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SUMMARY OF EXPERIMENTAL RESULTS

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PLANT RESEARCH DIVISION

WORK COMPLETED OR IN PROGRESS 1970.

1. Yield Selection Characteristics

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70 GL21 - Moisture stress X apical
competition.
70 GL22 - Short term stresses X
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5. Solarimeter Readings.

1. Yield Selection Characteristics:

The programme has proceeded to the point where single plant selections made on the basis of plant measurement, have had their first yield test in 1970. The Yield testing of the ninety-five selections was done at Merredin and Wongan Hills Research Stations. The yields obtained are to be correlated with both the original plant measurement and with the same plant measurement made on the 1970 plots. The measurements on the 1970 plots will also be examined for variability since they were made on single plants. Plotting of original single plant measurement against mean 1970 yield has not given an encouraging picture. Statistical treatment will however be completed. The 1970 plant measurements will not be completed for some weeks.

It is felt that a further yield test will be required regardless of the outcome of 1970 correlations.

2. Sorghum Development.

Two experiments have been completed in the phytotron cabinets. These examined the effects of photo-period and temperature on flower initiation. Temperatures used ranged from 27°C day, 22°C night, to 36°C day and 31°C night. Initiation was delayed by higher temperatures for the cultivars tested, as shown in the table below.

Days to initiation at various temperatures

Cultivar	28/23°C	30/25°C	32/27°C	34/29°C
Texas 610	22	23	27	36
Rok Y 15	23	26	30	38
Meloland	30	39	35	49

3. Moisture stress effects on Wheat

Three trials were carried out on the effects of moisture stress on grain set and grain filling. The moisture stress was applied by the perhaps questionable method of limited water application. Daily weighings to predetermined moisture contents allowed a figure for plant water use to be estimated. In one trial stresses were applied at anthesis in cabinets with the following results:

69GL15

MS = Medina sand H = High humidity NS= No moisture stress
 RL = Red loam L = Low humidity S= moisture stressed to wilting point

TREAT	PEDUNCLE LENGTH (cm)	GRAIN No.	MEAN GRAIN Weight (g)	GRAINS Pikelet	MEAN DAILY PLANT Water Loss
MS H S	32.8	34.3	0.043	2.59	10.1
MS H NS	36.8	37.4	0.042	2.87	17.6
MS L S	30.4	30.5	0.041	2.37	13.0
MS L NS	35.1	37.4	0.042	2.81	19.6
RL H S	27.2	43.2	0.043	2.42	8.0
RL H NS	36.4	52.6	0.044	3.04	22.9
RL L S	24.8	37.4	0.040	2.11	8.3
RL L NS	36.2	52.7	0.044	2.93	35.0

...../2.

The effects of stresses applied before and after anthesis may be gauged from the following tables:-

70 GL3

Treatment	Grains/ spikelet	Peduncle Length	Mean daily Plant water Loss	
A No moisture stress	3.09	37.2	29.5	26.0
B Stressed severely at anthesis	1.89	21.6	2.1	
C Stressed to wilting point at anthesis	2.52	26.9	9.9	
D Stressed severely before anthesis	1.67	13.5		1.2
E Stressed to wilting pt before anthesis	2.63	25.5		5.9

70GL18

Treatment	Grains/ Spikelet	Peduncle Length	Mean daily moisture losses		
A No stress	3.17	38.4	32.0	31.8	20.7
B Stressed for 7 days after anthesis	3.03	30.1	13.8		
C Stressed for 7 days @ 21 days after anthesis	3.16	40.0		13.6	
D Stressed from 21 days after anthesis to maturity	3.20	40.9			11.6

It was noted in the experiments that a wheat plant may show little visible sign of moisture stress even though conditions are such that grain set is seriously reduced. Peduncle length and moisture use are sensitive measurements of moisture stress. Moisture stress reduced plant water loss, peduncle length, final grain number and hence grains per spikelet. The effect was as pronounced at anthesis as before, and more than stress during grain filling.

4. Flower Abortion of Lupins.

Several experiments have been attempted with a view to examining the effects of soil moisture, temperature and humidity at various physiological stages on the pod setting of lupins. Field grown lupins were transplanted into pots, allowed to establish and then given differential humidity treatment with ample watering in phytotron cabinets. The high humidity gave 0.30 pods per flower while the low humidity gave 0.15 pods per flower.

A technique of applying soil moisture stresses by controlled water application to lupins growing in pots has had only limited success. This is due to poor growth of plants leading to a small number of flowers on the terminal apex. The poor growth may have been due to lack of root exploration of the undrained pots and inadequate nutrition.

...../3.

The results of one trial using this technique are shown below. The figures have not been statistically treated. The flower numbers obtained are very low and may limit the relevance of the result.

