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Potassium nutrition of lupins on the sandplain soils of Western Australia.

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TITLE: Potassium Nutrition Of Lupins On The Sandplain Soils Of
Western Australia

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EX NUMBER: 6154

TRIAL NUMBER: 89EC32, 89GE90, 89MO51, 89TS56, 90GE100, 90MO59

DATE: 1990

AIMS: Develop recommendations for optimal potassium fertilizer
application strategies for lupin production.

Further develop soil and tissue test calibrations for
lupin grain production.

Potassium nutrition of lupins on sandplain soils.

89EC32/EX6154

Location: East Chapman Research Station

Soil type: Deep yellow sand (> 1 m)

Fertilizer: At sowing: 50 kg/ha DAP, 50 kg/ha Urea topdressed. 100 kg/ha Urea topdressed 10/7

Seeding date: 5 June

Species: Spear wheat - 50 kg/ha

Treatments: K rates topdressed by hand on fresh plots randomised within the block - 20/6

Vegetative sampling dates: 24/8

Harvest: 30/11

Results:

Table 1. Effect of K on vegetative growth and grain yield

Crop	Potassium rate (kg/ha)	Vegetative yield (t/ha)		Grain yield (t/ha)	
		1989	1990	1989	1990
Wheat	0		2.07		1.78
	10	1.65	2.39	1.65	2.00
	20	1.58	2.15	1.68	2.02
	40	1.98	1.79	1.84	1.78
	80	2.25	1.86	1.65	2.03
	160	2.21	2.45	1.90	2.28
MEAN		1.94	2.13	1.75	2.02

Table 2. Effect of potassium fertilizer on the concentration of K (% db) in the whole tops, youngest leaves and grain

Crop	Potassium rate (kg/ha)	Whole tops		Youngest leaves		Grain	
		1989	1990	1989	1990	1989	1990
Wheat	0	1.74		1.95		0.40	
	10	1.92	2.52	2.04	2.35	0.42	0.41
	20	1.62	2.10	1.89	2.27	0.42	0.41
	40	1.98	2.50	2.08	2.69	0.45	0.40
	80	1.72	2.97	2.04	2.86	0.40	0.41
	160	1.98	3.59	2.00	3.28	0.44	0.40
MEAN	1.84	2.74	2.01	2.69	0.43	0.41	

Comments:

The response to K applied in 1989 was compared to K applied in 1990. There was no effect on dry matter but there was a small effect on grain yield of the year K was applied in. The K % in the whole tops and youngest leaves was affected by the year of application, with K % in the whole tops where K was applied in 1989 being below the critical level(2 %) for wheat.

Potassium nutrition of lupins on sandplain soils

89GE90/EX6154

Location: J. Edwards, Allanooka

Soil type: Deep yellow sand (> 1 m)

Fertilizer: At sowing: 120 kg/ha Agras No. 1. 100 kg/ha Urea topdressed 10/7

Seeding date: June 3

Species: Reeves wheat - 80 kg/ha

Treatments: K rates topdressed by hand on fresh plots randomised within the block - 19/6

Vegetative sampling dates: 17/8

Harvest: 30/11

Results:

Table 1. Effect of K on vegetative growth and grain yield

Crop	Potassium rate (kg/ha)	Vegetative yield (t/ha)		Grain yield (t/ha)	
		1989	1990	1989	1990
Wheat	0	2.31		1.90	
	10	2.59	2.26	2.04	1.83
	20	2.20	2.57	1.83	2.09
	40	2.46	2.29	1.94	1.69
	80	2.47	2.53	2.00	1.97
	160	2.26	2.54	1.97	2.24
MEAN		2.40	2.44	1.96	1.96

Table 2 Effect of potassium fertilizer on the concentration of K (% db) in the whole tops, youngest leaves and grain

Crop	Potassium rate (kg/ha)	Whole tops		Youngest leaves		Grain	
		1989	1990	1989	1990	1989	1990
Wheat	0	2.23		2.04		0.37	
	10	2.12	2.39	2.08	2.19	0.33	0.34
	20	1.95	2.24	2.14	2.09	0.33	0.33
	40	2.31	2.17	2.17	2.21	0.33	0.34
	80	2.35	2.77	1.96	2.39	0.34	0.36
	160	2.58	2.73	2.31	2.44	0.37	0.34
MEAN		2.26	2.46	2.13	2.26	0.34	0.34

Comments:

The response to K applied in 1989 was compared to K applied in 1990. There was no effect of year of application or response to K in wheat at this site. There was a small effect on K % in whole tops and youngest leaves.

