1990

Long-term rotation trials.

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TITLE: Long-term rotation trials

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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.

Rainfall: in mm

May	June	July	August	September	October	Total
7	35	48	23	27	26	166

Wheat Yields: Gutha sown on June 13

Rotation	Crop	Grain yield kg/ha No urea	Plus urea at ( ) kg/ha	
Control	25th	1,110	931	(98)
1 crop : 1 pasture	1	1,162		
1 crop : 2 pasture	1	1,243		
1 crop : 4 pasture	1	1,329		
2 crop : 2 pasture	1st	1,086		
	2nd	1,052		
2 crop : 4 pasture	1st	1,081		
	2nd	843		
3 crop : 3 pasture	1st	1,067		
	2nd	995		
	3rd	814		

1. All plots (stubble and pasture) were burnt on March 7. Crop plots sprayed with 1 L/ha 2,4D Ester + 500 mL/ha Roundup on March 20. Crop plots were scarified on June 11 (except 6 and 29). 2 L/ha of Sprayseed on June 11, sown with 81 kg/ha of superphosphate. Continuous crop plots had urea at 98 kg/ha prior to seeding, on the northern half. Sprayed with 1.5 L/ha Hoegrass + 2 L/ha Bromoxynil on August 8.

2. Continuous cropping using direct drilling (without added nitrogen fertilizer) had a yield as good as most rotations. Addition of 98 kg urea/ha increased growth at anthesis by 40% but reduced grain yield.

Weed counts: Plants per sq metre. Done on August 20

Rotation	Crop	Wild oats	Annual ryegrass	Barley grass	Doublegee
Control	25th	16	3	2	0
1 crop : 1 pasture	1	32	167	2	0
1 crop : 2 pasture	1	6	96	0	0
1 crop : 4 pasture	1	6	20	0	6
2 crop : 2 pasture	1	38	34	4	4
	2	5	2	0	0
2 crop : 4 pasture	1	23	144	5	4
	2	4	59	0	2
3 crop : 3 pasture	1	13	41	2	0
	2	12	12	2	0
	3	0	41	0	0

1. Plots had been sprayed with 1.5 L/ha Hoegrass + 2 L/ha Bromoxynil on August 8 and weed species counted (except barley grass) were dying.

Pasture composition on September 13. Per cent medic (A), grass (B) and herbs (C)

Rotation	Years pasture 1			2			3			4		
	A	B	C	A	B	C	A	B	C	A	B	C
1 crop : 1 pasture	92	0	8									
1 crop : 2 pasture	75	6	19	52	24	24						
1 crop : 4 pasture	46	25	29	52	40	8	67	26	7	54	26	20
2 crop : 2 pasture	96	0	4	53	35	12						
2 crop : 4 pasture	58	11	31	65	21	14	72	23	5	56	33	11
3 crop : 3 pasture	73	0	27	66	30	4	81	16	3			
Continuous pasture in its 26th year				60	36	4						

1. Observation of pasture production showed first year pastures was well down compared to older pasture.

2. Grass in older pastures was mainly barley grass. In the permanent pasture it was a mix of barley and silver grass.

3. Herbs were mainly doublegees and marshmellow, with doublegees being predominant in first year pastures and more marshmellow as pastures get older.

67C13/2332EX:

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

Soil type: Red brown loamy sand

History:

An 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 to 83 all plots were reseeded with Northam at 20 kg/ha. In 1988 rotations were altered to allow inclusion of grain lupins, the following changes were made:

