

of cultivation has been run over three years. The stubble was free from grass and weeds and the soil was in good tilth. The results indicate that for these years fall discing and harrowing resulted in 2½ bushels larger yield than spring discing and harrowing, and that spring discing and harrowing gave almost three bushels (2 bus. 53 lbs.) more than stubble ground that had received no cultivation.

In the dry autumn preceding the 1914 crop, early fall discing increased the yield 1 bus. 10 lbs. over late fall discing, but in the average yield of the next two seasons, which were preceded by moist autumns, early fall discing yielded 1 bus. 20 lbs. less than late fall discing. The early fall cultivation produced a considerable growth of volunteer plants, while the later work caused no growth. The decrease we believe was due to the loss of moisture thru the volunteer plants the cultivation started into growth. Such results do suggest however the advisability of early fall discing to control weeds.

Time and Depth of Plowing Stubble on Wheat Yield

Wheat and flax stubble, pea ground, potato ground and corn ground were plowed three inches deep in the fall and spring and six inches deep fall and spring, making twenty-four plots in all on this experiment. The soil was brown clay loam, and over the years 1914, 1915, and 1916 there was little difference from the fall or spring or deep or shallow plowing. The corn, potato and pea ground of course gave much higher yields than the other stubble. The comparative average from all stubbles was for shallow fall plowing, 41 bus. 18 lbs.; for shallow spring plowing, 40 bus. 45 lbs.; for deep fall plowing, 40 bus. 28 lbs.; and for deep spring plowing, 37 bus. 11 lbs. The land was not grassy nor did it have a hard-pan subsoil. Under either of these conditions the deep plowing would probably have given the better results. The spring plowing, however, was always done in April, or it would have given lower returns. We have conducted no tests that show it, but our observations suggest that the chief objection to spring plowing in Saskatchewan is that it can seldom be done early enough for best results with wheat. The lowest average yields over all these different stubble lands was obtained from the deep spring plowing. The explanation for this lower yield is probably to be found in the fact that it was done early in the spring when the lower layers of plowed soil were rather too wet to be in the best condition for plowing. In these stubble tillage tests the only spring cultivation the autumn tilled plots received was double harrowing. In some cases this was not sufficient to prepare a good seed bed. This was perhaps not fair to the fall cultivation. In future a good seed bed will be prepared in the spring and the cost even on the fall tilled land will be charged to the plot.

Different Kinds of Tillage for Stubble Land

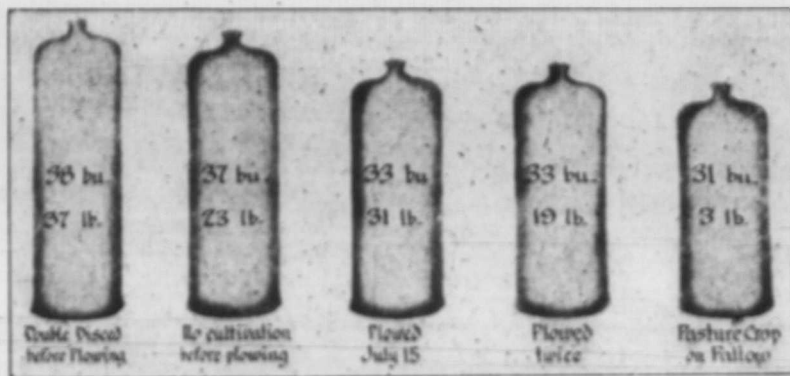
Experiments covering the effect of different kinds and amounts of spring tillage of wheat and flax stubble, pea stubble, potato ground and corn ground on the yield of wheat were run. All this land was plowed shallow early in the fall. The average yields on the different stubbles when disced, packed and harrowed was 36 bus. 48 lbs.; when disced and harrowed was 34 bus. 16 lbs., and when no spring tillage was given was 32 bus. 15 lbs. The averages covered three years on the wheat and flax stubble, two years on potato ground and one year on corn ground. The results show that the more of the tillage mentioned that was given fall plowed land the greater the yield. Harrowing increased the yield 2 bushels per acre, and discing and harrowing nearly 4 bushels per acre, while discing, packing and harrowing increased it slightly over 4½ bushels per acre. In this test harrowing, the cheapest operation, paid best and discing the next best, while packing hardly more than paid its way. We now regret that we did not have a test for packing and harrowing. We think this on grass free soil in good tilth would give us nearly as large an increase and a considerably more profitable one than did discing and harrowing. We are now using packing and harrowing as a standard preparation on all grass-free land that plows up in good condition, and in future we shall add it to this test.

