



1981

## Long term rotation trials.

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DEPARTMENT OF AGRICULTURE

Western Australia

SUMMARY OF EXPERIMENTL RESULTS

For 1981

LONG TERM ROTATION TRIALS

66M29  
67C13  
67N4  
68E5  
68SG5  
73SG16

Lupins : Wheat Rotation

79GE36  
79GE37  
80TS3

Continuous Cropping with Nitrogenous Fertiliser

80NA6

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PLANT RESEARCH DIVISION

66M29/2083EX

Locality: Paddock 5AE on Merredin Research Station.

Soil type: Merredin sandy clay loam

History:

An old land site, cleared in 1909. First sown to Cyprus Barrel medic in 1955, grazed and topdressed. Cropped 1962 and 1964. Medic resown in 1965. In the last few years the medic component of the pasture has disappeared and the pasture is dominated by ryegrass and barley grass. The proportion of the latter increases with age of the pasture.

Rainfall: in mm.

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May	June	July	August	September	October	Total
73	45	39	37	7	11	212

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Wheat Yields: Madden sown on 17th June, 1981. No sprays used.

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Rotation	Crop	kg grain/ha
Control	16th	890
1 crop : 1 pasture	1	868
1 crop : 2 pasture	1	1,278
1 crop : 4 pasture	1	1,310
2 crop : 2 pasture	1st	816
	2nd	999
2 crop : 4 pasture	1st	1,290
	2nd	1,097
3 crop : 3 pasture	1st	1,083
	2nd	1,099
	3rd	813

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1. The very dry finish greatly reduced the grain yield of these crops. Harvest index of between 0.18 and 0.22 were found for most rotations.
2. Rotations with cropping intensities of 50 per cent generally yielded less than longer ones. Thus the year in : year out yielded 410 kg/ha less than the 1:2 rotation. In 1979 the difference was about 100 kg/ha in favour of the 1:2. Further work is needed to see if this is a continuing decline due to a rundown in fertility caused by the extremely poor pasture years or due to some other factors such as weeds, soil structure, soil moisture, etc.

67C13/2332EX:

Locality: Paddock 19B on Chapman Research Station (Nabawa)

Soil type: Red brown loamy sand

History:

At old land site, cleared in 1903. Sown to Dwalganup sub clover in 1964, topdressed each year until the start of the trial in 1967. In 1981 all pasture plots were reseeded with Northam at 20 kg/ha.

Rainfall: in mm.

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May	June	July	August	September	October	Total
116	140	64	82	14	18	434

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Wheat Yields: (Gamenya) sown on 16th June 1981, sprayed with 1 l AMIDI/ha on 28th July.

Weeds, especially grasses such as annual ryegrass, brome grass, barley grass and vulpia species were so bad in all first crops and the continuous crop plots that grain results are meaningless. Second and third crops had less grass but turnip had choked most of them, despite the use of a broadleaf spray on the 28th July (1 l Amidi/ha).

67N4/2333EX

Locality: Newdegate Research Station

Soil type: Grey sand over gravel at 20 - 30 cms.

History:

An old land site, cleared in 1951 and in pasture (Dwalganup sub clover) from 1963 to 1967. All plots have been reseeded with NUNGARIN at 20 kg/ha.

Rainfall: in mm.

May	June	July	August	September	October	Total
61	48	51	43	18	12	233

Wheat Yield: (Gamenya) sown on 19th June 1981, sprayed with 1 l Banex/ha on 21st July.

Seed - 50 kg/ha

Super - 105 kg/ha

Rotation	Crop	kg grain/ha no Urea	Plus urea at ( ) kg/ha	Ryegrass Plants/m <sup>2</sup>
Control	15th	197	662 (97)	41
1 crop : 1 pasture	1	604	713 (28)	52 H
1 crop : 2 pasture	1	1,042	-	30 H
1 crop : 4 pasture	1	1,556	-	20
2 crop : 2 pasture	1st	678	-	22 H
	2nd	898	1,250 (78)	53 H
2 crop : 4 pasture	1st	1,183	-	7
	2nd	991	1,264 (78)	7
3 crop : 3 pasture	1st	664	-	204 H
	2nd	1,051	1,282 (78)	25 H
	3rd	537	889 (78)	21

H - Plots sprayed with 1 l Hoegrass/ha on 31st July.

