1973

Lupin Split Seed Pilot Trial - Esperance Downs Research Station.

J. W. Gartrell

Lupin Split Seed Pilot Trial - Esperance Downs Research Station.

SOIL TYPE: Not recorded (sandy).

ORIGINAL VEGETATION: Not recorded.

HISTORY: Not recorded. (Bulk lupins in Paddock E2a1)

VARIETY: Not recorded. Basal fertiliser and seeding rates as used on bulk lupins.

TREATMENTS: Solutions of 4% of the mineral materials by weight in water were sprayed by knapsack until leaves were wet on October 23 and 24th when the lupins had flowered and most pods had formed. However, little $CaCO_3$ could have been applied in this way as it is relatively insoluble.

1. Control - unsprayed.
2. Manganese sulphate.
3. Copper sulphate.
4. Cobalt "compound".
5. Calcium carbonate.
6. Magnesium sulphate.
7. Potassium sulphate.

These treatments were applied in triplicate all randomised in one block in plots 2 m. x 9 m. The following 3 m. wide cross strips were applied.

1. Control - unsprayed.
2. Metasystox 280 ml. act. ingred/ha (7 mls. liquid/sub - treatment), applied by mister.
3. Benlate 280 g act. ingred/ha (7g powder/18l water/sub-treatment), applied by knapsack until leaves wet.

Results:

Observations:

The copper sulphate and cobalt compound sprays resulted in a high degree of leaf burn and defoliation. Plants in these two treatments were much smaller than the rest at maturity. Although no yield figures were obtained grain yield was observed to be much reduced. No other differences in plant height were noticed.

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Table 5.

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% of seed classed according to size and degree of splitting.

		N	I	S	E	A
Control	Control	29	25	28	11	7
	Meta	59	16	14	5	5
	Ben	63	9	16	3	9
	Mean	50.3	16.7	19.3	6.3	7.0
$MnSO_4$	Control	86	3	1	5	5
	Meta	95	1	0	0	4
	Ben	91	1	0	0	9
	Mean	90.0	1.7	0.3	1.7	6.0
$CuSO_4$	Control	72	11	1	3	13
	Meta	81	7	1	0	11
	Ben	77	3	0	0	20
	Mean	76.6	7.0	0.7	1.0	14.7
$Co(SO_4)$?	Control	47	29	4	5	16
	Meta	65	9	8	1	18
	Ben	74	6	3	0	17
	Mean	62.0	14.7	5.0	2.0	17.0
$CaCO_3$	Control	39	18	28	11	4
	Meta	48	20	23	5	3
	Ben	62	11	15	2	9
	Mean	49.7	16.3	22.0	6.0	5.3
$MgSO_4$	Control	27	31	19	17	6
	Meta	67	14	7	4	8
	Ben	68	13	8	6	5
	Mean	54.0	19.3	11.3	9.0	6.3
KSO_4	Control	19	18	26	21	7
	Meta	59	16	14	3	9
	Ben	63	12	13	5	7
	Mean	50.3	15.3	17.7	9.7	7.7
Mean	Control	47.0	19.3	15.3	10.4	8.3
	Meta	67.7	11.9	9.6	2.6	8.3
	Ben	71.1	7.9	7.9	2.3	10.9

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Effects on Split Seed Incidence; Initially 10 pods per sub. plot were taken at random on 20/8/73 and classified by Esperance officers. These results clearly showed that manganese and copper sulphate and the cobalt compound had reduced the degree of seed splitting. To obtain a more accurate assessment approximately 50 pods per sub. plot were taken 29/8/73 and sent to P.R.D. where they were classified. The results from the more intensive sampling are shown in Table 5.

Treatment effects on degree of split seed can be more easily seen in the following extracts from Table 5.

	% shrivelled and split seed (category E)			
	Control	Metasystox	Benlate	
$MnSO_4$	5	0	0	1.7
$CuSO_4$	3	0	0	1.0
Co?	5	1	0	2.0
Control	11	5	3	6.3
$CaCO_3$	11	5	2	6.0
$MgSO_4$	17	4	6	9.0
KSO_4	21	3	5	9.7
	10.4	2.6	2.3	
	% Normal seed			
$MnSO_4$	86	95	91	90.0
$CuSO_4$	72	81	77	76.7
Co?	47	65	74	62.0
Control	29	59	63	50.3
$CaCO_3$	39	48	62	49.7
$MgSO_4$	27	67	68	54.0
KSO_4	29	59	63	50.3
	47.0	67.7	71.1	

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Remarks:

1. The Mn, Cu and Co sprays all substantially reduced the proportion of split and shrivelled seed. Mn had the greatest effect in reducing the three split seed categories and increasing the proportion of normal seed.

   It is thought that the Cu and Co effects were due to the growth retardation caused by defoliation resulting in higher Mn levels in the smaller plants.

2. Metasystox and benlate sprays had marked effects in reducing split and shrivelled seed. Metasystox and benlate increased the proportion of normal seed to a degree intermediate between Cu and Co sprays. The explanation for the metasystox and benlate effects is unknown.

3. The remaining materials had negligible effects although there was a suggestion that in the absence of Meta or Ben the Mg and K sulphate increased the proportion of shrivelled split seed without reducing the proportion of normal seed.

