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Experiments in Wheat Culture.

By LUTHER FOSTER AND W. H. FAIRFIELD.

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Experiments in Wheat Culture.

Outline.

Introduction.
Variety Tests.
Inter-Tillage Versus Field Culture.
Quantity of Seed per Acre.
Subsoiling Versus Plowing.
Wheat After Alfalfa.
Profits of Wheat Growing.
Treatment for Smut.

Introduction.

In the following pages Mr. W. H. Fairfield has reported some experiments in wheat culture and has brought together, in popular form, the results of the various other investigations in this line that have been conducted at this Station and at the various substations in the State as reported from time to time in previous bulletins. The first experiments with wheat began in 1891. Since then the work has been continuous, including variety comparisons, the quantity of seed to sow per acre, stooling trials, cultural tests, the cost of growing wheat, and a number of other experiments intended to encourage farmers to engage more largely in wheat growing and thus develop that branch of farming as much as possible in Wyoming.

The information obtained through these experiments is given in this bulletin with only enough detail for clear understanding, the facts being condensed and arranged for easy reference.

Since the organization of the Station, ten years ago, the acreage of wheat has gradually increased until, in the area cultivated, it is the principal grain crop, though the amount produced is small in comparison with some of our neighboring states.

The following table, compiled from the reports of the Statistician of the United States Agricultural Department, shows some facts of interest concerning the wheat crop from 1891 to 1900:

Wyoming Wheat Crop, 1891 to 1900.

Acreage, Yield and Value.

YEAR.	Acres.	Bushels.	Dollars.	Bushels per Acre.	Value per Acre.	Price per Bushel.
1891	5,500	110,000	$ 90,200	20.0	$16.40	$0.82
1892	5,775	101,000	66,702	17.5	11.55	.66
1893	5,082	95,033	61,771	18.7	12.15	.65
1894				19.6	12.35	.63
1895	7,623	198,198	126,847	26.0	16.64	.64
1896	9,148	224,126	138,958	24.5	15.19	.62
1897	19,083	477,075	333,952	25.0	17.50	.70
1898	22,136	524,623	361,990	23.7	16.35	.69
1899	21,029	395,345	264,881	18.8	12.60	.67
1900	20,819	366,414	278,475	17.6	13.38	.76

It will be seen that the acreage increased from 5500 acres in 1891 to 22,136 acres in 1898, since which time it has slightly declined. The total yield and value of the crop were also greatest for that year. In comparison with other states the average yield per acre for all the years is high. As an example of comparison, in 1895 when the average in Wyoming was 26 bushels per acre, the average for South Dakota was only 12 bushels, Washington 15.5 bushels, Idaho 17.8 bushels, Nebraska 12 bushels, Kansas 7.7 bushels, and the general average for all the states was 13.72 bushels. At present there is not enough wheat produced in the State to supply its population with bread. Even in

some localities where mills have been erected, there is not enough wheat produced to supply the local markets with flour and merchants have to secure the larger part of their supply from neighboring states. Wheat is a sure crop in almost all parts of the State and it ought to be a profitable one, too, because of the large yields, small expense of tillage and strong home demand. As the crop producing areas of the State become more thickly settled and secure railway communication, the wheat crop will doubtless increase sufficiently to supply, at least, the people of the State with bread.

SUMMARY OF RESULTS.

From the matter presented in the following pages, the conclusions given below have been drawn:

1. A large proportion of the wheat varieties tested gave very satisfactory results, but the following are recommended as among the best: Velvet Chaff, Scotch Fife, Scotch of Scotch, Saskatchewan Fife, Nox, and Pride of America.

2. While the work on inter-tillage versus field culture has given nothing definite enough upon which to base a conclusion, it may be safely stated that under present conditions the inter-tillage of wheat will not sufficiently increase the yield to pay for the extra labor required.

3. The results of the stooling experiment indicate that 70 pounds of thoroughly cleaned seed wheat is ordinarily a sufficient quantity to sow per acre, but in high altitudes where the seasons are short or when the seeding is delayed beyond the usual time a larger quantity should be used to shorten the time required for maturity.

4. The effects of one subsoiling continued through a period of three or more years and were more apparent the second year after the subsoiling was done than they were the first and still more apparent the third year than the second. An average of all the observations taken, three seasons at Laramie, two at Sheridan and one each at Wheatland and Sundance, shows a

single subsoiling to have increased the yield of wheat 251 pounds per acre.

