

AGRONOMY FOR LUPIN SEED PRODUCTION

MARTIN HARRIES DPIRD



GRDC

GRAINS RESEARCH
& DEVELOPMENT
CORPORATION



GOVERNMENT OF
WESTERN AUSTRALIA

Department of
**Primary Industries and
Regional Development**

Why look at lupin seed production?

Several reports of poor establishment in recent years which may be connected with seed quality

- Jurien release 2015/16
- NVT trials 2018
- Commercial paddocks

Many reports of high levels of split seed

Will go through these examples and look at aspects of agronomy for seed production

Jurien bulk-up 2015/16

- 40+ mm of rain on mature plants prior to harvest.

Harvested after rain

Harvested before rain

An example of rain damaged seed:
Farmers paddock 2005



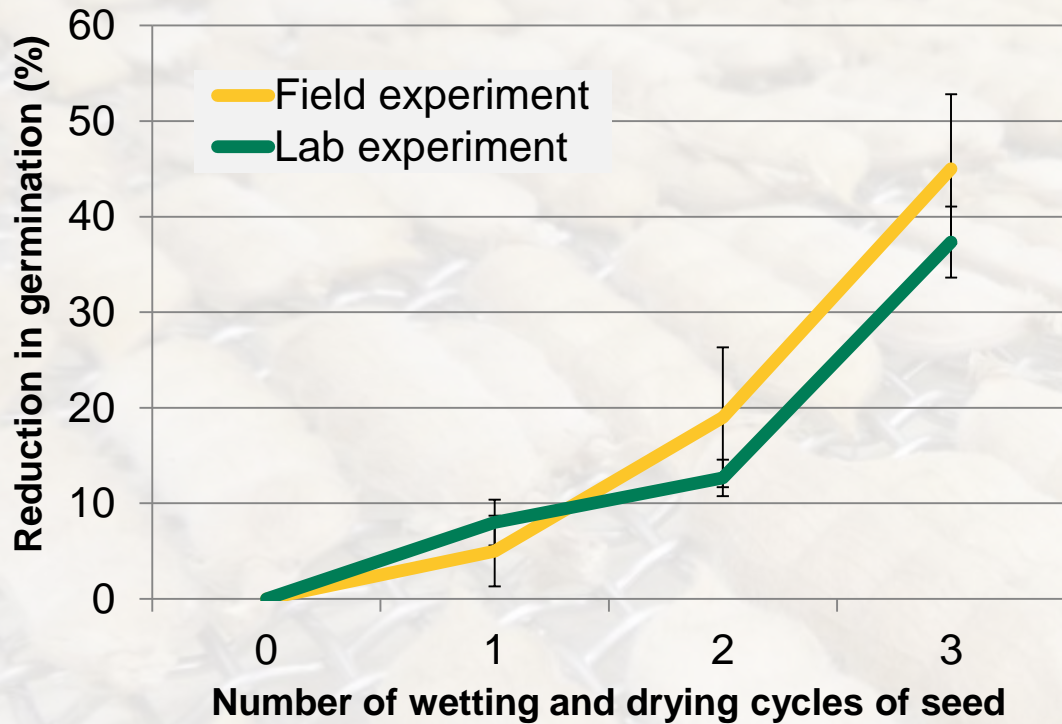
'Rain' at harvest trials

3 trials: 1 laboratory, 2 field

Gungurru, Mandelup & Jurien

Harvest date: 31 Oct (no irrigation), 14 Nov (1 irrigation),
28 Nov (2 irrigations) and 15 Dec (3 irrigations).

