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AGRICULTURE

Albert L. Clapp, Danvers, Mass.

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This invention deals with agriculture, being more particularly concerned with the maintenance of the soil in a condition to promote plant growth therein to best advantage.

Within recent years, it has sometimes been the practice to spread tar paper or similar sheet material on cultivated soil to keep it moist and to stifle weed growth therein. Aside from the fact that such practice is expensive, it entails the disadvantage that such sheet material is not readily disintegrated and assimilated by the soil when the latter is plowed and further that such sheet material tends to shed rain water to the depressed portions or hollows inevitably formed therein with the attendant unsightliness of a cultivated field after a rain storm.

In accordance with the present invention, I can form directly on the cultivated soil a web or sheet material which among other advantages permits water to pass therethrough freely to the soil and yet inhibits evaporation of water from the soil, which stifles weed growth, which maintains the soil in a state of cultivation, which assumes the natural lay of the land, and which can be readily plowed into the soil and assimilated thereby to furnish humus. The web or sheet material which I produce on the cultivated soil partakes of the qualities of paper, as I utilize cellulose fiber as the primary ingredient thereof. I have found that a web or sheet material of the desired quality may be produced by depositing evenly upon the soil an aqueous suspension of cellulose fibers having about the same consistency of that delivered to paper making machines. Such an aqueous suspension of cellulose fiber flows readily and may be handled on the field like water. The water of the suspension percolates through the pores of the soil much in the same way as it drains through the openings of the wire gauze or cylinder mold of a paper machine, with the fibers being retained on the soil by interlocking or bonding therewith as a web or mat of interfelted or entangled fiber units. It is thus seen that no fastening means, such as staples, are necessary to assure a permanent fixation of the web to the soil. The farmer or agriculturist may purchase the pulp in the same form as it is supplied to the paper manufacturer. That is, he may receive it in a moist compact condition known as "wet pressed pulp" or in a dry condition known as "drier sheet". In any event, on the field, the pulp must be disintegrated and agitated with sufficient water to produce a free flowing suspension of the proper consistency. Various kinds of cellulose fiber, such as chemical or mechanical wood pulp, may be employed. A free or substantially unhydrated pulp is preferable in that, after it has been deposited as a web on the soil and then permitted to dry, the web does not tend to crack during drying as do webs formed from beaten pulps. Evidently because webs composed of hard-beaten or gelatinized pulp tend to shrink greatly during drying and their shrinking is restrained by their fixation or interlocking with the soil, cracks develop therein.

In actual practice, the pulp may be slushed or suspended in sufficient water to produce a suspension of, say ½% to 2% fiber content. The pulp suspension may be delivered from a supply reservoir as through a flexible hose and nozzle (e. g. a garden hose and nozzle) which may be carried by the operator from place to place with the stream issuing from the nozzle being played uniformly over the cultivated soil area to be covered. The supply reservoir may be mounted on wheels, for instance on a wagon or truck, close to the operator so that he may cover a considerable area of ground. Or the pulp suspension may be delivered under suitable pressure from a supply at a point remote from the operator. When the pulp suspension contacts with the ground, the water immediately percolates through the soil at a rate depending upon the dryness of the soil. As soon as the excess water has been taken up by the soil, the pulp web is complete and conforms to the soil surface, including sloping or irregular patches as well as level areas. This dispenses with the necessity for leveling or evening out land as is sometimes done when laying preformed sheet material. The pulp web when dried is essentially a porous paper through which the air passes to the soil and plant roots and through which rain water can readily find its way to the underlying soil. It tends to inhibit evaporation of moisture from the ground and further to smother such weeds as would otherwise germinate and grow in the soil, and, as already stated, keeps the soil in a state of cultivation, by which I mean that the soil is kept loose and porous and protected from being packed or rendered hard through the action of repeated rains and dryings. When formed on soil around perennial growths, such as rose bushes, and left intact during the winter the web serves as an insulator in the sense that it keeps the soil from cracking and severe frosts

