THE pH-REACTION OF THE PEAT IN LONG-TERM SOIL IMPROVEMENT AND FERTILIZING TRIALS AT THE LETEENSUO EXPERIMENTAL STATION

YRJÖ PESSI

Peat Cultivation Society, Experimental Station Leteensuo

Received January 29. 1962

At the Leteensuo Experimental Station of the Peat Cultivation Society a number of long-term soil improvement and fertilizing trials have been in progress during several decades. Results from these trials have been published in several connections in recent years (2, 4, 5, 6, 9). Other studies have also been carried out in order to investigate various questions related to these trials (3, 7, 8, 10, 11). The purpose of the present investigation was to determine the change of pH-reaction that has occurred in the peat of the plough layer on the cultivated bog lands in these trials. In these trials the most recent soil improvement treatment was done relatively long ago, and fertilization has been constant year after year. The trials in question have previously been studied in this respect by TUORILA (13, 14).

The pH-reaction in cultivated fields is a question studied in a great number of investigations. In the present paper no extensive treatment of the topic on the basis of existing literature is intended; the author merely desired to throw some light on the long-term trials at Leteensuo in regard to the soil pH-reaction.

Trial fields and methods of investigation

The trials were established on two areas with peat layers consisting of unhumified Sphagnum peat derived from *Sph. fuscum* and of slightly humified forest sedge peat, respectively. The pH-reactions of the Sphagnum peat and of the forest sedge peat prior to cultivation were about 3.3 and 4.1, respectively. The other properties of the peats are described in the results of analyses reported by RINDELL (16, p. 184; 15 p. 32). The mineral soils (clay and sand) used for soil improvement were characterized in a paper by VESIKIVI (15, p. 34). It may suffice here to mention that the sand and clay had pH values of 5.9 and 4.4, respectively.

The pH measurements were made with a Philips pH meter, using the glass electrode. In virtually all instances measurements were made in three different ways, namely, from water suspension and from 0.1-n KCl and 0.1-n $CaCl_2$ suspensions.

The soil samples were taken with the sampling cylinder devised by HEINONEN (1). From each of the trial plots of 50 m^2 size about 5—6 samples were taken and from 100 m^2 plots about 10 samples were taken. The samples were carefully mixed and a subsamples immediately taken for pH measurement.

Water or KCl or $CaCl_2$ solution was added to the soil sample to produce a pulpy consistency. The measurements were made 20—24 hours after this addition.

Before the actual measurements were started, a series of measurements was carried out in order to determine the effect caused by the time interval from the preparation of the pulpy mixture to the time of measurement. Such measurements were made with eight samples and at time intervals of ½, 3, 7, 18 and 48 hours. The results revealed an average change of the measured pH by —0.07, —0,04, 0.00 and + 0.02 units at the above-mentioned time intervals.

The effect of the sampling procedure on the results was also investigated in the following preliminary study. From each soil improvement test plot ten samples were taken and the pH of each was measured separately. The ten samples were then combined, and subsamples from this mixture were measured in order to determine how far the pH characteristics had been homogenized as a result of mixing the original samples. The results, shown in Table 1, reveal that the pH-reaction of the soil sample has been essentially equalized due to the mixing operation. On the other hand, it may be noted that the soil improving agents have not been uniformly admixed to the soil in spite of its cultivation during several decades.

Table 1. Results from preliminary investigation on the homogeneity of the peat in the trial plot with respect to pH and significance of mixing of the soil samples.

Treatment	Original subsamples		Subsamples from the mixed sample	
	Mean pH	Range	Mean pH	Range
Unclayed, unlimed	4.13	0.38	4.14	0.08
Clayed, unlimed	4.94	0.41	4.94	0.17
Unclayed, limed	4.82	1.19	4.77	0.15
Clayed and limed	5.34	0.92	5.40	0.16

Objects of investigation

The objects of investigation were the long-term soil improvement and fertilizing trials at Leteensuo. Detailed descriptions of the planning, establishment, and management of the trials have been given in previous papers dealing with the results of the trials (2, 4, 5, 7, 9). Only the most essential factors from the point of view of the present topic shall be mentioned here.

