Kimmo Tolonen

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USEFULNESS OF FIVE COMMON METHODS OF DETERMINING THE DEGREE OF DECOMPOSITION IN ESTIMATING THE AMOUNT AND ENERGY CONTENT OF FUEL PEAT IN FINLAND

VIIDEN YLEISESTI KÄYTETYN MAATUMISASTEEN MÄÄRITYSMENETELMÄN KÄYTTÖKELPOISUUS POLTTOTURPEEN MÄÄRÄN JA ENERGIAPITOISUUDEN ARVIOIMISEEN SUOMESSA

ABSTRACT

Five common methods were tested for Finnish peats by the author. These methods were v. Post's hand method, Pyavchenko's laboratory volume weight method, unrubbed and rubbed fiber content, centrifuge method (Gost) and colorimetric method. The relationships of the results obtained in the above mentioned analyses for the dry peat yield and the energy content of peat were examined in terms of bulk density, calorific and carbon analyses.

The potentials of predicting accurate amount and energy content of peat by means of these conventional methods used, were not found very high. More promising tools for both purposes were new electronic field and laboraroty methods, which are under development in Finland.

1. INTRODUCTION

Characteristic for peatlands and peats is a great variation involved in their botanical and physical properties. Consequently, a great number of samples is usually needed, for instance, when making decision about the "geological" suitablity of a peatland for fuel peat mining. Determining the dry peat yield by taking sufficient amounts of volumetric core samples and their energy content by acceptable standards (see e.g. Day) *et al.* 1979) is both laborious and expensive. Therefore different more rapid indirect methods have been suggested for estimating the quantitity and quality of peat both in field and in laboratory conditions. For both these purposes the degree of decomposition by different methods is commonly applied so far. However, the true relationships between the variables in question or the suitability of the methods in different areas or materials have not always been known or understood in the estimation of fuel peat resources.

The present paper compares five common methods (plus some modifications) in analysing the degree of peat decomposition and their potentials in estimating the fuel peat resources in Finnish peatlands.

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2. MATERIAL AND METHODS

Three from the used methods: v. Post's (1922) hand method, Pyavchenko's (1956) volume weight method and the centrifuge method, which is the current standard method in the USSR (Anonymous 1976) were earlier compared to the bulk density values of peats in Finland (Tolonen & Saarenmaa 1979, Saarenmaa 1980). The material (531 peat samples) came from thirteen peatlands in different parts of country. Subsequently, in the present study, the fiber content and the pyrophosphate index (Sneddon *et al.* 1971, Bascomb *et al.* 1977: 135) were determined for the same samples as was also carbon content by infrared CO_2-analyzer (Salonen 1979) for 330 samples. In addition, the colorimetric method using NaOH extracts by different wavelengths (Sapek *et al.* 1980), was compared to the other above mentioned methods in the submaterial of representative peat samples from eight of these peatlands (Nos 1—8 in Fig. 1). About a half of these

Author's address — *Kirjoittajan osoite:* Department of Botany, University of Helsinki Fabianink. 24 A, 00100 Helsinki 10, Finland.

peats belongs to *Sphagnum* peats the rest *chiefly* consisting of *Carex* and Bryales peats.

The calorific value of 106 peat samples from three peatlands was analysed according to DIN standard (51900) in the State Fuel Centre (Vapo) in Jyväskylä.

Independently from those materials, 165 sedge peat samples from an aapa mire Suolamminneva, Ähtäri, Finland (see Tolonen & Ijäs 1982) were analysed for rubbed and unrubbed fiber content as well as for colorimetric pyrophosphate index in accordance with the instructions in Bascomb *et al.* (1971). These data were compared with the bulk density values from the same samples. All the peat samples were collected using the Russian peat sampler and techniques described in Tolonen & Ijäs (1982).

All the peat samples are obtained from practically undrained peatlands. The peat samples were divided into six groups on the basis of their botanical composition. These groups are:

— Sphagnum peats (abbr. S),
— Eriophorum-Sphagnum peats (ErS),
— Carex peats (C),
— Carex-Sphagnum (CS),
— Woody peats (L) and
— Bryales (Hypnum) peats (B).

