CIRCULAR Nº 47 MAY 1921

THE USE AND CONSTRUCTION of HOME MADE IMPLEMENTS

by

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ISSUED BY THE EXTENSION SERVICE
MONTANA STATE COLLEGE
REVISED EDITION
MAY 1921

SUMMER TILLAGE ILLUSTRATED.

The Aim Should be —— But Too Often We See

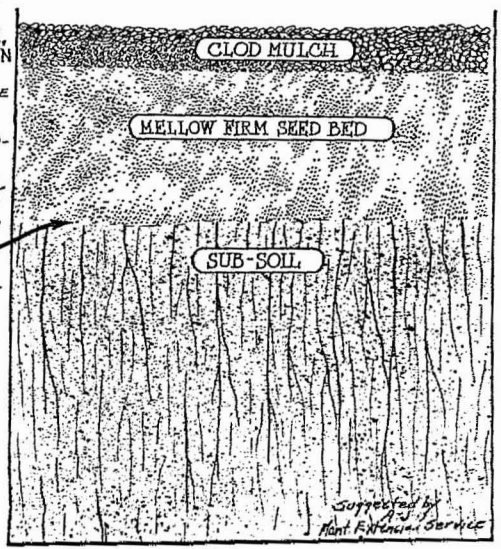
FREEDOM FROM WEEDS.
NO LOSS OF MOISTURE THRU PLANTS

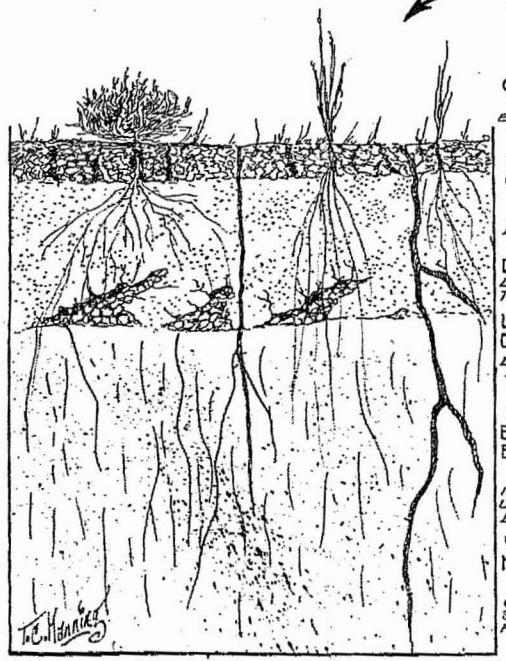
CLODDY, LOOSE, GRANULAR, OPEN SURFACE
LOSS FROM SURFACE EVAPORATION REDUCED

SEED BED SUPPLIED WITH MOISTURE & AIR.
MORE PLANT FOOD AVAILABLE THRU BACTERIAL ACTION

A FIRM CONNECTION BETWEEN PLOWED LAYER AND SUBSOIL

MOISTURE STORED IN SUBSOIL
GOOD CROP INSURANCE.





GROWTH OF WEEDS
ENORMOUS LOSS OF SOIL MOISTURE

DUST MULCH OR BAKED SURFACE
HEAVY RAINS LOST BY RUN-OFF.

DEEP CRACKS
LOSS OF MOISTURE THRU EVAPORATION

LOOSE, OPEN, & DRY SEED BED
LIMITED BACTERIAL ACTIVITY AND PLANT FOOD

OPEN SPACES BETWEEN PLOWED LAYER AND SUBSOIL
INEFFICIENT MOISTURE STORAGE AND LOSS OF WATER.

VERY LITTLE MOISTURE IN SUBSOIL
GAMBLING ON SEASONAL RAINFALL-NO INSURANCE

MONTANA EXTENSION SERVICE IN AGRICULTURE AND HOME ECONOMICS

F. S. COOLEY, Director

Montana State College of Agriculture and Mechanic Arts and the United States Department of Agriculture, Cooperating.
Acts of Congress May 8 and June 30, 1914.

NUMBER 47 (Revised May, 1922) JUNE, 1921.

