SOUTHERN
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GRDC GROWNOTES™

GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

LUPIN

SECTION A

INTRODUCTION

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MORE INFORMATION

GRDC Final Reports: https://grdc.com.au/research/reports

GRDC Project Summaries: https://grdc.com.au/research/projects

GRDC Pulse Australia 'Australian Pulse Crop Forecasts': http://pulseaus.com.au/storage/app/media/industry/20160613_AU-pulse-crop-forecast.pdf

Lupins.org: www.lupins.org

DPIRD 'Guide to Growing Lupins': https://www.agric.wa.gov.au/lupins/lupin-essentials-%E2%80%93-growing-successful-lupin-crop

DAFWA 'Bulletin 102008 Producing Lupins': http://researchlibrary.agric.wa.gov.au/cgi/viewcontent.cgi?article=1009&context=bulletins

Introduction

A.1 Crop overview

Australia dominates as a world lupin producer and has been responsible for about 85 percent of global supply of this pulse grain annually during the past decade.

Lupin is a winter crop, grown in Western Australia, South Australia, New South Wales and Victoria.

Production in the southern cropping region is focused on narrow leafed lupin (*Lupinus angustifolius*), also known as Australian sweet lupin, and albus lupin (*L. albus*), or white lupin.

Narrow leafed lupin suits acidic, sandy or low fertility soils and development of a range of varieties has assisted southern growers, especially in SA, to include this beneficial break crop in rotations.

In the southern region, albus lupin is grown mostly in VIC (along with narrow leafed varieties) and is best suited to fertile, well-drained and heavier soils. These varieties do particularly well on the more alkaline soils in the south of that State.

Narrow leafed lupin has major advantages as a rotational break crop in cereal cropping systems, including contributing to nitrogen (N) fixation, offering a quality stock feed product option and having potential for sale into existing high-value export markets.

Australian lupin grain production significantly contracted during the past two decades, from almost two million tonnes in 1999 to 578,400 t in 2015.[1]

This was mainly due to difficulties in weed control, aggravated by development of herbicide resistance in the main weed species of lupin-wheat rotations and high returns for canola as an alternative break crop.

Lupin grain production has started to increase in recent years as new varieties and management options have become available to Australian growers on the back of research, development and extension efforts.

A.2 Value of lupin in crop rotations

When planning lupin in a cropping rotation, key considerations include crop sequences, weed burdens and types, herbicide options and disease issues.

The ability of lupin to thrive in low nutrient soils and effectively fix N typically results in higher yielding cereal crops following a lupin crop than cereals following pastures. In turn, a lupin crop tends to yield better after cereals than a pasture.

It is recommended to avoid growing lupin immediately following lupin or pasture in sequences and to ensure good summer paddock preparation for weed control.

1 Pulse Australia (2016). Australian sweet lupin production 2010-11 to 2015-16, http://www.pulseaus.com.au/storage/app/media/industry/AU-lupin-exports.pdf

FEEDBACK

A.3 Nutrition

The timing and rates of nutrient and fertiliser application are best planned to meet the lupin plant's growth cycle and requirements.

In southern Australia, manganese (Mn) deficiency can be particularly difficult to correct and potentially leads to split seed disorder later in the season.[2]

Zinc (Zn), phosphorus (P) and sulfur (S) deficiencies can significantly reduce legume production in parts of the southern region.

Most soils in this region also have low natural P levels, which can lead to poorer productivity of narrow leafed varieties in some areas.

A.4 Weeds and pests

Weed and pest management in southern lupin crops starts with summer and pre-emergence control, followed by monitoring and control measures after the crop has emerged.

Integrated pest and weed management plans are recommended. These take into account tactics including:

- Rotations to reduce weed burdens and pest presence
- Cultivation to eliminate food sources
- Machinery and vehicle hygiene
- Crop competition
- Use of herbicides and insecticides per label recommendations.

Typically, a lupin-cereal rotation is beneficial to remove grass weeds in broadleaf lupin crops and broadleaf weeds in cereal crops.

This can also help to reduce carry-over of disease and pests.

Major weeds affecting lupin crop production in the southern region include annual ryegrass (*Lolium rigidum*), wild oats (*Avena fatua L.*), brome grass (*Bromus diandrus* and *B. rigidus*), barley grass (*Hordeum*) and wild radish (*Raphanus raphanistrum L.*).