3. Manganese sprayed strip on S. Richardson's, Dandaragan.

SOIL TYPE: 0-10 cm grey sand, 10-30 to 90 cm pale yellow sand over gravel.

ORIGINAL VEGETATION: Mallee, scrub, Xmas tree, scattered blackbutt.

HISTORY: Not recorded.

BASAL TREATMENT: Sown 1st week May to Uniharvest 60 kg/ha, 200 kg/ha super drilled + 240 kg/ha super:potash 5:1 topdressed.

TREATMENT: 4 lb $MnSO_4$ in 4 gallons water over strip 400 yds. long. It was felt that most of the spray fell fairly close to the vehicle as mister was not U.L.V. Spray only had an appreciable effect over a strip 3 yards wide. If all spray fell in this 3 yards the application rate approximates 16 lb/ac $MnSO_4$ but actual rate would be less depending on the amount of drift. Spray was applied 20/8/73. Basal flowers on primary spike opened 25/8/73.

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Observations:

1. When inspected in September the crop appeared very healthy and well grown.

2. On 19/11/73 unsprayed lupins showed severe shrivelling and seed splitting particularly on lateral spikelets. Affected pods were blackened and the typical regreening was prominent. Stems were still green. In the treated strip plants had mostly dried off and pods were dry and pods were normal healthy straw colour. In patches the treated strip still showed a degree of regreening.

Incidence of Split Seed:

Two, fifty pod samples were taken from lateral inflorescences of the response strip and the unsprayed crop immediately to windward of the sprayed strip and the seed classified for degree of splitting with the results shown in Table 6.

Table 6. Percent of seed in categories of split seed.

	Unsprayed	Mn sprayed
Normal	6.1	79.8
Not split but necrotic lesions	29.7	8.6
Split but normal size	13.1	6.9
Shrivelled, split	51.1	4.8

Grain Yield: Strips were harvested by the M.F. 31 header. Mn content of the grain is shown.

	kg/ha grain	Mn ppm. Pod	Testa	Embryo
Unsprayed	410	4.2	6.2	11.7
Mn sprayed	880	4.9	13.2	4.8

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4. Manganese sprayed 50 acres on S. Richardson's Dandaragan.

In the same paddock as the responsive strip discussed above, Mr. Richardson sprayed 50 acres with a solution of manganese sulphate and a selenium compound using the mister. This was applied on a different day to the strip at a similar rate of manganese.

The effect of the spray was barely detectable and adjacent sections whether sprayed or unsprayed were very severely damaged by split seed.

5. Manganese Levels in Relation to Split Seed.

Mr. Perry has the task of finding out the pattern of manganese distribution in healthy and split seed affected plants and levels associated with normal and affected material from noraml and affected situations.

Attention is drawn to his separate report. These are a few points to note:

1) For whole mature seed, Mn levels associated with split seed were all less than 10 ppm Mn. The sampled number of split seed crops (7) was not large and the upper level may be found to be higher. (Perry Table 1)

2) Whole immature seeds from 73PE2 (Perry Table 4) from a crop which had split seed contained about 15 ppm. This seed was still green and was sampled 23/10/73. Mature seed from the same trial but randomly sampled contained 5 ppm Mn.

3) Whole mature seed from 2 of the 11 healthy crops surveyed contained 10 ppm Mn or less. (Perry Table 3). Another had 12 ppm and two went about 15 ppm. The lowest level recorded from a healthy crop was 7 ppm in seed from Gidgegannup, an area regarded as sound.

4) The large and consistent differences in Mn content of healthy and split seed affected crops from paired sites (Perry Table 5) is further (but still inconclusive) evidence that manganese itself is directly connected with the split seed disorder and that the disorder is a type of nutritional deficiency of manganese.

5) The critical level of Mn (if such a thing exists) in different lupin tissues has not been defined but "suspect ranges" are suggested by Perry's data.

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6) The immobility of Mn in the plant means that "normal" Mn levels in early, mid or even late season vegetative material do not ensure an adequate Mn supply for later tissues.

7) Conditions unfavourable for late season growth such as prolonged moisture stress, zinc deficiency and low phosphate levels, and chemical defoliation would be expected to reduce the incidence of split seed by reducing the amount of Mn needed by the tissue formed late in the season. Based on points 6) and 7) one could expect that for any given early season lupin tissue Mn level split seed may or may not occur.

8) Additional to Perry's data are results obtained in 1972 from 72BA7 on Badgingarra Research Station when whole and split seeds from the 10 treatments were analysed.

	Mn ppm	Cu ppm	Ca %	N %	K %	Zn ppm	Fe ppm
Whole	4.9	3.5	0.07	6.0	0.8	35	56
Split	4.5	3.3	0.12	5.9	0.8	36	54

It is interesting that within the same crop split and healthy seeds can have the same manganese content and is some indication of the non critical nature of critical levels born of the crude approach to the critical level concept.

6. Lime Effect on Split Seed.

Moora office reported a case from Regansford where split seed was clearly much more severe on an area that had received a ton/ac lime sand some years previously. Undoubtedly this was due to the frequently recorded effect of lime reducing the availability of Mn and indeed is one of the effects we were looking for from the lime treatments applied in experiments at Badgingarra, Gillingarra and Jerramungup in 1972.

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No such effects were noticeable in these experiments probably because the lime was not sufficiently incorporated into the soil.

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