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90/R/BK/1 Broadbalk - W. Wheat, Potatoes

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90/R/BK/1

BROADBALK

Object: To study the effects of organic and inorganic manures on continuous w. wheat. From 1968 two three-year rotations were included: potatoes, beans, w. wheat and fallow, w. wheat, w. wheat. In 1979 the first rotation was changed to fallow, potatoes, w. wheat. In 1980 the second rotation reverted to continuous w. wheat. Since 1985 part of the second rotation has been added to the first to extend the rotation to fallow, potatoes, w. wheat, w. wheat, w. wheat.

The 147th year, w. wheat, fallow, potatoes.

For previous years see 'Details' 1967 and 1973, Station Report for 1966, pp. 229-231, Station Report for 1968, Part 2, and 74-89/R/BK/1.

Areas harvested:

Wheat:	Section	
	0	0.00311
	1	0.00572
	2,3,6 and 7	0.00473
	8 and 9	0.00497
Potatoes:	4	0.00348

Treatments:

Whole plots

PLOT	Fertilizers and organic manures:-			
	Plot	Treatments until 1967	Treatments from 1968	Treatments from 1985
01DN4PK	01	-	D N2 P K	D N4 P K
21DN2	21	D	D N2	D N2
22D	22	D	D	D
030	03	None	None	None
05F	05	P K Na Mg	P K (Na) Mg	PK Mg
06N1F	06	N1 P K Na Mg	N1 P K (Na) Mg	N1 P K Mg
07N2F	07	N2 P K Na Mg	N2 P K (Na) Mg	N2 P K Mg
08N3F	08	N3 P K Na Mg	N3 P K (Na) Mg	N3 P K Mg
09N4F	09	N*1 P K Na Mg	N4 P K (Na) Mg	N4 P K Mg
10N2	10	N2	N2	N2
11N2P	11	N2 P	N2 P	N2 P
12N2PNA	12	N2 P Na	N2 P Na	N2 P Na
13N2PK	13	N2 P K	N2 P K	N2 P K
14N2PKMG	14	N2 P Mg	N2 P K Mg	N2 P K Mg
15N5F	15	N2 P K Na Mg	N3 P K (Na) Mg	N5 P K Mg
16N6F	16	N*2 P K Na Mg	N2 P K (Na) Mg	N6 P K Mg
17N1+3FH	17	N2 (A)	N2 1/2 (P K (Na) Mg)	N1+3 1/2 (PK Mg) +
18N0+3FH	18	P K Na Mg (A)	N2 1/2 (P K (Na) Mg)	N0+3 1/2 (PK Mg) +
19C	19	C	C	C
20NKMG	20	N2 K Na Mg	N2 K (Na) Mg	N2 K Mg

(A) Alternating

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+ This change since 1980. Treatments shown are those to w. wheat; autumn N alternates. Potatoes receive N3 1/2 (PK Mg) on both Plots 17 and 18.

N1,N2,N3,N4,N5,N6: 48, 96, 144, 192, 240, 288 kg N (as sulphate of ammonia until 1967, except N* which was nitrate of soda. All as 'Nitro-Chalk' in spring from 1968 to 1985, as 'Nitram' since 1986.)
 N0+3; N1+3: None in autumn + 144 kg N in spring; 48 kg N in autumn + 144 kg N in spring
 P: 35 kg P as single superphosphate until 1987, triple superphosphate in 1974 and since 1988
 K: 90 kg K as sulphate of potash
 Na: 55 kg Na as sulphate of soda
 (Na): 16 kg Na as sulphate of soda until 1973
 Mg: 30 kg Mg annually to Plot 14, 35 kg Mg every third year to other plots since 1974. All as kieserite since 1974, previously as sulphate of magnesia annually
 D: Farmyard manure at 35 tonnes
 C: Castor meal to supply 96 kg N until 1988, none since
 F: P K (Na) Mg H: Half rate

Strips of sub plots: Until 1967 wheat alone was grown on the experiment, with some bare fallowing on strips of sub plots. From 1968, ten sub plots were started with the following cropping:-

		70,	71,	72,																
		73,	74,	75,																
		and	and	and																
SECTION	Section	68	69	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90		
0/39B	0*	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
1/24B	1	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
2/2B	2	BE	W	P	BE	W	F	P	W	F	P	W	W	W	F	P	W	W	W	W
3/3B	3	W	W	F	W	W	F	W	W	W	W	W	W	F	P	W	W	W	W	W
POTATOES	4	W	P	BE	W	P	P	W	F	P	W	F	P	W	W	W	F	P		
-	5	W	F	W	W	F	W	W	W	W	W	W	W	F	P	W	W	W	W	F
6/13B	6**	F	W	W	F	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
6/13S	6**	F	W	W	F	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
7/1B	7	P	BE	W	P	BE	W	F	P	W	F	P	W	W	W	F	P	W		
7/1S	7	P	BE	W	P	BE	W	F	P	W	F	P	W	W	W	F	P	W		
8/2B	8+	W	W	W	W	W	W	W	F	W	W	W	W	W	W	F	W	W		
9/32B	9	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W		
9/32S	9	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W		

W = w. wheat, P = potatoes, BE = s. beans, F = fallow

* Straw incorporated since 1987. ** No sprays except weedkillers since 1985. + No weedkillers.

