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# Agronomy of Low Alkaloid Lupins - Preliminary Investigations

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1969 RESULTS OF FIELD EXPERIMENTS

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## AGRONOMY OF LOW ALKALOID LUPINS- PRELIMINARY INVESTIGATIONS

### BACKGROUND :

Although the value of leguminous crops in the pattern of Western Australia's agriculture has been recognised for a number of years (Gladstones (1968))*, they have received comparatively little scientific attention. Whilst one such crop, the "sweet" lupin, has occasionally produced highly profitable yields, there is nevertheless a high incidence of near failures which may to a large degree be logically attributed to lack of knowledge of the basic agronomy of the crop.

As a preliminary to more extensive trials at a large number of locations, it was proposed to study the effect of some basic agronomic practices (and of the interactions between them) on the yield of the lupin species Uniwhite (*Lupinus angustifolius*).

### LOCATION AND DESIGN:

Sited at the Forestry block, Esperance on fallowed soil previously bearing Chittock *Lambertia inermis*, the experiment was designed as a factorial with 162 treatments. These were divided into 9 blocks - 9 treatment plots per block split with respect to rhizobial treatment.

### TREATMENTS:

Seeding rates (S) - 25, 50, 75 lb/acre
Super rates (R) - 200, 400, 600 lb/acre
Nitrogen rates(N) - 9, 20, 40 lb/acre
Times planting(T) - April, May, June.
Rhizobium.... (R) - WAU425, WU72.

Plot size was to 100 square links - hand sown and harvested. The superphosphate and nitrogen was topdressed and the inoculum applied as a slurry immediately before seeding.

Estimates were taken in September of the dry matter yields of 20 plants from each plot (or 10 per Rhizobial treatment).

### RESULTS:

All the main effects were significant and all were involved in a number of significant interactions.

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* Gladstones, J.S. (1958) Empire - J. Experimental Agriculture 17 : 332.

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| | Significance of Variance Ratio |
|---|---|
| Seeding Rates (S) | * * * |
| Super Rate (P) | * * * |
| Nitrogen (N) | * * * |
| Time of Planting (T) | * * * |
| S x P | N.S. |
| S x N | N.S. |
| S X T | * |
| P x N | * |
| P x T | * * * |
| N x T | N.S. |
| Rhizobium | * * * |
| S x R | * |
| P x R | * |
| N x R | * |
| T x R | * * |

TABLE 1.

Effects of Primary Treatments on Dry Matter Yield

| Treatment | | Yield per Plant (gms x 100) |
|---|---|---|
| Seeding rate - lb/ac | 25 | 357 |
| | 50 | 428 |
| | 75 | 473 |
| Superphosphate lb/ac | 200 | 156 |
| | 400 | 533 |
| | 600 | 577 |
| Time of Planting - April | | 530 |
| May | | 527 |
| June | | 211 |
| Nitrogen at seeding lb N/ac | 0 | 363 |
| | 25 | 439 |
| | 50 | 462 |
| Rhizobium WU 72 | | 479 |
| WU 425 | | 362 |

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Effects of Some Interactions on Dry Matter Yield :

A. Effects of Superphosphate and Time of Seeding

Yield/Plant (gms x 100)

| Seeding (T) | lb. Superphosphate (P) | | |
|---|---|---|---|
| | 200 | 400 | 600 |
| April | 198 | 678 | 717 |
| May | 199 | 651 | 733 |
| Junc | 73 | 271 | 276 |

The significant P∠ .001 interaction between P and T arises because the differences between planting time effects are greatest at the higher super rates.

B. Interaction Between Applied N and Phosphate

| Nitrogen (N) | lb. Superphosphate (P) | | |
|---|---|---|---|
| | 200 | 400 | 600 |
| Nil | 147 | 442 | 502 |
| 25 lb. | 172 | 555 | 591 |
| 50 lb. | 150 | 603 | 633 |

A significant (P∠ .05) interaction as the N response occurs only at the highest super rates.

C. Effect of Rhizobium on nitrogen application

| Nitrogen (N) | Rhizobium Treatment (R) | |
|---|---|---|
| | WU 425 | WU 72 |
| Nil | 282 | 444 |
| 25 lb | 387 | 491 |
| 50 lb | 422 | 502 |

A significant N x R interaction because the difference between nitrogen treatments is larger for the least effective rhizobial treatment, viz. WU 425.

D. Rhizobium x Time of Seeding

Dry weight per plant x 100

| Seeding (T) | WU 426 | WU 72 |
|---|---|---|
| April | 480 | 581 |
| May | 425 | 629 |
| June | 189 | 225 |

A significant (P∠ .01) interaction as the difference between time of planting is greatest for the most effective rhizobial treatment.

DISCUSSION:

Like all legumes on new land there were marked responses to superphosphate and time of planting. The lack of difference between April and May seeding was undoubtedly due to insufficient rain in April with the true break of the season being May 9th.

The trial was originally planned to include seed yield and soil N data, but severe spring attacks of yellow bean virus made accurate seed yield estimates impossible and the current data is based only on plant size which is usually well correlated with yield (Gladstones personal communication).

The short fallow (1 month) provided a low nitrogen situation where responses to applied nitrogen were predictable, as was the interaction between N and Rhizobium treatment. The latter interaction arises due to the greater N response on plants inoculated with WU 425, the less effective of the two inoculation treatments. The very marked differences associated with the rhizobial treatments emphasises the need for efficient inoculation of lupins on new land, as there was a difference of some 25 per cent, in the dry matter yields associated with the two treatments. Adjacent trials carried out by Dr Chatel comparing the same rhizobial strains indicate WU425 to be at least as effective as W72 so that yield differences in the current trial appear likely to be an expression of rhizobial numbers in the seed. The fact that in every case an "excess" of inoculum was used in this trial emphasises a very real danger of at least relative nodulation failure of lupins in large scale plantings on short term fallow, particularly with seed pelleted at commercial rates several weeks before planting.

There are other basic lessons from this trial to be recognised in future designs, notably the principal of limiting factors. Lack of N response at low P rates is a good example showing the need to adequate P before N differences can be measured. It also points to the need, in studies comparing rhizobial strain effectiveness, to choose a very low N soil type to allow fullest expression of differences between rhizobial treatments. Early plantings and adequate P are also essential.

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