DEPARTMENT OF AGRICULTURE, SOUTH AUSTRALIA

Agronomy Branch Report

CEREAL RESPONSES TO NITROGEN FERTILISERS & HERBICIDE TREATMENTS ON SKELETON WEED INFESTED LAND IN THE MURRAY MALLEE REGION OF SOUTH AUSTRALIA

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Report No. 31

FOREWORD

This series of thirteen experiments was commenced in 1963 with financial support from the Wheat Industry Research Council and the South Australian Wheat Industry Research Committee.

The work was co-ordinated through the Sub-Committee for Skeleton Weed research which was formed at the 53rd Meeting of the Australian Agricultural Council in 1960. This Sub-Committee continued its work until November 1971 and during that period approximately $630,000 was directed from Wheat Funds to the skeleton weed research projects carried out by various research groups throughout Australia. South Australia was allocated approximately $57,000 which not only supported the work reported herein but it also made possible the projects recorded in Agronomy Branch Report No. 32 and No. 33. Mr. A.F. Tideman, acted as the South Australian technical representative on the Sub-Committee.

Although many farmers in the Murray Mallee assisted by making land available for trials, most of the work was conducted on the properties of Messrs. D.G. Dutzchke of Karoonda and C.H. Johnson of Parilla. Their helpful co-operation is greatly appreciated.

I also wish to thank my colleagues in the Department of Agriculture for their advice and assistance. Much of the work reported was commenced by my predecessor, R.J. Luxmoore. His work was a good foundation for this programme. I also wish to particularly mention Messrs Spry, Hughes and Lewis whose assistance in the field enabled the work to proceed under the many difficulties experienced.

October 1971 R. McR. WOOD

Cereal responses to nitrogen fertilizers and herbicide treatments on Skeleton Weed land in the Murray Mallee

a. SUMMARY

During the period 1963-1967, ten trial plots were conducted near Parilla (mean rainfall 13.8"), two near Loxton (10.7") in 1965 and one at Karoonda (13.6") in 1967. Most of the sites were on a solodized solonetz soil type, heavily infested with skeleton weed.

All experiments confirmed that wheat growing on skeleton weed land in the Murray Mallee was uneconomic. Even with the use of nitrogen fertilizer, yields were very low, rarely exceeding 6 bushels per acre with 1½ cwt. of sulphate of ammonia at sowing.

Further experiments with amine 2,4-D crop spray (12 oz. a.e./acre) showed that suppression of skeleton weed from the fully tillered stage until after harvest could not be expected to improve yield of grain. There was an obvious need to control the weed before sowing a cereal crop.

The use of picloram as a pre-crop spray in February - March in 1965 and 1967 showed early promise following observations of its effectiveness on skeleton weed at low rates (1-2 oz. a.e./acre). Results of the 1965 trials suggested no wheat yield increase from picloram spraying at any stage without using at least ½ cwt. of sulphate of ammonia at sowing. However, it was necessary to apply 1 cwt. of sulphate of ammonia in order to show that the February picloram treatment was superior to picloram applied to the crop itself. Thus, the wheat yield increase was dependent upon the control of the weed before sowing and the use of nitrogenous fertilizer at sowing time. Application of urea as a crop spray was less effective than sulphate of ammonia at sowing.

The effect of skeleton weed on crop yield was further demonstrated in 1967 (a drought year). Noyep barley was sown on two sites infested with the weed, but only one trial was reaped because of low yields. Heron wheat was sown on a sandy area not infested with the weed and yield 16 bushels per acre, with no measurable effects from picloram sprays or nitrogen fertilizer.

In contrast the average barley yield was 3.5 bushels per acre on plots receiving 2 oz. of picloram and 56 lbs. of sulphate of ammonia - clearly not enough to pay for these treatments.

The technique of February pre-crop picloram spraying for cereal cropping on skeleton weed land is not the answer. This herbicide requires some rainfall in the period between spraying and sowing the crop to leach into the root zone of the skeleton weed in order to be effective. In the Mallee, rainfall is very uncertain during this time of the year.

Experiments on pasture establishment have also shown that picloram residues can remain in the soil for several years depending on the rate, rainfall and soil type. (See Project 3). This fact precludes the use of picloram over large areas to control skeleton weed for cereal cropping.

The low yields of cereals on skeleton weed land emphasise the need for legume pasture improvement.

b. BACKGROUND

Experiments aimed at controlling skeleton weed in cereal crops in South Australia were conducted during the 1950's. In 1956, a recommendation to use 2,4-D (12 oz. a.e./acre) to control the weed in cereal crops was issued (Orchard, 1956). This treatment was intended for use in areas where the weed had formed broad acre patches. It was claimed to kill 50 per cent of the plants and strongly suppress the remainder until harvest.

Experiments to study nitrogen and moisture competition between skeleton weed and wheat, carried out from 1961-63 have already been mentioned (Ross, 1965).

The knowledge that skeleton weed competes strongly for soil moisture and nitrogen prompted further trial work initiated by R.J. Luxmoore (1963-65) and continued until 1967.

c. OBJECTIVES

- To examine cereal variety responses to the interaction of applied nitrogen and crop spray treatments.
- To examine the time and rate of application of nitrogen fertilizers.
- To test suitable herbicides for suppression of skeleton weed during cropping.

d. TRIAL REPORTS

EXPERIMENT 1

RESPONSES OF THREE WHEAT VARIETIES TO NITROGEN AND 2,4-D CROP SPRAY ON SKELETON WEED LAND. (W.E. 34)

LOCATION:

Parilla. Section 2 Hundred of Parilla (C.H. Johnson)

Rainfall 30 year average 13.7"
1963 = 15.8"
April-October 1963 = 13.2"

Soil Type Solodised solonetz

DURATION:

1/6/63 - 10/12/63

DESIGN:

Randomised block factorial with 2 replicates.
Wheat varieties: Gabo, Gamenya, Heron
Nitrogen: 0, 11½, 34½ lb. N/acre as ammonium sulphate applied at sowing.
Crop Spray: nil, ¼ lb. a.e. amine 2,4-D/acre
Plot Size: 12 ft. x 3 chains
Basal fertilizer was 100 lb. superphosphate/acre
Seeding Rate, 50 lb./acre

METHOD:

The trial was sown with a 20 hoe combine on 1/6/63. The 2,4-D crop spray was applied on 10/9/63 with a Landrover mounted sprayer, delivering 28 gallons per acre.

Wheat and skeleton weed plants were hand harvested on 10/12/63 and the following measurements were taken:

1. Skeleton weed: height, density, mean dry weight per plant

2. Wheat: height, number of fertile tillers, 1000 grains weight, mean grain number per head, grain yield, grain protein.

RESULTS:

(a) Effects on skeleton weed

Crop spraying was very effective in reducing the density and vigour of skeleton weed at harvest.

Effect of 2,4-D spray on skeleton weed

	Mean Height (ins.)	Mean Density (plants per 10 sq. lks.)	Mean Dry Weight (mgm. per plant)
Nil	17.6	73.4	325
2,4-D sprayed	7.3	2.4	231

L.S.D. 0.1% = 3.3

(b) Wheat height (inches)

A significant nitrogen x variety interaction was obtained. Height increased with increasing nitrogen in a linear fashion over the range tested.

	No	N½	N1	N1½	Mean
Gabo	14.5	14.9	18.8	25.7	18.5
Heron	13.2	17.4	15.9	18.7	16.3
Gamenya	17.9	19.2	21.7	22.3	20.3
Mean	15.2	17.2	18.8	22.2	

L.S.D's. 5% (N x V) = 3.3
(Variety) = 1.7
(Nitrogen) = 1.9

(c) Number of fertile tillers (per 12½ sq. links)

These data showed significant nitrogen x variety and nitrogen x spray interactions.

	No	N½	N1	N1½
Gabo	42	42	56	78
Heron	28	46	34	54
Gamenya	66	69	70	69

L.S.D. (N x V) 5% = 17

	No	N½	N1	N1½
nil	42	55	53	82
2,4-D	60	63	66	70

L.S.D. (N x S) 5% = 15

(d) 1000 grain weight (gms.)

Significant effects were obtained from nitrogen x variety x spray interactions.

	No.	N½	N1	N1½
Gabo	29.8	26.3	30.2	33.1
Heron	30.1	38.5	32.8	36.5
Gamenya	30.3	31.8	31.1	31.4

L.S.D. (N x V) 5% = 4.1

	Gabo	Heron	Gamenya
nil	27.0	30.4	29.7
2,4-D	32.7	38.5	32.6

L.S.D. (V x S) 5% = 2.9

(e) Mean grain number per fertile tiller

These data showed a significant nitrogen x variety interaction.

	No.	N½	N1	N1½	Mean
Gabo	5.16	4.74	8.55	15.76	8.56
Heron	4.15	9.07	6.83	11.42	7.87
Gamenya	9.15	9.24	11.61	13.79	10.95
Mean	6.16	7.68	9.00	13.66	

L.S.D.'s. 5% (N x V) = 3.88
(Variety) = 1.94
(Nitrogen) = 2.24

(f) Grain Yield (lb. per acre)

A significant nitrogen x variety interaction was obtained. There was no effect of crop spray on yield.

	No	N½	N1	N1½	Mean
Gabo	145	118	284	746	323
Heron	104	367	164	425	265
Gamenya	324	385	506	552	443
Mean	191	289	319	573	

L.S.D. 5% (N x V) = 230
(Variety) = 115
(Nitrogen) = 133

(g) Grain protein percentages

These data showed significant nitrogen x variety and nitrogen x spray interactions. The protein percentages are generally low and the grain is of poor baking quality.

	No.	N½	N1	N1½
Gabo	8.55	8.01	8.42	8.20
Heron	8.99	7.82	8.38	8.85
Gamenya	7.49	8.34	8.07	8.35

L.S.D. 5% (N x V) = 0.79

	No	N½	N1	N1½	Mean
Nil	8.37	7.88	7.86	7.78	7.97
2,4-D spray	8.31	8.23	8.72	9.15	8.60

L.S.D. 5% (N x S) = 0.65
0.1% (spray) = 0.59

DISCUSSION:

Yield analysis showed that fertile tiller number and grains per fertile tiller responded more markedly to nitrogen than did grain weight. The very low yields and low grain protein values obtained indicate the low soil nitrogen status of the soil.

Crop spraying allows easier harvesting without contamination from skeleton weed. There is apparently no economic benefit in terms of grain yield resulting from a reduction in skeleton weed competition during the last 2½ months before harvest. The crop yield was largely determined prior to the fully tillered stage in this experiment.

