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# Practical Experiments in Reclaiming "Galled" or Washed Lands, with Notes on Mulch and Mulch Materials

University of Tennessee Agricultural Experiment Station

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# BULLETIN

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# AGRICULTURAL EXPERIMENT STATION

OF THE

# UNIVERSITY OF TENNESSEE

STATE AGRICULTURAL AND MECHANICAL COLLEGE.

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PRACTICAL EXPERIMENTS IN RECLAIMING "GALLED" OR WASHED LANDS, WITH NOTES ON MULCH AND MULCH MATERIALS.

These Bulletins will be sent, upon application, free of charge, to all Farmers in the State.

KNOXVILLE, TENNESSEE, U. S. A.

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## AGRICULTURAL DIVISION.

# Practical Experiments in Reclaiming "Galled" or Washed Lands, with Notes on Mulch and Mulch Materials.

BY PAUL F. KEFAUVER.

Having attained a considerable degree of success in bringing up a run-down farm to a much better state of productiveness, and in building up the waste places thereof. I have considered it not foreign to the objects of this Station to present here a record of some of my work in that connection.

While the results of my labors have gone to prove that lands entirely denuded of soil—scarred and melancholy monuments to the shiftlessness and neglect of their owners—can often be built up, or at least covered up with a mantle of green, at not an unreasonable cost, still I would impress upon every one the utter impractibility of ever bringing up such lands to the original virgin state. You may so far recover as to remove them as "standing monuments" to your own incapacity, but it will be at far greater cost, and in the end very much less satisfactory, than to have prevented, by due diligence, the creation of such, in allowing the land to wash. Such land is liable to be treacherous, hard to catch in grass and doughty upon every occasion.

My experience and observation is that the most profitable disposition which can be made of these galled lands is to get them down in a good permanent sod, as soon as possible, and keep them in sod, and to this end the course of these experiments have tended. It may be added that all these experiments were made in Monroe county, Tenn. EXPERIMENT No. 1, 1878.—A two-acre piece of red clay and slate, a bald hillside, entirely denuded of soil, and scarred with gullies, many of them deep enough to bury an ox, was leveled off with plow and scraper, ploughed, some hillside ditches run in, and the whole sown to cow peas. No manure, fertilizer, or plaster.

*Result*—Peas made so little growth as not to justify turning under, and the experiment was a marked failure.

EXPERIMENT No. 2 — In the spring following, 1879, the hillside ditches having become filled up, were renewed, and to prevent the breaking up of the upper banks, and formation of small gullies above ditches, sedge-grass sod was set out on upper side of ditches, and some sedge-grass, mown the previous autumn and left on the ground all winter, was raked up and spread over some portions of the land, to assist in getting a catch of sedge on the whole.

*Result*—Sedge-grass sod made little progress, and the little seed left on mulch failed to catch to any great extent. Marked failure.

EXPERIMENT No. 3.—In the spring of 1880, pine and cedar brush was hauled and thrown into all the little washes which had started on the above piece, in the hope that it would catch drift-dirt and debris sufficient to afford the sedge-grass and other native grasses an opportunity to catch and form sod.

*Result*—The pine and cedar leaves dropped off, decayed, and turned loose the accumulation of drift before any sod had formed. Marked failure.

EXPERIMENT No. 4.—For the succeeding five years, the hillside ditches on the above plot of ground were kept in moderately good working order, and any breaks which started were kept pretty well stopped with brush and trash, still in hope that sedge and other wild grasses would gradually obtain a footing.

Result-Little progress. Marked failure.

EXPERIMENT NO. 5.—In the spring of 1884, small pieces of Bermuda grass sod were set out in various places over the plot.

*Result*—Bermuda grass grew well during the summer, considering the circumstances, but about all froze out the following winter. Marked failure.

EXPERIMENT No. 6.—In the spring of 1885, good permanent hillside ditches were put in with proper grade to clean themselves, with some occasional help with shovel, but not steep enough to wash. In making these ditches, with plough and shovel principally, as much dirt as practicable was thrown on the upper side, and Bermuda grass was again set out along the upper side of ditches, in hope that it would form sod, prevent the breaking of the upper banks and gradually extend upward.

*Result*-Fairly good growth during summer, again frozen out the winter following. Marked failure.