Tests on Sphagnum bog

All of the Sphagnum bog trials were concerned with plots located in an area where the peat consisted of nearly unhumified Sphagnum peat derived from *S. fuscum* moss.

Sphagnum bog liming and claying trial. — The trial area was cleared for cultivation in 1921 and the trial was started in 1923. Claying in accordance with the trial plan (at 300 m^3 per hectare) was done once at the beginning of the trial. Liming at 0, 1, 2, 3 and 4 tons per hectare, respectively, was done twice, namely, when the trial was started and again in 1932. The entire trial area has received the same fertilization.
Sphagnum bog claying, sanding and liming trial. — The area was cleared for cultivation in 1930 and the trial started in 1932. Mineral soil was added once when the trial was started. Liming, as specified by the trial plan, was done in 1932 (at 4 tons slaked lime per hectare) and in 1937 (2 tons per hectare). The entire trial area has received the same fertilization.
Sphagnum bog nitrogen fertilizing trial. — The area was cleared for cultivation in 1921 and the trial started in 1923. One half of the experimental strip between ditches received farmyard manure at the following rates (in tons per hectare): 20 tons in 1923—1924, 30.6 in 1929, 30 in 1930, and 30 tons in 1933. Up to 1949 the fertilization treatments on both halfstrips were: 0, PK, NPK, 2NPK and 3NPK (N = 100 kg calcium nitrate per hectare, P = 200 kg superphosphate per hectare, and K = 200 kg 50 % potassium salt per hectare). In 1949 the fertilizing schedule of the half with farmyard manure was changed to consist of the treatments: 0, PK, 3NPK, 6 NPK, and 9NPK.

Tests on fen soil

All tests relating to fen soil were located in an area containing a layer of relatively well-humified forest sedge peat.

Fen soil improvement and fertilizing trial. — The area was cleare for cultivation in 1909 and the trial started in 1910. Mineral soil quantities as provided by the trial plan (0, 100, 200, 300 and 400 m sand and clay per hectare) were applied twice, in 1910 and in 1928. The fertilizers throughout the trial period have been superphosphate and potassium salt according to the trial plan (P = about 100 kg superphosphate per hectare; K = about 100 kg 50 potassium salt per hectare).

Fen soil phosphorus and potassium fertilizing trial. — The area was cleared for cultivation in 1904 and the trial started in 1905. The experimental rates of fertilizer application were: 0, P, K, PK, and PK plus liming (P = 200 kg superphosphate per hectare; K = 200 kg 50 % potassium salt per hectare). Liming was done as follows: in 1905 2 tons of slaked lime were given per hectare, and 1 ton per hectare in the years 1923, 1927 and 1933.
Fen soil potassium fertilizing and claying trial. — The trial area was cleared in 1922 and the trial started in 1923. Claying (at 200 m^3 per hectare) was done twice, in 1923 and 1941. Potassium salt was used for potassium fertilization and superphosphate as phosphorus fertilizer (K = 20 kg K_2O per hectare up to 1930 and 30 kg per hectare subsequently: P = 300 kg superphosphate per hectare).
Superphosphate and fine-ground rock phosphate comparative trial on fen soil. — The area was cleared for cultivation in 1928 and the trial started in 1930. Up to 1948 Thomas phosphate was used in this test instead of fine-ground rock phosphate. The fertilizer rates were 20 and 40 kg P_2O_5 per hectare and 200 kg potassium salt per hectare. When the trial was started, the liming treatment received slaked lime at 2 tons per hectare. The liming was repeated in 1937 (at 2 tons of ground limestone per hectare).
Fen soil phosphorus fertilizing trial. — The area was cleared for cultivation in 1921 and the trial started in 1923. The phosphorus fertilizer was superphosphate at different rates (P = 20 kg P_2O_5 per hectare), the potassium fertilizer was potassium salt (K = 100 kg K_2O per hectare).