70 GL19

Treatment	Mean daily moisture loss during treatment		Seeds set per flower
1 High humidity not stressed	37.9	55.3	2.2
2 Some stress before flowering	8.2		1.2
3 Severe stress before flowering	3.7		0.75
4 Some stress during flowering		7.5	2.0
5 Severe stress during flowering		2.7	0
6 Low humidity not stressed	54.8	74.7	1.73
7 Some stress before flowering	11.1		1.22
8 Severe stress before flowering	6.1		0.29
9 Some stress during flowering		11.9	0.67
10 Severe stress during flowering		7.6	1.18

The stresses used were a two atmosphere treatment (some stress) and a wilting point treatment. The latter was sufficient to kill some plants in treatments 5, 8 and 10. The former treatment was sufficient to give a drastic reduction of moisture use and some reduction of grain set. Low humidity treatment caused an increase in moisture use but a reduced grain set under no stress.

Further trials are in progress to determine the most satisfactory method of growing lupins for moisture stress work.

On the question of timing of moisture stress applied to three lupin cultivars, a trial was carried out where stresses were applied suddenly at different times to plants growing in pots of 1/16" quartz grit.

The results obtained are shown below:

70GL22

Cultivar	Treatment	Grains/flower	Flower No.
1 Uniharvest	Not stressed	0.79	30.0
2	Stressed at bud formation	0.36	30.1
3	" at first flower	0.50	30.3
4	" at first pod appearance	0.27	33.4
5 Unicrop	not stressed	0.84	15.3
6	Stressed at bud formation	0.24	19.0
7	" at first flower	0.58	12.6
8	" at first pod appearance	0.35	16.9
9 Weiko	not stressed	1.37	37.6
	Stressed at bud formation	0.90	32.5
	" first flower	0.78	34.7
	" " pod appearance	0.52	38.6

Once again the results have not been analysed statistically. It would appear however, that the reduction of seed set due to moisture stress was a real effect. The cultivars unicolor and uniharvest seem to be less sensitive to moisture stress at flowering than before or after. Weiko however, seems to be more sensitive at first pod appearance. The explanation of this difference is not immediately apparent. The difference in flower numbers is of interest since all varieties were vernalized and flowered within a week or so of each other.

The main problem to be overcome in the lupin studies is to be able to grow lupins as well in soil (suitable for controlled moisture stress) as in quartz.

5. Solarimeter Readings.

Figures obtained to date from solarimeters installed on Research Stations and at Head Office are shown in the following table. The instrument registers all incoming radiation between 400 and 800 millimicrons wavelength, which is a little more than the photosynthetic range.

SOLARIMETER DATA

cal cm⁻² day⁻¹

Month Year	Chapman	Avondale	Badgingarra	Merredin	Salmon Gums	Wongan Hills	Mount Barker	Newdegate	Esperance	South Perth
6.69	297.6	229.0	254.5	257.0	214.5	254.3				340.4
7	309.4	256.9	226.1	278.9	255.2	276.2	182.9		223.1	240.5
8	378.0	289.2	333.1	343.1	306.0	340.4	234.2		281.0	298.2
9	488.5	413.5	442.0	483.5	384.1	455.9	327.9		370.1	446.2
10	610.1	582.7	601.3	666.2	528.0	625.9	488.2		526.4	582.7
11	649.9	655.4	665.9	669.3	607.8	692.7	606.9		619.9	634.0
12	680.6	728.3	707.1	781.3	678.5	759.1	615.7		658.4	728.6
1.70	642.6	736.9	688.8	757.8	721.4	768.0	732.9		689.1	688.2
2	518.1	605.4	566.6	632.4	571.9	579.5	575.6		604.7	597.6
3	560.7	526.9	548.2	564.1	524.1	560.4	426.7		487.1	520.6
4	414.1	392.9	406.9	427.1	378.7	420.7	324.4		358.2	391.6
5	318.2	276.0	299.9	312.0	262.3	310.8	222.3		239.4	285.8
6	222.9	200.2	208.1	224.1	219.1	226.7	179.6		218.4	203.3
7	278.7	270.8	239.3	272.4	268.1	261.5	194.6	256.7	235.6	215.1
8	324.9	214.3	292.4	309.8	273.2	338.5	242.2	318.6	292.8	271.5
9	431.2	380.4	401.9	406.7	362.7	348.5	309.4	396.3	350.0	382.2
10	548.1	576.7	545.3	599.9	525.5	581.2	470.5	588.9	507.6	512.63
11	648.0	654.3	681.7	716.1	591.2	581.4	531.8	677.8	579.6	596.75
12	676.9	754.7	719.9	760.8	693.5		646.7	725.8	695.9	675.71
