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Stubble Burning

By
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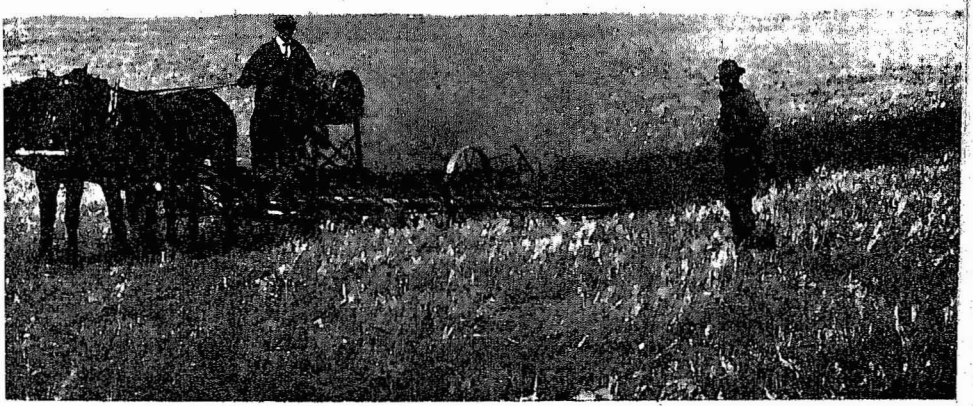

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Summary

Stubble burning has been practiced for only a few years in Montana and the ultimate effect upon the soil has not yet been determined. Some authorities are against the practice because of the loss of organic matter and plant food contained in the straw. Some farmers also take this viewpoint and do not burn their stubble.

With the present information stubble burning can be justified under Montana conditions only from the standpoint of greater immediate returns. The high stubble left by the combine harvester is worked into the soil with difficulty. Under Montana's limited rainfall conditions the straw decays slowly, takes moisture from the soil and thus decreases the supply of plant food. Every effort should be made to secure as clean a burn as possible. Burning will not be practical in dry years when the stubble is short and when there is a poor stand.

Stubble burning should not be practiced on soils that have started to blow. If soil blowing is likely to occur it is better to work the stubble into the surface.

The clean firm seed bed left after burning makes an excellent seed bed on which to make wild oats grow by giving the ground a shallow cultivation. When the oats start to grow they can be easily destroyed by cultivation.

Stubble burning machines for the average Montana farm are expensive, and operating costs are comparatively high. However, there may be a place for them on the larger wheat farms where considerable burning must be done each year. The development of improved machines and cheaper fuels may adapt the burners to smaller farms.

Burning in the fall is not recommended inasmuch as the stubble should be left to hold snow and to aid in the control of soil blowing. Considerably more moisture will be found in the surface soil where the stubble is left on the field over winter than where the stubble was removed in the fall.

Stubble Burning

By Elmer Starch, assistant professor, agricultural economics.
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The rapid increase in the number of combines being used on Montana farms and the high stubble left by these harvesting machines has raised the question of the advisability of stubble burning. Farmers find it difficult to cultivate the ground in the spring of the year when it is covered with stubble 12 to 18 inches high. Such great masses of straw as were left by both the 1927 and 1928 wheat crops clog tillage machinery and are difficult and expensive to work into the soil.

The practice of stubble burning is new in Montana and in this bulletin is set forth the experiences of farmers in Montana, Canada and other places.

Why Burn Stubble?

Stubble burning is for the purpose of clearing the land of stubble and weeds, leaving the ground as clean as possible for the tillage tools.

Burning stubble can be justified only from the standpoint of the greater immediate returns secured from this practice. Where rather large amounts of straw are plowed under or disked into the soil in the spring of the year, it interferes with forces that make plant food available. Much moisture is needed if straw is to decay and make available the plant food it contains. Plant food does not become available in a dry soil. Decreased yields are a common experience where very much straw has been incorporated in the soil, particularly if cropped the same year. Stubble should not be burned on soils that blow readily, but it should be worked into the surface as an aid in breaking the force of the surface wind.

