

Effective Integrated Weed Management - Case Study

Diligent hand weeding ultimately pays off

**The Loose Leaf Lettuce Company, Gingin,
Western Australia**



**INTEGRATED WEED
MANAGEMENT**

**Hort
Innovation**
Strategic levy investment

**VEGETABLE
FUND**

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University of
New England

Summary

Grower

Kevan, Barry and Maureen Dobra, *The Loose Leaf Lettuce Company*.

Location

Gingin, Lennard Valley, Western Australia.

Rainfall

Approximately 600 mm annual average.

Soil type

Sandy.

Crops produced

Up to a dozen baby leaf crops including spinach, rocket, mizuna, tatsoi, French kale, Swiss chard, Baby Cos Lettuce and coloured lettuce.

Major weeds

Pigweed (*Portulaca oleracea*), dwarf nettle (*Urtica urens*), winter grass (*Poa annua*), wireweed (*Polygonum aviculare*), lupin (*Lupinus* spp.), common sowthistle (*Sonchus oleraceus*).

Integrated weed management strategy

- Fallow herbicide (Spray.Seed® 250 (paraquat and diquat)).
- Fallow and bed formation tillage.
- Vigilant and comprehensive hand weeding at all stages.

Key benefits

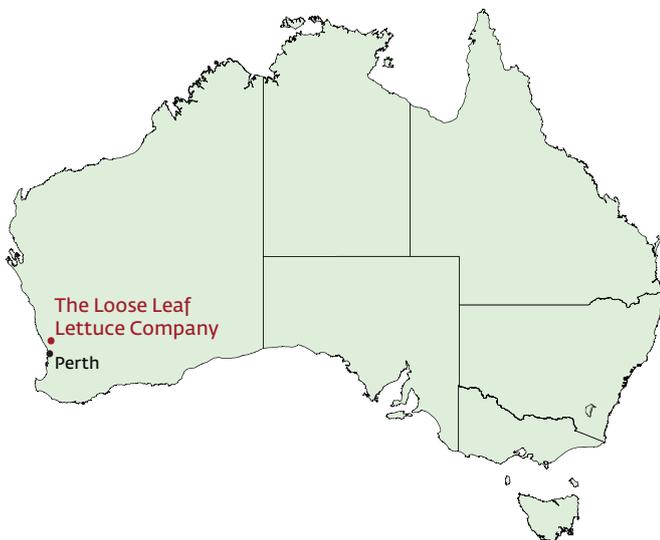
- Minimal weed impact after several seasons.
- No need for chemical fumigation or residual pre-emergent herbicide use.
- Reduced longer-term weed management costs.
- Minimal contamination of harvested produce by weeds.
- Improved staff morale and pride.

Introduction

History

The Dobra family are third-generation vegetable growers based in the Gingin district, approximately 90 km north of Perth, Western Australia.

Maureen and Barry Dobra have over 40 years experience growing a range of vegetables, including carrots, beets, turnips, radish, lettuce, broccoli and rockmelons. Their children Deanne, Simone, Kevan and Peter, and now two grandchildren are involved in the business.



Map 1 Location of the Loose Leaf Lettuce Company, Gingin district, Western Australia.

In 1996, a client request for smaller lettuce leaves led Deanne and Simone to start The Loose Leaf Lettuce Company, believing in the growth potential in focusing on loose leaf production. Eventually, loose leaf production became the family's sole production focus. In addition to the original 9.5 hectare farm, which has been in the family since 1981, the Company maintains a second larger farm, also in the Gingin district.

Markets and crops

The Loose Leaf Lettuce Company focuses on supplying the local (Perth and south-west Western Australian) market, producing approximately a dozen types of baby leaf salads, including spinach, Asian salad, rocket, chard, French Kale, mizuna and tatsoi.

Farm characteristics

The 9.5 hectare farm features sandy soils, irrigation from two spring-fed dams, and receives an average annual rainfall of approximately 600 mm. Here, the Company maintains an intensive year-round production cycle. In the warmer months, crops take approximately four weeks from sowing to harvesting. In winter, crops are usually harvested approximately seven weeks after sowing.

Production characteristics

The Company invested in the first loose leaf lettuce harvester in Australia in the late 1990s, eventually upgrading their equipment to a custom-made harvester suited to their specific needs.

Loose leaf production is an intensive year-round activity. Led by farm manager Steve Allie, harvesting occurs on most working days of the year to ensure maximum freshness and quality produce. Similarly, new crops are sown twice a week to maintain the production cycle. Harvest is usually completed in the early morning, and harvested crops are processed using facilities on-farm.



Figure 1 Loose leaf crop harvesting.