5. The wheat following alfalfa produced eight to twelve dollars more per acre than that following potatoes and grain.

6. The total cost of raising an acre of wheat, including seed, labor, irrigation, harvesting and threshing need not exceed $7.75. The average value of an acre of wheat at local prices, including fifteen tests at six different places in the State, was $20.54. Deducting the cost of production, $12.79 was left as profit and interest on the investment.

LUTHER FOSTER.

Experiments in Wheat Culture.

BY W. H. FAIRFIELD.

Variety Test at Laramie, 1896.*

In carrying out a test to determine the best of a number of varieties of any particular crop, it is necessary that the kinds to be compared should be grown under conditions as nearly the same as it is possible to make them. They should be grown the same season, on the same kind of soil, which has received uniform treatment for at least a few previous seasons. A variety test which answers these conditions fairly well was carried out in 1896 on the Experiment Farm at Laramie. There were sixteen varieties of wheat planted on Acre Plat 10. This plat had been broken from the native sod in the spring of 1891 and had been in cultivation since. The crop grown on the land the year previous to this test was rutabagas and cabbages. Each plat of wheat was laid out so that it contained the same area of land grown in rutabagas and cabbages respectively as every other plat. The rutabagas and cabbages were planted east and west in two strips, while the wheats were planted in strips running north and south. On April 20th and 22nd the plat was plowed seven to eight inches deep, on the 23d it was harrowed and leveled with a clod crusher and on the 24th the different varieties of wheat were planted with a press drill. There was one-twentieth of an acre planted with each variety. The seed

*The experime ts reported in this bulletin were conducted under Professor Buffum's direction. Mr. W. H. Fairfield was connected with the institution as Superintendent of the Station Farm from July, 1896, until April 1, 1901.

of all the varieties was treated with blue vitriol for the prevention of smut. Before the plats were ready to be harvested, fifty feet from the south end of each variety was cut. The balance of the plats was carefully harvested when ready and the yields were computed from these areas.

It is important to note that no fertilizer of any description had ever been applied to this ground since its cultivation began. The varieties were irrigated on June 20th and July 23d. The following table gives the results obtained:

Variety Test of Wheats, Laramie, 1896.

VARIETY	Date Harvested	Height	Length of Head	Matured in Days	Yield per Acre of Grain	Yield per Acre of Grain
		ft.	*ft.*		*lbs.*	*bu.*
Amethyst	Sept. 10	3.6	0.30	139	1956	32.5
Australian Club	Aug. 29	3.3	0.25	127	1891	31.5
Bearded Oregon	Sept. 2	3.5	0.26	131	1904	31.7
Blounts No. 16	Sept. 3	3.1	0.28	132	1930	32.0
Blue Stem	Sept. 10	3.6	0.30	139	1366	22.7
Chili	Sept. 10	3.9	0.32	139	1996	33.2
Improved Fife	Sept. 10	3.8	0.30	139	1864	31.0
Niagara	Sept. 5	3.2	0.22	134	1891	31.5
Nox	Sept. 5*	3.5	0.28	134	2022	33.7
Polish	Sept. 2	3.5	0.35	131	1339	22.2
Pride of America	Sept. 2	3.8	0.20	131	2022	33.7
Saskatchewan Fife	Sept. 5*	3.7	0.275	134	1799	29.9
Scotch Fife	Sept. 10	3.2	0.25	139	1891	31.5
Scotch of Scotch	Sept 5	3.7	0.29	134	2232	37.2
Seven Headed	Sept. 3	4.0	0.25	132	1720	23.6
White Touse	Sept. 3	3.9	0.30	132	2258	37.6

*Part of plat was not ripe at this date and so was not harvested until Sept. 10.

The White Touse did the best, giving a yield of 2258 pounds of grain per acre, or expressed in bushels, 37.6. The Scotch of Scotch did nearly as well, yielding 2232 pounds, or 37.2 bushels. The Nox and Pride of America came next in rank, they having both yielded the same, 2022 pounds, or 33.7 bushels.

VARIETY TEST, 1899.

A small variety test was carried out in 1899, but on account of the seed being planted too late the wheats did not fully mature. This will be of value, at least, in illustrating the importance of early sowing.