Many farmers and stubble burner salesmen have the impression that the heat generated in burning stubble is sufficient to destroy the vitality of all weed seeds on the ground as well as those partly covered with soil. Weed seeds are not affected by this heat unless they are entirely exposed to the fire. Tests made on the effect of burning on weed seeds at the Swift Current, Sas-

katchewan, Experiment Station in 1924, show that about 80 per cent of the weed seeds on top of the ground were killed. (These tests check with germination tests made in this state on weed seeds picked up from the ground after the stubble had been burned). Thermometers placed in the path of the stubble burner and covered with soil from a quarter of an inch to an inch in depth, showed an increase of only one to three degrees temperature. Any seeds covered with dirt were not affected in any way by the heat of the fire as such a small rise in temperature would not injure the germination.

Weed counts made at the Brockton Tractor Experiment Farm during the season of 1927, show that the number of weeds per acre on stubble burned ground was 88,000 per acre whereas on unburned stubble ground the count showed 144,000. Stubble burning will therefore kill a great many weed seeds, but by no means all of them.

Tests made to try out the effectiveness of burning weeds which had obtained some growth showed that weeds an inch or more in height could not be killed unless a hot blaze was held on them for about a minute, but about 50 per cent of those just sprouted and appearing above the ground were killed. Wild oats partially covered or which had worked somewhat into the soil were not injured by the fire. Neither has stubble burning any effect on insect eggs or larvae which are covered by even a small amount of soil.

Stubble Burning Machines

The evidence so far collected on stubble burners indicate that under many conditions the cost of burning is too high when the price of the machine is considered. Where the entire surface of the field must be covered by the stubble burner, the machines so far tested have been too expensive to operate under most conditions. Results of the Canadian Experiments on cost of operation, check closely with observation in Montana.

Various types of manufactured burning machines are being improved and if the fuel consumption can be reduced or a cheaper fuel developed they may become practical where large areas are to be burned. Some farmers are quite enthusiastic about the machines, while others have reported very unsatisfactory results

because of the expense of burning. The picture on the cover shows a burner in operation.

Cost of Burning with Machines

Figures do not include cost of machine

When necessary to go over entire field with burner Items	Cost per Acre	Cost per acre when fire carries from machine
Fuel—10 gal. @ 20c	$2.00	100 feet $0.41
Labor	.25	200 " ..... .21
Team	.20	400 " ..... .10½
Total cost per acre	$2.45	

The figures are from tests at the Brocton Experiment Farm. Kerosene was used for fuel. Cheaper fuels would aid materially in reducing burning costs.

S. G. Taggart, Supt. Swift Current Experiment Station, in his 1923 report, advises that when the fire will run and burn clean the cost is 20 cents per acre. (These figures do not include the cost of the machine.) When it is necessary to cover the ground completely with the burner the cost runs as high as $1.50 to $2.00 per acre. This is at the rate of 16 acres per day for one man and team.

Mr. Taggart's 1924 report shows that when it was necessary to cover all of the ground the costs of burning varied from $1.00 to $2.25 per acre, not including man labor or the team.

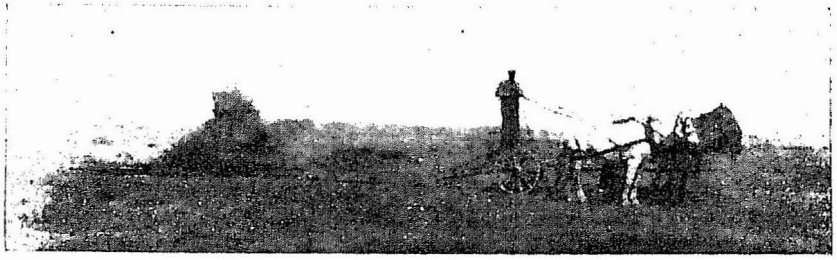

Fig. 1. The fire drag is cheap and effective when conditions are favorable.

Many Montana farmers find the fire drag a very effective burner as it can be operated with no overhead cost. Where burning conditions are good the fire drag or similar homemade implements will give nearly as good results as burning machines.

