

## Winter Wheat

Two uniform fertility trials were seeded in the fall of 1956. These trials are given in the 1955 and 1956 annual reports of the Northwestern Montana Branch Station, and will not be included in this report.

One fertilizer trial was located on the George Hubbard farm in Flathead County,  $1\frac{1}{2}$  miles northwest of the station. This soil is a fine sandy loam, on the Creston bench. Complete data was obtained, per specifications from this nursery. A slight modification was made in the other nursery located twelve miles east of Stevensville in Ravalli County. Because of the distance from the station, only moisture and yield data were obtained. Protein and Phosphours determinations will be made on the grain. Four row plots were used in the Ravalli County nursery, as compared to six in the Flathead County Nursery.

### Results and Discussion

Precipitation was 4.42 inches below normal for the crop year, September 1, 1956 to August 30, 1957 in the Creston area this past season. Weather data is taken from records at the Northwestern Montana Branch Station. This accounts in part for the low yields obtained and the lack of response to nitrogen normally obtained in this area. Twenty-one and Twenty-eight hundredths inches (21.28 in.) of moisture were used in growing 23.1 bushels of grain in 1956-57 in this trial. All moisture determinations were made from the check plot. Table XVI, gives data on these calculations.

Tables XVII, XVIII, and XIX show plot yields and averages of forage weights taken at three stages of growth, namely 6-8 inches, before heading, and at harvest. In all cases significance was found when analysed statistically. Given in table XX are data for grain yields of individual plots.

Table XXI gives a summary of all data obtained in 1957 except moisture data found in table XVI. Quality data has not been received at this time and should be included in the 1958 annual report. The highest yielding grain was obtained by using 30 pounds of nitrogen and 60 pounds of  $P_2O_5$  per acre. Also the greatest return per acre, or \$31.35 per acre. However, when compared to the 15 pound rate of  $P_2O_5$  per acre there was not any significance between these two treatments at the 5% level. There is a lower grain straw ratio at the 15 pound rate of  $P_2O_5$ . Lodging is high in the  $P_2O_5$  plots, because of the late maturity of nitrogen plots, harvest was delayed. With this delay and early maturity of  $P_2O_5$  plots, lodging was encouraged.

For the two year average, 30 pounds of  $P_2O_5$  has resulted in the greatest yield per acre. The greatest return per acre for a two year average was at the 30 pound rate of  $P_2O_5$  per acre and 30 pounds of nitrogen per acre, or \$36.07. The 30 pound rate of  $P_2O_5$  per acre gave a return of \$35.01 per acre. This would appear to be the more economical rate because of transportation and handling cost. These figures include the gross return less cost of fertilizer and check value. See table XXII.

Table XVI. Moisture data taken from untreated plots of the uniform fertility study on Wasatch winter wheat grown on the George Hubbard farm, Creston, Montana in 1955-56.

Depth in Inches	Moisture in Percent at seeding					Moisture in percent at harvest					Loss in Inches	Loss Total	
	I	II	III	Total	Ave- rage	I	II	III	Total	Ave- rage			Loss %
0-6	27.1	26.7	20.0	73.8	24.6	9.4	9.2	8.5	27.1	9.0	15.6	1.22	
6-12	21.7	27.0	20.0	68.7	22.9	9.7	7.2	7.1	24.0	8.0	14.9	2.32	
12-24	23.3	17.5	19.2	60.0	23.3	8.1	6.7	5.9	20.7	6.9	16.4	2.56	
24-36	14.4	16.4	17.1	47.9	16.0	6.6	5.3	7.2	19.1	6.4	9.6	1.50	
36-48	17.0	19.2	12.5	48.7	16.2	10.9	6.7	6.6	24.2	8.1	8.1	1.26	8.86

-  
25  
-

Precipitation, seeding to harvest, 12.42

Total moisture used in production, 23.1 bushels of Winter Wheat was 21.28 inches.

Table XVII. Agronomic data from Uniform fertility study on the George Hubbard farm, Creston, Montana 1956-57 on Wasatch winter wheat. Six row plots three replications. Total plant cutting, dry weight, 6 to 8 inches tall, May 18, 1957.

