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# Replacement of Sub Clover

A.C. Devitt

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DEPARTMENT OF AGRICULTURE, W.A.

PLANT RESEARCH DIVISION

1969 RESULTS OF FIELD EXPERIMENTS

A. C. Devitt.

This is a progress report in summary form outlining results obtained from trials studying clover replacement and evaluating Midland B, Dinninup 3, some members of *Trifolium subterraneum* subspecies *yannanicum*, Tornafield medic and Cyfield medic. Some comments are also included on two glasshouse experiments. In most cases complete results have been or will be circulated in report form.

(A.C. Devitt)  
RESEARCH OFFICER,  
PLANT RESEARCH DIVISION.

3rd March, 1970  
ACD:EH.

## 1. REPLACEMENT OF SUB CLOVER

Eight trials examining techniques of subterranean clover replacement were continued in 1969, one other (Avondale Research Station) was discontinued due to the atypical nature of the site.

Two trials, one at Narrogin (68NA12/2460 Ex) and one at Katanning (68KA6/2460 Ex) were commenced in 1969. Weather conditions prevented them being started in 1968. Both were sited on established Dwalganup sub clover pastures which yielded 1124.7 lbs of clover seed and 981.0 lbs of clover seed/acre respectively when sampled on March 17, 1969.

Both trials were sown as scheduled. Unfortunately the unfavourable season affected the growth of pasture and crop at both sites. A plague of red legged earth mite at Katanning is blamed for removing all of the few clover plants that germinated. The crop plots grew poorly (very uneven) and were damaged by sheep due to the fences being placed too close to the trial. These factors led to the immediate termination of the trial.

At Narrogin the nine first-year crop plots averaged 23 bushels of Gamanya wheat per acre. The pasture plots will be sampled in autumn 1970 for clover seed yield. This trial will be continued as scheduled.

The second year of similar trials were continued at Three Springs (68TS11/2460 Ex), Wongan Hills Research Station (68WH6/2460 Ex) and Gingin (68MO6/2460 Ex). All trials were sampled in autumn for clover seed yields. The results were:

Seed Yields (lbs/acre)

	68TS11 - 16.4.69	68WH6 - 28.3.69	68MO6 - 10.3.69
Under new } pasture }	668.3	72.05	255.0
After one crop	339.9	12.46	167.9
Under estab- } lished pasture }	368.2 (305.9*)	139.87 (72.0*)	393.5 (464.7*)

\* 1968 yields.

The samples from the new pasture plots include seed of the replacement strain (Daliak) and the established strain (Dwalganup, with Geraldton at Wongan Hills). These samples will be subsampled and grown out to determine the ratio of each in the mixture.

The relatively low yield at Three Springs (compared to under new pasture) was due to a heavy weed infestation which was not checked soon enough by grazing. During 1969 little growth occurred on the Daliak plots. By flowering time most plants had shrivelled up and died. It is expected that little seed will be set. The Dwalganup plants appear to have made better use of the unfavourable conditions. The crop also yielded poorly compared to 1968. It was sprayed on the 5th August for broad leaved weeds and webworm. It appeared as though the webworms had caused a lot of damage.

.... /2.

The result of the harvest was :

Plot Number	Yield (bushels/acre)	
	1968	1969
Block I		
2.	27.0	New Pasture
3.	27.3	20.7
4.	27.0	22.9
5.	24.8	New Pasture
8.	25.7	New Pasture
9.	26.3	15.1
Average	26.35	19.57
Block II		
10.	--	17.0
11.	--	13.8
14.	--	18.2
15.	--	20.7
16.	--	19.5
17.	--	15.7
Average		17.48

Due to its condition the trial will be discontinued immediately.

At Wongan Hills the low seed yield from under the established pasture may have been due to -

- (a) False break at the beginning of the 1968 season;
- (b) Weed infestation;
- (c) Early close to 1968 growing season.