The Use and Construction of Home Made Implements

For Summer Tillage

BY

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This circular has been prepared to answer the ever increasing inquiries received regarding the construction and use of home-made tillage implements, designed for effective summer tillage. The breakdown of the continuous cropping system on the dry farms of Montana has created a timely although somewhat belated interest in summer tillage and intertilled crops. There is demand and need for information with reference to the principles underlying successful summer tillage, as well as for definite suggestions as to their application. The discussion presented regarding tillage practices is far from complete. Where soil, climate and other factors vary to such an extent, it is difficult to lay down definite rules. Successful summer tillage does not depend upon any definite method or upon the use of any certain tool. It depends on the farmer having a correct idea of the fundamental principles of summer tillage and upon the common sense, good judgment and thoroughness with which he applies these principles.

Many farmers have been handicapped in obtaining the best results with summer tillage because of inefficient implements not especially adapted for this method of cropping. Too often a disk and a spike-tooth harrow are the only implements used. As a result labor cost is high, weeds are not properly controlled, the proper soil surface conditions for maximum moisture absorption are not maintained and often trouble from soil drifting is aggravated. One of the big needs on Montana dry land farms is better tillage implements. Implement manufacturers are meeting the demands for a specialized implement with machines of merit. It is now possible to purchase a make of machine to suit almost any condition if the money is available. There is no doubt that eventually they will be quite generally used. However, the dry farmers are at present hard pressed financially and in many instances the purchase of very much machinery is out of the question. For the man of small means or limited acreage, a homemade implement may be utilized at least temporarily. This circular presents a description of a few of the types of such machines which can be constructed in the farm shop or by the local blacksmith at a nominal cost.

Some Principles:—The successful dry farmer must keep the purposes for which he is cultivating definitely in mind, while choosing or using any particular implement. The blind following of rules has no place on the dry farm. The problem may be considered from any or all of the four angles:

1. Seed bed preparation.
2. Moisture conservation.
3. Weed eradication.
4. Soil blowing control.

Seed Bed Preparation:—While an ideal seed bed is not always attainable it is well to keep in mind what would constitute a reasonably good seed bed. There is ample opportunity for the capitalization of good judgment in its preparation. For small grains, it is important that there be provided proper conditions for germination of the seed and subsequent growth, before seeding, because very little can be done to correct a poor seed bed thereafter. This is not as important with intertilled crops like corn or potatoes for with them subsequent cultivation is possible.

Even then the substitution of cultivation for seed bed preparation is generally poor economy. While other considerations like soil blowing may modify the kind of seed bed desirable, it is generally agreed that the ideal condition is a firm and mellow soil, which is crumby. The connection between the plowed layer and the subsoil should be close. Air spaces should be reduced to a minimum. The soil should be as free as possible from weed seeds. In any event, the grain should be given an equal chance by the killing of all weed growth immediately before seeding. Moisture should be available for germination at the best seeding depth and this condition should continue into the subsoil.

Moisture Conservation:—It is important that as much of the precipitation be absorbed by the soil as is possible. The reduction of losses by "runoff" is essential. The so-called "dust mulch" is not generally efficient in this respect, especially on the heavier clay soils. A ridged, slightly lumpy surface will tend to hold the moisture sufficiently to allow the subsurface to absorb it, while a finely pulverized surface is apt to "puddle" and become almost waterproof.

Aside from the use of moisture by growing crops and weeds, we are concerned with the direct losses from the surface of the soil itself. The farmer probably overestimates the losses from the subsurface through direct evaporation. There is no question that a soil mulch does aid in preventing losses of water but ordinarily cultivation for the sole and only purpose of maintaining a mulch, dissipates as much moisture as is saved. (This statement applies to average dry land conditions.) An exception to this must be made on heavy soils which upon drying are apt to check badly. On our gumbo lands, deep cracks are invariably the rule as the soil dries. The inevitable losses of moisture through circulation of air within these cracks, should be controlled by cultivation. Ordinarily, however, it has been found that under dry land conditions, where there is an absence of free water within a reasonable depth, the control of weeds is a more important function of cultivation than the maintenance of a mulch.