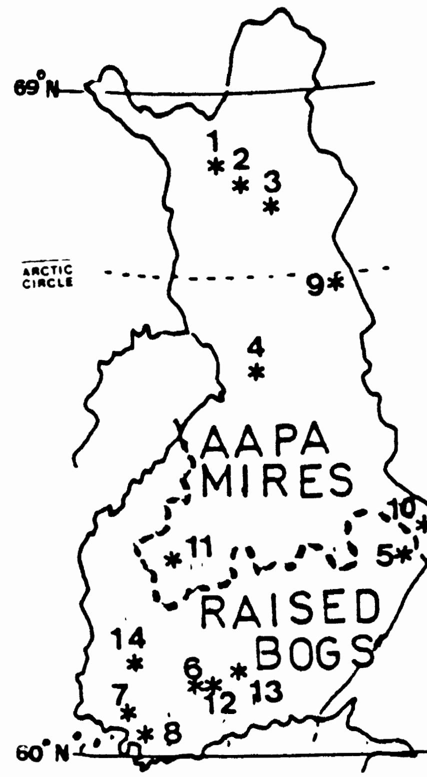

Fig. 1. The Study sites.

Kuva 1. Tutkitut suot.

Table 1. Statistical analyses of some properties studied from thirteen virgin peat profiles in Finland. Samples below water table used.

Taulukko 1. Kolmentoista suomalaisen luonnontilaisen turvekerrostuman eräiden ominaisuuksien tilastollinen analyysi. Vain suopohjavesipinnan alapuoliset näytteet otettu mukaan käsittelyyn.

	Mean	Range	Coefficient of variance
1. Depth (m) *Syvyys*	2.19	0.5—5.4	62.6 n = 435
2. v. Post *v. Post'in maatumisaste*	4.99	1—9	36.3 ,,
3. Bulk density (kg m^{-3}) *Turpeen tiheys (kuivap. + 105 °C/maastotilavuus)*	77.50	35.0—220.6	42.4 ,,
4. Unrubbed fiber % *Jauhamaton kuituisuussadannes*	62.85	21.7—99.4	29.5 ,,
5. Moisture content % wwt *Kosteussadannes (märkäpainosta)*	90.62	78.80—95.64	3.2 ,,
6. Centrifuge % *Sentrifugi (Gost) maatumissadannes*	23.28	3.0—61.25	36.6 ,,
7. Pyavchenko's % *Pjavtsenkon maatumissadannes*	23.34	1.0—61.60	61.6 ,,
8. Ash % *Tuhkasadannes*	2.74	0.15—42.91	163.1 ,,
9. Pyroph. index (d 1:2) *Pyrofosfaatti-indeksi (laim. 1:2) %*	28.68	2.6—67.0	47.1 n = 330
10. Pyroph. index (d 1:10) *Pyrofosfaatti-indeksi (laim. 1:10) %*	17.56	0.7—51.5	75.0 ,,
11. Carbon content % OM^{-1} *Tuhkaton hiilisadannes*	53.21	45.7—63.8	6.3 ,,
12. Gross calorific value (MJ kg^{-1}) *Kalorimetrinen lämpöarvo*	21.79	18.12—24.64	6.7 n = 106

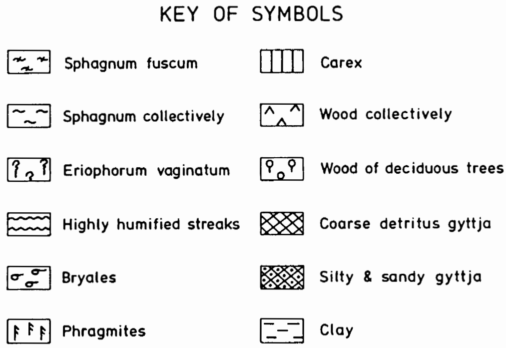

Fig. 2. Symbols for soil types of Figs 4—6.

Kuva 2. Maalajitunnukset.

3. RESULTS

Table 1 summarizes the results of the different analyses made on the main material.