EXPERIMENT 2

RESPONSES OF FIVE WHEAT VARIETIES TO NITROGEN AND 2,4-D CROP SPRAY ON SKELETON WEED LAND (W.E. 34)

LOCATION:

Parilla. Section 2 Hundred of Parilla (C.H. Johnson)

Rainfall 13.7" average, 1964 rainfall 17.8"
April-October, 1964 = 13.1"

Soil Type Solodised solonetz.

DURATION:

4/6/64 - 15/1/65

DESIGN:

Randomised block with 4 replicates.
Factorial arrangement of five wheat varieties, four nitrogen levels and two crop sprays.
Wheat Varieties: Gabo, Gamenya, Insignia 49, Heron, Wongoondy
Nitrogen: 0, 11.5, 23.0, 46.0 lb. N/acre
(= $\frac{1}{2}$, 1 and 2 cwt. of ammonium sulphate)
Crop Spray: nil, $\frac{3}{4}$ lb. a.e. amine 2,4-D/acre
Plot Size: 63" x 1 chain

Basal fertilizer was 85 lb. superphosphate, 7 lb. copper sulphate and 7 lb. zinc sulphate per acre. Seeding rate was 62 lb. per acre.

METHOD:

The trial was sown with a Mitchell 9 hoe combine 4/6/64. The 2,4-D crop spray was applied on 27/8/64 with a boom spray delivering 28 gallons per acre. Soil samples for total N and nitrate were collected on 2/6/64.

The density of skeleton weed on control plots was recorded on 25/9/64.

Wheat plants were hand harvested on 15/1/65 and the following measurements were taken: Plant height, number of fertile heads, yield, grain protein.

RESULTS:

(a) Soil nitrogen showed a small variation in total nitrogen with a mean for 0-3" = 0.031% and 3-6' = 0.017%. Soil nitrate values for 0-12" = 3.79 ppm., 12-24" = 1.18 ppm. These data show the very low nitrogen status of the sandy soil infested with skeleton weed.

(b) Skeleton weed density on control plots showed a mean density of 6.1 rosettes/sq. link. The crop spray treatment was not very effective in suppressing skeleton weed due to showery conditions at the time of application. Wild turnip (Brassica tournefortii) was suppressed on plots receiving the 2,4-D spray.

(c) Crop Height

There were significant differences in plant height between wheat varieties, and increase in nitrogen supply increased the mean plant height.

Varieties	Mean Height (inches)	
Gabo	19.1	
Gamenya	17.2	L.S.D. 5% = 1.4
Heron	16.4	
Insignia 49	16.2	
Wongoondy	20.2	
Nitrogen lb./ac.	**Mean**	
Nil	14.9	
11½	18.2	L.S.D. 5% = 1.2
23	18.3	
46	19.9	

(d) Number of fertile tillers

The fertile tiller number was increased with increase in nitrogen supply and with the crop spray treatment. There were significant differences between varieties.

Varieties	Mean No. of Fertile Tillers	
Gabo	25.4	
Gamenya	20.1	L.S.D. 5% = 4.1
Heron	18.6	

Varieties (cont.)	Mean No. of Fertile Tillers
Insignia 49	24.3
Wongoondy	25.5

Nitrogen (lb./ac.)	Mean No. of Fertile Tillers	
0	17.9	
11.5	23.4	L.S.D. 5% = 3.6
23	23.5	
46	26.3	

Spray	Mean	
Nil	21.4	
Spray	24.2	L.S.D. 5% = 0.8

(e) Grain Yield (lb. per acre)

Yield was increased with increase in nitrogen supply and there were small differences between varieties. No effect of spray was evident.

Nitrogen lb. per acre	Mean Grain Yield (lb./ac.)
0	126
11½	210
23	216
46	300

L.S.D. 5% = 60

Varieties	Mean Grain Yield (lb./ac.)
Gabo	258
Gamenya	180
Insignia	210
Heron	174
Wongoondy	234

L.S.D. 5% = 66

(f) Grain Protein Percentage

Nitrogen applications did not markedly influence grain protein, except at the highest nitrogen rate and there were significant varietal differences.

Spraying with 2,4-D at the fully tillered crop stage also significantly increased the grain protein %.

Mean data as follows:

(1) Nitrogen (lb. per acre)	Mean Grain Protein (%)	
0	7.41	
11½	7.53	L.S.D. 5% = 0.26
23	7.40	
46	8.38	

(2) Wheat Varieties	Mean Grain Protein %	
Gabo	7.50	
Gamenya	7.92	L.S.D. 5% = 0.29
Insignia	7.65	
Heron	7.44	
Wongoondy	7.88	

(3) Crop Spray	Mean Grain Protein %	
Nil	7.22	
2.4-D	8.13	L.S.D. 0.1% = 0.31

(4)

Spray x Nitrogen	No.	N½	N1	N2	Mean Grain Protein %
Nil	6.99	7.24	6.96	7.69	
					L.S.D. 5% = 0.36
Spray	7.83	7.81	7.83	9.06	

EXPERIMENT 3

RESPONSES OF GAMENYA WHEAT TO TIME AND RATE OF NITROGEN APPLICATION ON SKELETON WEED LAND (W.E 34 Expt. 3)

LOCATION:

Parilla. Section 2 Hundred of Parilla (C.H. Johnson)

Rainfall: 13.7" 1964 17.8"
April-October, 1964 = 13.1"
May-July, 1964 = 3.1"

Soil Type: Solodized solonetz

DURATION:

4/6/64 - 14/1/65

DESIGN:

Randomised block factorial: 4 replicates
Nitrogen: 0, 11½, 23, 46, 92 lb./acre as ammonium sulphate.
Time of application: sowing, 7 weeks after sowing.
Plot Size: 63" x 1 chain

Basal fertiliser was 82 lb. superphosphate, 6½ lb. copper sulphate and 6½ lb. zinc sulphate per acre. Seeding rate was 62 lb. per acre.

METHOD:

The trial was sown with a Mitchell 9 hoe combine on 4/6/64. The late nitrogen treatments were applied by hand broadcast on 21/7/64. Soil samples for total N and nitrate were collected on 2/6/64. Skeleton weed density counts on control plots were made on 24/9/64.

A crop spray of 12 oz. a.e. amine 2,4-D was applied to all plots on 27/8/64 with a boom spray delivering 28 gallons per acre.

The plots were hand harvested on 14/1/65 and the following measurements taken: plant height, number of fertile heads, mean grain number per head, 1000 grain weight, yield and grain protein.

RESULTS

(a) Soil Nitrogen: Total soil nitrogen was low, being 0.019% for 0-3" and 0.011% for 3-6". The soil nitrate value for 0-12" was 2.7 ppm. and for 12-24" was 1.0 ppm.

(b) Skeleton Weed: Mean density on control plots was 6.4 rosettes per sq. link.

(c) Wheat Crop:

1. Plant height

The following significant effects were shown:

Nitrogen (lb./acre)	Mean Height (ins.)	
Nil	10.8	
11½	15.7	
23	15.7	L.S.D. 5% = 2.3
46	18.2	
92	19.7	

Time of Application	Mean Height (ins.)	
Sowing	15.3	
		L.S.D. 5% = 1.5
After Sowing	16.8	

2. Number of Fertile Tillers

Fertile tiller number was increased with increase in nitrogen supply.

Nitrogen (lb./acre)	Mean	
Nil	12.8	
11½	22.0	
23	18.7	L.S.D. 5% = 5.2
46	22.3	
92	26.6	

3. Mean grain number per fertile tiller

Increased nitrogen supply resulted in an increase in the mean grain number and there was a small increase, but not significant due to the later time of application.

Nitrogen (lb./acre)	Transformed Mean x log (x + 1)	Arithmetic Mean
Nil	0.69	2.9
11½	0.92	8.1
23	0.87	6.4
46	1.13	12.5
92	1.24	16.4

L.S.D. (Transformed means) (5% - 0.15)

4. 1000 grain weight (gms.)

Applied nitrogen increased 1000 grain weight; however there were no significant differences between 11½ lb. N/acre and 92 lb. N/acre.

Nitrogen (lb./acre)	Transformed Mean x log (x + 1)	Arithmetic Mean
Nil	1.18	14.1
11½	1.43	25.9
23	1.36	21.9
46	1.41	24.7
92	1.42	25.3

L.S.D. (Transformed means) 5% = 0.15

5. Grain Yield (lb. per acre)

Grain yield increased with increase in nitrogen supply and with the latter time of application.

Nitrogen (lb./acre)	Transformed Mean x log (x + 1)	Arithmetic Mean
Nil	1.36	22
11½	2.04	109
23	1.88	75
46	2.27	185
92	2.43	268

L.S.D. (Transformed means) 5% = 0.29

Time	Transformed Mean	Arithmetic Mean
	x log (x + 1)	
Sowing	1.90	78
Late	2.09	122

L.S.D. (Transformed means) 5% = 0.19

6. Crude Grain Protein %

There was no effect of time of application of nitrogen on protein content. Increased nitrogen supply increased grain protein %.

Nitrogen (lb./acre)	Mean
0	6.9
11½	6.6
23	6.9
46	7.5
92	8.6

L.S.D. (5%) = 0.67

DISCUSSION:

Grain yield analysis showed that the increase in yield with increase in rate of applied nitrogen was largely due to increase in the number of fertile tillers and grain weight. The yields obtained in the experiment were very low with an average of 4½ bushels/acre being obtained with the addition of 4 cwt. of sulphate of ammonia per acre.

Greater yields were obtained with the later time of nitrogen application. Increases in both the number of fertile tillers and mean grain number per fertile tiller contributed to the yield increase although these factors themselves did not show significant responses to time of application.

The above average rainfall for 1964, coupled with the sand over clay soil type caused nitrogen to be lost by leaching.

EXPERIMENT 4

RESPONSES OF GAMENYA WHEAT TO EARLY AND NORMAL CROP SPRAYS AT SEVERAL NITROGEN LEVELS ON SKELETON WEED LAND (W.E 34 Expt. 4)

LOCATION:

Parilla. Section 2 Hundred of Parilla. (C.H. Johnson)

Rainfall: Average: 13.7"
April-October, 1964 = 13.1"
Total for 1964 = 17.8"

Soil Type: Solodised solonetz.