Weed Control:—The greatest losses of soil moisture are due to growing vegetation and it is therefore evident that the elimination of weeds, the prime dissipators of soil moisture, should be

of first importance. The time to kill weeds is when they are young and tender. A stitch in time saves nine in weed control. The job should also be thorough. It is important that implements be used that do not allow the weeds to slip by or escape destruction in any other way. Shallow cultivation is generally recommended. Stirring the soil deeply causes direct losses of soil moisture without any advantage in weed control in spite of the fact that the draft of the implement is increased. Some of the special machines are a big improvement over the ordinary implements used.

Soil Blowing:—Some methods are out of the question on light soils that are apt to blow. As the root fiber and organic matter in our soil gradually become depleted, more trouble along this line may be expected. Ordinarily it is deemed best to cover stubble, straw and trash, but on soils apt to blow, the trash and lumps should be brought to the surface. Many of the newer types of tilllage implements tend to sift the fine soil below the clod mulch so desirable on top. Ridging the soil at right angles to the prevailing winds is also an aid in keeping the surface soil in place. To obtain the clod surface, it is necessary to use the proper machine when the soil is moist. Working the soil while dry has a pulverizing effect. Implements vary in this regard, however. Some types will pulverize very little as they do not disturb the top soil to any marked degree.

Bearing these principles in mind, we are ready to look over the available machines. It is not our aim to make any specific recommendations, for the final choice will depend on local conditions and individual preference.

HOME MADE IMPLEMENTS

Types of Commercial Machines.

Types of commercial machines having a place in summer tillage operations may be classified into the following groups:

1. **Spike Tooth Harrow.** This is the most common type of implement used in soil preparation and is found as standard equipment on all farms. It gives a fine mulch and will kill small weeds but is of little value for large weeds and perennials such as the Canadian thistle. Harrowing, which fines the soil, caus-

ing soil blowing trouble and inefficient absorption of rainfall, should be avoided.

2. **Spring Tooth Harrow.** This type of harrow is suitable for tearing up hard and rocky soil and has a place on most dry farms. It tends to work the lumps and rubbish to the surface allowing the finer particles to sift down into the seed bed. It is especially recommended as a substitute for the spike-tooth harrow on some soils especially those apt to blow.

3. **Disk Harrow.** The disk harrow is well adapted for use on stubble ground and on sod before plowing. In summer tillage, the place for a disk is before plowing. Its use after plowing, other than as a packer, is not generally advisable if better implements are available. The disk is apt to pulverize the soil excessively, thereby tending to destroy rather than maintain the clod mulch. It is common observation that plowed ground which has been disked, usually dries rapidly to the depth of the disking. It does not rank high as an eradicator of weeds.

4. **Curved Blade or Knife Weeder.** There are many makes of this type of weeder and generally they give good results. They can be used successfully in hard or average soil and on rough ground. The different makes vary considerably in their pulverizing effect and their efficiency in weed control.

5. **Duckfoot Cultivator.** This type of weeder gives good satisfaction on most soils. Experience with various types of weeders in other dry farming regions, especially in Canada, indicate that eventually the duckfoot type of cultivator will be the most popular for the proper care of fallowed land.

6. **Rotary Rod Weeder.** This weeder does good work on light soils and leaves the surface in good condition but it is not especially satisfactory on rough, hard, or stony ground. This machine has become quite popular on the soils peculiar to the Great Basin, but it does not seem to be generally adapted to Montana conditions.

HOME MADE WEEDERS

It is now possible to purchase a make of machine to suit almost any condition, but the cost of these machines is prohibitive to many of the dry land farmers, under present economic

conditions, and a simple home made implement may be used at least temporarily. The home-made weeders described in this circular can be made by the handy man in his farm shop or by the village blacksmith at a reasonable cost. The implements described are representative of most of the successful homemade machines, but it should be understood that many successful modifications have been made by farmers throughout the state.

The Sled Knife Weeder or "Slicker."

This is a simple weeder consisting of a sled, fitted with a broad, flat blade sharpened on one edge, which when pulled through the soil at the proper depth cuts off and kills the weeds and creates a clod mulch. Knife weeders are adapted to heavy and medium soils. They are satisfactory when the weeds and trash are well turned in plowing, but are apt to clog badly when the soil is full of rubbish, stubble and undecayed roots and fiber.