Potassium nutrition of lupins on sandplain soils

89M051/EX6154

Location: M. Burns, Lancelin

Soil type: Deep grey over yellow sand (> 1 m)

Fertilizer: At sowing: 110 kg/ha Agras No. 1. 60 kg/ha Urea topdressed 10/7

Seeding date: 19 June

Species: Reeves wheat - 75 kg/ha

Treatments: K rates topdressed by hand on fresh plots randomised within the block - 3/7

Vegetative
sampling
dates: 12/9

Results:

Table 1. Effect of K on vegetative growth

Crop Year K applied	Potassium rate (kg/ha)	Vegetative yield (t/ha)	
		1989	1990
Wheat	0	0.76	
	10	0.91	0.86
	20	0.80	0.89
	40	0.82	0.79
	80	0.81	0.97
	160	1.07	0.82
MEAN		0.88	0.87

Table 2. Effect of potassium fertilizer on the concentration of K (% db) in the whole tops, youngest leaves

Crop	Potassium rate (kg/ha)	Whole tops		Youngest leaves	
		1989	1990	1989	1990
Wheat	0	1.04		0.88	
	10	1.09	1.13	0.79	0.93
	20	1.27	1.26	0.97	1.13
	40	1.15	1.60	0.89	1.45
	80	1.24	1.87	1.11	1.74
	160	1.43	2.22	1.43	2.19
MEAN		1.24	1.62	1.04	1.49

Comments:

The response to K applied in 1989 was compared to K applied in 1990. There was no effect of K or year of application on dry matter at this site. Crop growth was very poor, partly due to the late sowing. The trial was damaged by birds before harvest, so grain results are not shown.

Potassium nutrition of lupins on sandplain soils

89TS56/EX6154

Location: G Boak, West Three Springs

Soil type: Deep grey over yellow sand (> 1 m)

Fertilizer: At sowing: 120 kg/ha Agras No. 1. 100 kg/ha Urea topdressed
5/7

Seeding date: 29/5

Species: Reeves wheat - 62 kg/ha

Treatments: K rates topdressed by hand on fresh plots randomised within
the block - 13/6

Results: Trial was severely damaged by kangaroos in August, so grain
yields could not be assessed

TIME OF APPLICATION OF POTASSIUM FOR LUPINS

90GE100/EX6154

Location: John Newton, Nangetty
 Soil type: Deep grey over yellow sand (> 1 m)
 Fertilizer: 100 kg/ha Super Mn drilled
 Seeding date: 9 May
 Management: Simazine, SpraySeed applied 28/4, Roundup 8/5, Fusilade 15/6
 Species: Gungurru lupins - 100 kg/ha, sown dry
 Treatments: K rates topdressed by hand - immediately after seeding,
 2 weeks after, 4 weeks after, 6 weeks after
 Vegetative
 sampling
 dates: 11/7, 10 leaf stage
 Harvest: 20/11

Results:

Table 1. Effect of potassium fertilizer on growth of lupins (kg/ha), 10 leaf stage

K applied kg/ha	At seeding	Time of application			Mean
		2 Weeks	4 Weeks	6 Weeks	
0	240	220	240	230	230
20	340	370	300	220	310
40	390	320	280	210	300
80	380	390	250	220	310
160	340	340	300	280	310
200	270	330	290	260	290
Mean	330	330	280	240	

Potassium LSD (P < 0.001) 50, Time of application LSD (p < 0.001) 75, K x Time interaction NS.

Table 2 : Effect of potassium fertilizer on grain yield of lupins (t/ha).

K applied kg/ha	At seeding	Time of application			Mean
		2 Weeks	4 Weeks	6 Weeks	
0	0.57	0.55	0.65	0.57	0.59
20	1.00	1.01	1.10	0.81	0.98
40	1.34	1.19	1.10	0.87	1.13
80	1.43	1.33	1.16	0.91	1.21
160	1.22	1.41	1.20	1.09	1.23
200	1.28	1.39	1.32	1.06	1.26
Mean	1.14	1.15	1.09	0.89	

Potassium LSD ($p < 0.001$) 0.425, Time of application LSD ($p < 0.05$) 0.20, K x Time interaction NS.

Table 3. Effect of potassium fertilizer on K concentration in lupin whole tops (% K db) at 10 leaf stage

K applied kg/ha	At Seeding	Time of application			Mean
		2 Weeks	4 Weeks	6 Weeks	
0	0.82	0.84	0.90	0.88	0.86
20	1.19	1.35	1.34	0.89	1.19
40	1.51	1.47	1.42	1.04	1.36
80	1.91	2.05	1.79	1.12	1.72
160	2.31	2.65	2.22	1.09	2.07
200	2.59	2.59	2.27	1.11	2.14
Mean	1.72	1.82	1.66	1.02	

Potassium LSD ($p < 0.001$) 0.20, Time of application LSD ($p < 0.001$) 0.16, K x Time interaction LSD ($p < 0.001$) 0.39.

Table 4. Effect of potassium fertilizer on K concentration in lupin tips (% K db) at 10 leaf stage

K applied kg/ha	At Seeding	Time of application			Mean
		2 Weeks	4 Weeks	6 Weeks	
0	1.68	1.66	1.71	1.60	1.66
20	2.00	2.00	1.97	1.69	1.91
40	2.12	2.08	2.06	1.66	1.98
80	2.29	2.29	2.19	1.73	2.12
160	2.45	2.51	2.34	1.78	2.27
200	2.54	2.44	2.47	1.81	2.32
Mean	2.18	2.16	2.12	1.71	

Potassium LSD ($p < 0.001$) 0.20, Time of application LSD ($p < 0.001$) 0.16, K x Time interaction LSD ($p < 0.02$) 0.28.

