1968

Report on Trials Conducted in 1978 and 1969 by Plants Research Division and Wheat and Sheep Division

J W. Gartrell

DEPARTMENT OF AGRICULTURE, WESTERN AUSTRALIA

LAND RESOURCE EVALUATION - NINETY MILE TANK

REPORT ON TRIALS CONDUCTED IN 1968 and 1969 BY PLANT RESEARCH DIVISION AND WHEAT AND SHEEP DIVISION.

by J.W. Gartrell, Research Officer, Plant Research Division.

* * *

In the late 1920's the seven million acres of virgin land between Hyden and Salmon Gums were considered for settlement under the "3,500 farms scheme" because it constituted "practically the only large area of wheat lands in a suitable climatic zone not then settled in Australia" (Teakle 1939). At that time the sandy scrub-plain soils were more a liability than an asset because methods of profitably farming the light soils had not then been evolved. These useless scrubplains merely increased the distances between patches of more fertile soils. The scheme for settlement was based mainly on the potential of the heavy woodland soils with limited use made of the clay based mallee soils on which yields quickly dropped off after a small number of cereal crops (which more recent experience suggests was simply due to nitrogen deficiency). The woodland soils constitute only about 30 per cent of the total area. One third of the area of woodland soils was considered to be unsuitable for normal cropping due to excess soil salt. Despite the fact that only about 25 per cent of the total area was considered sound for intensive cereal cropping and an additional 20 per cent for extensive grazing, Teakle concluded that there seemed no reason from the standpoint of soils why settlement should not spread across the area in question should there be an economic urge for increased wheat and wool production after consolidation in settled areas.

In the last two decades until the recent introduction of wheat quotas there has been a strong demand for all types of virgin agricultural land. In the late 1950's strains of pasture legumes which could flourish on many of the sandy soils in dry areas were found. Some farmers found they could successfully grow these pasture legumes while others experienced failures. Sowings of pasture legumes increased. The price of fertilizer nitrogen dropped to a level at which its use on light land cereal crops was clearly economic. These two factors, together with earlier discoveries of the need to apply copper and zinc, and high rates of phosphate fertilizers allowed scrubplain soils to be farmed at a profit by some but not all farmers.

A number of those seeking to expand or to find farming land for their sons turned their attention to the vacant land between Hyden and Salmon Gums. The Department of Agriculture with the help

of farmers' groups from Hyden and Kondinin did many trials with cereals and pasture legumes each year between 1960 and 1967 in a twenty-acre area of yellow loamy sand 47 miles east of Hyden. The performances of the best varieties of cereals and pastures in these trials were highly satisfactory provided they were sown early with adequate fertilizer. Under these conditions the best wheat varieties averaged 18 bushels per acre and sufficient growth was made by the pastures in all years to support more than ½ sheep per acre. An application of molybdenum markedly improved clover growth at this site.

In cooperation with the Meteorological Bureau and the Kondinin Shire Council rainfall records were obtained at the plots and another four gauges located as far as 100 miles east of Hyden. To date the area between Hyden and 55 miles to the east has received a similar rainfall to Hyden (long term average 1320 points) dropping by 30 points over the next 20 miles and then a sharper decline of 265 points over the next 25 miles to the rather low estimated long term average of 1025 points near Mount Roundtop.

The provision of stock water by conventional means in the stretches of scrubplain, which in some places cover patches of several thousand acres, may present a problem. Generally the potential of the area surrounding the plots seems equal to that of light land in settled areas near Hyden.

To obtain factual information on plant performance in a part of the area most distant from settled districts two new experimental sites were established in 1968 near the Ninety Mile Tank, half way between Salmon Gums and Hyden. Rainfall figures collected here since 1963 suggest the long term average may be just over twelve inches with a flatter winter peak than Hyden but sharper than Salmon Gums.

