

PHOSPHATE DISTRIBUTING ATTACHMENT FOR MANURE SPREADERS

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In very recent years inereasing attention has been given the subject of where to place commercial fertilizer, particularly phosphates, in relation to the seed and subsequent growing plants. I will consider phosphates only in this discussion.

Experimental evidence on a large variety of crop plants with great diversity of both rate and type of fertilizer treatment is presented in the "Proceedings of the Eighteenth Annual Meeting of the National Joint Committee on Fertilizer Application". (1), Specifically dealing with sugar beets, the above publication presents, on page 67, data from Iowa Agricultural Experiment Station on various methods of application of phosphate to the beet crop. In general there appears to be a decided trend toward a deeper placement of phosphate fertilizers.

Hockensmith, et al, (2) have reported that in calcareous soils there is little or no movement of phosphates from the limited region in which they are placed. This, then, becomes the principal reason for a deeper placement of the material. We must put the fertilizer down into the region most available to the plant roots and not leave it in the top two or three inches of soil, which for many plants is above the root zone, and in addition is dry a large percentage of the growing season.

One of the most important factors (especially in western areas where soil is alkaline) is how to prevent the "fixation" or reversion of phosphates to the insoluble forms which obviously are unavailable to growing plants. Two practical methods now appear to be available by which the fixation of phosphate may be delayed. (1) Apply the phosphate in a concentrated band on the plow sole. (2) In areas where barnyard manure is used more generally, apply phosphate directly with the manure or other organic matter being plowed under as fertilizer.

Each of the two methods above arrive at the main objective, only by different routes. In (1) only a relatively small portion of phosphate is exposed to the soil solution at one time and thus by a "mass action" effect, fixation is retarded. In (2) the phosphate is placed in intimate contact with decaying organic matter, which in the process of decay releases acids or acid forming substances. Fixation of phosphate in an acid media is measurably retarded.

We are not forgetting the importance of placing a small amount of phosphate directly with the seed to give the seedling plant a readily available supply until its root system is established.

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This we accomplished in 1943 by adding, as a dust, a small amount of fume phosphate. Larger amounts of the same material may be applied to the seed by a "gluing on" process developed at our experiment station headquarters this past season.

As to the mechanical method of attaining the above objective, (prevention of fixation and deeper placement) I believe that farm practices in different sections of the country might easily become the deciding factor. To clarify this statement, for example in non-irrigated sections, the one-way plow is used more extensively than it is in the irrigated sections. Under these conditions and especially where little or no use is made of barnyard manure, then the plow attachment recently developed by The International Harvester Company would quite obviously be the machine to use. This attachment, however, apparently is not adapted for use on our two-way plows and especially those of the "tumble" type now meeting with increasing favor by farmers in irrigated sections.

Under irrigated conditions, therefore, it appears that the fertilizer attachment for manure spreaders is perhaps the logical machine with which to do the job. This implement was developed at the Billings factory of the Great Western Sugar Company in the spring of 1943, and limited tests of the agronomic and mechanical aspects begun immediately. In these limited agronomic tests, the yields of beets were as good as with any other method of application. Mechanically the machine is very gratifying. It gives a very uniform application and apparently greater accuracy as to quantity applied than does any other machine with which I have come in contact.

Why would a farmer buy such equipment?

Simply because it means money and effort saved as well as the possibility of increased yields and therefore greater returns. To clarify this statement, take a concrete example. A common practice in beet-growing regions is to prepare the seed bed, then drill in phosphate and re-level the field before planting. Therefore, by placement of phosphate on the plow sole or with manure, the farmer eliminates the phosphate drilling and re-leveling and is, in many cases, able to plant the crop at a more timely date. A more timely date of planting will in itself serve to increase yields, as our past records will show.

In some regions where we depend upon precipitation for germination of the seed, the use of a phosphate drill prior to seeding is objectionable; it loosens the topsoil and permits loss of moisture needed for germination.

A brief description of some of the mechanical principles of the fertilizer attachment for manure spreaders might be in order. There is nothing mechanically new about any of the ideas used. Rather it is a combination of some well-tried methods to do a new job. Metering is accomplished by means of a fluted shaft extending the full length of the hopper. This shaft is driven by a ratchet and pawl. The ratchet arm is in turn activated by a variable cam.

attached to the upper-beater shaft of the spreader. Adjustment of the rate of application is accomplished by changing this variable cam.

We have completed a re-drawing of the design of this machine to incorporate features which will simplify construction and make for greater ruggedness to withstand possible abuse under farm conditions. The later design also permits of somewhat more flexibility in rate of application than does the experimental model now in use.

The machine appears to fit almost all makes and models of spreaders. Installation is exceedingly simple.

- (1) Proceedings of the Eighteenth Annual Meeting of the National Joint Committee on Fertilizer Application, Including Reports of Cooperators. Held at St. Louis, Missouri.
- (2) Hockensmith, R. D., Gardner, R., Kezer, A., The Effect of Depth of Placement on the Availability of Superphosphate in Calcareous Soils. Soil Sci. XXXVI: I July 1933.