

THE INFLUENCE OF STRAW RESIDUES ON NUTRIENT UPTAKE AND GRAIN YIELD OF WHEAT

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Field trials conducted in 1967 and 1968 determined the extent of immobilization of nitrogen and minor elements during the microbial degradation of wheat straw. The results have indicated that the direct physical effects of the straw on plant growth are greater than its effect on fertility. In 1967 when surface crusting was a problem, addition of straw to a Grey Wooded soil tended to increase yields. In 1968 the opposite was true. Tracer N15 experiments (Myers, 1969) conducted under field conditions have shown that the addition of 2 ton straw per acre results in the temporary immobilization of 4 lb of N. This amount of nitrogen has a yield potential of about 2-3 bu per acre. This yield difference usually cannot be measured significantly in normal field experiments especially where other factors such as the physical effects of the straw are prevalent. Tracers must be utilized to obtain the information relating to the tie-up of nitrogen by the straw residues.

Plant and soil samples were taken at regular intervals from the field trial on the Orthic Black soil (Blaine Lake Association) in 1967. The concentration of other nutrients (P,K,Ca,Mg,Zn,Fe,Mn and Cu) in the plants were not affected at any growth stage by the incorporation of straw (Tahir, 1969). When nitrogen fertilizer was applied with phosphorus to the straw incorporation plots, the total amount of nutrient removed in the above ground portion of the wheat plants was found to be significantly increased. For instance, on the plot which had three ton of straw incorporated (plus fertilizer 52 lb N 13 lb P/acre) the amount of Zn,Mn,Cu, and Fe removed in the plant material was approximately double that removed in the check plot. Micronutrient supply did not limit yield on any of these plots as (1) application of micronutrients to the growing crop did not increase yield and (2) soil analyses showed that the levels of extractable nutrient in the soil were not seriously depleted.

A further study, conducted in the greenhouse, examined the effect of adding straw to an Orthic Black and a Grey Wooded soil (Blaine Lake and Waitville associations respectively) on the uptake of a monovalent cation. Cesium¹³⁷ was used as a tracer and wheat was the plant grown in this pot experiment. The addition of straw increased the uptake of Cs from the Waitville soil but did not affect the uptake from the Blaine Lake soil. An examination of the soil chemical properties suggest that the difference may be due to a cation antagonism.

Effect of fertilizer addition on the macronutrient composition of wheat plants on stubble-present (normal) soil (in percent)

Blaine Lake soil association (Rosthern plot)

Growth Stage	%N			%P			%K			%Ca			%Mg		
	A	B	D	A	B	D	A	B	D	A	B	D	A	B	D
1st Node	3.3	3.1	3.5	0.36	0.36	0.31	3.01	2.53	4.04	0.20	0.22	0.29	0.23	0.17	0.20
Boot	2.1	1.9	2.3	0.32	0.32	0.27	2.04	2.07	2.30	0.16	0.11	0.15	0.15	0.14	0.21
Flowering	1.5	1.5	1.8	0.39	0.30	0.25	0.91	0.77	0.89	0.16	+Lo	+Lo	0.13	0.11	0.13
Maturity	1.4	1.6	1.8	0.42	0.38	0.32	0.97	0.67	0.70	0.11	+Lo	+Lo	0.17	0.14	0.14

Effect of fertilizer addition on the micronutrient composition of wheat plants on stubble-present (normal) soil (in ppm).

Blaine Lake soil association (Rosthern plot)

Growth Stage	Zn ppm			Mn ppm			Fe ppm			Cu ppm		
	A	B	D	A	B	D	A	B	D	A	B	D
1st node	35	31	37	51	52	44	95	115	110	7	7	7
Boot	28	30	15	46	62	55	63	83	112	6	8	9
Flowering	40	36	47	55	61	56	95	85	99	7	7	8
Maturity	46	40	54	68	59	73	89	91	134	6	5	7

A = 0N 0P
 B = 7N 13P
 D = 52N 13P

Blaine Lake Grain Data 1967

<u>Treatment</u>		<u>Straw Removed</u>	<u>Stubble</u>	<u>Stubble + 1 Ton</u>	<u>Stubble + 3 Ton</u>
N	P	<u>bushels per acre</u>			
0	0	14.0	13.2	13.1	15.1
7	13	14.4	13.6	14.0	15.3
27	13	15.6	16.4	16.7	17.0
52	13	17.9	18.4	18.5	21.4
77	13	19.7	20.2	18.1	19.3

L.S.D.	N	P	
	0	0	- Control
	7	13	- N.S.
	27	13	- 2.6
	52	13	- 5.2
	77	13	- 5.5

Waitville Grain Data 1967

<u>Treatment</u>		<u>Straw Removed</u>	<u>Stubble</u>	<u>Stubble + 1 Ton</u>	<u>Stubble + 3 Ton</u>
N	P	<u>bushels per acre</u>			
0	0	6.8	11.1	7.3	8.2
7	13	10.0	10.8	11.3	11.8
27	13	10.4	14.5	17.9	17.0
52	13	9.2	11.4	14.5	18.2
77	13	8.9	10.7	19.3	22.6

L.S.D.	N	P	
	0	0	- Control
	7	13	- N.S.
	27	13	- 6.6
	52	13	- N.S.
	77	13	- 7.1

1968

<u>Treatment</u>		<u>Straw Removed</u>	<u>Stubble</u>	<u>Stubble + 1 Ton</u>	<u>Stubble + 3 Ton</u>
N	P				
0	0	20.5	18.4	25.2	20.3
7	13	26.4	30.4	18.2	16.1
27	13	26.8	29.9	24.7	21.3
52	13	38.2	30.8	28.9	26.4
77	13	34.6	23.3	25.2	29.5