DURATION:

4/6/64 - 13/1/65

DESIGN:

Randomised block factorial: 4 replicates
Nitrogen: 0, 23, 46 lb. N peracre as sulphate of ammonia.
Crop Spray: Nil

Early: 2 oz. a.e. amine 2,4-D/acre
16 oz. a.e. 2,4,-DB/acre
Normal: 1½ oz. a.e. picloram/acre
8 oz. a.e. amine 2,4-D/acre

Plot Size: 63" x 1 chain

Basal fertiliser 85 lb. superphosphate, 7 lb. copper sulphate and 7 lb. zinc sulphate per acre. Seeding rate 62 lb. per acre.

METHOD:

Soil nitrogen and nitrate samples were collected on 2/6/64.

The trial was sown on 4/6/64 with a Mitchell 9 hoe combine. Early crop spray was applied on 21/7/64 with a boom spray delivering 28.7 gallons/acre.

Normal crop spray was applied on 27/8/64 with same boom spray. (Picloram was applied as the potassium salt formulation).

Skeleton weed density on control plots was counted on 24/9/64.

A restricted soil sampling of three treatments for soil nitrogen and nitrate was made on 23/10/64.

The plots were hand harvested on 13/1/65 and the following measurements were taken: plant height, number of fertile heads, mean grain number per head, 1000 grain weight, yield and grain protein.

RESULTS:

(a) Soil Nitrogen

Total nitrogen content 0-3" = 0.023%
3-6" = 0.013%
Soil nitrate content 0-12" = 3.6 ppm.
12-24" = 1.3 ppm.

Soil nitrogen and nitrate samples were taken from three plots on 23/10/64 with the following spray treatments.

$1\frac{1}{2}$ oz. picloram/acre

8 oz. 2,4-D/acre

No spray

1. Soil nitrogen analysis showed no significant differences between the no spray or picloram plots; however, the 2,4-D sprayed plot had a higher total nitrogen content.

	Mean Soil N%
Picloram	0.11
2,4-D	0.14 L.S.D. 5% = 0.002
Nil	0.11

2. Soil nitrate was significantly higher on the picloram plot than the control.

	Mean Soil NO_3
Picloram	1.32
2,4-D	1.19
Nil	0.92

These data indicate one of the benefits of picloram crop spraying resulting from the complete suppression of skeleton weed.

(b) Skeleton Weed density

Mean density 5.4 rosettes/sq. link.

(c) Crop Spray effects on skeleton weed

Visual observations of skeleton weed density and vigour showed that picloram was the most outstanding treatment, causing complete suppression of skeleton weed during the post-tillering stages of crop growth.

Amine 2,4-D at 8 oz. a.e. per acre gave some suppression of skeleton weed, reducing its density and delaying the onset of full flowering.

The early crop spray treatments were applied before all skeleton weed rosettes had emerged following sowing and there was little or no visible effect apparent at harvest time. Rain following spraying was partly responsible.

(d) Crop Plant Height

Increase in nitrogen supply increased plant height and the picloram crop spray significantly reduced plant height.

Nitrogen (lb. per acre)	Mean Height (ins.)	
Nil	16.5	
23	20.4	L.S.D. 0.1% = 2.1
46	22.8	

Crop Spray	Mean Height (ins.)	
Nil	20.9	
2 oz. amine 2,4-D (early)	19.6	
16 oz. 2,4-DB (early)	20.1	L.S.D. 5% = 1.5
8 oz. amine 2,4-D		0.1% = 2.6
1½ oz. Picloram	17.9	

2. Fertile Tiller Number

Increased nitrogen supply and the picloram crop spray significantly increased the number of fertile tillers.

Nitrogen (lb. per acre)	Mean	
Nil	28.3	
23	34.2	L.S.D. 1% = 3.7
46	38.8	

Crop Spray	Mean	
Nil	31.5	
2 oz. 2,4-D (early)	32.4	
16 oz. 2,4-D (early)	31.7	L.S.D. 0.1% = 6.3
8 oz. 2,4-D	33.3	
1½ oz. Picloram	39.9	

3. Mean Grain Number per Fertile Tiller

Nitrogen (lb. per acre)	0	23	46	Mean
Crop Spray per acre				
Nil	11.4	16.7	19.5	15.9
2 oz. Amine 2,4-D (early)	7.6	12.2	21.6	13.8
16 oz. 2,4-DB (early)	9.4	13.3	20.0	14.2
8 oz. Amine 2,4-D	8.6	18.1	19.6	15.4
1½ oz. Picloram	6.3	7.6	7.6	7.2
Mean	8.7	13.6	17.7	

L.S.D. 5% (Nitrogen x Spray means) = 4.7
(Nitrogen means) = 2.1
(Spray means) = 2.7

A significant nitrogen x crop spray interaction was apparent in these data.

An increase in nitrogen supply increased the mean grain number per fertile tiller for all crop spray treatments except the picloram spray. Considerable grain abortion was induced with the 1½ oz. picloram/acre crop spray.

4. 1000 grain weight (gms.)

Increase in nitrogen supply increased 1000 grain weight and there were significant differences between crop spray treatments.

Nitrogen (lb. per acre)	Mean
0	27.4
23	30.5
46	31.6

L.S.D. 5% = 1.1

Crop spray (per acre)	Mean
Nil	29.0
2 oz. Amine 2,4-D (early)	28.3
16 oz. 2,4-DB (early)	28.5
8 oz. Amine 2,4-D	29.0
1½ oz. Picloram	34.3

L.S.D. 5% = 1.5

5. Grain Yield (lb. per acre)

The picloram crop spray considerably reduced grain yield however there was no significant effect of the other crop spray treatments on grain yield. Increase in nitrogen supply increased yield slightly.

Nitrogen (lb./acre)	Mean Yield (lb./acre)
0	202
23	407
46	546
L.S.D. 5% = 65	

Crop Spray (per acre)	Mean Yield (lb./acre)
Nil	418
1 oz. Amine 2,4-D (early)	410
16 oz. 2,4-DB (early)	385
8 oz. Amine 2,4-D	456
1½ oz. Picloram	257
L.S.D. 5% = 84	

6. Grain Protein

An increase in nitrogen supply increased grain protein content. There were small effects due to the 2,4-D and 2,4-DB crop sprays while the picloram spray greatly increased grain protein.

Nitrogen (lb./acre)	Mean Crude Protein %
0	7.71
23	7.76
46	8.02
L.S.D. 5% = 0.25	

Spray	Mean Crude Protein %
Nil	6.51
2 oz. Amine 2,4-D (early)	6.63
16 oz. 2,4-DB (early)	7.07
8 oz. Amine 2,4-D	6.93
1½ oz. Picloram	11.99
L.S.D. 5% = 0.32	

The large effect of picloram on grain protein was probably due to a concentration effect resulting from the reduction in wheat yield where picloram was applied.

CONCLUSION:

The results indicate that on this very fertile site, if skeleton weed competition is removed, wheat plants are still under stress due to the low level of supply of nutrients essential for growth.

Picloram requires examination at rates less than 1½ oz. a.e. per acre, as crop damage occurred at this rate.

EXPERIMENT 5

RESPONSES OF NOYEP BARLEY TO NITROGEN AND 2,4-D CROP SPRAY ON SKELETON WEED LAND (W.E 34 Expt. 5)

LOCATION:

Parilla. Section 2. Hundred of Parilla (C.H. Johnson)

Rainfall: average 13.7" for 1964 17.8"
April-October, 1964 =13.1"

Soil Type: Solodised Solonetz

DURATION:

3/6/64 - 1/12/64

DESIGN:

Randomised Block Factorial: 4 replicates
Nitrogen: 0, 11½, 23, 46 lb. per acre as ammonium sulphate.
Crop Spray: nil, 12 oz. a.e. Amine 2,4-D per acre.
Plot Size: 63" x 1 chain

Basal fertiliser 85 lb. superphosphate, 7 lb. copper sulphate, 7 lb. zinc sulphate per acre. Seeding rate 53 lb. per acre.

METHOD:

The trial was sown with a Mitchell 9 hoe combine on 3/6/64. The 2,4-D crop spray was applied on 27/8/64 with a boom spray delivering 28 gallons per acre. Soil samples for total N and nitrate were collected on 2/6/64. Control plot skeleton weed density was assessed on 24/9/64.

Plots were harvested on 1/12/64 with a tractor mounted stripper, yield and grain protein were determined.

RESULTS:

(a) Soil Nitrogen

Total nitrogen content	0-3"	= 0.022%
	3-6"	= 0.010%
Soil nitrate content	0-12"	= 4.1 ppm.
	12-24"	= 1.4 ppm.

(b) Skeleton Weed Density

Mean density for site 5.4 rosettes sq. link.

(c) Grain Yield

Harvested yields were extremely low in this experiment. Increase in nitrogen supply increased yield; however there was no effect of crop spray.

Nitrogen (lb./acre)	Mean Grain Yields (lb./acre)
0	70
11½	220 L.S.D. 5% = 132
23	243
46	404

(d) Crude Protein Percent

Application of 2,4-D crop spray significantly increased crude protein content of the barley, and there was an increase at the highest nitrogen application rate.

Crop Spray	Mean Grain Protein %
Nil	5.76
2,4-D	6.73 L.S.D. 0.1% = 0.57

Nitrogen (lb./acre)	Mean Grain Protein %
0	6.33
11½	5.95 L.S.D. 5% = 0.44
23	5.88
46	6.83

CONCLUSION

The small yield response to applied nitrogen indicates that leaching may be extremely rapid on the coarse sandy soil and/or that other deficiencies are limiting crop growth.

EXPERIMENT 6

RESPONSES OF HERON WHEAT TO TIMES AND RATES OF PICLORAN SPRAYS AND NITROGEN FERTILISER

LOCATION:

Taplan. Section Hundred of Bookpurnong (F.G. Zimmermann)

Rainfall: Mean = 10.1" 1965 = 8.7"
April-October, 1965 = 7.3"

Soil Type: Red mallee sand

DURATION:

23/2/65 - 23/12/65

DESIGN:

Randomised Block with 18 treatments and 4 replicates.
List of treatments (same for Experiment 7)

	Time of Application	Rate of Picloram (oz. per acre)	Nitrogen (lb. per acre)
1	-	-	0
2	-	-	23
3	-	-	46
4	February	½	0
5	February	1	0
6	February	1	23
7	February	1	46
8	February	1¾	0
9	3 - leaf stage	¼	0
10	3 - leaf stage	½	0
11	3 - leaf stage	½	23
12	3 - leaf stage	½	46
13	3 - leaf stage	1	0
14	Fully tillered	¼	0
15	Fully tillered	½	0
16	Fully tillered	½	23
17	Fully tillered	½	46
18	Fully tillered	1	0

Nitrogen: was applied as ammonium sulphate at sowing

Basal Fetilizer: 1 cwt. superphosphate per acre

Seeding Rate: 65 lb. per acre

Plot Size: 9 rows x 66 feet.