from penetrating to the roots. Sloping land on which the web is deposited is protected against heavy rains eroding the soil or washing away of short rooted plants or seeds planted therein. If the web is formed on the ground prior to planting, the seeds may be scattered on the web, as it is of sufficient porosity to permit roots to penetrate therethrough; or the web may be broken through where seeding of the soil is to be effected. An advantage in forming the web before planting, is that it keeps a conditioned or cultivated soil surface in condition for planting for a considerable period of time. By "conditioned" or "cultivated" soil, I mean a soil which has been stirred up by cultivators, which, as is known, kill the weeds and produce a loose and porous condition in the soil highly conducive to plant growth. After the web has served its purpose for a season, it can be readily disintegrated by the action of a plow or spade and assimilated by the soil, in which it decomposes in time under the influence of moisture, air and soil bacteria to furnish humus.

Rather than employing a straight cellulose fiber suspension, I may apply the principles of the present invention in connection with pulp compositions of the character disclosed and claimed in my application Serial No. 343,564 filed February 28, 1929. Such compositions preferably contain sawdust and leather fiber as well as cellulose fiber, as the sawdust enhances water-absorptivity and porosity of the web and the leather fiber functions as a fertilizer. The pulp composition is preferably rendered neutral by the addition of a suitable alkali, such as lime, particularly since sawdust and leather fiber are apt to be in such highly acid condition as to be injurious to the growth of some plants. In some instances, however, depending upon the soil and whether the plant to be grown is stimulated by an acid or alkaline condition in the soil, the pulp composition may be left suitably acid or rendered suitably alkaline. An advantage of a pulp suspension containing leather fiber is that in addition to furnishing fertilizer in fibrous form and thus assisting the interfelting of the cellulose fiber, it possesses the natural brown appearance of the soil. In some instances, however, the pulp may be dyed green or otherwise colored to blend with the landscape where the web is to be formed. Or the pulp may be colored black or another color which has a high coefficient of heat absorption so as to bring about high absorption of the heat radiated from the sun.

The web may be combined with fertilizer other than leather fiber. For instance, water-insoluble fertilizers, such as ground bones, may be admixed and suspended with the pulp, in which case considerable of the fertilizer will initially be associated with the layer of fibers on the ground but will gradually be carried by rain water through the web to the soil. When water-soluble fertilizers, such as ammonium sulphate, are employed, it is preferable first to form the web on the ground and then to sprinkle or dust the dry, powdered fertilizer on the web. The water-soluble fertilizer is initially absorbed by the web and is then gradually leached out of the web as rain water passes therethrough. The fertilizer is thus progressively supplied to the soil as it is consumed by the plant. Insecticidal agents, such as nicotine sulphate and lead arsenate, or fungicidal agents, such as Bordeaux-mixture, may be added to the pulp suspension or they may be applied to the web after its formation on the ground.

As previously indicated, one of the desirable characteristics of a web formed on cultivated soil is its porosity which allows air and rain to reach the roots. In certain instances, however, it may be desirable to add to the pulp suspension sizing or waterproofing materials, such as rosin size, which may be precipitated on the fibers by the addition of a precipitating agent, such as alum, before the pulp suspension is flowed over the ground. Suitable aqueous dispersions or emulsions of waterproofing materials, especially dispersed asphalt, may be added to the pulp to form what is in effect a tar paper on the ground. Such dispersions of asphalt may be stabilized by suitable colloids, such as colloidal clays or soaps. The tar papers thus formed on the ground are more porous than they would be if the composition used in the formation were fabricated or pre-formed on papermaking machines. The drying of a web of sized fibers results in a more or less waterproof paper which is more resistant to disintegration than an unsized paper, especially when it is walked upon or otherwise abraded in the presence of water.