Treatment and Rate per acre		Plot weights in grams			Total Grams	Average Pounds Per Acre
N	P <sub>2</sub> O <sub>5</sub>	I	II	III		
0	0	4.2	5.4	4.4	14.0	74.7
	15	11.6	11.8	18.7	42.1	224.6*
	30	31.0	12.0	28.6	71.6	382.0** ✓
15		4.7	7.2	8.7	20.6	109.9
15	15	23.4	14.9	27.4	65.7	350.5**
15	30	25.1	12.7	15.8	53.6	286.0**
30		3.7	3.5	5.0	12.2	65.1
30	15	9.8	15.8	25.0	50.6	270.0**
30	30	16.9	21.7	26.8	65.4	348.9** ✓
	60	9.5	18.1	18.7	46.3	247.0*
15	60	25.4	38.6	29.5	93.5	498.8** ✓
30	60	15.3	11.7	19.6	46.6	248.6*
	90	13.5	23.4	18.8	55.7	297.2** ✓
15	90	15.1	25.2	28.3	68.6	366.0** ✓
30	90	12.6	23.2	19.2	55.0	293.4** ✓

\*Treatments yielding significantly more than the check (5%).

\*\*Treatments yielding significantly more than the check (1%).

Analysis of Variance

Source	D.F.	Mean Square	F	
Reps	2	91.665	3.28	Mean Yield.....270.81
Treatment	14	164.935	6.91**	S. E. $\bar{x}$ ..... 48.8367
Error	28	27.9306		L.S.D. (5%).....142.5
Total	44			L.S.D. (1%)....190.5
				C. V. ....18.03%

Table XVIII. Dry weights of green material from Wasatch winter wheat cut, June 4, just before heading from uniform fertility trial on the George Hubbard farm, Creston, Montana 1956-57.

Planted. October 5, 1956

Size of Plot. 6 Square feet.

Treatment and Rate Per Acre		Grams Per Plot			Total Grams	Average Pounds Per Acre
N	P <sub>2</sub> O <sub>5</sub>	I	II	III		
0	0	39.4	42.9	47.7	130.0	693.6
	15	91.0	114.0	95.5	300.5	1603.2**
	30	124.1	136.4	112.4	372.9	1989.5**
15		16.3	50.7	28.3	95.3	508.4
15	15	132.3	99.5	131.7	363.5	1939.3**
15	30	105.9	122.9	134.2	363.0	1936.6**
30		43.0	137.3	36.6	216.9	1157.2
30	15	76.8	88.4	104.9	270.1	1441.0*
30	30	115.2	122.0	140.6	377.8	2015.6**
	60	125.6	161.2	140.1	426.9	2277.6**
15	60	122.5	160.6	163.0	446.1	2380.0**
30	60	75.2	150.1	186.9	412.2	2199.1**
	90	64.6	119.8	162.8	347.2	1852.3**
15	90	162.7	133.5	134.2	430.4	2296.2**
30	90	111.2	144.8	132.6	388.6	2073.2**

\*Treatments yielding significantly more than the check (5%).

\*\*Treatments yielding significantly more than the check (1%).

Analysis of Variance				Mean Yield.....1757.5
Source	D.F.	Mean Square	F	S. E. $\bar{x}$ .....232.4
Rep	2	2,929.82	4.63*	L.S.D. (5%).....673.8
Treatment	14	3,859.55	6.10*	L.S.D. (1%).....907.3
Error	28	632.745		C. V. ....13.22%
Total	44			

Table XIX. Straw-grain weights from uniform fertilizer test of Wasatch winter wheat on the George Hubbard farm, Creston, Montana 1956-57. Area harvested, 32 square feet.

Planted, October 5, 1956

Harvested, August 15, 1957

Size of Plot, 32 Sq. Ft.

Treatment and Rate per Acre		Ounces Per Plot			Total Ounces	Average Pounds Per Acre
N	P <sub>2</sub> O <sub>5</sub>	I	II	III		
0	0	37.00	59.25	49.25	145.50	4126.3
	15	62.25	85.00	82.25	229.50	6508.6**
	30	81.25	79.00	69.75	230.00	6522.7**
15		49.00	72.50	48.00	169.50	4807.0
15	15	63.00	65.50	53.25	181.75	5154.4
15	30	80.00	94.00	72.50	246.50	6990.7**
30		57.00	56.50	55.00	168.50	4778.6
30	15	64.00	87.00	64.00	215.00	6097.3**
30	30	76.00	79.00	79.00	234.00	6636.2**
	60	70.50	83.75	81.00	235.25	6671.6**
15	60	80.00	85.00	89.50	254.50	7217.5**
30	60	86.00	103.50	96.00	285.50	8096.7**
	90	73.75	94.50	64.75	233.00	6607.8**
15	90	77.50	88.25	60.00	225.75	6402.2**
30	90	86.75	91.00	60.00	237.75	6742.5**

\*Treatments yielding significantly more than the check (5%).