No variety effect 2 of 3 trials



**Reduced germination
from wetting and drying
seed (10mm 'rain')**

1 cycle = 5 to 10%

2 cycles = 10 to 20%

3 cycles = 35 to 45%

2018 NVT trials



**Poor establishment of
Mandelup, Barlock, Jurien &
Gunyidi**

These all came from a separate
bulk-up to other varieties

Seed rate adjusted for germ

Photo Jackie Bucat

Seed used in 2018 NVT trials

- 100 mm rain at harvest
- Seed size; very small (Recommend $\geq 16\text{g}/100$ seed)
- Germination; not great (Recommend above 90%)
- Field establishment; low
- Mn concentration; good

Variety	100 seed weight (g)	Germination (%) Jan 18	Field estab (%)	Mn (ppm)
Mandelup	13.5	90	71	29
Barlock	11.4	89	61	26
Jurien	12.9	83	42	36
Gunyidi	12.2	71	38	32

Re-tested Gunyidi 15/2/19



Rapid seed
deterioration

46% germ a year later
indicates rain on seed
accelerated the aging
process

Harvest timing & physical damage

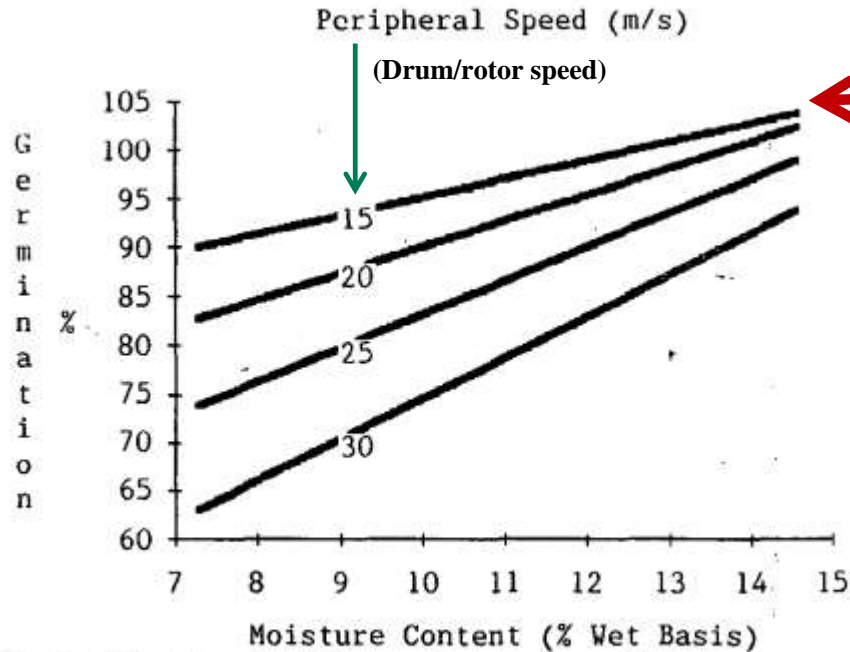


Figure 5 : Germination rate versus moisture content for Danja lupins at four impact peripheral speeds.