1. The 4 plots of 2 crop : 2 pasture were changed to 2 reps of wheat : lupins or lupins : wheat.

2. The 3 crop : 3 pasture had lupins included as the second crop, are now 3 pasture : wheat : lupins : wheat.

Rainfall: in mm

May	June	July	August	September	October	Total
60	67	84	51	23	21	306

Wheat Yields: Gutha sown on July 29

Rotation	Crop	Grain yield kg/ha No urea	Plus urea at ( ) kg/ha	
Control	24th	129	197	(150)
Lupin : wheat		898		
1 crop : 1 pasture	1	831	556	(100)
1 crop : 2 pasture	1	678		
1 crop : 4 pasture	1	813		
2 crop : 4 pasture	1st	942		
	2nd	840	969	(100)
3 crop : 3 pasture	1st	921		
2nd crop is lupins	3rd	461		

1. Wheat plots were sprayed with Roundup at 500 mL/ha on May 1. Plots on June 11 were sown with Eradu at 50 kg/ha with 70 kg/ha of plain superphosphate and the rates of urea were topdressed prior to seeding. Because of germination problems, all cereal plots were sprayed with 500 mL/ha Roundup on July 27 and re-seeded with Gutha at 50 kg/ha on July 29. Nugrass at 1 L/ha on August 31. Barrel at 1 L/ha on September 4.

2. Very poor yields (for this trial) due to very late reseeding because of germination problems caused by surface crusting.

Lupin Yields: Gungarru sown on May 29

Rotation	Yield kg/ha
Wheat : lupins	1,788
3 pasture : wheat : lupins	1,647

1. Lupin plots sprayed with Roundup at 500 mL/ha on May 19. Sown with Gungarru at 90 kg/ha with superphosphate at 70 kg/ha. Simazine at 2 L/ha on May 19.

Weed counts: Plants per sq metre, done September 6. In wheat crops

Rotation	Annual ryegrass
Continous wheat	57
Lupin : wheat	1
1 crop : 1 pasture	7
1 crop : 2 pasture	2
1 crop : 4 pasture	1
2 crop : 4 pasture	0
	0
3 crop : 3 pasture	1
	6

1. Very late planting and extra weed control caused by this had killed all the weeds present.

2. Lupins were not counted but were observed to be relatively weed free.

Pasture: Plant counts on July 17. Sub.clovers per sq metre

Rotation	Years of pasture 1	2	3	4
1 crop : 1 pasture	206			
1 crop : 2 pasture	143	212		
1 crop : 4 pasture	176	254	698	291
2 crop : 4 pasture	111	157	365	337
3 crop : 3 pasture	134	92	476	
Continuous pasture in its 29th year		319		

1. Long dry period after good opening rains had caused many plants to die.

Total production as kg dry matter/ha on September 6

Rotation	Years of pasture 1	2	3	4
1 crop : 1 pasture	2,168			
1 crop : 2 pasture	1,910	1,686		
1 crop : 4 pasture	2,360	1,591	2,208	1,372
2 crop : 4 pasture	1,345	1,820	1,842	1,430
3 crop : 3 pasture	1,544	1,231	1,456	
Continuous pasture in its 29th year - 1,754				

1. Pasture were topdressed with superphosphate at 70 kg/ha on May 20.

Pasture composition on September 6. Per cent clover (A), grass (B) and herbs (C)

Rotation	Years pasture 1			2			3			4		
	A	B	C	A	B	C	A	B	C	A	B	C
1 crop : 1 pasture	25	21	54									
1 crop : 2 pasture	33	24	43	44	14	42						
1 crop : 4 pasture	28	32	40	39	16	45	40	38	23	61	15	24
2 crop : 4 pasture	22	55	18	21	37	42	38	23	39	53	8	39
3 crop : 3 pasture	50	13	20	31	18	51	31	18	51			
Continuous pasture in its 29th year				42	21	37						

1. Grasses mainly silver and barley grass with some annual ryegrass in first year pastures.

2. Herbs were predominately capeweed with flatweed and doublegees as secondary.

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 were sown to Nungarin sub clover, by 1982 all plots had been resown. In 1988 rotations were altered to allow inclusion of grain lupins, the following changes were made:

1. The 4 plots of 2 crop : 2 pasture were changed to 2 reps of wheat : lupins or lupins : wheat.

2. The 3 crop : 3 pasture had lupins included as the second crop, are now 3 pasture : wheat : lupins : wheat.

Rainfall: in mm

May	June	July	August	September	October	Total
78	41	68	14	25	16	242

Wheat Yield: Aroona sown on June 6

Rotation	Crop	Grain yield kg/ha No Agran	Plus urea at ( ) kg/ha	
Control	24th	179	246	(200)
Lupin : wheat		1,250		
1 crop : 1 pasture	1	933	1,214	(50)
1 crop : 2 pasture	1	1,408		
1 crop : 4 pasture	1	1,417		
2 crop : 4 pasture	1st	1,429		
	2nd	1,086	1,337	(75)
3 crop : 3 pasture	1st	1,417		
2nd crop is lupins	3rd	1,517		

1. Crop plots were sprayed with Roundup CT at 1.0 L/ha and Goal at 75 mL/ha on May 22. Plots scarified on May 28, sprayed with Glean at 20 gm/ha on June 6. Sown with Aroona at 45 kg/ha and superphosphate at 75 kg/ha. Topdressed urea on July 3.

2. Wireweed in the area surrounding the trial and on plots which had wheat or lupin stubble was again very bad after heavy rain in January and caused problems at seeding.

Lupins Yields: Yorrel sown on May 29

Rotation	Yield kg/ha
Wheat : lupins	590
3 pasture : wheat : lupins	675

1. Lupin plots sprayed with Roundup at 1.0 L/ha on May 22, scarified on May 28. Simazine at 2 L/ha on May 28 which was worked in with offset disc harrows. Yorrel at 100 kg/ha with super at 75 kg/ha sown.

Weed counts: Plants per sq metre, done August 14. In wheat crops

Rotation	Crop	Annual ryegrass	Brome grass	Wire weed
Control	24th	339	0	135
Lupins : wheat		44	0	15
1 crop : 1 pasture	1	13	27	3
1 crop : 2 pasture	1	32	24	0
1 crop : 4 pasture	1	4	12	1
2 crop : 4 pasture	1st	14	6	0
	2nd	2	1	43
3 crop : 3 pasture	1st	22	23	1
	3rd	6	0	0

Weed Counts: Plants per sq. metre, done August 14. In lupins

Rotation	Annual ryegrass	Brome grass	Wireweed
Wheat : lupins	7	0	30
3 pasture : wheat : lupins	32	0	34

1. Annual ryegrass is a major weed problem in the continuous wheat.

2. Wireweed has rapidly become a problem in rotations involving a year of lupins. Grew unchecked after summer rain and set a lot of seed. Also the dried vines are a big problem at seeding of the following wheat crop.

Pasture: Plant counts on July 12. Sub.clovers per sq metre

Rotation	Years of pasture 1	2	3	4
1 crop : 1 pasture	141			
1 crop : 2 pasture	425	619		
1 crop : 4 pasture	337	221	772	2,181
2 crop : 4 pasture	88	332	1,003	1,968
3 crop : 3 pasture	18	217	716	

Continuous pasture in its 29th year - 1,514

1. Multiple cropping was hard on the seed carryover.

Total production as kg dry matter/ha on September 11

Rotation	Years pasture 1	2	3	4
1 crop : 1 pasture	2,100			
1 crop : 2 pasture	2,840	2,754		
1 crop : 4 pasture	3,135	3,064	3,040	3,309
2 crop : 4 pasture	1,964	2,886	3,206	3,314
3 crop : 3 pasture	1,804	2,064	2,969	

Continuous pasture in its 29th year 3,549

1. All pastures were topdressed with 75 kg/ha of superphosphate on June 12.

2. Total production was down in only the first year pasture after 2 or 3 crops.

Pasture composition on September 11. Per cent clover (A), grass (B) and herbs (C)