1. Urea was topdressed on a 2.1 m drill run of the successive crop plots and on the year in : year out, at the rate shown in ( ), immediately prior to sowing.

The rate selected for the year in : year out rotation was obviously too low. Fertility rundown in this plot is more serious than thought. This rotation and the third crop in the 3:3 will get higher rates in 1982.

2. First crops in the three 50 per cent cropping systems (1:1, 2:2 and 3:3) were relatively poor. This seemed to be due to lower levels of soil mineral nitrogen. The figures for nitrogen uptake of the unfertilised crop further show the difference. The first crops referred to above had an average uptake of 16 kg N/ha compared to 35 kg N/ha for first crops in the 1:2, 1:4 and 2:4 rotations.

Pasture:

In 1980 all the pasture plots were sown with 20 kg Nungarin/ha, this grew reasonably well but failed to set much seed. The pasture growth in 1981 reflected this, with an average clover content of only 8 per cent for plots sown in 1980. Plots coming into pasture in 1981 were sown to Nungarin at the same rate, these averaged 41 per cent clover.

Total Dry Matter kg/ha cut 8/9/1981 from enclosures

Rotation	1	2	3	4	Years pasture
1 crop : 1 pasture	1,737				
1 crop : 2 pasture	1,240	1,251			
1 crop : 4 pasture	1,781	1,417	1,561	956	
2 crop : 2 pasture	955	622			
2 crop : 4 pasture	1,534	1,639	659	1,207	
3 crop : 3 pasture	881	296	442		

Although total pasture production is less in the 2:2 and 3:3 systems the proportion of clover in the first year (i.e. resown in 1981) is similar.

Clover Dry Matter kg/ha cut 8/9/1981 from enclosures

Rotation	1st year
1:1	695
1:2	434
1:4	392
2:2	430
2:4	828
3:3	449

792

68E5/2474EX

Locality: Paddock N1A on Esperance Downs Research Station (Gibson)

Soil type: Fleming gravelly sand.

History:

Cleared in 1951 and sown to clover, cropped in 1961 and 1962 then Woogenellup sub clover and Brome grass were sown in 1963, topdressed until the start of the trial in 1968. Lupins were sown in trial in 1974. Esperance sub clover has been established on all plots.

Rainfall: in mm.

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May	June	July	August	September	October	Total
51	97	48	62	13	38	309

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Lupin Yields: (Yandee) sown on 11th June 1981  
Simazine sprayed 13th June  
Hoegrass sprayed 29th July on plots marked H.

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Rotation	kg/ha	Ryegrass per m <sup>2</sup>
Control : 4th lupin	813 H	270
1 lupin : 1 clover	987 H	43
1 lupin : 1 wheat	1,227	8
2 clover : 1 lupin : 1 wheat	1,012 H	62
2 clover : 1 wheat : 1 lupin	1,179	13
4 clover : 1 lupin : 1 wheat	1,195	3
4 clover : 1 wheat : 1 lupin	1,463	10

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Wheat Yields: (Egret) sown on 24th June 1981  
Treflan sprayed on 18th June  
Hoegrass sprayed on 29th July on plots marked H.

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Control : 14th cereal	815 H	15
1 lupin : 1 clover	1,865 H	25
2 clover : 1 lupin : 1 wheat	1,809	11
2 clover : 1 wheat : 1 lupin	1,701 H	22
4 clover : 1 lupin : 1 wheat	1,745	9
4 clover : 1 wheat : 1 lupin	1,771	6

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1. Annual ryegrass is still a serious problem in continuously cropped lupins despite use of Hoegrass in the last four crops. Root diseases remove about 20 per cent of plants, but surprisingly not that bad considering this was the 8th successive lupin crop.
2. All lupins suffered flower abortion caused by hot dry weeks in September. They were also planted later than optimum because of the very late opening rain.
3. Continuous cereal had a problem with broadleaf weeds (especially capeweed) which could not be sprayed because of adjacent lupin plots. A strip (2.1 m wide) in the continuous cereal had 120 kg urea/ha topdressed prior to seeding. This increased grain yield by 181 kg/ha, not enough to pay for the urea.
4. The continuous cropping with lupins alternating with wheat again showed that yields of both phases were comparable to rotations including 2 or 4 years of pasture. This has been a consistent result for the 7 years that lupins have been sown.



