1982

Organic matter as a source of nitrogen.

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Summary of Experimental Results 1982

ORGANIC MATTER as a Source of NITROGEN

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1982 EXPERIMENTAL SUMMARY .

81GE4 1982

Treatment	Seed Rate	Min. N after incubat. 18.1.82 + Com.	Min. N after incubation 24/4/82 + Com.	- Com.	Rating (0-5) Dry mat. 2/9/82	Total Dry Matter Produced kg/ha
Nungarin	90	12	31	35	2.8	892
	30	11	32	31	2.2	842
	15	7	26	27	2.2	495
	7.5	7	26	25	2.0	649
Harbinger	90	24**	39	39*	3.2	892
	30	21**	32	31	2.5	849
	15	17	25	28	2.6	678
	7.5	9	24	28	2.4	721
Northam	15	9	27	24	2.2	485
Geraldton	15	9	31	31	2.5	728
Swani	15	10	25	36	2.6	899
Serena	15	10	25	24	1.7	585
Tornafield	15	10	28	28	2.8	685
Kondinin Rose	15	6	27	28	2.5	442
Buffer Nil	-	9	27	29	2.3	635
Buffer Agran						
40	-				3.2	871
80	-				4.3	1163*
120	-				4.5	992*
240	-				4.8	1727*

** Signif. diff. to nil 5%
* Signif. diff. to nil 1%

Plots were not harvested.

Note: Large changes in min. N after incubation between sampling dates. The only significant increases in mineral nitrogen levels occurred where high levels of pasture occurred.

Plots were not harvested.
Except for the high seeding rates of clover, the amount of nitrogen applied onto the Nil plots to maintain the production of the clover plots was less than 10 kg nitrogen/ha.
For the high rates of clover this was up to 30-40 kg Agran/ha.

81GE4

1981 Treatment	Seed Rate	kg/ha DM (pasture)	%N	kg/ha N in pasture
Nungarin	90	1170	2.49	29
	30	1091	2.02	22
	15	630	2.02	13
	7.5	508	1.93	10
Harbinger	90	2580	2.42	62
	30	2140	2.17	46
	15	1160	2.17	25
	7.5	1190	2.07	25
Northam	15	590	1.96	12
Geraldton	15	391	2.02	8
Swanni	15	508	2.07	15
Serena	15	280	2.16	6
Tornafield	15	608	2.22	11
Kondinin Rose	15	740	2.41	15

Treatment Seed Rate	Mineral N 8.3.82 Init ppm	After incub. ppm	Anthesis D.wts kg/ha	Tiller No. at anthesis /m²	Dry wts 2611.82 kg/ha	26.11.82 Head No. /m²	wt/head g	seed wt. /1000g	Harvest index	Harvest Grain Yields t/ha
Nungarin										
7.5	20	31	3456	172	5388	198	1309	29.1	.39	1.60
15	20	31	4176*	220	4840	204	1.11	27.9	.36	1.60
30	24	44	4331*	220	4870	202	1.12	28.8	.36	1.50
90	25	45	4639*	233	5365	218	1.11	26.8	.33	1.50
Daliak										
7.5	25	34	3908	206	5138	213	1.10	27.9	.34	1.41
30	23	36	4074*	216	4462	228	0.91	28.0	.42	1.54
Illyarri										
40	38*	57*	4296*	233	4518	202	.95	28.0	.25	1.18
Lupins										
80	39*	56*	4148*	226	4749	244	.65	27.3	.27	1.09
Dun Peas										
60	32*	48*	3988*	196	5073	212	.95	28.9	.29	1.19
100	35*	43	3691	221	4540	223	.80	26.1	.20	.85
Oats										
Nil	18	22	3028	159	3941	175	1.13	31.0	.40	1.44
Agran										
40			3405	179	4633	191	1.15	30.1	.38	1.45
80			3616	151	4363	187	1.05	28.3	.34	1.42
120			4216*	243	4449	219	.69	22.1	.21	.86
240			4691*	255	3973	203	.62	24.9	.18	.45

* Signif. different to NIL treat. 5% level

Anthesis yield = 2882 + 26.9 Min. N (+ Com) R^2 = .36

Note:

Some very large dry matter responses occurred due to the presence of legumes. However, 'haying off' and Cu deficiency on the high dry matter plots caused large decreases in the grain yields.

