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Results of the Classical and Other Long-term Experiments 2022

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Rothamsted Research

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22/R/HB/2 HOOSFIELD SPRING BARLEY

Object: To study the effects of organic manures and inorganic fertilizers on continuous spring barley. From 1968 to 1978 a rotation of potatoes, beans and spring barley was practised on parts of the experiment. The rotation was discontinued in 1979 and the whole experiment reverted to continuous spring barley. The experiment was modified for 2003. The main plots continue as previously. The Silicate Test plots continue but are not split to test rates of N (basal N is applied). The remaining plots are to be used to study the effect on yield of P residues (basal N applied).

The 171st year, spring barley.

For previous years see 'Details' 1967 and 1973, Station Report for 1966 and Yield Books for 74-21/R/HB/2.

Treatments:

Whole plots

MANURE		Fertilizers and Organic Manures:		
	Plot	Form of N 1852-1966	Additional treatments 1852-2002	Treatments since 2003
---	11	None	-	-
-P-	22	None	P	(P)
--K	31	None	K (Na) Mg	K(Mg)
-PK	41	None	PK (Na) Mg	(P) K (Mg)
A--	12	A	-	-
AP-	22	A	P	(P)
A-K	32	A	K (Na) Mg	K(Mg)
APK	42	A	PK (Na) Mg	(P) K (Mg)
D1852	72	None	D	D
(D)	71	None	(D)	(D)
(A)	62	None	(Ashes)	(Ashes)
-	61	None	-	-
D2001[(a)]	73[(a)]	-	D	D
P2KMg[(a)]	63[(a)]	-	P2KMg	P2KMg

[(a)] Plots 63 and 73 started in 2001

A: 48 kg N as sulphate of ammonia
P: 35 kg P as triple superphosphate in 1974 and from 1988 to 2002, single superphosphate in other years
(P): (none) under review
P2: 44 kg P as triple superphosphate since 2001
K: 90 kg K as sulphate of potash
(Na): (none), 16 kg Na as sulphate of soda until 1973
Mg: 35 kg Mg as kieserite every third year since 1974 (applied at 30 kg in 1992, 1995 and 1998) (sulphate of magnesia annually until 1973). Annually at 35 kg Mg to new plot 63.
(Mg): (none) under review
D1852: Farmyard manure at 35 t (fresh weight) since 1852
D2001: Farmyard manure at 35 t (fresh weight) since 2001
(D): Farmyard manure at 35 t (fresh weight) 1852 – 1871 only
(Ashes): Weed ash 1852-1916, furnace ash 1917-1932, none since

Sub-Plots

N Nitrogen fertilizer (kg N), as "Nitro-Chalk" (calcium ammonium nitrate), since 1968 (cumulative N applications until 1973, on a cyclic system since 1974): 0, 48, 96, 144 kg N/ha

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Silicate Test plots

Treatments:

Whole plots

MANURE	Plot	Fertilizers: Additional treatment 1852-1979	Changes since 1980	Treatments since 2003
N----	131	-	-	N3
NP---	231	P	-	N3 (P)
N-K--	331	K(Na)Mg	-	N3 K(Mg)
NPK--	431	PK(Na)Mg	-	N3 (P)K(Mg)
N---S	132	-	Si added	N3 Si
NP--S	232	P	Si added	N3 (P)Si
N-K-S	332	K(Na)Mg	Si added	N3 K(Mg)Si
NPK-S	432	PK(Na)Mg	Si added	N3 (P)K(Mg)Si
N--SS	133	Si	-	N3 Si
NP-SS	233	P Si	-	N3 (P)Si
N-KSS	333	K(Na)MgSi	-	N3 K(Mg)Si
NPKSS	433	PK(Na)MgSi	-	N3 (P)K(Mg)Si
N—S-	134	Si	no Si	N3 (Si)
NP-S-	234	P Si	no Si	N3 (P)(Si)
N-KS-	334	K(Na)MgSi	no Si	N3 K(Mg)(Si)
NPKS-	434	PK(Na)MgSi	no Si	N3(P)K(Mg)(Si)

N: From 1852-1966 whole plots received 48 kg N as nitrate of soda. Between 1968-2002 whole plots were split to test 4 rates of N as "Nitro-chalk" (calcium ammonium nitrate) (cumulative applications until 1973, on a cyclic system from 1974).
N3: Basal N, 144 kg N as "Nitro-chalk" (calcium ammonium nitrate) since 2003
Si: Silicate of soda at 450 kg (Note: S also refers to silicate of soda)
(Si): Silicate of soda omitted since 1980
P, (P), K, Mg, (Mg), (Na): as above

Phosphorus Test plots

Treatments:

Since 2003 the remaining plots [ex-Castor meal (plots 14, 24, 34 & 44) and those testing combinations of NPK with and without Mg (Strip 5 plots 55, 56, 57 & 58)] have been used to study the effect of P residues on yield. Previous treatments have resulted in different levels of available P in the soil. Large dressings of K were applied to some plots to increase levels of exchangeable K in the soil such that K should not limit yield; plots 141 and 241 were sacrificed and used as discard areas so that the K application did not encroach on adjacent no K plots on the Silicate Test. Other plots received the normal rate of K. The level of exchangeable Mg in the soil is such that Mg should not limit yield; the need to apply Mg was reviewed for 2017.

