ECON

U. S. COMMERCIAL COMPANY
UNITED STATES PACIFIC FLEET
COMMANDER MARIANAS
BOX 22 %F.P.O.
San Francisco, Calif.

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From: Wm. D. Mark, Mining Engineer.
To : Douglas L. Oliver, Special Representative.

Subject: The suitability of Rota Phosphate for Direct Application to the Soils in the Marianas, without Acidulation to Form Superphosphates.

1. You will recall that while in Honolulu I discussed with you the possibility of fine grinding Rota phosphate for direct application to phosphate- deficient soils in the Marianas. I was aware that an increasingly substantial quantity of rock was being ground for direct application in the United States and that Pacific Chemical and Fertilizer Company at Honolulu was also fine-grinding Florida phosphate rock for direct use in the Hawaiian Islands. I went out to the Associated Sugar Companies Research Laboratories in Honolulu and discussed the matter there with Mr. Ayers, their soils expert. He advised me that finely-ground rock was very beneficial to acid soils deficient in phosphate and that he was of the opinion that definitely worthwhile results could also be obtained through application of finely ground phosphate rock to alkaline soils, but that in such case the phosphate would become plant-available more slowly and heavier applications at less frequent intervals would be required.

2. At that time I did not realize that the phosphate at Rota has a soil-like texture which would require no fine grinding. When wetted and pinched between the fingers, Rota phosphate is so fine grained that no grit can be felt. At least 90 percent of the mineral particles composing it are fine enough to pass through a 400-mesh screen.

3. It is advisable to digress here for a moment to discuss the difference between phosphate rock imported from the United States as compared with the Pacific islands phosphates.

a. Nedule phosphate derives its name from its commonly nodular or coliitic (fish egg) structure. Although occuring as continous hard-rock strata similar to limestone, it nearly always is composed of a dense mass of cemented rounded grains similar in size to bird shot. The world's largest known deposits, which occur principally in Idaho, are of this nature. Such rock is mined by underground methods and is produced as lumps, like coal or limestone and hence must be crushed and gound before it can be treated with acid to produce superphosphate. It is generally recognized that such phosphates are of marine origin having been deposited by organisms in deep clear sea water. In many respects their formation is similar to the formation of ordinary marine limestone, and places are known where such phospatic colites are being deposited in the ocean at the present time. When the raw ground rock of this character is treated with 2 percent citric acid, usually only about 5 percent and seldom over 8 percent is found to be soluble. This is regarded as a measure of its plant availability in its unacidulated state. This will again be referred to following discussion of the kind of phosphates which occur in the Pacific Islands. The phosphate rock from Florida and Tennessee, where the great bulk of American phosphates are produced, are of the aforementioned marine type. However, instead of being in continous hard-rock strata

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the way it occurs in the West, the Florida rock occurs as pebbles and fine grains which are the result of erosion of what were at one time continous strata. Such pebbles and fine grains occur in a matrix of sand and clay from which they must be separated by washing, screening, hydraulic classification and selective flotation or agglomeration. Ten to twenty tons of material are commonly handled in Florida to obtain one ton of phosphate rock, the marketable product.

b. Guano Phosphates.

