
The Variation of Chemical and Physico-chemical Characteristics of Paddy Soils on Submergence—Experiment II

D. M. RODRIGO

(Department of Agriculture, Ceylon)

IN A PREVIOUS experiment (Rodrigo 1961) conducted under greenhouse conditions in glazed pots with a side opening at the bottom twenty different paddy soils were submerged without any rice plants grown on them and the variations of chemical and physicochemical characteristics were determined. The pots were filled to the brim and the 2" of standing water was maintained by daily addition of distilled water. After submergence the following determinations were made on the wet soils at intervals of 2 weeks initially and later at intervals of 4 weeks :—ammonia, nitrate, iron, manganese, oxidisable matter pH and redox-potential at a depth of 6" below the surface of the soils. Water percolates were analysed at intervals for ammonia, nitrate, iron, manganese, oxidisable matter and conductivity. Eh of the soils was measured in situ by placing 2 blank platinum electrodes seated permanently in each pot 6" below the surface of the soil. About 50 grams of the soil were extracted with a glass tube 24" long and 2 cms. diameter by inserting it in a circular motion. This was used for the analysis of the wet soils. The water percolates were collected through the side opening.

The analysis of the dry soils readily permitted the soils to be grouped into the following seven classes :—

1. Strongly acid lateritic rice soils of the ultra wet zone.
2. Strongly acid humic rice soils.
3. Ground water podzolic rice soils.
4. Acid lateritic rice soils of the wet zone.
5. Non-lateritic rice soils of the dry zone.
6. Calcareous rice soils.
7. Non-lateritic clayey rice soils.

* A paper read at the nineteenth annual sessions of the Ceylon Association for the Advancement of Science held in November, 1963.

The redox-potentials of the soils measured at a depth of 6" below the surface of the soils fell sharply immediately after submergence, then it was gradual and from about 70 days of submergence the redox-potentials were more or less constant. The pH of the soils increased with time. Ammonia, iron, manganese, oxidisable matter of the soils and the percolates, and the conductivity of the percolates increased, reached a peak and then decreased with time. There was a total disappearance of Nitrate of the percolates and the wet soils within 14 days of submergence. In another experiment (Rodrigo & Pollard, 1962) it was observed that the redox-potentials of the supernatant liquids were more or less constant and in the oxidising range and the pH values of the supernatant liquids, as in the case of the soils, increased with time to reach more or less constant values towards the end of the experiment.

When a soil is submerged the oxygen supply is almost completely cut off and anaerobic decomposition of organic matter sets in. Ammonia is the most important product of anaerobic decomposition.

The variations in ammonia, iron, manganese, oxidisable matter and conductivity were explained by the following hypothesis. It was postulated that ammonia formed in the bulk of the soil diffuses upwards on a concentration gradient and when it reaches the oxidised layer of soil at the surface it is converted to nitrate. The nitrate thus formed again on a concentration gradient diffuses downwards and when it reaches the reducing layers of the soil denitrification takes place. During denitrification nitrate acts as an oxygen donor to oxidise the constituents of the soil viz. reduced iron, reduced manganese, oxidisable matter, etc., and nitrogen escapes as a gas. There were no detectable amounts of ammonia or nitrate in the supernatant liquid and there were no detectable amounts of nitrate in the percolates. This indicated that nitrate formed in the oxidising layer readily diffuses downwards and is quickly denitrified. Ammonification, Nitrification and Denitrification take place simultaneously. During the initial stages of submergence there was more ammonification than denitrification, thus ammonia values rose; later there was more denitrification than ammonification and the values for ammonia fell.

These findings were of very important practical significance. Hitherto it was believed that deep-placement of ammonia fertilizers will prevent loss of nitrogen due to denitrification. It was inferred that even with deep-placement of ammonium fertilizers denitrification still takes place; hence the rate and time of application of ammonium fertilizers are important.

VARIATION OF CHEMICAL AND PHYSICO-CHEMICAL CHARACTERISTICS OF
PADDY SOILS ON SUBMERGENCE

Two questions that arose from the findings of these experiments were :—

1. What contributes to the rise in pH of the soil and of the supernatant liquid when submerged ?
2. If, as deduced earlier, submergence of puddled soils leads to denitrification, why did not the redox-potentials rise after it had fallen to a low level ? (in the earlier experiment redox-potentials were measured *in situ* at a depth of 6" below the surface of the soil).

The object of this study is to find answers to these two questions.

EXPERIMENTAL

The same twenty soils that were used in the previous experiment (Rodrigo, 1961) were used in this study. The experiment was carried out under greenhouse conditions in glazed pots with a side opening at the bottom through which percolates could be extracted at intervals of time. No rice plants were grown ; the pots were filled to the brim and the 2" of standing water was maintained by daily addition of distilled water.

After submergence the following determinations were made on the supernatant liquid once in two weeks initially and later at intervals of four weeks :—conductivity, pH, redox-potential, ammonia, nitrate, iron, manganese, oxidisable matter, calcium, sodium and potassium. About 50 cc of the supernatant liquids were collected and immediately used for determining their conductivity. About 200 cc of the supernatant liquids were collected in flasks containing 1 cc of Conc : H_2SO_4 and were used for the chemical analyses. The Eh of the supernatant liquids were measured *in situ* by placing a blank platinum electrode when measurements were taken and likewise the pH values were measured by placing the electrodes at the time of taking the readings.

After submergence the following determinations were made at intervals on the water percolates :—conductivity, ammonia, nitrate, iron, manganese, oxidisable matter, calcium, sodium and potassium.

After draining off about 100 cc, 50 cc were collected and immediately used for the determination of conductivity. Then, about 200 ccs of the percolates were collected in flasks containing 1 cc of Conc : H_2SO_4 and were used for the chemical determinations.

After submergence the pH of the soils were measured at intervals by placing the electrodes in the pots at the time of taking the measurements. At intervals the redox-potentials (Eh) of the soils at two depths of 2" and 4" below the surface of the soil were measured *in situ* by placing 2 blank platinum electrodes seated permanently in each pot at depths of 2" and 4".

RESULTS AND DISCUSSION

Dry Soils.—The analysis of the dry soils is given in Table I and Table II of the earlier paper (Rodrigo, 1961) ; and as stated there, their chemical and physico-chemical characteristics readily permit the soils to be grouped into seven classes.

Supernatant Liquids.—Throughout the experiment there were no detectable amounts of ammonia, nitrate, iron and manganese. The redox-potentials were in the oxidizing range and almost constant throughout the experiment. The observed values of the redox-potentials reduced to pH 7 using the factor-60 mv per unit pH for the Eh-pH relationship are given in Table I. The averages of the seven groups of soils are given in Table II. These are graphically shown in Figure I. The high Eh values of the supernatant liquids and the absence of reduced iron, manganese and ammonia indicate that oxidizing conditions prevail in the supernatant liquids.

Sodium and potassium too were constant throughout the experiment. Their values are given in Tables III and V and the averages of the seven groups are given in Tables IV and VI. These are graphically shown in Figures II and III.

Oxidisable matter and conductivity, at first increased, reached a peak and then decreased. Oxidisable matter increases as it comes into the supernatant liquid from the bulk of the soil solution ; it decreases when it gets oxidised as oxidising conditions prevail in the supernatant liquid and when it comes into contact with air at the surface of the supernatant liquid. Their values are given in Tables VII and IX and the averages of the seven groups are given in Tables VIII and X. These are graphically shown in Figures IV and V.

pH and calcium increased with time to reach more or less constant values. Their values are given in Tables XI and XIII and the averages of the seven groups are given in Tables XII and XIV. They are graphically shown in figures VI and VII.

VARIATION OF CHEMICAL AND PHYSICO-CHEMICAL CHARACTERISTICS OF
PADDY SOILS ON SUBMERGENCE

The means of the averages of the seven groups are given in the respective tables of averages and are graphically shown in Figure VIII. Figure VIII shows that the rise in pH is due to the rise in calcium. The question arises why the rise in calcium did not contribute to conductivity. Calcium appears to contribute more to pH and not so much to conductivity and oxidisable matter appears to contribute more to conductivity and not so much to pH. What constitutes oxidisable matter is still unknown. The identification of the various compounds of organic matter of the heterogeneous mass of soil is almost a hopeless task. Calcium rises from 0 to 25 ppm which is the same as 1.25 equivalents per million cc. The maximum amount of oxidisable matter is 4.5 cc. of 0.01 N KMnO_4 per 10 cc. of supernatant liquid; this is nearly 135 equivalents per million cc. Oxidisable matter may compose of such compounds that it contributes to conductivity and not to pH. The preponderance of oxidisable matter over calcium of its effect on conductivity is seen from the above values.

Water Percolates.—Ammonia, reduced iron, reduced manganese, oxidisable matter and conductivity at first increased, reached a peak and then decreased. Their values are given in Tables XV, XVII, XIX, XXI and XXIII and the averages of the seven groups are given in Tables XVI, XVIII, XX, XXII and XXIV. They are graphically shown in Figures IX to XIII.

The variations in ammonia, iron and manganese could be explained by the following hypothesis. It is postulated that ammonia formed in the bulk of the soil diffuses upwards on a concentration gradient and when it reaches the oxidised surface layer of the soil it is converted to nitrate. The nitrate thus formed again on a concentration gradient diffuses downwards and when it reaches the reducing layers of the soil denitrification takes place. During denitrification nitrate acts as an oxygen donor to oxidise reduced iron, reduced manganese, &c., and nitrogen escapes as a gas. There were no detectable amounts of nitrate or ammonia in the supernatant liquid and there were no detectable amounts of nitrate in the water percolates. This indicates that nitrate formed in the oxidising layer of the soil readily diffuses downwards and is quickly denitrified. Ammonification, nitrification and denitrification take place simultaneously. During the initial stages of submergence there is more ammonification than denitrification, thus ammonia values rise; later there is more denitrification than ammonification and values for ammonia fall. The same could not be said of oxidisable matter. Oxidisable matter includes Fe^{++} , NO_2^+ and S_1 among the inorganic

constituents and soluble organic matter that is oxidised under relatively mild conditions. This is a relative determination and has only comparative significance. The method is based on the oxidation of the sample with potassium permanganate under standard conditions. The sample (the volume used varied from 1.0 cc. to 10 cc.) was added to a mixture of 10 cc. of 0.01N KMnO_4 and 10 cc. of 1:3 H_2SO_4 with sufficient water to make a total volume of 100 cc. in a 250 cc. conical flask. The flask was heated in a boiling water bath for 30 minutes along with a blank. By this procedure the factors (strength of KMnO_4 , acidity of the medium and time of digestion) on which the figure for oxidisable matter depends, were kept nearly constant. Immediately after digestion 10 cc. of 0.01N Ammonium Oxalate solution was added and the excess oxalate back titrated with 0.01N KMnO_4 . The difference between this reading and the blank reduced to an equivalent of 10 cc. of the percolate was taken as an index of the concentration of oxidisable matter. Oxidisable matter has found its way to the supernatant liquid and there under oxidising conditions seems to be oxidised. The identification of organic redox systems that operate in soils is a very difficult task as soil organic matter consists of such a heterogeneous mass of organic substances in all stages of decomposition together with microbial cells and their metabolic products. The problem is further complicated by the fact that many biological oxidations are irreversible and do not give rise to thermodynamic potentials. As oxidisable matter, without being oxidised in the oxidising surface layer of the soil, has found its way to the supernatant liquid it could be inferred that there are some organic redox systems that operate at high potentials.

Sodium and Potassium were more or less constant throughout the experiment. Their values are given in Tables XXV and XXVII and the averages of the seven groups are given in Tables XXVI and XXVIII. These are graphically shown in Figures XIV and XV.

pH of the soils was measured by placing the electrodes in the pots at the time of taking the measurements. These pH values could be taken as the pH values of the percolates too, because in reality when the pH of a soil is determined it is the pH of the soil solution that is measured.

pH and calcium increased with time to reach more or less constant values. Their values are given in Tables XXIX and XXXI and the averages of the seven groups are given in Tables XXX and XXXII. They are graphically shown in Figures XVI and XVII.

VARIATION OF CHEMICAL AND PHYSICO-CHEMICAL CHARACTERISTICS OF
PADDY SOILS ON SUBMERGENCE

The variations of ammonia, iron and manganese have been explained earlier. The inter-relationships of oxidisable matter, conductivity, calcium and pH could be explained in the same manner as for the supernatant liquids. Calcium appears to contribute more to pH and not so much to conductivity and oxidisable matter appears to contribute more to conductivity and not so much to pH. It should be mentioned that variation of magnesium has not been studied by the author.

The means of the averages of the seven groups of soils are given in the respective tables of averages and are graphically shown in Figure XVIII.

Figures VIII and XVIII show that, of the constituents studied, the rise in pH of the supernatant liquids and percolates, in general, is due to the rise in calcium.

Wet Soils.—Wet soils have been studied earlier and are given in Tables V and VI and graphically shown in Figures VI to XII in the previous paper (Rodrigo, 1961). Ammonia, iron, manganese, oxidisable matter increased, reached a peak and then decreased. pH increased with time to reach more or less constant values. The redox-potentials of the soils measured at a depth of 6 inches below the surface of the soils fell sharply immediately after submergence, then the fall was gradual and from about 70 days of submergence the redox-potentials were more or less constant.

In this experiment redox-potentials of the soils were measured in situ at two depths of 2 inches and 4 inches below the surface of the soils by placing two blank platinum electrodes seated permanently in the pots throughout the experiment. The observed values reduced to pH 7 using the factor -60 mv per unit pH for the Eh-pH relationship are given in Tables XXXIII and XXXV and the averages of the seven groups of soils are given in Tables XXXIV and XXXVI. These are graphically shown in Figures XIX to XXII.

At a depth of 4 inches Eh of the soils at first decreased and thereafter began to rise and remained constant after about 84 days of submergence. At a depth of 2 inches Eh at first decreased, but not to the level of 4 inches and then increased and remained constant after about 84 days of submergence. The variations of Eh values of the soils at various depths indicate that denitrification takes place and under the conditions of these experiments denitrification takes place above a depth of 6 inches of the soil.

The means of the averages of the seven groups of soils together with the redox-potential values of this experiment are graphically shown in Figure XXIII.

As stated in the previous paper (Rodrigo, 1961), the variations of pH of the soils, reduced iron of the percolates and reduced iron of the soils demand special merit. The initial values of the reduced iron of the soils seems to depend on the free iron oxide content. The maximum values and the final values depend on the total iron content of the soils. It is of great ecological importance to note that though the amount of iron reduced in the soil depends on its iron content, the amount of iron brought into solution depends on its pH. The lower the pH more is the iron brought into solution; this is clearly shown in the table below.

		<i>Maximum Fe ppm in the percolates</i>		<i>Maximum Fe ppm in the wet soils</i>		<i>pH of dry soils</i>
Group 1	..	252	..	2157	..	4.84
Group 2	..	158	..	3042	..	4.65
Group 3	..	75	..	210	..	5.47
Group 4	..	159	..	4885	..	5.65
Group 5	..	38	..	1825	..	7.26
Group 6	..	7	..	930	..	7.78
Group 7	..	91	..	5162	..	6.22

The clayey soils with a reduced iron content of 5162 ppm have only 91 ppm in the percolate with a high pH of 6.22, whereas the ultra-wet zone soils with a reduced iron content of 2157 ppm (less than half that of the clayey soils) have as much as 252 ppm in the percolate with a low pH of 4.84.

The peak values of reduced iron in the percolates are correlated to pH, the largest values are reached with the lowest pH and *vice versa* or in other words the amount of iron brought into solution is proportional to the increase in pH.

The presence of potassium in the supernatant liquid indicates that potassium is being taken away by the surface flow of water under field conditions. Thus there may be a benefit from and need for top-dressing with potassium fertilizers as reported (Adm. Rep. D. A., 1960, Adm. Rep. D. A., 1960-61). Raymundo *et al* (1962) found that exchangeable potassium was lower in the paddy soils than the associated upland soils. This also shows that there is a gradual depletion of potassium from paddy soils by the surface flow of water.

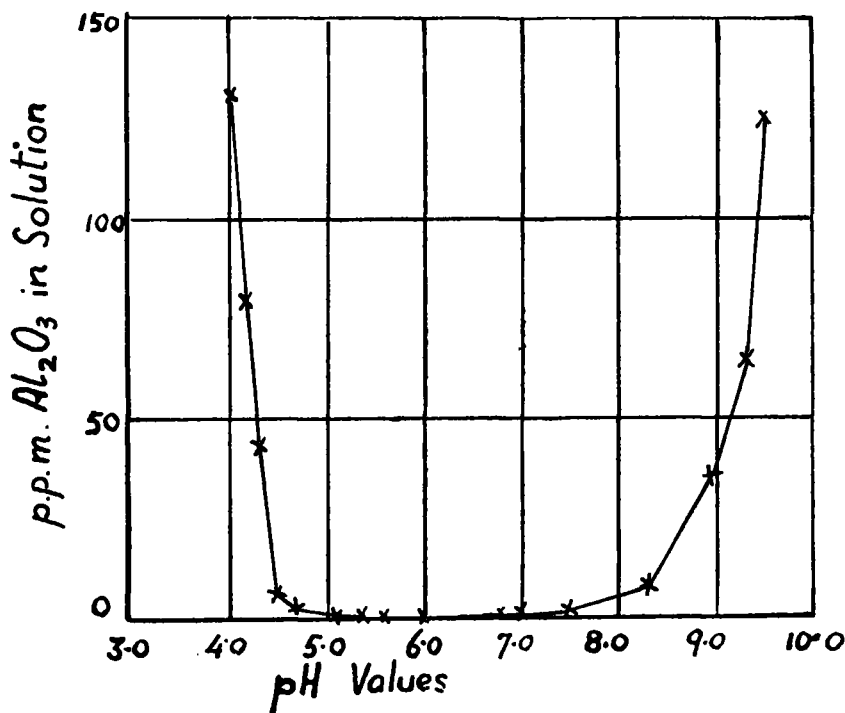
Kelly (1914) showed that solubility of substances in submerged soils is abnormally high. Iron, manganese, lime, magnesia, phosphoric acid, bicarbonates, silica, alumina and potash going into solution were greater on submergence. Gillespie (1920) found that the changes in acidity are accompanied by changes in several constituents. Subrahmanyam (1927) noticed an increase in pH when he incubated a Rothamstead soil and an Indian soil for 40 days. In another experiment he incubated 24 Indian soils for 10 days. Since

the rise in pH was accompanied by a rise in ammonia he attributed the rise in pH to the rise in ammonia. Schollenberger (1928) submerged soils for 3 weeks and analysed the soils for exchangeable aluminium, manganese, calcium, magnesium, sodium and potassium. pH increased from 4.7 to 5.0, aluminium decreased and manganese increased. He attributed the increase in pH to the increase in manganese. Dennet (1932) was perhaps the first to draw attention to the $\text{Fe}^{+} - \text{Fe}^{+}$ equilibrium on pH of soils. Joffe (1935) strongly emphasised the role of $\text{Fe}^{+++} - \text{Fe}^{++}$ system on the changes of pH. In his studies on podzol soils he noticed that the pH was higher in the glei zone and states that glei formation is not a climatogenic formation but a hydrogenic formation. Reed and Sturgis (1939) attribute the increase in pH to the increase in sodium and magnesium. They also noticed an increase in iron and silica. They drew attention to the magnitude of the increase in pH; the increase in pH was more pronounced when the pH of the soils was low and in the presence of organic matter. Kurunkar and Daniel (1950) confirm that the increases in pH were greater when pH of the soils was lower. They also attempt to correlate the increase in pH with the increase in ammonia. Metzger (1930) attributes the increase in pH to increase in ammonia and reduction products. Mortimer (1941) found that the increase in pH of lake muds, following thermal stratification and depletion of oxygen, could be accounted for by the increase in iron, manganese and ammonia. The physico-chemical properties underlying the calcium-carbon dioxide—pH equilibrium have been studied by Bradfield (1941). He showed that carbon dioxide can have a marked depressing effect on pH; the restraining influence of carbon dioxide on the increase in pH is indicated even in the presence of added lime. Robinson (1930) was, perhaps, the first to notice that iron in the soil solution increases on submergence, reaches a peak value and then decreases. 500 grms of soil with 2,500 cc. of water were stoppered and shaken everyday, "care being taken to admit as little air as possible." He analysed the soil solution at intervals for 60 days. The solubility of iron increased with time but passed through a maximum in some soils. The maximum was at 22 days. This he states "may be due to the oxidation of ferrous bicarbonate and consequent precipitation of ferric hydroxide by the admission of a small quantity of air when the samples were shaken". In another experiment he demonstrates that the introduction of such quantities of air has no significant effect on the concentration of iron in the soil solution. He found that some of the submerged soil solutions contained comparatively large quantities of calcium and magnesium, "a great increase

in the solubility of lime and magnesia as well as an increase in iron and manganese—silica and presumably alumina remain much the same as in the beginning, except that the solubility of silica is somewhat increased in the soils containing much organic matter." Magistad (1925) in a brilliant paper determined the solubility of aluminium in water at various pH values. His values are shown below.

pH value	Al_2O_3 in Solution ppm.
3.96	200.0
4.02	130.0
4.19	79.0
4.27	43.0
4.51	6.5
4.66	2.3
5.22	1.2
5.40	0.8
5.62	0.7
6.00	0.4
6.80	0.3
7.00	0.4
7.55	2.0
8.36	8.4
8.95	34.6
9.28	63.4
9.48	124.0

This is graphically shown below :—



He states "the amount of aluminium which can exist in solution is markedly increased when the reaction becomes more acid than pH 4.7 or more alkaline than pH 8.5." Between pH 4.7 and 8.0 the concentration of aluminium as Al_2O_3 is less than 3 ppm. He, further, determined the solubility of aluminium of soils at various pH values and found that "The curve for the solubility of aluminium in the soil solution at various reactions practically coincides with the curve for the solubility of aluminium in water at the same reaction " Since the two curves practically coincide, one can predict with a fair degree of certainty the amount of soluble aluminium present in a soil solution on knowing the pH value of the soil. Thus it becomes evident the amount of soluble aluminium greater than 3 ppm. can exist in a soil only when the reaction is more acid than pH 4.7 or more alkaline than about pH 8.0. From pH 5.4 to 7.0 the amount of aluminium present in solution is usually less than one part per million." Robinson (1930) referring to Magistal's work stated "it is apparent therefore, that the solubility of aluminium is not increased by submerged soil conditions" and concluded "the toxicity of submerged soil solutions therefore cannot be due in general to dissolved alumina".

The experimental work of the present paper and the previous paper (Rodrigo 1961) shows that pH and calcium increase with time to reach more or less constant values. Ammonia, reduced iron and reduced manganese at first increased, reached a peak and then decreased. During the initial stages of submergence, until the peak values are reached, ammonia, iron and manganese will contribute to the rise in pH. After the peak values are reached and when their concentrations diminish, these decreasing values will have a depressing effect on the pH, but the increasing values of calcium have a predominating effect on pH and make the pH continuously rise until the values of calcium too become constant when the pH is also constant. This interpretation is, in general, in conformity with the experimental findings of the authors cited above.

Ramiah (1952) reports physiological diseases of rice from various countries under various local names. These diseases have caused serious losses in yield and in some cases it was severe enough to cause the death of the plant. The main symptoms are discoloration of leaves, stunted growth and damaged root system. Ministry of Agriculture and Forestry, Tokyo (1954) is of opinion that the physiological disease observed in the degraded rice soils of Japan is due to the production of hydrogen sulphide. Sik (1950) working in Hungary observed that the addition of small amounts of hydrogen

sulphide or ferrous iron to a culture solution produced symptoms of rice-browning. Vamos (1959) ascertained by field survey and microbiological study that hydrogen sulphide is the cause of browning of rice plant in Hungary. Ponnamperuma, Bradfield and Peach (1955), Ponnamperuma (1955 and 1958), are of opinion that high concentrations of ferrous iron in the soil solution are probably responsible for the disease. Leveque and Mlle Beley (1959) working in France with hydroponic culture observed toxicity due to ferrous iron at 200 ppm. in the culture solution. According to Dastur (1937) "Pan Sukh" disease in India is due to lack of soil aeration.

Yamada (1959) working in Ceylon, determined iron in the soil after extraction with 0.2 per cent. aluminium chloride acetate buffer solution of pH 4.5 and inferred that "there is no relation between the occurrence of bronzing and the iron content of the soils." According to Ponnamperuma (1955, 1958) it was iron in the soil solution that was responsible for the disease. Further, Yamada "assuming that all iron in the soil determined here is present in the soil water, iron content is expressed on the water basis." Author's work (Rodrigo, 1961) shows that there is no relationship between iron in the soil and iron in the soil solution; the iron reduced in the soil depends on the iron content of the soil and iron brought into solution depends on its pH. Ota (1962) and Ota and Yamada (1962) in their work on "Physiological Study on Bronzing of Rice Plant in Ceylon" too determined iron in the soil after extracting with 0.2 per cent. aluminium chloride acetate buffer solution of pH 4.5 and stated that the free iron content of the soil is not related to the severity of bronzing. They determined various chemical constituents including iron and aluminium of the leaf blades of rice plants exhibiting different grades of bronzing. There were only traces of aluminium in the leaf blade. From their scatter diagram of mg. Fe/g dry weight and grades of bronzing they find no relation between the iron content and grades of bronzing and concludes that this "furnishes a conclusive evidence that bronzing is not caused by iron." A closer examination of this scatter diagram, however, shows that there is a fair correlation between the iron contents of the leaf blades and the grades of bronzing. Ota and Yamada (1960) in their study on "The Physiological Effect of Iron on Rice Plant" found that the free iron content of the soil was negatively correlated to Eh; the lower the Eh greater was the iron content and vice versa. In pots "where iron was applied to paddy land reductive soil, almost all plants were dead due to severe occurrence of akagare (ferrous iron toxicity) lowering of yield due to iron application was more remarkable with the soil of lower Eh value

phosphate content was significantly reduced by iron application it was also observed that absorption of silica and potassium is also influenced by the presence of excessive iron in soil."

It is possible that the reports of disease from different countries may not refer to the same disease and the cause of the disease may be different. The literature cited above shows that the disease is attributable to the reducing conditions which prevail in submerged rice soils, no matter what actual agent is involved.

ANALYTICAL METHODS

1. *Physical*.—Texture. Coarse sand, fine sand, silt and clay were determined by the international pipette mechanical analysis method as described by Piper.

2. *Physico-Chemical*.—Redox-Potentials (Eh) were determined *in situ*. Blank platinum electrodes were seated permanently in each pot at various depths from the surface of the soil. The potentials were measured with a Beckman pH meter Model G using a saturated calomel electrode.

pH measurements were made with a glass—calomel electrode system using a Beckman pH meter Model G.

Specific conductance of the supernatant liquids and water percolates was determined with a Conductivity Bridge embodying a cathode ray tube as null indicator using an immersion cell with a cell constant of 1.16.

3. *Chemical (a) Dry Soils*.—Nitrogen was determined by the Kjeldahl digestion and distillation method.

Organic matter was determined by the method of Walkley and Black.

Base Exchange Capacity was determined by the method of Peach *et al*.

Total Exchangeable Bases was determined by the method of Bray and Willwhite.

Available Silica was determined by Kahler's method modified by Imaizium and Yoshida.

Available Phosphorus was determined by the method of extraction of Olsen and the colour development of Dickman and Bray.

Free Iron was determined by the method of extraction of Deb and the colour development by the O-phenanthroline method as described by Fortune and Mellon.

Easily Reducible Manganese was determined by the method of extraction of Sherman and colour development by Peach *et al.*

Total Iron and Total Manganese were determined after extraction with constant boiling hydrochloric acid and colour developed as stated above.

(b) *Supernatant Liquids and Water Percolates.*—For the analysis of ammonia and nitrate, the interfering substances were removed by a modification of the method prepared by the American Public Health Association for the clarification of water and sewage. Fifty millimeters of the percolate were treated in a 25 × 250 mm. test tube with 5 drops of 10 per cent. zinc sulphate and a few drops of 25 per cent. sodium hydroxide to give a pH of approximately 10. To this was added Darco activated carbon to decolorize the percolate. The tubes were gently inverted a number of times and filtered. The filtered colourless percolate was used for the determination of ammonia and nitrate by the methods described below.

Ammonia was determined by a modification of the method proposed by Peach *et al* for the estimation of absorbed ammonia in cation exchange capacity determinations.

Aliquots of the clarified percolate were transferred into a 50 ml. volumetric flask containing about 40 ml. of water. Two and a half ml. of Nessler's solution prepared according to the directions of Peach *et al* were added and the mixture made up to the mark. The contents of the flask mixed well, allowed to stand 25 minutes and the transmittancy read at 410 μ on a Coleman Junior Spectrophotometer, using a 15 mm. cell. Zero to 100 micrograms N as NH_4Cl were used for the standard curve.