Whole plots

Manure

Plots	Treatment since 2003	Plots	Treatment since 2003
142, 143, 144	N3K*	551, 552	N3K
242, 243, 244	N3K*	561, 562	N3K
341, 342, 343, 344	N3K	571, 572	N3K*
441, 442, 443, 444	N3K	581, 582	N3K*

N3: Basal N, 144 kg as "Nitro-chalk" (calcium ammonium nitrate)
K: 90 kg K as sulphate of potash
K*: 450 kg K as sulphate of potash 2003-2004; 90 kg K since

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Experimental Diary

Date		Application	Rate	Units
06/10/2021	f	Applied using Cascade Spreader, JD6830; Sulphate of Potash (SOP) using Cascade Spreader, JD6830; Plots 141-144, 241-244, 311-314, 321-324, 331-334, 341-344, 411-414, 421-424, 431-434, 441-344, 551,552,561,562, 571, 572, 581, 582, 631-634	217	kg/ha
06/10/2021	f	Applied; Triple Superphosphate (TSP); Plots 631-634	215	kg/ha
06/10/2021	f	Applied; Kieserite; Plots 631-634	233	kg/ha
08/10/2021	f	Applied; Farmyard Manure (FYM); Plots 721-724, 731-734	35	t/ha
02/11/2021	p	Sprayed using Knight 24m Sprayer, NH T6030; Samurai (16238)	2	L/ha
02/11/2021	p	Sprayed using Knight 24m Sprayer, NH T6030; Buffalo Elite	1	L/ha
03/11/2021	f	Applied using Cascade Spreader, JD6830; Silicate of Soda using Cascade Spreader, JD6830; 132, 133, 232, 233, 332, 333, 432, 433	450	kg/ha
09/11/2021	a	Topped using McConnel SR620 Batwing Topper, JD6230	-	-
22/11/2021	a	Plough 20 cm using KV Five Furrow Plough, JD6145R Premium; direction E; soil thrown S	-	-
23/03/2022	a	Cultivate/level using Cousins Spring Tines, JD6830	-	-
23/03/2023	s	Drilled using Accord Combination Drill No. 4, JD6830; Spring Barley (Diablo), trt Rancona i-Mix (19847)	-	-
24/03/2022	a	Rolled using 6m Flexicoil Cambridge Roll, JD6230	-	-
29/04/2022	p	Sprayed using Micron shrouded plot end sprayer, JD5620; Samurai (16238)	3	lt/ha
29/04/2022	p	Sprayed using Micron shrouded plot end sprayer, JD5620; Buffalo Elite	1	lt/ha
09/05/2022	a	Power harrow cutting paths Kilworth Power Harrow 1.3 m Iseki ISTH4335	-	-
10/05/2022	f	Applied NitroChalk (27% N) by Hand; Plots 112, 123, 212, 223, 314, 324, 414, 422, 613, 624, 634, 711, 722, 731	177	kg/ha
10/05/2022	f	Applied NitroChalk (27% N) by Hand; Plots 114, 122, 213, 224, 312, 323, 411, 424, 612, 622, 632, 714, 723, 733	355	kg/ha
10/05/2022	f	Applied NitroChalk (27% N) by Hand; Plots 111, 121, 214, 221, 311, 322, 413, 423, 614, 623, 633, 713, 724, 734	532	kg/ha
09/05/2022	f	Applied Nitram (34.5%) using Cascade Spreader, JD6830; Old Strip 5 (551, 552, 561,562, 571, 572, 581, 582), Series C (141 to 144, 241 to 244, 341 to 344, 441 to 444) and Series AA (131 to 134, 231 to 234, 331 to 334, 431 to 434)	417	kg/ha
23/05/2022	p	Sprayed using Knight 24m Sprayer, NH T6030; Presite X (18776)	75	g/ha
23/05/2022	p	Sprayed using Knight 24m Sprayer, NH T6030; Hallmark with Zeon Technology (12629)	50	mL/ha
23/05/2022	p	Sprayed using Knight 24m Sprayer, NH T6030; Cello (18290)	0.6	L/ha
23/05/2022	p	Sprayed using Knight 24m Sprayer, NH T6030; Bugle (17821)	0.7	L/ha
23/05/2022	p	Sprayed using Knight 24m Sprayer, NH T6030; Axial Pro (10910)	0.6	L/ha
23/05/2022	p	Sprayed using Knight 24m Sprayer, NH T6030; Moraine (19608)	0.6	L/ha
19/06/2022	p	Sprayed using Knight 24m Sprayer, NH T6030; Mobius (13395)	0.4	L/ha
09/08/2022	a	Harvest (Combine) using Claas Tucano 430; Surrounds	-	-
11/08/2022	a	Harvest (Combine) using Claas Tucano 430; Odds and Ends	-	-
11/08/2022	a	Harvest (Combine using Haldrup C-85 2m cut	-	-