Five of the better varieties were planted on Acre Plat 3. Cabbages had been grown on the land the previous season. The ground was not plowed but was gone over with a disk harrow and then a smoothing harrow and clod crusher. May 12th the wheats were planted with a press drill. This is at least two weeks later than wheat should be sown on the Laramie Plains. To insure the maturing of the crop it is best to plow the land in the fall and then sow the wheat as early in the spring as possible. Any time in April will do. The seed of the five varieties was treated with blue vitriol to prevent smut. The following table gives the results:

VARIETY.	Date Harvested	Height	Length of Heads	Yield per Acre of Straw	Yield per Acre of Grain	Weight per Bushel
		ft.	*ft.*	*lbs.*	*lbs.*	*lbs.*
Amethyst	Sept. 14	3.25	0.32	652	816	54
Blounts No. 16	Sept. 14	3.25	0.28	1293	1194	55
*Chili	Sept. 14	3.25	0.27	1890	736	53
Improved Fife	Sept. 14	3.50	0.30	3264	1214	53
Scotch of Scotch	Sept. 14	3.25	0.30	4050	1224	53

*This variety was planted on one side of the acre plat and adjacent to a hedge of willows which had so impoverished the soil, or drew such an amount of moisture from it, that this variety did not make nearly so vigorous a growth as the others.

None of the varieties were ripe when frost occurred September 10. This ripened them prematurely, making the yield small and the grain very light.

Wheat at Laramie.

NAME OF WHEAT.	Year Grown	Yield of Straw per Acre	Yield of Grain per Acre	Weight of Grain per bu.	Remarks.
		lbs.	*lbs.*		
Australian Club	1895	....	1179	....	
Bearded Oregon	"	....	1121	....	
Blounts No. 16	"	....	1015	....	Grown on alkali ground.
Velvet Chaff or Blue Stem	"	....	918	....	Frosted while still green.
Niagara	"	....	1152	....	
Pride of America	"	....	1479	....	
Saskatchewan Fife	"	....	1052	....	
White Russian	"	....	1707	....	Reported in bull. on cost and [profit of wheat growing.
White Touse	"	....	1221	....	
Amethyst	1896	....	1956	....	
Australian Club	"	1866	997	....	Part not subsoiled.
Australian Club	"	1684	943	....	Part subsoiled.
Australian Club	"	....	1891	....	
Blounts No. 16	"	....	1930	....	
Blounts No. 16	"	1020	428	....	On sod—very poor prepara- [tion of soil.
Blue Stem	"	....	1366	....	
Chili	"	....	1996	....	
Improved Fife	"	....	1864	....	
Niagara	"	....	1891	....	
Nox	"	....	2022	....	
Polish	"	....	1339	....	
Pride of America	"	....	2022	....	
Saskatchewan Fife	"	....	1799	....	
Scotch Fife	"	....	1891	....	
Scotch of Scotch	"	....	2232	....	
Seven Head	"	....	1720	....	
White Touse	"	....	2258	....	
Bearded Oregon	"	....	1904	....	
Blounts No. 16	1897	1246	965	....	Ordinary field culture.
Blounts No. 16	"	1080	630	....	Cultivated once during season
Scotch of Scotch	"	1018	876	....	Part not subsoiled.
Scotch of Scotch	"	1273	901	....	Part subsoiled.
Amethyst	1898	1990	1743	....	
Blounts No. 16	"	1235	930	....	Ordinary field culture.
Blounts No. 16	"	1425	841	....	Cultivated once during season
Polish	"	3972	1497	....	
Chili	"	2875	1578	....	
Scotch of Scotch	"	1294	833	....	Part not subsoiled.
Scotch of Scotch	"	1252	918	....	Part subsoiled.
Improved Fife	1899	1314	939	61.5	
Scotch of Scotch	"	1810	1085	58	Alfalfa test.
Scotch of Scotch	"	3315	1803	56	[chickens and blackbirds.
Chili	"	2911	962	59.5	Some grain destroyed by
Blounts No. 16	"	1047	614	55	Rowed culture.
Blounts No. 16	"	1107	419	58	Field culture.
Kubanka, U. S. Dept. Agr. No. 2953	"	3639	1879	59.5	
Pererodka, U. S. Dept. Agr. No. 2954	"	3567	1732	59	
Chili	"	1890	736	53	Short and poor because next [to willows.
Scotch of Scotch	"	4049	1224	53	
Improved Fife	"	3264	1214	53	Variety test but planted too [late for varieties to ma- [ture.
Amethyst	"	2468	816	54	
Blounts No. 16	"	2487	1194	55	
Average up to 1900		....	1378	....	
No. 2953, Kubanka	1900	....	1377	....	
No. 2954, Pererodka	"	....	983	....	
Lamona	"	....	821	....	
Improved Fife	"	....	2462	....	
Chili	"	....	838	....	
Scotch of Scotch	"	....	1051	....	
Amethyst	"	....	971	....	