Nitrate was determined by the brucine method described by Knoll and the transmittancy measured at 470 μ , using a 15 mm. cell. Zero to 50 micrograms N as KNO_3 were used for the standard curve.

Iron was estimated, after reduction with hydroxylamine, by the O-phenanthroline method as described by Fortune and Mellon. The transmittancy was measured at 508 μ , using a 15 mm. cell. Zero to 50 micrograms Fe as Ferrous ammonium sulphate in acid solution were used for the standard curve.

VARIATION OF CHEMICAL AND PHYSICO-CHEMICAL CHARACTERISTICS OF
PADDY SOILS ON SUBMERGENCE

Manganese was determined by the periodate method according to the procedure described by Peech *et al*, after oxidation of organic matter and removal of chlorides by evaporation with nitric acid. The transmittancy was measured at 530μ , using a 15 mm. cell. Zero to 50 micrograms Mn were used for the standard curves.

Oxidisable matter was determined by a modification of the method presented by the American Public Health Association for the estimation of the oxygen consuming capacity of sewage.

Oxidisable matter includes soluble Fe^{++} , NO_2^1 and S^1 among the inorganic constituents and soluble organic matter that is oxidised under relatively mild conditions. This determination would give a measure of the reducing capacity of the soil solution. This is an arbitrary determination and has only comparative significance.

The method is based on the oxidation of the sample with potassium permanganate under standard conditions. The modified procedure used in this investigation is described below.

The sample (the volume used varied from 1.0 ml. to 10 ml.) was added to a mixture of 10 ml. of 0.01 KMnO_4 and 10 ml. of 1 : 3 H_2SO_4 with sufficient water to make a total volume of 100 ml. in a 250 ml. conical flask. The flask was heated in a boiling water bath for 30 minutes along with a blank. By this procedure the factors (strength of KMnO_4 , acidity of the medium and time of digestion), on which the figure for oxidisable matter depends, were kept nearly constant. Immediately after the digestion 10 ml. of 0.01N ammonium oxalate solution was added and the excess oxalate back titrated against 0.01 KMnO_4 . The difference between this reading and the blank reduced to an equivalent of 10 cc. of the percolate was taken as an index of the concentration of oxidisable matter or the reducing capacity of the percolates.

Calcium, sodium and potassium were determined by the flame photometer.

(c) *Wet Soils*.—About 50 grams of soil were extracted with a glass tube 24 in. long and 2 cm. diameter by inserting it into the pot in a circular motion. This was used for the analysis of the wet soils. About 7 grams of soil were used for pH and moisture determinations and the remainder for Morgan's extracts.

pH and moisture determinations were run on the same sub-sample. The sample was transferred to a tared 50 ml. beaker and the weight of the moist soil quickly determined. An equal weight (volume) of oxygen free distilled water was added, the beaker swirled and the pH determined with a glass electrode. The soil adhering to the electrodes

was washed into the beaker with a jet of water. After expulsion of the bulk of water on a water bath the soil was dried further in an oven at 105°C and the moisture percentage determined.

The remaining soil was transferred into a 500 ml. conical flask which had been previously weighed. The weight of the moist soil quickly determined, a rough allowance was made for the moisture content, on the basis of preliminary experience, and measured amounts of Morgan's solution added to give a soil extractant ratio of approximately 1 : 5. The flasks were allowed to stand for 24 hours with occasional swirling and the solution filtered through fluted filter paper. This solution was used for determining ammonia, iron, manganese and oxidisable matter by methods described for percolates. Morgan's extract of the soil will extract ferrous iron and not ferric iron. These figures will characterize the extent of reduction of the soil. With the aid of the amount of Morgan's extract added and the moisture content of the soil all figures are reduced to ppm of the dry soil. The values for oxidisable matter are reduced to ccs of 0.01N KMnO_4 per gm. of dry soil.

SUMMARY AND CONCLUSIONS

Twenty typical paddy soils collected from different parts of the island were kept submerged under greenhouse conditions without any rice plants grown in them. At intervals various chemical and physico-chemical characteristics of the supernatant liquids, water percolates and wet soils were determined.

Dry Soils

The analysis of the dry soils readily permit the soils to be grouped into seven classes.

Supernatant Liquids

(1) There were no determinable amounts of ammonia, nitrate, iron and manganese.

(2) Redox-potentials were constant and in the oxidising range.

(3) Sodium and potassium were more or less constant throughout. The presence of potassium indicates that it is taken away by the surface flow of water under field conditions.

(4) Oxidisable matter and conductivity increased, reached a peak and then decreased.

(5) pH and calcium increased and reached constant values.

Water Percolates

- (1) There were no detectable amounts of nitrate.
- (2) Ammonia, iron, manganese, oxidisable matter and conductivity increased, reached a peak and then decreased.
- (3) Sodium and potassium were more or less constant throughout.
- (4) pH and calcium increased and reached constant values.

Wet Soils

- (1) There were no detectable amounts of nitrate.
- (2) Ammonia, iron, manganese and oxidisable matter increased, reached a peak and then decreased.
- (3) pH increased and reached constant values. There was a negative correlation between the initial pH and the increase in pH. The lower the initial pH the greater was the increase.
- (4) The variations of Eh at depths of 2 ins., 4 ins. and 6 ins. indicate that denitrification takes place and their values show that reducing conditions prevail in the bulk of the soil.
- (5) The path of pH in the supernatant liquids and soils appear to depend more on the variations of calcium than on any other constituent.
- (6) Though the amount of iron reduced in the soil depends on its iron content, the amount of iron brought into solution depends on its pH. The lower the pH more iron is brought into solution and the amount of iron brought into solution is proportional to the increase in pH.

General

- (1) Application of nitrogenous fertilizers at the time of planting is not necessary for paddy as there is sufficient mineralization of soil nitrogen to the ammonical form of nitrogen when soils are puddled.
- (2) There are large losses of nitrogen due to denitrification when soils are puddled that the rate and time of application of nitrogenous fertilizers are extremely important.
- (3) Even with deep-placement of ammonical fertilizers denitrification still takes place.
- (4) Analysis of paddy soils under field conditions—wet state—is rather impractical and not necessary as it depends on the duration of submergence. The analysis of dry soils should permit the prediction of the chemical and physico-chemical status on submergence.

ACKNOWLEDGMENTS

The author gratefully acknowledges the assistance rendered by Messrs. B. M. Nizar and P. S. G. Perera, Laboratory Assistants, in conducting this experiment, in the chemical analysis and drawing of graphs.

REFERENCES

1. Administration Report of the Director of Agriculture, Ceylon, for 1960, p. 172.
2. Administration Report of the Director of Agriculture, Ceylon, for 1960-61, p. 240.
3. American Public Health Association. N. Y. 1953, Standard Methods for the Examination of Water and Sewage.
4. BRADFIELD, R., 1941, *Proc. Soil Sc. Soc. of Amer.* : 6 : 8-15.
5. BRAY, R. H., and WILLWHITE, F. M., 1929, *Ind. Eng. Chem. (Anal. Ed.)* Vol. 1 : 144.
6. DEB., B. C., 1949-50, *Jour. Soil Sc.* Vol. 1 : 212.
7. DENNET, J. H., 1932, *Malay Agric. Jour.* : 20 : 518.
8. DICKMAN, S. R., and BRAY, R. H., 1940, *Ind. Eng. Chem. (Anal. Ed.)* Vol. 12: 665.
9. FORTUNE, W. B., and MELLON, M. G. 1938, *Ind. Eng. Chem. (Anal. Ed.)* Vol. 10: 60.
10. GILLESPIE, L. J., 1920. *Soil Science*, 9, 199-216.
11. IMAZIUM, K., and YOSHIDA, S., 1958, *Bull. Nat. Inst. Agric. Sc. Japan. Series B. (Soils & Fert.)* 303.
12. JOFFE, J. S., 1935, *Soil Science*, 39 : 391-401.
13. KAHLER, H. L., 1941, *Ind. Eng. Chem. (Anal. Ed.)* Vol. 13 : 537.
14. KARUNKAR, P. D., and DANIEL, F. L., 1950, *Indian Jour. Agric. Sc.*—173-184.
15. KELLY, W. P., 1914, *Hawai Agric. Expt. Stat. Bull.* 31.
16. KNOLL, C. A., 1945, *Ind. Eng. Chem. (Anal. Ed.)* Vol. 17 : 426.
17. LEVEQUE, L. A., and BELLEY, MILLE, 1959, seventh sessions of the working party of Rice soils, water and Fertilizer Practices of the F.,A.O. International Rice Commission.
18. MAGISTAD, O. C., 1925, *Soil Science.* 20 : 181-225.
19. METZGER, W. H., 1930, *Soil Science*, 29 : 251-260.
20. MORTIMER, C. H., 1941, *Jour. Ecol.* 29 : 280-329.
21. Ministry of Agriculture and Forestry, Tokyo, 1954, Physiological diseases of the rice plant in Japan.
22. OLSEN, S. R., 1954, *U. S. D. A. Circular* 939.
23. OTA, Y., 1962, Symposium on 'Rice Production and Environment.' Ceylon Association for the Advancement of Science, Section B.
24. OTA, Y. and YAMADA, N., 1962, *Proc. Crop. Sc. Soc. Japan*, Vol. XXXI. No. 1: 90-97.
25. OTA, Y., and YAMADA, N., 1960, *Proc. Crop. Sc. Soc. Japan*, Vol. XXVIII. No. 4 : 367-370.

VARIATION OF CHEMICAL AND PHYSICO-CHEMICAL CHARACTERISTICS OF
PADDY SOILS ON SUBMERGENCE

26. PEECH *et al.*, 1947, *U. S. D. A. Circular No.* 757.
27. PIPER, C. S : Soil and Plant Analysis.
28. PONNAMPERUMA, F. N., Bradfield, R., and PEACH, M., 1955, *Nature* 175 : 265.
29. PONNAMPERUMA, F. N., 1955, *Tropical Agriculturist*, Vol : CXI : 92-101.
30. PONNAMPERUMA, F. N., 1958, *Intern. Rice Comm. News letter* No. 7 : 10-13.
31. RAMIAH, K. 1952, *Inter. Rice Com. News letter* No. 3, 1-9.
32. RAYMONDO, M. E. PANTASTICO, E. B., and MANARPAAC, V. T., *The Philippine Agriculturist*, 1962, Vol : XLVI, No. 7, p. 566.
33. REED, F. J., and STURGIS, M. B., 1939, *Lousiana Bull* : No. 307.
34. ROBINSON, W. O., 1930, *Soil Science* 30 : 197-217.
35. RODRIGO, D. M., 1961, *Trop. Agriculturist*, Vol. CXVII, 245-272.
36. RODRIGO, D. M., & POLLARD, A. G., 1962 *Jour. of Sc. of Food and Agric.*, No. 1, 43-48.
37. SCHOLLENBERGER, C. J., 1928, *Soil Science*, 25 : 357-358.
38. SHERMAN *et al.*, 1942, *Journal of Soil Science*, 253.
39. SIK, K. 1950, *Agrartud*, 2 : 400-422.
40. SUBRAHMANYAN, V., 1927, *Jour. Agric. Sc.*, 17 : 429-467.
41. VAMOS, R., 1959, *Plant and Soil*, 11 (1) : 65-77.
42. WALKLEY, A., and BLACK, I. A., Soil and Plant Analysis by Piper.
43. YAMADA, N., 1959, *Tropical Agriculturist*, Vol : CXV. No. 4 : 241-247.

INDEX TO GRAPHS

1. Strongly acid lateritic rice soils of the ultra wet zone.
2. Strongly acid humic rice soils.
3. Ground water podzolic rice soils.
4. Acid-lateritic rice soils of the wet zone.
5. Non-lateritic rice soils of the dry zone.
6. Calcareous rice soils.
7. Non-lateritic clayey rice soils.

VARIATION OF CHEMICAL AND PHYSICO-CHEMICAL CHARACTERISTICS OF
PADDY SOILS ON SUBMERGENCE

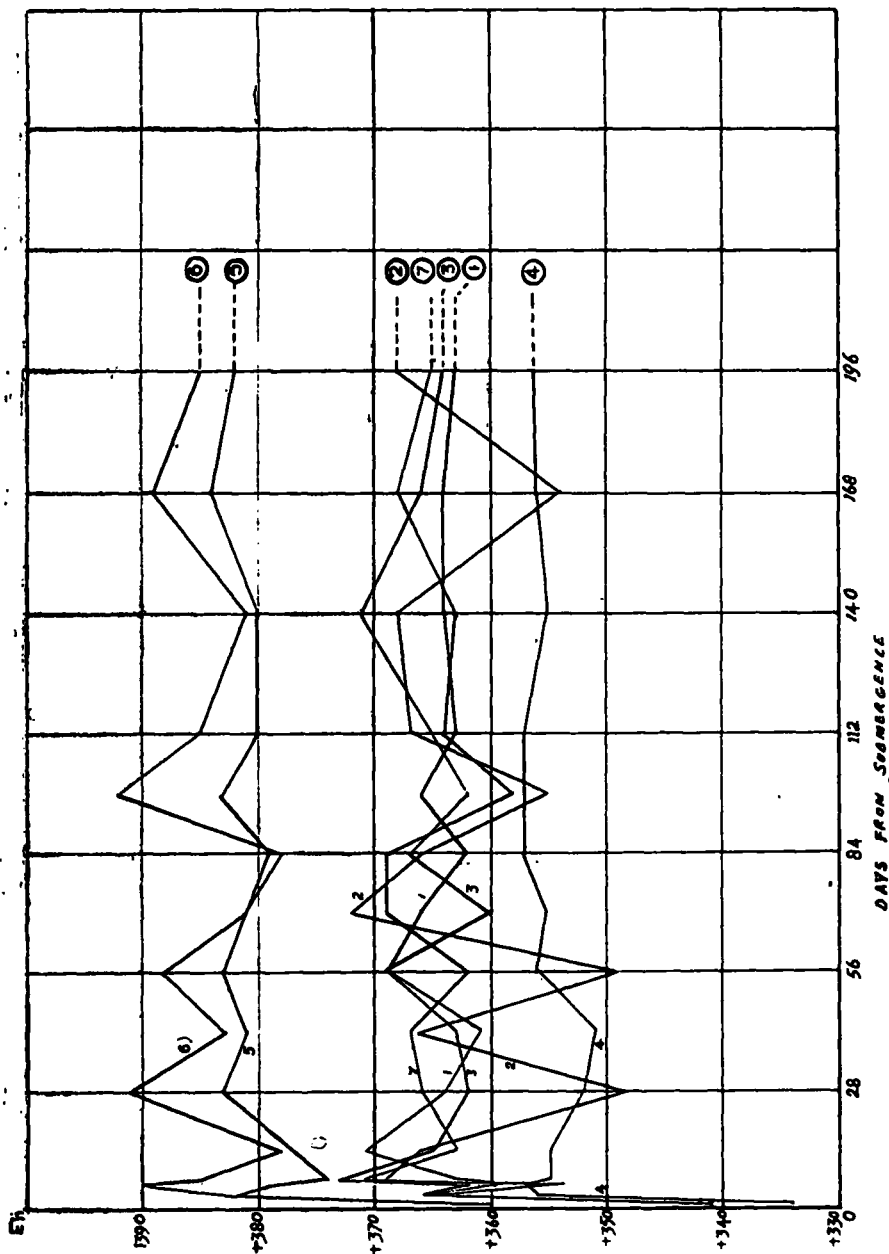


FIG. 1. Eh of Supernatant Liquids at pH 7.0.

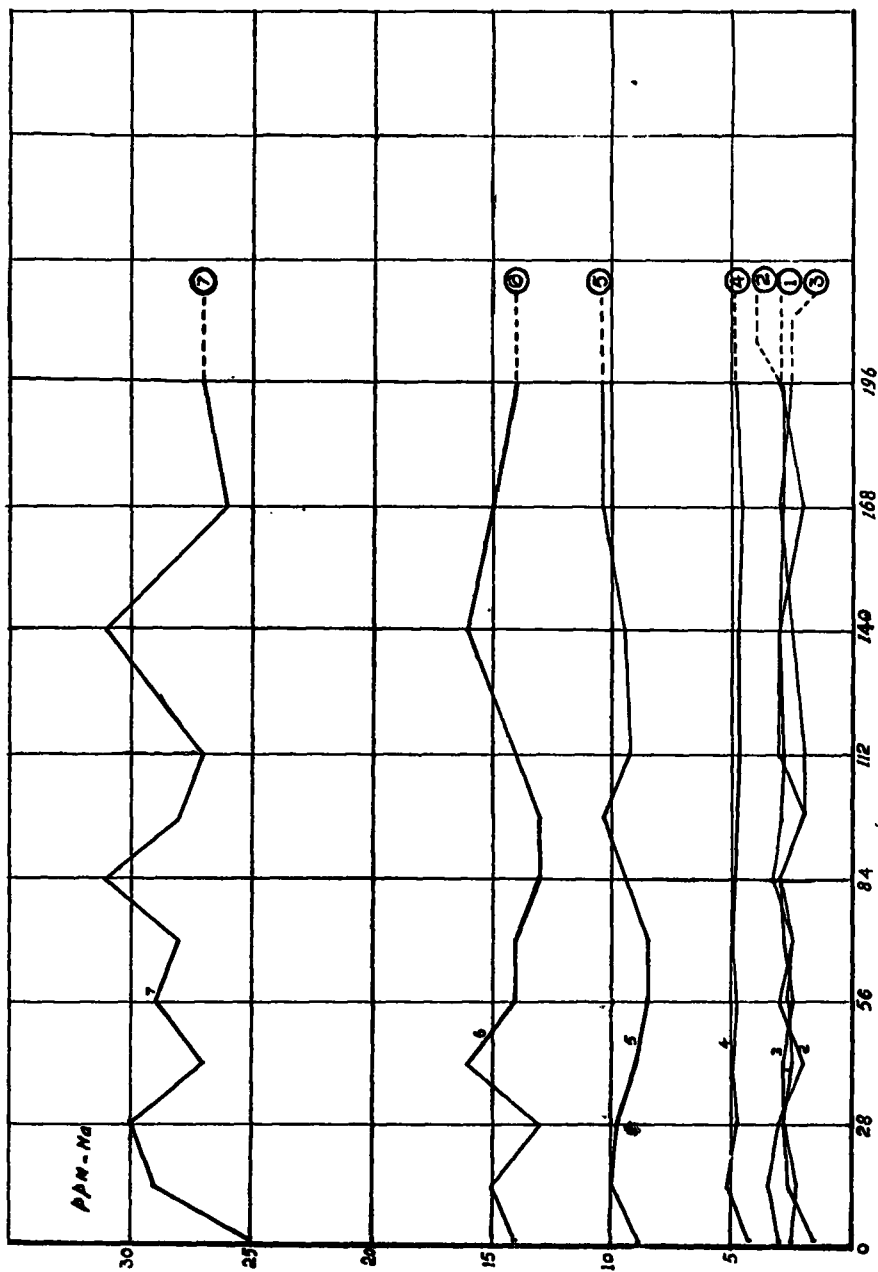


FIG. II. Supernatant-Liquids—Sodium ppm.

VARIATION OF CHEMICAL AND PHYSIOO-CHEMICAL OHARAACTERISTICS OF
PADDY SOILS ON SUBMERGENCE

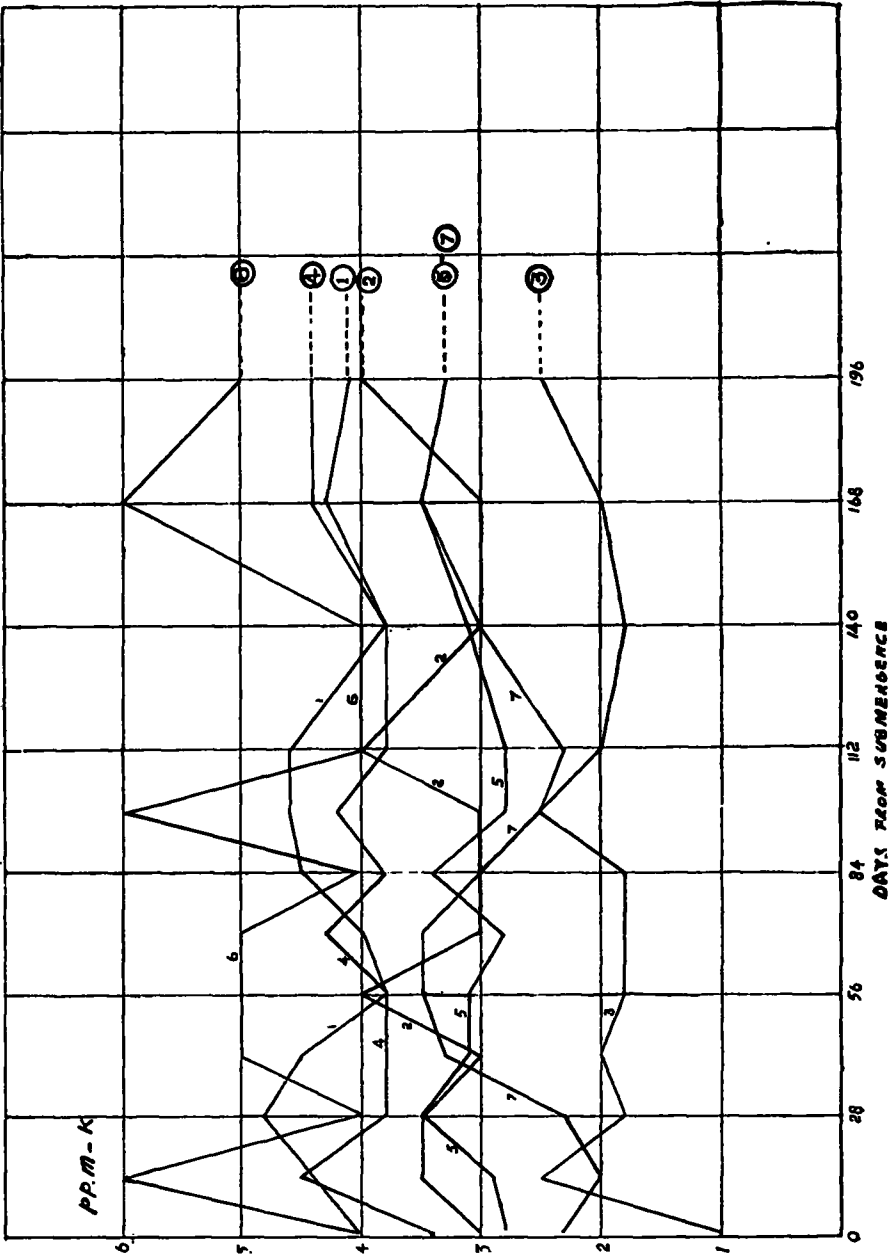
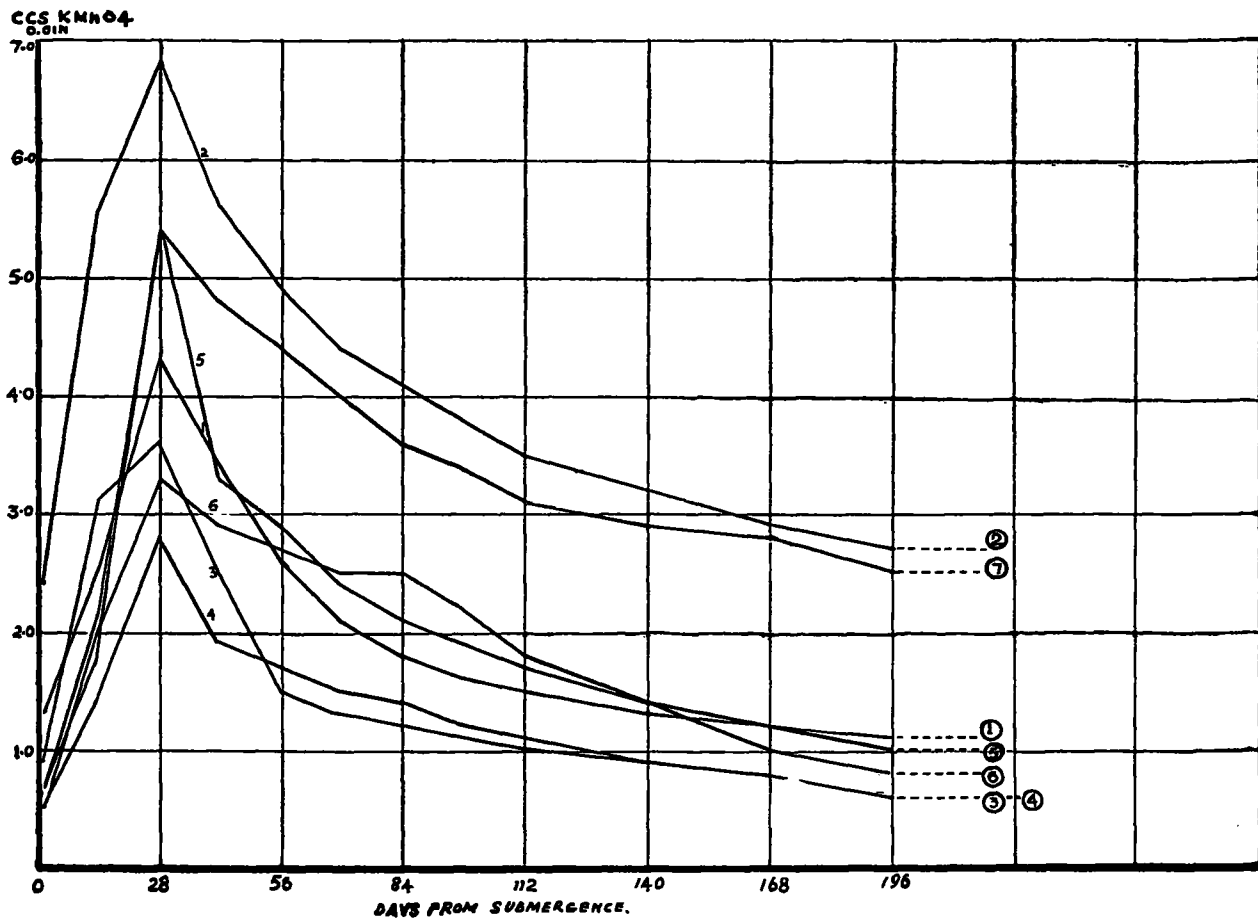


FIG. III. Supernatant-Liquids—Potassium ppm.



FIG. IV. Oxidisable Matter of Supernatant Liquids—ccs of KMnO_4 0.01 N per 10 cc.

VARIATION OF CHEMICAL AND PHYSICO-CHEMICAL CHARACTERISTICS OF
PADDY SOILS ON SUBMERGENCE

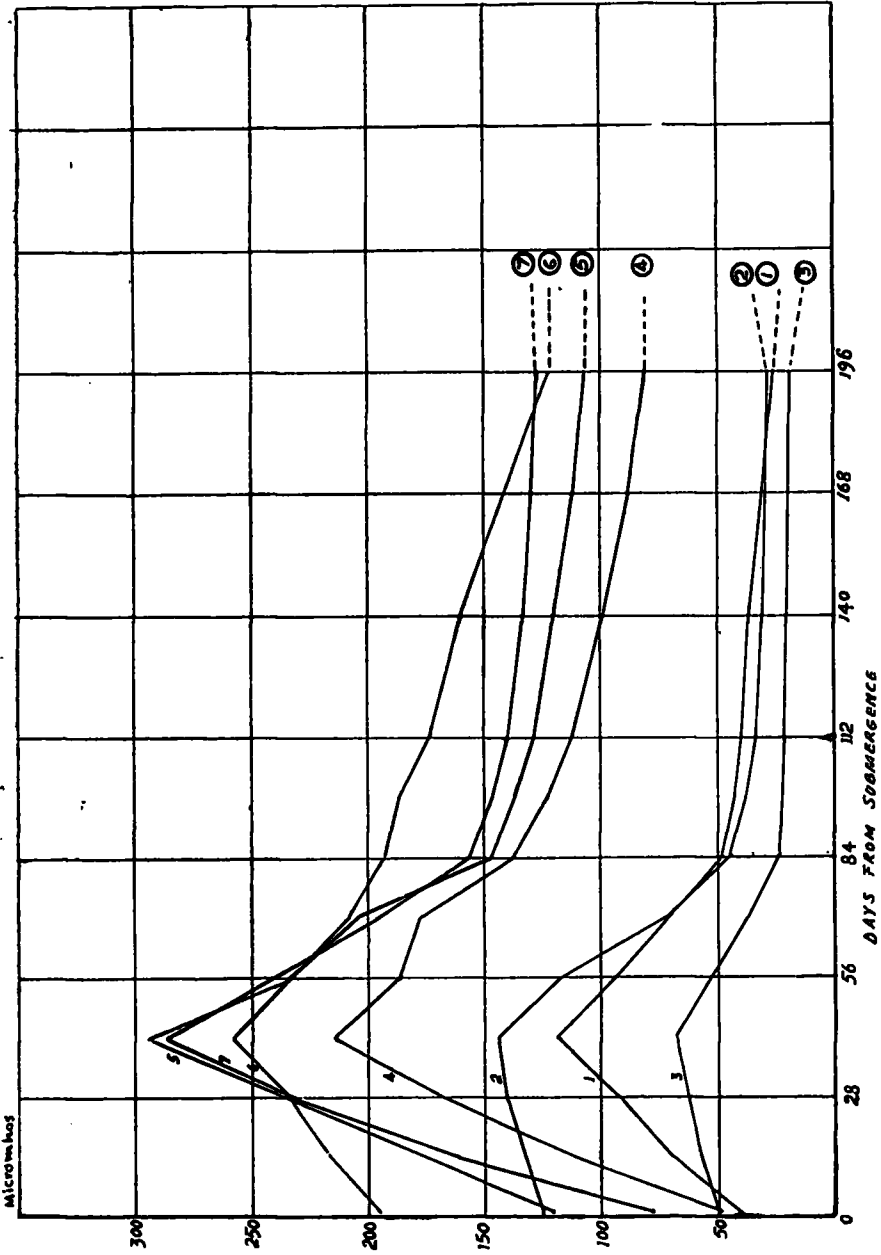


FIG. V. Conductivity of Supernatant Liquids in micromhos.