1981 PASTURE DRY WEIGHTS AND N CONTENTS

1981 Treatments		kg/ha	%N	N in Tops
Nungarin	7.5 kg/ha	3540	1.44	51
	15 kg/ha	3640	1.26	46
	30 kg/ha	3980	1.60	64
	90 kg/ha	4340	1.66	72
Daliak	7.5 kg/ha	3300	1.37	45
	30 kg/ha	3740	1.54	57

Note: Pastures had high cape weed contents.

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1981 Treatments	1981 Seed Rate	1982 Agran Rate	Initial Mineral Nitrogen + Com. 5.3.82	Mineral Nitrogen after incubat. + Com. 5.3.82	Mineral N after incubation + Com. 10.5.82	Mineral N after incubation - Com. 10.5.82	Germination counts plants/m^2	Dry Matter Yields 26.7 kg/ha	Dry Matter Yields 20.8 kg/ha	Dry Matter Yields 20.9 kg/ha	Dry Matter Yields 21.10 kg/ha	Harvest Yield 13/12/82
Clover + tops	8	-	35	50	53	53	105	69	708	4071	4541	1547
Clover + tops	20	-	35	49	73*	69**	88	120	902	3947	5897	1830
Clover + tops	100	-	28	50	73*	72**	96	129	902	4566	6204	1766
Clover - tops	8	-	33	44	60	49	99	113	867	5143	6368	1743
Clover - tops	20	-	30	46	62	61	103	132	902	3504	6490	1949
Clover - tops	100	-	35	52	72*	73**	105	98	885	5244	6111	1862
Wheat + tops	-	Nil	25	25	45	46	79	66	442	2451	4055	1299
Wheat + tops	-	50						92	513	3945	4491	1394
Wheat + tops	-	100						96	761	4816	4869	1362
Wheat + tops	-	150						117	831	4941	5719	1538
Wheat + tops	-	300						112	849	4720	6240	1327
Wheat - tops	-	Nil	27	35	52	48	105	79	672	2750	4605	1531
Wheat - tops	-	50						112	902	4508	5444	1782
Wheat - tops	-	100						109	938	5371	5704	1736
Wheat - tops	-	150						102	973	5432	6783	1894
Wheat - tops	-	300						106	1132	6230	7347	1505

** Signif. different from wheat treatments 1%
 * Signif. different from wheat treatments 5%

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81A5

1981 Treatment		Dry Matter	%N	kg/ha N
Nungarin	5 kg/ha	2550	1.72	44
	15 kg/ha	3163	1.82	58
	90 kg/ha	3731	2.12	79

Note:

Retaining the wheat stubble caused large decreases in plants germinated. Large differences occur in mineral N after incubation between sample dates. By 20.8.82 the wheat plots with the tops removed took up approximately 30% more nitrogen than the tops retained plots. No significant differences in nitrogen uptake occurred between any of the clover treatments. The wheat on clover plots had taken up amounts of nitrogen (30 kg/ha) equivalent to applying 140 kg/ha Agran onto wheat (+ tops) and 50 kg/ha Agran onto wheat (- tops).

Dry matter yields at anthesis (21.10) show this to be higher.

Some 'haying off' had occurred in the grain yields.

5.3.82 - Soil sample 0-10cm.

Anthesis yield = 2436 + 70.6 Min. N (after inc.*) $R^2 = .36$
Anthesis yield = 2520 + 97.1 Min. N (initial) $R^2 = .16$

10.5.82 - Soil sample 0-10cm

Anthesis yield = 1093 + 72.5 Min. N (after inc. + COM) $R^2 = .64$
Anthesis yield = 2284 + 55.1 Min. N (after inc. - COM) $R^2 = .36$

* Mineral nitrogen after 2 wk. aerobic incubation.