Wheat at Sub-Stations.

NAME OF WHEAT.	Year.	Yield of Grain per Acre	Yield of Grain per Acre	Weight per Bushel	Locality.	Remarks.
		lbs.	*bu.*	*lbs.*		
Saskatchewan Fife	1895	1922	31	62	Lander.	
Saskatchewan Fife	"	2170	35	62	"	
Fultz Winter	"	1254	22	57	"	
Velvet Chaff	"	3542	54.5	65	Sheridan.	
Saskatchewan	"	....	26.6	....	"	
Amethyst	1896	1834	....	....	"	
Defiance	"	2022	....	....	"	
Mannels	"	1626	....	....	"	
Hard Manitoba	"	720	....	....	"	
Scotch Fife	"	2324	....	....	"	
Wyoming Amber	"	2845	....	....	"	
Bearded Oregon	"	1120	....	....	"	Named, "Oregon [(Bearded)."
Scotch Fife	1897	2318	38	61	"	
Velvet Chaff	"	....	14.5	....	"	Grown on alkali [ground.
Velvet Chaff	1895	....	35	....	Wheatland.	
Blounts No, 10	"	....	28	....	"	
Blounts No. 16	"	....	27	....	"	
Defiance	"	....	40	....	"	
Dominion	"	1550	25	62	"	
Chili	"	1827	29	63	"	
Knox	"	1680	28	60	"	
Amethyst	"	1674	27	62	"	
White Russian	"	1612	26	62	"	
Saskatchewan	"	2491	47	53	"	
*Velvet Chaff	1896	840	14	60	"	
*Australian Blount	"	944	16	59	"	
*Defiance	"	812	14	58	"	
*Saskatchewan Fife	"	720	12	60	"	

*Injured by hail. Superintendent reported that the wheats made about half a crop.

Wheat Varieties at Laramie—Average Yield.

VARIETY.	No. of Trials Given	Average Yield of Grain per Acre.	Average Yield of Grain per Acre
		lbs.	*bu.*
Australian Club	4	1252.5	20.8
Bearded Oregon	2	1512.5	25.2
Blounts No. 16	6	1075.5	17.9
Velvet Chaff or Blue Stem	2	1142.0	19.0
Niagara	2	1521.5	25.3
Pride of America	2	1750.5	29.1
Saskatchewan Fife	2	1425.5	23.7
White Russian	1	1707.0	28.4
White Touse	2	1739.5	28.9
Amethyst	3	1505.0	25.1
Chili	4	1318.0	21.9
Improved Fife	3	1339.0	22.3
Nox	1	2022.0	33.7
Polish	2	1418.0	23.6
Scotch Fife	1	1891.0	31.5
Scotch of Scotch	8	1209.0	20.1
Seven Headed	1	1720 0	28.6
Kubanka	1	1879.0	31.3
Pererodka	1	1732.0	28.9

Inter-Tillage Versus Field Culture.

It is well known that small plats of wheat on rich soil, when they are given careful cultivation during the growing season, produce phenomenal yields. An experiment was begun in 1897 to determine whether this increase in yield would be commensurate with the additional labor of cultivation. This experiment has been continued since the start on the same ground. It was thought that it might be of interest to report the results so far as obtained in this bulletin. A half acre was set apart for this work on Acre Plat 20. The north half of this area, or one-fourth acre, was drilled each year in the ordinary manner and the south portion was drilled in exactly the same manner except that every other drill hole was closed. Therefore on this portion just half as much seed was sown as on the other. The drills or shoes on the press drill used were eight inches apart, so that the rows in the portion to receive cultivation were sixteen inches apart. The plan was to give but a small amount of cultivation, so for the first two years but one cultivation during the season was given, and in the first year this came too late to be of any good; at least the wheat did not grow as tall nor yield as much grain or straw as the portion planted by the ordinary method. During the third season much more cultivation was given and the resulting crop was materially increased. No results were obtained in 1900, as a hail storm in July destroyed the crop. The following table gives the results for the three years:

Inter-Tillage Versus Field Culture.