METHOD:

The February spray treatments were applied on 23/2/65 to skeleton weed in the late flowering stage, with the landrover sprayer delivering 60 gallons per acre. The trial area was worked up by the farmer and sown with a Mitchell 9 hoe drill on 29/6/65.

The second spray treatments were applied on 4/8/65 to the crop in the 2-3 leaf stage and the final spray treatments were applied to the fully tillered crop on 9/9/65 with the landrover sprayer delivering 86 gallons per acre.

Soil samples for nitrogen and nitrate determinations were collected on 20/5/65.

Skeleton weed density counts were made on 9/9/65, 21/10/65 and 7/12/65 on all plots.

Wheat plants were hand harvested (six samples per plot each 1 row x 6 feet) on 8/12/65 and the following measurements were made: plant height, number of fertile tillers, mean grain number per head, 1000 grain weight, yield of grain.

The plots were stripper harvested on 23/12/65 and samples taken for grain protein analysis.

RESULTS:

(a) Soil Nitrogen (means of 8 samples)

Total nitrogen content	0-3"	= 0.020%
	3-6"	= 0.018%
Soil nitrate content	0-12"	= 1.5 ppm.
	12-24"	= 1.2 ppm.

These determinations indicate an extremely low level of soil nitrogen occurring in the soil prior to sowing.

(b) Mean Skeleton Weed Density (rosettes per 10 sq. links)

Date of Assessment	9/9/65	21/10/65	7/12/65
1	97.5	66.6	63.8
2	85.9	57.2	32.2
3	71.9	59.7	34.7
4	3.8	20.7	16.6
5	0.6	1.6	10.9
6	0.3	1.6	6.3
7	0.0	1.3	5.3
8	0.0	0.0	3.1
9	38.1	39.7	27.8
10	44.7	21.9	13.4
11	35.9	16.9	9.7
12	24.6	13.1	9.7
13	23.4	3.8	1.3
14	112.8	89.4	39.7
15	102.5	70.9	18.7
16	84.7	25.0	17.2
17	94.4	25.3	14.4
18	104.4	36.9	18.7

There were large treatment effects on the skeleton weed population during the crop growth which resulted in a variety of competition relationships between the crop and the weed. The February applied picloram reduced the amount of skeleton weed in the crop to a very low level. The sprays applied at the 3 leaf stage gave greater relief to the crop from competition than the fully tillered sprays.

The February spray treatments however encouraged the establishment of annual grasses, particularly Bromus rigidus and these weeds competed with the crop.

(c) Crop height

The following table summarises the results obtained:

Picloram Spray Treatment		Nitrogen Rate lb./acre 0	23	46
Control - not sprayed		7	13	16
Feb.	½ oz.	10	-	-
	1 oz.	9	16	17
	1¾ oz.	9	-	-
3 leaf	¼ oz.	8	-	-
	½ oz.	8	13	14
	1 oz.	7	-	-
F.T.	¼ oz.	7	-	-
	½ oz	7	11	14
	1 oz.	7	-	-

L.S.D.'s. 5% = 2
1% = 3
0.1% = 4

Significant increases in crop height were obtained with the use of nitrogen fertilizer at sowing.

At the high levels, plant height was depressed by the use of sprays at the 3 leaf and fully tillered stages.

Plants on the plots which received ½ and 1 oz. of picloram in February were significantly taller than the controls except at the 46 lb. nitrogen level. These plants were also taller than those sprayed at the 3 leaf or fully tillered stages.

(d) Number of heads per sample
(sample = 1 row x 6 feet)

There were no significant differences between treatments.

(e) 1000 grain weight

(f) Grain yield (hand harvested)

(g) Grain number per head

With low yields and high variability within plots it was decided not to analyse these results.

Figures for grain yield and grain number per head are unlikely to be of value because the plots were damaged by birds prior to harvesting.

(h) Stripper harvested yield

Yield figures (lbs./acre) were transformed to $\log_{10}(x + 1)$. The treatment means are given in the following table.

Picloram Spray Treatment		Nitrogen rate lbs. / acre 0	23	46
Control - not sprayed		1.22	2.88	2.31
Feb.	½ oz.	1.54	-	-
	1	1.59	2.48	2.54
	1¾	1.39	-	-
3 leaf	¼	1.50	-	-
	½	1.22	2.20	2.47
	1	1.11	-	-
F.T.	¼	1.29	-	-
	½	1.32	1.89	2.32
	1	1.22	-	-

L.S.D. 5% = 0.35 1% = 0.47 0.1% = 0.62

Application of fertiliser nitrogen at 1 cwt./acre gave significant increases in grain yield. The increases in yield from 23 lb. N/acre to 46 lb. N/acre were not significant.

Application of 1 oz. a.e. picloram in February prior to working up for the crop appears to increase the yield of grain where no nitrogen was applied.

(i) Grain protein

The crude protein percentages on a 13.5% moisture basis are given as treatment means in the following table.

Grain Protein %

Picloram Spray Treatment		Nitrogen Rate lb./acre 0	23	46
Control - not sprayed		7.63	7.64	8.57
	½ oz.	7.87	-	-
Feb.	1	7.75	7.37	9.67
	1¾	7.67	-	-
	¼ oz.	7.47	-	-
3 leaf	½	8.51	7.48	8.95
	1	8.46	-	-
	¼	8.27	-	-
F.T.	½	8.27	7.79	8.36
	1	7.41	-	-

L.S.D. 5% = 0.34 0.1% = 1.40

There appears to be an increase in grain protein at the maximum nitrogen applications. The most notable increase can be seen on the February picloram plots receiving 46 lb. N/acre. Grain protein was influenced by the yield. Reduction in grain yield due to some treatment effect can result in increase in grain protein.

DISCUSSION:

The interpretation of the above results must be made with caution for the following reasons:

1. The crop yield was very low throughout the trial, especially on the control plots which yielded approximately 20 lb. of grain per acre. The best treatment yielded approximately 6 bushels per acre (Treatment 7).

2. The soil type was of very low fertility, and nitrate utilization appears to be very inefficient, due to low rainfall.

3. The trial was not a standard factorial design.

4. These results apply to only one year and one site.

This experiment was continued for another 12 months in order to assess the residual effect of the picloram sprays on legume pasture establishment. A report on this aspect is given in Project 3, Expt. 9.

The spray unit used in this experiment delivered about six times that used normally on farms, and results require verification with a LO-VOL unit.

EXPERIMENT 7

RESPONSES OF GAMENYA WHEAT TO TIMES AND RATES OF PICLORAM SPRAYS AND NITROGEN FERTILISER (W.E. 34 Expt. 7)

LOCATION:

Parilla. Section 7 Hundred of Parilla (C.H. Johnson)

Rainfall: mean = 13.8" 1965 = 11.7"
April-October 1965 = 8.7"

Soil Type: Solodised solonetz

DURATION:

25/2/65 - 21/12/65

DESIGN:

Randomised Block with 18 treatments and 4 replicates
List of treatments: identical with experiment 6
Nitrogen: applied as ammonium sulphate at sowing.
Basal Fertilizer: 1 cwt. superphosphate per acre.
Seeding Rate: 65 lb. per acre.
Plot Size: 9 rows x 70 feet.

METHOD:

The February spray treatments were applied on 25/2/65 to skeleton weed in the late flowering stage, with the Landrover sprayer delivering 60 gallons per acre. The trial area was worked up by the farmer and sown with a Mitchell 9 hoe drill on 17/6/65.

The 3 leaf crop spray was applied on 4/8/65 and the fully tillered crop spray was applied on 8/9/65 with the landrover sprayer delivering 86 gallons per acre.

Soil samples for nitrogen and anitrate determination were collected on 26/5/65.

Skeleton weed density counts were made on 8/9/65 and 30/11/65 on all plots.

Wheat plants were hand harvested (six samples per plot each 1 row x 6 feet) on 1/12/65 and the following measurements were made: plant height, number of fertile heads, mean grain number per head, 1000 grain weight and yield of grain.

The plots were stripper harvested on 21/12/65 and yield was measured and samples taken for grain protein analysis.

RESULTS:

(a) Soil nitrogen (means of 8 samples)

Total nitrogen content	0-3"	= 0.049%
	3-6"	= 0.027%
Soil nitrate content	0-12"	=11.5 ppm.
	12-24"	= 3.1 ppm.

These determinations indicate a considerable variation with depth. Although total nitrogen is comparatively low (c.f. 0.10% for a Red Brown Earth) the nitrate content is high - especially in the upper 12".

(b) Mean Skeleton Weed Density (rosettes per 10 sq. links)

	Skeleton Weed Density		
Date of Assessment / Treatment	8/9/65	27/10/65	30/11/65
1	97.8	80.6	95.9
2	109.1	93.4	102.5
3	134.7	81.3	80.9
4	34.4	39.1	50.3
5	19.7	19.4	17.2
6	6.3	14.1	20.9
7	5.6	9.7	19.1
8	6.6	8.4	2.8
9	65.9	64.4	61.3
10	63.1	40.3	49.1
11	92.5	47.8	58.4
12	70.6	56.3	56.9
13	26.9	15.9	18.8
14	101.3	66.9	52.8
15	82.5	31.9	29.4
16	119.4	11.6	18.4
17	98.4	18.8	20.6
18	98.8	24.1	22.5

The skeleton weed densities obtained were higher for this experiment than for Experiment 6 and the control obtained was not as effective. It is inferred that there are ecological variations which are the main reasons for these observed differences.

The February applied treatments greatly reduced the skeleton weed density during crop growth and the 3 leaf applied and the fully tillered applied treatments reduced skeleton weed competition considerably following spraying.

(c) Crop height

The treatments caused significant variation in crop height. Treatment means are given in the following tables:

Crop Height (inches)

Picloram Spray Treatment		Nitrogen rate lbs./acre 0	23	46
Control - unsprayed		15	18	18
	½ oz.	16	-	-
Feb.	1	16	21	20
	1¾	17	-	-
	¼	14	-	-
3 leaf	½	15	17	18
	1	15	-	-
	¼	13	-	-
F.T.	½	15	18	17
	1	14	-	-

L.S.D. 5% = 2 1% = 3 0.1% = 4

Addition of nitrogen as $(NH_4)_2SO_4$ at sowing resulted in a significant increase in plant height. There were no differences between the 23 lb. and 46 lb. N per acre rates.

Greater plant heights were recorded on February picloram plots where nitrogen had been applied.