Results

Effect of the soil improvement agents

Trials on Sphagnum bog. — The results of the soil improvement trials on Sphagnum bog are presented in Tables 2—4. In the liming and claying trial, the pH value was also investigated in the 20—30 cm and 50—60 cm layers below the plough layer. These values have also been included in Table 2.

Table 2. Sphagnum bog liming and claying trial. pH-reaction of the peat at different depths.

CaO, tons per hectare		Clayed		Unclayed		Change produced by claying	
		pH	t value	pH	t value		t value
				Plough layer			
0	pH (H_2O)	4.98	—	4.17	—	0.81	10.5***
1	Change	0.14	1.27	0.07	1.40	0.88	9.8***
2		0.28	2.09	0.17	2.56*	0.92	7.2***
3		0.42	3.92*	0.43	6.15***	0.80	7.7***
4		0.54	6.30**	0.56	7.77***	0.79	9.7***
0	pH (KCl)	4.55	—	4.04	—	0.51	5.7***
1	Change	0.12	0.97	0.02	0.50	0.61	6.5***
2		0.25	2.27	0.10	1.80	0.66	7.7***
3		0.38	2.81*	0.37	7.50	0.52	4.6**
4		0.48	5.00**	0.47	4.35	0.52	4.3**
0	pH ($CaCl_2$)	4.20	—	3.68	—	0.52	7.4***
1	Change	0.16	1.66	−0.01	0.25	0.69	8.8***
2		0.24	2.18	0.10	1.70	0.66	6.0***
3		0.37	3.29*	0.35	4.60**	0.54	4.7**
4		0.47	5.12**	0.42	4.24**	0.57	4.7**
				20—30 cm layer			
0	pH (H_2O)	4.41	—	3.95	—	0.45	7.25***
1	Change	0.18	1.73	0.01	0.45	0.63	7.68***
2		0.14	1.82	0.05	1.08	0.55	10.37***
3		0.18	1.65	0.21	5.83**	0.43	4.83**
4		0.19	1.75	0.31	10.32***	0.34	3.95*
0	pH (KCl)	3.98	—	3.78	—	0.20	3.33*
1	Change	0.14	1.44	0.04	0.73	0.30	3.20*
2		0.14	2.15	0.05	0.89	0.29	4.75**
3		0.16	1.33	0.16	2.85*	0.20	1.66
4		0.18	1.66	0.24	3.00*	0.14	1.20
0	pH ($CaCl_2$)	3.58	—	3.39	—	0.19	4.87**
1	Change	0.13	1.27	0.06	1.50	0.26	2.50*
2		0.18	2.90*	0.02	0.63	0.35	5.83**
3		0.17	1.38	0.14	2.54*	0.22	1.70
4		0.14	1.84	0.23	2.55*	0.10	0.90
				50—60 cm layer			
0	pH (KCl)	3.52	—	3.50	—	0.02	—
1	Change	0.17	3.14*	0.03	0.30	0.16	1.51
2		0.20	5.55**	0.04	—	0.18	2.14
3		0.16	1.46	0.24	2.29	−0.06	—
4		0.14	1.40	0.18	1.72	−0.02	—

The results presented in Table 2 show that liming distinctly increased the pH value on the clayed as well as the unclayed strip of land. The increase in pH caused by liming was almost completely linear ($y = 4.55+0.122\ x$; $r = 0.999^{***}$, pH in KCl solution for the clayed strip). The liming had little effect on the pH of the deeper layers. It can also be seen from Table 2 that claying exerted a distinct effect on the acidity of the peat. As has been mentioned before, the clay had the relatively high pH of 5.9. Therefore it produced a considerable neutralizing effect. The influence of claying also extended to the 20—30 cm layer, as is shown by the values of the t-test.