Former weed management approach

Weed management methods

In the past, The Loose Leaf Lettuce Company's weed management approach included the following:

- *Chemical fumigation* of the soil, using metham sodium, to manage soil-borne diseases as well as the weed seed bank.
- Heavy reliance on a number of *pre-emergent herbicides*. Depending on the crop being grown, these included Dual Gold® (s-metolachlor), Dachthal® 900WG (chlorthal-dimethyl), and Ramrod® (propachlor).
- *Frequent tillage*, including 3-4 tillage passes in summer and up to 5 in winter, to incorporate and break down crop residue, control weeds, and prepare the beds for the next crop.
- Application of glyphosate *non-selective herbicide* to the crop beds post-harvest, as well as along irrigation lines, buffer zones, and surrounding infrastructure such as fencelines, sheds and water storage.

Why did they decide to change?

Ongoing weed problems

Despite their hard work, the team noticed that paddock irrigation lines remained heavily infested with weeds. This was causing ongoing weed issues within the crops through a large weed seed bank that was not being reduced.



Figure 2 Milk thistle (*Sonchus oleraceus*) in the irrigation lines in April, 2014.

Staff time and morale

Keeping on top of the weed issue was taking a lot of paddock staff time, causing issues for processing staff, and reducing the team's morale.

Insect hosting

Weeds were considered to be a host of insect pests which had negative effects on the crops. Weeds and crops which have been rotary hoed in also host stable fly, which is a serious issue for livestock producers around Gingin.

Processing costs

Weed contamination of harvested loose leaf had been an ongoing problem for the Company's processing staff, and exposed the Company to complaints from their clients if not addressed during processing.

Pre-emergent herbicide reliance

Their heavy reliance on pre-emergent herbicides led the Company to become concerned about the possible risks this posed to staff health, possible negative side-effects for soil health, and crop stunting.

Dislike of weeds

Company management and staff all disliked seeing weeds on their farm. They took pride in maintaining clean paddocks, and were attracted to the idea of alternative approaches that would minimise the problem of weeds over time.

New weed management approach

In response to these ongoing issues and motivated by a desire to improve the morale of their staff and maintain clean paddocks, Kevan, Maureen and Barry, and their farm manager Steve, worked out an alternative integrated approach to weed management in 2014.

This approach needed to suit their intensive production system which meant there was very little time between harvest and sowing the next crop. Intensive production excluded considering approaches such as stale or false seed beds, long fallows with non-selective herbicide application or regular tillage, or cover crops to suppress weeds and improve soil health.

Hand weeding ✓✓✓

Constant and diligent hand weeding is central to the Company's Integrated Weed Management (IWM) strategy.

The decision to focus on particularly intensive hand weeding required a number of significant farm management practice changes.

- Making a significant up-front investment in hand weeding labour.
- Motivating all staff to make hand weeding a much larger part of their activity.
- Willingness to keep up with hand weeding over several seasons as the weed seed bank was depleted.
- Recognition amongst staff that their diligence and hard work would eventually be rewarded.



Figure 3 Removing winter grass (*Poa annua*) from the crop by hand to minimise weed seed production and crop contamination.

All field staff are encouraged to do the following:

- **Remain vigilant and always look for weeds.** Make a note of where weed outbreaks had been found and remove them immediately, or otherwise as soon as possible.

- **Remove weeds by hand at any time**, from the irrigation lines as well as within the crop beds.
- **Use other field activities as an opportunity to carry out immediate hand weeding.** Examples include checking on irrigation infrastructure or inspecting the crops.
- **Dispose of all weeds off-paddock.** Hand-pulled weeds are taken away from the paddock and deposited on the farm's burn pile. Leaving removed weeds in the paddock means they can potentially re-establish or deposit weed seed, creating problems in subsequent crops.
- **Take pride in the weed-free crops they produce.**



Figure 4 Field staff carry buckets during field activities to allow all weeds removed to be taken off-paddock to the farm's burn pile.

Initially, one staff member was employed full-time to hand weed the vegetable paddocks. Several years of diligently removing as many weeds as possible by hand means that today the team need only spend a combined 3-4 hours per week on hand weeding.

Herbicide

While herbicides were heavily relied upon in the Company's previous IWM approach, the new approach now results in only one herbicide being used to manage weeds within the crop beds, with fewer applications.

When are herbicides used in the crop?

The broad-spectrum herbicide Spray.Seed® 250 (paraquat and diquat) is applied once during the short fallow period in the intensive production system, to burn off the residual crop plants as well as any weeds that have grown in the fallow. The residual crop plants and weeds are controlled quickly.

Other herbicide application

Fence lines, buffer zones and other nearby infrastructure are spot-sprayed with either Spray.Seed® 250 or glyphosate, to ensure that weeds in these areas do not produce seed and encroach on the crop, or host crop pests and diseases.



Figure 5 Wide buffer zones around the paddocks are kept free of weeds using herbicide, to minimise the risk of weed seed spreading into the cropped area.