(d) Number of heads per sample

Sample = 1 row x 6 feet

There were no significant differences between the treatments where no nitrogen had been applied. However, a reduction in heads/sample accompanied higher nitrogen levels. The spray applications caused no differences except at the highest N level - the February 1 oz. treatment produced more heads than the other sprayed plots.

The treatment means were recorded in the following table:

Number of heads per sample

Picloram Spray Treatment		Nitrogen lbs./acre		
Time	Rate/acre	0	23	46
Control - not sprayed		51	43	36
	½ oz.	53	-	-
Feb.	1	50	45	47
	1¾	52	-	-
	1¼	49	-	-
3 leaf	½	49	44	41
	1	49	-	-
	¼	49	-	-
F.T.	½	47	44	34
	1	49	-	-

L.S.D. 5% = 7 1% = 10 0.1% = 13

(e) 1000 grain weight

Significant treatment differences were observed.

1000 grain weight (treatment in gms.)

Picloram Spray Treatment		Nitrogen rate lbs./acre		
Time	Rate/acre			
Control - not sprayed		25.1	26.6	26.7
	½ oz.	27.0	-	-
Feb.	1	27.6	30.1	28.6
	1¾	27.9	-	-
	¼	25.3	-	-
3 leaf	½	25.7	26.7	28.7
	1	28.5	-	-
	¼	26.6	-	-
F.T.	½	28.1	30.2	28.1
	1	28.5	-	-

L.S.D. 5% = 2.2 1% = 2.9 0.1% = 3.9

The results suggest an insignificant response to applied nitrogen on the unsprayed control plots, and an increase when picloram has been applied at rates of ½ - 1 oz. per acre at any of the three times.

(f) Grain number per head

An analysis of variance was carried out revealing highly significant treatment differences.

In most cases, grain number per head has responded to nitrogen application at sowing. However, the increased response from 23-46 lbs. N/acre was not significant.

Picloram application at the fully tillered stage to plots receiving no additional nitrogen has caused apparent depression in grain number per head. The February 1 oz. picloram plots which received added nitrogen yielded the most grains per head.

The treatment means are tabulated as follows:

Grain number per head

Picloram Spray Treatment		Nitrogen rate lbs./acre		
Time - Rate/acre		0	23	46
Control - unsprayed		13.1	15.4	20.6
	½ oz.	11.1	-	-
Feb.	1	10.5	19.1	21.8
	1¾	12.7	-	-
	¼	9.6	-	-
3 leaf	½	10.8	13.9	15.8
	1	10.6	-	-
	¼	8.0	-	-
F.T.	½	8.9	16.4	16.4
	1	8.5	-	-
L.S.D. 5% = 3.5		1% = 4.7		0.1% = 6.1

(g) Hand Harvested Yield

The results obtained are given in the following table:

Picloram Spray Treatment		Nitrogen rate lbs./acre		
		0	23	46
Control - unsprayed		340	501	741
	½ oz.	428	-	-
Feb.	1	390	775	735
	1¾	491	-	-
	¼	373	-	-
3 leaf	½	381	515	511
	1	451	-	-
	¼	356	-	-
F.T.	½	357	536	450
	1	351	-	-
L.S.D. 5% = 187		1% = 250		0.1% = 326

There were no significant differences between the spray treatments on the No plots.

On the N_{23} plots, the No. Feb. picloram treatment yielded significantly more than the control and the No. Felo. picloram treatment.

On the N_{46} plots, yield was depressed by spraying at the 3 Leaf and Fully Tillered crop stages with $\frac{1}{2}$ oz. of picloram per acre.

(h) Stripper Harvested Yield (bushels/acre)

There were statistically significant treatment differences. The highest yields were obtained from the February 1 oz. picloram plots, where there was no yield response to applied nitrogen above 1 cwt. $(NH_4)_2SO_4$. (As above) Application of picloram to the crop resulted in no differences compared with the control. In most cases, there was a response to 1 cwt. of $(NH_4)_2SO_4$.

The treatment means are given in the following table:

Stripper Harvested Yield (bu./acre)

Picloran Spray Treatment		Nitrogen rate lbs./acre		
Time	Rate/acre	0	23	46
Control - unsprayed		3.6	5.6	5.6
Feb.	$\frac{1}{2}$ oz.	4.8	-	-
	1	5.5	9.9	9.9
	$1\frac{3}{4}$	5.4	-	-
3 Leaf	$\frac{1}{4}$	3.6	-	-
	$\frac{1}{2}$	4.3	5.7	6.8
	1	5.0	-	-
Fully Tillered	$\frac{1}{4}$	3.0	-	-
	$\frac{1}{2}$	3.1	6.7	5.7
	1	3.4	-	-

L.S.D. 5% = 1.7 0.1% = 2.9

(i) Grain Protein Analysis

Crude protein was determined on a 13.5% moisture basis. Significant responses to applied nitrogen and spray treatments were observed. Treatment means are given in the following table.

Grain Protein %

Picloram Spray Treatment		Nitrogen rate lb./acre		
Time	Rate/acre	0	23	46
Control - not sprayed		8.33	8.95	10.74
Feb.	½ oz.	8.42	-	-
	1	8.35	8.96	11.42
	1¾	8.58	-	-
3 Leaf	¼	8.17	-	-
	½	8.59	8.98	11.42
	1	8.95	-	-
Fully Tillered	¼	8.14	-	-
	½	8.67	8.55	10.28
	1	9.05	-	-

L.S.D. 5% = 0.145 1% = 0.80

Grain protein was greatest on plots receiving high rates of ammonium sulphate and picloram - either in February (1 oz.) or at the 3 leaf stage (½ oz.).

DISCUSSION:

Competition between a perennial plant and an annual cereal is very complex and environmental factors such as April-October rainfall, soil type, skeleton weed density and applied nitrogen overlap in their effects on the cereal plants.

Superficially it can be seen that the number of grains per head appears to respond more markedly to applied nitrogen, whereas picloram, applied in February seems to increase the number of fertile heads. It is possible that these treatments can influence crop yield in different ways. The apparent depression in the number of heads per sample by increased rates of nitrogen is unexplained.

The residual effects of the 1965 treatments on legume pasture establishment was assessed on this site in 1966. This is discussed in Project 3, Experiment 10.

EXPERIMENT 8

RESPONSES OF HERON WHEAT TO TIMES AND RATES OF NITROGEN APPLICATION ON SKELETON WEED LAND (W.E. 34 Expt. 8)

LOCATION:

Taplan. Section Hundred of Bookpurnong (F.G. Zimmermann)

Rainfall: mean 10.1" 1965 = 8.7"
April-October 1965 = 7.3"

Soil Type:

DURATION:

28/6/65 - 8/12/65

DESIGN:

Randomised block factorial with 10 treatments and 4 replicates
Nitrogen Rate: (lb. per acre) nil, 11½, 23, 46, 92. as ammonium sulphate and urea.
Time of Application: sowing and post sowing. Nitrogen at sowing was applied as ammonium sulphate and nitrogen at the post sowing treatment was given as a urea (low biuret content) spray delivered by the landrover sprayer in 86 gallons per acre.
Basal fertilizer: 1 cwt. superphosphate per acre.
Seeding Rate: 65 lb. per acre (Heron Wheat)
Plot Size: 9 rows x 66 feet

METHOD:

The trial was sown with a Mitchell 9 hoe combine on 28/6/65. The post seeding nitrogen application was made on 4/8/65.

Soil samples for total N and nitrate were collected on 20/5/65.

Skeleton weed density counts were taken on 9/9/65 in the area of this trial (Experiment 6). The plots were hand harvested (six samples per plot each 1 row x 6 feet) on 8/12/65 on the following measurements taken: Plant height, number of heads, mean grain, number per head, 1000 grain weight, yield of grain, grain protein.

RESULTS:

(a) Soil nitrogen (means of 8 samples)

Total nitrogen content	0-3"	= 0.021%
	3-6"	= 0.016%
Soil nitrate content	0-12"	= 1.25 ppm.
	12-24"	= 1.13 ppm.

These data indicate the extremely low nitrogen status of this soil type.

(b) Skeleton weed density

Counts taken from an adjacent trial (Experiment 6) indicate a mean density of 9.8 rosettes per sq. link on the control plots.

(c) Crop height at harvest

Both nitrogen rate and time of application resulted in significant differences.

1. Time of Application

	Mean Height (ins.)
At sowing: ammonium sulphate	13.2
Late: Urea	11.3

L.S.D. 0.1% = 1.0

2. Nitrogen rate

	Mean Height (ins.)
No	7.8
$N\frac{1}{2}$	12.1
N1	13.0
N2	14.1
N4	14.2

L.S.D. 5% = 0.9 1% = 1.2 0.1% = 1.6

3. Time x Rate Means

	Mean Height (ins.)	
	Sowing	Late
No	7.6	7.9
$N\frac{1}{2}$	13.6	10.5
N1	13.9	12.2
N2	15.2	13.1
N4	15.5	13.0

L.S.D. 5% = 1.3 1% = 1.7 0.1% = 2.3

Application of ammonium sulphate at sowing resulted in increase in plant height. (See time x rate table). The response was statistically significant between No - N½ and N1 - N2 treatments.

Urea produced a smaller response in plant height when applied approximately 6 weeks after sowing.

It is not possible to separate the effects of time of application from the effects of nature of the fertilizer - i.e. these are confounded.

The late application (of urea) resulted in lower crop height than the ammonium sulphate at sowing.

(d) Number of fertile heads per sample

Significant results were borne out by statistical treatment of results. The estimated S.E. per sample was high (= 11.82 or 34%). Although the late application as urea resulted in more heads per sample the difference was barely significant at the 5% level. The rate of nitrogen applied had no real influence on heads per sample.

(e) 1,000 grain weight (gms.)

Nitrogen	Means
No	24.7
N½	31.4
N1	34.2
N2	34.1
N4	29.1

L.S.D. .05 = 4.0 .01 = 5.4 .001 = 7.1

(f) Hand harvested yield (lbs./acre)

Nitrogen	Means	Time	Means
No	51	Sowing	255
N½	183	Late	206
N1	247		
N2	290		
N4	381		

L.S.D. .05 = 56 .01 = 76 .001 = 101 L.S.D. .01 = 48 .001 = 64

(g) Grain Number per head

Nitrogen	Means	Time	Means
No	2.5	Sowing	9.1
$N\frac{1}{2}$	6.9	Late	6.8
N1	8.0		
N2	9.8		
N4	12.7		

L.S.D. .05 = 1.9 .01 = 2.6 L.S.D. .001 = 2.2
.001 = 3.5

DISCUSSION:

Results obtained on this site in 1965 showed worthwhile yield responses to nitrogen. Responses were observed up to the highest N rate, but the greatest yield response per unit of N applied was measured for the $N\frac{1}{2}$ treatment.

