1988

Crop establishment methods for lupin disease management

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EXPERIMENTAL SUMMARY 1988

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Contents

1. Crop establishment methods for lupin disease management

1.1 Pleiochaeta root rot

88WH33 Cultivation and sowing depth effects on lupin root rot and growth

Co-researchers: M. Dracup, R. Jarvis and R. Belford

Aim: To determine the effect of pre-seeding cultivation on Pleiochaeta spore distribution and the interactions of cultivation and sowing depth on root rot, establishment and plant vigour.

Location: Wongan Hills Research Station (Paddock 2EA)

Soil type: Wongan yellow loamy sand

Rotation: Lupins 82, 84, 86 Wheat 83, 85, 87
Pleiochaeta soil test: 2100 spores/gram

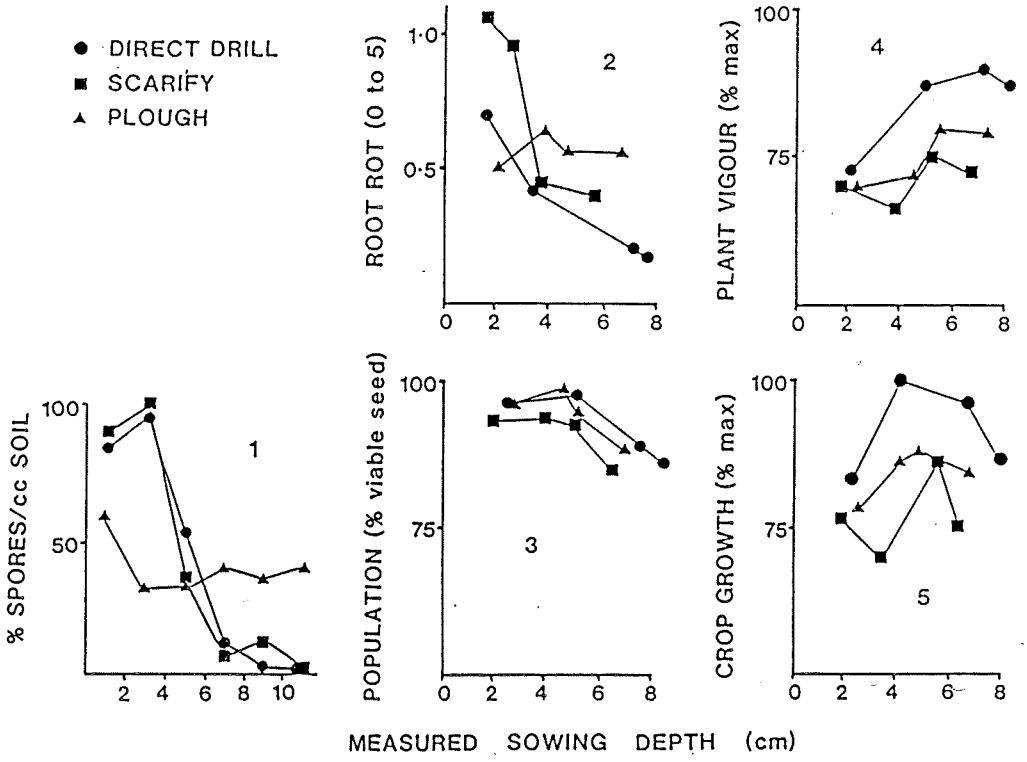
Establishment: Cereal stubble burnt. Sprayseed + Simazine. Gungurru 100 kg/ha. Super 120 kg/ha (drilled). Cultural treatments 6/5. Sowing date 6/5.