Table 5. Effect of potassium fertilizer on K concentration in lupin grain (% K db)

K applied kg/ha	At Seeding	Time of application			Mean
		2 Weeks	4 Weeks	6 Weeks	
0	0.71	0.70	0.71	0.73	0.71
20	0.71	0.73	0.74	0.72	0.72
40	0.71	0.70	0.72	0.70	0.71
80	0.73	0.74	0.72	0.74	0.73
160	0.74	0.76	0.73	0.75	0.74
200	0.76	0.77	0.77	0.75	0.76
Mean	0.73	0.73	0.73	0.73	

Potassium LSD ($p < 0.001$) 0.03, Time of application NS, K x Time interaction NS.

Comments:

There was a difference between the reps in response to K, although no difference in the soil type was observed prior to sowing. There was a dry matter response to 20 kg/ha of K and a grain response to 40 kg/ha of K. Yields were the same when K was applied from seeding to 4 weeks after seeding, but reduced when K application was delayed until 6 weeks after seeding. Three weeks of no rain from the fourth time of application would have reduced the availability of K applied then.

The K % in the whole tops at the 10 leaf stage were below 3% (critical level) even when there was no further growth response to K. Applying K increased the K % in the grain at this site.

TIME OF APPLICATION OF POTASSIUM FOR LUPINS

90MO59/EX6154

Location: Brennan, West Moora
 Soil type: Deep pale yellow sand (> 1 m)
 Fertilizer: 120 kg/ha Super Cu Zn Mo topdressed, 120 kg/ha Super Mn drilled
 Seeding date: May 11
 Management: Simazine 1.5 L, Spray Seed 0.5 L applied 1/5
 Species: Gungurru lupins - 100 kg/ha, sown dry
 Treatments: K rates topdressed by hand - immediately after seeding, 2 weeks after, 4 weeks after, 6 weeks after
 Vegetative sampling dates: 29/8, flowering on primaries
 Harvest: 30/11

Results:

Table 1. Effect of potassium fertilizer on growth of lupins (t/ha)

K applied kg/ha	Time of application				Mean
	At Seeding	2 Weeks	4 Weeks	6 Weeks	
0	3.96	3.79	3.78	3.86	3.85
20	3.58	3.56	3.27	3.60	3.50
40	3.17	3.46	3.48	3.96	3.52
80	3.30	3.90	3.81	3.20	3.55
160	3.50	3.30	3.50	4.10	3.60
200	3.38	3.51	3.58	3.57	3.51
Mean	3.48	3.58	3.57	3.72	

Potassium NS, Time of application NS.

Table 2. Effect of potassium fertilizer on grain yield of lupins (t/ha)

K applied kg/ha	At Seeding	Time of application			Mean
		2 Weeks	4 Weeks	6 Weeks	
0	2.39	2.42	2.56	2.58	2.49
20	2.51	2.52	2.40	2.49	2.48
40	2.37	2.53	2.56	2.65	2.53
80	2.36	2.58	2.66	2.50	2.53
160	2.50	2.44	2.59	2.53	2.51
200	2.43	2.41	2.53	2.58	2.49
Mean	2.43	2.48	2.55	2.55	

Potassium NS, Time of application NS.

Table 3. Effect of potassium fertilizer on K concentration in lupin whole tops (% K db)

K applied kg/ha	At Seeding	Time of application			Mean
		2 Weeks	4 Weeks	6 Weeks	
0	1.90	1.84	2.00	1.87	1.90
20	2.12	2.03	1.89	2.02	2.01
40	2.21	2.09	2.13	2.08	2.13
80	2.36	2.11	2.29	2.24	2.25
160	2.58	2.22	2.49	2.45	2.44
200	2.49	2.49	2.57	2.54	2.52
Mean	2.28	2.13	2.23	2.20	

Potassium LSD ($p < 0.001$) 0.21, Time of application LSD ($p < 0.05$) 0.10.

Table 4. Effect of potassium fertilizer on K concentration in lupin grain (% K db).

K applied kg/ha	At Seeding	Time of application			Mean
		2 Weeks	4 Weeks	6 Weeks	
0	0.78	0.75	0.76	0.78	0.77
20	0.77	0.77	0.75	0.76	0.76
40	0.75	0.76	0.80	0.75	0.76
80	0.77	0.77	0.77	0.77	0.77
160	0.75	0.78	0.78	0.76	0.77
200	0.74	0.77	0.76	0.78	0.76
Mean	0.76	0.77	0.77	0.77	

Potassium NS, Time of application NS.

Comments:

There was no lupin response to K at this site.