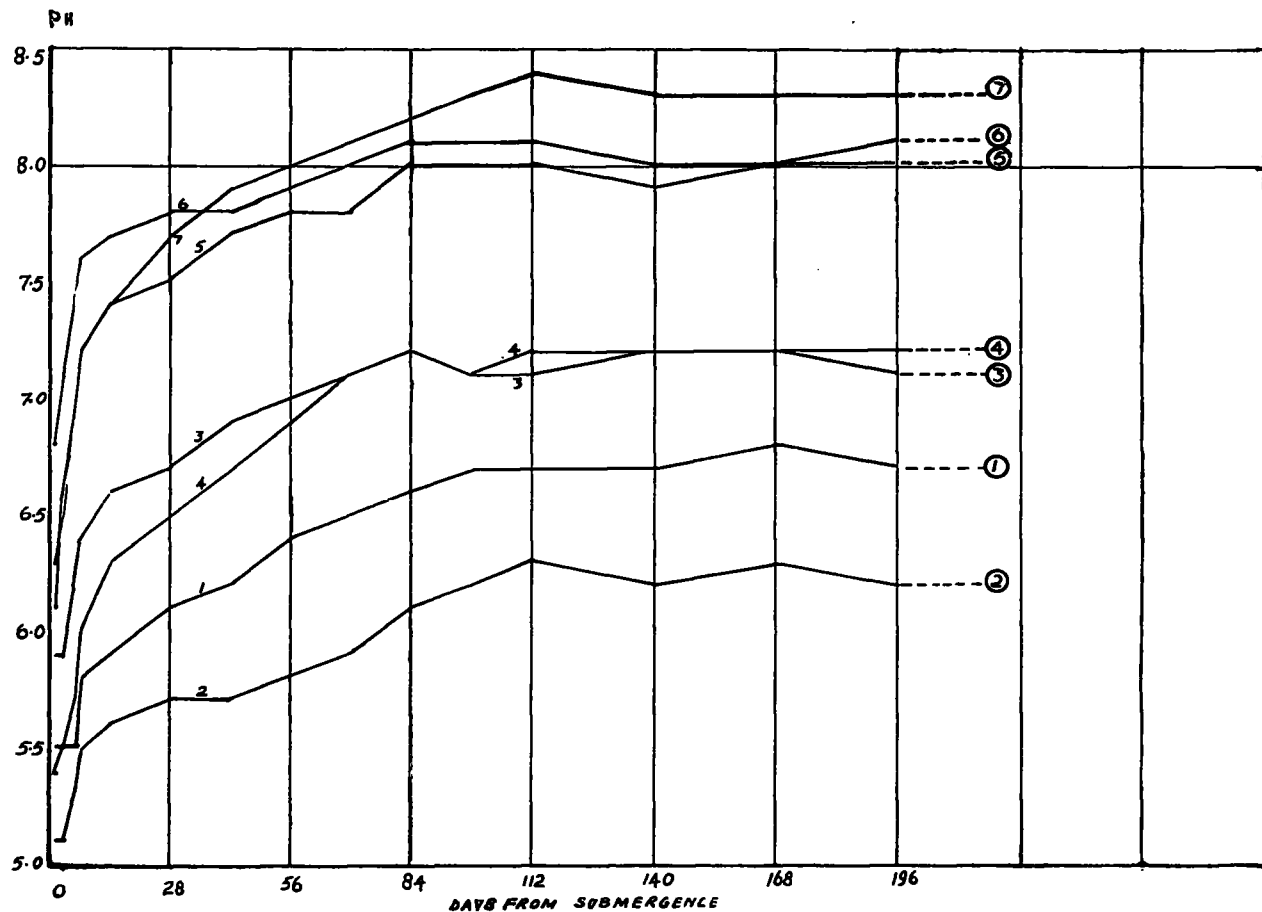


FIG. VI. pH of Supernatant Liquids.

VARIATION OF CHEMICAL AND PHYSICO-CHEMICAL CHARACTERISTICS OF
PADDY SOILS ON SUBMERGENCE

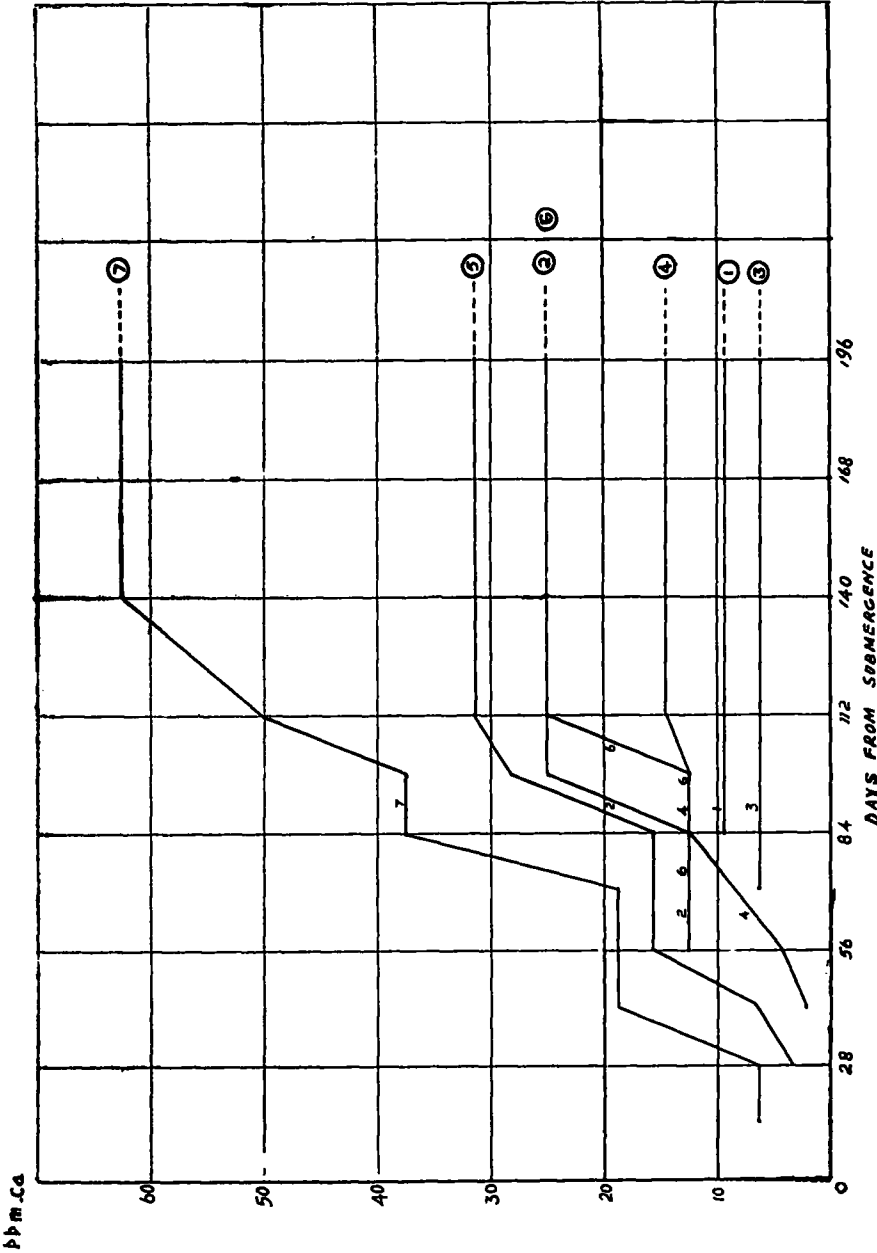


FIG. VII. Supernatant Liquids—Calcium ppm.

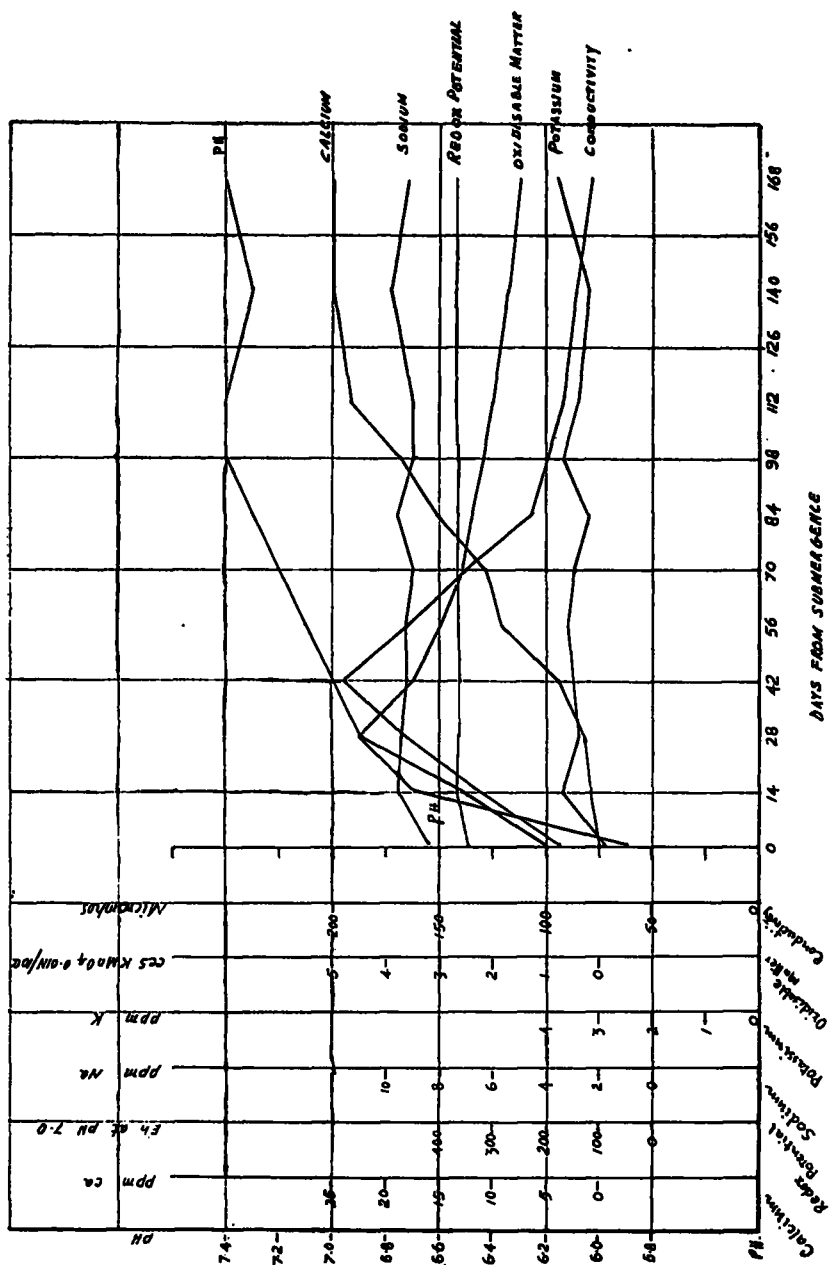


FIG. VIII. Supernatant Liquids—Means of the averages of the 7 groups of soils.

VARIATION OF CHEMICAL AND PHYSICO-CHEMICAL CHARACTERISTICS OF
PADDY SOILS ON SUBMERGENCE

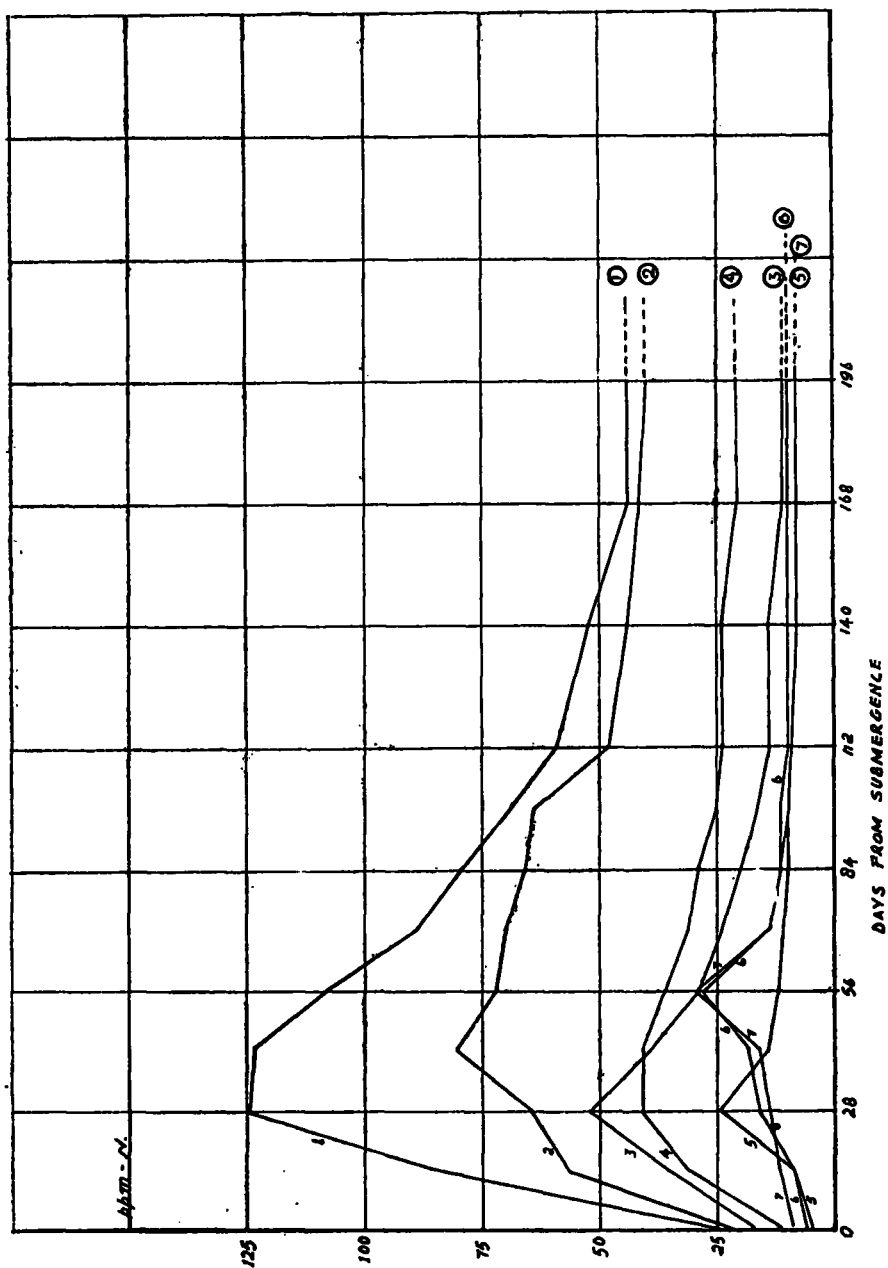


FIG. IX. Water percolates NH_4 -ppm-N.

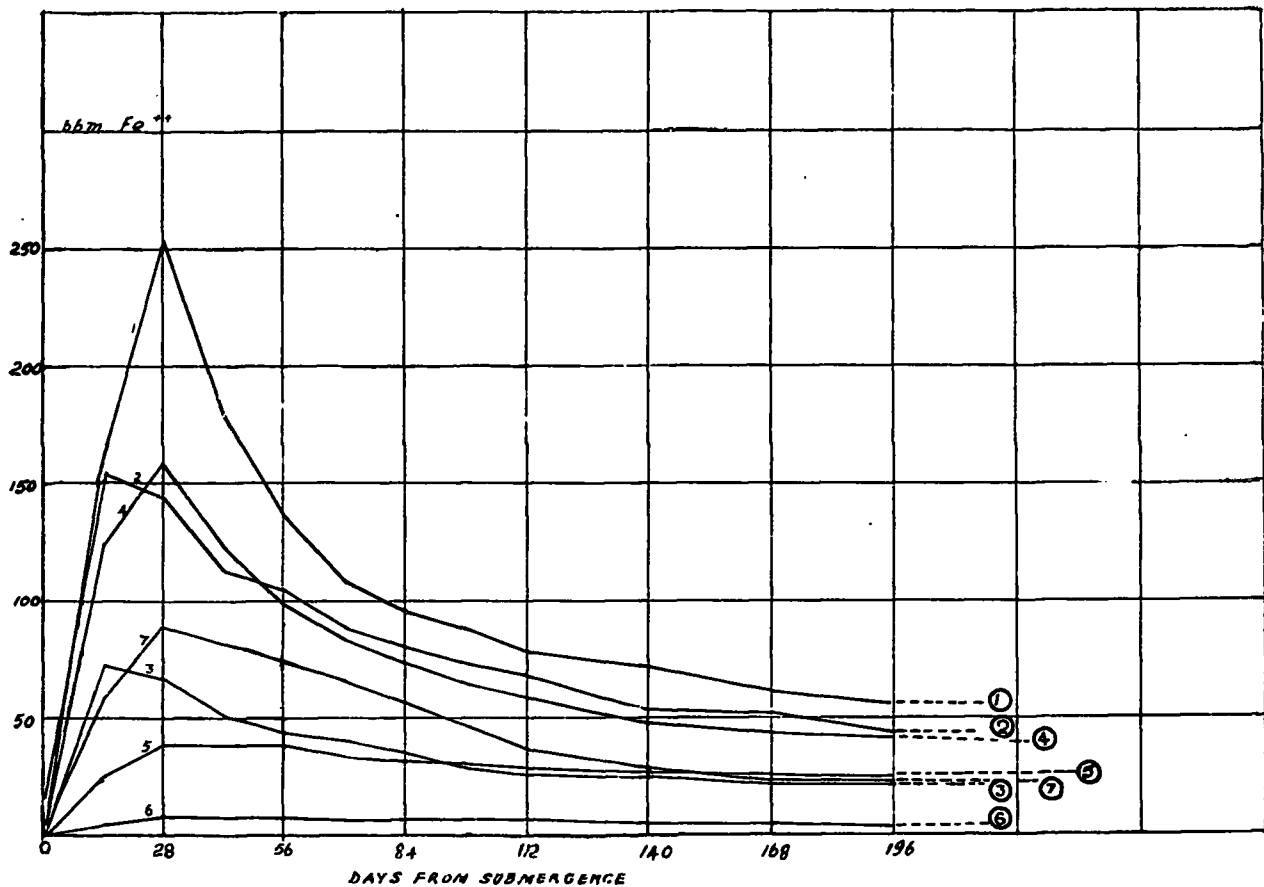


FIG. X. Water percolates — Fe⁺⁺ — ppm.

VARIATION OF CHEMICAL AND PHYSICO-CHEMICAL CHARACTERISTICS OF PADDY SOILS ON SUBMERGENCE

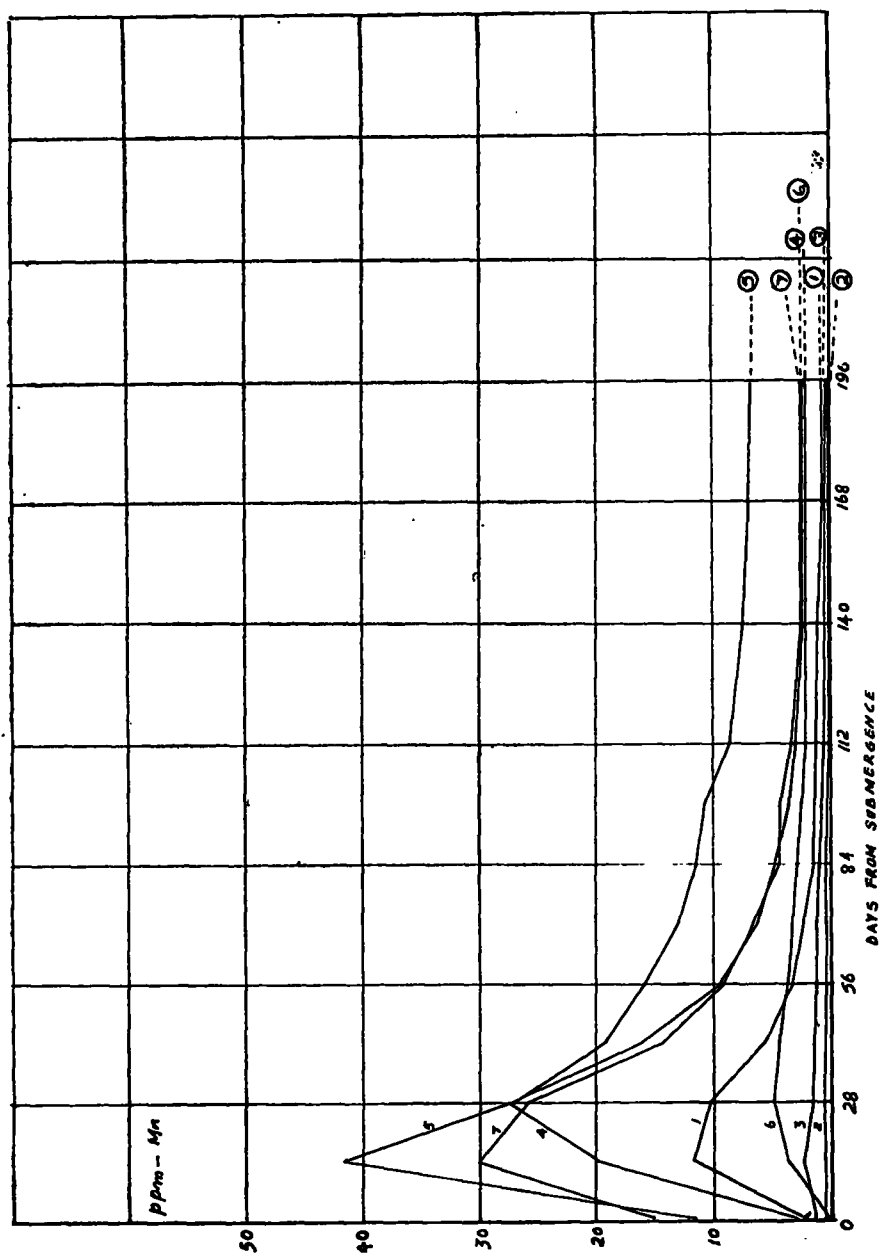


FIG. XI. Water parcolates—Mn—ppm.

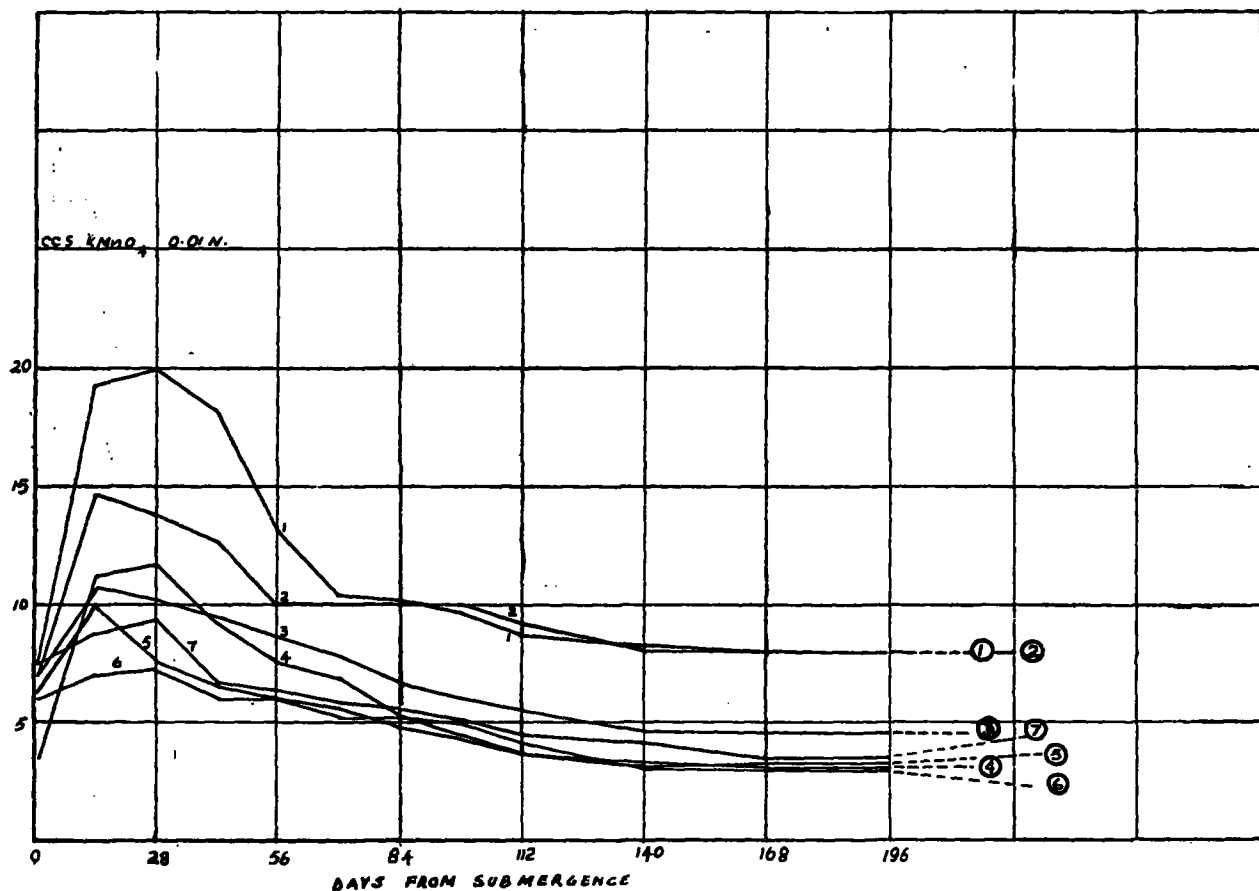


FIG. XII. Water percolates—Oxidisable Matter—ccs KMnO_4 0.01N per 10 cc.