The pH-reaction of the peat in the plough layer in this trial was previously investigated by TUORILA in 1925 (13). He made his measurements from aqueous suspension by the quinhydrone method. Although this method was different from that in the present investigation and although liming, according to the trial plan, was repeated once, after 1925, it is still interesting to compare the results. This can be done with the aid of Table 3, which contains both sets of results. It can be seen that the effect of liming was considerably stronger in the initial phase of the trial

Table 3. Sphagnum bog liming and claying trial. pH-reaction of the peat in the plough layer measured from aqueous suspension in 1925 and 1961.

CaO, tons per hectare	Clayed			Unclayed		
	1925	1961	Diff.	1925	1961	Diff.
0	4.3	5.0	−0.7	3.3	4.3	−1.0
1	4.6	5.1	−0.5	4.1	4.2	−0.1
2	5.4	5.3	+0.1	5.0	4.3	+0.7
3	6.3	5.4	+0.9	5.7	4.6	+1.1
4	5.9	5.5	+0.4	6.2	4.7	+1.5

than after several decades of cultivation. On the other hand, it is evident that the pH-reaction of the peat has changed in the course of time even as a result of cultivation alone, unless there should be some other factor responsible for the different pH values of the unlimed trial plot in 1925 and in 1961.

The results shown in Table 2 reveal that claying increased the pH value (as measured from aqueous suspension) by about 0.8—0.9 pH units, independent of liming. According to TUORILA's measurements, the effect of claying was not dependent on liming, and it was greatest (1.0 units) for the unlimed trial plot, decreasing and actually obtaining negative values with increasing application of lime. With respect to the effect of claying on the acidity of the soil, it appears justifiable to infer that this treatment caused no decrease in pH even during decades of cultivation.

The pH-reaction of the plough layer in the liming and claying trial on Sphagnum bog was investigated at two different times in the summer of 1961, the first determinations being made on June 27th and the second on October 3rd. The results can be seen in Table 4. They show that the pH of the peat has been different at different

Table 4. Sphagnum bog liming and claying trial. pH-reaction of the peat in the plough layer on 27. VI and 3. X. 1961

CaO, tons per hectare	Clayed				Unclayed			
	pH 27.6	pH 3.10	Diff. (pH 3.10 – pH 27.6)	t value	pH 27.6	pH 3.10	Diff. (pH 3.10 – pH 27.6)	t value
	$pH(H_2O)$							
0	4.98	5.27	0.29	3.62*	4.17	4.51	0.34	8.09***
1	5.12	5.41	0.29	3.41*	4.24	4.64	0.40	5.80**
2	5.26	5.45	0.19	1.68	4.34	4.76	0.42	5.06**
3	5.40	5.61	0.21	1.82	4.60	5.03	0.43	5.44**
4	5.52	5.65	0.13	1.26	4.73	5.08	0.35	4.43**
	pH (KCl)							
0	4.55	4.81	0.26	3.00*	4.04	4.09	0.05	1.67
1	4.67	4.96	0.29	3.00*	4.06	4.21	0.15	3.66*
2	4.80	5.05	0.25	3.33*	4.14	4.34	0.20	2.56*
3	4.93	5.20	0.27	2.06	4.41	4.64	0.23	4.10**
4	5.03	5.22	0.19	2.04	4.51	4.67	0.16	1.28
	$pH (CaCl_2)$							
0	4.20	4.41	0.21	3.23*	3.68	3.68	0.00	—
1	4.36	4.56	0.20	1.99	3.67	3.77	0.10	1.92
2	4.44	4.63	0.19	1.90	3.78	3.88	0.10	1.25
3	4.57	4.74	0.17	1.24	4.03	4.15	0.12	1.33
4	4.67	4.79	0.12	1.03	4.10	4.24	0.14	1.21

Table 5. Sphagnum bog claying, sanding and liming trial. pH-reaction of the peat in the plough layer.

