1983

# Summary of experimental results 1982/83.

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Plant Research Division

# SUMMARY OF EXPERIMENTAL RESULTS

1982/83.

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|---|---|
| 82C22<br>82C23 | Wheat Production Trials |
| 82C24 | Nitrogen flows from different legume species and varieties |
| 82C10 | Lupins undersown with Harbinger |
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| 82C21 | Pea variety trial |
| 82C23 | The effect of green manuring on wheat yields. |

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Report on "Wheat Production Trials" Trials 82C22 and 23.
District Office trials at Gill's and Criddle's by Dr J. Hamblin.

Rationale.

Nitrogen is a major problem for wheat growing on sandplain as the nitrogen response is very variable due to either leaching or excessive vegetative growth. The purpose of this trial was two-fold, (1) to obtain further information on the response of wheat to rates of N and timing of application of N and (2) to familiarise myself with the problems of growing cereals experimentally on sand plain, so that the 1983 cropping programme in the N flows trial (82C24) would be realistic and successful.

Experimental details.

3 sites were used (A. Criddle, Balla; S. Gill, West Northampton and the Annex to CVRS). These sites were chosen to give a uniform soil type (deep yellow sand) but variation in rainfall. The rainfall figures for May-October were 155mm at Criddle's, 298mm at the annex and 428mm at Gill's.

The trials involved 5 rates of N : 0, 33, 66, 100, 200 kg of N (34:0 used) and 4 application times (all 4 weeks after seeding; split 50:50, at seeding and at 4 weeks; split 33:33:33, at seeding, 4 and 7 weeks and split 25:25: 25:25, at seeding, 4,7 and 10 weeks), making 17 N treatments in all (4 rates x 4 times + 0). At each site there were 2 dates of planting, on the break and at approximately 4 weeks later (site details are given in Table 1). At the annex two areas were used, one on lupin stubble, one on wheat stubble. In the initial analysis planting dates have been considered separately.

Table 1. Site details.

| | Criddle | Gill | Annex Lupins | Annex Wheat |
|---|---|---|---|---|
| Date of planting 1 | 25.5.82 | 26.5.82 | 27.5.82 | 27.5.82 |
| Date of planting 2 | 1.7.82 | 30.6.82 | 29.6.82 | 29.6.82 |
| Soil test N ppm | 28 | 9 | 15 | 13 |
| P ppm | 16 | 6 | 16 | 10 |
| K ppm | 44 | 38 | 52 | 43 |

Superphosphate was topdressed at the rate of 250 kg/ha at Criddle's and Gill's and 300 kg/ha at the Annex; Super Cu, Zn, was also topdressed at the same rate as the plain super. The wheat variety used was Gamenya, sown at 50 kg/ha. The plots were 20m long and 8 rows wide and were planted by a cone seeder with cultitrash floats. No herbicide was used at Gills' and Criddle's (both sites were very clean); at the Annex Glean was used at the early sowing date and Glean + sprayseed at the late sowing date.

Results.

The sites and planting date were analysed separately, and significant differences between N treatments were only obtained in some instances. See Table 2.

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Table 2.

Significant results obtained.

| | Gill | | Criddle | | Annex Lupin Stubble | | Annex Wheat Stubble | |
|---|---|---|---|---|---|---|---|---|
| | Date 1 | Date 2 | Date 1 | Date 2 | Date 1 | Date 2 | Date 1 | Date 2 |
| Significance | *** | *** | NS | ** | NS | * | NS | NS |
| Mean Yield t/ha | 1.16 | .39 | .80 | .61 | .68 | .93 | .82 | .68 |
| CV% | 21 | 15 | 15 | 12 | 22 | 9 | 18 | 27 |

NS = Not significantly different
* = Significantly different at 5%
** = Significantly different at 1%
*** = Significantly different at 0.1%

In all cases, except Annex lupin stubble, the later sown trials yielded less than the early sown trials. In the case of the Annex lupin stubble trial, the early sown plot yields were depressed by a very severe brome grass infestation that was so heavy that it overcame the "Glean". This was due to the fact that the lupins in 1981 had not been sprayed with "Simazine", and a very high level of weed challenge was present. In the late sown trial this was killed by the sprayseed.