More benefit was obtained from sulphate of ammonia at sowing than from urea applied to the emerged crop as a spray.

Grain number per head responded markedly to the $N\frac{1}{2}$ treatment, as did 1000 grain weight.

Results from this experiment need to be studied in relation to the adjacent herbicide x nitrogen experiment (Expt. 6). The responses to 11.5 and 23 lbs. of nitrogen reflect the very low soil nitrogen status of skeleton weed infested soil at Taplan. The April-October rainfall of 7.3 inches was also an important factor in obtaining these responses.

EXPERIMENT 9

RESPONSES OF GAMENYA WHEAT TO TIME AND RATE OF NITROGEN APPLICATION ON SKELETON WEED LAND.

LOCATION:

Parilla. Section Hundred of Parilla

Rainfall: mean = 13.8" 1965 = 11.7"
April-October 1965 = 8.7"

Soil Type: Sododised solonetz

DURATION:

17/6/65 - 1/12/65

DESIGN:

Randomised block factorial with 10 treatments and 4 replicates.
Nitrogen rates (lb. per acre) nil, 11½, 23, 46, 92 applied as sulphate of ammonia and urea.
Time of Application: sowing and post sowing Nitrogen at sowing was applied as sulphate of ammonia and the second treatment was sprayed as urea with the landrover sprayer delivering 86 gallons per acre.
Basal fertilizer: 1 cwt. superphosphate per acre.
Seeding Rate: 65 lb. per acre (Gamenya wheat)
Plot Size: 9 rows x 70 feet.

METHOD:

The trial was sown with a Mitchell 9 hoe combine on 17/6/65. The post seeding nitrogen application was applied on 5/8/65.

Soil samples for total N and nitrate were taken on 26/5/65.

Skeleton weed density counts were taken on 8/9/65 in the area of this trial (on Experiment 7). The plots were hand harvested (six samples per plot, each 1 row x 6 feet) on 1/12/65 and the following measurements were made: plant height, number of heads, mean grain number per head, 1000 grain weight, yield of grain, grain protein.

RESULTS:

(a) Soil nitrogen (means of 8 samples)

Total nitrogen content 0-3" = 0.044%
3-6" = 0.018%

Soil nitrate content 0-12" = 6.8 ppm.
12-24" = 1.9 ppm.

There were profile differences in both total nitrogen and nitrate contents.

(b) Skeleton Weed Density (8/9/65)

Counts made on an adjacent trial (experiment 7) showed that the density of rosettes was 9.8 per square link.

(c) Plant height

Significant differences were obtained due to nitrogen rate and block effects.

Variation within plots was high C.V. 26%.

Summary of Results: Mean Height (ins.)

1. Nitrogen rate

	Mean
No	6.9
N½	8.7
N1	10.4
N2	10.9
N4	10.9
L.S.D. 5% =	1.4
1% =	1.9

2. Time of Application

At sowing:	9.1
Late:	10.0
L.S.D. 5% =	0.9
1% =	1.2

(d) Number of fertile heads per sample

Significant treatment differences were obtained.
C.V. = 11%

1. Time of Application

	Means	
At sowing as sulphate of ammonia	1.29	L.S.D. 0.1% = 0.08
Late (as urea)	1.62	

2. Nitrogen Rate

	Means	
No	1.50	
N½	1.45	L.S.D.
N1	1.55	5% = 0.07
N2	1.41	1% = 0.09
N4	1.37	0.1% = 0.13

3. Time of Application x Nitrogen

	Means		
	Sowing	Late	
No	1.50	1.50	
N½	1.32	1.58	L.S.D.
N1	1.44	1.66	5% = 0.10
N2	1.14	1.67	1% = 0.13
N4	1.05	1.68	0.1% = 0.8

The above data indicate that plant height was influenced more by nitrogen rate rather than time (or form) of nitrogen fertilizer application.

The number of heads per sample was increased by the late nitrogen application as urea, when compared with the mean for ammonium sulphate.

Study of the interaction (table 3, above) indicates depression in number of fertile heads with ammonium sulphate and an increase when urea is applied. This difference in behaviour was highly significant.

(e) 1,000 grain weight (gms.). There were no significant differences.

(f) Hand harvested yield (lbs./acre)

Nitrogen	Means	Time	Means
No	41	Sowing	123
N½	139	Late	209
N1	224		
N2	215		
N4	211	L.S.D. .001 = 83	

L.S.D. .05 = 73
.01 = 98
.001 = 131

(g) Grain number per head

Nitrogen	Means
No	2.4
N½	5.2
N1	7.2
N2	9.0 L.S.D. .05 = 1.9
N4	9.9

The time of nitrogen application did not affect grain number.

DISCUSSION:

These results show differences compared with nitrogen responses obtained on the Loxton site. In fact the behaviour was the reverse on these two sites. On the solodised solonetz soil type there appears to be toxicity due to ammonium sulphate applied at sowing.

EXPERIMENT 10

COMPARISON OF SEVERAL PICLORAM HERBICIDES AND AMINE 2,4-D FOR CONTROL OF SKELETON WEED IN A BARLEY CROP (W.E 34 EXPT. 10)

LOCATION:

Parilla. Section 7 Hundred of Parilla. (C.H. Johnson)

Rainfall: Mean = 13.8" 1966 = 10.98"
April-October, 1966 = 7.06"

Soil Type: Solodised solonetz

DURATION:

June, 1966 - December, 1966

AIM:

To compare different formulations of herbicides containing picloram, 2,4-D, dicamba and M.C.P.A. with the standard recommendation for skeleton weed in a cereal crop (12 oz. a.e. 2,4-D amine per acre). The sprays to be applied when the crop has tillered, but before jointing.

DESIGN:

Randomised incomplete block: 15 herbicide treatments and one control per replication. Two replications.
Picloram rates: 0, 2, 0.4, 0.6 ozs. acid equivalent per acre.
2,4-D amine rates: 8 ozs. and 12 ozs. acid equivalent per acre.
Plot Size: 10 feet x 66 feet.

METHOD:

The paddock was sown to Prior barley by the farmer at the end of June 1966. The paddock was variable in soil type and skeleton weed was thick on the sandy rises where the trial site was chosen.

The herbicide treatments were applied on 6/9/66 under ideal conditions using a 10' boomspray delivering 12 gallons of spray per acre.

The crop was approximately two months old at the time of spraying. Conditions had been unusually dry during this period and this undoubtedly had retarded the development of the crop. This retardation was particularly noticeable where the skeleton weed was present.

The barley plants were varied in their stage of development and height. Most had 5 leaves and one or two weak tillers.

To obtain accurate counts on skeleton weed rosettes before and after spraying, fixed wire quadrats, 2 sq. links in area and 5 per plot, were laid down. Counts were taken on 6/9/66 and 25/11/66.

The plots were stripper harvested on 22/12/66 using a "Poynter" harvester. Five rows of the crop were taken; two samples were harvested per plot.

Treatment No.	Product	Rate Per Acre of product (pints)	Rates of Active Constituents in oz.			
			Picloram	2,4-D	Dicamba	MCPA
1.	Tordon 50-D	0.2	0.2	0.8	-	-
2.		0.4	0.4	1.6		
3.		0.6	0.6	2.4		
4.	Tordon	1.4	0.36	5.7	-	-
5.	herbicide	2.9	0.72	11.4		
6.	M2878	4.3	1.08	17.1		
7.	Tordon M	0.9	0.23	-	-	3.7
8.		1.8	0.46	-	-	7.4
9.		2.7	0.69	-	-	11.1
10.	I.C.I.	1.0	0.2	3.0	0.4	-
11.	Mixture A	2.0	0.4	6.0	0.8	
12.	I.C.I.	1.0	0.2	-	0.4	3.0
13.	Mixture B	2.0	0.4		0.8	6.0
14.	"Amoxone" 50	0.8	-	8	-	-
15.		1.2		12		
16.	Control					

Originally it was indended to have picloram rates 0.2, 0.4, and 0.6 oz. per acre. There was some misunderstanding of the percentage of each constituent at the time of spraying, resulting in different actual picloram rates applied.

RESULTS:

(a) Percentage regrowth of Skeleton Weed Rosettes on 25/11/66

No.	Treatment	Picloram rate ozs. a.e./acre	Mean % Regrowth for each treatment	
			REP. I	REP II
1.	Tordon 50-D	0.2 ozs.	93.2	83.2
2.	"	0.4	0	28.8
3.	"	0.6	10.0	0
4.	Tordon M2878	0.36	8.8	4.8
5.	"	0.72	0	3.4
6.	"	1.08	4.0	23.6
7.	Tordon M	0.23	23.6	37.0
8.	"	0.46	0	1.2
9.	"	0.69	2.4	5.8
10.	I.C.I.	0.2	38.6	62.6
11.	Mixture 'A'	0.4	0	3.4
12.	I.C.I.	0.2	22.2	50.8
13.	Mixture 'B'	0.4	5.0	0
14.	2,4-D	8.0	30.0	79.0
15.	Amine	12.0	5.0	43.0
16.	Control	-	108.6	102.0

All spray treatments reduced the regrowth of skeleton weed at the above rates. There was considerable variation between quadrat counts within each treatment. Only an approximate indication of the effects can be obtained because of variability within the site.

(b) Stripper harvested grain yield

Although the plots were harvested, yields were extremely low due to the presence of skeleton weed and poor rainfall during the 1966 growing season.

The highest yield obtained was 158 lbs. per acre from a plot which received 0.2 oz. of picloram per acre as Tordon 50-D.

The control plot in Rep. II yielded 156 lbs. of grain per acre whereas in Rep. I, a control yield figure of 14 lbs. of grain per acre was obtained.

DISCUSSION:

The results of this trial indicate the extreme variability in skeleton weed density and crop yield between replicates and between plots. Even when fixed quadrats were used, there was considerable variation within plots.

In future trials with herbicides on skeleton weed, more replications and control plots will be essential. Plots need to be much smaller to cut down the area and overall variability within the experiment.

The use of picloram sprays in fully tillered crops has not been shown to be worthwhile on these poor soil types. Work may be continued with these formulations on good cropping sites to estimate their effect on the crop.

EXPERIMENTS 11, 12 AND 13

CEREAL RESPONSES TO PRE-CROP PICLORAN AND NITROGEN FERTILIZERS AT SOWING ON SKELETON WEED LAND

AIM:

To assess the value of picloram as a pre-crop spray to suppress skeleton weed in the crop at two levels of nitrogen fertilizer.