Tillage Practices on Various Stubbles

One series of experiments was conducted to find the influence of various tillage practices on wheat and flax stubble (five years), on pea stubble (two years), on potato ground (two years), and on corn ground (two years). The different treatments given each class of ground mentioned was (1) No cultivation (grassy stubble), this particular treatment

only applied on wheat and flax stubble; (2) No cultivation (clean stubble); (3) Surface cultivation of clean stubble; (4) Burning over, followed by surface cultivation of clean stubble; (5) Deep spring plowing; (6) Deep fall plowing; (7) Shallow spring plowing; and (8) Shallow fall plowing.

A careful study of the results of these experiments, together with the notes and observations for the different years the work has been under way, indicates that one of the chief causes of poor crops on stubble fields is the presence of grass. All our work shows that when grass is present only plowing will control it. When grass is not present plowing may not be necessary. The problem then becomes one of saving moisture, handling the stubble, preparing a seed bed and keeping down the cost. Neither deep nor shallow plowing, nor fall nor spring plowing, where done well and in the proper time have shown much difference on the average yield after wheat and flax—although shallow spring plowing has in these tests proven superior to the others on pea, potato and corn ground. Plowing generally results in larger yields than surface cul-



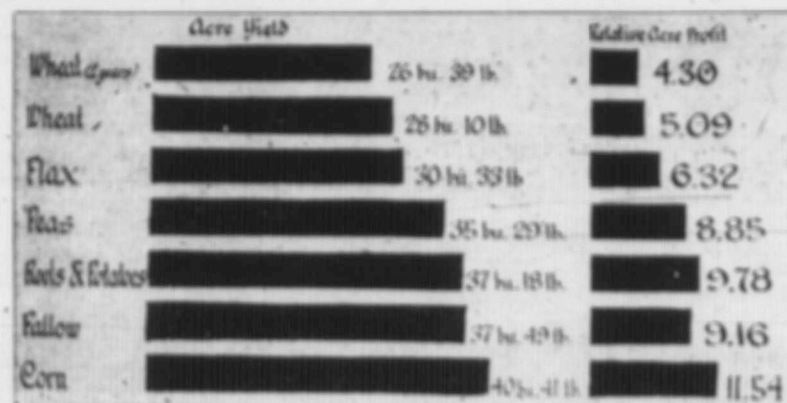
No. 3—Showing influence of different methods of tilling summerfallow on the yield of wheat. Where not otherwise stated the land was surface cultivated before plowing, plowed June 15, and later cultivated enough to control weed growth.

tivation, and both leave the land in better shape for the second crop after. But on summer-fallow stubble, on a soil that does not bake in the spring and that is free from grass, it has not paid as large net returns as surface cultivation.

Relative Profits from Various Tillage Methods

The following table gives the relative acre profit under the different methods of cultivation just mentioned under the preceding heading. These figures are from the different methods on wheat and flax stubble alone. These figures show that yield is not a true measure of profit. The following table gives in detail the results from this experiment, while the lower illustration on page seven gives part of the same results in more graphic form.

Treatment	Yield (5 years) Bus. Lbs.	Acre value at 70c	Rel. profit on basis of \$24 per acre	Rel. profit %
No cultivation, (grassy)	9 50	\$6.88	\$0.44	1.2
No cultivation, (clean)	17 59	12.60	4.53	12.5



No. 4—Showing the influence of the preceding crop on the acre yield of Margate wheat.