Effect of Burning on Yields

Results at Swift Current, Saskatchewan.
(1924 report of Supt. J. G. Taggart)

Three year rotation—fallow, wheat, wheat:

	Per Acre			
	Yield	Cost	Value	Profit
Spring plowed, harrowed, seeded and harrowed	30.0 bu.	$12.84	$42.00	$29.16
Spring burn—disked, seeded and harrowed	31.8 bu.	11.58	44.52	32.94
Spring disked, seeded and harrowed	27.0 bu.	10.95	37.80	26.85
Difference in favor of burning				$6.09

Results at Scott, Saskatchewan

(1925 report of Supt. Victor Mathews)

	10-year average yields
Wheat seeded after burning stubble in spring	23.6 bu. per acre
Plowed 4 inches deep in spring	22.4 " " "
Burned stubble in fall, spring disked	21.8 " " "
Disked stubble in fall	19.3 " " "
Fall plowed—4 inches	18.1 " " "
Fall plowed—4 inches after burning stubble	20.7 " " "

Two Year's Results at Lethbridge, Alberta

(1925 report of Supt. W. H. Fairfield)

	Average 1924-25
Disked stubble in spring	9.36 bu. per acre
Burned stubble in spring and disked	13.97 " " "
Burned stubble in spring and plowed	15.14 " " "
Spring plowed—3 to 4 inches	13.50 " " "
Spring plowed—6 inches	14.24 " " "

It is very apparent from these results that stubble left on the ground until spring greatly aids in holding the snow as yields from all spring worked stubble are higher than from fall worked stubble.

Burn When Conditions are Favorable

Experience has taught that if burning is to be done cheaply and cleanly, stubble must be dry and wind must be favorable. Usually there are only a few days each spring that are ideal for burning. It will pay to wait for favorable conditions.

Burning against, rather than with, the wind aids materially in obtaining a clean burn. If the wind is from the left burning should start on the right 100 to 200 or more feet inside the edge of the field, depending upon how well the fire will carry. A much cleaner burn can be secured by this method than by starting on the windward side of the field. When burning with the wind the fire usually will carry across in streaks or patches, leaving much of the stubble still on the field.

If Second Crop After Fallow Must Be Seeded

In spite of the experiences of many Montana farmers who have found that the alternate summer fallow and crop system is the most profitable and dependable over a period of years, many still "take a chance" on the season and grow two or more crops after fallow. If the returns from the second crop after fallow are

Fig. 2. Burn against the wind, not with it. The above field was burned with the wind, the fire spread little and much stubble was left standing.

to compare favorably with that secured on fallow the crop must be produced as cheaply as possible and with the largest yield obtainable.

When suitable conditions for burning are present a good clean burn leaves the soil in excellent condition for immediate cultivation (without plowing) and early seeding. This work should be done early so as to save moisture and hasten germination. The first cultivation after burning should aim to put a cloddy mulch on the surface of the ground. The soil is then in an ideal condition to absorb all the rainfall possible, the force of the wind is

checked and evaporation retarded. When the stubble is high, burning will produce more bushels per acre than when the stubble is disked into the surface.

Plowless Fallow Aids in Controlling Wild Oats

Wild oats must be made to grow if they are to be controlled. Stubble burning will clear the land and leave a clean, firm seed bed and shallow cultivation immediately after will cover up the wild oats. This firm seed bed will cause many wild oats to grow and they can be easily destroyed by cultivation. Several crops can thus be made to grow in one year and destroyed.

Fig. 3. When a field is properly burned off conditions are favorable for good cultivation. Stubble burning followed by shallow cultivation will help in the control of wild oats.

This method of tillage can be called plowless summer fallow. Should the crop following this plowless fallow contain too many wild oats the same method of handling the ground can be used again. By cleaning the surface of the soil of this weed pest before turning it over with the plow, the wild oats can then be cleaned on one side of the furrow slice. The same method can then be used in handling the other side of the furrow when turned over with the plow. This requires a wild oat control program for several years as wild oats cannot all be eliminated in any one year because all of the seed does not germinate at the same time or in the same year. Yields secured on plowless fallow which has been properly cared for are comparable to those secured on plowed fallow.