line phosphatase. It should be observed that the enzyme is not within the nerve fibers nor does it appear to be clearly within the cells associated with these end organs. It may be associated with cell surfaces or with the nerve sheaths of the end organs (*6*).

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6 December 1961

Separation of Aluminum Phosphate from Iron Phosphate in Soils

Abstract. Aluminum phosphate in the soil can be more discretely separated from iron phosphate by extracting 1 gram of soil with 50 milliliters of neutral 0.5*N* ammonium fluoride solution for 1 hour than by extracting with alkaline solution for a longer period of time.

Inorganic phosphates exist in soils in three main forms, namely, calcium phosphate, aluminum phosphate, and iron phosphate. Chang and Jackson reported a method of fractionation of soil phosphorus, in which the total amount of aluminum phosphate can be separated discretely from iron phosphate by extracting 1 g of soil with 50 ml of neutral ammonium fluoride in 1 hour (*1*). Fife suggested recently a modified procedure in which the *p*H of the ammonium fluoride solution was increased from 7 to 8.5 and the time of extraction was lengthened from 1 hour to 16 hours (*2, 3*). In order to evaluate Fife's procedure for a wide range of soil groups, 12 soil samples of different characteristics were investigated. Samples 1–4 listed in Table 1 are latosols with *p*H from 5.3 to 5.8, samples 5–7 are sandstone and shale alluvial soils with *p*H from 5.3 to 6.3, and samples 8–12 are slate, schist, and mudstone alluvial soils with *p*H from 6.5 to 7.5.

Table 1. Effect of *p*H of ammonium fluoride solution and extracting time on the amount of phosphorus extracted.

Soil No.	Amount extracted (ppm)					
	1 hr at *p*H			24 hr at *p*H		
	7	8	8.5	7	8	8.5
1	29	30	31	53	55	50
2	8	8	8	8	9	9
3	48	50	45	56	65	63
4	18	20	21	25	28	30
5	200	195	190	231	248	263
6	18	15	16	25	25	23
7	25	23	24	43	39	38
8	10	11	11	13	13	
9	11	10	13	14	16	19
10	18	16	19	23	24	24
11	33	31	33	50	48	53
12	9	9	9	13	15	14

Six 1-g samples of each soil, after removal of exchangeable calcium with 50 ml of neutral 1*N* ammonium chloride, were extracted with 50 ml of 0.5*N* ammonium fluoride solution of *p*H 7, 8.0, and 8.5 for 1 hour and 24 hours, respectively. The phosphorus in the extract was determined. The results (Table 1) indicate that, within the limits of experimental error, *p*H of ammonium fluoride solution in the range 7 to 8.5 does not affect the amount of phosphorus extracted. However, more phosphorus was extracted in 24 hours than in 1 hour. Chang and Jackson found that 50 ml of neutral ammonium fluoride in a single extraction for 1 hour can completely dissolve the aluminum phosphate in 1 g of common soil (*2*). Therefore the increased amount of phosphorus extracted in 24 hours was most possibly due to the dissolution of iron phosphate. It was found in this investigation that the increased amount of phosphorus (average at 3 *p*H values in Table 1) was positively proportional to the total amount of iron phosphate in the soil. The correlation coefficient between them is 0.965 (Fig. 1).

For ascertaining the possibility of hydrolysis of iron phosphate at *p*H above 7, samples of soils 1, 5, and 10 were used for study. Three 1-g samples of each soil, after removal of aluminum phosphate, were extracted each with 50 ml of 1*N* ammonium chloride solution of *p*H 7, 8, and 8.5, respectively. The phosphorus in the extract was determined. The amounts of phosphorus extracted at the three *p*H values were 0.5, 1.0, and 1.5 ppm for soil No. 1; 0, 0, and 1.0 ppm for soil No. 10; and 7, 17, and 34 ppm for soil No. 5, respectively. The results indicated that appreciable hydrolysis of iron phosphate occurs above *p*H 7 in the sandstone and shale alluvial soil (sample No. 5).

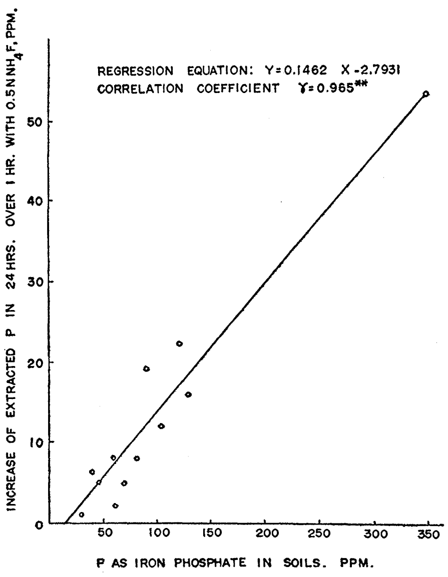

Fig. 1. Phosphorus as iron phosphate in soils as related to the increased amount of extracted P in 24 hours over 1 hour with ammonium fluoride solution.

Since ammonium fluoride with *p*H from 7 to 8.5 will extract approximately the same amount of phosphorus, and since both prolonging the extraction time and using an alkaline reaction will cause a considerably large amount of iron phosphate to be included in the aluminum phosphate fraction, we conclude that extracting for 1 hour at *p*H 7 as originally suggested by Chang and Jackson (*1*) is better for obtaining complete separation of aluminum phosphate from iron phosphate than extracting for 16 hours at *p*H 8.5, as suggested by Fife (*2, 3*). However, in view of the fact that in the neutral ammonium fluoride solution, there occurs reprecipitation of phosphate released from aluminum phosphate by the ferric ions as demonstrated by Fife (*2*) on one hand, and dissolution of iron phosphate as found by Chang and Jackson (*1*) on the other, Chang and Jackson's original method (*1*) may be modified as follows: the phosphorus extracted by the neutral solution in 1 hour may represent the total amount of aluminum phosphate with no need for correction for the dissolved iron phosphate, assuming that these two amounts of phosphate are approximately counterbalanced.

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6 March 1962