VARIATION OF CHEMICAL AND PHYSICO-CHEMICAL CHARACTERISTICS OF
PADDY SOILS ON SUBMERGENCE

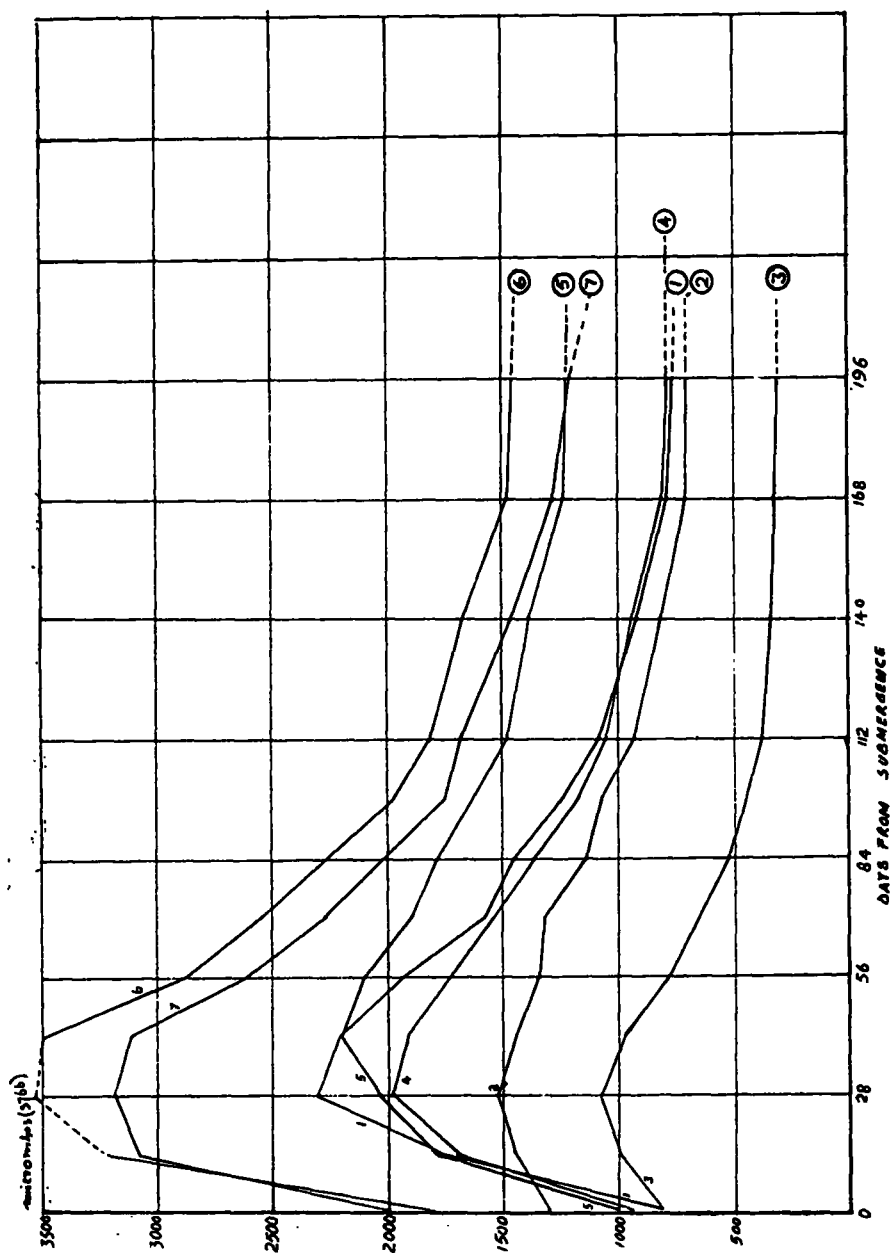


FIG. XIII. Conductivity of Water percolates in micromhos.

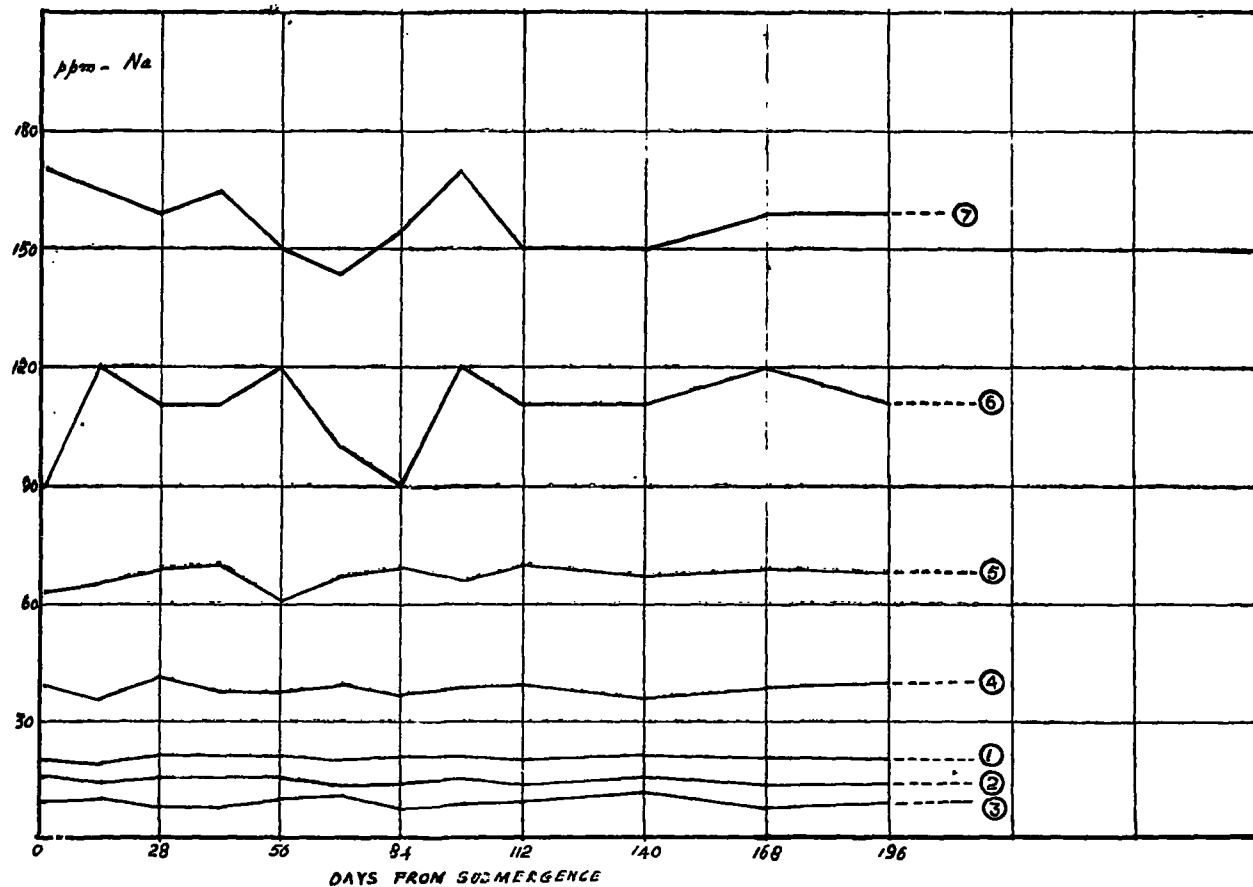


FIG. XIV. Water percolates—Sodium ppm.

VARIATION OF CHEMICAL AND PHYSIO-CHEMICAL CHARACTERISTICS OF
PADDY SOILS ON SUBMERGENCE

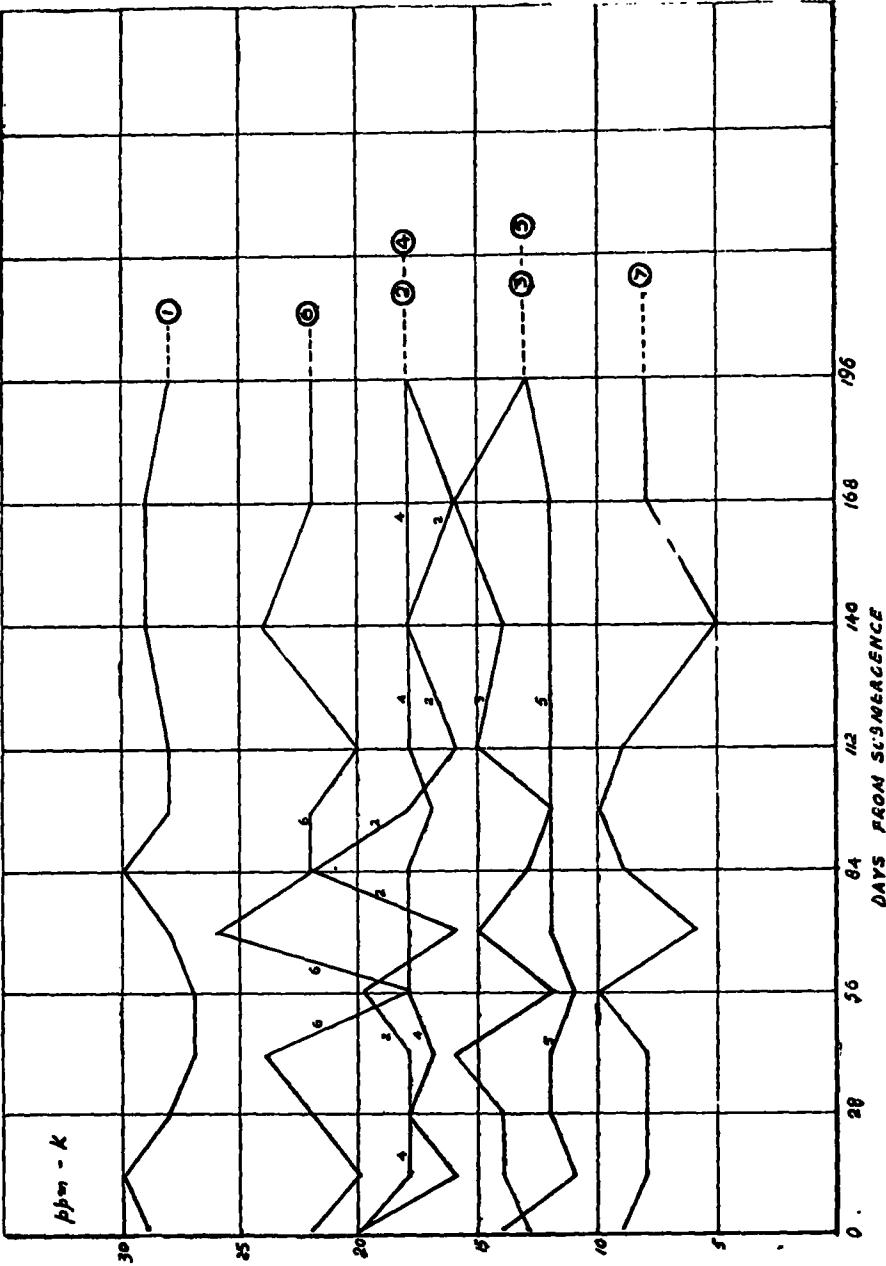


FIG. XV. Water percolates—Potassium ppm.

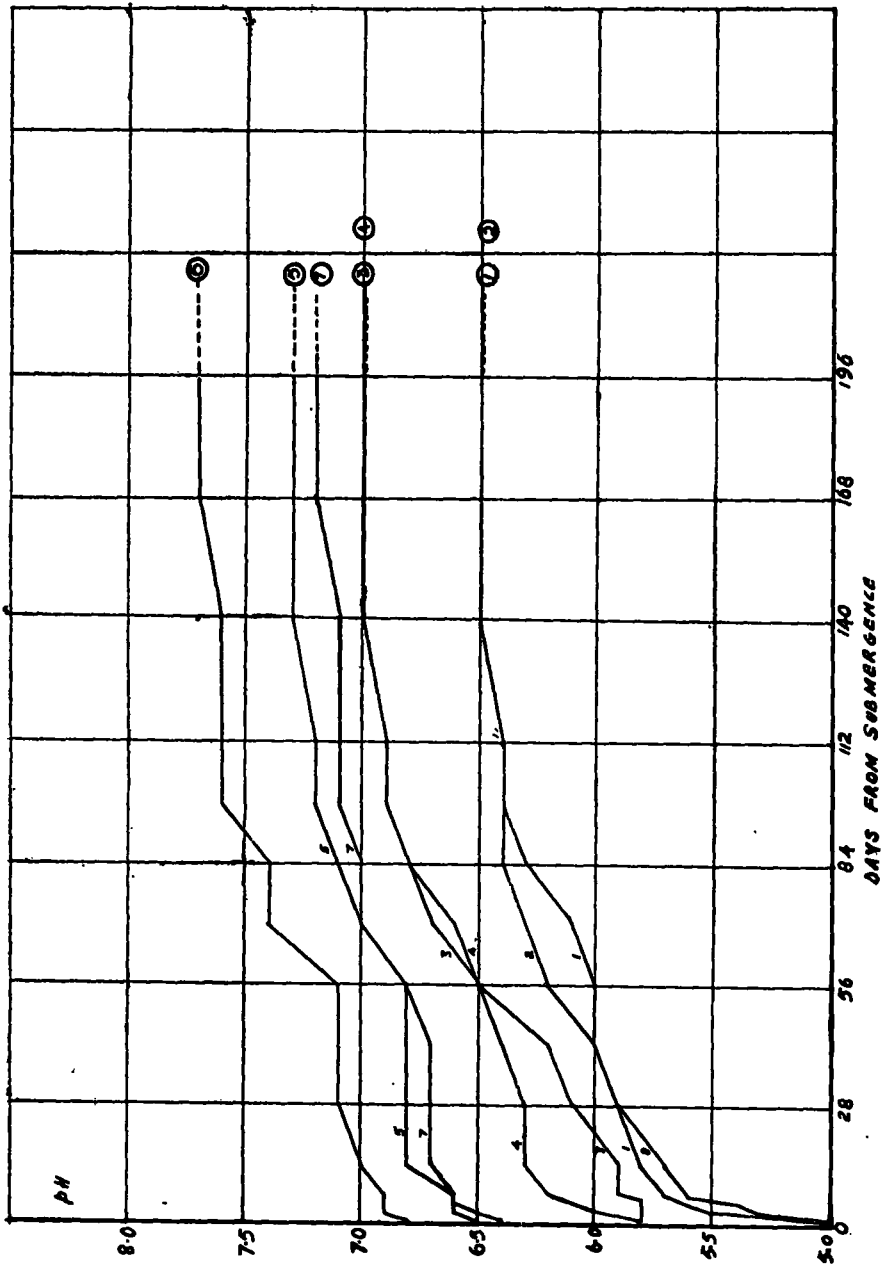


FIG. XVI. pH of soils.

VARIATION OF CHEMICAL AND PHYSICO-CHEMICAL CHARACTERISTICS OF
PADDY SOILS ON SUBMERGENCE

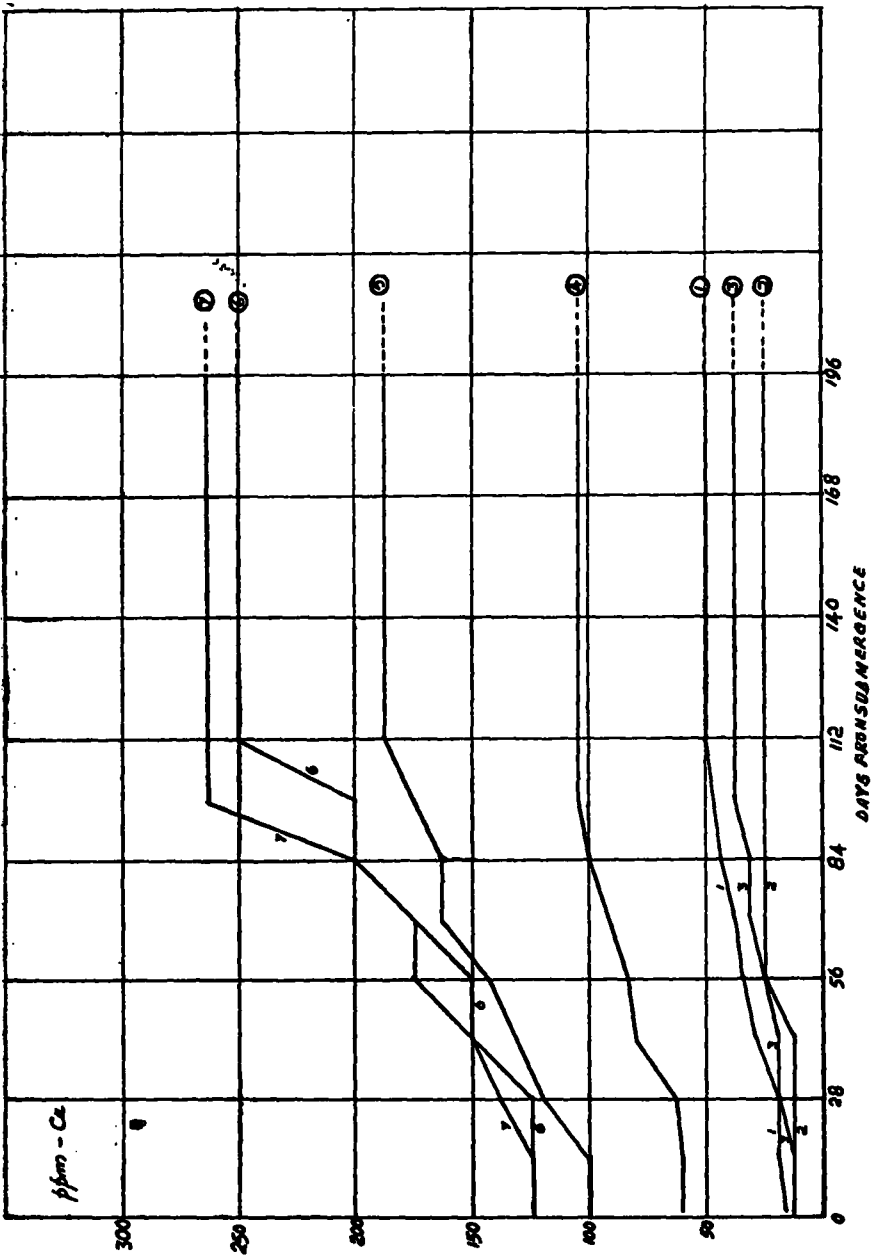
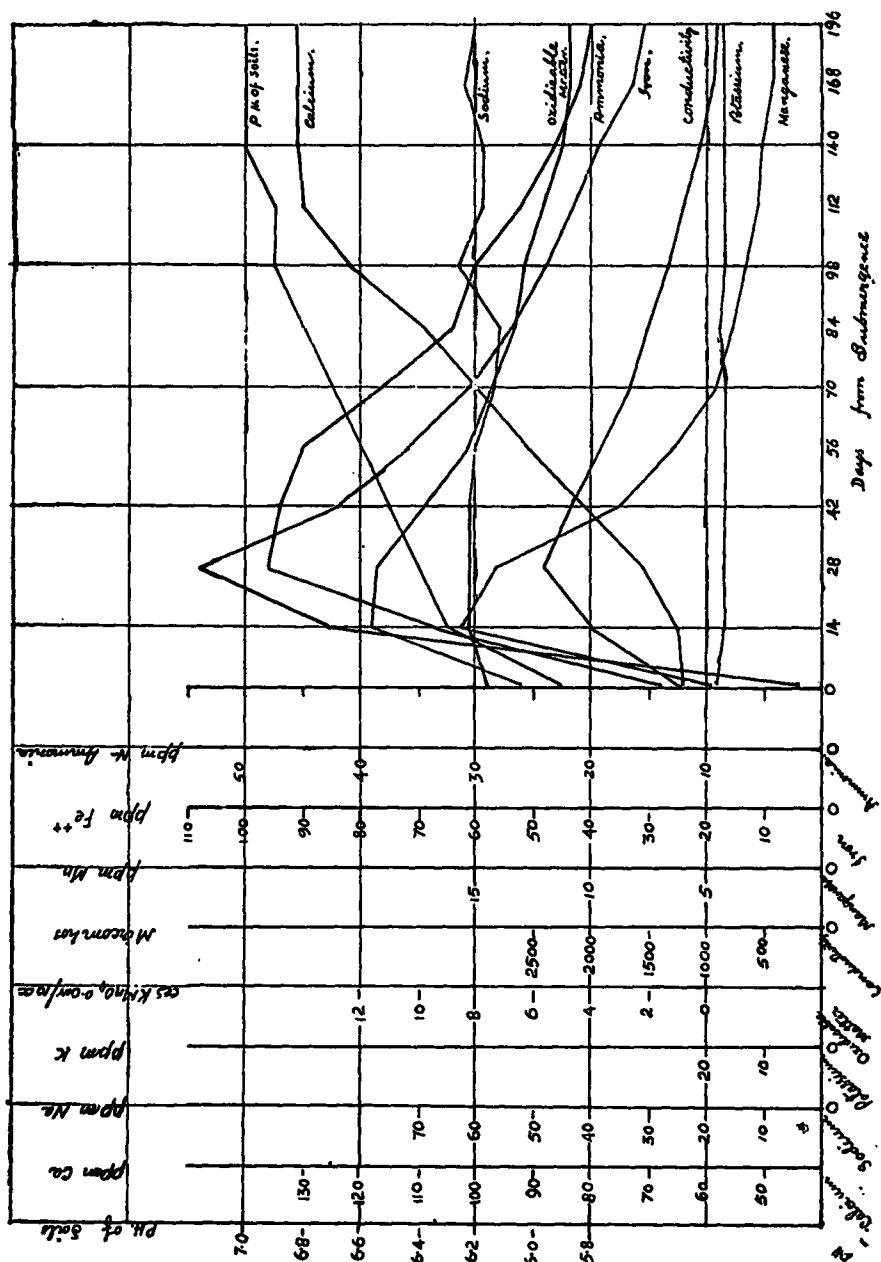


FIG. XVII. Water percolates—Calcium ppm.



VARIATION OF CHEMICAL AND PHYSICO-CHEMICAL CHARACTERISTICS OF PADDY SOILS ON SUBMERGENCE

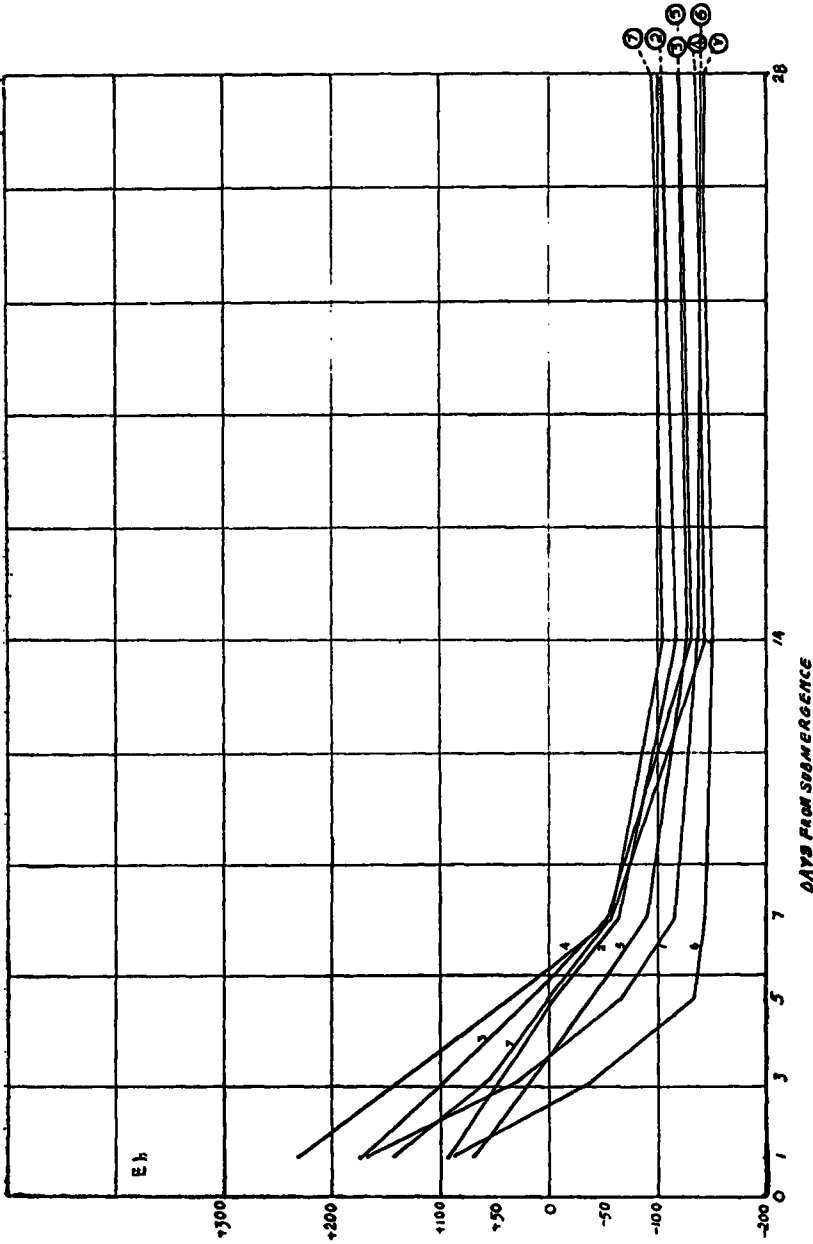


FIG. XIX. Redox—Potential of Soils at 2 inches below surface—Eh at pH 7.0.

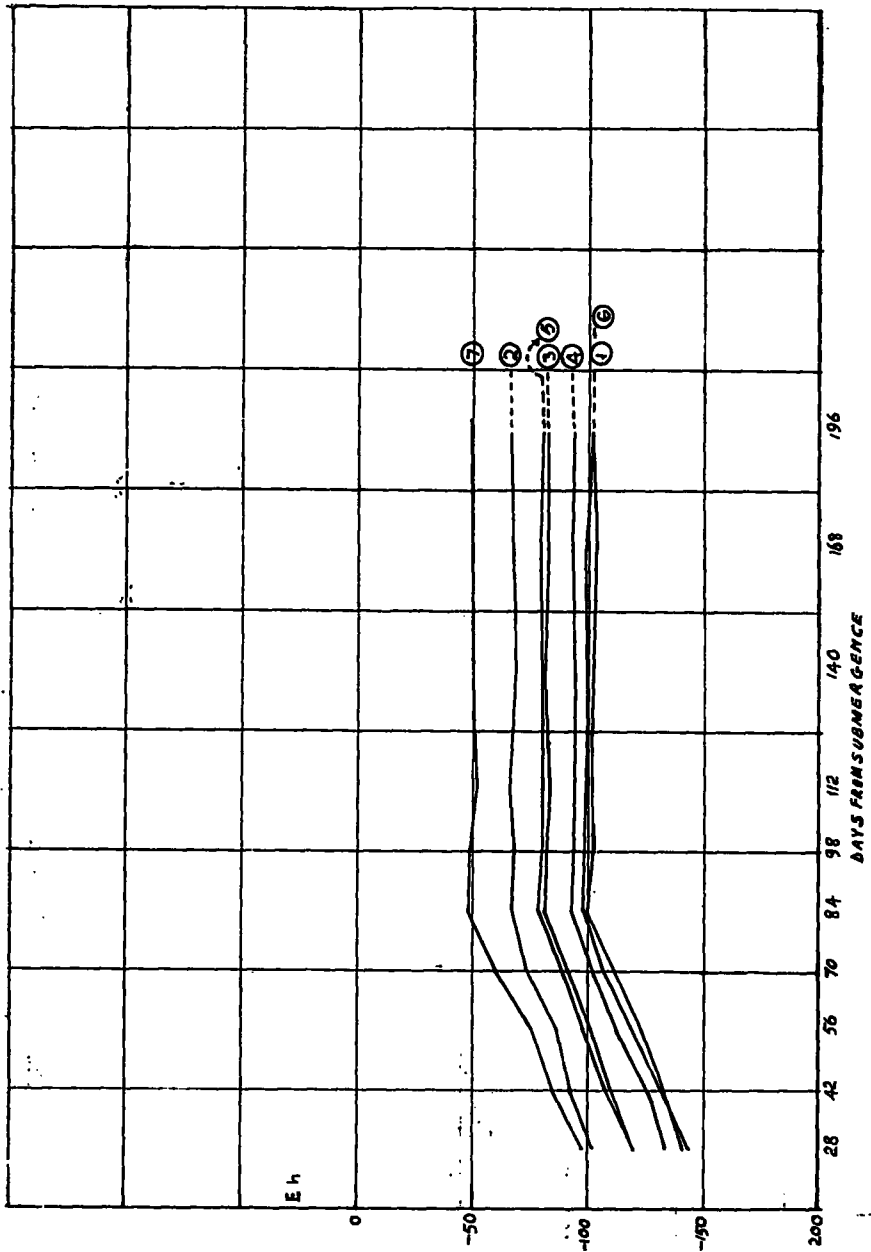


FIG. XX. Redox—Potential of soil at 2" below the surface—Eh at pH 7.0.