The phosphates known to occur on the Pacific islands are of the Guano type. Unlike the nodule phosphates, which are of marine origin, the Guano phosphates are of terrestial origin. Although the known reserves of Guano phosphates amount to only 160 million tons as compared with about 12 billion tons of nodule phosphates, of which 7 million tons occur in the United States, they are generally of substantially higher grade and more plant soluble than the nodule phosphates. The Guano phosphates are derived from the accululations of bird droppings and their bony skeletons. During the mating season marine birds congregate in great numbers on rocky coral islands at places overlooking the sea, where they mate and rear their young. Such birds feed on fish but are unable to assimilate the skeletons which are rich in phosphate. The droppings are also rich in nitrate but this element forms soluble compounds which are leached back into the sea by the rain water, except where the climate is arid, as on certain islands off of the Peruvian Coast where great quantities of nitrate-rich Guano once accumulated and have since been mined. On the other hand the phosphoric portion of the Guano reacts chemically with the underlying coral limestone to form tricalcium phosphate, acompound which is relatively insoluble in water. Whereas typical nodule phosphates are stone like, the Guano phosphates occur as porceous masses, as a powdery or granular form, and sparingly as coagulated lumps. The Rota phosphate occurs a reddish-brown soil in which small colites, like bird shot, can sometimes be seen. A surprising quality of Guano phosphates is that from 50% to 90% of the phosphoric contents can be dissolved with a 2% solution of citric acid, as compared with a solubility of only 5% to 8% of the phosphoric content of the usual nodule phosphates of marine origin, as are all of the American deposits. Inasmuch as the foregoing test is regarded as a measure of plant-available phosphate, it is thus seen that without acid treatment, the Pacific island phosphates, such as those on Rota, Fais and Anguar, are far better suited to direct application to the soil than would be the fine-ground rock from the United States which nevertheless is now used in quantity without conversion to superphosphate with sulphuric acid.

4. In the writers mind there is no doubt that Rota phosphate can be put to definitely beneficial use as a phosphate fertilizer on Guam and other islands of the Marianas. However, for those not well versed in agriculture I wish to point out that phosphate is only one of the most important of the three major fertilizer elements. The three are nitrogen, phosphorous and potassium and all three of these major elements as well as possibly a dozen minor elements such as calcium, magnesium, copper, iron, manganese, boron, etc. must be present in available form, to obtain good healthy balanced plant growth.. In passing it is well to mention that in balanced commercial fertilizers, the percentage of

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phosphate present is usually equal to or greater than the sum of the potash and nitrate; hence the phosphate amounts to at least half of the fertilizer that would otherwise have to be imported and the other fertilizer elements can be purchased separately without purchasing the phosphate.

5. The phosphate plant building at Rota contains 600 dry tons of phosphate which contains between 20 and 30 % P_2O_5. (The Rota stock piles have been sampled by the writer, but he has not yet received their analysis.) In six long winrows on Sabana plateau, about twelve miles from Rota harbor, there is a total of 17,000 tons of phosphate which could be cheaply loaded and trucked to tidewater. In addition to this there is roughly 50,000 tons of unmined low-grade material still in reserve.

6. Unfortunately Rota is infested with the Giant African Snail and therefore proper precautions must be taken to sterilize all phosphate removed from Rota, and this is especially true when the material is to be moved to islands not already infested with this pest. I am informed by Mr. Fred Hadden, U.S.C.C. entomologist, that this can be done by heating the material on a plate dryer up to 150°F which will kill any snail eggs present. (The eggs are white or yellow, depending on age, and about the size of buck shot.) A plate drier is simply constructed by supporting a ship's plate of piece of sheet iron, about four feet by eight feet, on stones or bricks about a foot above the ground and building a fire beneath it. The material should be spread not more than a few inches deep on the plate in order that all of it be uniformly heated throughout up to a temperature high enough to kill all eggs present. From the drier the material can be shoveled to a raised snail-proof platform to cool before it is sacked for shipment.

7. All plants, and sweet potatoes particularly, grow luxuriantly in stockpiles of Rota phosphate. Therefore there is no danger of burning a crop by an excessive application of it, as is the case with chemical fertilizers. Inasmuch as this material contains only twenty some percent of P_2O_5, it is suggested that not less than one ton be applied per acre, and preferably two tons. Because it has not been chemically treated, the material is less soluble than the commercial product and therefore is more slowly released as plant food. When possible it should be first spread and then disked into the soil to root depth. Phosphates are little affected by rain water and are not subject to being leached to depth out of reach of the roots as are nitrate and potash. Beneficial results could, no doubt, also be obtained by using the material as a top dressing on existing lawns, golf courses and flower beds as well as on established pastures.

8. It is strongly recommedned that a substantial amount of the Rota phosphate, particularly that now at the plant, be conserved for use at Guam and that steps be taken in the near future to utilize this mineral resource.

/s/ Wm. D. Mark.
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