Tillage

The Loose Leaf Lettuce Company has significantly reduced the amount of tillage used for weed control.

In summer, this usually involves only two tillage passes per crop, which in turn promotes good environmental practices. Approximately two days after Spray.Seed® 250 application, crop and weed residues are incorporated

using a single tillage pass. Immediately before the crop is established, the soil is tilled a second time.

In winter, a third tillage pass may be required before crop establishment, since residues from the previous crop take longer to break-down in cooler conditions. This is only carried out if needed.



Figure 6 The Loose Leaf Company's IWM strategy has resulted in paddocks that are nearly free of weeds, after several years of dedicated application.

Benefits of the new approach

Weed management and impact

- **There are now relatively few weeds growing in the crops.** Those that still emerge are removed diligently by the team before they produce seed.
- Soil samples collected across the farm as part of an industry-funded national weed seed bank study yielded **only a single viable weed seed** – an extremely rare outcome.
- **Pre-emergent herbicides are no longer required.** After 2-3 seasons of using their new IWM strategy, the Company decided to stop all pre-emergent herbicide use. This has helped address their previous concerns about staff health and welfare, soil health, and crop stunting.
- Similarly, **chemical fumigation using metham sodium is no longer necessary**, with significant benefits for beneficial soil biota assumed, as well as reduced risk to staff health.
- After several seasons of more intense hand weeding, the team now need to spend relatively little time on hand weeding to stay on top of weed issues – **shorter-term investment in hand weeding has achieved longer-term ongoing rewards.**
- The Company has managed to approximately **halve its use of tillage** (and associated costs) while at the same time maintain significantly improved weed management.

Farm impact

- The impact of weeds on the crops have greatly decreased. This includes their direct impacts in competing with crop plants and contaminating the harvested leaves, but also reduced impact of insect pests that may be hosted by weeds.
- The Loose Leaf Lettuce Company estimates that minimising the weed burden on the farm has increased crop yield by approximately 10%.
- Processing staff are benefiting greatly from having relatively few weeds to separate from the cut leaf after harvest; similarly, the Company's customers benefit from having access to higher quality weed-free produce.
- Because the residual crop plants and any weeds present after harvest are controlled quickly using Spray. Seed® 250, the incorporated organic matter does not act as a host for stable fly. Other insects that may damage the crop are also less likely to thrive.
- Pride and morale amongst both field and processing staff has improved by observing the many benefits of maintaining a relatively weed-free farm, and noticing that their early hard work is now paying off with weeds becoming a relatively small ongoing management issue. Visitors to the farm also often comment on farm aesthetics and cleanliness of the paddocks.

Financial benefits

- Reduced costs in herbicide purchase and application (salary, machinery and fuel).
- Reduced costs associated with tillage (salary, machinery and fuel).
- Improved yield.
- Reduced processing costs.

Suitability to other vegetable farms

The key principle of The Loose Leaf Lettuce Company's strategy is to *minimise the number of weeds that mature and produce seed*.

No matter what IWM approach is used, this principle is applicable to all vegetable farms.

The specific IWM approach used by The Loose Leaf Lettuce Company may not apply fully to all vegetable farms. The production team noted several limitations to their approach.

- Not all growers will have the ability to spend extra time or employ extra staff to remove all weeds by hand before they produce seed.
- Some farmers may prefer not to use Spray.Seed® 250 herbicide.
- This approach is potentially suited to smaller vegetable farms where it may be more feasible to 'keep on top of' the weed burden manually.
- Some farm operations include longer fallow periods, whereas the intensive production system of The Loose Leaf Lettuce Company means that a long fallow is not applicable. Longer fallow periods may require additional weed management options, such as:
 - additional tillage or non-selective herbicide application or thermal weeding;
 - cover crops to suppress weeds and improve soil health and structure; or
 - a stale or false seed bed to reduce germinated weeds before the crop is established.

Conclusion

The experience of The Loose Leaf Lettuce Company suggests that **diligent application of a simple but effective weed management approach over several years can have long-term benefits**.

Although their approach is **initially** more costly and time consuming, Kevan, Maureen and Barry and their team, led by Steve, are now enjoying the many rewards of their dedication and hard work.

Effective weed seed bank management should be the overall goal of any Integrated Weed Management Strategy.

We are grateful to Kevan, Maureen and Barry Dobra, Steve Allie and The Loose Leaf Lettuce Company for sharing their story of successful Integrated Weed Management.

Disclaimer

Descriptions of herbicide use in this guide are not to be taken as recommendations. Herbicides must only be used in accordance with the recommendations provided on herbicide labels. Readers are reminded that off-label use of herbicides may be restricted or not permitted under relevant legislation. Landholders are therefore advised to determine current registrations and legal requirements for herbicides they may be considering, and to consult with their State or Territory government departments regarding the legal requirements they are obligated to adhere to relating to herbicide use and weed control.

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