VARIATION OF CHEMICAL AND PHYSICO-CHEMICAL CHARACTERISTICS OF
PADDY SOILS ON SUBMERGENCE

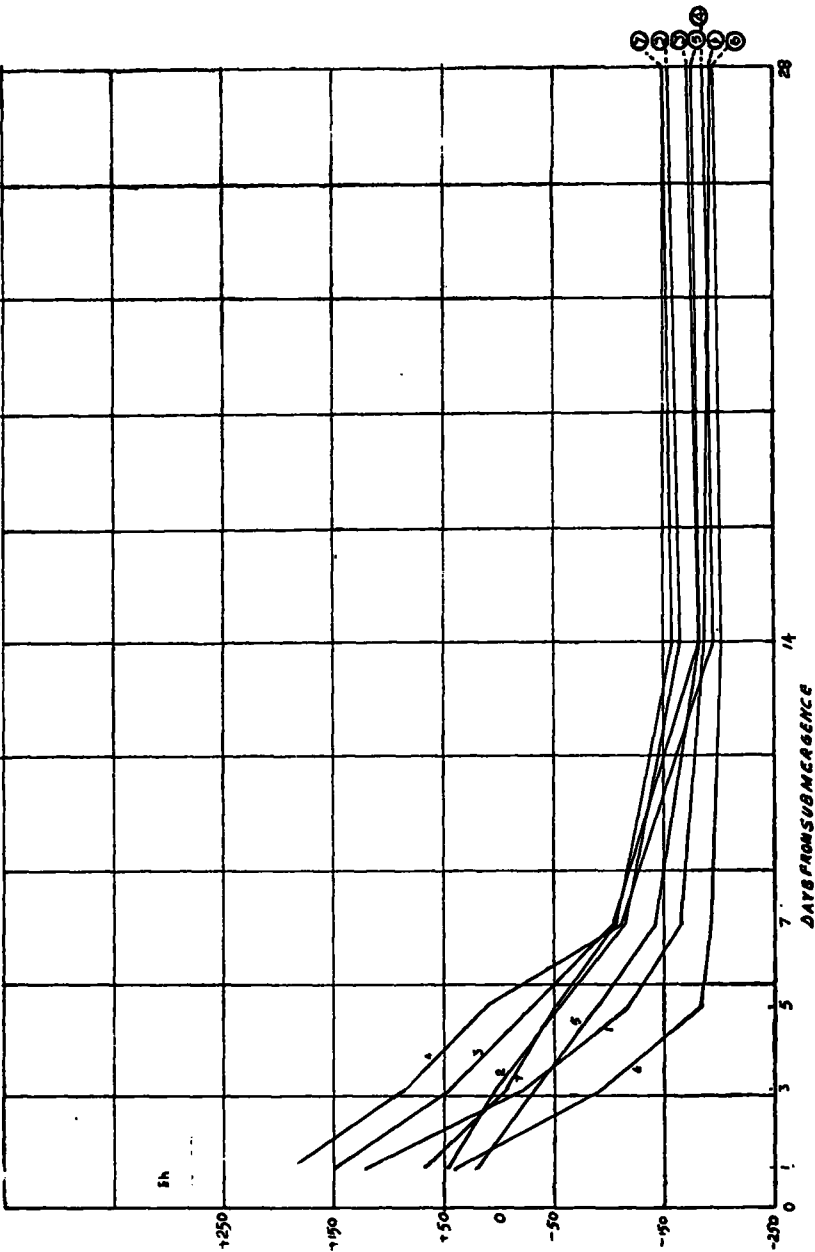


FIG. XXI. Redox-Potential of Soils 4" below surface—Eh at pH 7.0.

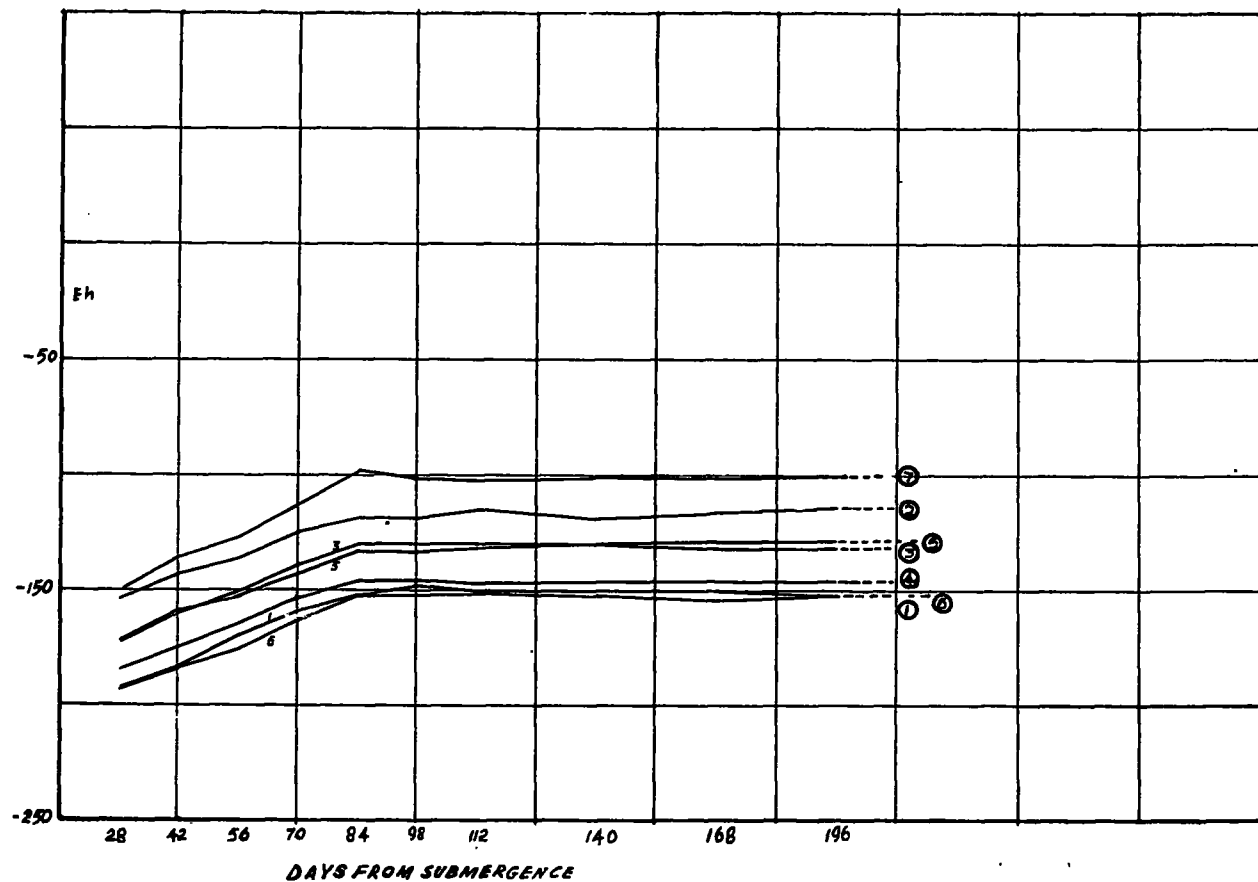


FIG. XXII. Redox—Potential of Soils 4" below surface—Eh at pH 7.0.

VARIATION OF CHEMICAL AND PHYSICO-CHEMICAL CHARACTERISTICS OF PADDY SOILS ON SUBMERGENCE

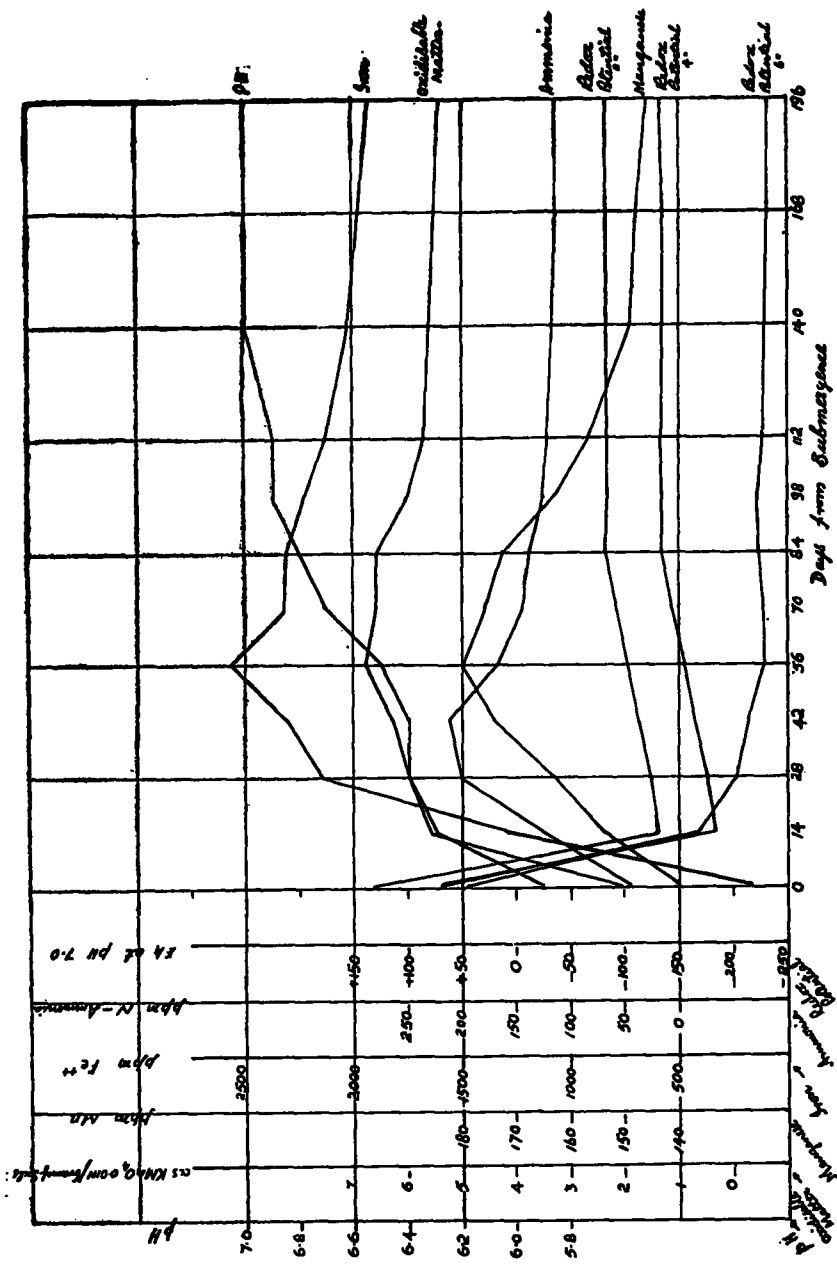


Fig. XXIII. Wet Soils—Means of the averages of the 7 groups of soils.

TABLE 1
Supernatant Liquids—Redox Potentials—Eh at pH?

Days from Submergence	1	3	5	7	14	28	42	56	70	84	98	112	140	168	196
1. Strongly Acid Lateritic Rice Soils of the Ultra Wet Zone—															
(1) Panagoda ..	320 ..	345 ..	330 ..	352 ..	362 ..	344 ..	341 ..	358 ..	346 ..	344 ..	356 ..	339 ..	342 ..	346 ..	344
(2) Mirigama ..	350 ..	377 ..	363 ..	372 ..	382 ..	374 ..	362 ..	376 ..	384 ..	372 ..	366 ..	374 ..	378 ..	376 ..	372
(3) Mapalana ..	352 ..	374 ..	372 ..	383 ..	382 ..	372 ..	369 ..	374 ..	376 ..	368 ..	373 ..	381 ..	374 ..	368 ..	374
(4) Karapincha ..	342 ..	366 ..	371 ..	364 ..	359 ..	367 ..	371 ..	368 ..	369 ..	363 ..	369 ..	358 ..	367 ..	366 ..	362
2. Strongly Acid Humic Rice Soils—															
(1) Bombuwela Peaty ..	348 ..	365 ..	354 ..	369 ..	386 ..	348 ..	366 ..	349 ..	372 ..	366 ..	355 ..	367 ..	368 ..	354 ..	368
3. Ground Water Podzolic Rice Soils—															
(1) Bombuwela Sandy ..	344 ..	368 ..	364 ..	375 ..	358 ..	366 ..	369 ..	374 ..	364 ..	376 ..	354 ..	364 ..	382 ..	366 ..	366
(2) Battie, Ioa ..	342 ..	363 ..	360 ..	370 ..	371 ..	358 ..	357 ..	364 ..	366 ..	358 ..	370 ..	365 ..	360 ..	366 ..	362
4. Acid Lateritic Rice Soils of the Wet Zone—															
(1) Wellmada ..	332 ..	354 ..	348 ..	352 ..	361 ..	355 ..	363 ..	357 ..	348 ..	352 ..	362 ..	354 ..	355 ..	359 ..	353
(2) Bibile ..	336 ..	355 ..	364 ..	342 ..	354 ..	344 ..	344 ..	358 ..	356 ..	363 ..	365 ..	354 ..	356 ..	342 ..	358
(3) Peradeniya ..	348 ..	369 ..	374 ..	372 ..	366 ..	368 ..	368 ..	366 ..	372 ..	368 ..	354 ..	362 ..	371 ..	374 ..	370
(4) Kundasale ..	331 ..	355 ..	343 ..	362 ..	352 ..	356 ..	348 ..	354 ..	356 ..	364 ..	352 ..	356 ..	348 ..	356 ..	354
(5) Matale ..	326 ..	348 ..	353 ..	352 ..	347 ..	344 ..	341 ..	340 ..	348 ..	346 ..	355 ..	354 ..	347 ..	348 ..	346
(6) Nalanda ..	332 ..	354 ..	359 ..	360 ..	348 ..	357 ..	353 ..	360 ..	348 ..	348 ..	356 ..	360 ..	350 ..	354 ..	356
5. Non-lateritic Rice Soils of the Dry Zone—															
(1) Polonnaruwa ..	356 ..	378 ..	372 ..	368 ..	366 ..	375 ..	377 ..	363 ..	362 ..	375 ..	376 ..	375 ..	369 ..	382 ..	377
(2) Hingurakgoda ..	358 ..	380 ..	377 ..	372 ..	385 ..	382 ..	381 ..	371 ..	373 ..	386 ..	384 ..	380 ..	377 ..	382 ..	385
(3) Maha Iluppallama Red ..	362 ..	383 ..	380 ..	375 ..	378 ..	385 ..	381 ..	388 ..	378 ..	374 ..	383 ..	386 ..	381 ..	385 ..	382
(4) Maha Iluppallama Grey ..	364 ..	385 ..	388 ..	382 ..	378 ..	388 ..	385 ..	391 ..	390 ..	382 ..	385 ..	380 ..	392 ..	386 ..	384
6. Calcareous Rice Soils—															
(1) Jaffna ..	361 ..	383 ..	390 ..	385 ..	378 ..	39 1 ..	383 ..	388 ..	381 ..	378 ..	392 ..	385 ..	381 ..	389 ..	385
7. Non-lateritic Clayey Rice Soils—															
(1) Ambalantota 1 ..	340 ..	364 ..	358 ..	370 ..	361 ..	369 ..	365 ..	362 ..	369 ..	372 ..	358 ..	356 ..	361 ..	368 ..	365
(2) Ambalantota 2 ..	344 ..	366 ..	358 ..	372 ..	365 ..	362 ..	360 ..	361 ..	369 ..	366 ..	363 ..	372 ..	365 ..	368 ..	364

TABLE II
Supernatant Liquids—Redox Potentials—Eh at pH 7—Averages

<i>Days from Submergence</i>	<i>1</i>	<i>3</i>	<i>5</i>	<i>7</i>	<i>14</i>	<i>28</i>	<i>42</i>	<i>56</i>	<i>70</i>	<i>84</i>	<i>98</i>	<i>112</i>	<i>140</i>	<i>168</i>	<i>196</i>
1. Strongly Acid Lateritic Rice Soils of the Ultra Wet Zone ..	341 ..	366 ..	359 ..	363 ..	371 ..	364 ..	361 ..	369 ..	366 ..	362 ..	366 ..	363 ..	364 ..	364 ..	363
2. Strongly Acid Humic Rice Soils (one soil) ..	343 ..	365 ..	354 ..	369 ..	366 ..	348 ..	366 ..	349 ..	372 ..	366 ..	355 ..	367 ..	368 ..	354 ..	368
3. Ground Water Podzolic Rice Soils ..	343 ..	366 ..	362 ..	373 ..	365 ..	362 ..	363 ..	369 ..	360 ..	367 ..	362 ..	365 ..	371 ..	366 ..	364
4. Acid Lateritic Rice Soils of the Wet Zone ..	334 ..	356 ..	357 ..	355 ..	355 ..	352 ..	351 ..	356 ..	355 ..	357 ..	357 ..	357 ..	355 ..	356 ..	356
5. Non-lateritic Rice Soils of the Dry Zone ..	360 ..	382 ..	379 ..	374 ..	377 ..	383 ..	381 ..	383 ..	381 ..	379 ..	383 ..	380 ..	380 ..	384 ..	382
6. Calcareous Rice Soils (one soil) ..	361 ..	383 ..	390 ..	385 ..	378 ..	391 ..	383 ..	388 ..	381 ..	378 ..	392 ..	386 ..	381 ..	389 ..	385
7. Non-lateritic Clayey Rice Soils ..	342 ..	365 ..	358 ..	371 ..	363 ..	366 ..	367 ..	362 ..	369 ..	369 ..	358 ..	364 ..	363 ..	368 ..	365
Means of the Averages ..	346	369	366	370	368	367	367	368	369	368	367	369	369	369	369

TABLE III
Supernatant Liquids—Sodium ppm

<i>Days From Submergence</i>	1	14	28	42	56	70	84	98	112	140	168	196
1. Strongly Acid Lateritic Rice Soils of the Ultra Wet Zone—												
(1) Panagoda ..	1 ..	2 ..	2 ..	3 ..	2 ..	3 ..	3.5 ..	3 ..	2 ..	3 ..	3 ..	3
(2) Mirigama ..	2 ..	4 ..	3 ..	2 ..	3.5 ..	2.5 ..	4 ..	3 ..	2.5 ..	3 ..	3 ..	3.5
(3) Mapalana ..	1 ..	1.5 ..	3 ..	2 ..	3 ..	2 ..	2.5 ..	3 ..	3.5 ..	3 ..	2.5 ..	3
(4) Karapincha ..	2 ..	3 ..	3 ..	3 ..	2 ..	2.5 ..	3 ..	3 ..	3 ..	3 ..	3 ..	2
2. Strongly Acid Humic Rice Soils—												
(1) Bombuwela Peaty ..	3 ..	3.5 ..	3 ..	2 ..	3 ..	2.5 ..	3 ..	2 ..	3 ..	3 ..	2 ..	3
3. Ground Water Podzolic Rice Soils—												
(1) Bombuwela Sandy ..	3 ..	2 ..	3 ..	3 ..	2 ..	2.5 ..	3 ..	2 ..	2 ..	3 ..	3 ..	3
(2) Batticaloa ..	2 ..	2.5 ..	2.5 ..	2.5 ..	3 ..	3 ..	3 ..	2 ..	2 ..	2 ..	3 ..	2
4. Acid Lateritic Rice Soils of the Wet Zone—												
(1) Welimada ..	9 ..	11 ..	11 ..	10 ..	9 ..	9 ..	10 ..	10 ..	11 ..	10 ..	11 ..	11
(2) Bibile ..	4 ..	3 ..	3 ..	5 ..	5 ..	3 ..	3 ..	3 ..	4 ..	3 ..	4 ..	4
(3) Peradeniya ..	4 ..	6 ..	4 ..	5 ..	5 ..	4.5 ..	5.5 ..	6 ..	4 ..	5 ..	4 ..	4
(4) Kundasale ..	3 ..	5 ..	5 ..	4 ..	4 ..	4 ..	3 ..	4 ..	4 ..	5 ..	3 ..	4
(5) Matale ..	2 ..	3 ..	3 ..	2.5 ..	2.5 ..	3 ..	3 ..	2 ..	2 ..	2 ..	2 ..	3
(6) Nalanda ..	4 ..	2.5 ..	2.5 ..	3 ..	3 ..	4 ..	4 ..	3 ..	3 ..	3 ..	3.5 ..	3

5. Non-lateritic Rice Soils of the
Dry Zone—

(1) Polonnaruwa	..	9	..	13	..	11	..	12	..	10	..	10	..	10	..	13	..	11	..	12	..	12	..	13	
(2) Hingurakgoda	..	6	..	8	..	6	..	6	..	7	..	6	..	7	..	7	..	7	..	8	..	7	..	6	
(3) Maha Illuppalama Red	9	..	11	..	11	..	10	..	9	..	9	..	10	..	10	..	11	..	10	..	11	..	11	..	11
(4) Maha Illuppalama Grey	11	..	8	..	11	..	8	..	8	..	9	..	10	..	11	..	8	..	8	..	11	..	11	..	11

6. Calcareous Rice Soils—

(1) Jaffna	..	14	..	15	..	13	..	16	..	14	..	14	..	13	..	13	..	14	..	16	..	15	..	14
------------	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

7. Non-lateritic Clayey Rice
Soils—

(1) Ambalantota 1	..	32	..	38	..	40	..	32	..	36	..	38	..	40	..	36	..	36	..	40	..	34	..	34
(2) Ambalantota 2	..	18	..	20	..	20	..	22	..	22	..	18	..	22	..	20	..	18	..	22	..	18	..	20

TABLE IV
Supernatant Liquids—Sodium ppm—Averages

<i>Days from Submergence</i>	<i>1</i>	<i>14</i>	<i>28</i>	<i>42</i>	<i>56</i>	<i>70</i>	<i>84</i>	<i>98</i>	<i>112</i>	<i>140</i>	<i>168</i>	<i>196</i>
1. Strongly Acid Lateritic Rice Soils of the Ultra Wet Zone	1.5 ..	2.6 ..	2.8 ..	2.5 ..	2.6 ..	2.5 ..	3.3 ..	3.0 ..	2.8 ..	3.0 ..	2.9 ..	2.9
2. Strongly Acid Humic Rice Soils (one soil)	3.0 ..	3.5 ..	3.0 ..	2.0 ..	3.0 ..	2.5 ..	3.0 ..	2.0 ..	3.0 ..	3.0 ..	2.0 ..	3.0
3. Ground Water Podzolic Rice Soils	2.5 ..	2.3 ..	2.8 ..	2.8 ..	2.5 ..	2.8 ..	3.0 ..	2.0 ..	2.0 ..	2.5 ..	3.0 ..	2.5
4. Acid Lateritic Rice Soils of the Wet Zone	4.3 ..	5.1 ..	4.8 ..	4.9 ..	4.8 ..	4.9 ..	4.8 ..	4.7 ..	4.7 ..	4.7 ..	4.6 ..	4.8
5. Non-lateritic Rice Soils of the Dry Zone	8.8 ..	10.0 ..	9.8 ..	9.0 ..	8.5 ..	8.5 ..	9.3 ..	10.3 ..	9.3 ..	9.5 ..	10.3 ..	10.3
6. Calcareous Rice Soils (one soil)	14.0 ..	15.0 ..	13.0 ..	16.0 ..	14.0 ..	14.0 ..	13.0 ..	13.0 ..	14.0 ..	16.0 ..	15.0 ..	14.0
7. Non-lateritic Clayey Rice Soils	25.0 ..	29.0 ..	30.0 ..	27.0 ..	29.0 ..	28.0 ..	31.0 ..	28.0 ..	27.0 ..	31.0 ..	28.0 ..	27.0
Means of the Averages	8.4	9.6	9.5	9.2	9.2	9.0	9.6	9.0	9.0	9.8	9.1	9.2

TABLE V
Supernatant Liquids—Potassium ppm.

<i>Days from Submergence</i>		1	14	28	42	56	70	84	98	112	140	168	196
1. Strongly Acid Lateritic Rice Soils of the Ultra Wet Zone													
(1) Panagoda ..	..	8.0..	6.0..	9.0..	7.0..	6.0..	8.0..	7.0..	8.0..	9.0..	6.0..	7.0..	7.0
(2) Mirigama ..	..	1.0..	1.5..	2.0..	1.0..	2.0..	1.0..	2.0..	1.5..	1.5..	2.0..	1.0..	1.5
(3) Mapalana ..	..	4.0..	5.0..	4.0..	6.0..	4.0..	4.0..	6.0..	5.0..	4.0..	4.0..	5.0..	4.0
(4) Karapincha ..	..	3.0..	5.0..	4.0..	4.0..	3.0..	3.0..	3.0..	4.0..	4.0..	3.0..	4.0..	4.0
2. Strongly Acid Humic Rice Soils—													
(1) Bombuwala Peaty ..	..	3.0..	3.5..	3.5..	3.0..	4.0..	3.0..	3.0..	3.0..	4.0..	3.0..	3.0..	4.0
3. Ground Water Podzolic Rice Soils—													
(1) Bombuwala Sandy ..	..	1.5..	3.0..	2.0..	2.0..	2.5..	3.0..	1.5..	3.0..	2.0..	2.0..	3.0..	3.0
(2) Batticaloa ..	..	0.5..	2.0..	1.5..	2.0..	1.0..	0.5..	2.0..	2.0..	2.0..	1.5..	1.0..	2.0
4. Acid lateritic Rice Soils of the Wet Zone—													
(1) Welimada ..	..	3.0..	6.0..	4.0..	3.0..	3.0..	3.5..	4.0..	6.0..	5.0..	3.0..	4.0..	4.0
(2) Bibile ..	..	8.0..	11.0..	8.0..	9.0..	9.0..	10.0..	8.0..	8.0..	9.0..	8.0..	10.0..	11.0
(3) Peradeniya ..	..	2.0..	3.0..	3.5..	3.0..	2.0..	3.5..	3.0..	2.0..	3.0..	3.0..	3.5..	3.0
(4) Kundasale ..	..	1.0..	1.0..	1.0..	2.0..	2.0..	1.5..	1.5..	1.0..	1.0..	2.0..	2.0..	2.0
(5) Matale ..	..	3.0..	4.0..	4.0..	3.0..	5.0..	4.0..	3.0..	5.0..	3.0..	4.0..	4.0..	3.0
(6) Nalanda ..	..	3.5..	2.0..	2.5..	3.0..	2.0..	3.0..	3.0..	3.0..	2.0..	2.5..	3.0..	3.5
5. Non-lateritic Rice Soils of the Dry Zone—													
(1) Polonnaruwa ..	..	1.5..	3.0..	3.0..	1.5..	3.0..	2.5..	3.0..	2.0..	2.0..	3.0..	3.0..	2.5
(2) Hingurakgoda ..	..	2.0..	3.0..	3.0..	3.5..	3.0..	3.0..	2.0..	2.0..	2.0..	3.5..	3.0..	3.0
(3) Maha Illuppallama Red ..	..	5.0..	4.0..	6.5..	5.5..	4.0..	4.0..	6.0..	4.5..	5.5..	4.0..	6.0..	5.0
(4) Maha Illuppallama Grey ..	..	2.5..	1.5..	1.5..	2.0..	2.5..	1.5..	2.5..	2.5..	1.5..	2.0..	2.0..	2.5
6. Calcareous Rice Soils—													
(1) Jaffna ..	..	4.0..	6.0..	4.0..	5.0..	5.0..	5.0..	4.0..	6.0..	4.0..	4.0..	6.0..	5.0
7. Non-lateritic Clayey Rice Soils—													
(1) Ambalantota (1) ..	..	2.5..	2.0..	3.0..	4.0..	4.0..	3.5..	3.0..	2.0..	2.0..	3.0..	3.5..	3.5
(2) Ambalantota (2) ..	..	2.0..	2.0..	1.5..	2.5..	3.0..	3.5..	3.0..	3.0..	2.5..	3.0..	3.5..	3.0

TABLE VI

Supernatant Liquids—Potassium ppm.—Averages

<i>Days from Submergence</i>	1	14	28	42	56	70	84	98	112	140	168	196
1. Strongly Acid Lateritic Rice Soils of the Ultra Wet Zone ..	4.0..	4.4..	4.8..	4.5..	3.8..	4.0..	4.5..	4.6..	4.6..	3.8..	4.3..	4.1
2. Strongly Acid Humic Rice Soils (one soil)	3.0..	3.5..	3.5..	3.0..	4.0..	3.0..	3.0..	3.0..	4.0..	3.0..	3.0..	4.0
3. Ground Water Podzolic Rice Soils ..	1.0..	2.5..	1.8..	2.0..	1.8..	1.8..	1.8..	2.5..	2.0..	1.8..	2.0..	2.5
4. Acid Lateritic Rice Soils of the Wet Zone ..	3.4..	4.5..	3.8..	3.8..	3.8..	4.3..	3.8..	4.2..	3.8..	3.8..	4.4..	4.4
5. Non-lateritic Rice Soils of the Dry Zone ..	2.8..	2.9..	3.5..	3.1..	3.1..	2.8..	3.4..	2.8..	2.8..	3.1..	3.5..	3.3
6. Calcareous Rice Soils (one soil) ..	4.0..	6.0..	4.0..	5.0..	5.0..	5.0..	4.0..	6.0..	4.0..	4.0..	6.0..	5.0
7. Non-lateritic Clayey Rice Soils ..	2.3..	2.0..	2.3..	3.3..	3.5..	3.5..	3.0..	2.5..	2.3..	3.0..	3.5..	3.3
Means of the Averages ..	2.9	3.7	3.4	3.5	3.6	3.5	3.2	3.7	3.4	3.2	3.8	3.8