\*\*Treatments yielding significantly more than the check (1%).

Analysis of Variance				Mean Yield.....6224.3
Source	D.F.	Mean Square	F	S. E. $\bar{x}$ .....357.98
Rep	2	805.6	15.17	L.S.D.(5%).....1038.0
Treatment	14	489.416	9.21	L.S.D.(1%).....1397.0
Error	28	53.1104		C. V. ....5.75%
Total	44			

Table XX. Grain yield data from Uniform fertilizer nursery on winter wheat grown on the George Hubbard farm, Creston, Montana, 1957. Six row plots, three replications.

Planted. October 5, 1957      Harvested. September 3, 1957      Size of Plot. 32 Sq. Feet

Treatment and rate in Pounds Per Acre		Lod- ging %	Grams per Plot			Total Grams	Average Bushel Per Acre	Bushel Wt. in Pounds
N	P <sub>2</sub> O <sub>5</sub>		I	II	III			
0	0	45	333	560	490	1383	23.1	-
0	15	77	648	925	836	2409	40.2**	61.6
0	30	60	850	840	710	2400	40.0**	61.0
15	0	21	485	557	500	1542	25.7	60.0
15	15	47	670	670	499	1839	30.7*	61.5
15	30	80	755	905	758	2418	40.3**	61.2
30	0	17	575	550	550	1675	27.9	60.5
30	15	55	595	901	640	2136	35.6**	61.6
30	30	45	780	790	780	2350	39.2**	60.9
0	60	82	724	919	902	2545	42.4**	62.5
15	60	88	755	887	930	2572	42.9**	61.2
30	60	90	843	1030	860	2733	45.6**	60.9
0	90	87	760	975	685	2420	40.4**	61.9
15	90	77	796	950	655	2401	40.0**	61.0
30	90	98	877	957	655	2489	41.5**	61.0

\*Treatments yielding significantly more than the check (5%).

\*\*Treatments yielding significantly more than the check (1%).

Analysis of Variance

Source	D. F.	Mean Square	F
Rep	2	86,067.5	12.15**
Treatment	14	56,465.0	7.97**
Error	28	7,086.571	
Total	44		

Mean Yield....37.0  
 S. E.  $\bar{x}$ .....2.4309  
 L.S.D.(5%)....7.1  
 L.S.D.(1%)....9.5  
 C. V. ....6.57%

Table XXI. Summary of agronomic data of a uniform fertility trial conducted on the George Hubbard farm, with Wasatch winter wheat in 1956-57, Creston, Montana. Six row plots, three replications.