Rotation	Years pasture											
	1			2			3			4		
	A	B	C	A	B	C	A	B	C	A	B	C
1 crop : 1 pasture	45	6	49									
1 crop : 2 pasture	70	17	13	63	9	28						
1 crop : 4 pasture	41	5	54	43	9	48	60	10	30	68	9	23
2 crop : 4 pasture	47	5	48	47	10	43	60	9	31	60	10	30
3 crop : 3 pasture	6	14	80	33	13	54	57	12	31			
Continuous pasture in its 29th year				67	9	24						

1. The clover component in first year pasture in a 3:3 rotation was well down, as expected from the counts done in July.

2. In all first year pastures annual ryegrass was present with less amounts of silver and brome grasses. For all older pastures there was no ryegrass and were mainly silver grass with lesser amounts of brome grass. There was a small amount of barley grass in the continuous pasture.

3. Herbs were predominately erodium with lesser amounts of capeweed and flatweed. The exceptions being in a 1:1 rotation where capeweed was the main species and in the first year of a 1:2 rotation which had 50% capeweed.

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

May	June	July	August	September	October	Total
79	41	56	32	32	81	321

Lupin Yields: Gungarru sown on June 8

Rotation	kg/ha	Ryegrass per m^2
Control : 17th lupin	202	33
1 lupin : 1 wheat	82*	97
2 clover : 1 lupin : 1 wheat	197	0
2 clover : 1 wheat : 1 lupin	384	1
4 clover : 1 lupin : 1 wheat	286	0
4 clover : 1 wheat : 1 lupin	494	2

* This plot was in an area that became waterlogged.

Wheat Yields: Aroona sown on June 19

Rotation	Urea Rate in ( ) Nil	Ryegrass per m^2
Control : 24th cereal	781	760	272
1 lupin : 1 wheat	1,717	1,662	85
1 clover : 1 wheat	1,386	1,314	1
2 clover : 1 lupin : 1 wheat	1,569	1,648	3
2 clover : 1 wheat : 1 lupin	1,686	1,717	1
4 clover : 1 lupin : 1 wheat	1,667	1,564	741
4 clover : 1 wheat : 1 lupin	1,645	1,590	0

1. All crop plots sprayed with Roundup at 750 mL/ha on May 23.

   Lupin plots - Sprayseed at 1.2 L/ha and Simazine at 2 L/ha on June 7 sown with Gungurru at 95 kg/ha on June 8 with super at 120 kg/ha. Sprayed Sertin at 500 mL/ha plus sprayoil at 1.0% volume on July 25.

   Wheat plots - sprayed with Logran at 35 gm/ha on June 19. Sown with Aroona at 45 kg/ha and super at 126 kg/ha on June 19. Half of urea topdressed on the two continuous cereals before sowing, the other urea topdressed on July 18. All wheat sprayed with Glean at 12 gm/ha plus wetter at 250 mL/ha on July 30. All wheat plots were accidentally grazed by sheep of July 19.

2. Annual ryegrass that was counted on August 15, all died with the use of different chemicals.

Pasture: Plant counts on July 7. Sub.clover and a small leaf naturalized clover (probably cluster Trifolium glomeratum)

Clover per sq. metre

Rotation	Years pasture 1	2	3	4
1 pasture : wheat	314			
2 pasture : lupin : wheat	411	3,114		
2 pasture : wheat : lupin	416	3,378		
4 pasture : lupin : wheat	107	1,815	7,581	4,768
4 pasture : wheat : lupin	471	2,624	11,093	5,313

Continuous pasture in its 17th year - 4,121

1. Excellent season for clover germination, especially of the T. glomeratum.

Total production as kg dry matter/ha on September 12

Rotation	Years pasture 1	2	3	4
1 pasture : wheat	1,230			
2 pasture : lupin : wheat	1,522	1,576		
2 pasture : wheat : lupin	1,230	1,700		
4 pasture : lupin : wheat	510	1,944	1,734	1,870
4 pasture : wheat : lupin	2,044	1,926	2,044	2,884

Continuous pasture in its 17th year - 2,536

1. All pasture plots were topdressed with manganese superphosphate at 100 kg/ha on July 25.

2. Only explanation for the poor growth in first year in a 4 pasture : lupin : wheat is that it was in an area of plots which became waterlogged.