TABLE VII

Days from S ubmergence		Supernatant Liquids—Oxidisable Matter—ccs KMnO ₄ 0.01N per 10 cc.												
		1	14	28	42	56	70	84	98	112	140	168	196	
1.	Strongly Acid Rice Soils of the Ultra Wet Zone—													
	(1) Panagoda ..	1.8	3.5	8.3	6.1	4.7	3.9	3.4	3.0	2.6	2.1	1.7	1.5	
	(2) Mirigama ..	0.7	1.5	2.4	1.6	1.3	1.2	1.1	1.0	1.1	1.0	1.1	1.0	
	(3) Mapalana ..	1.1	3.2	3.8	3.3	2.9	2.0	1.5	1.4	1.3	1.3	1.2	1.2	
	(4) Karapincha ..	1.4	1.7	2.6	2.5	1.6	1.3	1.0	0.9	0.9	0.9	0.8	0.8	
2.	Strongly Acid Humic Rice Soils—													
	(1) Bombuwela Peaty ..	2.4	5.6	6.8	5.6	4.9	4.4	4.1	3.8	3.5	3.2	2.9	2.7	
3.	Ground Water Podzolic Rice Soils—													
	(1) Bombuwela Sandy ..	1.1	3.0	3.3	2.9	1.6	1.4	1.3	1.2	1.1	1.0	0.9	0.7	
	(2) Batticaloa ..	0.7	3.1	3.8	2.0	1.4	1.2	1.0	0.9	0.8	0.7	0.6	0.4	
4.	Acid Lateritic Rice Soils of the Wet Zone—													
	(1) Welimada ..	0.5	1.6	2.8	1.4	1.4	1.3	1.2	1.1	1.0	0.9	0.8	0.6	
	(2) Bibile ..	0.4	1.0	1.8	1.6	1.5	1.4	1.4	1.2	1.1	0.9	0.8	0.5	
	(3) Peradeniya ..	0.5	1.0	3.3	2.9	2.5	2.0	1.5	1.3	1.1	0.9	0.7	0.4	
	(4) Kundasale ..	0.4	1.4	2.8	1.6	1.3	1.1	1.0	0.9	0.9	0.8	0.8	0.8	
	(5) Matala ..	0.7	1.5	2.8	1.7	1.6	1.6	1.5	1.4	1.2	1.0	0.9	0.8	
	(6) Nalanda ..	0.4	1.8	3.0	2.0	1.8	1.6	1.5	1.3	1.1	0.9	0.8	0.6	
5.	Non-lateritic Rice Soils of the Dry Zone—													
	(1) Polonnaruwa ..	0.7	2.5	6.3	5.8	5.4	4.7	4.4	3.9	3.4	2.9	2.4	2.1	
	(2) Hingurakgoda ..	0.8	3.0	7.8	3.4	2.9	1.8	1.5	1.3	1.1	0.9	0.7	0.5	
	(3) Maha Illuppallama Red ..	0.5	1.8	4.7	2.1	1.5	1.3	1.0	0.9	0.9	0.8	0.7	0.6	
	(4) Maha Illuppallama Grey ..	0.3	1.2	2.8	1.9	1.7	1.6	1.5	1.4	1.2	1.0	0.8	0.7	
6.	Calcareous Rice Soils—													
	(1) Jaffna ..	0.5	2.0	3.3	2.9	2.7	2.5	2.5	2.2	1.8	1.4	1.0	0.8	
7.	Non-lateritic Clayey Rice Soils—													
	(1) Ambalantota 1 ..	0.4	1.5	5.8	5.1	4.7	4.0	3.4	3.3	3.2	3.0	2.9	2.6	
	(2) Ambalantota 2 ..	0.7	2.0	4.9	4.4	4.1	3.9	3.7	3.4	3.0	2.8	2.7	2.4	

VARIATION OF CHEMICAL AND PHYSICO-CHEMICAL CHARACTERISTICS OF
PADDY SOILS ON SUBMERGENCE

TABLE VIII

Supernatant Liquids—Oxidisable Matter—ccs KMnO_4 —0.01N per 10cc.—Averages

<i>Days from Submergence</i>	1	14	28	42	56	70	84	98	112	140	168	196
1. Strongly Acid Lateritic Rice Soil of the Ultra Wet Zone	1.3	.. 2.5	.. 4.3	.. 3.4	.. 2.6	.. 2.1	.. 1.8	.. 1.6	.. 1.5	.. 1.3	.. 1.2	.. 1.1
2. Strongly Acid Humic Rice Soils (one soil)	.. 2.4	.. 5.6	.. 6.8	.. 5.6	.. 4.9	.. 4.4	.. 4.1	.. 3.8	.. 3.6	.. 3.2	.. 2.9	.. 2.7
3. Ground Water Podzolic Rice Soils ..	.. 0.9	.. 3.1	.. 3.6	.. 2.5	.. 1.5	.. 1.3	.. 1.2	.. 1.1	.. 1.0	.. 0.9	.. 0.8	.. 0.6
4. Acid Lateritic Rice Soils of the Wet Zone	.. 0.5	.. 1.4	.. 2.8	.. 1.9	.. 1.7	.. 1.5	.. 1.4	.. 1.2	.. 1.1	.. 0.9	.. 0.8	.. 0.6
5. Non-lateritic Rice Soils of the Dry Zone	.. 0.6	.. 2.1	.. 5.4	.. 3.3	.. 2.9	.. 2.4	.. 2.1	.. 1.9	.. 1.7	.. 1.4	.. 1.2	.. 1.0
6. Calcareous Rice Soils (one soil)	0.5	.. 2.0	.. 3.3	.. 2.9	.. 2.7	.. 2.5	.. 2.5	.. 2.2	.. 1.8	.. 1.4	.. 1.0	.. 0.8
7. Non-lateritic Clayey Rice Soils	0.6	.. 1.8	.. 5.4	.. 4.8	.. 4.4	.. 4.0	.. 3.6	.. 3.4	.. 3.1	.. 2.9	.. 2.8	.. 2.5
Means of the Averages	.. 1.0	2.6	4.5	3.5	3.0	2.6	2.4	2.2	2.0	1.7	1.5	1.4

VARIATION OF CHEMICAL AND PHYSICO-CHEMICAL CHARACTERISTICS OF PADDY
SOILS ON SUBMERGENCE

TABLE IX
Supernatant Liquids—Conductivity-Micromhos

<i>Days From Submergence</i>	1	14	28	42	56	70	84	98	112	140	168	196
1. Strongly Acid Rice Soils of the Ultra Wet Zone—												
(1) Panagoda	41	62	83	100	88	68	40	37	34	29	20	14
(2) Mirigama	41	74	108	165	112	86	58	64	50	46	36	29
(3) Mapalana	40	67	92	120	95	63	43	38	34	33	30	26
(4) Karapinchu	42	63	82	100	83	65	52	44	41	39	38	36
2. Strongly Acid Humic Rice Soils—												
(1) Bombuwela Peaty	125	132	140	144	118	72	45	38	34	32	30	28
3. Ground Water Podzolic Rice Soils—												
(1) Bombuwela Sandy	75	79	82	86	70	50	33	33	32	30	29	26
(2) Batticaloa	24	33	42	48	34	22	16	13	12	12	11	11
4. Acid Lateritic Rice Soils of the Wet Zone—												
(1) Welimada	55	83	116	140	130	119	111	104	96	92	88	88
(2) Bibile	59	122	184	226	190	148	111	88	72	54	45	36
(3) Peradeniya	40	72	94	130	92	84	77	73	68	63	59	56
(4) Kundasale	58	141	232	302	272	334	190	176	163	148	132	120
(5) Matale	53	164	272	356	312	274	232	210	192	168	161	142
(6) Nalanda	28	84	118	132	122	110	102	90	78	66	53	44
5. Non-lateritic Rice Soils of the Dry Zone—												
(1) Polonnaruwa	93	165	240	320	280	336	212	200	189	175	163	152
(2) Hingirakgoda	86	148	224	290	235	186	142	130	121	108	101	98
(3) Maha Illuppallama Red	65	128	194	278	216	164	113	108	103	97	92	88
(4) Maha Illuppallama Grey	63	202	276	290	200	142	116	110	104	98	93	86
6. Calcareous Rice Soils—												
(1) Jaffna	195	216	234	258	233	207	193	188	174	160	142	122
7. Non-lateritic Clayey Rice Soils—												
(1) Ambalantota 1	132	186	238	290	236	198	145	138	134	130	128	126
(2) Ambalantota 2	107	168	232	284	241	192	166	154	146	138	132	128

TABLE X
Supernatant Liquids—Conductivity—Micromhos—Averages

<i>Days from Submergence</i>	1	14	28	42	56	70	84	98	112	140	168	196
1. Strongly Acid Lateritic Rice Soils of the Ultra Wet Zone	41 ..	67 ..	91 ..	119 ..	94 ..	70 ..	48 ..	43 ..	40 ..	37 ..	31 ..	26
2. Strongly Acid Humic Rice Soils (one soil)	.. 126	.. 132	.. 140	.. 144	.. 118	.. 72	.. 45	.. 38	.. 34	.. 32	.. 30	.. 28
3. Ground Water Podzolic Rice Soils ..	.. 50	.. 56	.. 62	.. 67	.. 52	.. 36	.. 24	.. 23	.. 22	.. 21	.. 20	.. 19
4. Acid Lateritic Rice Soils of the Wet Zone	.. 49	.. 111	.. 169	.. 214	.. 186	.. 178	.. 137	.. 124	.. 112	.. 99	.. 88	.. 81
5. Non-lateritic Rice Soils of the Dry Zone	.. 77	.. 161	.. 234	.. 205	.. 233	.. 205	.. 146	.. 137	.. 129	.. 120	.. 112	.. 106
6. Calcareous Rice Soils (one soil)	195 ..	216 ..	234 ..	258 ..	233 ..	207 ..	193 ..	188 ..	174 ..	160 ..	142 ..	122
7. Non-lateritic Clayey Rice Soils	120 ..	177 ..	235 ..	287 ..	239 ..	195 ..	156 ..	146 ..	140 ..	134 ..	130 ..	127
Means of the Averages	<u>.. 94</u>	<u>131</u>	<u>166</u>	<u>195</u>	<u>165</u>	<u>138</u>	<u>107</u>	<u>100</u>	<u>93</u>	<u>86</u>	<u>79</u>	<u>73</u>

VARIATION OF CHEMICAL AND PHYSICO-CHEMICAL CHARACTERISTICS OF PADDY
SOILS ON SUBMERGENCE

TABLE XI
Supernatant Liquids—pH Values

<i>Days from Submergence</i>	1	3	5	7	14	28	42	56	70	84	98	112	140	168	196
1. Strongly Acid Lateritic Rice Soils of the Ultra Wet Zone—															
(1) Panagoda ..	5.6..	5.8..	5.8..	5.9..	5.9..	6.1..	6.2..	6.2..	6.4..	6.5..	6.5..	6.6..	6.7..	6.6..	6.7
(2) Mirigama ..	5.4..	5.5..	5.5..	5.7..	5.8..	6.0..	6.0..	6.2..	6.4..	6.5..	6.5..	6.4..	6.4..	6.5..	6.4
(3) Mapalana ..	5.3..	5.3..	5.5..	5.7..	5.8..	5.8..	6.0..	6.2..	6.3..	6.4..	6.5..	6.6..	6.5..	6.6..	6.5
(4) Karapincha ..	5.2..	5.3..	5.3..	5.8..	6.1..	6.3..	6.5..	6.8..	7.0..	7.1..	7.2..	7.3..	7.2..	7.3..	7.3
2. Strongly Acid Humic Rice Soils—															
(1) Bombuvala Peaty ..	5.1..	5.1..	5.3..	5.5..	5.6..	5.7..	5.7..	5.8..	5.9..	6.1..	6.2..	6.3..	6.2..	6.3..	6.2
3. Ground Water Podzolic Rice Soils—															
(1) Bombuvala Sandy ..	5.4..	5.4..	5.9..	6.2..	6.4..	6.5..	6.7..	6.8..	7.0..	7.1..	7.0..	7.0..	7.1..	7.1..	7.0
(2) Batticaloa ..	6.3..	6.3..	6.4..	6.6..	6.8..	6.9..	7.1..	7.2..	7.2..	7.3..	7.2..	7.2..	7.3..	7.2..	7.2
4. Acid Lateritic Rice Soils of the Wet Zone—															
(1) Welimada ..	5.3..	5.3..	5.3..	5.7..	6.1..	6.2..	6.4..	6.7..	6.9..	7.0..	6.9..	6.9..	7.0..	6.9..	7.0
(2) Bibile ..	5.3..	5.4..	5.8..	6.0..	6.2..	6.3..	6.5..	6.6..	6.7..	6.8..	6.8..	6.7..	6.8..	6.8..	6.8
(3) Peradeniya ..	6.2..	5.3..	5.5..	5.7..	6.0..	6.2..	6.4..	6.6..	6.7..	6.8..	6.7..	6.8..	6.8..	6.8..	6.8
(4) Kundasale ..	5.1..	5.3..	5.8..	6.1..	6.3..	6.5..	6.7..	6.9..	7.0..	7.1..	7.2..	7.3..	7.2..	7.2..	7.2
(5) Matale ..	5.4..	5.6..	5.9..	6.2..	6.5..	6.7..	6.9..	7.1..	7.3..	7.4..	7.5..	7.4..	7.4..	7.5..	7.5
(6) Nalanda ..	5.9..	5.9..	6.0..	6.3..	6.6..	6.9..	7.2..	7.5..	7.7..	7.8..	7.7..	7.8..	7.7..	7.7..	7.8
5. Non-lateritic Rice Soils of the Dry Zone—															
(1) Polonnaruwa ..	6.1..	6.5..	6.9..	7.1..	7.3..	7.4..	7.7..	7.8..	7.8..	7.9..	8.0..	7.9..	7.9..	8.0..	7.9
(2) Hingurakgoda ..	6.2..	6.6..	6.9..	7.2..	7.4..	7.5..	7.7..	7.9..	7.9..	8.0..	8.1..	8.2..	8.1..	8.1..	8.1
(3) Maha Illuppallama Red ..	6.1..	6.5..	6.9..	7.2..	7.3..	7.4..	7.6..	7.7..	7.8..	7.9..	7.9..	7.8..	7.8..	7.9..	7.8
(4) Maha Illuppallama Grey ..	6.1..	6.6..	7.0..	7.2..	7.4..	7.5..	7.7..	7.8..	7.8..	8.0..	8.0..	8.0..	7.9..	7.9..	8.0
6. Calcareous Rice Soils—															
(1) Jaffna ..	6.8..	7.1..	7.4..	7.6..	7.7..	7.8..	7.8..	7.9..	8.0..	8.1..	8.1..	8.1..	8.0..	8.0..	8.1
7. Non-lateritic Clayey Rice Soils—															
(1) Ambalantota 1 ..	6.4..	6.7..	7.1..	7.4..	7.5..	7.7..	7.8..	8.0..	8.1..	8.2..	8.3..	8.4..	8.3..	8.3..	8.3
(2) Ambalantota 2 ..	6.2..	6.3..	6.6..	7.0..	7.3..	7.6..	7.9..	8.0..	8.1..	8.2..	8.3..	8.3..	8.2..	8.2..	8.2

TABLE XII
Supernatant Liquids—pH Values—Averages

<i>Days from Submergence</i>	1	3	5	7	14	28	42	56	70	84	98	112	140	168	196
1. Strongly Acid Lateritic Rice Soils of the Ultra Wet Zone ..	5.4..	5.5..	5.5..	5.8..	5.9..	6.1..	6.2..	6.4..	6.5..	6.6..	6.7..	6.7..	6.7..	6.8..	6.7
2. Strongly Acid Humic Rice Soils (one soil) ..	5.1..	5.1..	5.3..	5.5..	5.6..	5.7..	5.7..	5.8..	5.9..	6.1..	6.2..	6.3..	6.2..	6.3..	6.2
3. Ground Water Podzolic Rice Soils ..	5.9..	5.9..	6.2..	6.4..	6.6..	6.7..	6.9..	7.0..	7.1..	7.2..	7.1..	7.1..	7.2..	7.2..	7.1
4. Acid Lateritic Rice Soils of the Wet Zone ..	5.4..	5.5..	5.7..	6.0..	6.3..	6.5..	6.7..	6.9..	7.1..	7.2..	7.1..	7.2..	7.2..	7.2..	7.2
5. Non-lateritic Rice Soils of the Dry Zone ..	6.1..	6.6..	6.9..	7.2..	7.4..	7.5..	7.7..	7.8..	7.8..	8.0..	8.0..	8.0..	7.9..	8.0..	8.0
6. Calcareous Rice Soils (one soil) ..	6.8..	7.1..	7.4..	7.6..	7.7..	7.8..	7.8..	7.9..	8.0..	8.1..	8.1..	8.1..	8.0..	8.0..	8.1
7. Non-lateritic Clayey Rice Soils ..	6.3..	6.5..	6.9..	7.2..	7.4..	7.7..	7.9..	8.0..	8.1..	8.2..	8.3..	8.4..	8.3..	8.3..	8.3
Means of the Averages ..	5.9	6.0	6.3	6.5	6.7	6.9	7.0	7.1	7.2	7.3	7.4	7.4	7.3	7.4	7.4

VARIATION OF CHEMICAL AND PHYSICO-CHEMICAL CHARACTERISTICS OF PADDY
SOILS ON SUBMERGENCE

TABLE XIII
Supernatant Liquids—Calcium—ppm.

<i>Days from Submergence</i>	1	14	28	42	56	70	84	96	112	140	168	196
1. Strongly Acid Lateritic Rice Soils of the Ultra Wet Zone—												
(1) Panagoda ..	t ..	t ..	t ..	t ..	t ..	t ..	12.5 ..	12.5 ..	12.5 ..	12.5 ..	12.5 ..	12.5 ..
(2) Mirigama ..	t ..	t ..	t ..	t ..	t ..	t ..	12.5 ..	12.5 ..	12.5 ..	12.5 ..	12.5 ..	12.5 ..
(3) Mapalana ..	t ..	t ..	t ..	t ..	t ..	t ..	12.5 ..	12.5 ..	12.5 ..	12.5 ..	12.5 ..	12.5 ..
(4) Karapincha ..	t ..	t ..	t ..	t ..	t ..	t ..	12.5 ..	12.5 ..	12.5 ..	12.5 ..	12.5 ..	12.5 ..
2. Strongly Acid Humic Rice Soils—												
(1) Bombuwela Peaty ..	t ..	t ..	t ..	t ..	12.5 ..	12.5 ..	12.5 ..	25.0 ..	25.0 ..	25.0 ..	25.0 ..	25.0 ..
3. Ground Water Podzolic Rice Soils—												
(1) Bombuwela Sandy ..	t ..	t ..	t ..	t ..	t ..	12.5 ..	12.5 ..	12.5 ..	12.5 ..	12.5 ..	12.5 ..	12.5 ..
(2) Batticaloa ..	t ..	t ..	t ..	t ..	t ..	t ..	t ..	t ..	t ..	t ..	t ..	t ..
4. Acid Lateritic Rice Soils of the Wet Zone—												
(1) Welimada ..	t ..	t ..	t ..	t ..	t ..	t ..	t ..	t ..	t ..	t ..	t ..	t ..
(2) Bibile ..	t ..	t ..	t ..	t ..	t ..	t ..	12.5 ..	12.5 ..	12.5 ..	12.5 ..	12.5 ..	12.5 ..
(3) Peradeniya ..	t ..	t ..	t ..	t ..	t ..	12.5 ..	12.5 ..	12.5 ..	12.5 ..	12.5 ..	12.5 ..	12.5 ..
(4) Kundasale ..	t ..	t ..	t ..	12.5 ..	12.5 ..	12.5 ..	25.0 ..	25.0 ..	25.0 ..	25.0 ..	25.0 ..	25.0 ..
(5) Matale ..	t ..	t ..	t ..	t ..	12.5 ..	12.5 ..	12.5 ..	12.5 ..	25.0 ..	25.0 ..	25.0 ..	25.0 ..
(6) Nalanda ..	t ..	t ..	t ..	t ..	t ..	12.5 ..	12.5 ..	12.5 ..	12.5 ..	12.5 ..	12.5 ..	12.5 ..
5. Non-lateritic Rice Soils of the Dry Zone—												
(1) Polonnaruwa ..	t ..	t ..	t ..	t ..	12.5 ..	12.5 ..	12.5 ..	25.0 ..	25.0 ..	25.0 ..	25.0 ..	25.0 ..
(2) Hingurakgoda ..	t ..	t ..	12.5 ..	12.5 ..	25.0 ..	25.0 ..	25.0 ..	50.0 ..	50.0 ..	50.0 ..	50.0 ..	50.0 ..
(3) Maha Illuppallama Red ..	t ..	t ..	t ..	12.5 ..	12.5 ..	12.5 ..	12.5 ..	12.5 ..	25.0 ..	25.0 ..	25.0 ..	25.0 ..
(4) Maha Illuppallama Grey ..	t ..	t ..	t ..	t ..	12.5 ..	12.5 ..	12.5 ..	25.0 ..	25.0 ..	25.0 ..	25.0 ..	25.0 ..
6. Calcareous Rice Soils—												
(1) Jaffna ..	t ..	t ..	t ..	t ..	12.5 ..	12.5 ..	12.5 ..	12.5 ..	25.0 ..	25.0 ..	25.0 ..	25.0 ..
7. Non-lateritic Clayey Rice Soils—												
(1) Ambalantota 1 ..	t ..	12.5 ..	12.5 ..	25.0 ..	25.0 ..	25.0 ..	50.0 ..	50.0 ..	75.0 ..	75.0 ..	75.0 ..	75.0 ..
(2) Ambalantota 2 ..	t ..	t ..	t ..	12.5 ..	12.5 ..	12.5 ..	25.0 ..	25.0 ..	25.0 ..	50.0 ..	50.0 ..	50.0 ..

TABLE XIV

Supernatant Liquids—Calcium—ppm—Averages

<i>Days from Submergence</i>	1	14	28	42	56	70	84	98	112	140	168	196
1. Strongly Acid Lateritic Ride Soils of the Ultra Wet Zone	t ..	t ..	t ..	..	t ..	t ..	9.4 ..	9.4 ..	9.4 ..	9.4 ..	9.4 ..	9.4
2. Strongly Acid Humic Rice Soils (one soil)	t ..	t ..	t ..	t ..	12.5 ..	12.5 ..	12.5 ..	25.0 ..	25.0 ..	25.0 ..	25.0 ..	25.0
3. Ground Water Podzolic Rice Soils	t ..	t ..	t ..	t ..	t ..	6.3 ..	6.3 ..	6.3 ..	6.3 ..	6.3 ..	6.3 ..	6.3
4. Acid Lateritic Rice Soils of the Wet Zone	t ..	t ..	t ..	2.1 ..	4.2 ..	8.3 ..	12.5 ..	12.5 ..	14.6 ..	14.6 ..	14.6 ..	14.6
5. Non-lateritic Rice Soils of the Dry Zone	t ..	t ..	3.1 ..	6.3 ..	15.6 ..	15.6 ..	15.6 ..	28.1 ..	31.3 ..	31.3 ..	31.3 ..	31.3
6. Calcareous Rice Soils (one soil)	t ..	t ..	t ..	t ..	12.5 ..	12.5 ..	12.5 ..	12.5 ..	25.0 ..	25.0 ..	25.0 ..	25.0
7. Non-lateritic Clayey Rice Soils	t ..	6.3 ..	6.3 ..	18.8 ..	18.8 ..	18.8 ..	37.5 ..	37.5 ..	50.0 ..	62.5 ..	62.5 ..	62.5
Means of the Averages	t	0.9	1.5	3.9	9.1	10.6	15.2	18.8	23.1	24.9	24.9	24.9

TABLE XV
Water Percolates—Ammonia—ppm. N.

<i>Days from Submergence</i>	1	14	28	42	56	70	84	98	112	140	178	196
1. Strongly Acid Lateritic Rice Soils of the Ultra Wet Zone—												
(1) Panagoda ..	68	176	244	228	196	138	122	106	88	78	62	62
(2) Mirigama ..	6	28	64	62	50	48	46	42	38	34	32	30
(3) Mapalana ..	5	58	84	96	88	78	76	68	58	48	42	42
(4) Karapincha ..	20	76	102	106	100	88	72	60	50	46	40	40
2. Strongly Acid Humic Rice Soils—												
(1) Bombuwela Peaty ..	22	56	64	80	72	70	66	64	48	44	42	40
3. Ground Water Podzolic Rice Soils—												
(1) Bombuwela Sandy ..	20	42	68	48	36	28	22	16	14	14	8	8
(2) Batticaloa ..	14	28	36	30	22	20	18	18	14	14	14	14
4. Acid Lateritic Rice Soils for the Wet Zone—												
(1) Welimada ..	6	20	28	30	24	22	20	20	18	18	18	18
(2) Bibile ..	40	58	78	72	68	64	56	44	42	42	30	28
(3) Peradeniya ..	8	40	50	52	42	42	36	34	34	32	30	30
(4) Kundasale ..	4	28	30	30	26	14	14	14	12	12	10	10
(5) Matala ..	4	18	28	24	22	20	18	18	18	18	18	18
(6) Nalanda ..	12	22	32	36	28	26	24	22	20	20	20	20
5. Non-lateritic Rice Soils of the Dry Zone—												
(1) Polonnaruwa ..	6	8	22	18	16	16	16	16	14	14	14	14
(2) Hingurakgoda ..	8	10	38	18	16	16	14	12	12	10	10	8
(3) Maha Iluppallama Red ..	2	6	10	8	8	7	7	7	6	6	6	5
(4) Maha Iluppallam Grey ..	3	8	24	10	6	4	4	4	3	3	3	3
6. Calcareous Rice Soils—												
(1) Jaffna ..	6	8	16	18	28	14	12	12	10	10	10	10
7. Non-lateritic Clayey Rice Soils—												
(1) Ambalantota 1 ..	14	16	17	20	26	14	12	12	10	8	8	8
(2) Ambalantota 2 ..	4	8	10	12	32	14	12	8	8	8	8	8

TABLE XVI

Water Percolates—Ammonia—ppm.—N.—Averages

<i>Days from Submergence</i>	1	14	28	42	56	70	84	98	112	140	168	196
1. Strongly Acid Lateritic Rice Soils of the Ultra Wet Zone	25	.. 85	.. 124	.. 123	.. 109	.. 88	.. 79	.. 69	.. 59	.. 52	.. 44	.. 44
2. Strongly Acid Humic Rice Soils (one soil)	.. 22	.. 56	.. 64	.. 80	.. 72	.. 70	.. 66	.. 64	.. 48	.. 44	.. 42	.. 40
3. Gound Water Podzolic Rice Soils ..	.. 17	.. 35	.. 52	.. 39	.. 29	.. 24	.. 20	.. 17	.. 14	.. 14	.. 11	.. 11
4. Acid Lateritic Rice Soils of the Wet Zone ..	.. 12	.. 31	.. 41	.. 41	.. 36	.. 31	.. 28	.. 25	.. 24	.. 24	.. 21	.. 21
5. Non-lateritic Rice Soils of the Dry Zone ..	.. 5	.. 8	.. 24	.. 14	.. 12	.. 11	.. 10	.. 10	.. 9	.. 8	.. 8	.. 8
6. Calcareous Rice Siols (one soil)	6	.. 8	.. 16	.. 18	.. 28	.. 14	.. 12	.. 12	.. 10	.. 10	.. 10	.. 10
7. Non-lateritic Clayey Rice Siols	9	.. 12	.. 14	.. 16	.. 29	.. 14	.. 12	10	.. 9	.. 8	.. 8	.. 8
Means of the Averages	.. 14	34	48	47	45	38	32	30	26	23	21	20

VARIATION OF CHEMICAL AND PHYSICO-CHEMICAL CHARACTERISTICS OF PADDY
SOILS ON SUBMERGENCE

TABLE XVII
Water Percolates—Reduced Iron—ppm.