81C4 1982 DATA

1981 Treatment		Agran Rate kg/ha	Min. N after incubat. + Com.	Min. N after Incubat. - Com.	6 week plant D.wt. 3.8.82 kg/ha	Anthesis D.wt. 19.10.82 kg/ha	Grain yields t/ha 13.12.82
Nungarin	2.5		28	29	240	3918	1.81
	15		32	29	244	5261	2.18
	90		36	35	239	5401	2.29
Northam	15		34	36	219	5224	2.29
	90		39	40	259	6241	2.57
Wheat		Nil	22	25	112	3226	1.78
Wheat		40	-	-	223	3517	1.72
Wheat		80	-	-	235	3448	1.90
Wheat		120	-	-	322	4076	1.79
Wheat		240	-	-	380	5555	2.06

Good correlation of min. N after incubat. and anthesis D.W.

1981 DATA

Treatment		Dry Matter	kg/ha N
Nungarin	2.5	1010 kg/ha	20
	15	1300	30
	90	1410	33
Northam	15	1470	35
	90	1390	37

81LAB 2:

The effect of different plant materials.

This incubation experiment involved adding 30 different plant materials collected from the field, to incubation vials at rates equivalent to 3,000 and 6,000 kg/ha on two soil types. (Table 1). When the mineral nitrogen produced is regressed against the nitrogen content of the organic material, the linear regression accounted for 84 to 95 per cent of the variation.

It may be expected that the water soluble or the inorganic nitrogen contents would reflect the more available nitrogen compared to the use of total nitrogen content of the organic material. However, the regression of mineral nitrogen after incubation against the inorganic and water soluble nitrogen of the organic matter, accounted for much less of the variation than the total nitrogen content of the organic matter..

The high regression between the mineral nitrogen and the per cent nitrogen (Figure 1) suggests that most plant materials found in the field may be characterized (for the purpose of their effect on mineral nitrogen levels) by their nitrogen contents. Further inspection of Figure 1 suggests that when all the plant materials which were partly or wholly green, are removed from the regression, the regression is further improved. However, it also demonstrates that nearly all the material found in the field in the dry state is less than 2 per cent nitrogen. This includes materials from pastures with a high proportion of clover in the dry matter. Therefore it may be expected that very little nitrogen will be released from the organic material in the short term.

Table 1

No.	Plant	Maturity	Chemical analysis			Mineral nitrogen after a two week incubation			
						Wongan Hills		Avondale	
			% C	% N	C/N	3000 kg/ha	6000 kg/ha	3000 kg/ha	6000 kg/ha
1	Green clover (dried)	1	41.2	3.64	11.3	36	65	44	58
2	Nungarin pasture (15 kg/ha)	2	40.1	1.42	28.2	11	6	9	1
3	" " (90 kg/ha)	2	39.1	2.69	14.5	23	24	25	31
4	Kondinin Rose pasture	3	40.8	2.06	19.8	16	18	20	17
5	Serena	4	42.9	1.06	40.4	8	1	7	1
6	Tornafield	3	41.3	1.87	22.0	13	18	22	20
7	Blue lupin leaves	3	42.9	1.77	24.2	15	7	14	4
8	" " stems	3	46.0	1.13	40.7	11	1	9	3
9	Lupin seeds		39.6	3.64	10.8	43	77	46	69
10	" stems	2	45.5	1.49	30.5	9	2	14	6
11	" leaves	2	42.8	3.56	12.1	51	79	43	64
12	" roots (+ old nodules)	2	44.1	1.32	33.4	11	0	16	8
13	Young lupin roots nodules	1	38.4	6.61	5.8	96	160	109	196
14	" " " stems	1	42.0	1.42	29.5	20	1	19	9
15	Dunn pea leaves	2	42.1	3.52	11.9	31	48	38	46
16	" " stems	2	43.9	2.15	20.4	27	24	30	27
17	Green brome grass	1	42.6	3.03	14.0	42	36	32	41
18	Cape weed	3	39.1	2.00	19.5	17	18	13	6
19	Dry brome grass	3	44.1	1.79	24.6	14	0	8	0
20	Rye grass	4	46.0	1.45	31.7	8	0	8	0
21	Wild oat stems	4	43.9	0.20	21.5	3	0	0	0
22	" " leaves	4	43.3	0.44	98.4	0	0	0	0
23	Green radish (dried)	3	43.6	2.58	16.9	37	35	31	39
24	Silver grass	4	44.4	0.96	46.2	9	0	1	0
25	Thistle	4	42.6	0.68	62.6	2	0	2	0
26	Wire weed (green)		44.9	1.84	24.4	6	0	6	0
27	Wheat tops (low N)	1	44.1	1.9	23.2	15	8	16	13
28	" " (high N)	1	44.4	2.12	20.9	14	8	15	9
29	Rapeseed leaves	4	41.0	1.57	26.1	12	10	13	3
30	" stems	4	42.5	0.46	92.3	10	0	6	0