EXPERIMENT No. 7.—In the winter of 1885–1886, 50 wagon loads of good, rich drift earth were hauled from the flat below, and spread along the lower bank of middle ditch (there were three) in a strip, four feet wide. In the spring, Bermuda grass was set out in this strip, in the hope that having obtained a good hold on the fertile strip, it would gradually extend downward, as the rich earth and soluble fertility from said strip worked downward, and would eventually cover the whole space between ditches.

*Result*—After three years' standing, the Bermuda had made little progress beyond the strip of imported earth. Marked failure.

EXPERIMENT No. 8.—In the spring of 1887, a small piece of thoroughly scoured clay, about one-eighth acre, was plowed, leveled, two good loads of manure worked into the surface with harrow, and planted to Bermuda.

*Result*—Bermuda made a very good growth, and stood the winters of 1888 and 1889 very well, but did not make as dense a sod as I had hoped, and never fully occupied the land. During the summer of 1889, it showed signs of giving way, the clay having become very much compacted, so in the spring of 1890 it was turned for another experiment. Moderately successful.

EXPERIMENT No. 9—In the spring of 1890, the plot above referred to was turned, subsoiled, two more wagon loads of good manure worked into the surface, sown to blue grass, red-top, and clover, and in May mulched with sedge-grass.

*Result*—A decided success. The Bermuda grass came up with renewed energy, the other grasses and clover have taken firm hold, including the sedge (!) and the piece is now a dense sod.

EXPERIMENT No. 10.—In the springs of 1888 and 1889, a narrow strip, four feet wide, above each hillside ditch, in plot referred to in Experiments Nos. 1 to 7, was plowed, subsoiled, heavily manured, and planted to Bermuda grass, in the sod of which there was an admixture of white clover and blue grass.

*Result*—A decided success. A dense sod, principally Bermuda, which has resisted frost, effectually checked washing and breaking of the banks and formed beautiful and conspicuous ribbons of green.

EXPERIMENT No. 11.—In 1888, there was a "galled" hillside, about half an acre, in a field which was put into corn. In February

eighteen wagon loads of good manure were spread on this plot, and it was plowed and subsoiled. In March, seven loads more were spread on the surface and worked in with harrow. The corn made many large stalks, but little grain. It was all cut up for silo in the fall, and the land sown to wheat with about 200 pounds of good ammoniated fertilizer per acre. In the spring it was sown to clover, with some of the same fertilizer (at the rate of 100 lbs. per acre) as top dressing.

*Result*—Clover grew off nicely, but a moderate drought in summer scalded it nearly a'l out, except where some trash had been hauled out as mulch and to prevent washing. Marked failure, but would probably have been saved by mulching. My second experience of this kind.

EXPERIMENT No. 12.—In September, 1889, a half-acre piece, a bare slate and clay hillside. was leveled, plowed, subsoiled, four good loads of manure worked into the surface, and seeded to clover and red-top, with half a bushel of winter oats. As soon as the seeding came up, the piece was mulched with clover-halm, sorghum pomace, and sedge-grass.

*Result*—A success. Oats pastured off. Clover ... especially good stand, grass fairly good, both better under clover-halm.

EXPERIMENT No. 13.—In Sept., 1889, a raw clay hillside, one acre, was leveled, plowed, subsoiled, and seeded to clover and redtop. It was mulched as soon as the grass came up with damaged ensilage from store of previous year, sorghum pomace, briers, weeds, etc., from fence corners, and sedge-grass, in separate strips. No manure or fertilizer.

*Result*-Clover and grass about all froze out except under ensilage mulch, where a good sod was obtained.

EXPERIMENT No. 14.—In Sept., 1889, a bare clay and slate hillside, quarter of an acre, was leveled, plowed, subsoiled and seeded to clover and red-top. This plot was covered in November and Deember, with brush, cut from a grove near by, the summer before,

*Result*—Grass all froze out. Re-seeded in spring; result doubtful. An impracticable method for areas of any great extent.

EXPERIMENT No. 15.—In the spring of 1890, a two and a quarter acre hillside, much worn, was leveled, plowed, subsoiled, and seeded to clover, red-top, and blue grass with 100 lbs. per acre of good ammoniated fertilizer. First seeding killed by a March freeze, and re-seeded. In May, this piece was mulched with sedge-grass, cut and stacked the previous autumn.