Best germination = **low speed & high moisture**

Germination = $\geq 12\%$

Same principle for handling

Same principle for air seeders

Manganese deficiency

Split seed



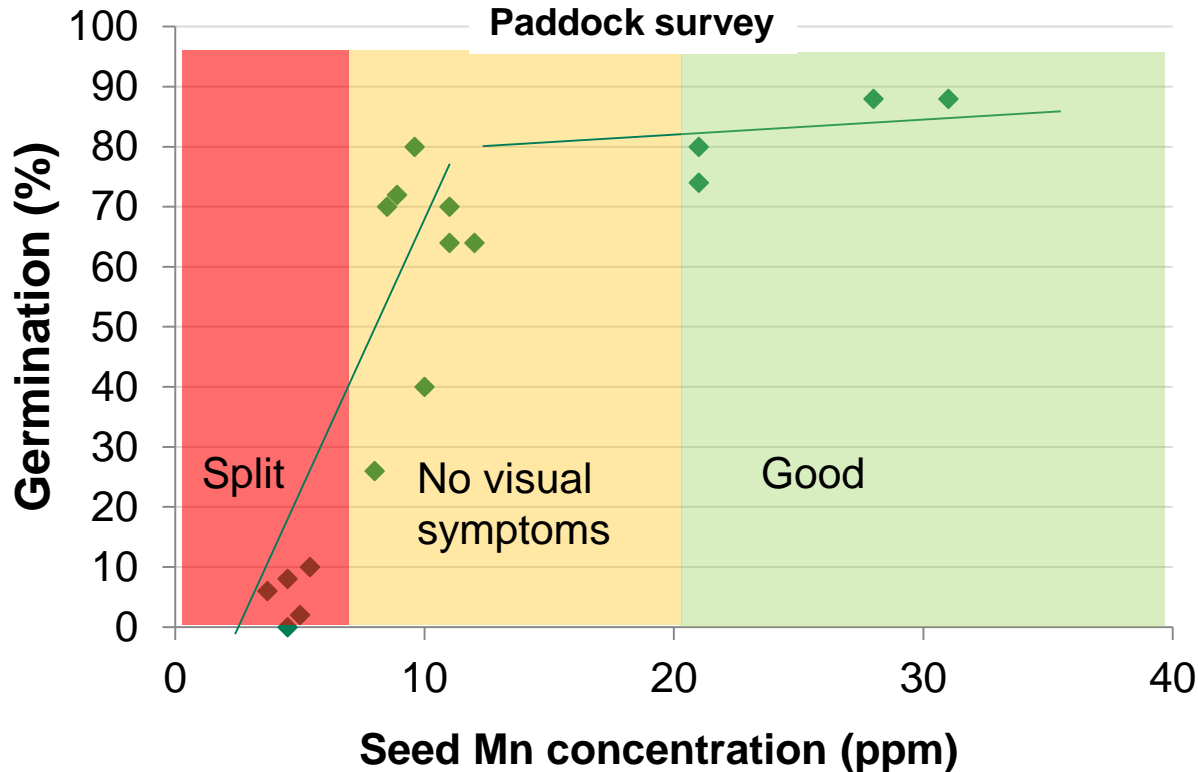
Cotyledon symptoms



**Poor germination +
won't emerge**



Low Mn conc. = low germination %

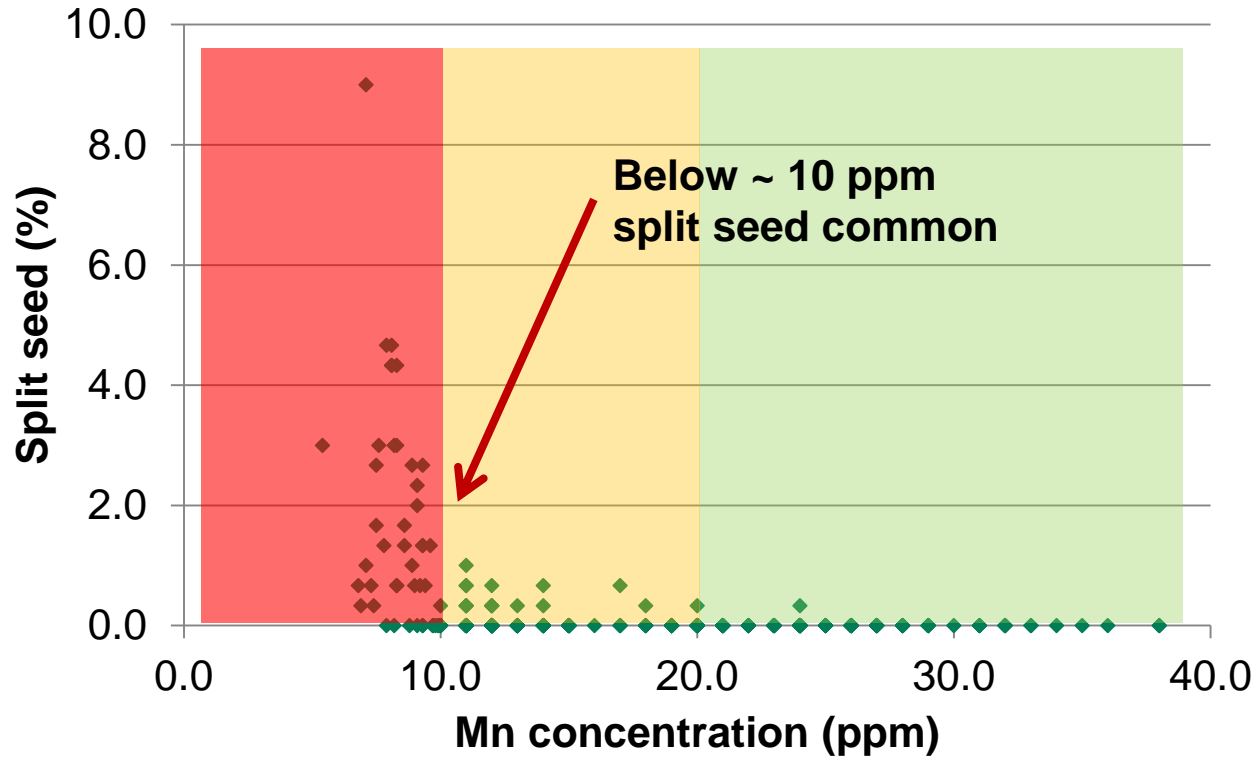


Split seed <7 ppm
won't emerge

~8-20 ppm can look ok,
has variable germ %
and vigour

A low % of split seed
means the rest of the
seed lot is probably low
Mn too

2018 NVT: relationship btw % split and Mn conc.



Test results from 2018 NVT

3 of 6 sites av Mn conc. 12.6 or lower

Range across trials
25 ppm to 8 ppm

Large environmental effect

Do varieties differ?

	Mn	Mn rank (1-14)
PBA Gunyidi	20.5	2.0
Mandelup	20.1	2.3
Jenabillup	19.2	3.3
Breeder line 1	18.5	5.7
PBA Jurien	18.1	6.3
Breeder line 2	17.0	7.0
PBA Leeman	17.3	7.0
Breeder line 3	16.9	7.5
Coromup	16.5	8.7
Breeder line 4	16.4	9.0
PBA Bateman	15.8	10.3
PBA Barlock	15.9	10.5
Breeder line 5	14.4	12.2
Breeder line 6	13.9	13.2
	4/6 sites sig	