The average effect of splitting the N is shown in Table 3, with T1 being all at 4 weeks, T2 being split 50:50, T3 being split 33:33:33, and T4 being split 25:25:25:25.

Table 3.

Yield of wheat with split N application (tonnes/ha).

| | Criddle | | Gill | | Annex Lupin | | Annex Wheat | | Average | | Overall |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | D1 | D2 | D1 | D2 | D1 | D2 | D1 | D2 | D1 | D2 | |
| T1 | .77 | .56 | 1.06 | .38 | .73 | .86 | .91 | .63 | .87 | .61 | .74 |
| T2 | .78 | .66 | .89 | .42 | .59 | .98 | .74 | .73 | .75 | .70 | .72 |
| T3 | .82 | .63 | .98 | .42 | .66 | .93 | .87 | .66 | .83 | .66 | .74 |
| T4 | .84 | .62 | 1.00 | .44 | .75 | .97 | .76 | .71 | .84 | .68 | .76 |

It is apparent from Table 3 that there was no advantage from splitting the N application.

The response to rate of N applied is shown in Table 4.

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Table 4.

Yield of wheat at different rates of applied N (tonnes/ha).

| | Criddle | | Gill | | Annex Lupin | | Annex Wheat | |
|---|---|---|---|---|---|---|---|---|
| Kg/ha N | D1 | D2 | D1 | D2 | D1 | D2 | D1 | D2 |
| 0 | .72 | .50 | .10 | .09 | .61 | .77 | .82 | .53 |
| 33 | .79 | .65 | .78 | .35 | .57 | .88 | .86 | .69 |
| 66 | .81 | .63 | .91 | .47 | .69 | .97 | .76 | .68 |
| 100 | .82 | .63 | 1.10 | .44 | .73 | .94 | .80 | .64 |
| 200 | .79 | .56 | 1.17 | .46 | .74 | .96 | .85 | .73 |

It is apparent from Table 4 that only at Gill's was there a marked response to applied N (this was a very nutrient deficient site. Table 1), which was surprising as one might have expected the higher rates to hay off, particularly at Criddle's (rainfall only 150mm). However, the harvest index (H.I.) did not fall with increasing rate of N (38, 33, 35, 35, 35, for rates 0 - 200 kg/ha early sown N applied treatments, respectively.)

Discussion.

The results confirmed the Department recommendation that applying N 4 weeks after planting is, on average, no worse than other treatments. The importance of weed control in early planting was vividly illustrated. With the N flow experiment in 1983 the plots will be sown after a weed germination and with sprayseed and SSH to ensure adequate weed control.

Acknowledgements.

Dr J. Hamblin was funded by the Wheat Industry Research Council of Australia and by the Western Australia Wheat Industry Research Committee; CSBP is kindly carrying out the plant chemical analysis.

Report on "Nitrogen flows from different legume species and varieties", Trial 82C24 by Dr J. Hamblin , Mr A. Reincke and Dr A. Hamblin.

Rationale.

Legumes are an important source of soil fertility on the deep yellow sands of the Geraldton region. However, there is very little comparative data as to their relative value in the cropping cycle. The aim of this trial is to examine the effect of a wide range of legume species on the succeeding wheat crop. Where possible an early and a late variety of each species was included to discover whether maturity influenced the residual value of the legume. Both grain and pasture legumes were included in this study.

Experimental details.

3 sites were used (A. Criddle, Balla; S. Gill, W. Northampton and the annex to CVRS). These sites were chosen to give a uniform soil type (deep yellow sand) and variation in rainfall. Site details are given in table 1.