It is of course possible to form webs of various thicknesses on the soil, but one need not exceed a usage of ten pounds of dry pulp per 100 square feet of soil surface to be treated in securing the desired covering or blanket for the soil. Although the pulp is most efficiently utilized in the form of a dilute pulp suspension in water, it is possible to scatter the pulp in a thickened condition over the ground and then to effect the desired distribution of the pulp by delivering a stream of water as from a garden hose thereonto. This latter procedure is essentially the same as that followed when using a dilute pulp suspension except that the dilution and spreading of the suspension on the ground is less efficient and satisfactory than when dilution is effected with agitation in a container under controlled conditions and the dilute suspension is then delivered over the ground to be treated. The dilute pulp suspension may, of course, be scattered over the ground from pails or ladles or may be delivered from such devices as spray guns. In some instances, patches of the ground may be blanketed with preformed sheets of pulp and the pulp sheets made adherent to the ground by pulp suspension applied to and beyond the marginal areas of the sheets so as to lock or bond them to the ground at their margins and thus prevent their being lifted or displaced by the wind.

Pulps other than cellulose, for instance, asbestos pulp, which is characterized by its lack of hydratability and its ability to mat into a sheet which holds considerable water, but which does not shrink or crack much on drying, may be used alone, or together with, the cellulose pulp.

I claim:

1. In the art of soil cultivation, that step which comprises distributing over loose, porous soil a dilute, aqueous suspension of fibers of a fiber content not exceeding about 2% to cause the deposition of a substantially uniform web of interfelted fibers on the soil after the water of the suspension has passed into the soil.

2. In the art of soil cultivation, that step which comprises distributing over loose, porous soil a

dilute, aqueous suspension of substantially unhydrated cellulose pulp of a fiber content not exceeding about 2%, thereby depositing a substantially uniform web of interfelted fibers on the soil after the water of suspension has passed into the soil.

3. In the art of soil cultivation, that step which comprises distributing over the soil a dilute, aqueous suspension of cellulose fibers and leather fibers.

4. In the art of soil cultivation, that step which comprises distributing over the soil a dilute, aqueous suspension of cellulose fibers, leather fibers, and sawdust.

5. In the art of soil cultivation, that step which comprises distributing over the soil a dilute, substantially neutral, aqueous suspension of cellulose fibers, leather fibers, and sawdust.

6. In the art of soil cultivation, that step which comprises delivering uniformly over loose, porous soil a dilute, aqueous suspension of cellulose fibers containing a waterproofing agent for said fibers and of a fiber content not exceeding about 2%, thereby depositing a substantially uniform web of interfelted fibers on the soil after the water of suspension has passed into the soil.

7. In the art of soil cultivation, those steps which comprise distributing over the soil a dilute, aqueous suspension of fibers of a fiber content not exceeding about 2% to cause the deposition of a web of fibers on the soil after the water of the suspension has passed into the soil, and sprinkling a water-soluble fertilizing agent on said web.

8. In the art of agriculture, a process which comprises initially rendering the soil loose and porous for planting, depositing from dilute, aqueous suspension having a fiber content not exceeding about 2% on the soil a substantially uniform web of interfelted cellulose fibers, and planting.

9. In the art of agriculture, a process which comprises depositing from dilute, aqueous suspension having a fiber content not exceeding about 2% on loose, porous soil, a substantially uniform web of interfelted cellulose fibers, breaking through the web where planting is to be effected, and planting in the soil at the broken web portions.

10. In the art of soil cultivation, that step which comprises playing uniformly upon loose, porous soil a stream of cellulose pulp suspension of a fiber content of about ½% to 2%, thereby depositing a substantially uniform web of interfelted fibers on the soil after the water of suspension has passed into the soil.

11. In the art of soil cultivation, that step which comprises distributing over the soil a dilute, aqueous suspension of mixed fibers containing both cellulose and animal fibers to cause the deposition of a web of mixed fibers on the soil after the water of the suspension has passed into the soil.

12. In the art of soil cultivation, that step which comprises distributing over the soil a dilute, aqueous suspension of mixed fibers containing both cellulose and asbestos fibers to cause a deposition of a web of mixed fibers on the soil after the water of the suspension has passed into the soil.

ALBERT L. CLAPP.