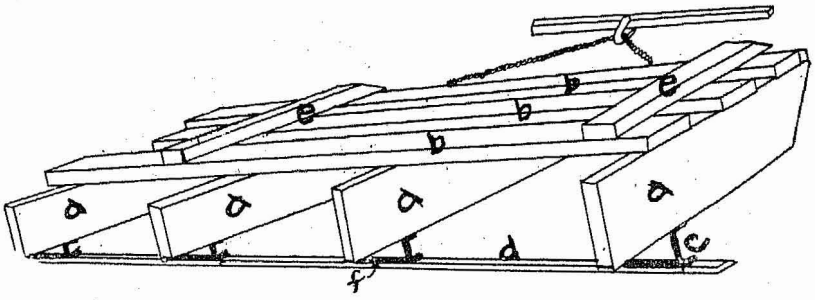

FIG. 1. Sled Knife Weeder.

To facilitate clearing, handle-like projections may be provided on the two middle runners which permits dumping with little trouble. The blade is set from two to four inches below the runners. The runners (a) are made of two-inch by ten-inch material, four feet long. The platform (b) is constructed from two-inch by eight-inch or two-inch by ten-inch material. Half-inch bolts eighteen inches long are used to secure the cutting blade to the runners. A piece of three-quarter-inch gas pipe (c) two to four inches long is used between the blade and the runners. The cutter bar braces (f) are made of bars, three-eights by one

and one-half inches. For depths of cut to three inches, it may not be necessary to use the braces indicated. The runners (e) are made of two by four-inch or two by six-inch lumber and are attached to the top for use in transporting the weeder. The length of the weeder is eight feet. The blade can be made of three-eighths by two and three-quarters-inch or one-half by three-inch steel. A road grader blade is often utilized.

The Non-Clog Large Knife Weeder.

To avoid the difficulty of clogging as experienced in the weeder described in the last paragraph, a number of modifications of the ordinary sled knife weeder has been devised. Figure 2 shows one of these designs, where the knives are shorter and are set on a slant with the frame, thus producing a shear cut. The weeder is made in sections four feet square. This permits of its being used to better advantage on rough ground than where

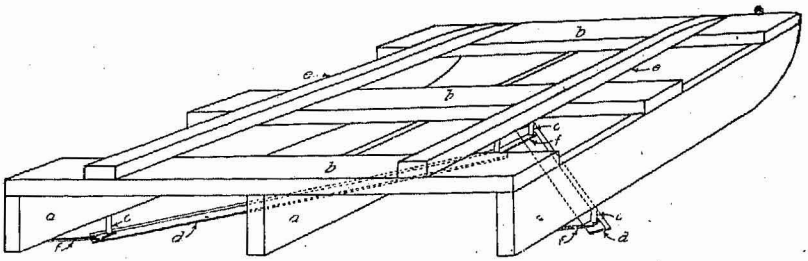

FIG. 2. Non-Clog Large Knife Weeder.

it is made in one section eight or more feet long. The sections can be connected the same as those of spike tooth harrows. The construction is quite similar to that of the knife "slicker."

The Non-Clog Small Knife Weeder.

Figure 3 shows the construction of another modification of the sled knife where small knives are used. The advantage of the small slanting knife is that somewhat lighter material may be used in the construction throughout and that the ground is left a little more evenly ridged than is possible with the other type.

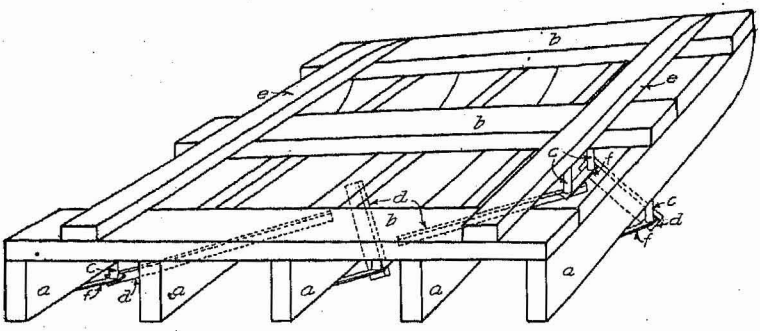

FIG. 3. Non-Clog Small Knife Weeder.

