SOUTHERN
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GRDC GROWNOTES™

GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

FABA BEAN

SECTION 14

ENVIRONMENTAL ISSUES

KEY POINTS | ABIOTIC STRESS | IMPROVING THE FARM RESOURCE BASE | SOIL EROSION | WATER | NUTRIENTS | BIOLOGY

Environmental issues

Key points

- **Important environmental issues include: soil erosion management, responsible pesticide stewardship and biosecurity.**
- **Other issues include water use, managing nutrient losses, rhizobium activity with changed atmosphere, and integrated management of pests, weeds and diseases.**

FEEDBACK

Table 1: Environmental issues affecting the Australian grains industry, based on stakeholder consultation workshops.

Global	National/industry	State/regional	Local/farm
• Climate change • Water availability • Energy • Biosecurity	• Water • Drought • Land degradation • Biosecurity • Changing land use • Adoptable, adaptive farming systems • Genetically modified organisms (GMO) • Greenhouse emissions	• Resource condition and management targets • Environmental flow, water quality, sediments • Shifting production zones, changing farming systems, 'marginal cropping' • Biosecurity	• Healthy soils • Managing drought: variability • Managing pests and weeds • Balance • Local environment

Source: M Blumenthal, A Umbers, P Day (2008) GRDC A Responsible Lead: an Environmental Plan for the Australian Grains Industry. Grains Research and Development Corporation, https://grdc.com.au/uploads/documents/GRDC_Environmental_Plan.pdf

14.1 Abiotic stress

14.1.1 Drought and heat stress

For information on faba bean response to drought or moisture deficit, see Section 5.5.4 Drought.

For more information on faba bean response to heat stress, see Section 5.5.3 High temperature and wind.

14.1.2 Waterlogging

For information on faba bean response to waterlogging, see Section 5.5.7 Waterlogging.

14.1.3 Frost

For information on faba bean response to frost, see Section 5.5.2 Frost.

14.1.4 Lack of sunlight

For information on faba bean response to lack of sunlight, see Section 5.5.5 Low light.

14.2 Improving the farm resource base

One of the GRDC's six themes – 'Improving your farm resource base' – focuses on protecting and enhancing the farm's soil, water, habitat and atmospheric resources to maintain production performance under a variable climate and to demonstrate to consumers and the wider community the sustainable nature of Australian grains production.

Soil carbon is declining in many grains catchments, as is soil pH. Although water consumption by agriculture is being reduced and becoming more efficient, water quality in some key catchments requires further management. Native vegetation (plant) communities have become highly fragmented, affecting both biodiversity balance and the potential for exploitation as habitat for beneficial organisms.[1]

1 GRDC (2012) Investment themes and outcomes, Strategic plan, http://strategicplan2012.grdc.com.au/investment_themes_and_outcomes/part6_theme_5_improving_your_farm_resource_base.html

FEEDBACK

MORE INFORMATION

The GRDC has produced a booklet on environmental planning, *GRDC A Responsible Lead: an Environmental Plan for the Australian Grains Industry*, https://grdc.com.au/uploads/documents/GRDC_Environmental_Plan.pdf

Soil health is declining in many cropping areas. As soil organic carbon levels decrease, soil acidification increases and soil erosion can be a problem if stubbles are not retained during the cropping phase of rotations.

14.2.1 Environmental issues plan

The GRDC, in consultation with industry partners, has developed an environmental plan for the grains industry to help ensure that environmental issues are prioritised when developing research policy.

It should help equip Australian grain growers to manage a broad range of environmental challenges – including climate change – while continuing to develop a profitable, progressive and sustainable industry.[2]

14.2.2 Industry issues

Management of a number of environmental issues pertaining to faba bean are detailed in the guide *Growing Australian Grain: safely managing risks with crop inputs and grain on-farm* (http://grainsguide.grainproducers.com.au/). It includes information on:

- managing farm chemicals related to maximum residue limits (MRLs) and cross-contamination with handling equipment;
- harvest fire risk compliance;
- fertilisers free of excess contamination of heavy metals; and
- biosecurity.

14.3 Soil erosion

Information relating to crop nutrition, soil fertility and managing faba bean in hostile soils is found in Section 6 Nutrition and Fertiliser.

14.3.1 Reducing risk of soil erosion

Pulses can leave soils prone to water and wind erosion as they leave little to no stubble after harvest. Faba bean crops leave soil at less risk of erosion than chickpea, lentil and field pea.

Retaining cereal stubbles

Retaining cereal stubbles when sowing faba bean will protect soil and young crops from wind damage. Two tonnes per hectare of cereal stubble reduces the risk of wind and water erosion. Heavy stubbles need to be broken down into 10–15 cm lengths.

Retaining stubbles has a number of other environmental benefits. It provides a source of organic matter, allowing recycling of plant nutrients. Organic matter improves soil structure and earthworm activity and can increase grain yields and farm viability.