*Result*—Moderately successful. The cultivated grasses and clover have done well on the better portions, but where the soil

was entirely gone, they have made little show and seem to have derived little benefit from the fertilizer. Seeds from sedge-grass mulch, however, have taken a fairly good hold here.

EXPERIMENT No. 16 -Becoming convinced of the great value of mulch in saving young grass and clover from being scalded out on raw clay exposures during summer, I had all the sedge-grass, weeds, etc., on the place mowed down and stacked up for that purpose during the fall of 1889. During this fall also, and the winter succeeding, the two-acre piece referred to in experiments 1-7, except the strips referred to in experiment 10, as well as all other galled places on the farm not already under treatment, was leveled, plowed, subsoiled, and manured, at the rate of twenty good loads of manure per acre on the surface. In the spring of 1890 this was thoroughly worked in with harrow and the whole seeded to clover, six lbs. red-top, one bu., blue grass one bu. per acre. with 100 lbs. good, complete fertilizer per acre. This seeding was killed by a March freeze, and it was re-seeded as before, but without any more fertilizers. In May the whole was carefully mulched with sedge-grass.

*Result*—A decided success. A rather costly, but altogether, perhaps, the cheapest and most satisfactory method of reclaiming galled hillsides. I have given the plots a good dressing of rough stable manure this fall, and expect to have no more trouble with them.

#### Other Experiments.

A.—A four-acre knoll, part of an old peach orchard, largely grown up in blackberry briers. sprouts, etc., but much bare clay, was cleared off, plowed, subsoiled, top-dressed with seventy loads of good manute on the thinner portions, in fall and winter of 1888 and 1889. Sown to clover, with one bushel of oats pet acre, in spring of 1889.

*Result*—A fine stand of clover on all parts previously occupied by blackberries. On the bald clay spots, mostly scalded out during summer. My third experience of the kind.

B.—Re-seeded and top-dressed above spots, with coarse stable manure in spring of 1890, seed harrowed in.

Result—A stand,

C - A twelve-acre piece of heavy clay land, much of the soil gone in places, was planted in cow peas in 1886, 1887, 1888, three years in succession, and successively "hogged off." During this period, sixty-seven wagon loads of good manure were applied to the thinner sections. In the spring of 1889, the Clark cutaway disc harrow was run twice over this land, it not having been turned, and one bushel of orchard grass, one bushel of red-top, and six pounds clover seed sown per acre and brushed in.

Result-A fine sod. Marked success.

D.-IN STOPPING GULLIES.—Rev. J. P. Kefauver is quite successful in dealing with gullies. His method is to fill them full in various places, or altogether if possible, with brush, stumps, trash, etc., and sow red-top seed in the gully. I have found, by experience, that the above is quite a satisfactory method, where the gully being treated lies in and is *fed* from a fertile soil, but on galled hillsides it avails little.

E.—Some ditches on the farm being very persistent in trying to wash out into gullies, after putting in barricades (brush) in various places, I set out Bermuda grass in the bottom at various points in the spring of 1890.

*Result*—An immense growth, completely sodding over the bottom in nearly every place, in one season.

### On Mulch.

Every farmer knows something of the value of mulch in protecting tender vegetation from the scorching rays of the summer sun, as well as from the blasts of winter. It not only preserves moisture in the soil, for summer use, maintains a good capillary connection up to the very surface, prevents breaking and washing, protects it as a blanket in winter, adds vegetable matter (*humus*) to the soil by its decay, and generally livens up the soil, but in the light of recent discoveries it does even more.

It has at last been determined, first by Hellriegal, a German experimenter, and lately confirmed by Sir J. B. Laws, that many plants, such as clover, peas, vetches, etc., do indirectly and through the agency of certain micro-organisms -bacteria, microbes-obtain a considerable proportion of nitrogen from the atmosphere. "The relation between the roots of leguminous plants and certain of these bacterial organisms appears to be a true symbiotic one, each developing more vigorously at the expense of the other." These bacteria, which have the power of appropriating nitrogen from the atmosphere, coming in contact with the roots of the plants, produce in various places, an irritation of the delicate membranes which causes the plant to throw out an excrescence in the form of a "nodule" or tubercle. In this the microbes flourish, multiply enormously, die, and by their decay render available as plant food, among their other elements, the nitrogen appropriated from the atmosphere. Not only this, but these "soil microbes have proven their ability to take their required supplies of lime and potash from solid fragments of gypsum and feld spar," which soon become available plant-food in the same way.