1 Cut in spring
2 Cut at Early seed set
3 Cut at Late seed set
4 Cut at Maturity

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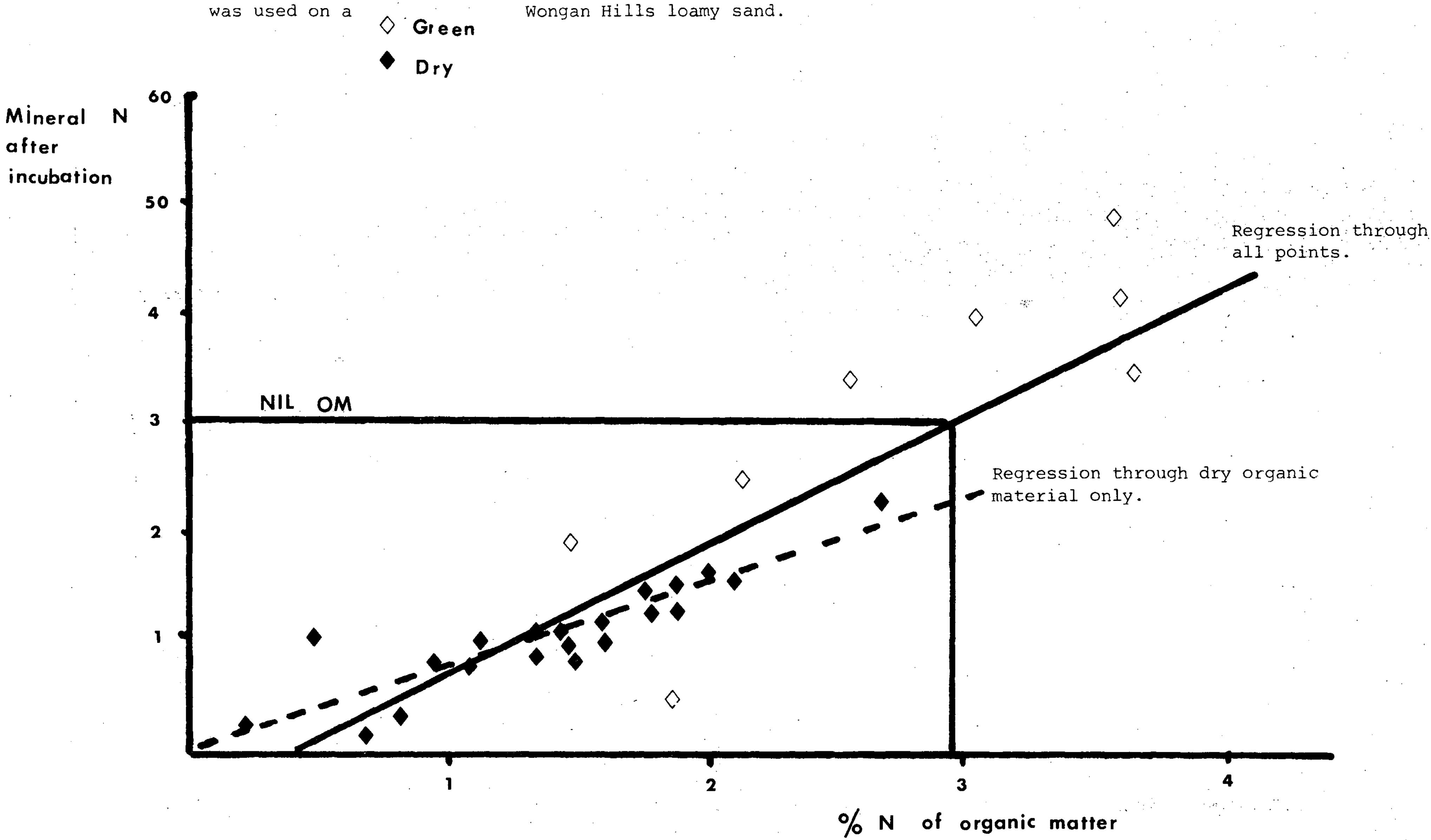
FIG 1 The comparison of different organic materials collected from the field on the production of mineral nitrogen at their respective N contents. One rate (3000 kg/ha) was used on a Wongan Hills loamy sand.