YEAR.	Mode of Planting.	Date Planted	Cultivated When and How.	Height, feet.	Length of Heads, feet.	Ready for Market.	Yield of Straw.	Yield of Grain.	Yield of Straw and Grain.	Weight per Bushel	Per Cent. of Grain in Straw and Grain.
1897 . .	Field method	April 21		2.8	0.28	Sept. 17	1246	965	2211		44
	Inter-tilled Method	April 21	July 29, with horse, just after the second irrigation which was given July 27.	2.7	0.27	Sept. 13	1080	630	1710		36
1898 . .	Field method.	April 16		2.5	0.25	Aug. 24	1235	930	2165		43
	Inter-tilled method.	April 16	June 17, with horse.	3.0	0.32	Sept. 3	1425	841	2266		37
1899 . .	Field method.	April 27		2.8	0.25	*Sept. 16	1107	419	1526	58	28
	Inter-tilled method .	April 27	June 7 and 21, with wheel hoe; July 6 with horse.	3.0	0.29	*Sept. 16	1047	614	1661	55	37

*Both plats frosted before the grain was ripe. The plat grown by the ordinary field method was about matured before the frost, while the plat inter-tilled was only starting to ripen and so the grain was somewhat shrunken.

It will be seen by referring to the table that the height of the grain and the length of the heads were greater in the cultivated portion for the second and third years but shorter the first year. The reason for the growth being less the first year can be accounted for by the fact that it was so late in the season when the cultivation occurred. The effect, therefore, instead of stimulating growth and benefiting the plants in general, was exactly the opposite. The cultivation destroyed so many roots that the plants probably did not have time to recuperate before it was time to mature the seed. The height of grain and length of head the second and third years was increased by the cultivation. The yield of both grain and straw the first year was less in the cultivated portion than on the portion receiving the ordinary field culture. This was probably due to the lateness of the cultivation, as just mentioned. The second year the yield of straw was increased by the tillage but the yield of grain was not. This would seem to indicate that though the cultivation given produced more vigorous growth, still the plants were not sufficiently stimulated to furnish the desired increase in yield. The weight per bushel was not taken the first two seasons, but though the kernels were slightly larger from the cultivated portion, they were not as plump and consequently would probably not have weighed quite as much to the bushel.

The third season three cultivations were given in all, the first two with a hand wheel hoe such as is used by market gardeners, and the last one with a horse cultivator after the plants were sufficiently high not to be covered. The yield of straw and grain taken together was greater on the cultivated portion, though the yield of straw alone was less and of the grain alone more. This indicates that the conditions of growth in the inter-tilled portion were more nearly correct than were those on the other portion, because not only did the inter-tilled portion produce taller and more vigorous growing plants, but the proportion of grain to the total amount of growth was greater. The

percent of grain in the total quantity of straw and grain was 37 percent in the inter-tilled portion, against 28 percent in the portion receiving the ordinary field culture. The grain from both plats was somewhat shrunken and therefore light in weight. This condition was due to its being frosted before it was mature. The inter-tilled portion being more immature than the other when frost occurred, weighed consequently less per bushel.

This experiment has not been carried on long enough to furnish sufficient data from which it would be safe to draw conclusions as to the relation between the additional cost of cultivation and the average increase in yield which may be expected.

Quantity of Seed Per Acre.

From the experiment on the stooling of grains reported in Bulletin No. 37, the following deductions are made as to the quantity of seed wheat to sow per acre for the best results:

1. When planted in drills eight inches apart, enough seed should be sown to secure one plant for each inch of the drill row. A less quantity will reduce the yield per acre though it may give more grain in proportion to the quantity of seed planted.

2. Thin seeding produces more straw than thick in proportion to the yield of grain, the heads are larger and contain a larger number of kernels, the grain matures less evenly and is longer in coming to maturity. Thick seeding should be practiced in high altitudes to shorten the time of ripening.