Table 1. Site details.

| | | Criddle | Gill | Annex |
|---|---|---|---|---|
| Rainfall (May-October mm) | | 155 | 428 | 298 |
| Date sown | | 1.6.82 | 27.5.82 | 28.5.82 |
| Soil test | N ppm | 16 | 9 | 16 |
| | P ppm | 11 | 3 | 11 |
| | K ppm | 29 | 33 | 65 |

Superphosphate was topdressed at the rate of 300 kg/ha at the Annex and at 250 kg/ha at the other two sites; Super, Cu,Zn was also topdressed at all sites at the same rate as the straight superphosphate. The seeding rate used was 80 kg/ha for all the legume species and 50 kg/ha for wheat. The pasture legumes were seeded at the same rate as the grain legumes so that all legumes had the same biological starting point and differences in residual value would not be confounded by differences in seeding rate. An extra plot of each of the Lupinus angustifolius varieties was sown, so that the effect of harvesting could be compared with unharvested control plots.

The trials were sown with a cone seeder, using cultitrash floats. All species except the Serradella established well. The results for the Serradella variety Pitman must be treated with caution.

The control plots used were wheat (at 5 rates of applied N, 0, 33, 66, 100 and 200 kg/ha), native pasture and fallow. Plots were 60m long, 8 rows wide (17.5cm between rows) and 35m between plots.

The varieties and species used are listed in table 2. Within a species the earlier flowering varieties are listed above the later flowering varieties.

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Table 2. Species and varieties used in this study.

| Species | Variety |
|---|---|
| *Lupinus angustifolius* | P 22612 |
| | Chittick |
| | Uniharvest |
| *Lupinus cosentinii* | Erragulla |
| *Trifolium subterraneum* | Nungarin |
| | Seaton Park |
| *Trifolium hirtum* | Hykon |
| | Kondinin |
| *Pisum sativum* | Buckley |
| | Dun |
| *Vicia benghalensis* | Popanney |
| *Medicago polymorpha* | Serena |
| | Circle Valley |
| *Medicago truncatula* | Cyprus |
| | Jemalong |
| *Medicago tornata* | Swani |
| | Tornafield |
| *Medicago littoralis* | Harbinger |
| *Medicago scutellata* | Snail |
| *Triticum aestivum* | Gamenya |
| *Ornithopus compressus* | Pitman |

The trials were sown as randomised blocks with 3 replications. They were sampled for several characteristics of growth and development in collaboration with Mr A. Reincke and Dr A. Hamblin. The following measurements were made:

Flowering date
Biological yield (mid September)
Seed yield
Root depth
Root mass
Root distribution
Soil N
Plant N content

In 1983 the soil will be sampled before planting for N content, and the plots will be tested with a penetrometer to discover whether any major differences in soil structure have developed.

The degree of sampling depended on the character examined. For example flowering date was scored on all replicates at all sites whereas root distribution was only measured on one replicate at two sites. The amount of work involved determined the degree of sampling.

Results.

At this point in time only an initial examination of the data is possible as only a limited amount has been processed.

Root depth.

The species differed significantly in root depth ($p < .001$), but there was

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no effect of site and no site x treatment interaction. This result was not expected as the sites differed greatly in rainfall (Table 1), but the mean rooting depth (over all treatments) and mean Biological Yield (BY) was:

| | Criddle | Gill | Annex |
|---|---|---|---|
| Depth | 100 | 108 | 111 |
| Biological Yield | 1.3 | 2.6 | 2.6 |

It is seen that despite large differences in BY and rainfall there was little effect on rooting depth. The lack of both a site and a site x treatment interaction suggests that the results found for the different varieties was a general result and would be little influenced by season. However, it is likely that soil type will markedly affect rooting depth.

The relationship between rooting depth, BY and seed yield was examined for each site. The results are given in Table 3.

Table 3.

The correlation between rooting depth, BY and seed yield at each site.

| | Criddle | Gill | Annex |
|---|---|---|---|
| Root depth v BY | .87*** | .12ns | .71*** |
| Root depth v seed yield | .64** | -.17ns | .29ns |

These results show that at Criddle's the depth of rooting determined the amount of water available to the crop and consequently the growth and seed yield. This is the expected result in a low rainfall situation; whereas at the Annex the rainfall effect was less important. Nonetheless, it still had a significant effect on BY but not on seed yield. At Gill's, the high rainfall site (Table 1), the rainfall was not the limiting factor, and therefore there was no correlation between root length and growth; there is even a hint that seed yield was inversely related to root length, suggesting an over investment of dry matter in root growth at the expense of seed yield.