<i>Days from Submergence</i>	1	14	28	42	56	70	84	98	112	140	168	196
(1) Strongly Acid Lateritic Rice Soils of the Ultra Wet Zone—												
1. Panagoda ..	5	158	144	96	68	46	44	38	34	28	26	25
2. Mirigama ..	1	168	354	216	144	120	108	96	82	76	64	58
3. Mapalana ..	8	164	292	214	178	142	118	116	110	104	90	84
4. Karapinchu ..	1	162	220	190	154	126	108	96	84	76	62	58
(2) Strongly Acid Humic Rice Soils—												
1. Bombuwela Peasy ..	16	154	144	112	104	88	80	72	68	54	52	44
(3) Ground Water Podzolic Rice Soils—												
1. Bombuwela Sandy ..	0	60	68	52	41	38	32	30	26	24	20	20
2. Batticaloa ..	0	84	64	48	46	42	38	28	26	26	24	24
(4) Acid Lateritic Rice Soils of the Wet Zone—												
1. Welimada ..	0	118	138	116	98	92	86	76	74	54	52	52
2. Bibile ..	0	154	142	122	106	88	74	56	52	42	40	36
3. Peradeniya ..	0	156	158	102	82	64	60	52	48	40	34	34
4. Kundasale ..	0	82	92	74	72	62	54	48	42	36	32	30
5. Matale ..	0	146	228	138	96	84	80	72	68	62	54	52
6. Nalanda ..	0	88	198	180	138	108	84	74	64	54	52	44
(5) Non-lateritic Rice Soils of the Dry Zone—												
1. Polonnaruwa ..	1	40	56	32	50	44	42	40	38	36	34	34
2. Hingurakgoda ..	0	40	56	62	54	44	42	40	36	30	30	28
3. Maha Illuppallama Red ..	0	12	22	18	18	18	16	16	16	15	15	15
4. Maha Illuppallama Grey ..	0	8	18	20	28	26	26	24	24	22	22	22
(6) Calcareous Rice Soils—												
1. Jaffna ..	0	4	7	7	7	6	6	6	6	5	5	4
(7) Non-lateritic Clayey Rice Soils—												
1. Ambalantota 1 ..	6	48	70	82	74	68	58	48	38	24	22	22
2. Ambalantota 2 ..	4	64	108	80	74	62	54	44	36	30	24	24

TABLE XVIII

Water Percolates—Reduced Iron—ppm—Averages

<i>Days from Submergence</i>	1	14	28	42	56	70	84	98	112	140	168	198
1. Strongly Acid Lateritic Rice Soils of the Ultra Wet Zone	4	.. 163	.. 253	.. 179	.. 136	.. 109	.. 95	.. 87	.. 78	.. 71	.. 61	.. 56
2. Strongly Acid Humic Rice Soils (one soil)	.. 16	.. 154	.. 144	.. 112	.. 104	.. 88	.. 80	.. 72	.. 68	.. 54	.. 52	.. 44
3. Ground Water Podzolic Rice Soils ..	.. 0	.. 72	.. 66	.. 50	.. 44	.. 40	.. 35	.. 29	.. 26	.. 25	.. 22	.. 22
4. Acid Lateritic Rice Soils of the Wet Zone ..	.. 0	.. 124	.. 159	.. 122	.. 99	.. 83	.. 73	.. 63	.. 58	.. 48	.. 44	.. 41
5. Non-lateritic Rice Soils of the Dry Zone ..	.. 0	.. 25	.. 38	.. 38	.. 38	.. 33	.. 32	.. 30	.. 29	.. 26	.. 25	.. 25
6. Calcareous Rice Soils (one soil)	0	.. 4	.. 7	.. 7	.. 7	.. 6	.. 6	.. 6	.. 6	.. 5	.. 5	.. 4
7. Non-lateritic Clayey Rice Soils	5	.. 56	.. 89	.. 81	.. 74	.. 65	.. 56	.. 46	.. 37	.. 27	.. 23	.. 23
Means of the Averages	.. 4	85	108	84	72	61	54	48	43	39	33	31

TABLE XIX

Water Percolates—Reduced Manganese—ppm

Days From Submergence	1	14	28	42	56	70	84	98	112	140	168	196
1. Strongly Acid Lateritic Rice Soils of the Ultra Wet Zone—												
(1) Panagoda ..	0 ..	0.4 ..	0.3 ..	0.2 ..	0.2 ..	0.2 ..	0.2 ..	0.2 ..	0.2 ..	0.1 ..	0 ..	0
(2) Mirigama ..	6.4 ..	40.0 ..	36.4 ..	18.0 ..	9.0 ..	6.2 ..	4.8 ..	4.2 ..	3.6 ..	2.8 ..	2.1 ..	2.0
(3) Mapalana ..	1.8 ..	2.8 ..	1.6 ..	1.6 ..	1.5 ..	1.0 ..	0.4 ..	0.3 ..	0.3 ..	1.0 ..	0.5 ..	0.5
(4) Karapinchu ..	0.8 ..	3.8 ..	3.4 ..	2.6 ..	2.2 ..	1.8 ..	1.6 ..	1.2 ..	1.0 ..	0.8 ..	0.8 ..	0.8
2. Strongly Acid Humic Rice Soils—												
(1) Bombuwela Peaty ..	0.3 ..	0.3 ..	0.4 ..	0.3 ..	0.3 ..	0.3 ..	0.2 ..	0.2 ..	0.1 ..	0.1 ..	0.1 ..	0.1
3. Ground Water Podzolic Rice Soils—												
(1) Bombuwela Sandy ..	0.3 ..	0.5 ..	0.6 ..	0.5 ..	0.5 ..	0.4 ..	0.3 ..	0.3 ..	0.2 ..	0.1 ..	0.1 ..	0.1
(2) Batticaloa ..	2.0 ..	3.8 ..	3.0 ..	2.4 ..	1.8 ..	1.8 ..	1.6 ..	1.2 ..	1.0 ..	0.6 ..	0.6 ..	0.6
4. Acid Lateritic Rice Soils of the Wet Zone—												
(1) Welimada ..	9.0 ..	34.0 ..	18.2 ..	8.4 ..	4.8 ..	3.2 ..	2.8 ..	2.4 ..	1.8 ..	1.6 ..	1.2 ..	1.2
(2) Bibile ..	22.0 ..	74.0 ..	38.0 ..	18.0 ..	12.0 ..	8.0 ..	6.0 ..	4.2 ..	3.4 ..	2.2 ..	2.0 ..	2.0
(3) Peradeniya ..	6.0 ..	44.0 ..	20.0 ..	12.0 ..	6.0 ..	4.2 ..	2.2 ..	2.0 ..	1.4 ..	0.8 ..	0.6 ..	0.6
(4) Kundsale ..	2.2 ..	24.0 ..	26.0 ..	18.0 ..	12.0 ..	9.0 ..	8.2 ..	7.4 ..	6.0 ..	5.2 ..	4.8 ..	4.8
(5) Matale ..	6.4 ..	38.0 ..	20.0 ..	8.0 ..	4.2 ..	2.2 ..	1.6 ..	1.6 ..	1.4 ..	0.8 ..	0.6 ..	0.6
(6) Nalanda ..	24.0 ..	36.0 ..	46.0 ..	32.0 ..	18.0 ..	10.0 ..	8.4 ..	4.6 ..	4.0 ..	3.4 ..	3.4 ..	3.4
5. Non lateritic Rice Soils of the Dry Zone—												
(1) Polonnaruwa ..	4.4 ..	30.4 ..	24.0 ..	22.0 ..	18.0 ..	16.0 ..	14.0 ..	14.0 ..	10.0 ..	9.2 ..	9.2 ..	9.0
(2) Hingurakgoda ..	3.2 ..	12.0 ..	18.0 ..	16.0 ..	14.0 ..	12.0 ..	10.8 ..	10.2 ..	8.6 ..	7.8 ..	6.4 ..	6.4
(3) Maha Iluppallama Red ..	1.4 ..	24.0 ..	50.0 ..	20.0 ..	14.0 ..	8.0 ..	7.2 ..	6.2 ..	5.2 ..	4.6 ..	4.4 ..	4.4
(4) Maha Iluppallama Grey ..	6.8 ..	12.8 ..	18.6 ..	19.2 ..	18.0 ..	16.0 ..	13.8 ..	12.4 ..	10.4 ..	8.2 ..	7.8 ..	7.8
6. Calcareous Rice Soils—												
(1) Jaffna ..	0.2 ..	3.6 ..	4.8 ..	4.4 ..	3.6 ..	3.2 ..	3.0 ..	2.6 ..	2.4 ..	2.2 ..	2.2 ..	2.2
7. Non-lateritic Clayey Rice Soils—												
(1) Ambalantota 1 ..	22.0 ..	32.0 ..	20.0 ..	8.4 ..	6.6 ..	4.4 ..	3.6 ..	2.4 ..	2.2 ..	1.8 ..	1.8 ..	1.8
(2) Ambalantota 2 ..	8.0 ..	28.0 ..	32.0 ..	20.0 ..	12.0 ..	8.0 ..	6.0 ..	6.0 ..	4.2 ..	2.8 ..	2.8 ..	2.8

TABLE XX

Water Percolates—Reduced Manganese—ppm—Averages

<i>Days from Submergence</i>	1	14	28	42	56	70	84	98	112	140	168	196
1. Strongly Acid Lateritic Rice Soils of the Ultra Wet Zone	2.3 .. 11.8 .. 10.4 .. 5.6 .. 3.2 .. 2.3 .. 1.8 .. 1.5 .. 1.3 .. 1.2 .. 0.9 .. 0.8											
2. Strongly Acid Humic Rice Soils (one soil)	.. 0.3 .. 0.3 .. 0.4 .. 0.3 .. 0.3 .. 0.3 .. 0.2 .. 0.2 .. 0.1 .. 0.1 .. 0.1 .. 0.1											
3. Ground Water Podzolic Rice Soils ..	.. 1.2 .. 2.2 .. 1.8 .. 1.5 .. 1.2 .. 1.1 .. 1.0 .. 0.8 .. 0.6 .. 0.4 .. 0.4 .. 0.4											
4. Acid lateritic Rice Soils of the Wet Zone	.. 11.6 .. 41.7 .. 28.0 .. 16.1 .. 9.5 .. 6.1 .. 4.9 .. 3.7 .. 3.0 .. 2.3 .. 2.1 .. 2.1											
5. Non-lateritic Rice Soils of the Dry Zone	.. 4.0 .. 19.8 .. 27.7 .. 19.3 .. 16.0 .. 13.0 .. 11.5 .. 10.7 .. 8.6 .. 7.5 .. 7.0 .. 6.9											
6. Calcareous Rice Soils (one soil) ..	.. 0.2 .. 3.6 .. 4.8 .. 4.4 .. 3.6 .. 3.2 .. 3.0 .. 2.6 .. 2.4 .. 2.2 .. 2.2 .. 2.2											
7. Non-lateritic Clayey Rice Soils ..	.. 15.0 .. 30.0 .. 26.0 .. 14.2 .. 9.3 .. 6.2 .. 4.8 .. 4.2 .. 3.2 .. 2.3 .. 2.3 .. 2.3											
Means of the Averages	.. 4.9 .. 15.6 .. 14.2 .. 8.8 .. 6.4 .. 4.6 .. 3.9 .. 3.3 .. 2.7 .. 2.6 .. 2.1 .. 2.1											

TABLE XXI

Water Percolates—Oxidisable Matter—ccs. KMnO_4 0.01N per 10 cc.

<i>Days from Submergence</i>	1	14	28	42	56	70	84	98	112	140	168	196
1. Strongly Acid lateritic Rice Soils of the Ultra Wet Zone—												
(1) Panagoda	8.4	19.3	19.2	22.3	18.1	14.3	14.0	14.0	13.1	13.1	13.0	13.0
(2) Mirigama	9.0	17.3	21.5	16.3	7.8	7.2	6.0	6.4	4.4	4.0	4.0	4.0
(3) Mapalana	7.2	24.3	23.5	21.6	18.3	14.4	13.2	12.2	11.4	11.0	10.0	9.8
(4) Karapincha	5.4	16.6	14.8	12.0	9.0	7.3	7.0	6.0	6.0	5.0	5.0	5.0
2. Strongly Acid Humic Rice Soils—												
(1) Bombuwala Peaty	7.0	14.6	13.8	12.6	10.0	10.0	10.0	10.0	9.2	8.1	8.0	8.0
3. Ground Water Podzolic Rice Soils—												
(1) Bombuwala Sandy	4.2	10.6	10.8	9.6	8.2	7.4	6.0	5.0	5.0	4.0	4.0	4.0
(2) Batticaloa	9.8	10.8	9.6	9.4	9.0	8.2	7.2	7.0	6.0	5.2	5.2	5.2
4. Acid lateritic Rice Soils of the Wet Zone—												
(1) Welimada	3.8	9.0	16.8	13.2	8.0	6.0	5.0	5.0	3.2	3.2	3.2	3.0
(2) Bibile	3.4	20.0	12.2	8.4	6.0	5.4	4.8	3.6	2.0	2.0	2.0	2.0
(3) Peradeniya	3.6	8.6	8.8	7.6	7.2	7.0	5.0	5.0	4.2	4.0	4.0	4.0
(4) Kundasale	4.2	8.9	7.8	7.8	7.2	7.0	5.2	4.2	4.0	3.2	3.2	3.2
(5) Matale	3.2	14.8	13.9	10.9	10.2	10.1	7.2	6.0	6.0	5.2	5.0	5.0
(6) Nalanda	2.0	6.0	10.0	8.0	6.3	5.2	5.0	3.2	3.0	3.0	2.0	2.0
5. Non-lateritic Rice Soils of the Dry Zone—												
(1) Polonnaruwa	9.0	10.9	9.9	9.5	9.2	9.1	6.6	5.8	5.4	5.0	5.0	5.0
(2) Hingurakgoda	10.0	10.2	9.2	8.0	7.4	6.2	6.0	6.0	5.2	4.2	4.0	4.0
(3) Maha Illuppallama Red	3.6	12.0	6.8	4.2	3.2	3.0	3.0	2.4	2.0	2.0	2.0	2.0
(4) Maha Illuppallama Grey	2.6	6.2	4.2	4.0	4.0	4.0	3.6	3.2	2.2	2.0	2.0	2.0
6. Calcareous Rice Soils—												
(1) Jaffna	6.0	7.0	7.2	6.0	6.0	5.2	5.2	5.0	4.2	3.2	3.0	3.0
7. Non-lateritic Clayey Rice Soils—												
(1) Ambalantota 1	7.8	9.8	10.0	7.2	7.0	6.4	6.0	5.2	5.0	5.0	4.0	4.0
(2) Ambalantota 2	7.2	7.8	8.8	6.0	5.8	5.4	5.2	5.0	4.0	3.2	3.0	3.0

TABLE XXII

Water Percolates—Oxidisable Matter—ccs. KMnO_4 0.01N per 10 cc.—Averages

<i>Days from Submergence</i>	1	14	28	42	56	70	84	98	112	140	168	196
1. Strongly Acid Lateritic Rice Soils of the Ultra Wet Zone ..	7.5	19.4	19.8	18.1	13.3	10.8	10.1	9.7	8.7	8.3	8.0	8.0
2. Strongly Acid Humic Rice Soils (one soil) ..	7.0	14.6	13.8	12.6	10.0	10.0	10.0	10.0	9.2	8.1	8.0	8.0
3. Ground Water Podzolic Rice Soils ..	7.0	10.7	10.2	9.5	8.6	7.8	6.6	6.0	5.5	4.6	4.6	4.6
4. Acid Lateritic Rice Soils of the Wet Zone ..	3.4	11.2	11.6	9.3	7.5	6.8	5.4	4.5	3.7	3.4	3.2	3.2
5. Non-lateritic Rice Soils of the Dry Zone ..	6.3	9.8	7.5	6.5	6.0	5.6	4.8	4.4	3.7	3.3	3.3	3.3
6. Calcareous Rice Soils (one soil)	6.0	7.0	7.2	6.0	6.0	5.2	5.2	5.0	4.2	3.2	3.0	3.0
7. Non-lateritic Clayey Rice Soils ..	7.5	8.8	9.4	6.6	6.4	5.9	5.6	5.1	4.5	4.1	3.5	3.5
Means of the Averages	6.4	11.6	11.4	9.8	8.3	7.4	6.8	6.4	5.6	5.0	4.8	4.8

**VARIATION OF CHEMICAL AND PHYSICO-CHEMICAL CHARACTERISTICS OF PADDY
SOILS ON SUBMERGENCE**

TABLE XXIII
Water Percolates—Conductivity—Micromhos

<i>Days from Submergence</i>	1	14	28	42	56	70	84	98	112	140	168	196
1. Strongly Acid Lateritic Rice Soils of the Ultra Wet Zone—												
(1) Panagoda ..	1458..	2330..	3312..	3386..	2822..	1912..	1890..	1524..	1280..	1024..	856..	832
(2) Mirigama ..	628..	1338..	1874..	1586..	1208..	1058..	956..	822..	778..	684..	602..	598
(3) Mapalana ..	420..	1702..	1888..	1802..	1682..	1482..	1386..	1202..	1022..	966..	784..	728
(4) Karapincha ..	782..	1702..	2156..	2102..	2076..	1888..	1592..	1412..	1238..	1022..	884..	834
2. Strongly Acid Humic Rice Soils—												
(1) Bombuwela Peaty ..	1302..	1444..	1522..	1444..	1348..	1312..	1132..	1066..	934..	812..	702..	696
3. Ground Water Podzolic Rice Soils—												
(1) Bombuwela Sandy ..	1022..	1184..	1328..	1202..	956..	802..	604..	502..	422..	398..	384..	376
(2) Batticaloa ..	602..	804..	822..	724..	612..	488..	426..	388..	336..	284..	266..	246
4. Acid Lateritic Rice Soils of the Wet Zone—												
(1) Welinada ..	1268..	1376..	1602..	1780..	1802..	1744..	1666..	1444..	1302..	1132..	966..	922
(2) Bibile ..	2094..	2584..	2702..	2856..	2756..	2422..	2066..	1676..	1412..	1222..	1008..	966
(3) Peradeniya ..	466..	1386..	1488..	1294..	1088..	978..	902..	844..	802..	742..	646..	634
(4) Kundesale ..	988..	1776..	2288..	2244..	2112..	1940..	1644..	1422..	1232..	1076..	902..	888
(5) Metale ..	298..	1744..	1932..	1446..	1144..	966..	888..	784..	756..	678..	644..	632
(6) Nalanda ..	522..	1288..	1902..	1844..	1482..	1186..	1024..	884..	802..	766..	644..	624
5. Non-lateritic Rice Soils of the Dry Zone—												
(1) Polonnaruwa ..	832..	2244..	2502..	2632..	2488..	1912..	1898..	1888..	1703..	1534..	1344..	1336
(2) Hingirakgoda ..	2044..	2222..	2246..	2622..	2602..	2488..	2334..	2122..	1848..	1744..	1546..	1532
(3) Maha Illuppallama Red	422..	1284..	1576..	1588..	1402..	1304..	1234..	1122..	1046..	1002..	902..	888
(4) Maha Illuppallama Grey	722..	1426..	1818..	1984..	1934..	1886..	1676..	1422..	1322..	1234..	1134..	1102
6. Calcareous Rice Soils—												
(1) Jaffna ..	1812..	3224..	3766..	3488..	2876..	2546..	2256..	1976..	1812..	1666..	1476..	1452
7. Non-lateritic Clayey Rice Soils—												
(1) Ambalantota 1 ..	1968..	3986..	3502..	3412..	2928..	2586..	2322..	2068..	1956..	1768..	1528..	1468
(2) Ambalantota 2 ..	2012..	2144..	2876..	2812..	2302..	1968..	1732..	1432..	1402..	1146..	1034..	934

TABLE XXIV

Water Percolates—Conductivity Micromhos—Averages

<i>Days from Submergence</i>	1	14	28	42	56	70	84	98	112	140	168	196
1. Strongly Acid Lateritic Rice Soils of the Ultra Wet Zone	822..	1768..	2308..	2219..	1947..	1585..	1456..	1240..	1080..	924..	782..	748
2. Strongly Acid Humic Rice Soils (one soil)	1302..	1444..	1522..	1444..	1348..	1312..	1132..	1066..	934..	812..	702..	696
3. Ground Water Podzolic Rice Soils	812..	994..	1075..	963..	784..	645..	515..	445..	378..	341..	325..	311
4. Acid Lateritic Rice Soils of the Wet Zone	939..	1692..	1986..	1911..	1731..	1539..	1365..	1176..	1051..	936..	802..	778
5. Non-lateritic Rice Soils of the Dry Zone	1005..	1794..	2036..	2207..	2107..	1898..	1786..	1639..	1480..	1379..	1232..	1215
6. Calcareous Rice Soils (one soil)	1812..	3224..	3766..	3488..	2876..	2546..	2256..	1976..	1812..	1666..	1476..	1452
7. Non-lateritic Clayey Rice Soils	1990..	3065..	3189..	3112..	2615..	2277..	2027..	1750..	1679..	1457..	1281..	1201
Means of the Averages	1240	1997	2412	2192	1915	1686	1505	1327	1202	1074	943	914

**VARIATION OF CHEMICAL AND PHYSICO-CHEMICAL CHARACTERISTICS OF PADDY
SOILS ON SUBMERGENCE**

TABLE XXV
Water Percolates—Sodium—ppm.

<i>Days from Submergence</i>	1	14	28	42	56	70	84	98	112	140	168	196
(1) Strongly Acid lateritic Rice Soils of the Ultra Wet Zone—												
(1) Panagoda ..	22	20	24	20	22	22	24	26	22	24	22	22
(2) Mirigama ..	18	20	18	22	20	18	22	20	18	18	22	20
(3) Mapalana ..	20	18	22	22	18	18	18	20	22	22	20	18
(4) Karapinchu ..	20	19	18	18	22	22	18	18	18	20	18	18
(2) Strongly Acid Humic Rice Soils—												
(1) Bombuwela Peaty ..	16	14	16	16	16	14	14	16	14	16	14	14
(3) Ground Water Podzolic Rice Soils—												
(1) Bombuwela Sandy ..	11	10	8	9	11	12	8	9	10	11	8	9
(2) Batticaloa ..	8	12	10	8	10	12	8	10	12	14	8	10
(4) Acid lateritic Rice Soils of the Wet Zone—												
(1) Welimada ..	80	70	85	75	80	80	70	85	85	70	85	85
(2) Bibile ..	60	50	65	60	50	60	60	55	65	55	55	60
(3) Peradeniya ..	35	32	38	42	40	35	32	32	35	35	32	32
(4) Kundasale ..	26	28	28	26	30	32	30	26	26	24	28	28
(5) Matale ..	14	18	16	16	14	16	16	18	14	14	16	16
(6) Nalanda ..	20	14	16	16	14	18	16	16	14	16	16	18
(5) Non-lateritic Rice Soils of the Dry Zone—												
(1) Polonnaruwa ..	110	120	130	140	110	120	130	120	140	130	140	130
(2) Hingurakgoda ..	48	44	46	46	44	48	46	46	48	44	48	46
(3) Maha Illuppallama Red ..	47	50	50	55	47	55	55	50	50	48	48	50
(4) Maha Illuppallama Grey ..	48	46	44	40	44	44	46	48	40	44	40	44
(6) Calcareous Rice Soils—												
(1) Jaffna ..	90	120	110	110	120	100	90	120	110	110	120	110
(7) Non-lateritic Clayey Rice Soils—												
(1) Ambalantota 1 ..	200	230	200	190	200	200	190	220	180	200	200	200
(2) Ambalantota 2 ..	140	100	120	140	100	90	120	120	120	100	120	120

TABLE XXVI

Water Percolates—Sodium ppm—Averages

<i>Days from Submergence</i>	1	14	28	42	56	70	84	98	112	140	168	196													
1. Strongly Acid lateritic Rice Soils of the Ultra Wet Zone	20	..	19	..	21	..	21	..	20	..	21	..	21	..	20	..	21	..	21	..	20				
2. Strongly Acid Humic Rice Soils (one soil)	..	16	..	14	..	16	..	16	..	14	..	14	..	16	..	14	..	16	..	14	..	14			
3. Ground Water Podzolic Rice Soils ..	..	10	..	11	..	9	..	9	..	11	..	12	..	8	..	10	..	11	..	13	..	8	..	10	
4. Acid lateritic Rice Soils of the Wet Zone	..	39	..	35	..	41	..	38	..	38	..	40	..	37	..	39	..	40	..	36	..	39	..	40	
5. Non-lateritic Rice Soils of the Dr Zone	..	63	..	65	..	68	..	70	..	61	..	67	..	69	..	66	..	70	..	67	..	69	..	68	
6. Calcareous Rice Soils (one soil)	90	..	120	..	110	..	110	..	120	..	100	..	90	..	120	..	110	..	110	..	110	..	120	..	110
7. Non-lateritic Clayey Rice Soils	170	..	165	..	160	..	165	..	150	..	145	..	155	..	170	..	150	..	150	..	150	..	160	..	160
Means of the Averages	..	58	61	61	61	60	57	56	63	59	59	62	60												

TABLE XXVII
Water Percolates—Potassium ppm.