Planted, October 5, 1956

Harvested, August 15, 1957

Treatment and Rate Per Acre	N	P <sub>2</sub> O <sub>5</sub>	Dry Weights in lbs/A cutting made 6 to 8" tall <sup>1</sup>	Dry Weights in lbs/A cutting made before heading <sup>2</sup>	Grain Straw Weights in Lbs/Acre at Harvest <sup>3</sup>	Grain Straw Ratios	Yield in Bushel Per A.	Bushel Weight in Pounds	Lod- ging in %	Fert- ilizer cost	Gross Return Per Acre	Return above Fertilizer cost or Below
0	0		74.7	693.6	4126.3	1.97	23.1	-	45	0.00	42.04	-
	15		224.6*	1603.2**	6508.6**	1.70	40.2**	61.6	77	1.35	73.16	29.77
	30		382.0**	1989.5**	6522.7**	1.72	40.0**	61.0	60	2.70	72.80	28.06
15			109.9	508.4	4807.0	2.12	25.7	60.0	21	2.10	46.77	2.60
15	15		305.5**	1939.3**	5154.4	1.80	30.7*	61.5	47	3.45	55.87	10.38
15	30		286.0**	1936.6**	6990.7**	1.89	40.3**	61.2	80	4.80	73.35	26.51
30			65.1	1157.2	4778.6	1.86	27.9	60.5	17	4.20	50.78	4.54
30	15		270.0**	1441.0*	6097.3**	1.85	35.6**	61.6	55	5.55	64.79	17.20
30	30		348.9**	2015.6**	6636.2**	1.82	39.2**	60.9	45	6.90	71.34	22.40
30	60		247.0**	2277.6**	6671.6**	1.62	42.4**	62.5	82	5.40	77.17	29.73
15	60		498.8**	2380.0**	7217.5**	1.80	42.9**	61.2	88	7.50	78.08	28.54
30	60		248.6*	2199.1**	8096.7**	1.96	45.6**	60.9	90	9.60	82.99	31.35
	90		297.2**	1852.3**	6607.8**	1.72	40.4**	61.9	87	8.10	73.53	23.39
15	90		366.0**	2296.2**	6402.2**	1.67	40.0**	61.0	77	10.20	72.80	20.56
30	90		293.4**	2073.2**	6742.5**	1.70	41.5**	61.0	98	12.30	75.53	21.19
Means			270.8	1757.5	6224.3		37.0					
S E $\bar{x}$			48.8367	232.4	357.98		2.4309					
L.S.D.(5%)			142.5	673.8	1038.0		7.1					
L.S.D.(1%)			190.5	907.3	1397.0		9.5					
C.V.%			18.03	13.22	5.75		6.57					

\* 5% level  
\*\* 1% level

<sup>1</sup>May 18, 1957  
<sup>2</sup>June 4, 1957  
<sup>3</sup>August 15, 1957

Table XXII. Summary of economic data from fertilizer study on winter wheat as it pertains to fertilizers, cost, and value, 1956-57.

Treatment rate per acre N	Fert- ilizer P <sub>2</sub> O <sub>5</sub> Cost	1956			1957			Two Year Average			
		Yield in Bu. Per A.	Gross Return Per A.	Return above Fertilizer cost or below	Yield in Bu. Per A.	Gross Return Per A.	Return above Fertilizer cost or below	Yield.	Return Above Fert. Cost		
0	0	55.9	101.73		23.1	42.04		71.89	39.5		
	15	1.35	56.4	102.64	-44	40.2	73.16	29.77	87.91	48.3	29.33
	30	2.70	61.2	111.38	6.95	40.0	72.80	28.06	92.09	50.6	35.01
15	0	2.10	65.0	118.30	14.47	25.7	46.77	2.60	81.97	45.4	17.07
15	15	3.45	65.2	118.66	13.48	30.7	55.87	10.38	87.36	48.0	23.86
15	30	4.30	60.6	110.29	3.76	40.3	73.35	26.51	91.9	50.5	30.27
30		4.20	65.6	119.39	13.46	27.9	50.78	4.54	85.18	46.8	18.00
30	15	5.55	63.1	114.84	12.11	35.6	64.79	17.20	89.73	49.3	29.31
30	30	6.90	67.2	122.30	13.67	39.2	6.90	22.40	96.82	53.2	36.07

Wheat calculated @ 1.82/Bu.

P<sub>2</sub>O<sub>5</sub> - .09/lb.

N - .14/lb.



## Winter Wheat

### Results and Discussion (Mc Fadgen)

No precipitation records were obtained in the area where the uniform nursery was grown. However, yields in the winter wheat region in Ravalli county were about average in 1956-57.

Observation of these plots, July 11, 1957 were as follows:

- (a) Delay of maturity in the nitrogen plots.
- (b) No visual response from  $P_2O_5$  was noticeable on this date.

Table XXIII shows moisture data for, 0-6, 6-12 inch depths. Moisture data was obtained for 12-24, and 24-36 inch depths at seeding time, however moisture samples at these depths could not be obtained at harvest time. This was impossible with the equipment available and the extremely dry soil condition at harvest time. Therefore the moisture data shows only losses for the 0-6 and 6-12 inch depth. In that there were no precipitation records, complete weather data for this study could not be obtained.