Results:

	Measured sowing depth (cm) (4 wks)	Root rot (4 wks)	Plant population (%) (3/5 wks)	Plant mass (g/plant) (3/5 wks)	Nodulation tap root (12 wks)	Grain yield (t/ha)
Cultivation						
Direct drill	5.3	0.37	86.1	0.84	1.98	2.77
Modified combine	5.3	0.47	-	-	2.43	2.79
Scarify	3.9	0.72	85.6	0.71	2.37	2.41
Disc plough	4.6	0.58	87.8	0.75	2.34	2.54
LSD (P = .05)	0.5	0.16	NS	NS	NS	0.28
Sowing depth						
2 cm	2.3	0.72	89.0	0.71	2.52	2.54
4 cm	3.8	0.70	90.2	0.75	2.45	2.56
6 cm	5.6	0.36	86.0	0.81	2.14	2.76
8 cm	7.3	0.36	80.7	0.79	2.01	2.65
LSD (P = .05)	0.3	0.17	7.0	NS	0.19	0.11

The spore profile was disturbed least by direct drilling. Ploughing distributed a lot of surface spores deeper into the profile while scarifying caused much less spore burial (Fig. 1). Root rot decreased with depth of seeding for the direct drilled and scarified treatments. However, deeper

sowing did not reduce infection in the ploughed treatment (Fig. 2) due to the presence of spores deeper in the profile. Deeper sowing clearly reduced emergence (Fig. 3). Plant vigour was greatest in the direct drilled treatment and increased with sowing depth from 2 to 7 cm (Fig. 4), reflecting reduced root rot. Crop growth appeared optimum at sowing depths of 4 to 5 cm with direct drilling (Fig. 5).



88M38 Cultivation and sowing depth effects on lupin root rot and growth

Co-researcher: R. Jarvis

Aim: To determine the effect of pre-seeding cultivation on Pleiochaeta spore distribution and the interactions of cultivation and sowing depth on root rot, establishment and plant vigour.

Location: Merredin Research Station (Paddock 9C)

Soil type: Acid sandplain

Rotation: Lupins 1986, wheat 1987.
Pleiochaeta soil test: 4300 spores/gram

Establishment: Cereal stubble burnt. Sprayseed + Simazine.
Danja 90 kg/ha. Super kg/ha (drilled). Cultural treatments 28/4. Sowing date 4/5.

Results:

	Measured sowing depth (cm)	Root rot severity (4 wks)	Plants per m^2 (28/9)
Cultivation			
Direct drill	6.3	0.26	18.0
Modified combine	7.3	0.12	15.7
Scarify	5.5	0.20	18.6
Disc plough	5.3	0.64	16.4
LSD (P = .05)	0.4	0.24	2.3
Sowing depth			
2 cm	3.8	0.44	23.6
4 cm	5.8	0.34	19.3
6 cm	6.9	0.26	14.2
8 cm	8.1	0.19	11.5
LSD (P = .05)	0.6	0.09	2.9

There was substantially greater root rot in the ploughed treatment as a result of spore burial.

The trial was not harvested due to severe radish infestation.

88WH34 Seeding implement and sowing depth for lupin establishment

Co-researchers: M. Dracup, R. Belford and R. Jarvis

Aim: To compare the combine and cultitrash for their effects on root rot establishment, and seedling vigour of lupins.

Location: Wongan Hills Research Station (Paddock 2EA)

Soil type: Wongan yellow loamy sand Pleiochaeta soil test: 2100 spores/g

Establishment: Cereal stubble burnt. Sprayseed 1.0, Simazine 1.0, Treflan 1.0 L/ha
Super 120 kg/ha (Drilled/topdressed).
Gungurru 100 kg/ha. Sowing date 7/5.

Results:

Seeder	Sowing depth (cm)	Measured sowing depth (cm)	Root rot (4 wks)	Plant population (%)	Seedling vigour (mg/plant) (8 wks)	Nodulation (tap root) (12 wks)	Grain yield (t/ha)
Combine	2	2.1	0.44	94	93	2.59	2.94
	4	3.7	0.39	92	97	2.36	2.89
	6	5.2	0.29	95	95	2.41	3.10
	8	6.6	0.18	93	100	1.94	2.99
Cultitrash	2	1.5	0.45	96	85	2.45	2.70
	4	2.8	0.40	94	83	2.59	2.85
	6	3.6	0.43	89	91	2.26	2.81
	8	3.5	0.63	95	92	2.41	2.78
LSD (P = .05)		0.4	0.09			0.25	0.23

The cultitrash gave very poor depth control and at the deepest setting caused most root rot. By contrast the combine had less root rot with increasing sowing depth. The effect of treatments on grain yield were small due to the relatively low level of disease at the site. However, the combine significantly outyielded the cultitrash.