The 1969 treatments were delayed until the 19th June hoping for better sowing conditions. However, the continued dryness only allowed a light and patchy germination of clover and the likelihood of little seed being set by the end of the season. The crop grew poorly as shown by the harvest figures:

Plot Number	Yield (bushels/acre)	
	1968	1969
Block I		
2.	28.9	New Pasture
3.	28.0	12.9
4.	28.0	13.3
5.	27.5	15.7
6.	29.4	18.9
7.	31.5	New Pasture
10.	34.4	New Pasture
11.	33.3	18.2
12.	27.5	16.1
Average	29.8	15.85
Block II		
13.	--	21.3
14.	--	20.3
15.	--	18.9
18.	--	21.0
19.	--	20.3
20.	--	19.9
21.	--	17.5
22.	--	19.9
23.	--	21.3
Average	--	20.0

.../3.

Although the 1969 season had a detrimental effect on the experiment and the evaluation of the techniques of pasture replacement, it will be continued.

At Gingin two blocks were sown on June 5, 1969, one with Daliak as the replacement strain and the other with Seaton Park.

Generally the crop and pasture grew relatively better at this site, particularly early in the season. Unfortunately the crop became very weed infested and was then damaged by cattle. Several plots were not harvested. The yields obtained were as follows:

Plot Number	Yield (bushels/acre)	
	1968	1969
Block I	2. 18.4 damaged	New pasture
	3. 36.8	Too weedy
	4. 37.5	"
	5. 35.6	"
	6. -- damaged	"
	7. 35.6	New pasture
	10. 26.7	New pasture
	11. 28.6	Too weedy
	12. 10.8 damaged	5.7
Average	33.5	5.7
Block II	13. --	8.8
	14. --	13.2
	15. --	8.2
	16. --	11.9
	19. --	15.7
	20. --	15.1
	21. --	17.6
	22. --	17.6
	23. --	13.8
Average	--	
Block III	26. --	24.5
	27. --	20.1
	28. --	27.0
	29. --	26.7
	30. --	24.5
	31. --	22.0
	34. --	28.9
	35. --	25.8
	36. --	23.9
Average	--	

This experiment will be continued as scheduled.

Two other clover replacement trials were commenced in 1966; one at Esperance (66ES11/2157 Ex), the other at Bridgetown (66BR25/2158 Ex).

The result of an autumn clover seed sampling at Bridgetown was as follows:

Treatment			Clover seed (lbs/acre)
Cropped 1966, 7, 8	Nil	N	61.7
	Low	N	82.9
	Med	N	95.5
	High	N	68.7
	Mean		77.2 (61.0)*
Cropped 1967, 8	Nil	N	302.1
	Low	N	159.2
	Med	N	125.9
	High	N	125.6
	Mean		178.2 (302.6)*
Cropped 1968	Nil	N	300.6
	Low	N	368.5
	Med	N	281.3
	High	N	311.8
	Mean		315.6
No crop	Block I		1014.7
	II		868.4
	III		1106.6
	Mean		996.6 (610.9)*
Crop 1967, 8 + Spray + Med N			212.6 (362.5)*
Crop 1968 + Spray + Med N			159.8

\* Figures in bracket - last year's results for the same plots with one less crop.

After three crops there was still at least 60 lbs of clover seed per acre. This may make clover replacement quite difficult. The spray treatments also gave conflicting results.

The 1969 treatments were carried out on the 6th May, 1969. Block I was oversown with Seaton Park and included three cross treatments. Observations on the 17th September showed the herbicide cross treatment to be the most effective, with ploughing and scarifying almost indistinguishable.

A clover plant count taken under the Block II and III crops indicated that a poor weed kill had been obtained. Plant numbers tended to decrease as N application increased.