Test results from 2018 NVT seed

Varieties did differ in Mn concentration at 4 sites

Range between varieties = 6.6 ppm

Variety less of a factor than environment

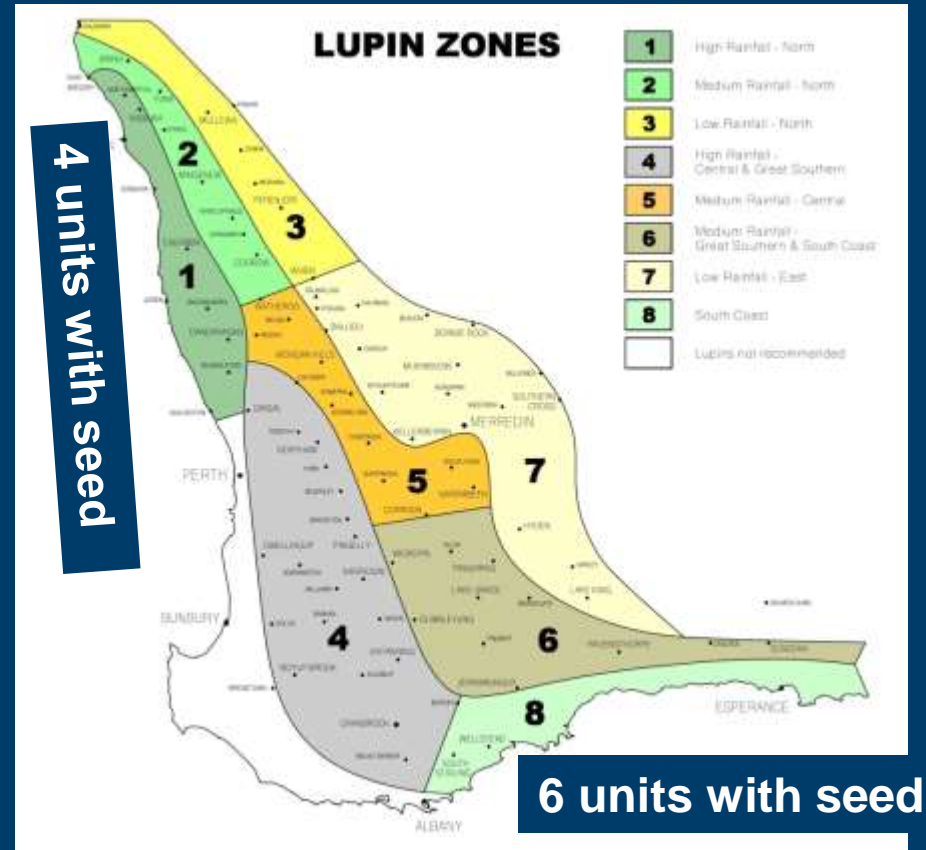
No data here to say Jurien is a problem but should keep testing

Environmental factors & Mn seed conc.

Zones 8, 1 and northern parts of 2 & 3 (sands), pick heavier soils for seed production.

Low rainfall = less Mn uptake

Last few season late starts...
a major effect on split seed



Reduced supply?

- Fertiliser product and placement
 - A lot of paddocks sown without Mn
 - Higher P:Mn ratio compound fertilisers
 - Top-dressing ~25% as effective as deep banding
 - Are you getting enough Mn on?
- Increased lime application
- Reduced compound Mn over the rotation with reduced lupin production
- Effects of soil inversion on Mn distribution within the soil profile unknown.

Increased demand?

- Increased yields
- Soil amelioration and changes in plant yield architecture
- 2018 demo
 - Un-ripped 2% yield secondary laterals
 - Ripped 19%



Other things to consider

Crop topping

Timing

Glyphosate not registered & will reduce germination

Storage

Wild radish: lupin seed germ dropped by 20% after 5 days at 5% contamination with green radish pods

Temp and moisture: $<25^{\circ}\text{C}$ & $<13\%$ moisture

Poor establishment due to many other factors

i.e. Herbicides on ameliorated soils, fert tox, soil pathogens and other pests...?

Testing

Do the basics

- Seed size
- Inspect for damage
- Germination
- Vigour
- Manganese concentration



Summary

Growing lupin grain for seed requires some attention to detail;

- Site selection
- Nutrition
- Early harvest
- Good handling and storage
- Testing of seed



Environment and management are much bigger effects than variety

Further information

Manganese

My Crop Diagnosing manganese deficiency <https://www.agric.wa.gov.au/mycrop/diagnosing-manganese-deficiency-narrow-leafed-lupins>

Brennan R. F. Longnecker N. E (2001a) Effects of the concentration of manganese in the seed in alleviating manganese deficiency of *Lupinus angustifolius* L.. *Australian Journal of Experimental Agriculture* **41**, 1199-1205. <https://doi.org/10.1071/EA01046>

Brennan R. F. , Gartrell J. W. Adcock K. G. (2001b) Residual value of manganese fertiliser for lupin grain production. *Australian Journal of Experimental Agriculture* **41**, 1187-1197.
<https://doi.org/10.1071/EA00178>

Brennan R. F. (1999) Lupin grain yields and fertiliser effectiveness are increased by banding manganese below the seed. *Australian Journal of Experimental Agriculture* **39**, 595-603. <https://doi.org/10.1071/EA98179>