Seeder	Superphosphate	Root rot (4 wks)	Plant population (%)	Seedling vigour (mg/plant)	Nodulation (tap root) (12 wks)	Grain yield (t/ha)
Combine	Topdressed	0.34	98	92	2.57	2.95
	Drilled	0.31	89	100	2.07	3.00
Cultitrash	Topdressed	0.51	91	86	2.33	2.77
	Drilled	0.44	95	89	2.52	2.78
LSD (p = .05)		NS			0.18	0.13

When seeding with a combine, drilled super reduced plant establishment and inhibited tap root nodulation but increased plant vigour.

88M39 Seeding implement and sowing depth for lupin establishment

Co-researcher: R. Jarvis

Aim: To compare the combine and cultitrash for their effects on root rot, establishment and seedling vigour of lupins.

Location: South Carrabin Research Station (Kidson Paddock)

Soil type: Yellow sandplain pH = 4.7
Pleiochaeta soil test: 4000 spores/g

Establishment: Cereal stubble burnt. Sprayseed + Simazine. Super 100 kg/ha (drill/topdressed). Danja 100 kg/ha. Sowing date 11/5.

Results:

Seeder		Measured sowing depth (cm)	Root rot (4 wks)	Plant population (plants/m^2) (4 wks)
Combine	2 cm	2.0	0.52	34.5
	4 cm	3.6	0.25	32.7
	6 cm	4.9	0.14	28.6
	8 cm	6.7	0.06	17.8
Cultitrash	2 cm	3.1	0.51	31.4
	4 cm	3.2	0.56	27.1
	6 cm	3.8	0.61	22.2
	8 cm	3.1	0.61	18.8
LSD (P = .05)			0.16	4.0

As with 88WH34, the cultitrash could not achieve the optimum seeding depth (about 5 cm) even at the deepest setting (discs cutting 8 cm). As a result root rot severity was greater for the cultitrash compared to the combine. The trial was severely affected by brown spot at about 2 weeks after sowing which resulted in substantial seedling death. The deeper sown plants suffered more plant mortality, apparently being at a more susceptible stage (i.e. smaller) at the time of the severe rain event.

The trial was virtually destroyed by brown spot and was not harvested.

87WH45 Effect of cultivation in the wheat phase on lupin root rot

Co-researcher: R. Jarvis

Aim: To determine the effect of pre-seeding cultivation in wheat crops on the distribution of Pleiochaeta spores down the soil profile and on root rot in the subsequent lupin crop.

Location: Wongan Hills Research Station (Paddock 2EA)

Soil type: Wongan yellow loamy sand

Rotation: Lupins 1984, 1986; wheat 1985, 1987

Establishment: Lupins 1988: direct drilled

Results:

	Wheat phase (1987)	Lupin phase (1988)				
Cultivation	Wheat yield (t/ha)	Target sowing depth (1988)	Measured sowing depth (cm)	Root rot severity	Plant population (%) (plants/m^2)	Grain yield (t/ha)
Direct drill	1.74	2	1.9	0.58	26.7	1.32
		5	4.0	0.27	30.2	1.52
Scarify .5 cm	1.99	2	2.3	0.53	26.5	1.57
		5	4.9	0.24	23.2	1.01
Scarify .15 cm	2.27	2	2.9	0.50	28.1	1.90
		5	4.4	0.39	26.5	1.62
Disc .5 cm	2.00	2	3.0	0.68	33.4	1.77
		5	4.5	0.29	26.9	1.48
Disc .15 cm	2.75	2	2.9	0.65	30.3	2.09
		5	4.2	0.71	27.1	1.84
Chisel .5 cm	1.85	2	1.6	0.68	26.7	1.26
		5	4.5	0.34	24.9	1.39
Chisel .15 cm	2.30	2	2.3	0.58	26.2	1.94
		5	5.2	0.33	24.4	1.81
Deep rip .30 cm	2.30	2	2.8	0.69	27.4	1.97
		5	5.5	0.32	23.5	1.45
LSD (p = .05)	0.31		1.4	0.35	6.7	0.42

Examination of the soil profile immediately prior to seeding in 1988 showed that disc ploughing the previous season had buried Pleiochaeta spores deeper into the profile where they survived for 12 months. Root rot was more severe in the 2 cm compared to the 5 cm plots in all but the disc 15 cm plots.