Treatment			Plant Number/Sq. Link
Crop 1967, 8, 9	Nil	N	21.8
	Low	N	21.4
	Med	N	12.6
	High	N	14.9
Crop 1968, 9	Nil	N	23.8
	Low	N	21.2
	Med	N	14.6
	High	N	19.5
Crop 1969			4.8
Crop 1968, 9 + Spray + Med N			1.0 (Plants sick)
Crop 1969 + Spray + Med N			0.0

..../5.

The oat crop was harvested on the 12th December with the following results:

Treatment		1968 (bus/ac)	1969 (bus/ac)
<u>BLOCK II</u>			
Crop 1967, 8, 9	Nil N	32.5	14.1
	Low N	34.5	15.6
	Med N	35.8	17.7
	High N	33.5	15.6
	Mean	34.8	15.8
Crop 1968, 9	Med N	38.4	13.1
Crop 1968, 9 + Spray + Med N		38.1	15.2
Crop 1969		--	10.6
<u>BLOCK III</u>			
Crop 1968, 9	Nil N	42.4	7.5
	Low N	44.0	9.2
	Med N	45.1	8.9
	High N	36.6	8.2
	Mean	42.0	8.5
Crop 1969	Med N	--	8.2
Crop 1969 + Spray + Med N		--	9.6

Cattle broke into the crop in spring; thus the yield figures are useless. However, the experiment will be continued as scheduled.

The results of the autumn clover seed sampling at Esperance are still being analysed.

The 1969 treatments were carried out on the 18th June. Block I, oversown with Seaton Park, also included three cross-treatments. The poor season appeared to ruin any chance of getting any worthwhile results: however, seed samples will be taken in autumn 1970. Very little clover grew in Block I, and the rest of the pasture plots were very weedy. This was also true to a certain extent in the crop plots, particularly where sorrel infested the wheat crops. The crop, however, did yield better than in the previous year.

Treatment	1968 (bus/ac)	1969 (Bus/ac)
<u>BLOCK II</u>		
Oats 1967; wheat 1968, 9	13.9	15.6
Oats 1968; wheat 1969 (2 sprays)	17.0	21.6
Oats 1968; wheat 1969	21.0	26.2
Oats 1969	--	35.0
<u>BLOCK III</u>		
Oats 1968; wheat 1969	22.9	22.2
Oats 1969	--	36.9
Oats 1969 + spray	--	38.4

About 10% of the oat yield was lost due to shedding.

The experiment will be continued as scheduled.

...../6.



The last of the replacement trials was sown with all treatments in 1965 at Esperance (65ES41/2157 Ex). A clover seed sampling was carried out in autumn 1969. The seed was weighed (converted to lbs/acre) and separated.

Treatment	1968		1969	
	Black	White	Black	White
8 lbs Woog. disc drilled	32.0	17.1	337.3	127.9
16 " " " "	19.3	22.6	359.4	75.0
24 " " " "	13.8	46.9	385.8	89.3
8 lbs " ploughed twice + disc drilled	29.2	61.7	298.7	113.5
16 lbs Woog. ploughed twice + disc drilled	30.3	59.0	305.3	105.8
24 lbs Woog. ploughed twice + disc drilled	27.6	59.0	325.2	99.2
Control	0.6	487.8	35.3	605.2
16 lbs Woog. + inoc. + ploughed twice + disc drilled.	44.6	61.2	305.3	102.5
16 lbs Woog. - inoc. + ploughed twice + disc drilled	19.8	35.3	226.0	85.8

White seed = Yarloop  
Black seed = mostly Woogenellup.

The plots had been heavily grazed in the previous spring and allowed to recover. This reduced weed infestation and improved seed set. Unfortunately the plots became very weed infested again this year due to a delay in getting the plots grazed. The plots will be sampled in autumn 1970 and the experiment terminated.

## 2. DINNINUP X UNIWAGER (DINNINUP 3) CROSSBRED TRIALS

The results of samples collected from 10 sites in 1968 have been fully tabulated. These include plant counts, isoflavone analyses, seed yields, dry matter production and the results of a germination test.