Faba bean stubble management

The presence of stubble can protect soil from rain impact and reduce water run-off and erosion. On sloping land, 3 t/ha is needed to reduce the erosion risk.

Pulse stubbles require careful grazing management on light soils. But careful grazing is also required on heavier soils, where overgrazing can create dust problems, in turn affecting clean fleece yields.[3]

2 M Blumenthal, A Umbers, P Day (2008) GRDC A Responsible Lead: an Environmental Plan for the Australian Grains Industry. Grains Research and Development Corporation, https://grdc.com.au/uploads/documents/GRDC_Environmental_Plan.pdf

3 Pulse Australia (2016) Rotational benefits and profitability. Southern Faba & Broad Bean – Best Management Practices Training Course Module 1. 65 pp, Pulse Australia.

Effect of soil type on erosion risk

An assessment of the erosion risk caused by break crops in the Mallee (which did not include faba bean) found that the majority of pulse crops had a very low risk of erosion on all soils but one in three pulse crops posed an unacceptable erosion risk in dune soils.[4]

For pulse crops, choose the more fertile paddocks with medium to heavy textured soils. Otherwise utilise stubble retention systems to minimise erosion risk in the pulse crop.

Poor emergence is more likely with pulses on hard-setting soils, which can lead to a greater potential for soil erosion.

Agronomic management to reduce erosion risk

Rolling after sowing a pulse crop can leave some soils prone to erosion; in these situations rolling after crop emergence is preferred.

Strip cropping may be used to protect the erosion prone crop with alternate strips of 'protective' crop.[5]

14.4 Water

Understanding climate and estimating target yields of faba bean, enabling tailored management decisions and benchmarking water use efficiency is detailed in Section 2.7 Yields and yield targets.

Details of stubble retention and controlling summer weeds to improve water use efficiency are found in Section 2.3 Stubble and summer weed management.

Management of irrigated faba bean to maximise grain yields and water use efficiency is covered in, Section 2.6 Irrigation layout and planning.

14.5 Nutrients

Growers aim to match the crop's nutrient requirements with fertiliser inputs. A study in the high-rainfall zone found that where growers optimise their gross margins they are likely to be optimising their environmental performance.[6] For more details on crop nutrition, including precision agriculture and nitrogen fixation in faba bean, refer to Section 6 Nutrition and Fertiliser.

14.5.1 Nutrient losses

In addition to removal of nutrients in produce, nutrients can be lost from farms through run-off, drainage beyond the root zone (leaching), soil erosion, lateral flow in the soil profile and emission of gases (including burning).[7]

An outcome of the major GRDC initiative More Profit from Crop Nutrition is better matching of nitrogen, phosphorus, potassium and sulfur inputs to meet crop demand and minimise losses and tie-up. A list of projects included in the initiative can be found at: https://grdc.com.au/Research-and-Development/Major-Initiatives/More-Profit-from-Crop-Nutrition.[8]

A study in Victoria's high-rainfall zone concluded that, overall, flexible cropping systems that maximise crop potential with a minimum of applied nitrogen at sowing, maximise both economic and environmental performance.

4 http://grainsguide.grainproducers.com.au/

5 Pulse Australia (2016) Rotational benefits and profitability. Southern Faba & Broad Bean – Best Management Practices Training Course Module 1. Pulse Australia.

6 D Nash (undated) Management of high rainfall cropping systems to improve water quality and productivity. GRDC Project Summary, DAV00059, https://grdc.com.au/uploads/documents/Project%20summary%20DAV00059%20FINAL.pdf

7 Australian Soil Information Resources System, www.asris.csiro.au/themes/nutrient.html

8 GRDC (undated) More profit from crop nutrition, https://grdc.com.au/Research-and-Development/Major-Initiatives/More-Profit-from-Crop-Nutrition

Monitoring run-off suggests that high-rainfall cropping in the southern region could adversely affect receiving waters. Soil studies of the long-term cropping trial site in north-east Victoria also suggest that nutrient concentrations in run-off may be higher from reduced-tillage systems. However, there was less drainage from these systems and therefore lower nutrient exports, overall.[9]

14.5.2 Nitrogen fixation and changing atmosphere

Research into the effects of elevated carbon dioxide (CO_2) on cropping systems has shown that higher CO_2 provides more nitrogen from pulse stubble but no increase in *Rhizobium* activity.[10]

14.6 Biology

14.6.1 Biosecurity

Biosecurity is the protection of farms, industries and the natural environment that could be harmed through the introduction of new pests.

Growers need to prevent exotic pests and diseases from entering their farm and detect new pests early with vigilant surveillance and excellent farm hygiene.

For details of pest-related biosecurity issues for faba bean, see Section 8.6 Exotic faba bean insects – biosecurity threats.[11]

For factsheets on biosecurity in grains farms, visit: www.planthealthaustralia.com.au/national-programs/grains-farm-biosecurity-program/grains-biosecurity-fact-sheets/

14.6.2 Integrated pest management

Integrated pest management aims to minimise the use of highly toxic pesticides, and/or those that are harmful to the predators and parasites that help keep pests in check.