To note any changes in cereal yield characteristics and grain quality.

DESIGN:

(a) Statistical

2 picloram formulations x 3 rates x 2 nitrogen rates. Replicated 4 times - 48 plots.

(b) Treatments

Tordon 50-D and Tordon 22K, at 0.1 and 2 ozs. picloram a.e. per acre.

24 plots to receive sulphate of ammonia at sowing (rate approx. ½ cwt.).

(c) Plot Size 63" x 66' Expts. 11 and 12
63" x 30' Expts. 13

(d) Assessments

1. Initial skeleton weed density March 1961.
2. Final skeleton weed density Nov. 1961.
3. Crop yield-quadrats hand harvested.
4. Crop yield-stripper harvested.
5. Grain protein and baking quality.
6. Residual effects of the treatments on stubble sown legumes (see project 3)

EXPERIMENT 11

LOCATION:

D.G. Dutschke Section 44 Hundred of Marmon-Jabuk

SOIL TYPE:

Solodised solonetz. Sandy clay layer at 20" approx.

RAINFALL:

30 year mean = 13.43"
May-October 1967 = 5.42"
Total 1967 = 6.90"

PERSONNEL:

R. McR. Wood and Field Assistant

DURATION:

March 1967 - December 1967

METHODS:

The site was selected and pegged out on an area of dense skeleton weed, on 17/3/67. Because of moisture stress and heavy grazing, there was little top growth of skeleton weed present. Counts of initial density were taken on 22/3/67 using 6 four square link quadrats per plot (thrown at random).

The picloram sprays were applied on 31/3/67, using a hand boom delivering 15 gallons of spray per acre. Conditions were dry at the time of spraying as no rain had been received since early March.

The area was worked up with a combine by the farmer on 1/6/67 following 25 points of rain in late May. The direction of working was at right angles to the sprayed plots.

The plots were sown to Noyep barley with a 9 hoe combine on 7/6/67. The sowing rate was 40 lbs./acre with either 107 lbs./ acre of superphosphate or 164 lbs./acre of 2:1 super ammonia.

On 16/11/67, the barley was harvested. Cereal samples and counts were taken from four 10 sq. link quadrats in each plot. Each quadrat enclosed 3 crop rows 30" long. Skeleton weed density was also counted in each quadrat. Some plots were reaped with a small row stripper, but yields were very poor. Many plots were not worth reaping.

Head samples were threshed and the grain weighed and bulked for each plot.

RESULTS:

a. Initial skeleton weed density on 22/3/67 was estimated from 6 four sq. link quadrats per plot. Total quadrats thrown = 228. The mean density of skeleton weed rosettes was 3.2 per sq. link overall (many dried up rosettes).

b. Final skeleton weed density on 16/11/67 - The following table summarizes the counts of stalks or rosettes per sq. link. Each value is a mean of four 10 sq. link quadrats per plot:

TABLE I

Treatment		I	II	III	IV	MEAN
1.	Control	2.6	5.5	5.0	5.0	4.5
2.	Control + N	3.3	5.0	2.6	5.0	4.0
3.	50D 1 oz	2.9	1.7	2.3	4.4	2.8
4.	50D 1 oz + N	1.4	4.1	2.2	3.8	2.9
5.	50D 2 oz	0.5	2.4	1.6	1.2	1.4
6.	50D 2 oz + N	1.1	0.3	2.3	1.2	1.2
7.	Control	2.8	4.7	5.0	5.0	4.4
8.	Control + N	2.1	5.1	3.3	5.0	3.9
9.	22K 1 oz	1.2	3.9	5.0	3.7	3.5
10.	22K 1 oz + N	1.2	2.7	2.0	3.8	2.4
11.	22K 2 oz	0.4	3.3	2.3	0.9	1.7
12.	22K 2 oz + N	0.8	3.6	1.7	0.8	1.7

Statistical analysis of these data was carried out and a significant difference between spray rates was indicated. Neither spray formulation nor fertilizer treatment caused significant differences.

Rate			
Nil	44 plants per 10 sq. link	L.S.D.	.05 = 8
1 oz.	29		.01 = 10
2 oz.	15		.001 = 14

c. Crop yield (based on four hand harvested 10 sq. link quadrats per plot). The total yield of the quadrats in each plot was converted to lbs./acre. A summary of the yields is given in the following table:

TABLE 2 HAND HARVESTED YIELD

lb./acre

Treatment		I	II	III	IV	Mean
1.	Control	64	36	12	0	28
2.	Control + N	39	55	24	23	37
3.	50D 1 oz	159	250	114	138	167
4.	50D 1 oz + N	101	89	141	64	99
5.	50D 2 oz	240	243	43	350	219
6.	50D 2 oz + N	160	301	126	175	190
7.	Control	0	61	0	0	15
8.	Control + N	13	50	22	0	21
9.	22K 1 oz	246	114	0	123	121
10.	22K 1 oz + N	27	126	189	125	117
11.	22K 2 oz	239	132	103	200	169
12.	22K 2 oz + N	216	63	123	186	147

Spray rate differences were detected upon statistical analysis, summarised as follows.

Spray Formulation	Mean		
Tordon 50D	1.88	L.S.D.	0.05 = 0.31
			0.01 = 0.42
Tordon 22K	1.57		0.001 = 0.55

Rate	Mean		
0 oz	1.03		0.05 = 0.38
1 oz	1.95	L.S.D.	0.01 = 0.51
2 oz	2.20		0.001 = 0.67

Estimated standard error per plot = 30%

d. Stripper harvested yield - An area 8 rows x 66' was harvested from some of the better yielding plots as a comparison for hand harvested yields. However, the maximum yield obtained by this method was 1.6 bus/ac (treatment 5 in block 1). The variability between blocks for the same treatment was exceptionally high.

f. Grain Protein Percentage - The results of crude protein determinations carried out by the Department of Chemistry are set out in table 3. Values have been corrected to a 10% grain moisture content.

TABLE 3 CRUDE PROTEIN (N x 5.7%)

	Plain Super	2:1 Super-Ammonia
Control	8.5	9.2
Tordon 50D 1 oz.	8.2	8.5
Tordon 50D 2 oz.	8.1	8.9
Tordon 22K 1 oz.	7.8	8.9
Tordon 22K 2 oz.	8.1	9.1
MEANS	8.1	8.9

Tests were carried out on bulked samples from the four replications.

Picloram treatments did not improve the crude protein content of the Noyep barley but the ammonium sulphate appears to have increased protein levles by 0.8% overall. The significance of this improvement is doubtful.

DISCUSSION:

Both picloram formulations reduced skeleton weed density in the crop as shown in Table 1 confirmed subsequently by statistical analysis. At harvest time, rosette density was reduced to approximately 1/3 of the unsprayed plot density, by 2 ozs. of picloram applied in March. At the same time, 1 oz. of picloram reduced skeleton weed density to about 2/3 of the unsprayed plot density.

As the cost of picloram per ounce a.e. is approximately $2-25 the above results do not appear to be financially acceptable, especially when the crop yield response is considered.

From Table 2, the yields of grain from each treatment were very low - about ½ a bushel per acre on the unsprayed plots. The highest yield obtained was a little over 6 bushels on a plot sprayed with 2 ozs. a.e. picloram (as Tordon 50D) in March. The mean for this treatment was about 4 bushels. Yields from the plots treated with Tordon 50D were a little better overall than the Tordon 22K (picloram only). The only explanation that can be offered is that the 2,4-D content in Tordon 50D must have aided skeleton weed suppression, despite the unfavourably dry conditions at spraying time.

The use of nitrogen fertilizer at sowing did not significantly improve yields, and in many cases appeared to reduce them by a small amount. Seasonal conditions did not favour a nitrogen response, and grassy weeds (mainly Bromus sp.) competed with the crop for this nutrient. Even removal of skeleton weed with picloram prior to sowing failed to allow the barley to show a positive N response.

Because skeleton weed had been dense on this particular site for about 15 years, the fertility was very low. Legume growth on the area was sparse - the main species being Trifolium glomeratum (cluster clover).

Grass competition (mainly from Bromus sp.) was a problem on the picloram treated plots, and this was a worse problem where nitrogen was used as well.

EXPERIMENT 12

LOCATION:

C.H. Johonson Section 2 Hundred of Parilla, Parilla

SOIL TYPE:

Sandy mallee

RAINFALL:

30 year mean = 13.8"
May-October 1967 = 4.91
Total for 1967 = 6.89"

PERSONNEL:

R. McR. Wood and Field Assistant

DURATION:

March 1967 - December 1967

DESIGN:

as for experiment 11.
2 picloram formulations presowing

(Randomised block) 3 picloram rates (0, 1, 2 ozs.)
4 replications.

METHOD:

The area was selected in March 1967 on a soil type more suited to wheat growing. The area had already been fallowed on the February rains. There was no skeleton weed present on the area although there were some patches on rising ground nearby. The farmer intended to sow the whole paddock to wheat, and it was decided to sow the variety Insignia 49 on the trial area.

The picloram sprays were applied with the CO_2 pressure boomspray on 23/3/67. The 6' wide boom delivered 20 gallons of spray per acre at a walking speed of 3' per second.

Following rains in late May, the trial was sown to wheat, using a 9 hoe Departmental combine on 8/6/67. The cereal was sown at 55 lbs./acre, and half the plots received 2:1 super ammonia at 164 lbs./acre. The remaining plots received 107 lbs./acre of plain super.

On 30/11/67, the plots were subsampled. Two 6' long samples were cut from each plot to obtain information on the number of heads and their grain yield. Harvesting was then completed using a 6' Autoheader.