Dinninup 3 does not appear to have fulfilled the objective of an isoflavone free sub clover strain with the maturity and ability to produce of Dinninup. It appears to have inherited many of Uniwager's characteristics having a prostrate growth habit, and pale green leaves with no leaf markings. Its maturity also falls in the range of Daliak and Seaton Park, two clovers which it appears unlikely to replace by reason of dry matter production or seed yields. Also from recent work it appears that the desire for oestrogen free clovers is purely historical. It has now been shown that genistein content is no longer a criterion for selection, plus the fact that a large number of naturally occurring low formononetin sub clovers now exist.

Further samples were taken from several sites at the end of 1969. These results are still being analysed. It is suggested that unless results obtained this year conflict with previous results, no further work will be warranted on Dinninup 3.

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68AL17 - MT BARKER RESEARCH STATION. Sampled 3rd February 1969.

Seed Yields (in grams)

Replications Strains	1	2	3	4	Total	Mean lb/ac
Daliak	36.0	37.0	27.7	47.3	148.0	815.7
Dinninup 3	23.9	29.0	22.0	32.4	107.3	591.4
Seaton Park	32.3	30.2	25.9	36.4	124.8	687.9
Yarloop	28.3	31.8	33.8	40.0	133.9	738.0
Dinninup	25.8	16.3	30.0	38.5	110.6	609.6
Woogenellup	35.8	27.1	43.5	41.2	147.6	813.5
Total	182.1	171.4	182.9	235.8	772.2	

## A. O. V

Variance due to	D.F.	S.S.	M.S.	V.R.
Replications	3	209.9342	69.9781	5.44 **
Strains	5	194.6900	38.9380	3.03 *
Error	15	192.8783	12.8586	
Total (a)	23	597.5025		
Within Plots	24	466.6300	19.4429	
Total	47	1064.1325		

L.S.D's between Strain Means =  $P/2 .05 = 5.40$  119.1 lb/acDry Matter Production (in grams) Sampled 3rd February 1969

Replications Strains	1	2	3	4	Total	Mean lb/ac
Daliak	255.8	282.1	220.6	297.1	1055.6	5818.0
Dinninup 3	232.3	304.5	137.8	254.4	929.0	5120.3
Seaton Park	317.3	282.7	245.9	296.1	1142.0	6294.2
Yarloop	226.5	296.0	292.9	268.3	1083.7	5972.9
Dinninup	352.4	180.2	248.2	307.4	1088.2	3997.7
Woogenellup	234.8	221.3	325.1	272.9	1054.1	5809.8
Total	1619.1	1566.8	1470.5	1696.2	6352.6	

## A. O. V.

Variance due to	D.F.	S.S.	M.S.	V.R.
Replications	3	2244.1708	748.0569	$\frac{1}{1}$ N.S.
Strains	5	3160.8717	632.1743	$\frac{1}{1}$ N.S.
Error	15	21253.6467	1416.9098	
Total (a)	23	26658.6892		
Within Plots	24	14648.0900	610.3371	
Total	47	41306.7792		

3. EVALUATION OF TORNAFIELD AND CYFIELD MEDIC

In 1968 a series of small plot medic evaluation trials were sown at Northam (68N040/2555 Ex), Tammin (68N039), Merredin (68ME35), Southern Cross (68ME34), Wanneroo (68PE11) and Bedford Harbour (68ES42). The first four sites were on heavy land, the last two on light.

The results from the 1968 sampling have been fully tabulated. These include seed yields, dry matter production and the results of a germination test. Some samples were taken from Bedford Harbour in 1969: however, these are still being analysed. No other sites were sampled due to the effect of dry season on plant growth.

Tornafield has impressed on some of the light land sites and for this reason has been released commercially. Less information, however, is known about Cyfield. It is being put up for

certification in the near future. Further information is required on this strain: therefore a series of new trials is to be commenced in 1970.