The high yield of the disc ploughed plots cannot be explained. It may be due to increased bare fallow buffer between the ploughed plots giving them access to more moisture or an inversion of the soil P bank giving a "P banding" effect.

87M52 Effect of cultivation in the wheat phase on lupin root rot

Co-researcher: R. Jarvis

Aim: To determine the effect of pre-seeding cultivation in wheat crops on the distribution of Pleiochaeta spores down the soil profile and on root rot in the subsequent lupin crop.

Location: Merredin Research Station (Paddock 9C)

Soil type: Acid sandplain

Rotation: Lupins 1986, 1988, wheat 1985, 1987

Results:

	Wheat phase (1987)	Lupin phase (1988)				
Cultivation	Wheat yield (t/ha)	Target sowing depth (1988)	Measured sowing depth (cm)	Root rot severity	Plants/m^2 (28/9)	Grain yield (t/ha)
Direct drill	1.40	2 cm	2.9	0.97	36.2	1.35
		5 cm	5.6	0.90	20.6	0.96
Scarify .5 cm	1.46	2 cm	3.2	1.34	38.6	1.23
	5 cm	5.8	0.70	23.1	1.14	
Scarify .15 cm	1.50	2 cm	3.4	1.42	36.6	1.25
	5 cm	6.1	0.90	18.6	1.03	
Disc .5 cm	1.40	2 cm	3.3	1.76	31.7	1.41
	5 cm	5.1	1.34	22.1	1.15	
Disc .15 cm	1.52	2 cm	2.6	2.11	35.8	1.21
	5 cm	5.5	1.10	21.8	0.99	
Chisel .5 cm	1.48	2 cm	2.9	1.41	34.5	1.39
	5 cm	5.5	0.73	22.6	1.01	
Chisel .15 cm	1.47	2 cm	3.3	1.12	34.0	1.16
	5 cm	6.2	0.68	18.8	0.90	
LSD (p = .05)	NS			0.60	5.4	

Root rot was most severe on plots ploughed the previous season due to spore burial. Grain yields do not relate to root rot levels but more to stand density which declined at the deeper sowing depths. Sowing depths were a little deeper than aimed for. However, 3 cm rather than 5 cm seems to have given optimum plant establishment and yields.

1.2 Brown Spot and Pleiochaeta root rot

88M40 Establishment systems for lupin disease management

Co-researchers: Riethmuller, Jarvis

Aim: To demonstrate how farmers can minimize brown spot and root rot and achieve the best establishment of lupin crops with presently available machinery.

Location: South Carrabin Research Station (Kidson Paddock)

Soil type: Yellow loamy sand pH = 4.5

Rotation: Lupins 1986, wheat 1987
Pleiochaeta spore test: 5100 spores/g

Establishment: Cereal stubble treatments in May. Sprayseed, Simazine 12/5. Sown 6/6. 100 kg/ha super drilled.

Results:

	Stubble cover (%)	Sowing depth (cm)	Root rot	Brown spot L16-L20 (19/9)	Dry wt. 19/9 (g/m^2)	Final stand density (29/9)	Grain yield (kg/ha)
Cereal stubble							
Treatment							
Burn	9	3.3	0.46	1.28	123	28.3	445
Rake	23	3.0	0.54	1.30	110	28.0	376
Chop and spread	20	3.2	0.61	1.23	110	27.3	378
Graze	33	3.1	0.57	1.21	112	27.2	395
		NS	NS	NS	NS	NS	NS
Seeder							
Combine	18	4.0	0.33	1.18	135	28.8	512
Cultitrash	22	2.4	0.76	1.34	97	27.4	285
		0.4	0.12	0.09	6	NS	48
Harrows							
Nil	19	2.8	0.61	1.26	114	28.3	354
Phoenix	25	3.6	0.48	1.25	117	27.9	442
		0.4	0.12	NS	NS	NS	59

The amount of stubble present prior to the treatments was small (about 0.8 t/ha). There was no effect of the stubble treatments on the Brown Spot levels measured late in the season. Brown spot was not severe in the seedling stage of this trial as it escaped the most severe rain events due to the late sowing. The lower brown spot in the combine treatment appeared to be due to its greater height and canopy development.