Surface cultivation	22 25½	15.70	5.80	16.1	.55
Burned and surface cultivation	22 49	15.97	5.83	16.2	.56
Deep fall plowing	22 53½	16.02	3.36	9.3	.56
Shallow spring "	23 17½	16.30	4.24	11.7	.63
Deep spring plow	23 18	16.31	3.65	10.1	.65
Shallow fall "	23 37	16.53	4.48	12.4	.62

Average... 20 46 14.52 4.03 11.2 .54

The relative acre cost for each method of cultivation can be secured by simply subtracting the acre profit from the value of the crop in each case. If one wishes to find what the relative acre cost including interest at seven per cent. on an investment of \$26 per acre is, \$2.52 should be added to the acre cost in each case. That again, of course,

will render the relative acre profit just that much less. We have not included this in figuring relative acre profit and it does not figure in the profit on investment column.

Why Plowed Plots Yielded Low

Here we notice that clean stubble that received no cultivation yielded only 17 bushels 59 pounds per acre, but gave a net profit of 12.5 per cent., whereas deep fall plowing which gave a yield of 22 bushels 53 pounds per acre rendered a net profit of only 9.3 per cent. A little explanation may be given that will perhaps account to some extent for the fact that the profit is relatively low from all plots that were plowed. The previous crop to that from which these figures were taken was grown on summer-fallow land, and there is no doubt but that the influence of the fallowing was felt by the crops from which these figures were obtained. The favorable influence of the fallow is relatively greater upon a crop grown on fallow stubble that receives no cultivation than it is upon the crop grown on fallow stubble that has been plowed before sowing. Each plot was in a condition of fairly good tilth before the second crop was sown, and the additional tillage (especially plowing), did not increase the yield sufficiently to pay the extra cost of the cultivation. The only case where this does not apply is in that of "No cultivation of grassy stubble." This plot really required plowing to eradicate the grass and would probably have responded to plowing by giving an increased yield worth much more than the cost of the additional tillage. In fact this result was secured in 1914, when grassy stubble that was plowed yielded 13 bushels 30 pounds, while disced stubble that was grassy yielded only 5 bushels per acre.

Up to the present time no means have been found of accurately estimating the influence of a fallow upon the second crop or how much of the cost of fallowing should be charged to the first and how much to the second crop. In the absence of such figures we can only state that we believe that the fallow has considerable beneficial influence upon the second crop, and providing the fallowing is done thoroughly and no grass is present in the land after the first crop, greater relative profits can often be obtained from the second crop if the land is merely surface cultivated than if it is plowed before the second crop is sown. If this land had been grassy, plowing would in all probability have shown much higher profits than any of the other treatments.

As mentioned, the above table only covers the returns from wheat and flax stubble. Other figures covering the relative returns from different methods of tilling flax, pea, corn and potato stubble over two years give very similar results. Again we find that the profit from plowed land is relatively low in most cases, and the same reason as that given above accounts for this to some extent. The plentiful rainfall during the summer of 1916 had a greater relative influence upon the plots that received no cultivation than upon those that were plowed. In a dry season it is probable that the uncultivated plots would have suffered more than the plowed plots and less difference show in the profit column. Although the average profit from the four plots that received no cultivation, i.e., on flax, pea, potato and corn ground, is 39.4 per cent., while that from those that were plowed deep in the fall is only 28.5 per cent., it does not necessarily follow that it is better not to cultivate land than to practice fall plowing. The method to be practiced depends upon the condition of the land after the first crop is taken off, and while plowing does pay its way where it is necessary, it will not always pay the greatest profit where it is not necessary. This point is further brought out by the fact that the highest profit of all was obtained from uncultivated corn stubble. The corn had been frequently intertilled during the previous year and the land was in good tilth after harvest, and deep fall plowing for the wheat crop only increased the yield 43 pounds per acre over the uncultivated plot and decreased the profit of 10.7 per cent.

These results agree with the accepted practice of the older agricultural countries, viz., that surface cultivation after intertilled crops is on more soils a more profitable procedure than plowing. Of course if the intertilled crop is not kept clean these results cannot be expected. Nor are they likely to be secured on soils that bake in the spring. An interesting observation was that the greatest average profit was from wheat on corn ground, the next greatest from potato ground, the next from peas

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