Hannam RJ , Davies WJ , Graham RD Riggs JL (1984) The effect of soil- and foliar-applied manganese in preventing the onset of manganese deficiency in *Lupinus angustifolius*. *Australian Journal of Agricultural Research* **35**, 529-538. <https://doi.org/10.1071/AR9840529>

Longnecker, N., J. Crosbie, F. Davies, and A. Robson (1996). Low Seed Manganese Concentration and Decreased Emergence of *Lupinus angustifolius*. *Crop Sci.* 36:355-361. doi:10.2135/cropsci1996.0011183X003600020024x

Perry, M. W., and Gartrell, J. W. (1976). Lupin split seed. *Journal of Agriculture, Western Australia* (4th series) 17, 20–5.
https://researchlibrary.agric.wa.gov.au/cgi/viewcontent.cgi?article=2359&context=journal_agriculture4

Walton GH & CF Francis (1975). Genetic Influences on the Split Seed Disorder in *Lupinus angustifolius* L. <http://www.publish.csiro.au/AR/pdf/AR9750641>

Walton GH (1978) The effect of manganese on seed yield and the split seed disorder of sweet and bitter phenotypes of *Lupinus angustifolius* and *L. cosentinii*. *Australian Journal of Agricultural Research* **29**, 1177-1189. <https://doi.org/10.1071/AR9781177>

White P, French B, McLarty A (2008). Producing lupins; chapter 7 Plant Nutrition. Department of Agriculture, Perth WA

Further information

Physical damage & storage

Blanchard, ED. The Effect of Mechanical Damage on the Seed Viability of Lupin and Field Pea, Grain Legume Seeds [online]. In: Agricultural Engineering Conference (1990: Toowoomba, Qld.) <https://search.informit.com.au/documentSummary;dn=650029242526730;res=IELENG>

Blanchard E (1994) Physical damage of grain legumes during harvesting, handling and seeding and its effect on seed viability. GRDC final report, project DAW 36G

Lupin grow note chapter 10: harvest https://grdc.com.au/_data/assets/pdf_file/0023/366143/GrowNote-Lupin-South-10-Harvest.pdf

Harvest timing

Harries M, Seymour M, Boyce S (2018). Pre-harvest rain reduces lupin seed quality. In proceedings of Research Updates Conference Perth Western Australia. <http://www.giwa.org.au/2018researchupdates>

Harries M, Seymour M, Boyce S (2018). Lupin yield loss from delayed harvesting. In proceedings of Research Updates Conference Perth Western Australia. <http://www.giwa.org.au/2018researchupdates>

Contacts

AgWest plant laboratories

Email: DDLS-STAC@agric.wa.gov.au

Phone +61 (0)8 9368 3721

<https://www.agric.wa.gov.au/plant-biosecurity/ddls-seed-testing-and-certification-services>

<https://www.agric.wa.gov.au/plant-biosecurity/seed-testing>

<https://www.agric.wa.gov.au/fees-charges-and-procurement>

Chemistry centre of WA

Mn seed testing; around \$50 per sample, but minimum charge around \$200.

T: +61 8 9422 9800 W: www.chemcentre.wa.gov.au

Acknowledgments

Thanks to Stephanie Boyce and DPIRD research station staff for technical assistance
Belinda Eastough and Peter Bird for raising seed quality issues
GRDC for financial support

Important disclaimer

The Chief Executive Officer of the Department of Primary Industries and Regional Development and the State of Western Australia accept no liability whatsoever by reason of negligence or otherwise arising from the use or release of this information or any part of it.

© State of Western Australia 2018

Harvest timing

6 varieties: Leeman, Jurien, Barlock, Gunyidi, Mandelup and Gungurru

No variety response

Delaying 2 weeks (mid Nov) = 6% loss

Delaying 6 weeks (mid Dec) = 15% loss

Gungurru 292 kg/ha vs Jurien 367 kg/ha

Higher yielding variety = more yield loss