Discussion.

The initial results from this trial are very interesting. As further data becomes available (root mass, distribution, N% etc.) further interpretation will be possible. In 1983 the plots will be cropped to wheat at 5 rates of applied N. This will allow an assessment of the residual values of the species and varieties of legume to be assessed in terms of wheat production. It is hoped that this will in part be related to the N input as measured from the trials in 1982.

Acknowledgements.

Dr J. Hamblin was funded by the Wheat Industry Research Council of Australia and by Western Australia Wheat Industry Research Committee; CSBP is kindly carrying out the plant chemical analyses.

Report on 'Lupins undersown with Harbinger' , Trial 82C10 by Dr J. Hamblin.

This trial failed due to mechanical problems with the cone seeder. It will be repeated in 1983.

See report on Trial 82C19.

Report on "The effect of Simazine on Harbinger Medic", Trial 82C19
by Dr J. Hamblin.

Rationale.

Harbinger medic has been reported by farmers as growing well under lupins sprayed with Simazine. The objective of this trial was to study the effects of different rates of Simazine on the establishment, growth, nitrogen content and seed production of Harbinger medic (Medicago littoralis).

Experimental Details.

The site was the Annexe to CVRS and the soil a deep, yellow sand. Superphosphate at 300 kg/ha and Super Cu Zn at 300 kg/ha was topdressed onto the site before seeding. The Harbinger was sown at 80 kg/ha on 31.5.82 and was sprayed with Simazine at emergence on 15.6.82. The treatments were Simazine at 0, 0.5, 1 and 2 l/ha, and there were 6 replicates. Plant counts were made on 21.7.82, and plant cuts were taken for dry weight and N content on 30.8.82. Seed production was measured after the pasture matured.

Results.

The results are given in the table below.

| Rate of Simazinel/ha | Plants/$m^2$ | Dry Matter kg/ha | N content | Seed Yield kg/ha |
|---|---|---|---|---|
| 0 | 1088 | 1236 | 3.25 | 428 |
| 0.5 | 1024 | 991 | 3.33 | 500 |
| 1.0 | 1152 | 1052 | 3.25 | 387 |
| 2.0 | 838 | 921 | 3.26 | 387 |
| LSD 5% | 207 | NS | NS | NS |

Discussion.

Simazine at 2 l $ha^{-1}$ (more than recommended on sandplain for lupins) slightly reduced plant numbers (sign. 5%), but Simazine had no significant effect on dry matter production, N content of the plants or seed yield.

The farmer's observation that Harbinger is not affected by Simazine appears correct.

The next stage is to see if it is possible to establish Harbinger pastures under lupins, using low seeding rates of Harbinger. If this is possible it allows the option of getting back into pasture cheaply on the Eradu Sands.

Acknowledgements.

Dr Hamblin was funded by the Wheat Industry Research Council of Australia, CSBP kidnly carried out the N analysis and Vicky Hackett assisted with the field work.

Report on "Pea variety trial". Trial 82C21 by Dr J. Hamblin.

This trial failed due to

a) very dry July and August, giving poor pea growth
b) weeds, combined with a caused low yields
c) inexperience in growing peas.

The plots were hand-sampled, and the seed will be increased in 1983 to allow for further testing in 1984. In 1983 agronomic trials will be carried out to determine the best way to grow peas on sandplain in a short season environment.

I would like to thank Dr Greg Berry of V.D.A., Horsham, for making his material available.

Report on "The effect of green manuring on wheat yields". Trial 82C23.
by Dr J. Hamblin and Mr A. Reincke.

With the possible use of W.A. blue lupins as a cheap green manure source, it was decided to get some initial data on green manuring a lupin crop.

There were 10 treatments: 3 times of cutting, flowering, mid pod fill, mature
by 3 methods, ploughed in, cut and left, cut and carted
and harvested normally as the control.

The design was a randomised block with 3 replications. In 1983 the plots will be sown to wheat at 5 rates of N to determine the response curve of wheat to different green manure treatments.

The growth at the different stages of cutting was measured and CSBP is currently carrying analyses of the plant material.