3. Pastures were heavily grazed.

Pasture composition on September 12. Per cent clover (A), grass (B) and herbs (C)

Rotation	Years pasture 1			2			3			4		
	A	B	C	A	B	C	A	B	C	A	B	C
1 pasture : wheat	10	69	21									
2 pasture : lupin : wheat	13	79	8	12	57	31						
2 pasture : wheat : lupin	18	67	15	31	45	24						
4 pasture : lupin : wheat	11	89	0	49	24	27	31	18	51	51	11	38
4 pasture : wheat : lupin	19	63	18	33	35	32	56	14	30	52	12	36
Continuous pasture in its 17th year				68	15	17						

1. In the first year pastures the grass component was only annual ryegrass. In the second year some barley and winter grass was mixed with the ryegrass. In older pastures the ryegrass was less dominant and barley grass being more obvious with other grasses such as winter, silver and brome.

2. In first year pastures the herb component was only capeweed, the exception being the low production plot referred to above which only had erodium. As pastures get older other herbs such as erodium and flatweed buildup.

65SG5/2475EX

Locality: Paddock H5 on Salmon Gum Research Station

Soil type: Complex of Kumarl loam (heavy) and Circle Valley/Beete calcarious 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 was topdressed with superphosphate. The other two blocks regenerate volunteer pasture which was not topdressed. In 1984 all pasture plots were sown to SERENA medic. This grew exceptionally well in 1984 and set a lot of seed. In 1987 field peas were introduced into 4 reps of an existing medic : crop rotation.

Rainfall: in mm

May	June	July	August	September	October	Total
35	35	30	18	13	47	178

Wheat yields: Aroona sown on May 31

27th crop - Nil N fertilizer	510 kg/ha	119 Ryegrass per m^2
27th crop - + 52 kg urea/ha	164	

Rotation	kg/ha	Ryegrass per m^2
1 crop : 1 year medic, 1st crop	221	28
1 crop : 3 year medic, 1st crop	94	7
3 crop : 3 year medic, 1st crop	297	30
2nd crop	175	16
3rd crop	422	13
1 peas : 1 wheat	211	8

Pea yields: Dundale sown on June 7

Rotation	kg/ha	Ryegrass per m^2
1 wheat : 1 peas	Not harvested	108

1. All crop plots were scarified on April 23, worked back with a scarifier on May 24. Wheat (Aroona) was sown at 50 kg/ha with super at 100 kg/ha on June 7. Northern half of continuous wheat topdressed with 52 kg/ha of urea on June 2. All wheat sprayed with Hoegrass at 1 L/ha on July 26.

   Peas (Dundale) sown at 124 kg/ha with super at 100 kg/ha on June 7. Sprayed with Rogor at 85 mL/ha on July 4, and with Fusilade at 500 mL/ha on July 27.

2. Crop "hayed off" with more soil nitrogen, i.e. longer the rotation, the worse the yield. The top yield was the earlier poorly grown 27th continuous crop without added nitrogen fertilizer.

3. Annual ryegrass worse in the continuous wheat with the added nitrogen. Other weeds were stattice in second and third wheat crops and wild mustard in the wheat after peas.

Pasture: Plant counts on July 11. Serena per sq. metre

Rotation	1	2	3
1 year medic : 1 crop	179		
3 years medic : 1 crop	242	132	210
3 years medic : 3 crops	140	75	256

1. Pasture topdressed with super at 100 kg/ha on June 27.

2. Stattice (Limonium sp.) has become a problem in the pasture phase of all rotations. It becomes worse with increase in age of pasture and is worse in reps 3 and 4 which are on heavier country.

