Ohio Agricultural Experiment Station.

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FLOATS

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The use of floats as a supplementary carrier of phosphorus, to be used in connection with farm manures and green manures, is becoming quite extensive in Ohio and the Experiment Station is constantly receiving inquiries as to the use of this material, in response to which demand we feel that we should furnish such information as we have on the subject in this circular, which will be followed by a bulletin on fertilizers and their use.

Floats is the commercial name for finely ground phosphate rock, which is a natural formation of what is technically known as tricalcium phosphate. This substance is but slightly soluble in water, but practice has shown that under the influence of decaying organic matter and bacterial action it is made sufficiently available to plants to make its use in connection with farm manures and green manures both profitable and desirable. It is not claimed that a pound of phosphorus in floats is as effective for immediate use as a pound of phosphorus in acid phosphate, but the cost of a pound of phosphorus in floats, as compared with the cost of a pound of phosphorus in acid phosphate, when both are used with manures, gives a net profit dollar for dollar about equal from the two materials, beside leaving a residual amount of phosphorus in the soil for future use largely in favor of floats.

The above results have been obtained on clay soils and silt loam soils, but we are not prepared to make an unqualified statement as to the use of floats on very light or sandy soils; however, where it is necessary to compost manure before applying to the soil, we feel sure that the use of floats on light soils with compost would be an economical success.

Practically all floats used in Ohio comes from the Mt. Pleasant district in Tennessee, and the greater part is made from low grade rock which cannot be used profitably for making acid phosphate, on account of the low percentage of phosphorus or the high percentage of iron and aluminum oxides present.

The brown rock phosphate, which contains less than 30 to 31 percent of phosphoric acid ($P_2 O_5$) cannot be used profitably in making acid phosphate, especially when the haul has to be made any distance, so this grade of rock is ground and put on the market as floats. However, it does not necessarily follow that all floats is as high as 30 percent phosphoric acid, for by far the larger part of the refuse rock in the Mt. Pleasant district is below 28 percent phosphoric acid and we do not think it would be economical for the Ohio farmer to buy floats containing less than 24 percent phosphoric acid unless he can get it at a very low price.

The question has arisen, whether or not there is a difference between the availability of kiln dried and sun dried floats.

By chemical analysis we found that a sample of raw floats bought for use at the Experiment Station and subsequently ground to pass an 80-mesh seive, gave 26.77 percent total $P_2 O_5$, 6.54 percent of which was soluble in 2 percent citric acid. A sample of this was then heated until it was almost melted and again ground to pass an 80 mesh seive and analyzed, giving 28.17 percent total and 2.78 percent soluble in citric acid. This would seem to show that high heat would tend to decrease the availability of the $P_2 O_5$, so far as the chemical action goes, but this will have to be confirmed by plant experiments which are now in progress at this station, before we will be justified in condeming the use of kiln dried or calcined floats.

In order to give the farmer an idea of the difference between sun dried and kiln dried rock we will describe the methods in vogue in the Mt. Pleasant district. The kilns are made by piling wood and mixing the rock through it so that the wood will burn freely and then piling more rock on top; then the wood is burned.

Sun drying is done in large open fields where the rock is spread and dried by the sun, being cleaned by handling it with forks once or twice while drying. Kiln drying is seldom resorted to by the producers except during wet seasons, for the reason that it is cheaper to spread the rock on the ground and let the sun dry it than it is to kiln dry it, running the risk of the next rain wetting the rock again. In case the rock is kiln dried, only that which is close to the fire is heated red hot and this does not constitute more than one third of the pile.

Before floats came into use as a fertilizer it was the practice among the producers of phosphate rock, where kiln drying was resorted to, to burn their kiln and by use of forks to separate the fine rock and dirt from the salable rock and then burn another kiln on top of this refuse, thus accumulating a large pile of this low grade material which would necessarily be heated more intensely

than if the whole pile, including the marketable rock, were ground into floats.

Since the recognition of the fertilizer value of ground phosphate and the use of mechanical dryers has become general, these old kiln beds are being taken up and passed through the dryers, the larger pieces of rock of high grade are marketed for the purpose of acid phosphate making, and the finer pieces and other refuse are ground and sold as floats.

There may be some question as to this class of material being of as much value as the sun-dried product; however, there is not a great amount of this product available and we would judge that in a year or two it will all be used up and be entirely off the market.

There is what is known as the dryer system in use, which consists in passing the rock through hollow, revolving drums with holes of varying sizes, through which the small rock and dirt pass. The drum is heated by a fire below one end which passes up through and around the drum and dries the rock without heating it much over 212°F.

It will be readily understood from this that even though high heating does decrease the solubility of the phosphoric acid in 2 per cent citric acid, an agent is not justified in telling a customer that kiln dried floats is worthless nor in making the statement that his firm is the only one which makes floats from sun dried rock.

The degree of fineness of floats is considered of great importance in determining its fertilizing value. We would advise that farmers insist upon a statement of the fineness of the floats they buy. Seives running 40, 60, 80 and 100 meshes to the inch are commonly used in determinining the fineness, and when ground for the purpose of making acid phosphate the practice is to require 96 percent of the total to pass an 80 mesh seive. This fineness can be obtained upon a commercial scale and would not be too much for the users of floats to require, while a finer ground product of the same composition should be given the preference.

A fair requirement for floats would be, not less than 26 percent phosphoric acid, not more than 8 percent iron and aluminum oxides combined, and not less than 93 percent to pass an 80-mesh seive.

This Station has been conducting experiments in the use of floats and acid phosphate for the reenforcement of manure since 1897. A report on this work is given in Bulletin 183, and later results in Circular 104.

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