Near the Ninety Mile Tank many of the major soils appear identical with those on the Salmon Gums Research Station or the plots east of Hyden. Large areas of two soil types which do not occur at these other places are also found near the Ninety Mile Tank. These are the sands and gravelly sands which contain less fine material than the loamy sand at the east Hyden plots, and heavy brown soils which appear more similar to the heavy soils of the eastern wheatbelt than those at Salmon Gums. Experimental sites were located on each of these two types of soil. The results obtained in the trials at the Ninety Mile Tank and at Forrestania suggest the area's yield potential is similar to Hyden or Salmon Gums. However the present agricultural marketing situation is unfavourable for further agricultural expansion and the large productive capacity of

this region would add to the problems were it developed at this time. The land is undoubtedly valuable even in today's agricultural climate. The area is only 90 to 160 miles direct from the port of Esperance.

Rainfall

	1968			1969			Long Term Average		
	Hyden	90M Tank	+Sal. Gums	Hyden	90M Tank	+Sal. Gums	Hyden	90M Tank*	+Sal. Gums
Jan.	234	177	226	12	112	54	56	60	81
Feb.	88		18	47		66	73	85	91
March	113	173	214	93	15	58	87	95	112
April	113	140	134	109	10	36	85	90	104
May	110	111	59	49	48	123	167	130	127
June	394	487	493	171	184	106	209	160	152
July	99	96	124	84	65	48	202	145	139
Aug.	130	95	88	49	74	52	161	130	130
Sept.	115	115	84	142	142	114	96	110	121
Oct.	48	20	75	2	105	256	79	95	111
Nov.	28	49	37	79	2	62	62	70	79
Dec.	44	15	74	11	2	41	54	65	78
Total (Year)	1476	1478	1626	848	769	1016	1331	1235	1325
May-Oct.	896	924	923	497	618	699	914	770	780

* estimated for the 90 M Tank
\+ Salmon Gums.

Notes on 1968 & 1969 seasons at 90M Tank

1. 1968: May-June. Light late May rains allowed good germination of sown cereals and pastures. June was excessively wet causing waterlogging on heavy land and loss of nitrogen. Nitrogen deficiency was apparent in cereals grown at low rates of nitrogen fertilizer. Pasture growth was satisfactory.

July-October. By the end of August the crops grown with high nitrogen rates were stressed for moisture due to the dry July and August. However, crops and pastures continued to grow quite well in the intermittent cool moist periods which occurred until the end of September. Pastures stopped growing and cereal grain matured in very dry October conditions.

Overall, conditions were judged as having been slightly better than the anticipated norm.

2. 1969: May-June. Germination of cereals and pastures was erratic with only light May rains following a dry April. A high proportion of pasture

seedlings died from lack of moisture. In June, rainfall was adequate but low temperatures retarded growth with pastures particularly slow and backward.

July-August. Moisture stress was severe during most of this period. Crops, which began to head at the end of August were short and pasture plants were stunted, new sowings being worse affected than second year stands, largely due to competition from dense self-sown cereals and later germination.

Sept.- Oct. Relatively good finishing rains provided favourable grain filling conditions for the short crops. Many signs of drought and frost damage were seen on cereal ears in late September, particularly on the heavy land. Crops grown on fallowed new land were clearly less affected by drought than those on non-fallowed new land. Most pasture varieties set some seed, although production appeared low. All annuals had dried off by the end of October. For cereals the season appeared to be average or slightly less favourable than the anticipated average while for pastures it is thought 1969 was substantially worse than usual.

SOIL TYPES:

Site 1. - Lateritic Sandplain

Yellow sand containing large amounts of ironstone gravel which occurs from 2 to 12 inches beneath the surface overlying, in most places, hard siliceous stone at 6 to 20 inches.

Site 2. - Heavy Land Site

Brown earth with smaller areas of grey-brown highly calcareous earth. Typically the profile consists of 2 to 6 inches brown slightly calcareous loamy sand or sandy loam over highly calcareous sandy clay containing variable quantities of lime nodules. Weak doming of the subsoil is evident in places. Shallower and deeper variants of the above occur. The subsoil is likely to be saline and salt may be a problem particularly in dry seasons but has not yet appeared.

DEVELOPMENT OF EXPERIMENTAL AREAS:

The areas were logged in October 1967 and burnt on February 27, 1968. The 1968 experimental sites were ploughed April 18 and 19, rootraked April 24 and sown by drill on May 7 to 9. Experiments were harvested November 19 and 20 using 6 ft auto-header.

