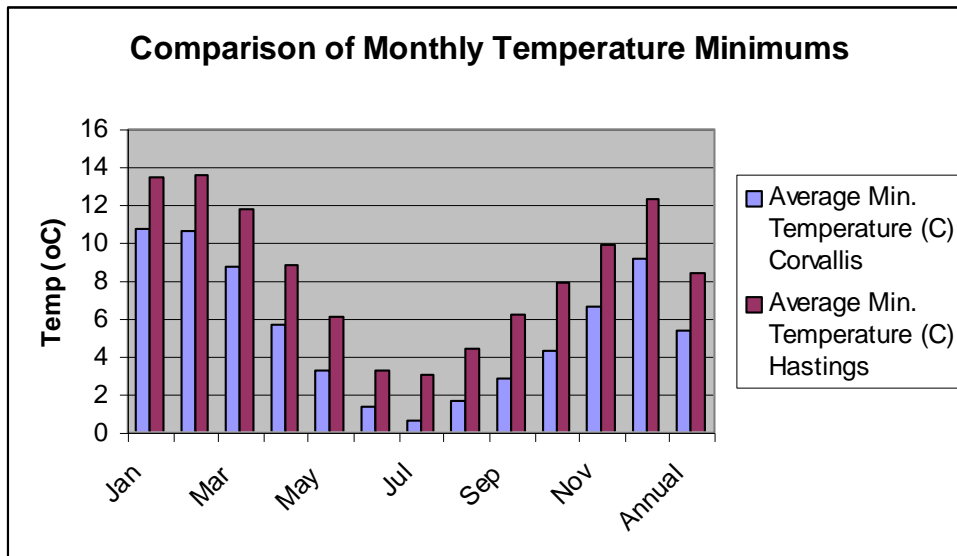
Period of Record : 1951 to 1980

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (C)	24.5	24.3	22.7	19.9	16.8	14.1	13.4	14.5	16.6	19.0	21.2	22.8	19.2
Average Min. Temperature (C)	13.5	13.6	11.8	8.8	6.1	3.3	3.1	4.4	6.2	7.9	9.9	12.3	8.4
Average Total Precipitation (mm)	49	52	71	60	63	75	77	80	55	51	40	68	741
Average Total SnowFall (mm)	0	0	0	0	0	0	0	0	0	0	0	0	0

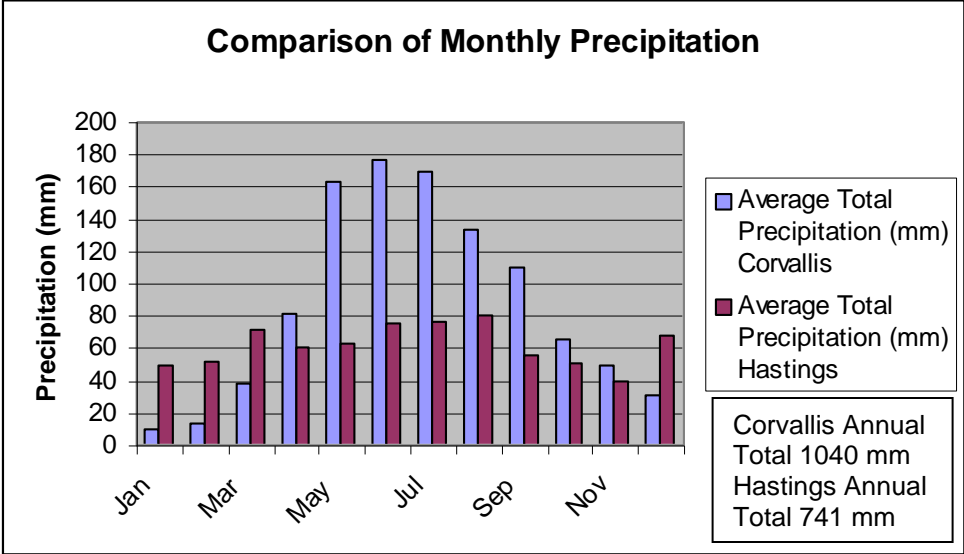
Source: Thompson, CS. 1987. The Climate and Weather of Hawke's Bay. NZ Met Service 115(5). 2nd Ed.



Note: Corvallis data adjusted by 6 months to align seasonally with Hastings



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