73SG16/3229EX

Locality: Lease block, 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. The Harbinger quickly became the dominant species.

In 1988 rotations changed with removal of a 2:2 system which is to be a second 1:3 medic but with control of grass in the pasture phase.

Grain Yields: Aroona sown June 5

Rotation	Grain yields kg/ha	Ryegrass per m^2
1 crop : 1 medic	720	110
1 crop : 3 medic (PM)	864	4
1 crop : 3 medic	674	0

(PM) Spraytopped third year pasture with Roundup at 500 mL/ha on September 5, 1989.

1. All crop plots scarified April 24, sprayed with Roundup at 600 mL/ha on May 25. Wheat sown June 5 at 55 kg/ha with super at 105 kg/ha.

2. Pasture manipulation in 1990 was to spraytop the second year pastures with Roundup at 360 mL/ha on August 20 and to spray third year pastures with Fusilade at 750 mL/ha on June 20.

88EB2/5714EX

Locality: East Beverley annexe

Soil type: Grey/brown sand over mottled sandy clay 30-40 cm

History:

The site in Paddock 1 was in sub.clover based pasture for the 3 years before the trial started.

Grain Yields: Aroona sown May 21

Rotation	Grain yield kg/ha	Ryegrass per m^2
Continuous, 3rd crop	1,282	53
2 pasture : wheat	2,016	34
Lupins : wheat	2,259	36
Peas : wheat	2,052	44
Yorrel sown May 21		
Wheat : lupins	1,126	3
Werriga sown May 24		
Wheat : peas	540	7

1. All crop plots were sprayed with Sprayseed at 2 L/ha on April 27. Cereal stubbles were burnt on May 3.

   Wheat: Sprayed with Sprayseed at 2 L/ha on May 15. Aroona sown on May 21 at 50 kg/ha with super at 150 kg/ha. Depth of seeding was uneven on old pasture. Sprayed with Hoegrass (1 L/ha) plus Brodal (100 mL/ha) plus wetter on June 14 in continuous wheat, and after lupins or peas.

   Lupins: Sprayed with Simazine at 2 L/ha on April 27 and with Sprayseed at 2 L/ha on May 15. Yorrel sown on May 24 at 100 kg/ha with super at 150 kg/ha. Sprayed with Hoegrass/Brodal mix on June 14.

   Peas: Sprayed with Sprayseed/Bladex at 2 L/ha each on May 24. Werriga sown on May 24 at 100 kg/ha with super at 150 kg/ha. Sprayed with Hoegrass/Brodal mix on June 24.

2. Wheat after pasture was actually after five years of pasture and problems at seeding may have reduced yields. Also this treatment was not sprayed for ryegrass control.

Pasture: Plant counts on July 4. Sub. clover per sq. metre

Rotation	Years pasture	Plants
2 years pasture : wheat	1st	203
	2nd	202
Permanent pasture	6th	174

Total production and composition on October 10

Rotation		Production kg/ha	Composition % Clover	Grass	Herbs
2 years pasture : wheat	1st year	2,256	41	35	24
	2nd year	2,405	54	21	26
Permanent pasture	6th year	2,281	66	17	17

1. Pastures topdressed with super at 150 kg/ha on May 25.

2. All pastures, especially the sub.clover was observed to look potassium deficient. Will all be topdressed in 1991.

3. First year pasture had mainly barley grass with decreasing amounts of silver, brome and ryegrass. Second year pasture had more silver grass with decreasing amounts of rye, barley and brome grass, also have clumps of brown-top bent (Agrostis tennis). Permanent pastures have silver grass as the dominant grass with less amounts of brome, barley and ryegrass, also clumps of bent.

4. The main herbs are capeweed and crassula in roughly equal amounts with no real difference in age of pasture and with lesser amounts of flatweed.