Land preparation for the 1969 sowings was as follows:

The fallowed areas were ploughed in November, 1968 and the non fallowed areas scarified on April 28, 1969. First year cereal crops were sown between May 6 and 8. Areas sown to second successive cereal crops were burnt late March, scarified May 8 and seeded on May 20.

Where pasture legumes were sown on stubbles, the areas were burnt in March, scarified late March and sown May 6 to 8.

1. Continuous Cropping with Urea on Gamenya Wheat.

(a) Light Land - 68JL4.

Urea lb/ac	Yield bu/ac			
	1968 Potash, muriate lb/ac			1969
	0	105	Mean	
0	8.4	10.8	9.6	4.5
40	19.4	19.5	19.5	8.1
80	25.6	24.1	24.9	10.9
120	26.5	26.2	26.4	12.4
200	28.8	27.6	28.2	12.5
Mean	21.7	21.6		
LSD's P/ 0.05	Between Treatments = 3.08		Urea Means = 2.18	Urea Means = 2.00

Replication: 1968; 2
1969; 4 for urea rates only.

Other conditions: 1968; super 220 lb/ac, bluestone 5 lb/ac, zinc oxide 1½ lb/ac, roasted molybdenite 2 oz/ac. Potash was topdressed immediately after seeding and urea two days later. New land, not fallowed.

1969; super 200 lb/ac. Urea was topdressed immediately after seeding on May 20th. An attempt was made to burn the stubbles in the summer but the nil urea plots would not carry a fire and the burn on the urea 40 lb/ac plots was patchy. On other treatments the burn was reasonable but not complete.

Comment:

In 1968 the unusually large response was attributable to (1) the area had not been fallowed so available natural soil nitrogen was low, (2) the June rainfall of nearly 5 inches caused some leaching of any mineralised nitrate nitrogen, (3) grain was

lost from the autoheader on low yielding treatments so that the actual response to urea was smaller than the harvester results indicate.

Maximum yield potential was about 29 bu/ac. Potash had no effect on yields.

In 1969 there was again a large increase due to urea. The soil at this site appears to have low reserves of nitrogen. Had it been possible to burn the stubble on the lower urea plots the increase due to nitrogen would have been smaller. At 12½ bu/ac the maximum yield was very poor. This low yield was due to a combination of low rainfall, high seeding rate due to incomplete control of self sown wheat and a later seeding date compared with the other light land trials.

This trial will be continued this season.

(b) Heavy Land - 68JL10.

	Yield bu/ac	
Urea lb/ac	1968	1969
0	15.2	6.6
40	21.7	12.7
80	22.6	14.8
120	21.8	16.1
200	20.9	14.8
LSD P/ 0.05	1.35	2.00

Replication: 4.

Other conditions: Super 180 lb/ac each year, urea topdressed by drill within a day of seeding in each year. The trial was sown on non-fallowed new land in 1968. The 1968 stubbles were burnt in summer 1969 but the fire carried unevenly particularly on the nil urea plots.

Comment:

The comments for the corresponding light land trial generally apply to this trial although waterlogging rather than leaching would have resulted from the heavy June 1968 rains.

In 1968 the maximum yield was about 22½ bu/ac compared with 16 bu/ac in 1969.

2. Superphosphate Rates on Gamenya Wheat.

(a) Light Land

Superphosphate lb/ac	Yields bu/ac	
	1968 - 68JL3	1969 - 69JL1
0	0.0	
60	17.6	
120	19.1	
150	19.3	
180	20.2	22.52
210	21.0	24.56
240	20.3	
270	20.2	
330	20.5	
Statistical	LSD P/0.05=1.59	By t-test, difference significant at P/0.05
Replication	4	16
Other conditions	Urea 50 lb/ac, bluestone 5 lb/ac zinc oxide 1½lb /ac, roasted molybdenite 2oz /ac. New land not fallowed.	Urea 50 lb/ac, bluestone 5 lb /ac, zinc oxide ¾ lb/ac, roasted molybdenite 2 oz /ac. New land fallowed.