Mineral soil m^3 per hectare		Limed		Unlimed		Change produced by liming	
		pH	t value	pH	t value		t value
None	pH (H_2O)	4.60	—	4.25	—	0.35	3.04*
Sand 200	Change	0.31	5.64**	0.27	2.18	0.39	5.49**
» 400		0.58	28.00***	0.37	3.10*	0.56	15.55***
Clay 200		0.39	13.00***	0.29	2.48*	0.45	13.63***
» 400		0.53	5.88**	0.53	4.25**	0.35	3.20*
None	pH (KCl)	4.10	—	3.70	—	0.40	3.60*
Sand 200	Change	0.26	5.00**	0.31	2.98*	0.35	10.00***
» 400		0.53	13.25***	0.38	3.16*	0.55	8.87***
Clay 200		0.38	5.20**	0.30	2.70*	0.48	6.57***
» 400		0.46	6.48***	0.51	4.47**	0.35	4.66**
None	pH ($CaCl_2$)	3.80	—	3.45	—	0.35	3.12*
Sand 200	Change	0.31	4.36**	0.29	2.11	0.37	5.87**
» 400		0.64	13.06***	0.41	3.59*	0.58	11.15***
Clay 200		0.44	5.95**	0.33	3.02*	0.46	6.48***
» 400		0.57	7.31***	0.56	5.13**	0.36	4.80**

times, the range of variation also depending on the measuring method. This variation of soil pH during the growing season has been investigated in greater detail, e.g., by SALONEN (12).

An effect similar to that of mineral soil addition and liming in the trial described above, can also be noted in the second trial on Sphagnum bog. The respective pH values are presented in Table 5. This trial also included sanding, which exerted a highly distinct effect on the pH value. The sand had a pH of 4.4.

Trials on fen soil. The results from the soil improvement tests on fen soil are given in Tables 6 and 7. These trials also included varions kinds of fertilization. be seen that the pH value of the peat increased as a result of mineral soil addition, but the effect is not as high as in the trials on Sphagnum bog.

Table 6. Fen soil improvement and fertilizing trial. pH-reaction of the peat in the plough layer measured from KCl solution.

Mineral soil, m^3 per hectare		0	P	2P	PK	2PK	Mean	t value for the change produced by the mineral soil
0	pH	4.00	3.99	4.07	4.21	4.23	4.10	—
200	Clay Change	−0.01	0.03	0.16	0.03	−0.02	0.04	1.24
400	»	0.16	0.23	0.17	0.24	−0.05	0.15	2.88*
600	»	0.13	0.35	0.20	0.22	0.11	0.20	4.75**
800	»	0.31	0.36	0.26	0.21	0.09	0.25	5.44**
200	Sand	0.00	0.02	0.12	−0.06	−0.13	−0.01	—
400	»	0.15	0.24	0.18	0.22	0.07	0.17	5.66**
600	»	0.32	0.33	0.28	0.24	0.15	0.26	7.87**
800	»	0.28	0.46	0.31	0.32	0.12	0.30	5.66**

Table 7. Fen soil potassium fertilizing and claying trial. pH-reaction of the peat in the plough layer.

Fertilizing		Clayed pH	Unclayed pH	Change produced by claying	t value
P	pH (H_2O)	4.75	4.41	0.34	4.47**
PK	Change	0.09	0.02	0.41	4.82**
P2K		0.08	0.05	0.37	4.30**
P3K		0.04	−0.01	0.39	3.27*
P4K		−0.05	−0.06	0.35	2.61*
P	pH (KCl)	4.43	4.08	0.35	5.55**
PK	Change	0.10	0.05	0.40	7.27***
P2K		0.08	0.06	0.37	4.93**
P3K		0.05	0.01	0.39	3.51**
P4K		−0.03	−0.04	0.36	2.88**
P	pH ($CaCl_2$)	4.26	3.83	0.43	6.61***
PK	Change	0.05	0.05	0.39	5.20**
P2K		0.05	0.05	0.38	3.22*
P3K		0.01	0.01	0.42	3.36*
P4K		−0.04	−0.04	0.41	3.15**

Effect of fertilization.