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81LAB4:

The effect of soil type on mineral nitrogen.

An incubation experiment was conducted where organic materials were screened over 19 different soil types. The soils contained nitrogen levels which covered the range of soils in most of our agricultural areas.

A linear regression was obtained for each soil type when the mineral nitrogen produced after incubation was plotted against the nitrogen content of the organic materials. The mean slope of the 19 regressions was 17.21. When the nil organic matter treatment was extrapolated across onto the regression, the corresponding per cent N equivalent on the horizontal axis had a mean of 2.45.

The response of the organic matter on different soil types was dependant on the mineral nitrogen level of the 2mm soil incubated alone. Therefore each individual regression could be predicted by knowing this value and incorporating into the following general equation:

$$\text{Mineral Nitrogen} = \text{Mineral N (Nil)} + (N - 2.45)\ 17.21$$

OR

$$\text{Mineral N} = (x - 2.45)\ 17.21$$

where N = per cent N of the organic matter

Mineral N (nil) = mineral nitrogen produced by the 2mm soil incubated alone.

In this experiment where only one rate of addition was applied at one time period, the regression accounted for 98 per cent of the variation in the actual values.

To allow for the different rates of organic material which may be present, the equation may be written:

$$\text{Min. N} = \text{Min. N}_{(nil)}\ 0.9\ \ -10.5A + 4.3(A) \times N$$

where A is the amount added in the organic matter.

81GH2.

The effect of different nitrogen contents of organic matter on the release of nitrogen with time.

In a glasshouse experiment, organic materials containing .94 per cent N (wheat straw), 3.96% N (clover tops) and 1.8% N (combination of above) were added to soils in pots. Wheat seedlings were grown in the pots, and harvested at intervals, upto a period of twelve weeks Corresponding soil samples were also taken.

The addition of clover tops caused increased wheat seedling growth for the entire period through to maturity. This reflected the increased amounts of available nitrogen made available for plant uptake from the clover tops. After six weeks the plants took up no more nitrogen due to the exhaustion of all available nitrogen. However, only 22 per cent of the nitrogen applied in the organic matter was taken up by the plants. This indicates that only a small proportion of the added organic matter is made available to the plants. The amounts taken up would probably be less under leaching conditions in the field situation.

The addition of wheat straw resulted in the immobilization of soil nitrogen, and consequent poorer growth for the entire 12 weeks.

The addition of material containing 1.8% N initially caused immobilization for the first 4 to 5 weeks. After this nitrogen was released, resulting in better growth than the nil treatment. This indicates that remineralization of nitrogen probably occurred. The plants eventually removed only 11 per cent of the applied nitrogen. This is of the order of nitrogen release we may expect in the field situation. However, not all of this nitrogen may be taken up because of losses.