68N040 - Northam.

Sampled 3rd December 1968

Strain	Dry matter lb/ac	Burr yield lb/ac	Seed yield lb/ac
Tornafield	2431.22	1130.53	461.86
Cyfield	2378.31	1162.94	262.89
Jemalong	3567.90	1380.76	365.96
Hannaford	1996.03	1175.07	304.78
Harbinger	2179.89	1123.92	239.75
C.B.M.	3546.30	1914.28	447.97

Dry matter : no significant differences.  
 Burr yield : P/ 0.05 305.8; 0.01 442.8; 0.001 584.4  
 Seed yield : PZ 0.05 80.5; 0.01 111.1; 0.001 153.7

68N039 - Tammin.

Sampled 30th October 1968

Strain	Dry matter lb/ac	Burr yield lb/ac	Seed yield lb/ac
Tornafield	1434.0	323.0	125.7
Cyfield	1995.0	529.0	117.4
Jemalong	1616.0	283.0	53.5
Hannaford	1739.0	750.0	192.9
Harbinger	1091.0	419.0	75.7
C.B.M.	1270.0	527.0	126.8

Dry matter : P/ 0.05 5.74  
 Burr yield : PZ 0.05 269.0  
 Seed yield : PZ 0.05 64.2 0.01 88.63

68N039 - Tammin.

Sampled 6th September 1968

Dry matter production lb/ac			
Tornafield	890.03	*2324.63	* Total dry matter from the two cuts.
Cyfield	1937.50	3932.50	
Jemalong	2460.94	4076.94	
Hannaford	1046.88	2785.88	
Harbinger	3289.06	4380.06	
C.B.M.	3898.44	5168.44	

68ME34 - Southern Cross

Sampled 1st December 1968

Strain	Dry matter lb/ac	Burr yield lb/ac	Seed yield lb/ac
Tornafield	1231.0	336	133.9
Cyfield	1428.0	462	112.4
Jemalong	2018.0	288	55.7
Hannaford	1260.0	607	155.4
Harbinger	1366.0	639	136.7
C.B.M.	1640.0	967	211.1

Dry matter : No significant differences  
 Burr yields : P/ 0.05 258; 0.01 357; 0.001 493  
 Seed yields : PZ 0.05 64.8; 0.01 89.7

68PE11 - Wanneroo

Sampled 28th January, 1969

Strain	Dry matter lb/ac	Burr yield lb/ac	Seed yield lb/ac
Tornafield	2106.3	1286.4	577.6
Cyfield	2228.5	1437.7	331.8
Jemalong	2089.4	1165.6	274.1
Hannaford	1826.4	1176.3	262.6
Harbinger	1902.7	1162.9	217.6
C.B.M.	1825.2	1320.7	272.0

.../9.

Dry matter : No significant differences  
 Burr yields : No significant differences  
 Seed yield : P/ 0.05. 91.7; 0.01. 126.8; 0.001. 175.2

68ES42 - Bedford Harbour

Sampled 10th December 1968.

Strain	Dry matter lb/ac
Tornafield	1038.4
Cyfield	1014.0
Jemalong	1033.0
Hannaford	992.5
Harbinger	916.7
C.B.M.	945.9

N.B. Cyprus and Harbinger are the earliest flowering (approx. 10 days before Dwalganup) followed by Cyfield and Tornafield 7-10 days later, followed by Hannaford and Jemalong 7-10 days later still. These figures are dependent on seasonal temperatures and date of sowing.

#### 4. MIDLAND B TRIALS

Five Midland B trials were sampled in 1969 for second year production. The results are not yet available. All results of 1968 observations and samplings are now available and these have been circulated to the District Offices concerned. These included plant count, isoflavone analyses, seed yields, dry matter production and seed ratios (weight and number) in mixtures. The results of germination tests are still being tabulated.