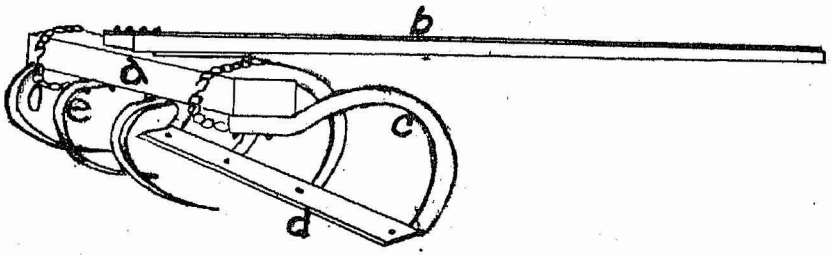

FIG. 4. Gooseneck Slicker.

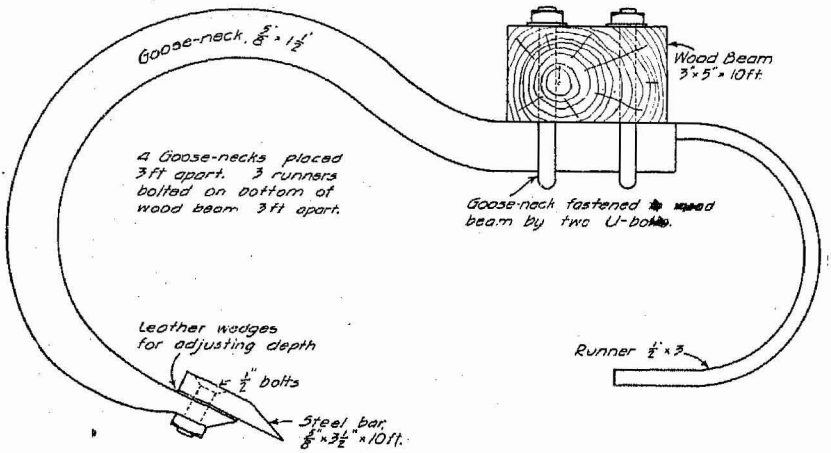

FIG. 5. End View—Gooseneck Slicker.

The "Gooseneck Slicker."

This weeder, figure 4, uses the same principle of operation as the sled knife weeder, but is an improved form, designed for harder conditions and for land infested with grass or perennial weeds. The driver rides on the tailboard (b) and by shifting his position, the depth of cut is regulated. This weeder can be made to handle larger weeds than the other type, including such perennials as Canadian thistles, grasses, etc. For average summerfallow, we see very little advantage of this type over the sled knife, especially when costs of construction are considered.

Figure 5 is an end view of the goosenecks (c) and the runners (e). These are all attached to the large beam (a) to which the hitch is also made. Some difficulty may be experienced in getting the proper slant to the knife. To make adjustment possible, leather washers are used under the blade. The curvature of the gooseneck is not an important feature and a simpler construction might be used. The important thing is the relative position of knife, beam and runners. The implement may be cleared of weeds and trash while in motion or it may be stopped and the knife raised out of the ground sufficiently for cleaning.

The Double Rod Weeder.

Where they can be used, stationary rod weeders leave a better surface condition than the knife types. The pressure of the soil on the rod cleans off most of the weeds and roots as it passes through the soil but trouble with clogging is unavoidable, especially where weeds are large or where the soil is full of "nigger wool." The rod loosens the weeds without pulverizing the surface. More power is usually needed, however, to operate the rod type than the knife weeder. This weeder is not well adapted to heavy soils. It should not be used on wet land but only when the soil is somewhat dry at the surface and requires cultivation. One advantage of the rod weeder is the fact that the work must be done at the right time to get effective results. The ordinary disk is apt to pulverize the surface too much, while the rod weeder will kill the weeds without forming a dust mulch but tends to work the clods and rubbish to the surface.