It is believed, moreover, that the beneficial work of soil microbes is not confined to that done in the root nodules and tubercles alone, but it is to a large extent general throughout the soil, wherever vegetable mould exists.

Soil microbes flourish in almost any kind of decaying vegetable matter. Hence when we spread mulch to decay on the land, we inoculate it with these soil microbes, or sow them, as Dr. Masters would have it.

Some kinds of decaying vegetable matter are more favorable to microbes than others, and this I believe is a partial explanation of the great value of damaged ensilage and of clover-halm as mulch. Both are thoroughly infested and capable of inoculating the ground, with a class of microbes which are very useful to clover as previously shown.

Apply a sack of good superphosphate, or phosphate and potash, per acre upon well prepared land, with a seeding of clover to be turned under, follow with any good mulch, and you have the latest scientific, and perhaps also most economical and practical method of reclaiming ordinary worn-out lands. "Galled" hillsides will usually require stronger treatment, according to the nature of the sub-soil.

#### Mulch Materials.

#### CLOVER-HALM.

In the Report from this Station for 1883-1884, pages 135 and 136, we find the following :

"A plot of wheat was mulched in the fall with clover hay which contained a considerable amount of clover seed. In the spring, a heavy crop of young clover plants came up, and after the wheat was harvested, a very large mowing of clover was taken from that plot the same season. The set of clover was very heavy and the growth exceedingly vigorous. The results were noted and the following fall other plots were mulched, one with straw, and in the spring they were seeded with clover together with plots equally fertile that were top-dressed, but not mulched. Again the very rapid and vigorous development of clover was noticed; the mulched crops giving a yield that season which more than doubled the productions from the plots fertilized but not mulched. Last year the experiments were repeated with the same satisfactory results. Such uniformity seems at least to indicate something like a general truth; \* \* \* but as yet we can only suggest that mulching and top-dressing may prove to be most important factors in the growing of clover."-It is to be regretted that these experiments were not continued. My own experience and observation entirely accords with the above.

## DAMAGED ENSILAGE.

I have frequently heard Prof. John W. Glenn, formerly Professor of Agriculture at the University, speak of the great value of damaged ensilage as mulch. For experiments with it on corn, see Reports of 1882, 1883, 1884, 1885, 1886. In every case save one, mulched but unworked plots yielded considerably above ordinarily cultivated plots by their side. Fortunately, I have never had much of this material to experiment with, but on one of the grass plots referred to it gave surprisingly good results, and I have annually mulched my strawberry bed with it, with good results.

GREEN WEEDS AND STRAW FROM STUBBLE FIELD.

In mowing off the young clover fields in the fall, quantities of this material may be cheaply obtained. It is good mulch. I always leave it on the ground until spring, for the benefit of the young clover, and when the field is cleared off for mowing, it is raked up and hauled to some poor knoll for mulch again.

#### SEDGE-GRASS.

This material deserves special mention on account of cheapness, abundance in many sections, extent of land covered by a given amount-four loads per acre for grass or clover—and general efficiency. It is especially valuable and practicable for "galled" hillsides, or on thin land where it is desired to grow a crop of clover to turn under. It settles very close to the ground after the first rain, effectually prevents washing, and will *not* blow off after becoming once settled.

Below I give a list of the various materials which I have used for mulch, in the order in which I value them, though all, unless it be the last, are we'l worth spreading.

Clover-halm.

Damaged ensilage.

Green weeds and straw from stubble field.

Sedge-grass.

Briers, weeds and trash, from fence corners.

Partially rotten straw.

Straw.

Sorghum cane pomace:

Dry weeds and trash from clover fields in spring.

Brush.

NOTE.—In planting Bermuda grass, I lay off shallow furrows two or three feet apart, drop small pieces of sod, just as one would potatoes, and partially cover and press down with the foot.