Farmyard manure fertilization. — In the nitrogen fertilizing trial on Sphagnum bog, fertilization with farmyard manure was also included at an early stage. The artificial fertilization treatments 0 and PK were the same throughout the trial period on the strips with and without farmyard manure, and the effects of manure can therefore be studied from the results obtained on these trial plots. The results, shown in Table 8, that the increase in pH caused by farmyard manure in combination with PK fertilization is statistically significant.

Table 8. The effect of farmyard manure on the pH-reaction of the peat.

Artificial fertilizer	With farmyard manure	Without farmyard manure	Diff.	t value
	pH (H_2O)			
0	5.20	4.99	0.21	2.33
PK	5.08	4.89	0.19	4.13**
	pH (KCl)			
0	4.61	4.49	0.12	1.06
PK	4.63	4.39	0.24	5.70**
	pH ($CaCl_2$)			
0	4.34	4.23	0.11	1.23
PK	4.40	4.11	0.29	9.40***

Nitrate fertilization. — The effect of calcium nitrate can be studied in the nitrogen fertilizing trial on Sphagnum bog. The results given in Table 9 show that continuous use of calcium nitrate produced some increase of the pH value in Spaghnum peat.

Table 9. Sphagnum bog nitrogen fertilizing trial. pH-reaction of the peat in the plough layer.

Artificial fertilizer		With farmyard manure		Artificial fertilizer	Without farmyard manure	
		pH	t value		pH	t value
PK	pH (H_2O)	5.08	—	PK	4.89	—
3NPK	Change	0.23	3.45*	NPK	0.12	2.02
6NPK		0.36	4.12*	2NPK	0.19	10.07***
9NPK		0.63	21.00***	3NPK	0.34	5.59**
PK	pH (KCl)	4.63	—	PK	4.39	—
3NPK	Change	0.23	3.07*	NPK	0.12	3.38*
6NPK		0.34	5.22**	2NPK	0.22	5.00**
9NPK		0.64	18.80***	3NPK	0.37	8.98***
PK	pH ($CaCl_2$)	4.40	—	PK	4.11	—
3NPK	Change	0.11	1.64	NPK	0.07	1.42
6NPK		0.27	5.02**	2NPK	0.20	4.44*
9NPK		0.62	10.18***	3NPK	0.32	4.45*

Table 10. Fen soil phosphorus and potassium fertilizing trial. pH-reaction of the peat in the plough layer.

Fertilization		pH (H_2O)	pH (KCl)	pH ($CaCl_2$)
0	pH	4.58	4.09	3.99
P	Change	0.22	0.12	0.13
K		−0.01	0.02	−0.04
PK		0.37	0.27	0.23
PK + Ca		0.61	0.57	0.51

Table 11. Comparative trial of superphosphate and fine-ground rock phosphate on fen soil. pH-reaction of the peat in the plough layer. sf=Superphosphate, hf=Rock phosphate.

Fertilizer	pH (H_2O)	t value	pH (KCl)	t value	pH($CaCl_2$)	t value
K pH	4.57	—	4.10		3.80	
KP_{sf} Change	0.04		0.03		0.06	
$K2P_{sf}$	0.12		0.15		0.19	2.48*
KP_{hf}	0.11		0.14		0.15	1.72
$K2P_{hf}$	0.14	1.54	0.16	1.42	0.16	1.58
K+Ca	0.35	2.67*	0.40	2.81*	0.39	2.86*
$K2P_{sf}$+Ca	0.45	4.78**	0.50	4.95**	0.49	5.47**
$K2P_{hf}$+Ca	0.40	5.63**	0.45	4.94**	0.42	4.88**

Table 12. Trial with different superphosphate quantities on fen soil. pH-reaction of the peat in the plough layer.

	pH		Change from the K plot					
	0	K	PK	t value	2PK	t value	3PK	t value
pH (H_2O)	4.50	4.49	0.09	1.32	0.18	2.12	0.15	1.73
pH (KCl)	4.15	4.15	0.10		0.17		0.14	
pH ($CaCl_2$)	3.97	3.97	0.07		0.16		0.13	

Phosphorus and potassium fertilization. — It can be concluded from the results in Tables 6, 7, 10, 11 and 12 that continuous use of potassium salt and superphosphate or fine-ground rock phosphate has not essentially changed the pH-reaction of the forest sedge peat of fen soil.