<i>Days From Submergence</i>	1	14	28	42	56	70	84	98	112	140	168	196
1. Strongly Acid Lateritic Rice Soils of the Ultra Wet Zone—												
(1) Panagoda ..	46	42	44	40	40	46	48	38	44	46	44	44
(2) Mirigama ..	7	6	5	4	5	3	6	7	5	4	4	5
(3) Mapalana ..	32	30	28	24	28	26	30	28	32	26	28	28
(4) Karapincha ..	32	40	36	38	34	36	36	40	32	38	40	36
2. Strongly Acid Humic Rice Soils—												
(1) Bombuwela Peaty ..	20	16	18	18	20	16	22	18	16	18	16	18
3. Ground Water Podzolic Rice Soils—												
(1) Bombuwela Sandy ..	18	22	20	24	16	20	20	18	22	20	22	18
(2) Batticaloa ..	8	6	7	7	8	9	6	5	7	8	9	7
4. Acid Lateritic Rice Soils of the Wet Zone—												
(1) Welimada ..	26	22	24	24	30	18	26	22	24	26	22	24
(2) Bibile ..	64	56	60	62	58	66	54	60	60	58	62	60
(3) Peradeniya ..	8	7	6	4	5	6	7	5	4	8	6	6
(4) Kundasale ..	3	6	4	5	2	4	4	3	5	4	5	3
(5) Matala ..	8	7	5	2	3	5	6	4	5	5	6	4
(6) Nalanda ..	8	10	8	6	7	9	8	8	10	6	8	8
5. Non-lateritic Rice Soils of the Dry Zone—												
(1) Polonnaruwa ..	12	6	9	10	8	9	7	11	9	8	9	10
(2) Hingurakgoda ..	20	15	17	14	19	17	19	15	17	16	18	17
(3) Maha Iluppallama Red ..	18	18	16	20	12	16	14	14	16	18	14	18
(4) Maha Iluppallama Grey ..	4	5	6	5	6	7	6	8	7	6	7	5
6. Calcareous Rice Soils—												
(1) Jaffna ..	22	20	22	24	18	26	22	22	20	24	22	22
7. Non-lateritic Clayey Rice Soils—												
(1) Ambalantota 1 ..	8	9	8	8	10	6	10	8	10	6	8	7
(2) Ambalantota 2 ..	10	6	8	8	10	6	8	12	8	4	8	8

TABLE XXVIII

Water Percolates—Potassium ppm—Averages

<i>Days from Submergence</i>	1	14	28	42	56	70	84	98	112	140	168	196
1. Strongly Acid Lateritic Rice Soils of the Ultra Wet Zone	29	.. 30	.. 28	.. 27	.. 27	.. 28	.. 30	.. 28	.. 28	.. 29	.. 29	.. 28
2. Strongly Acid Humic Rice Soils (one soil)	20	.. 16	.. 18	.. 18	.. 20	.. 16	.. 22	.. 18	.. 16	.. 18	.. 16	.. 18
3. Ground Water Podzolic Rice Soils	13	.. 14	.. 14	.. 16	.. 12	.. 15	.. 13	.. 12	.. 15	.. 14	.. 16	.. 13
4. Acid Lateritic Rice Soils of the Wet Zone	20	.. 18	.. 18	.. 17	.. 18	.. 18	.. 18	.. 17	.. 18	.. 18	.. 18	.. 18
5. Non-lateritic Rice Soils of the Dry Zone	14	.. 11	.. 12	.. 12	.. 11	.. 12	.. 12	.. 12	.. 12	.. 12	.. 12	.. 13
6. Calcareous Rice Soils (one soil)	22	.. 20	.. 22	.. 24	.. 18	.. 26	.. 22	.. 22	.. 20	.. 24	.. 22	.. 22
7. Non-lateritic Clayey Rice Soils	9	.. 8	.. 8	.. 8	.. 10	.. 6	.. 9	.. 10	.. 9	.. 5	.. 8	.. 8
Means of the Averages	18	17	17	17	17	17	18	17	17	17	17	17

TABLE XXIX
pH Values of Soils

<i>Days from Submergence</i>	1	3	5	7	14	28	42	56	70	84	98	112	140	168	196
1. Strongly Acid Lateritic Rice Soils of the Ultra wet zone—															
(1) Panagoda ..	5.3	5.4	5.4	5.4	5.4	5.6	6.0	6.0	6.0	6.1	6.2	6.2	6.2	6.3	6.3
(2) Mirigama ..	4.4	5.2	5.4	5.6	5.8	5.8	5.8	5.9	6.0	6.0	6.3	6.3	6.4	6.4	6.4
(3) Mapalana ..	4.7	5.5	5.6	5.8	5.9	5.9	5.9	5.9	6.1	6.2	6.5	6.5	6.6	6.6	6.6
(4) Karapinchu ..	5.5	6.0	6.0	6.0	6.0	6.1	6.2	6.3	6.4	6.5	6.6	6.6	6.8	6.8	6.8
2. Strongly Acid Humic Rice Soils—															
(1) Bombuwela Peaty ..	4.7	5.3	5.4	5.6	5.7	5.9	6.0	6.2	6.3	6.4	6.4	6.4	6.5	6.5	6.5
3. Ground Water Podzolic Rice Soils—															
(1) Bombuwela Sandy ..	5.4	5.5	5.5	5.6	5.6	5.9	6.0	6.2	6.5	6.7	6.8	6.8	6.9	6.9	6.9
(2) Batticaloa ..	6.1	6.1	6.1	6.1	6.1	6.2	6.3	6.8	6.8	6.9	6.9	6.9	7.0	7.0	7.0
4. Acid Lateritic Rice Soils of the wet zone—															
(1) Wellmada ..	5.4	5.8	5.9	6.0	6.2	6.3	6.3	6.3	6.3	6.5	6.7	6.8	6.9	6.9	6.9
(2) Bibile ..	5.7	6.0	6.1	6.2	6.3	6.4	6.4	6.5	6.7	6.9	6.9	6.9	7.0	7.0	7.0
(3) Peradeniya ..	5.5	5.6	5.7	5.8	6.0	6.1	6.1	6.3	6.5	6.7	6.8	6.8	6.9	6.9	6.9
(4) Kundasale ..	6.4	6.5	6.5	6.5	6.5	6.5	6.6	6.6	6.7	6.9	7.0	7.0	7.1	7.1	7.1
(5) Matale ..	5.6	5.9	6.1	6.1	6.2	6.3	6.4	6.6	6.5	6.8	6.9	6.9	7.0	7.0	7.0
(6) Nalanda ..	6.3	6.3	6.3	6.3	6.3	6.4	6.5	6.6	6.7	6.7	6.9	6.9	7.0	7.0	7.0
5. Non-lateritic Rice Soils of the dry zone—															
(1) Polonnaruwa ..	6.4	6.5	6.5	6.6	6.7	6.7	6.7	6.8	6.9	7.1	7.2	7.2	7.3	7.3	7.3
(2) Hingurakgoda ..	6.6	6.7	6.7	6.7	6.8	6.8	6.8	6.9	7.0	7.1	7.3	7.3	7.3	7.3	7.3
(3) Maha Iluppallama Red ..	6.5	6.6	6.6	6.6	6.7	6.7	6.7	6.7	7.0	7.0	7.2	7.2	7.2	7.2	7.2
(4) Maha Iluppallama Grey ..	6.6	6.7	6.7	6.7	6.8	6.8	6.9	6.9	7.1	7.1	7.2	7.2	7.3	7.3	7.3
6. Calcareous Rice Soils—															
(1) Jaffna ..	6.8	6.9	6.9	6.9	7.0	7.1	7.1	7.1	7.4	7.4	7.6	7.6	7.6	7.7	7.7
7. Non-lateritic Clayey Rice Soils—															
(1) Ambalantota 1 ..	6.5	6.6	6.6	6.7	6.8	6.8	6.8	6.8	7.0	7.0	7.1	7.2	7.2	7.2	7.2
(2) Ambalantota 2 ..	6.3	6.4	6.5	6.5	6.6	6.6	6.6	6.7	6.9	6.9	7.0	7.0	7.0	7.1	7.1

TABLE XXX
pH Values of Soils—Averages

<i>Days from Submergence</i>	1	3	5	7	14	28	42	56	70	84	98	112	140	168	196
1. Strongly Acid Lateritic Rice Soils of the Ultra wet zone ..	5.0	5.5	5.6	5.7	5.8	5.9	6.0	6.0	6.1	6.3	6.4	6.4	6.5	6.5	6.5
2. Strongly Acid Humic Rice Soils (one soil) ..	4.7	5.3	5.4	5.6	5.7	5.9	6.0	6.2	6.3	6.4	6.4	6.4	6.5	6.5	6.5
3. Ground Water Podzolic Rice Soils ..	5.8	5.8	5.8	5.9	5.9	6.1	6.2	6.5	6.7	6.8	6.9	6.9	7.0	7.0	7.0
4. Acid Lateritic Rice Soils of the wet zone ..	5.8	6.0	6.1	6.2	6.3	6.3	6.4	6.5	6.6	6.8	6.9	6.9	7.0	7.0	7.0
5. Non-lateritic Rice Soils of the dry zone ..	6.5	6.6	6.6	6.6	6.8	6.8	6.8	6.8	7.0	7.1	7.2	7.2	7.3	7.3	7.3
6. Calcareous Rice Soils (one soil) ..	6.8	6.9	6.9	6.9	7.0	7.1	7.1	7.1	7.4	7.4	7.6	7.6	7.6	7.7	7.7
7. Non-lateritic Clayey Rice Soils ..	6.4	6.5	6.6	6.6	6.7	6.7	6.7	6.8	7.0	7.0	7.1	7.1	7.1	7.2	7.2
Means of the Averages ..	5.9	6.1	6.2	6.2	6.3	6.4	6.5	6.6	6.7	6.8	6.9	6.9	7.0	7.0	7.0

**VARIAION OF CHEMICAL AND PHYSICO-CHEMICAL CHARACTERISTICS OF PADDY
SOILS ON SUBMERGENCE**

TABLE XXXI
Water Peroxides—Calcium ppm

<i>Days from Submergence</i>	1	14	28	42	56	70	84	98	112	140	168	196
1. Strongly Acid lateritic Rice Soils of the Ultra wet zone—												
Panagoda ..	12.5 ..	12.5 ..	12.5 ..	12.5 ..	25.0 ..	25.0 ..	25.0 ..	25.0 ..	25.0 ..	25.0 ..	25.0 ..	25.0 ..
(2) Mirigama ..	12.5 ..	12.5 ..	12.5 ..	25.0 ..	25.0 ..	37.5 ..	37.5 ..	37.5 ..	50.0 ..	50.0 ..	50.0 ..	50.0 ..
(3) Mapalana ..	12.5 ..	25.0 ..	25.0 ..	25.0 ..	37.5 ..	37.5 ..	37.5 ..	50.0 ..	50.0 ..	50.0 ..	50.0 ..	50.0 ..
(4) Karapinchu ..	25.0 ..	25.0 ..	25.0 ..	50.0 ..	50.0 ..	50.0 ..	75.0 ..	75.0 ..	75.0 ..	75.0 ..	75.0 ..	75.0 ..
2. Strongly Acid Humic Rice Soils—												
(1) Bombuwela Peaty ..	12.5 ..	12.5 ..	12.5 ..	12.5 ..	25.0 ..	25.0 ..	25.0 ..	25.0 ..	25.0 ..	25.0 ..	25.0 ..	25.0 ..
3. Ground Water Podzolic Rice Soils—												
(1) Bombuwela Sandy ..	12.5 ..	12.5 ..	25.0 ..	25.0 ..	25.0 ..	37.5 ..	37.5 ..	50.0 ..	50.0 ..	50.0 ..	50.0 ..	50.0 ..
(2) Batticaloa ..	12.5 ..	12.5 ..	12.5 ..	12.5 ..	25.0 ..	25.0 ..	25.0 ..	25.0 ..	25.0 ..	25.0 ..	25.0 ..	25.0 ..
4. Acid lateritic Rice Soils of the wet zone—												
(1) Wellimada ..	50.0 ..	50.0 ..	50.0 ..	75.0 ..	75.0 ..	100.0 ..	100.0 ..	100.0 ..	100.0 ..	100.0 ..	100.0 ..	100.0 ..
(2) Bible ..	50.0 ..	50.0 ..	50.0 ..	75.0 ..	75.0 ..	75.0 ..	100.0 ..	100.0 ..	100.0 ..	100.0 ..	100.0 ..	100.0 ..
(3) Peradeniya ..	37.5 ..	37.5 ..	50.0 ..	50.0 ..	50.0 ..	75.0 ..	75.0 ..	75.0 ..	75.0 ..	75.0 ..	75.0 ..	75.0 ..
(4) Kundasale ..	100.0 ..	100.0 ..	100.0 ..	100.0 ..	125.0 ..	125.0 ..	125.0 ..	125.0 ..	125.0 ..	125.0 ..	125.0 ..	125.0 ..
(5) Matale ..	75.0 ..	75.0 ..	75.0 ..	100.0 ..	100.0 ..	100.0 ..	100.0 ..	125.0 ..	125.0 ..	125.0 ..	125.0 ..	125.0 ..
(6) Nalanda ..	50.0 ..	50.0 ..	50.0 ..	75.0 ..	75.0 ..	75.0 ..	100.0 ..	100.0 ..	100.0 ..	100.0 ..	100.0 ..	100.0 ..
5. Non-lateritic Rice Soils of the dry zone—												
(1) Polonnaruwa ..	125.0 ..	125.0 ..	125.0 ..	175.0 ..	175.0 ..	200.0 ..	200.0 ..	200.0 ..	250.0 ..	250.0 ..	250.0 ..	250.0 ..
(2) Hingurakgoda ..	175.0 ..	175.0 ..	200.0 ..	200.0 ..	250.0 ..	250.0 ..	250.0 ..	275.0 ..	275.0 ..	275.0 ..	275.0 ..	275.0 ..
(3) Maha Iluppallama Red ..	50.0 ..	50.0 ..	75.0 ..	75.0 ..	75.0 ..	100.0 ..	100.0 ..	125.0 ..	125.0 ..	125.0 ..	125.0 ..	125.0 ..
(4) Maha Iluppallama Grey ..	50.0 ..	50.0 ..	75.0 ..	75.0 ..	75.0 ..	100.0 ..	100.0 ..	100.0 ..	100.0 ..	100.0 ..	100.0 ..	100.0 ..
6. Calcareous Rice Soils—												
(1) Jaffna ..	125.0 ..	125.0 ..	125.0 ..	150.0 ..	150.0 ..	175.0 ..	200.0 ..	200.0 ..	250.0 ..	250.0 ..	250.0 ..	250.0 ..
7. Non-lateritic Clayey Rice Soils—												
(1) Ambalantota 1 ..	125.0 ..	125.0 ..	150.0 ..	150.0 ..	200.0 ..	200.0 ..	200.0 ..	275.0 ..	275.0 ..	275.0 ..	275.0 ..	275.0 ..
(2) Ambalantota 2 ..	125.0 ..	125.0 ..	125.0 ..	150.0 ..	150.0 ..	150.0 ..	200.0 ..	250.0 ..	250.0 ..	250.0 ..	250.0 ..	250.0 ..

TABLE XXXII

Water Percolates—Calcium ppm—Averages

<i>Days from Submergence</i>	1	14	28	42	56	70	84	98	112	140	168	196
1. Strongly Acid Lateritic Rice Soils of the Ultra wet zone ..	15.6	18.8	18.8	28.1	43.4	37.5	43.8	46.9	50.0	50.0	50.0	50.0
2. Strongly Acid Humic Rice Soils (one soil) ..	12.5	12.5	12.5	12.5	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
3. Ground Water Podzolic Rice Soils	12.5	12.5	18.8	18.8	25.0	31.3	31.3	37.5	37.5	37.5	37.5	37.5
4. Acid Lateritic Rice Soils of the wet zone ..	60.4	60.4	62.5	79.2	83.3	91.7	100.0	104.2	104.2	104.2	104.2	104.2
5. Non-lateritic Rice Soils of the dry zone ..	100.0	100.0	118.8	131.3	143.8	162.5	162.5	175.0	187.5	187.5	187.5	187.5
6. Calcareous Rice Soils (one soil) ..	125.0	125.0	125.0	150.0	150.0	175.0	200.0	200.0	250.0	250.0	250.0	250.0
7. Non-lateritic Clayey Rice Soils ..	125.0	125.0	138.0	150.0	175.0	175.0	200.0	203.0	203.0	263.0	263.0	263.0
Means of the Averages ..	64.0	65.0	71.0	80.1	91.0	100.0	109.0	122.0	130.0	131.0	131.0	131.0

VARIATION OF CHEMICAL AND PHYSICO-CHEMICAL CHARACTERISTICS OF PADDY SOILS ON SUBMERGENCE

TABLE XXXIII

Redox-Potentials of Soils at 2" below the surface—Eh at pH 7

Days from Submergence	1	3	5	7	14	23	42	56	70	84	98	112	140	168	196
1. Strongly Acid Lateritic Rice Soils of the Ultra wet zone—															
(1) Panagoda	.. + 150.	.. 70.	.. 65.	.. 150.	.. 162.	.. 140.	.. 132.	.. 121.	.. 110.	.. 100.	.. 98.	.. 102.	.. 103.	.. 102.	.. 105
(2) Mirigama	.. + 202.	.. + 102.	.. 58.	.. 108.	.. 132.	.. 150.	.. 141.	.. 128.	.. 110.	.. 102.	.. 105.	.. 101.	.. 102.	.. 102.	.. 104
(3) Mapalana	.. + 126.	.. 26.	.. 78.	.. 103.	.. 126.	.. 158.	.. 138.	.. 118.	.. 108.	.. 104.	.. 102.	.. 106.	.. 107.	.. 105.	.. 106
(4) Karapincha	.. + 199.	.. + 100.	.. 63.	.. 98.	.. 138.	.. 126.	.. 117.	.. 109.	.. 96.	.. 86.	.. 87.	.. 88.	.. 84.	.. 87.	.. 87
2. Strongly Acid Humic Rice Soils—															
(1) Bombuwela Peaty	.. + 94.	.. + 50.	.. 2.	.. 63.	.. 110.	.. 102.	.. 92.	.. 86.	.. 74.	.. 67.	.. 68.	.. 66.	.. 68.	.. 67.	.. 66
3. Ground Water Podzolic Rice Soils—															
(1) Bombuwela Sandy	.. 26.	.. 57.	.. 84.	.. 112.	.. 146.	.. 137.	.. 125.	.. 116.	.. 107.	.. 98.	.. 97.	.. 99.	.. 96.	.. 97.	.. 99
(2) Batticaloa	.. + 375.	.. + 250.	.. + 124.	.. 4.	.. 113.	.. 102.	.. 94.	.. 86.	.. 75.	.. 64.	.. 66.	.. 67.	.. 65.	.. 66.	.. 64
4. Acid Lateritic Rice Soils of the wet zone—															
(1) Wellmada	.. + 146.	.. + 84.	.. 3.	.. 78.	.. 156.	.. 144.	.. 136.	.. 128.	.. 106.	.. 108.	.. 109.	.. 107.	.. 105.	.. 106.	.. 108
(2) Bibile	.. + 192.	.. + 102.	.. 12.	.. 101.	.. 163.	.. 141.	.. 133.	.. 124.	.. 111.	.. 103.	.. 102.	.. 104.	.. 103.	.. 103.	.. 104
(3) Peradeniya	.. + 233.	.. + 133.	.. 32.	.. 66.	.. 148.	.. 146.	.. 138.	.. 127.	.. 113.	.. 101.	.. 100.	.. 102.	.. 103.	.. 101.	.. 102
(4) Kundasale	.. + 296.	.. + 184.	.. 76.	.. 33.	.. 132.	.. 124.	.. 116.	.. 102.	.. 94.	.. 83.	.. 84.	.. 86.	.. 83.	.. 82.	.. 82
(5) Matale	.. + 263.	.. + 164.	.. 65.	.. 39.	.. 146.	.. 137.	.. 128.	.. 116.	.. 104.	.. 94.	.. 93.	.. 95.	.. 96.	.. 94.	.. 94
(6) Nalanda	.. + 250.	.. + 151.	.. 62.	.. 32.	.. 120.	.. 111.	.. 102.	.. 94.	.. 82.	.. 71.	.. 73.	.. 72.	.. 71.	.. 72.	.. 72
5. Non-lateritic Rice Soils of the dry zone—															
(1) Polonnaruwa	.. 49.	.. 74.	.. 102.	.. 121.	.. 142.	.. 134.	.. 121.	.. 110.	.. 101.	.. 93.	.. 92.	.. 94.	.. 95.	.. 92.	.. 93
(2) Hingurakgoda	.. 52.	.. 73.	.. 94.	.. 112.	.. 139.	.. 124.	.. 114.	.. 106.	.. 93.	.. 82.	.. 84.	.. 83.	.. 83.	.. 82.	.. 83
(3) Maha Iluppallama Red	.. + 208.	.. + 122.	.. 32.	.. 66.	.. 135.	.. 127.	.. 113.	.. 104.	.. 96.	.. 85.	.. 86.	.. 85.	.. 85.	.. 84.	.. 85
(4) Maha Iluppallama Grey	.. + 172.	.. + 96.	.. 20.	.. 60.	.. 104.	.. 96.	.. 87.	.. 74.	.. 66.	.. 57.	.. 58.	.. 56.	.. 57.	.. 56.	.. 57
6. Calcareous Rice Soils—															
(1) Jaffna	.. + 89.	.. 40.	.. 131.	.. 142.	.. 150.	.. 141.	.. 133.	.. 124.	.. 112.	.. 100.	.. 102.	.. 101.	.. 102.	.. 103.	.. 101
7. Non-lateritic Clayey Rice Soils—															
(1) Ambalantota 1	.. + 98.	.. + 47.	.. 3.	.. 52.	.. 107.	.. 96.	.. 84.	.. 75.	.. 66.	.. 54.	.. 55.	.. 57.	.. 56.	.. 54.	.. 54
(2) Ambalantota 2	.. + 129.	.. + 68.	.. 4.	.. 68.	.. 100.	.. 100.	.. 85.	.. 76.	.. 54.	.. 42.	.. 43.	.. 45.	.. 44.	.. 46.	.. 44

TABLE XXXIV
Redox-Potentials of Soils at 2" below the surface—Eh at pH 7—Averages

<i>Days from Submergence</i>	1	3	5	7	14	28	42	56	70	84	98	112	140	168	196
1. Strongly Acid Lateritic Rice Soils of the Ultra wet zone .. +	169.. +	27.. —	66.. —	115.. —	137.. —	144.. —	132.. —	119.. —	106.. —	98.. —	98.. —	99.. —	99.. —	99.. —	101
2. Strongly Acid Humic Rice Soils (one soil) .. +	94.. +	50.. —	2.. —	63.. —	116.. —	102.. —	92.. —	86.. —	74.. —	67.. —	68.. —	66.. —	68.. —	67.. —	66
3. Ground Water Podzolic Rice Soils +	175.. +	97.. +	20.. —	54.. —	130.. —	120.. —	110.. —	101.. —	91.. —	81.. —	82.. —	83.. —	81.. —	82.. —	82
4. Acid Lateritic Rice Soils of the wet zone .. +	230.. +	136.. +	38.. —	58.. —	143.. —	134.. —	126.. —	115.. —	102.. —	93.. —	94.. —	94.. —	94.. —	93.. —	94
5. Non-lateritic Rice Soils of the dry zone .. +	70.. +	18.. —	36.. —	90.. —	29.. —	120.. —	109.. —	99.. —	89.. —	79.. —	80.. —	80.. —	80.. —	79.. —	80
6. Calcareous Rice Soils (one soil) .. +	89.. —	40.. —	131.. —	142.. —	150.. —	141.. —	133.. —	124.. —	112.. —	100.. —	102.. —	101.. —	102.. —	103.. —	101
7. Non-lateritic Clayey Rice Soils .. +	114.. +	58.. +	1.. —	58.. —	104.. —	98.. —	85.. —	76.. —	60.. —	48.. —	49.. —	51.. —	50.. —	50.. —	49
Means of the Averages .. +	134	49	25	83	130	123	112	103	91	81	82	82	82	82	82

VARIATION OF CHEMICAL AND PHYSICO-CHEMICAL CHARACTERISTICS OF PADDY SOILS ON SUBMERGENCE

TABLE XXXV
Redox Potentials of Soils at 4' below the surface—Eh at pH 7

Days from Submergence	1	3	5	7	14	23	42	56	70	84	98	112	140	168	196
1. Strongly Acid Lateritic Rice Soils of the Ultra wet zone—															
(1) Panagoda	.. + 102.	.. + 122.	.. + 144.	.. + 198.	.. + 199.	.. + 185.	.. + 183.	.. + 172.	.. + 164.	.. + 163.	.. + 149.	.. + 152.	.. + 154.	.. + 152.	.. + 153.
(2) Mirigama	.. + 154.	.. + 53.	.. + 107.	.. + 159.	.. + 184.	.. + 201.	.. + 199.	.. + 177.	.. + 160.	.. + 153.	.. + 154.	.. + 162.	.. + 153.	.. + 154.	.. + 156.
(3) Mapalana	.. + 77.	.. + 76.	.. + 129.	.. + 154.	.. + 177.	.. + 206.	.. + 186.	.. + 171.	.. + 161.	.. + 155.	.. + 153.	.. + 157.	.. + 158.	.. + 156.	.. + 157.
(4) Karapinchu	.. + 152.	.. + 53.	.. + 114.	.. + 149.	.. + 189.	.. + 177.	.. + 165.	.. + 168.	.. + 147.	.. + 137.	.. + 136.	.. + 140.	.. + 136.	.. + 138.	.. + 136.
2. Strongly Acid Humic Rice Soils—															
(1) Bombuwela Peaty	.. + 46.	.. + 2.	.. + 53.	.. + 114.	.. + 109.	.. + 154.	.. + 143.	.. + 137.	.. + 125.	.. + 118.	.. + 119.	.. + 115.	.. + 119.	.. + 116.	.. + 114.
3. Ground Water Podzolic Rice Soils—															
(1) Bombuwela Sandy	.. + 77.	.. + 108.	.. + 136.	.. + 163.	.. + 197.	.. + 178.	.. + 174.	.. + 166.	.. + 159.	.. + 149.	.. + 147.	.. + 148.	.. + 146.	.. + 143.	.. + 143.
(2) Batticaloa	.. + 376.	.. + 200.	.. + 77.	.. + 42.	.. + 105.	.. + 155.	.. + 143.	.. + 137.	.. + 128.	.. + 117.	.. + 118.	.. + 116.	.. + 114.	.. + 116.	.. + 116.
4. Acid Lateritic Rice Soils of the wet zone—															
(1) Welimada	.. + 98.	.. + 33.	.. + 46.	.. + 129.	.. + 207.	.. + 198.	.. + 187.	.. + 179.	.. + 168.	.. + 159.	.. + 152.	.. + 153.	.. + 157.	.. + 158.	.. + 158.
(2) Bibile ..	.. + 144.	.. + 53.	.. + 66.	.. + 159.	.. + 206.	.. + 190.	.. + 182.	.. + 172.	.. + 160.	.. + 151.	.. + 152.	.. + 152.	.. + 152.	.. + 154.	.. + 154.
(3) Peradeniya	.. + 186.	.. + 84.	.. + 17.	.. + 118.	.. + 187.	.. + 195.	.. + 186.	.. + 175.	.. + 164.	.. + 152.	.. + 151.	.. + 152.	.. + 154.	.. + 153.	.. + 152.
(4) Kundasale	.. + 242.	.. + 133.	.. + 25.	.. + 87.	.. + 185.	.. + 177.	.. + 164.	.. + 154.	.. + 147.	.. + 135.	.. + 136.	.. + 137.	.. + 132.	.. + 134.	.. + 132.
(5) Matale ..	.. + 215.	.. + 116.	.. + 17.	.. + 88.	.. + 198.	.. + 185.	.. + 179.	.. + 168.	.. + 158.	.. + 155.	.. + 153.	.. + 156.	.. + 155.	.. + 154.	.. + 156.
(6) Nalanda ..	.. + 250.	.. + 103.	.. + 15.	.. + 85.	.. + 172.	.. + 163.	.. + 154.	.. + 142.	.. + 133.	.. + 122.	.. + 124.	.. + 123.	.. + 123.	.. + 122.	.. + 124.
5. Non-lateritic Rice Soils of the dry zone—															
(1) Polonnaruwa	.. + 98.	.. + 126.	.. + 154.	.. + 172.	.. + 193.	.. + 187.	.. + 172.	.. + 163.	.. + 151.	.. + 142.	.. + 144.	.. + 143.	.. + 142.	.. + 140.	.. + 143.
(2) Hingurakgoda	.. + 103.	.. + 124.	.. + 146.	.. + 164.	.. + 185.	.. + 176.	.. + 166.	.. + 159.	.. + 144.	.. + 132.	.. + 134.	.. + 133.	.. + 132.	.. + 134.	.. + 132.
(3) Maha Illuppallama Red	.. + 159.	.. + 73.	.. + 19.	.. + 116.	.. + 187.	.. + 176.	.. + 165.	.. + 155.	.. + 148.	.. + 137.	.. + 137.	.. + 135.	.. + 136.	.. + 134.	.. + 134.
(4) Maha Illuppallama Grey	.. + 120.	.. + 48.	.. + 33.	.. + 112.	.. + 158.	.. + 148.	.. + 138.	.. + 126.	.. + 117.	.. + 108.	.. + 106.	.. + 107.	.. + 108.	.. + 106.	.. + 107.
6. Calcareous Rice Soils—															
(1) Jaffna ..	.. + 40.	.. + 92.	.. + 182.	.. + 192.	.. + 202.	.. + 193.	.. + 184.	.. + 176.	.. + 163.	.. + 152.	.. + 152.	.. + 151.	.. + 152.	.. + 154.	.. + 151.
7. Non-lateritic Clayey Rice Soils—															
(1) Ambalantota 1	.. + 49.	.. + 3.	.. + 56.	.. + 104.	.. + 159.	.. + 143.	.. + 136.	.. + 126.	.. + 117.	.. + 105.	.. + 107.	.. + 108.	.. + 106.	.. + 107.	.. + 106.
(2) Ambalantota 2	.. + 83.	.. + 19.	.. + 44.	.. + 112.	.. + 156.	.. + 152.	.. + 135.	.. + 127.	.. + 103.	.. + 92.	.. + 94.	.. + 95.	.. + 96.	.. + 94.	.. + 94.

TABLE XXXVI

Redox-Potentials of Soils at 4" below the surface—Eh at pH 7—Averages

<i>Days from Submergence</i>	1	3	5	7	14	28	42	56	70	84	98	112	140	168	196
1. Strongly Acid Lateritic Rice Soils of the Ultra wet zone .. +	121..—	23..—	116..—	165..—	187..—	192..—	183..—	170..—	158..—	152..—	148..—	150..—	150..—	150..—	151
2. Strongly Acid Humic Rice Soils (one soil) .. +	46..+	2..—	53..—	114..—	166..—	154..—	143..—	137..—	125..—	118..—	119..—	115..—	119..—	116..—	114
3. Ground Water Podzolic Rice Soils +	150..+	46..—	80..—	103..—	181..—	171..—	159..—	152..—	144..—	133..—	133..—	132..—	130..—	132..—	132
4. Acid Lateritic Rice Soils of the wet zone .. +	189..+	87..—	12..—	111..—	104..—	185..—	175..—	165..—	153..—	146..—	146..—	147..—	146..—	146..—	146
5. Non-lateritic Rice Soils of the dry zone .. +	20..—	32..—	88..—	141..—	181..—	172..—	160..—	151..—	140..—	130..—	130..—	130..—	130..—	129..—	129
6. Calcareous Rice Soils (one soil) +	40..—	92..—	183..—	192..—	202..—	193..—	184..—	176..—	163..—	152..—	152..—	151..—	152..—	154..—	151
7. Non-lateritic Clayey Rice Soils .. +	66..+	8...—	50..—	108..—	158..—	150..—	136..—	127..—	113..—	99..—	101..—	102..—	101..—	101..—	100
Means of the Averages .. +	70 —	1 —	76 —	133 —	181 —	174 —	163 —	154 —	142 —	133 —	133 —	132 —	133 —	133 —	132