High yields in this nursery were obtained using 30 pounds of nitrogen and 15 pounds  $P_2O_5$  per acre. The greatest return per acre was the 30 pound rate of nitrogen and 15 pounds of  $P_2O_5$  per acre or \$21.03 cents per acre. See table XXIV for yields and table XXV for economic data.

Table XXIII. Moisture data taken from untreated plots of the uniform fertility study on Wasatch winter wheat grown on the L. B. Mc Fadgen farm, Stevensville, Montana in 1955-57.

Depth in Inches	Moisture in Percent at seeding					Moisture in Percent at harvest					Loss in %	Loss in Inches
	I	II	III	Total	Ave- rage	I	II	III	Total	Ave- rage		
0-6	17.5	14.2	13.9	45.6	15.2	2.1	3.1	2.0	7.2	2.4	12.8	1.00
6-12	19.9	16.6	14.6	51.1	17.0	5.1	3.2	4.2	12.5	4.2	12.8	2.00

Table XXIV. Yield data from fertility nursery on winter wheat grown in Ravalli County on the L. B. Mc Fadgen farm, Stevensville, Montana 1957. Four row plots three replications.

Planted. October 10, 1956      Harvested. August 20, 1957      Size of Plot. 32 Square feet.

Treatment and Rate Per Acre		Cost of Fertilizer	Grams Per Plot			Total Grams	Average Bushels Per Acre	Bushel Weight in Pounds	Loss or Gain
N #/A	P <sub>2</sub> O <sub>5</sub> #/A		I	II	III				
0	0		545	664	515	1724	28.7	61.0	
0	15	1.35	565	540	265	1370	22.8	61.5	-12.08
0	30	2.70	675	540	485	1700	28.3	62.0	-3.43
15	0	2.10	710	626	534	1870	31.2	61.5	+2.45
15	15	3.45	683	675	770	2128	35.5*	61.5	+8.93
15	30	4.80	719	675	500	1894	31.6*	61.0	+ .48
30		4.20	845	870	510	2225	37.1*	62.0	+11.09
30	15	5.55	855	917 <sup>1</sup>	826	2598	43.3**	61.5	+21.03
30	30	6.90	750	774	685	2209	36.8*	61.5	7.66
0	60	5.40	530	610	370	1510	25.2	61.0	-11.77
15	60	7.50	575	725	517 <sup>1</sup>	1817	30.3*	61.2	-4.58
30	60	9.60	725	815	650	2190	36.5*	61.1	4.60
	90	8.10	510	490	435	1435	23.9	61.5	-16.83
15	90	10.20	718	653 <sup>1</sup>	435	1806	30.1	61.6	-7.63
30	90	12.30	545	575	550	1670	27.8	61.5	-13.93

<sup>1</sup>Calculated missing plot.

\*Treatments yielding more than the check (5%).

\*\*Treatments yielding more than the check (1%).

Mean Yield.....31.3  
 S. E.  $\bar{x}$ .....2.2826  
 L.S.D.(5%).....6.5  
 L.S.D.(1%).....9.0  
 C. V. ....7.29%

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	2	89,771.0	14.37**
Treatments	14	38,413.714	6.15**
Error	25	6,247.88	
Total	41		

Table XXV. Economic data from uniform fertilizer study grown on the L.B. Mc Fadgen farm, Stevensville, Montana, 1956-57. Wasatch winter wheat.

Treatment and Rate per Acre	Fertilizer Cost	Average Bushels	Gross Return	Gain or Loss on Check and cost of Fertilizer	
N	P <sub>2</sub> O <sub>5</sub>	Per Acre	Per Acre		
0	0	28.7	52.23		
	15	1.35	22.8	41.50	-12.08
	30	2.70	28.3	51.50	-3.43
15	0	2.10	31.2	56.78	2.45
15	15	3.45	35.5	64.61	8.93
15	30	4.80	31.6	57.51	.48
30		4.20	37.1	67.52	11.09
30	15	5.55	43.3	78.81	21.03
30	30	6.90	36.8	66.79	7.66
0	60	5.40	25.2	45.86	-11.77
15	60	7.50	30.3	55.15	-4.58
30	60	9.60	36.5	66.43	4.60
	90	8.10	23.9	43.50	-16.83
15	90	10.20	30.1	54.78	-7.63
30	90	12.30	27.8	50.60	-13.93