RESULTS:

1. Crop Yield

Table 1 shows the wheat yield obtained from each plot

Table 1 Grain yield (Autoheader + subsample)

lbs./plot

Treatment No.	Block 1	2	3	4	Mean Yield/Treatment (bushels/acre)
1	5.8	10.4	11.8	5.6	17.6
2	3.0	8.9	9.0	4.9	13.7
3	5.0	9.0	10.3	5.9	15.8
4	6.1	8.4	10.0	7.6	16.8
5	6.8	8.2	7.2	7.2	15.4
6	5.6	8.8	9.7	7.3	16.4
7	5.9	9.5	7.6	6.6	15.5
8	5.1	9.2	9.9	5.3	15.5
9	4.8	10.3	5.9	5.7	13.7
10	5.2	9.6	10.3	5.6	16.0
11	6.5	10.7	10.7	5.7	17.6
12	4.8	9.4	7.4	6.6	14.8
MEANS	5.4	9.4	9.1	6.2	

Treatment Means: lbs./plot

1. Fertilizer Plain 7.6 (mean of 24 plots)
   2:1 7.4

2. Spray Formulation Tordon 50D 7.7 (mean of 16 plots)
   Tordon 22K 7.5

3. Picloram Rate Nil 7.4 (mean of 16 plots)

   1 oz. a.e./ac. 7.5
   2 oz. a.e./ac. 7.7

TABLE 2 DATA FROM SUBSAMPLES 30/11/67

Number of heads per 12' of row

Treatment	BLOCKS I	II	III	IV	Heads Total	Grain Yield (gms.)
1	109	138	108	141	496	333
2	76	145	110	485	416	331
3	90	123	123	128	464	294
4	109	101	130	147	487	360
5	122	135	105	126	488	334
6	143	150	107	133	533	376
7	94	123	97	143	457	307
8	111	134	100	141	486	332
9	78	141	107	98	424	252
10	95	139	107	119	460	329
11	108	132	131	136	507	380
12	80	123	92	155	450	294
Totals	1215	1584	1317	1552		

TABLE 3 BUSHEL WEIGHTS (LBS.)

Treatment	I	II	III	IV	Mean
1	62.8	64.5	65.3	60.6	63.3
2	62.6	65.1	65.2	60.0	63.2
3	60.3	65.9	65.0	61.2	63.1
4	62.6	64.5	65.4	63.3	63.9
5	63.9	65.2	66.9	62.8	64.7
6	62.7	65.7	65.2	61.4	63.7
7	62.9	64.7	65.1	60.9	63.4
8	62.9	65.3	65.0	59.9	63.3
9	63.2	64.5	65.0	60.9	63.4
10	62.1	65.7	66.2	60.2	63.5
11	63.3	65.2	66.0	62.2	64.2
12	63.8	66.0	66.0	62.0	64.5
Mean	62.8	65.2	65.5	61.3	

TABLE 4 1000 GRAIN WEIGHT (GMS.)

Treatment	I	II	III	IV	Mean
1	28.7	33.5	34.2	27.6	31.0
2	27.9	34.7	33.7	26.9	30.7
3	29.1	35.6	33.9	28.1	31.7
4	29.1	33.5	33.3	30.4	31.6
5	30.1	34.9	36.1	29.5	32.6
6	28.6	34.4	34.2	28.2	31.4
7	28.4	34.1	32.5	27.2	30.5
8	27.9	34.5	34.5	26.6	30.9
9	29.6	34.3	33.0	27.9	31.2
10	28.1	34.6	35.5	27.3	31.4
11	29.5	35.1	35.5	28.1	32.5
12	30.0	35.7	35.1	28.6	32.4
Mean	28.9	34.5	34.3	28.3	

TABLE 5 GRAIN PROTEIN ESTIMATIONS
(Department of Chemistry)

Treatment	Plain Super	2:1 Super Ammonia
Control	13.8	14.0
Tordon 50D 1 oz.	13.6	14.6
Tordon 50D 2 oz.	14.0	14.2
Tordon 22K 1 oz.	13.8	14.2
Tordon 22K 2 oz.	14.3	14.1

TABLE 6 RESULTS OF TESTS BY BREAD RESEARCH INSTITUTE OF AUSTRALIA

Treatment	Wheat Protein %	Baking Score
Control	14.0	78
Control	14.0	78
Tordon 50D 1 oz.	13.8	79
Tordon 50D 2 oz.	13.9	82*
Tordon 22K 1 oz.	14.3	77
Tordon 22K 2 oz.	13.6	77

Visual Assessment of Crop three weeks prior to harvest

There were only slight differences visible between plots and these were partly due to density of Capeweed. The spray and nitrogen treatments did not cause any consistent effect on the crop, but it was obvious that blocks I and IV were poorer than II and III. These poor blocks were adjacent.

DISCUSSION:

The most notable part of these results is the lack of response to the picloram and fertilizer nitrogen treatments in almost all determinations carried out on the crop. The mean yield column in Table I does not show any consistent variation which can be attributed to the picloram and nitrogen treatments. It was not considered necessary to examine the data statistically. Similar comments can be made for tables II, III and IV.

The only remaining point, which can be seen from Tables I, III and IV is the marked block effects. These may be attributed to the location of the trial near some mallee scrub. Blocks I and IV were about 50 feet from the scrub, and were noticeably poorer throughout the year.

There was some capeweed present on most plots but visual assessments of weed density did not correlate with any yield depression.

The treatment means from Table I suggest a slight yield depression when 2:1 super ammonia has been used. Tordon 50D caused a slight improvement when compared with Tordon 22K, and the 2.0 oz. picloram plots yielded a fraction more than unsprayed plots. It is pointed out that these final comments have no economic significance at the present time.

Data on grain protein content and baking quality are included. The high protein percentages given in Table V are unlikely to reflect any response to the treatments. A slightly higher protein level was recorded on plots which were sown with 164 lbs. of 2:1 super ammonia (= 55 lbs. of ammonia sulphate/ acre).

There is some suggestion that picloram at 1 oz. and $\frac{3}{4}$ oz. preplanting has improved protein percentage and in some cases, baking quality (Dow Chemical Co. February 1967). In one case however there was a decreased baking score with the preplant picloram, although protein content was increased slightly.

Post emergence applications of picloram (0.4 oz. a.e. per acre) did not cause any change in baking quality or protein % (Dow Chemical Company 1967).

Any herbicide which causes yield reduction would no doubt cause an increase in protein levels, and the overall effects can vary greatly from one season to the next.

EXPERIMENT 13

LOCATION:

C.H. Johnson, Section 2 Hundred of Parilla

SOIL TYPE:

Solodised solonetz

RAINFALL:

30 year mean = 13.8"
May-October 1967 = 4.9"
Total 1967 = 6.9"

PERSONNEL:

Mr. R. McR. Wood and Field Assistant

DURATION:

March 1967 - December 1967

METHODS:

The site was selected and pegged out in mid March 1967, and an area west of the trial was worked up by the farmer on 20/3/67. Subsequently, another two blocks were pegged out on the worked up area, so that the trial comprised 6 blocks, each of 12 plots 63" wide x 30' long. The area was heavily infested with mature skeleton weed, and the soil type was very poor (suitable for cereal rye or perhaps barley).

The spraying was carried out on 30/3/67 and 31/3/67 using a hand boom delivering 15 gallons per acre.

The farmer worked the whole area with a Trash Seeder on 1/6/67, travelling across the sprayed plots. A disc implement was used to minimise lateral transfer of treated soil. Noyep barley was sown on 8/6/67 using a 9 hoe Departmental combine. The seeding rate was 40 lbs./acre; with either 107 lbs./acre of plain superphosphate or 164 lbs. of 2:1 super ammonia.

A fence was erected around the area during the growing season as the remainder of the paddock was being grazed.

Because of grass competition (mainly Bromus rigidus) the barley did not yield at all well, and no harvest was attempted.

Skeleton weed density (rosettes) was counted on 30/11/67 using two 10 sq. link quadrats per plot.

RESULTS:

TABLE I SKELETON WEED DENSITY (rosettes per sq. link)

(Mean of two 10 sq. link quadrats per plot)

	BLOCK NO.						
Treatment	I	II	III	IV	V	VI	Mean
1	2.3	1.0	0.1	3.6	5.1	2.5	2.4
2	1.2	1.2	1.1	2.4	2.2	2.0	1.7
3	2.9	0.1	0.2	0.2	0.7	0.3	0.7
4	0.6	0.2	0.2	0.1	1.4	0.2	0.5
5	0.2	0	0	0.9	0	0.1	0.2
6	0	0	0	0.1	0	0	0
7	1.2	0.1	0.6	7.6	4.6	1.6	2.6
8	1.0	1.5	1.0	3.6	0.6	0.4	1.4
9	0.2	0.2	0	1.3	0.2	1.2	0.5
10	2.7	0.2	0	0.6	0.2	0.8	0.8
11	0.1	0.	0	0.2	0.1	0.3	0.1
12	0.3	0.2	0	0.1	0.3	0.3	0.2

Treatment Means	30/11/67
Control, plain super - mean density	2.5 rossettes/sq. link
Control, 2:1 Super Ammonia	1.5
1 oz. picloram (5OD)	0.6
2 oz. picloram (5OD)	0.1
1 oz. picloram (22K)	0.7
2 oz. picloram (22K)	0.15

Visual Assessments made on 29/9/67 may be summarised as follows:

Treatment 1 and 7 (Unsprayed, Plain Super)
Poor crop, much skeleton weed and some brome grass.

Treatment 2 and 8 (Unsprayed, 2:1 Super Ammonia)
Poor crop, much skeleton weed and prominent brome grass.

Treatment 3 and 9 (1 oz. picloram, plain super)
Poor crop, reduced skeleton weed. Grasses prominent.

Treatment 4 and 10 (1 oz. picloram 2:1 Super)
As for 3 and 9, but grasses more prominent.

Treatment 5 and 11 (2 oz. picloram, plain super)
Slightly better crop than above, much reduced skeleton weed but grasses still prominent.

Treatment 6 and 12 (2 oz. picloram 2:1 Super)
Poor crop, much reduced skeleton weed and dense brome grass.

DISCUSSION:

The 1967 growing season was certainly a factor in the poor yields obtained in this trial. The soil type is known to be very infertile, having practically no legume growth in previous years.

Results from spraying with picloram were encouraging, as can be seen from Table I. 1 oz. of either formulation reduced skelton weed density by 60% approximately while 2 oz. of picloram reduced this density by another 35%. Unfortunately, this reduction in weed density was not reflected in improved crop yield, even when additional nitrogen (equivalent to 55 lbs./acre of ammonium sulphate) has been applied. It may be concluded that from this trial, no response to additional nitrogen was obtained, and this seemed to be linked with a proliferation of brome grass on the treated plots. There is little doubt that lack of ground preparation resulting in the high levels of brome grass affected the yields markedly.

Visual assessment at harvest time (Table I) shows that none of the treatments eliminated skeleton weed completely. Inspection of the trial on 11/12/68 showed that skeleton weed had recovered from the 1967 treatments on all plots. There was a slight reduction in density on the plots where 2.0 oz. of Tordon 50D had been applied.

The plots were cross sown with Harbinger medic and Geraldton sub-clover in April 1968 to study the effect of picloram residues on stubble sown legumes (see W.E. 33, Experiment 11B).

LITERATURE REFERENCES

For list of literature references see Appendix III of Agronomy Branch Report No. 33.