3. Good plump wheat contains about 770 grains to the ounce. If 90 percent of these kernels may be relied upon to produce plants, seventy pounds per acre will give an average yield of one plant for each inch length of drills made eight inches apart.

4. At Laramie in 1897 one hundred pounds of wheat per acre gave no larger yield than fifty pounds, but the grain weighed more per bushel and it ripened earlier. The same year at Sheridan the best results were obtained with from sixty to seventy pounds of seed per acre.

5. Where the seasons are short or when the grain is planted later than the usual time, a larger quantity of seed per acre than ordinary should be sown.

6. Light seeding may produce as much grain per acre as heavy seeding, but the larger quantity of seed is favorable to higher weight of grain per bushel, a shorter period for maturing and evenness in ripening, and these may more than pay for the extra seed used.

Subsoiling Versus Plowing.*

In this experiment the land was plowed about eight inches deep and on the portion subsoiled it was loosened up six to eight inches deeper, making the total depth fourteen to sixteen inches. The land was subsoiled only once, but the crop yields of the two pieces compared were kept for three years.

The following table gives in condensed form the results of the experiment:

Subsoiling for Wheat.

Yields in Pounds per Acre.

		Laramie.		Sheridan.	Wheatland.	Sundance.	
		Straw and Grain.	Grain.	Grain.	Grain.	Straw and Grain.	Grain.
First Year.	Subsoiled	2627	943	3000	1726	3920	1440
	Plowed	2863	997	2550	1614	3440	1160
	Gain			450	112	480	280
	Loss	236	54				
Second Year.	Subsoiled	2174	901	2700			
	Plowed	1894	876	1950			
	Gain	280	25	750			
Third Year.	Subsoiled	2170	908				
	Plowed	2127	833				
	Gain	43	75				
Average.	Subsoiled	2323	917	2850	1726	3920	1440
	Plowed	2294	902	2250	1614	3440	1160
	Gain	29	15	600	112	480	280
Average for All Places.	Subsoiled	3122	1733				
	Plowed	2867	1482				
	Gain	255	251				

It will be observed that the effects of the single subsoiling extended through the three seasons of observation and may have had a beneficial effect for a much greater length of time.

During the time the experiment was in progress, the difference in yields increased each season, becoming more and more favorable to the subsoiling.

*Reported in Bulletin No. 41.

Wheat After Alfalfa.*

Of the two half-acre plats used in this experiment, one had been seeded to alfalfa for five years and the other had produced one crop of potatoes and four of grain during the same period. Both pieces were plowed in the fall after the last alfalfa crop had been harvested.

The following table shows the difference in results from the two plats:

Effect of Alfalfa.

PART OF PLAT.	Area.	Date Planted.	Date Ripe.	Heigth of Grain.	Length of Heads.	Per cent. of Smut.	Yield per Acre Straw and Grain.	Yield per Acre Grain.	Weight per Bushel.
	acres.			*ft.*	*ft.*		*lbs.*	*lbs.*	*lbs.*
South (rotation). .	0.14	April 27	Sept. 7	3.00	0.25	17.6	2895	1085	56
North (alfalfa land)	0.17	April 27	Sept. 14	3.75	0.30	16.8	5118	1803	58
Gain on alfalfa land	. . . .	. . . .	. . . .	.75	0.05	0.8	2223	718	2

The yield on the alfalfa land is shown to have been more than 60 percent greater than on the other and the weight of the grain two pounds per bushel higher. The conditions of growth were so much better that it took it longer to mature and the grain was not fully ripe the 24th of August when it was slightly frosted. At local market prices, an increase of eight to twelve dollars worth of wheat per acre was the result of using alfalfa ground. This method of fertilizing the land cost nothing, since the value of the hay produced was equal to that of the crop on the other plat during the previous five years.

The fixation of nitrogen by alfalfa overcomes the principal difficulty with arid soils and a rotation of crops in which alfalfa is one, practically solves the fertilizer problem over a large part of the west.

*Reported in Bulletin No. 44.

Besides fixing nitrogen in the soil alfalfa improves its tilth or physical condition. The plants shade the land, prevent the rapid loss of water by evaporation and the rise of alkali salts to the surface. The roots have an important mechanical effect also. They grow to large size and penetrate to unusual depths in the subsoil. When the land is plowed to destroy the alfalfa, the roots decay, producing humus which aids in loosening the soil, holds moisture, and helps other plants make use of the nitrogen which has accumulated. It is not necessary to plow under a crop of growing plants to secure the improvement, though green manuring in this way is often practiced with good results.