68SG5/2475EX

Locality: Paddock H5 on Salmon Gums Research Station.

Soil type: Complex of Kumarl loam (heavy) and Circle Valley/Beete calcareous sandy loam (lighter).

History:

Cleared in 1962, then cropped until the start of the trial in 1968. Two of the four blocks were sown to Cyprus Barrel medic which is topdressed with superphosphate. The other two blocks regenerate volunteer pasture which is not topdressed. These volunteer pastures are slowly getting a reasonable amount of medics included, both Goldfield and Cyprus.

Rainfall: in mm.

May	June	July	August	September	October	Total
34	77	27	28	7	26	199

Wheat Yields: Madden sown on 3 to 5th June 1981  
Hoegrass sprayed on 15th July  
24D sprayed on 5th August

18th crop - No. N fert. 172 kg grain/ha  
18th crop - +54 kg Agran 34/ha 138 kg grain/ha.

		Pasture	
		Medic	Volunt.
1 crop	: 1 year pasture 1st crop	114	152
1 crop	: 3 year pasture 1st crop	0	170
3 crop	: 3 year pasture 1st crop	45	181
	2nd crop	133	160
	3rd crop	116	65

1. Poor season has again resulted in poor yields and a yield depression due to nitrogen, both bag and soil.
2. Yields were further depressed in some rotations by the poor kill of annual ryegrass caused by spray problems when the Hoegrass (750 mls/ha) was applied. Ryegrass was very bad in the year in : year out rotation, also in third crop of a 3:3 rotation.

3. Barley grass was also very bad in first crops after three years pasture, particularly on medic blocks.

This was due to the buildup of barley grass in the pasture phase and the lack of post germination cultivation. Plots were only cultivated dry on the 20th May and then sown. This allows early seeding but can't control barley grass which then germinates with the crop.

73SG16/3229EX

Locality: Prosser's lease, Salmon Gums

Soil type: Circle Valley sand.

History:

The site was cropped in 1971 and 1972 after two years of volunteer pasture, mainly grasses and some wild legumes (Goldfields medic and wooly clover). In 1973 the trial started with pasture being sown to a mixture of Harbinger, Cyprus and Tornafield medics.

Wheat Yields: Madden sown on 10 and 11th June 1981  
Hoegrass (.75 l/ha) sprayed on 20th July.

Rotation	kg grain/ha				Ryegrass Plants/m <sup>2</sup>	
	1	2	3	4	Mean	Mean
1 crop : 1 medic	574	568	568	509	555	163
2 crop : 2 medic 1st	273	332	302	333	310	583
2nd	647	706	675	820	712	79
1 crop : 3 medic	361	243	422	573	400	248

5% LSD = 125

1. Yield differences were related to level of annual ryegrass infestation by a linear regression:

$$Y = 665 - 0.64 x \quad (r = -0.71)$$

where Y = grain yield in kg/ha  
and X = ryegrass/sq.m.

The most ryegrass plants were in the first crop of the 2:2 rotation, the same as for 1980. Although all plots were sprayed with Hoegrass, problems with the nozzles gave a much reduced kill.

2. First crops after three years pasture also had problems with barley grass due to lack of cultivation after opening rain.

79GE36/3288EX

Lupins : Wheat Rotation

Locality: V. Carson, West Binnu

Soil type: Sand plain.

History: Paddock in wheat in 1978. 1980 lupin crop averaged 2,086 kg/ha.

Rainfall: For Ajana (20 km N.E. of trial) in mm.

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May	June	July	August	September	October	Total
86	95	41	50	15	3	290

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Wheat Yields: Gamenya sown on 22nd June 1981  
Sprayseed on 26th June.

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Nitrogen rate	4th Wheat Crop	Wheat After Lupins
Nil	139	187
13 kg/ha	208	230
39	226	304
78	170	286
117	223	303
156	297	366

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1. Nitrogen was topdressed on plots immediately before sowing. On this deep sand which is very low in organic matter the applied nitrogen is being leached before the crop can utilize it. Split dressings will be tried in 1982.
2. Continuous wheat had a lot of brome and barley grasses.