Comment:

In 1968 the unusual response pattern of a very large response to the first increment of superphosphate and relatively small increases to additional increments was thought to be associated with the wet June conditions which may have increased the availability of applied superphosphate. This is consistent with the results obtained in the dry conditions of 1969 when 210 lb/ac superphosphate was clearly superior to 180 lb/ac which was not the case in 1968. The 24½ bu/ac obtained with 210 lb/ac superphosphate in 1969 is remarkable considering the dry seasonal conditions. Early planting (May 6th) on fallowed weed free new land produced the conditions which allowed such a high yield which adequate fertilizer and a good wheat variety alone could not have given.

The 1969 trial will be recropped with a range of superphosphate rates superimposed to obtain information on the superphosphate response curve for a second crop grown where near optimum superphosphate was applied to the first crop.

(b) Heavy Land:

Superphosphate lb/ac	Yields bu/ac	
	1968 - 68JL9	1969 - 69JL2
0	4.0	
60	15.1	
90	14.4	16.67
120	13.5	17.34
150	14.9	
180	14.7	
210	14.7	
270	13.7	
Statistical	LSD, P/ 0.05 = 2.51	By t-test, not signifi-cantly different at P/ 0.05
Replication	4	12
Other conditions	No other fertilizer. New land not fallowed. Some harvester loss from the superphosphate nil treatment.	Urea 30 lb/ac. Fallowed new land.

Comment:

As for the light land it is suspected that the wet June conditions in 1968 increased phosphate availability. Nevertheless 120 lb/ac superphosphate was not statistically better than 90 lb /ac in the dry 1969 conditions.

In 1968 the level of yields was limited by nitrogen deficiency which was not a factor in 1969.

3. Cereal Varieties ± Urea 50 lb/ac.

(a) Light Land - 68JL1.

Variety	Yields lb/ac (bu/ac)						Mean 2 yr
	1968			1969			
	0	Urea 50	Mean	0	Urea 50	Mean	
Wheat:							
Falcon	620(10.3)	1371(22.9)	996(16.6)	896(14.9)	995(16.6)	946(15.8)	971(16.2)
Gamenya	610(10.2)	1161(19.4)	886(14.8)	905(15.1)	929(15.5)	917(15.4)	902(15.1)
Bencubbin	581(9.7)	1343(22.4)	962(16.0)	1084(18.1)	990(16.5)	1037(17.3)	1000(16.7)
MEAN	604(10.1)	1292(21.5)	948(15.8)	962(16.0)	971(16.2)	967(16.1)	958(16.0)
Barley:							
Bussell	573(11.5)	1507(30.1)	1040(20.8)	792(15.8)	924(18.5)	858(17.2)	949(19.0)
Beecher	752(15.1)	1629(32.6)	1191(23.8)	995(19.9)	1056(21.1)	1026(20.5)	1109(22.2)
LSD P/0.05	Treatments	113.5lb/ac	80.3lb/ac	Treatments N.Sig.		137	
Replication	2						
Other conditions	Superphosphate 220 lb/ac, bluestone 5 lb/ac, zinc oxide 1½ lb/ac, roasted molybdenite 2 oz/ac. Urea topdressed by drill within two days after seeding. 1968 was on new land not fallowed, 1969 new land fallowed.						

Comment.

In 1968 Beecher barley produced the highest yields of all the cereals while Falcon wheat outyielded Gamenya wheat.

In 1969 the only statistically significant difference was the overall superiority of Beecher barley compared with Bussell.