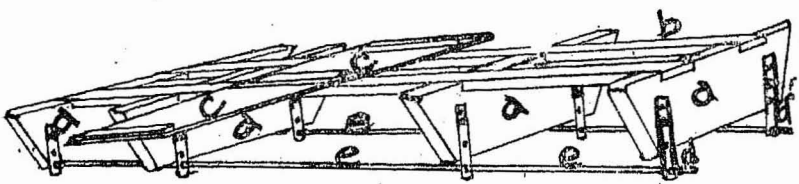

FIG. 6. Double Rod Weeder.

Figure 6 is a rear view of a double rod weeder, twelve feet long. The driver usually rides near the rear of the tailboard causing the rear rod to operate. When the rod becomes clogged, he moves forward thus allowing the rear rod to lift out of the ground and at the same time forcing the front rod into the soil. This shifting can be done quickly and the implement cleaned with a minimum amount of stopping.

The runners are made of two by twelve-inch material, four feet long. The frame to which the runners are bolted is made of two by ten-inch lumber. The 5/8-inch tool steel rods are attached to the frame through iron bars. In bolting these bars to the runners, they should be given a sufficient backward slant to prevent clogging. No skids are shown on top of the weeder for use in transporting, but these can be provided in the same manner as described for the sled knife weeder, (figure 1.)

On loose soils, the double rod weeder has given good satisfaction and has become very popular. It must be used timely to kill the weeds while young and will not give good results on large weeds.

The Bar Weeder.

Figure 7 is a photograph of a very simple weeder made at he College and is an improved model of a machine devised by Mr. Endersby of Rosebud county. It is known as the "Dry Land Safety Razor." This can be constructed at very little expense from wagon tire iron. The bar is not sharpened but operates similarly to a rod weeder. At the tillage implement demonstrations, this simple device gave a good account of itself. It will probably work on soils where the rod weeder will not. The tilting adjustment shown is for convenience in forcing the bar into com-

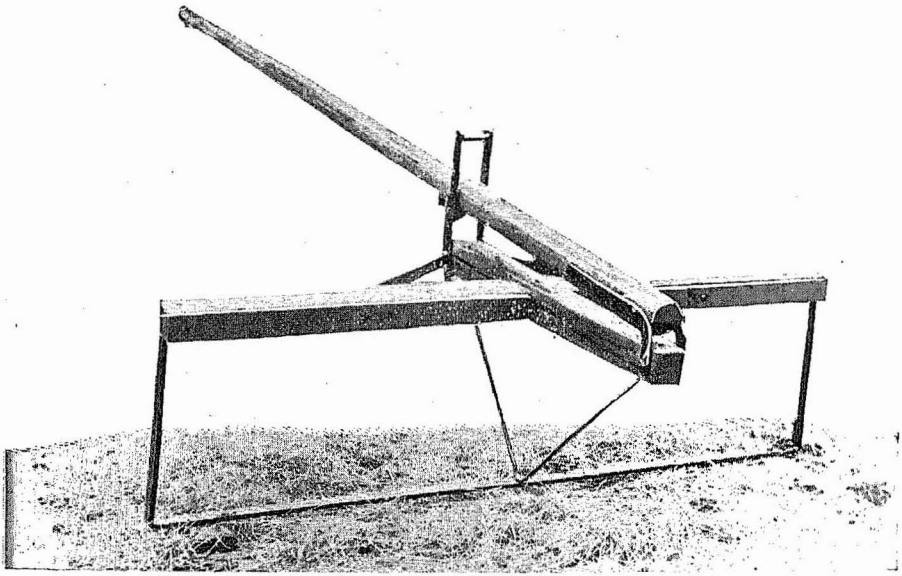

FIG. 7. Bar Weeder.

pact soil surfaces. The original model did not have the tilting device and variation in depth was attained by varying the weight on the frame and by adjusting the length of the neck yoke straps. The machine can be made from seven to eight feet in width with a clearance of about two feet.

THE BEST

SUMMER TILLAGE IMPLEMENT

IS THE ONE WHICH

Maintains the Clod Mulch

AND

Eliminates the Weeds

THE MOST EFFECTIVELY

On Your Farm

Due Consideration Being Given To

INITIAL COST, UPKEEP AND DRAFT

Of The Implement

For A Practical Discussion of "Summer Tillage in Montana" Write For Experiment Station Circular No. 102.