Lupin Yields:

Illyarie sown on 21st May 1981. Simazene used and sown dry. Average yield 1,008 kg/ha. Damage caused by drift of sprayseed, used to kill weeds for the wheat sowing, greatly reduced the lupin stand. The dry finish caused some flower and pod drop which further reduced yields.

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79GE37/3288E

Lupins : Wheat Rotation

Locality: P. Thomas, Pindar

Soil type: Gravelly sand loam

History: Paddock in wheat in 1978.  
Lupins grew in 1980, but no yield because of drought.

Rainfall: for Mullewa (25 km W of trial) in mm.

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May	June	July	August	September	October	Total
65	77	60	59	10	15	286

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Wheat Yields: Gamenya sown on 16th June 1981

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Nitrogen Rate	4th Wheat Crop	Wheat after Lupins
Nil	1,046	1,335
13 kg/ha	1,194	1,296
26	1,359	1,358
39	1,300	1,277
78	1,270	1,317
156	1,216	1,177

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1. Dry finish reduced the response to higher rates of nitrogen fertiliser.
2. The 1980 lupin crop was worth about 75 kg of Agran 34 to the following wheat crop. This increased yield by about 300 kg/ha but was at the cost of a lupin crop which gave no direct return. The stubble value for grazing would have to be substantial to help offset this cost.

Lupin Yields: Illyarrie sown on 2nd June 1981.  
Simazene used.  
Average yield 728 kg/ha.

80TS3/3288EX

Lupins : Wheat Rotation

Locality: J. Pericich, W. Arrino

Soil type: Sand plain

History: paddock in wheat in 1979.  
1980 lupin crop averaged 1,674 kg/ha.

Rainfall: for Three Springs (30 kg S.E. of trial) in m.m.

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May	June	July	August	September	October	Total
86	66	67	46	13	9	287

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Wheat Yields: Miling sown on 17th June 1981.  
Diuron and MCPA used to control raddish.

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Nitrogen Rate	3rd Wheat Crop	Wheat after Lupins
Nil	1,167	1,491
13 kg/ha	1,315	1,631
26	1,441	1,681
39	1,562	1,707
78	1,898	1,828
156	1,907	1,877

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1. The 1980 lupin crop increased wheat yield by 324 kg/ha which was achieved by using about 95 kg Agran/ha on a successive wheat crop.

Lupin Yields: Illyarrie sown on 10th June 1981.  
Sprayseed and simazene used.  
Averaged 1,334 kg/ha.

800

80NA6/1378EX

Continuous Cropping with Nitrogenous Fertiliser

Locality: B. Harrington, 6 km west of Darkan.

Soil type: Grey brown sandy/loamy gravel over orange gravel.

History: Cleared 1962, cropped 1977 (oats), 1978 (oats and lupins), pasture in 1979.

Rainfall: for Darkan in m.m.

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May	June	July	August	September	October	November	Total
81	45	79	67	20	18	48	358

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Trial: Cereals are to be grown continuously with wheat each year or with oats and wheat alternately. Six rates of nitrogen fertiliser (Agran 34) are applied each year. Oats are assessed for hay as well as grain.

Yields: OATS

Moore, sown on 17th June 1981.

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Nitrogen kg N/ha	Hay Yield kg DM/ha	Grain Yield kg/ha
Nil	3,515	1,346
25.5	4,170	1,527
51	4,893	1,743
76.5	5,338	1,790
102	5,381	1,825
153	5,726	1,816

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WHEAT

Egret, sown on 17th June 1981

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Nitrogen kg N/ha	2nd Wheat Crop	Wheat on Oats
Nil	495	952
25.5	451	1,041
51	563	1,403
76.5	893	1,482
102	683	1,527
153	667	1,657

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1. Nitrogen rates were topdressed on 8th July, using Agran 34 as the source of N.
2. Barley grass was very bad in all plots, but more so in wheat plots.
3. "Take-all" was very bad in the second wheat crops and probably accounted for most of the yield decline and lack of response to nitrogen. The wheat on oats had some "take-all" and this may have reduced yields.
4. All crops were affected by frost and by the dry September-October.

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