Seeder	Harrow	Tap root rot (4 weeks)	Sowing depth (cm)	Plant density (p/m^2) (29/9)	Top dry wt (g/m^2) (29/9)	Grain yield (kg/ha)
Cultitrash	Nil	0.81	1.9	27.7	96.2	277
	Phoenix	0.72	2.8	26.1	93.8	293
Combine	Nil	0.42	3.7	27.3	125.3	432
	Phoenix	0.24	4.3	29.8	142.0	592
LSD (p = 0.05)		0.18	0.5	ns	13.2	76

Although the two seeders were set up to seed at 4.5 cm, the average sowing depth of the cultitrash was significantly shallower than the combine. As a result Pleiochaeta root rot levels were higher with the cultitrash due to the greater concentration of spores adjacent to the roots. The measured increase in "sowing depth" with the Phoenix harrow is presumably due to the "fluffing-up" of the seed bed and the filling in of furrows in the case of the combine. The roots of the plants in the harrowed and unharrowed treatments should therefore be growing through the same soil spore concentration. So the root rot reducing effect of the harrow seems unlikely to be due to the normal sowing depth effect. It may have influenced soil moisture levels which can affect root rot (more disease in drier soil).

It is possible that the deeper sown treatments emerged earlier due to surface soil drying out after seeding.

88SC4 Phosphorus x disease on lupins

Co-researcher: J.W. Bowden

Aim: To identify the relationship between phosphorus nutrition and brown leaf spot and Pleiochaeta root rot of lupins.

Location: South Carrabin Research Station

Soil type: Yellow loamy sand
Pleiochaeta soil test: (spores/g soil) Wheat-lupin : 11,400;
Lupin-wheat : 2,800;
Oats-wheat : 200

Establishment: Stubble raked and burnt. Direct drilled at kg/ha sown 10/5.

Results:

Rotation 1986 1987	Root rot	Brown Spot mean leaf score L1-L4 8/6	L1-L8 28/6	L1-L20 17/8	Dry weight tops (g/plant) 8/6	17/8	P % tops 14/6	Plant density per m^2 8/6	Grain yield (t/ha)
Oats wheat	0.09	1.14	2.73	3.28	0.169	1.81	0.42	31.7	0.90
Lupin wheat	0.09	1.61	3.10	3.40	0.156	1.74	0.50	22.3	0.56
Wheat lupin	0.04	1.76	3.10	3.28	0.133	1.61	0.52	16.1	0.39
LSD (p = .05)	n.s.	0.12	n.s.	n.s.	0.019	n.s.	0.03		0.09
Super									
0	0.05	1.53	3.03	3.34	0.113	1.12	0.33	27.6	0.28
50	0.06	1.47	2.90	3.37	0.156	1.51	0.46	26.7	0.47
100	0.07	1.42	2.93	3.26	0.160	1.87	0.47	23.8	0.68
200	0.08	1.57	3.05	3.27	0.169	1.99	0.57	21.9	0.80
400	0.11	1.54	2.98	3.34	0.166	2.11	0.58	22.3	0.85
LSD (p=0.05)	n.s.	n.s.	n.s.	n.s.	0.024	0.31	0.03		0.12

The extremely low level of root rot resulted from precise sowing at 6-7 cm.

There was a severe brown spot attack three weeks after seeding (2 leaf stage) which killed many seedlings. There was less brown spot in the oat-wheat rotation early in the season but disease levels had equalized across all three rotations by 17/8.

There was no effect of applied superphosphate on disease severity contrary to observation in 1987 (87ME). This may have been due to the early severe disease attack (before the lupins had much access to the applied P). Also, even the high P plots were thin and did not achieve a complete canopy (giving rain splash protection) until late into the season.