Alfalfa also solves the weed problem. Where land has become infested with weeds, growing alfalfa two or more years will entirely clean them out of the land. Even foxtail, which is so troublesome in parts of Wyoming, succumbs to alfalfa treatment. We can not expect to destroy foxtail everywhere this way, as it grows in places not suitable for alfalfa, but where alfalfa will grow and is cut two or more times in a season, foxtail or any other weed which may be present soon disappears.

Profit of Wheat Growing.

Bulletin No. 25 contains a very complete report on the cost and profit of wheat growing in six of the principal grain raising sections of the state and from this the following facts pertaining to the subject were derived.

The table below gives the average results of three years' experiments:

Cost and Profit.

PLACE.	Years.	Yield per Acre		Value per acre	Cost per acre	Profit per acre
		Pounds	Bushels			
Laramie	1894 and 1895	1,904	31.7	$19.03	$10.15	$ 8.88
Lander	1893, 1894 and 1895	1,580	26.5	19.95	10.78	9.17
Saratoga	1894	2,410	40.2	24.00	7.30	16.70
Sheridan.	1893, 1894 and 1895	2,521	42.0	22.25	12.10	10.15
Sundance.	1893, 1894 and 1895	1,293	21.5	15.93	9.02	6.91
Wheatland	1893, 1894 and 1895	2,147	35.8	22.07	12.93	9.14
Average for the State		**1,976**	**32.9**	**20.54**	**10.38**	**10.16**

Since the cost given is the actual expense of growing single acres of wheat on the experiment grounds, it may be considered as at least 25 percent greater than it would have been on larger areas under ordinary field conditions.

The cost is influenced by a number of things, the principal of which are the price of labor, the extent to which improved machinery is used, the kind and condition of the soil, the season, and the ability of the farmer to plan and execute the work.

The table shows the expense of growing an acre of wheat to have varied greatly in the different localities, the price ranging from $7.30 to $13.36. It is estimated that on larger areas, such as farmers usually seed, the cost need not exceed $7.75 per acre in any of the localities. With this reduction in the expense, the profits would be largely increased, providing equally good yields were secured.

The profit depends primarily on the cost of production, but it varies principally with the yield and the market price

realized. While the profit varies widely in the experiment, ranging from a little less than two to almost eighteen dollars per acre, the average for the State for the three years is more than ten dollars per acre, enough to pay at least 40 percent on the market price of lands or over ten percent on a valuation of $100 per acre.

Treatment for Smut.

The U. S. Agricultural Department recommends the following different methods of treating seed wheat for smut:

CORROSIVE SUBLIMATE.

This well-known antiseptic has been found by Bolley to be efficacious in preventing stinking smut or bunt, if used at the rate of 1 pound to 50 gallons of water. The following are the directions given for applying this treatment: "Pile the wheat upon the floor or upon a canvas and thoroughly sprinkle or spray on the solution, while the grain is being constantly shoveled over so that every grain becomes wet over its entire surface. Do not use any more of the solution than necessary to do this, as an excess is injurious to seed."

Care must be taken not to allow the solution to touch any metals. Corrosive sublimate is extremely poisonous and may be absorbed by slight wounds on the hands. Seed treated with it is also likely to kill chickens or other animals that may eat it. The greatest caution must be exercised in using this treatment.

COPPER SULPHATE.

Immerse the grain twelve hours in a solution made by dissolving one pound of commercial copper sulphate in 24 gallons of water, after which place it for five minutes in limewater made by slacking 1 pound of good lime and then diluting to 10 gallons with water. This treatment is cheap, simple, and very effective. Grain thus treated, however, does not grow quite as well as that treated with hot water, but the difference in growth is inconsiderable. A stronger solution will require a shorter period of immersion. If one pound of the sulphate to two gallons of water be used, dipping or sprinkling as with corrosive sublimate is all that is necessary.

FORMALIN.

This substance, used at the rate of 1 pound to 50 to 60 gallons of water, has been found very effective in preventing smuts. The formalin of the trade is a 40 percent solution of formaldehyde, and only this strength should be purchased. The seed should be soaked two hours. The strong formalin is poisonous, but the dilute solution is not dangerous.