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Yields

Main Plots

Grain Yield, tonnes/hectare

Table of means

N	0	48	96	144	Mean
MANURE					
---	0.68	0.88	0.93	1.13	**0.91**
-P-	2.15	2.90	3.08	3.20	**2.83**
--K	1.59	2.09	2.18	2.14	**2.00**
-PK	1.65	3.12	3.69	4.59	**3.26**
A--	1.00	0.91	0.74	0.71	**0.84**
AP-	2.29	3.40	3.75	3.45	**3.22**
A-K	1.32	1.41	1.30	1.57	**1.40**
APK	1.73	2.90	3.87	4.74	**3.31**
FYM1852onwards	7.05	8.06	8.05	7.89	**7.76**
FYM1852-1871	0.69	*0.81	4.63	2.39	**2.13**
(A)	1.46	2.87	2.49	2.47	**2.32**
-	1.40	1.87	1.69	1.84	**1.70**
FYM2001onwards	6.12	7.22	7.07	7.44	**6.96**
P2KMg	2.66	3.16	4.49	5.05	**3.84**
Mean	**2.27**	**2.97**	**3.42**	**3.47**	**3.04**
Grain mean DM%	92.4				

Straw Yield, tonnes/hectare

Table of means

N	0	48	96	144	Mean
MANURE					
---	2.88	2.70	2.55	2.75	**2.72**
-P-	0.79	2.79	0.82	3.03	**1.86**
--K	0.46	3.19	2.92	0.87	**1.86**
-PK	3.06	3.80	1.70	4.42	**3.25**
A--	0.78	2.82	0.99	**	**1.53**
AP-	2.85	0.98	1.92	0.75	**1.62**
A-K	0.42	0.98	0.96	0.67	**0.76**
APK	0.53	1.47	1.84	2.16	**1.50**
FYM1852onwards	5.03	3.54	3.01	3.96	**3.88**
FYM1852-1871	2.47	*2.62	2.21	1.28	**2.14**
(A)	0.45	1.43	1.04	1.38	**1.07**
-	3.07	2.28	0.73	4.41	**2.62**
FYM2001onwards	2.54	2.65	2.16	3.60	**2.74**
P2KMg	**	3.97	1.87	3.17	**3.00**
Mean	**1.95**	**2.51**	**1.76**	**2.50**	**2.18**

Straw mean DM%	89.1	
Plot Area (ha)	0.00244	0.00183

Notes

* On 6 May 2022 there was a leak in the irrigation main the previous week, and the southeast corner of Hoosfield had a lot of water discharged. Plot 711 (FYM1852-1871;N1) was observed to have received a lot of water.

** There were incorrect straw dry matters for Plot 121 (A--;N3) and Plot 631 (P2KMg;N0), and so there are corresponding missing straw yields.

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PHOSPHATE PLOTS

Grain Yield, tonnes/hectare

Tables of means

PLOTS	
142	2.92
143	2.87
144	2.36
242	5.22
243	5.10
244	4.66
341	3.28
342	3.77
343	4.15
344	4.55
441	4.26
442	5.11
443	4.74
444	5.07
551	5.26
552	4.89
561	4.77
562	4.51
571	3.53
572	4.10
581	0.89
582	0.90
Mean	**3.95**

Grain Mean DM%	89.8
Plot area Harvested (ha)	0.00244

SILICATE PLOTS

Grain Yield, tonnes/hectare

Tables of means

PK	**N3--**	**N3P-**	**N3-K**	**N3PK**	**Mean**
Silicate					
(-)-	1.23	3.64	1.47	4.85	2.80
(Si)-	1.60	4.25	2.88	5.38	3.53
(-)Si	2.32	3.74	2.82	4.88	3.44
(Si)Si	2.11	3.78	3.20	5.21	3.58
Mean	**1.82**	**3.85**	**2.59**	**5.08**	**3.34**
Grain Mean DM%	89.3				
Plot area harvested (ha)	0.00244				