(b) Heavy Land - 68JL7

Variety	Yields lb/ac (bu/ac) 1968 0	1968 Urea 50	1968 Mean	1969 0	1969 Urea 50	1969 Mean	Mean 2 yr
Wheat:							
Falcon	819(13.7)	1276(21.3)	1048(17.5)	1028(17.1)	1136(18.9)	1082(18.0)	1065(17.8)
Gamenya	810(13.5)	1105(18.4)	958(16.0)	1258(21.0)	1438(24.0)	1348(22.5)	1153(19.3)
Bencubbin	743(12.4)	1229(20.5)	986(16.4)	858(14.3)	976(16.3)	917(15.3)	952(15.9)
MEAN	791(13.2)	1203(20.1)	997(16.6)	1048(17.5)	1183(19.7)	1155(18.6)	1076(17.6)
Barley:							
Bussell	975(19.5)	1550(31.0)	1265(25.3)	1169(23.4)	1287(25.8)	1228(24.6)	1247(25.0)
Beecher	1095(21.9)	1775(35.5)	1435(28.7)	1221(24.4)	1381(27.6)	1301(26.0)	1368(27.4)
LSD P/ 0.05	Treatments	210	151		192	137	
Replications	2						
Other conditions	Superphosphate 180 lb/ac. 1968 new land not fallowed. 1969 new land fallowed						

Comment.

In 1968 Beecher barley was the highest yielder. The wheats all yielded about the same as each other. In 1969 Beecher barley and Gamenya wheat gave similar yields which were superior to the other cereal varieties. The large response to Urea 50 lb/ac in 1968 contrasts with the small responses obtained in 1969.

4. Effect of seven-month fallow on 1st wheat crop.

(a) Light Land - 68JL6 (1969)

Urea bu/ac	Yield bu/ac No fallow	Fallowed	Mean
0	11.6	17.8	14.7
30	14.4	20.0	17.2
60	14.8	20.6	17.7
90	14.8	21.2	18.0
120	15.5	21.8	18.7
180	14.8	23.1	19.0
Mean	14.3	20.8	
LSD P/0.05	1.31		0.9
/0.01	1.78		1.3
Replication	3		
Other conditions:	Superphosphate 220 lb/ac, bluestone 5 lb/ac, zinc oxide ¾ lb/ac, roasted molybdenite 2 oz /ac. Whole area logged Oct.1967, burnt Feb. 1968. Fallowed treatments ploughed Oct 1968, non-fallowed were scarified May 1969. Urea topdressed by drill immediately after seeding.		

Comment:

Little of the large response to fallowing appeared to be due to any effect in releasing nitrogen from soil organic matter. Fallowing appeared to increase the moisture supply to the wheat even though only about two inches of rain fell in the seven-months period of fallow. The effect may have been at least partly due to better root growth. Urea increased yields more on the fallowed than on the non-fallowed treatments.

(b) Heavy Land - 68JL12 (1969)

Urea lb/ac	Yield bu/ac No fallow	Fallowed	Mean
0	13.8	21.4	17.6
30	14.5	23.4	19.0
60	15.3	22.2	18.8
120	14.8	23.3	19.1
Mean	14.6	22.6	
LSD P/ 0.05	2.04		N.S.
P/ 0.01	2.80		
Replication	4		
Other conditions	Superphosphate lb/ac. Whole area logged Oct.1967, burnt Feb.1968. Fallowed treatments ploughed Oct.1968. Urea was topdressed by drill immediately after seeding.		

Comment:

Wheat on the non fallowed area germinated better and early on appeared to grow slightly faster than on the fallowed plots due probably to the very rough cloddy nature of the fallow. Plants on the fallowed plots appeared less stressed for moisture than on the non-fallow.

5. Copper, Zinc and Molybdenum on Wheat

(a) Light Land - 68JL5 (1968).

Zinc Oxide lb/ac	Yield bu/ac Bluestone lb/ac 0	2½	5	7½	Mean
0	21.3	21.3	20.6	19.9	20.8
¾	22.3	22.4	22.5	22.4	22.4
1½	22.0	21.9	22.1	23.7	22.4
Mean	21.9	21.9	21.7	22.0	21.9
	LSD (Treatments) P/ 0.05 = 2.03		LSD(Cu Means) P/ 0.05= 1.17		LSD(Zn Means) P/ 0.05=1.02
MoO_3 2 oz/ac + Super 210 lb/ac applied to all these treatments					

Three treatments received no molybdenum. The comparison with corresponding molybdenum treatments is:-

CuZn	Nil Mo	+ Mo
Super 210 lb/ac	20.3	21.3
" " Cu 2½ Zn ¾	21.6	22.4
" " Cu 5 Zn 1½	22.7	22.1
Mean	21.5	21.9
	LSD (Treatments) P/ 0.05 = 2.03 LSD (Mo Means) P/ 0.05 = 1.17	