Midland B performed impressively in 1968 (See Table) and this prompted the commencement of a grazing trial comparing Midland B and Woogenellup at Mt Barker Research Station. Second year plant counts will be taken within the next few weeks following a premature rain that caused widespread germination. Also a largescale grazing trial will be commenced this year in the Bridgetown area.

Treatments	Isoflavones - Dry Site				Isoflavones - Wet Site			
	F	G	BA	Total	F	G	BA	Total
1. Yarloop	1.35	2.76	0.18	4.29	1.12	2.76	0.18	4.06
2. Midland B	0.04	1.50	0.38	1.92	0.04	2.53	0.45	3.02
3. Dinninup	1.14	0.51	1.90	3.55	1.35	0.62	2.76	4.73
4. Seaton Park	0.12	0.10	1.50	1.72	0.12	0.10	1.75	1.97

F = Formononetin; G = Genistein; BA = Biochanin A

On the 18th December 1968, four replications were sampled for dry matter production and seed yield. Each sample was taken from within a 5 link x 1 link quadrat.

#### Dry Matter Production (in gs)

18th December, 1968

##### Dry Site

Strain	Rep 1	Rep 2	Rep 3	Rep 4	Total	Mean	lb/ac
Yarloop	146.0	157.3	169.6	168.4	641.3	160.3	7067.95
Midland B	156.5	182.0	196.2	176.0	710.7	177.7	7835.15
Seaton Park	94.8	152.5	109.8	155.5	512.6	128.2	5652.59
Dinninup	108.4	175.0	148.9	150.2	582.5	145.6	6419.80
Sub Total	505.7	666.8	624.5	650.1	2447.1		
Y x Midland B	100.0	147.1	167.9	187.2	602.2	150.6	6640.26
Y x Seaton Pk	123.7	124.1	132.6	168.5	548.9	137.2	6049.42
Y x Dinninup	139.9	159.0	147.8	164.3	611.0	152.8	6737.26
Total	869.3	1097.0	1072.8	1170.1	4209.2		

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Wet Site

Strain	Rep 1	Rep 2	Rep 3	Rep 4	Total	Mean	lb/ac
Yarloop	104.8	120.1	122.9	146.8	494.6	123.7	5454.18
Midland B	150.0	159.0	122.9	147.5	579.4	144.9	6388.93
Seaton Pk	130.0	120.7	124.5	129.6	504.8	126.2	5564.41
Dinninup	126.0	123.4	102.8	130.8	483.0	120.8	5326.31
Sub Total	510.8	523.2	473.1	554.7	2061.8		
Y x Midland B	109.4	155.0	122.0	167.8	554.2	136.6	6111.15
Y x Seaton Pk	112.9	129.0	90.8	163.5	496.2	124.1	5471.82
Y x Dinninup	110.0	98.0	119.3	143.7	471.0	117.7	5191.83
Total	843.1	905.2	805.2	1029.7	3583.2		

A. O. V. Dry Site

Variance due to	D.F.	S.S.	M.S.	V.R.
Blocks	3	3977.5969	1425.8656	5.25 *
Treatments	3	5337.6469	1779.2156	7.05 **
Error	9	2271.1956	252.3551	
Total	15	11586.4394		

L.S.D. Between Treatment Means P .05 25.41  
.01 36.51

A. O. V. Wet Site

Variance due to	D.F.	S.S.	M.S.	V.R.
Blocks	3	853.9425	284.6475	2.00 N.S.
Treatments	3	1422.6875	474.2292	3.33 N.S.
Error	9	1282.9675	142.5519	
Total	15	3559.5975		

COMBINED:A. O. V.