Details of integrated pest management of invertebrate pests in faba bean can be found in Section 8.1 Integrated pest management (IPM).

14.6.3 Integrated weed management

An integrated weed management (IWM) system combines all available methods for control of weeds, including herbicide and non-herbicide options. For more information on IWM in faba bean, see Section 7.4 Integrated weed management (IWM).

Disease management in faba bean is critical, and relies on an integrated approach including variety choice, crop hygiene and strategic use of fungicides. For more information on integrated disease management, see Section 9.2 Integrated pest management (IPM) strategies.

14.6.4 Responsible pesticide stewardship

Legal considerations

Information on the registration status, rates of application and warnings related to withholding periods, OH&S, residues and off-target effects should be obtained before making decisions on which pesticide to use. This information is available from state department chemical standards branches, chemical resellers, the

9 D Nash (undated) Management of high rainfall cropping systems to improve water quality and productivity. GRDC Project Summary, DAV00059, 1 pp., https://grdc.com.au/uploads/documents/Project%20summary%20DAV00059%20FINAL.pdf

10 G Fitzgerald (undated) AGFACE: Elevated CO2 research in the great southern (dry) land.Presentation, AGFACE Crop Science Workshop, www.piccc.org.au/resource/agface-workshop-presentations/573

11 J Moran (2014) Biosecurity – local action to prevent exotic pest incursions. GRDC Update paper, 23 July 2014, https://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2014/07/Biosecurity-local-action-to-prevent-exotic-pest-incursions

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Australian Pesticides and Veterinary Medicines Authority (APVMA) and the pesticide manufacturer.

All pesticides go through a registration process, where they are formally authorised (registered) by the APVMA.[12] Details of product registrations and permits are available on the APVMA's website.[13]

The approved product label is a legal document that prescribes the pest and crop situation where a product can be legally used, and how. Using products for purposes or in manners not on the label involves potential risks. Guidelines on the label protect product quality and Australian trade by keeping pesticide residues below specified maximum residue limits (MRLs).

Material Safety Data Sheets (MSDS) document the hazards posed by the product, and the necessary and legally enforceable handling and storage safety protocols.

In some cases a product used on faba bean may not be fully registered but is available under a permit with conditions attached, which often require the generation of further data for eventual registration.

National residue survey

Pesticide residue levels in products must comply with maximum residue levels (MRLs) set in Australia and internationally (CODEX).

Australian grain samples are monitored as part of the National Residue Survey (NRS), conducted by the Department of Agriculture, Fisheries and Forestry (DAFF), for managing the risk of chemical residues and environmental contaminants in Australian food products.

Participation in the NRS is voluntary, and many of the pulse industry marketers and handlers participate. Failure to comply with safe pesticide use could jeopardise Australia's faba bean industry and markets.[14] See the NRS website (http://www.agriculture.gov.au/ag-farm-food/food/nrs) or call 1800 420 919.[15]

12 Pulse Australia (2016) Chemical application. Southern Faba & Broad Bean – Best Management Practices Training Course Module 1. 37 pp, Pulse Australia.

13 Australian Pesticide and Veterinary Medicine Authority (APVMA)

14 Pulse Australia (2016) Chemical application. Southern Faba & Broad Bean – Best Management Practices Training Course Module 1. 37 pp, Pulse Australia.

15 Department of Agriculture, Forestry and Fisheries, National Residue Survey

FEEDBACK

MORE INFORMATION

GRDC Fact Sheet: Spray right to avoid spray drift: best management practices, https://grdc.com.au/Resources/Bookshop/2008/12/Managing-Spray-Drift-fact-sheet

See the Spray Application Manual GrowNotes™

IN FOCUS

Prevention of spray drift

GRDC-funded research into managing spray drift is continuing, including use of shielded sprayers in wide row cropping.

For information on nozzle selection to reduce the risk of drift, see: https://grdc.com.au/Resources/Publications/2015/08/Nozzle-Selection-Guide. This nozzle selection guide includes litres per hectare at various speeds based on 50-cm nozzle spacing.[16]

For details of the effects of surface inversion layers on spraying, go to https://grdc.com.au/Resources/Factsheets/2014/08/Surface-temperature-inversions-and-spraying[17]

Other on-farm issues, including drought, moisture stress, waterlogging, frost and lack of sunlight, also impact on farm productivity. Information on these issues can be found in Section 5 Plant growth and physiology.

16 GRDC (2015) https://grdc.com.au/Resources/Publications/2015/08/Nozzle-Selection-Guide

17 GRDC (2014) Surface temperature inversions and spraying, fact sheet. Grains Research and Development Corporation, https://grdc.com.au/Resources/Factsheets/2014/08/Surface-temperature-inversions-and-spraying