The effect of the 400 to 500 p.p.m. Zn and 70 to 100 p.p.m. Cu in plain super is gauged by the comparison of the monocalcium phosphate (MCP) + gypsum treatment which was virtually trace element free but supplied the same quantities of phosphorus and sulphur:-

Super 210 lb/ac	20.3 bu/ac
MCP + gypsum = to super 210 lb/ac	19.3 "
The 1 bu/ac difference was not statistically significant	

Replication: 3. Other fertilizer: Urea 50 lb/ac. Trace elements were mixed with the superphosphate and drilled with the seed.

Comment:

1. Although yield was limited by nitrogen supply (to the extent of about 8 bu/ac below maximum) it was still well above the average obtained in eastern wheatbelt sandplain experiments.

2. Few differences were detected during the growing season. MCP + gypsum treatments appeared slightly poorer than the rest and some plants did show zinc deficiency symptoms. In view of this absence of severe zinc deficiency in the MCP + gypsum plots it is surprising to find a 1.6 bu/ac response to ¾ lb/ac zinc oxide (P/ 0.01). The response was apparently greater where the higher bluestone rates were used.

3. Bluestone (the copper source) was not beneficial.

4. Molybdenum had no significant effect.

5. Geraldton sub clover was sown without additional trace elements on these plots in 1969 to check pasture requirements for copper, zinc and molybdenum. The clover was darker green in colour and grew slightly better where molybdenum had been applied to the crop.

(b) Heavy Land - 68JL11

		Yield bu/ac				
		Bluestone lb/ac				
		0		5		
		Zinc Oxide lb/ac		Zinc Oxide lb/ac		
		0	1½	0	1½	Mean
Manganese Sulphate lb/ac NIL	MoO_3 Nil	14.6	15.9	16.0	15.9	15.6
	" 2 oz/ac	17.1	17.5	17.3	16.5	17.1
14	" Nil	15.4	17.0	16.0	15.9	16.1
	" 2 oz/ac	16.7	14.6	16.0	16.5	16.0
		LSD (Treatments) P/ 0.05 = 2.02 From AOV, Mo x Mn significant at P/ 0.05 Other effects not significant				LSD(Mo Means) P/0.05 = 1.01

The effect of small quantities of copper and zinc in plain super is gauged by comparison of super with MCP + gypsum.

Treatment	Bu/ac	LSD
Super 180 lb/ac	14.6	P/ 0.05 = 2.02
MCP + gypsum ≡ to super 180 lb/ac	17.8	

Replication: 2. Other fertilizer: Super 180 lb/ac to all treatments except the MCP + gypsum. Trace elements were applied mixed with super and drilled with seed.

Comment:

1. In the absence of manganese sulphate, molybdenum appeared to increase grain yield; MCP + gypsum gave a higher yield than super. Neither response can be readily explained by existing knowledge of plant nutrition on soils of this general type. The responses may have been due to chance.

2. At the rates used, neither copper nor zinc increased the yield.

3. Nitrogen supply was inadequate for maximum yields.

4. Tornafield disc medic was sown on this site in 1969. The trace elements applied to the previous crop had no effect on medic growth.

PASTURE LEGUMES

All pasture legumes sown in 1968 (the first year of trials) on both soil types produced reasonable first year stands.

Varieties sown were:-

(a) Light land:

(i) Sub clovers: Geraldton, Uniwager, Dwalganup, Daliak, Seaton Park.

(ii) Annual medics: Harbinger, Cyprus, Snail.
(iii) Lucerne : Hunter River.
(iv) Rose clovers: Sirint, Hykon, Troodos, Kondinin.
(v) Cupped clovers: Beenong, Lisare.
(vi) Serradellas: W. Australian, French.
(vii) Lupins: W. Australian blue, N.Z. blues.

The only variety which failed to set enough seed in 1968 for regeneration as a reasonable stand in 1969 was French serradella while the lupins were rather sparse.