B = Brimstone, S = Squareheads Master

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- NOTES:** (1) For a fuller record of treatments see 'Details' etc.
(2) From autumn 1975 to autumn 1986, chalk was applied at 2.9 t each autumn to all plots in sets of Sections on a three-year cycle. Year 1: Sections 1,2,3. Year 2: Sections 6,7,8,9. Year 3: Sections 0,4,5. Since autumn 1988 a five-year cycle has been used. Year 1: Sections 1,3. Year 2: Sections 2,8. Year 3: Sections 7,9. Year 4: Sections 4,6. Year 5: Sections 0,5.

Standard applications:

W. wheat: Manure: Chalk at 2.9 t (to sections 2 and 8 only).
Weedkillers: Glyphosate at 1.4 kg in 200 l (except to sections 7 and 8). Isoproturon at 1.7 kg with mecoprop at 2.0 kg in 200 l (except to section 8). Mecoprop at 2.2 kg, bromoxynil at 0.28 kg and ioxynil at 0.28 kg in 200 l (to sections 0, 1, 2 and 3). Mecoprop at 3.6 kg, bromoxynil at 0.45 kg and ioxynil at 0.45 kg in 200 l (to sections 6, 7 and 9). Fluroxypyr at 0.40 kg in 200 l (except to section 8). Fungicides (except to section 6): Prochloraz at 0.40 kg applied with the growth regulator in 200 l. Chlorothalonil at 1.0 kg with fenpropimorph at 0.75 kg in 200 l. Propiconazole at 0.12 kg with carbendazim at 0.25 kg and maneb at 1.6 kg in 200 l. Growth regulator (except to section 6): Chlormequat chloride at 1.6 kg.

Potatoes: Weedkillers: Glyphosate at 1.4 kg in 200 l. Linuron at 1.6 kg in 200 l. Fungicides: Maneb at 0.96 kg and zinc oxide at 0.022 kg applied with the insecticide in 200 l. Maneb at 0.96 kg and zinc oxide at 0.022 kg with a wetting agent, 'Bond' at 0.20 l, in 200 l. Mancozeb at 1.0 kg in 200 l on two occasions. Fentin hydroxide at 0.27 kg in 200 l on two occasions. Insecticide: Demeton-S-methyl at 0.24 kg in 200 l.

Fallow: Weedkiller: Glyphosate at 1.4 kg in 200 l.

Seed: W. wheat: Brimstone, dressed fonofos, and Squarehead's Master, both sown at 180 kg.

Potatoes: Pentland Crown.

Cultivations, etc.:-

All Sections:

K, Na and Mg applied: 14 Sept, 1989. P applied: 15 Sept. FYM applied: 27 Sept. Ploughed: 28 Sept. Spiked rotary cultivated: 7 Oct. Spiked rotary cultivated, rotary harrowed: 9 Oct.

Cropped Sections:

W. wheat: Straw chopped (section 0): 16 Aug, 1989. Glyphosate applied (except to sections 7 and 8): 29 Aug. Chalk applied (sections 2 and 8): 13 Sept. Autumn N treatments applied: 15 Sept. Rotary harrowed, all seed sown. 11 Oct. Isoproturon with mecoprop applied (except to section 8): 17 Nov. Spring N treatments applied: 9 Apr, 1990. Prochloraz with the growth regulator applied (except to section 6): 24 Apr. Mecoprop, bromoxynil and ioxynil applied to sections 0, 1, 2 and 3 and separately to sections 6, 7 and 9: 25 Apr. Chlorothalonil with fenpropimorph (except to section 6) and fluroxypyr (except to section 8) applied: 17 May. Propiconazole with carbendazim and maneb applied (except to section 6): 14 June. Combine harvested: 8 Aug.

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Cultivations, etc.:-

Potatoes: Glyphosate applied: 29 Aug, 1989. Deep-tine cultivated: 24 Nov. N treatments applied, rotary harrowed, potatoes planted, rotary ridged: 5 Apr, 1990. Linuron applied: 6 Apr. Maneb and zinc oxide with demeton-S-methyl applied: 15 June. Mancozeb applied: 29 June and 13 July. Maneb and zinc oxide with the wetting agent applied: 27 July. Fentin hydroxide applied: 13 Aug and 28 Aug. Haulm mechanically destroyed: 6 Sept. Lifted: 21 Sept.