Moves towards minimum or no-tillage farming systems with stubble retention and a changing climate have contributed to an increased impact of pests, costing the lupin industry in the southern region an estimated $14 million in control methods annually.[3]

Snails, Redlegged earth mites (*Halotydeus destructor*) and aphids (*Aphididae*) are among the main pests that cause lupin crop damage in SA, NSW and VIC.

A.5 Disease

Foliar and root diseases are a substantial risk to yield in lupin crops.

The main production-limiting disease, anthracnose, has occurred in narrow leafed lupin crops on the Eyre Peninsula in SA, but has not been sighted in recent years. Quarantine restrictions for importation of SA lupin grain into VIC and NSW have been in place since 1996.

While SA growers should be aware of anthracnose from a marketing perspective, its risk does not affect crop management - including variety choice.

Anthracnose was reported in commercial crops in NSW in 2016 and eradication zones are set up. More information can be found at: www.dpi.nsw.gov.au/biosecurity/plant/recent-pest-arrivals/lupin-anthracnose.

2 Lupins.org (2016) website Banding manganese fertiliser for lupins, http://www.lupins.org/production/#farming

3 Murray, D, Clarke, M and Ronning, D (2013). The current and potential costs of invertebrate pests in grain crops, Grains Research and Development Corporation, https://grdc.com.au/__data/assets/pdf_file/0026/159281/grdcreportcurrentpotentialcostsinvertebratepests-feb2013pdf.pdf.pdf

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Phomopsis stem and pod blight, Brown leaf spot, Cucumber mosaic virus (CMV) and Sclerotinia stem and collar rot also require control in some areas of the southern region in some seasons.

Incidence of root and hypocotyl rot diseases in southern region lupin crops has declined in the past 20 years, largely due to better variety resistance. However, these root diseases can still present significant production risk without stringent controls.

Monitoring during plant development and ensuring adequate weed and pest control can help to reduce the impacts of root and foliar diseases in lupin crops.

Fungicide treatment options can be limited for some diseases after lupin crops have germinated.

A.6 Plant maturity and harvest

Desiccation and crop-topping, with windrowing/swathing, to strategically apply herbicides and control crop maturity is an option with lupin crops.

But these methods can cause significant yield losses if not well-timed.

In recent years, lupin breeding and maturity development by Pulse Breeding Australia (PBA) has produced earlier maturing narrow leafed lupin varieties that are better suited to this system.

If growers choose to crop-top lupin, immediate harvest is advised after the required withholding periods are met.

In recent years, lupin breeding has assisted in release of varieties with traits for lower pod shatter to reduce losses at harvest.

It remains advisable to harvest lupin as soon as the crop is ripe to minimise potential for yield loss due to plant lodging, pod shattering or pod drop/shedding and grain quality decline.

The best harvesting window is within three weeks of maturity and when grain moisture reaches 14 percent, regardless of the outward appearance of the plant.

Harvesting below this moisture level can increase bruised and cracked seed risk and reduce germination and vigour in planting seed.

Key considerations for storage of lupin grain include moisture content and temperature control.

A.7 End uses

Narrow leafed lupin is predominantly used as a livestock feed source for grain and the crop stubbles for livestock grazing. Albus lupin is mainly used for human consumption in Middle East markets.

Lupin grain as a stock feed is cost effective, high in protein and metabolisable energy and low in starch levels. It can be safely consumed by ruminants (sheep and cows) and monogastrics (pigs and poultry). There is also increasing interest in lupin grain from the aquaculture sector.

Caution is advised when grazing lupin stubbles due to the risk of lupinosis developing in livestock.

This disease can damage the liver, cause loss of appetite and/or lead to poor production and possible death of affected animals.

There is a small, but increasing, interest in the use of lupin grain (as flakes and flour) for human food consumption.

FEEDBACK

A.8 Marketing

Industry standards apply to any sales of lupin grain for domestic or international markets.

In addition, some international markets have extra quarantine restrictions.

The standards applied in Australia, known as Australian Pulse Standards, address seed defects, disease and foreign matter.

In addition to these standards, lupin seed/grain entering VIC and NSW from SA or WA must have appropriate documentation and accreditation to minimise risks of anthracnose entering those States.

Lupin exports from Australia predominantly come out of WA and the biggest markets are South Korea, Japan and the Netherlands for narrow leafed varieties and Egypt for albus lupin.