Summary

The investigation is a report on the pH-reaction in the plough layer of the soil improvement and fertilizing tests carried on at the Experimental Station of Leteensuo during several decades. The tests were located on two areas with a peat layer consisting of Sphagnum peat with pH 3.3, derived from *S. fuscum* moss in one case, and of forest sedge peat with pH 4.1 in the other. The clay and sand employed as soil improving agents had pH 5.9 and 4.4, respectively.

The effect of liming has proved to be relatively prolonged on Sphagnum bog as well as on fen soil. In the test with different rates of lime addition on Sphagnum bog, the pH value was found to increase linearly with the lime quantity.

Addition of mineral soil has produced a remarkable increase in pH. Its effect, too, has been highly prolonged. In spite of their different inherent reactions, the sand and clay have exerted largely similar effects on the pH value of the plough layer.

Stable manure possesses an effect resulting in an increase of the pH value and this value is also increased by calcium nitrate fertilization, whereas fertilizing with potassium salt and with superphosphate or fine-ground rock phosphate did not affect the reaction of the peat in any noteworthy and distinct degree.

Acknowledgements. The present investigation was supported by a grant from the Agricultural Research Foundation of August Johannes and Aino Tiura (August Johannes ja Aino Tiuran maatalouden tutkimussäätiö). The author wishes to acknowledge this contribution with sincere gratitude.

Mr. Timo Mäkelä, University Student of Agriculture, participated in this investigation, for which my best thanks are due to him.

REFERENCES

(1) Heinonen, R. 1960. A soil core sampler with provision for cutting successive layers. Selostus: Kerrosnäytteiden ottoon sovellettu maanäytteenottolieriö. Maat.tiet. aikak. 32: 176–178.

(2) Pessi, Y. 1959. Kivennäismaan vaikutuksesta rahkasuon maanparannusaineena Leteensuon koeaseman pitkäaikaisten kenttäkokeiden perusteella. Summary: On the effect of mineral soil as a soil improving agent on Sphagnum bogs on the basis of prolonged field tests at Leteensuo Experimental Station. Acta. agr. fenn. 94, 14: 241–268.

(3) —»— 1959. On the effect of liming upon the thermal conditions of Sphagnum bog. Selostus: Kalkituksen vaikutuksesta rahkasuon lämpötilaan. Suo 10: 46–50.

(4) —»— 1960. Fen fertilization with potash in the light of tests at Leteensuo Experimental Station. Selostus: Mutasuon kalilannoituksesta Leteensuon kokeiden perusteella. Maatal.tiet. aikak. 32: 229–238.

(5) —»— 1960. Fertilization of Sphagnum bogs on the basis of certain field experiments at Leteensuo. Selostus: Rahkasuon lannoitus eräiden Leteensuon kokeiden perusteella. Ibid. 32: 144–157.

(6) —»— 1960. Kivennäismaan merkityksestä mutasuon maanparannusaineena Leteensuon koeaseman pitkäaikaisten kenttäkokeiden perusteella. Summary: On the significance of mineral soil as a soil improving agent on fens on the basis of prolonged field tests at Leteensuo Experimental Station. Acta agr. fenn. 95, 3.

(7) —»— 1960. The effect of claying carried out in 1923 upon the thermal conditions in cultivated Sphaghum peat soil in the summer of 1959. Selostus: Vuonna 1923 suoritetun saveuksen vaikutuksesta rahkasuoviljelyksen maan lämpöoloihin kesällä 1959. Maatal.tiet. aikak. 32: 1–4.