Fallow: Glyphosate applied: 29 Aug, 1989. Deep-tine cultivated: 24 Nov. Heavy spring-tine cultivated: 23 Apr, 1990. Cultivated by rotary grubber: 17 May. Heavy spring-tine cultivated: 29 June and 17 July.

W.WHEAT

GRAIN TONNES/HECTARE

***** Tables of means *****

SECTION PLOT	7/1B	7/1S	2/2B	8/2B	3/3B	6/13B	6/13S	1/24B	9/32B	9/32S	0/39B
01DN4PK	9.43	*	9.08	*	7.25	8.39	*	*	*	*	*
21DN2	10.02	*	9.17	5.25	7.45	8.36	*	7.22	8.21	*	7.23
22D	7.94	*	6.91	5.38	6.05	6.29	*	5.64	6.44	*	5.88
030	2.70	2.18	1.62	1.67	1.15	1.36	1.39	1.12	1.06	1.33	1.60
05F	1.71	1.38	1.70	2.64	1.75	1.63	1.43	1.41	1.72	1.24	1.88
06N1F	5.52	4.12	5.13	4.61	4.22	4.12	2.77	3.26	4.72	3.48	5.05
07N2F	8.51	5.09	6.99	6.35	4.94	6.55	3.88	5.45	6.36	4.50	6.37
08N3F	9.49	5.26	8.10	7.35	6.44	7.72	4.31	6.74	7.84	4.69	7.36
09N4F	9.42	4.72	8.41	7.77	6.56	7.48	4.25	6.74	6.96	4.80	6.98
10N2	6.99	4.58	6.73	4.71	4.64	4.85	3.30	4.73	4.70	3.01	5.28
11N2P	8.28	5.75	7.10	5.58	5.87	5.19	3.77	4.87	5.37	3.41	5.87
12N2PNA	8.55	5.65	7.58	6.14	6.76	5.51	3.98	6.81	6.26	3.54	7.18
13N2PK	7.67	5.22	7.35	5.69	5.83	4.44	3.48	6.55	6.46	4.20	6.62
14N2PKMG	8.25	5.31	7.28	6.02	6.40	5.40	3.43	6.76	6.60	4.22	7.08
15N5F	9.19	5.05	9.11	7.12	7.19	8.00	4.03	7.60	7.16	4.34	8.07
16N6F	9.53	4.74	9.20	7.43	7.70	8.32	3.76	7.03	8.27	4.38	6.63
17N1+3FN	9.59	5.16	9.04	6.91	6.70	8.15	4.35	7.59	7.82	5.00	7.66
18N0+3FN	9.79	5.35	8.49	6.65	5.48	7.58	4.23	7.33	7.41	4.61	7.78
19C	3.64	3.43	2.71	1.57	1.52	2.14	1.81	2.58	1.84	1.94	2.12
20NKMG	*	*	*	*	*	*	*	3.82	*	*	4.52

GRAIN MEAN DM% 89.7

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STRAW TONNES/HECTARE

***** Tables of means *****

SECTION PLOT	7/1B	7/1S	1/24B
01DN4PK	6.71	*	*
21DN2	6.28	*	4.65
22D	2.57	*	2.66
030	0.49	1.23	0.39
05F	0.25	0.67	0.39
06N1F	1.44	2.28	1.24
07N2F	2.50	5.05	2.53
08N3F	3.87	7.07	2.68
09N4F	2.87	7.59	2.75
10N2	1.71	4.61	1.82
11N2P	2.11	4.69	1.82
12N2PNA	2.73	4.97	2.52
13N2PK	1.81	4.95	1.79
14N2PKMG	2.24	4.23	2.20
15N5F	3.19	7.16	2.83
16N6F	5.13	8.04	2.75
17N1+3FN	3.44	7.00	2.18
18N0+3FN	3.73	7.27	2.30
19C	0.68	1.72	0.57
20NKMG	*	*	1.22

STRAW MEAN DM% 88.9

POTATOES

***** Tables of means *****

PLOT	TOTAL TUBERS	% WARE
	TONNES/ HECTARE	3.81 CM (1.5 INCH) RIDDLE
01DN4PK	14.5	71.8
21DN2	20.5	89.1
22D	19.6	87.4
030	3.7	41.4
05F	7.2	53.6
06N1F	13.7	79.8
07N2F	12.4	74.9
08N3F	17.9	85.2
09N4F	18.9	86.4
10N2	5.1	59.7
11N2P	6.0	64.9
12N2PNA	7.1	64.5
13N2PK	9.4	73.2
14N2PKMG	16.9	82.8
15N5F	20.9	86.9
16N6F	20.9	86.7
17N3FH	7.1	64.2
18N3FH	14.0	82.3
19C	6.2	55.3