Variance due to	D.F.	S.S.	M.S.	V.R.
Sites	1	4639.2528	4639.2528	23.50 ***
Reps within Sites	6	4831.5394	805.2566	4.08 **
Treatments	3	5309.3784	1769.7928	8.96 ***
Treats x Sites	3	1450.9560	483.6520	2.45 N.S.
Error	18	3554.1631	197.4535	
Total	31	19785.2897		

L.S.D. Between Treatments Means P .05 14.76  
.01 20.22  
.001 27.56

Seed Yields (in gs)18th December, 1968Dry Site

Strain	Rep 1	Rep 2	Rep 3	Rep 4	Total	Mean	lb/ac
Yarloop	10.3	16.8	16.5	8.7	52.3	13.075	576.50
Midland B	13.4	17.2	20.4	21.6	72.6	18.15	800.27
Seaton Park	10.5	8.1	8.1	7.1	33.8	8.45	372.58
Dinninup	6.0	6.2	4.2	5.5	21.9	5.475	241.40
Sub Total	40.2	48.3	49.2	42.9	180.6		
Y x Midland B	7.4	10.6	12.7	16.0	46.7	11.675	514.77
Y x Seaton Pk	5.4	17.7	7.6	13.3	44.0	11.60	485.01
Y x Dinninup	7.0	17.0	6.2	10.0	40.2	10.05	443.12
Total	60.0	93.6	75.7	82.2	311.5		

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## Wet Site

Strain	Rep 1	Rep 2	Rep 3	Rep 4	Total	Mean	lb/ac
Yarloop	9.0	12.5	14.0	17.3	52.8	13.20	582.01
Midland B	14.4	23.5	17.3	16.8	72.0	18.00	793.66
Seaton Park	17.3	16.8	13.4	16.6	64.1	16.025	706.57
Dinninup	12.5	13.8	11.1	10.3	47.7	11.925	525.80
Sub Total	53.2	66.6	55.8	61.0	236.6		
Y x Midland B	13.3	11.1	5.0	20.2	49.6	12.4	546.74
Y x Seaton Pk	6.4	3.5	8.1	21.4	39.4	9.85	434.31
Y x Dinninup	10.3	7.6	17.4	17.4	52.7	13.175	578.71
Total	83.2	88.8	86.3	120.0	378.3		

## A. O. V. Dry Site

Variance due to	D.F.	S.S.	M.S.	V.R.
Blocks	3	13.9725	4.6575	1
Treatments	3	368.5025	122.8342	12.62 **
Error	9	87.6025	9.7336	
Total	15	470.0775		

L.S.D. Between Treatment Means P .05 4.99  
.01 7.17

## A. O. V. Wet Site

Variance due to	D.F.	S.S.	M.S.	V.R.
Blocks	3	26.3875	8.7958	1.12 N.S.
Treatments	3	90.2625	30.0875	3.82 N.S.
Error	9	70.9475	7.8831	
Total	15	187.5975		

## COMBINED:

## A. O. V.

Variance due to	D.F.	S.S.	M.S.	V.R.
Sites	1	98.0000	98.0000	11.13 **
Reps within Sites	6	40.3600	6.7267	1
Treatments	3	358.7225	119.5742	13.58 ***
Treats x Sites	3	100.0425	33.3475	3.79 *
Error	18	158.5500	8.8083	
Total	31	755.6750		

L.S.D. Between Treatment Means P .05 3.12  
.01 4.27  
.001 5.32

L.S.D. Between Treatments within P Sites. .05 4.41

## 5. GLASSHOUSE TRIALS

The main glasshouse trials carried out in 1969 included a study of the effect of waterlogging on -

- (a) the nutrient concentration; and
- (b) the enzyme activity,

in the roots of subterranean clovers. At present a paper is being written on the results of the first experiment. With the completion of some minor work, the results of the second experiment will be written up for publication. It is anticipated that further glasshouse and small plot studies will be commenced this year to follow up the findings of these experiments.

A paper on "The effect of waterlogging on the growth and isoflavone content of *Trifolium subterraneum* L" appeared in the September issue of the Australian Journal of Agricultural Research.