(8) —»— 1960. The effect of claying upon the settling of the soil surface on cultivated Sphagnum bogs. Selostus: Saveuksen vaikutus maan pinnan laskeutumiseen rahkasuoviljelyksellä. Ibid. 32: 5–7.

(9) —»— 1961. Results from a soil improvement and fertilizing test on fen land at Leteensuo. Selostus: Mutasuon maanparannus- ja lannoituskokeen tuloksia Leteensuolta. Ibid. 33: 223-232.

(10) Pessi, Y. 1961. The ash content of the plough layer of cultivated peat lands cultivated by different methods. Selostus: Viljeltyjen turvemaiden muokkauskerroksen tuhkapitoisuudesta. Ibid. **33**: 215—222.

(11) —»— 1961. The volume weight of the organic matter in the plough layer of peat lands cultivated by different methods. Selostus: Viljeltyjen turvemaiden muokkauskerroksen orgaanisen aineen tilavuuspainosta. Ibid. **33**: 248—255.

(12) Salonen, M. 1956. Maasta saatavan pH-arvon vaihteluista kasvukauden aikana. Koetoim. ja käyt. **13**: 15—161

(13) Tuorila, P. 1926. Maanparannuksen ja lannoituksen vaikutuksesta viljeltyjen soittemme happamuuteen ja tämän sekä maan kasvukunnon välisestä suhteesta. S. Suovilj. yhd.vuosik. **30**: 97—145.

(14) —»— 1928. Wirkung der Kalziumkarbonat- und Schwefelsäurezugaben auf die Azidität von verschiedenen Torfarten. S. Suovilj.yhd. tiet. julk. **8**: 1—75.

(15) Vesikivi, A. 1929. Suon saveuksen ja -hiekoituksen taloudellisesta kannattavaisuudesta. Referat: Über die Rentabilität der Lehm- und Sandmischkultur auf Moorboden. Ibid. **12**: 1—129.

(16) —»— 1937. Superfosfaatti- ja thomasfosfaattilannoitteiden vertailu rahkasuolla. S. suovilj.yhd. vuosik. **41**: 184—124.

SELOSTUS:

LETEENSUON KOEASEMAN PITKÄAIKAISTEN MAANPARANNUS- JA LANNOITUSKOKEIDEN MUOKKAUSKERROKSEN TURPEEN REAKTIO

Yrjö Pessi

Suoviljelysyhdistys, Leteensuon koeasema

Tutkimuksessa on selostettu Leteensuon koeasemalla useita vuosikymmeniä jatkuneiden maanparannus- ja lannoituskokeiden muokkauskerroksen reaktiota. Kokeet ovat sijainneet alueilla, joista toisen turve on ollut *Sph. fuscum*-sammaleesta muodostunutta rahkaturvetta, pH **3.3**, sekä toisen metsäsaraturvetta, pH **4.1**. Maanparannusaineena käytetyn saven pH on ollut **5.9** ja hiekan **4.4**.

Kalkituksen vaikutus sekä rahkasuolla että mutasuolla on osoittautunut verraten pitkäaikaiseksi. Rahkasuon eri kalkkimäärien kokeessa pH-luku on kalkituksen vaikutuksesta noussut lineaarisesti.

Kivennäismaan lisäys on nostanut turpeen pH-lukua huomattavasti. Sen vaikutus on osoittautunut myös erittäin pitkäaikaiseksi. Huolimatta maanparannusaineina käytetyn saven ja hiekan reaktion erilaisuudesta ovat molemmat vaikuttaneet muokkauskerroksen reaktioon jokseenkin samalla tavoin.

Karjanlantalannoitus omaa vaikutuksen, mistä aiheutuu rahkaturpeen pH-luvun kohoaminen. Kalkkisalpietarilannoitus kohottaa myös turpeen pH-lukua. Sen sijaan kalisuola-, superfosfaatti- ja hienofosfaattilannoitus eivät ole sanottavasti ja selvästi vaikuttaneet reaktioon.