The survival of lucerne on both soils as a very good stand over a dry summer was remarkable. Noteworthy also was the good seed set of the latest maturing of the sub clovers, Seaton Park, in its first year.

Since the aim of the trials is to compare varietal ability to persist and produce high yielding swards, a number of years must elapse before final conclusions can be made.

Tornafield medic, not available for 1968 plantings, was sown on the heavy land in 1969.

At this stage the annual medics appear well suited to the heavy land and it is anticipated that Geraldton and Daliak sub clovers will prove satisfactory on the light lands. The good performance of lucerne on both soil types suggests it may be useful in even drier areas, particularly on lighter soil types, with wide row spacing and low seeding rates.

Seasonal conditions in 1969 were adverse for annual pasture legumes. Seedling mortality was high due to moisture stress with erratic light May rains. Growth was slow in the cold June and July and seed set was restricted by moisture stress in spring particularly for first year stands competing with self sown cereals. Substantial germination since cyclone Ingrid will have reduced seed supplies. The comparative persistence of the legumes in the face of such an adverse set of conditions will be of considerable interest.

SUMMARY.

1. Cereal yields have been measured from plots on a heavy and a light land site at the 90 Mile Tank in two seasons, 1968 and 1969. In the absence of serious weed, insect, vermin or disease problems and with early planting of selected varieties by sound techniques it is thought that the physical environment was the major influence restricting yield levels.

2. Given adequate nutrition the estimated yield potentials were as shown in the following table:

Yields of Gamenya wheat (bu/ac) where adequate nitrogen and phosphorus fertilizers were applied.

Soil	Non Fallow 1968	Non Fallow 1969	Fallow 1969	2nd successive crop 1969
Light Land	29.0	15.0	16.0 to 23.0*	12.5**
Heavy Land	22.0	15.0	23.0	15.0

** Self sown in this trial increased the effective plant density to the equivalent of more than 120 lb/ac seed which aggravated the degree of moisture stress in this dry season.

* Variation depended on location of different trials within the light land area.

3. A summary of the most profitable rates of urea found in the two seasons is shown in the table:-

Table showing the rate of urea (lb/ac) which was found most profitable in different conditions.

Soil	Non Fallow 1968	Non Fallow 1969	Fallow 1969	2nd successive crop 1969
Light Land	80	30	30	120*
Heavy Land	40	Nil	30	80

Based on: Urea at $80 per ton at gate
Wheat $1-00 per bushel at gate

* Overall yield level so low that the whole cropping operation would probably have been commercially unprofitable.

4. The following table summarises the information obtained on the profitability of superphosphate rates:

Table showing the profitability of superphosphate rates(lb/ac) in 1968 and 1969

Soil	1968	1969
Light Land	180 or 210	210 was better than 180
Heavy Land	60	90 was not clearly worse than 120

5. The trace element requirement of crops or pastures has been relatively low. On light land zinc oxide ¾ lb/ac increased wheat yields by 1½ bu/ac compared with untreated wheat. Molybdenum application slightly increased the growth and greeness of sub clover on the light land. A low rate of copper (2½ lb/ac bluestone) would probably be needed as insurance against copper deficiency in crops and animals on the light land but this was not shown in the single wheat experiment planted in 1968. No clear benefits have been shown from the use of copper, zinc, molybdenum or manganese in the heavy land site.

6. Using inoculated and lime pelleted seed, the growth and nodulation of various pasture legumes has been satisfactory. However the growth of these legumes on the light land site in the 2nd year was slightly better where either lime or muriate of potash was used. Because this effect of lime and muriate of potash was not additive it seems likely that the different materials were acting on the same unidentified growth factor.

PERSONNEL.

The conduct of these trials would not have been possible without the full support of many individuals, the list of whom grows longer each year. We acknowledge and thank them for their help. The managers of Salmon Gums and Newdegate Research Stations and officers of the Wheat and Sheep Division stationed at Esperance and Lake Grace have supervised the field operations.

The Plant Research Division is responsible for programme design, interpretation and general administration.

J.W. Gartrell
RESEARCH OFFICER,
PLANT RESEARCH DIVISION.

26.3.70
JWG:EH.