3.1. Amount of peat vs. fiber content

The bulk density values of 165 sedge *(Carex)* peat samples from four different coring sites in Suolamminneva, Central Finland are plotted against the unrubbed fiber content as measured from the vertically divided halfs of the same samples (Fig. 3). The correlation is highly significant ($p > 0.001$), but the correlation coefficient remained fairly low ($r = -0.576$, $R^2 = 33.2$ %).

The correlation between bulk density and rubbed fiber content was still weaker, even if highly significant ($r = -0.367$, $R^2 = 13,5$ %, $n = 102$). It might be mentioned that the correlation of bulk density to v. Post's humification degree in the same material was very low, as well ($y = 56.10 + 5.733x$, $r = 0.309$, $R^2 = 9.5$ %, $n = 165$, where y = bulk density, kg m^{-3}).

Correspondingly, in the main material the correlation of bulk density to unrubbed fiber content was $r = -0.524$, $R^2 = 27.4$ %, $n = 501$, when all peat types were included in the analyses.

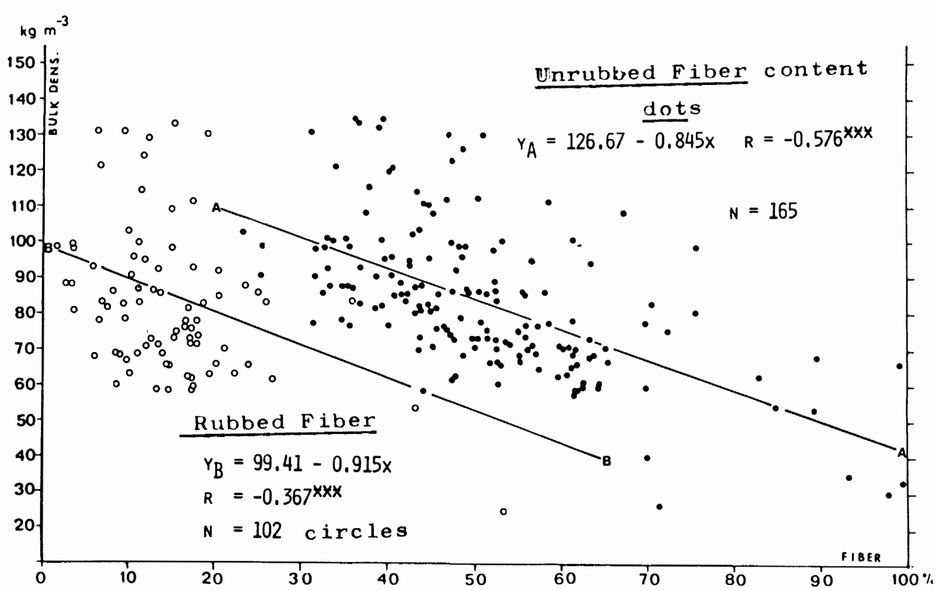

Fig. 3. Dry matter yield of peat (kg per *in situ* m^3) versus unrubbed (A) and rubbed (B) fiber content of peat in a sedge mire, Suolamminneva, in Finland.

Kuva 3. Turpeen kuiva-ainesaannon (turpeen tiheyden, kg/m³) riippuvuus jauhamattomasta (pallot) ja jauhetusta (renkaat) kuituisuussadanneksesta erääsä sarasuossa, Suolamminneva, Ähtäri.

Analyses in different peat types resulted in a considerable variation in this relationship:

S-peats	$r = -0.483^{xxx}$	$R^2 = 23.3$ %	$n = 145$
ErS-peats	$r = -0.404^{xxx}$	$R^2 = 16.3$ %	$n = 125$
C-peats	$r = -0.267^{xx}$	$R^2 = 7.1$ %	$n = 95$
CS-peats	$r = 0.155^{ns}$	$R^2 = 2.4$ %	$n = 42$
L-peats	$r = 0.107^{ns}$	$R^2 = 1.1$ %	$n = 40$
B-peats	$r = -0.389^{xx}$	$R^2 = 15.1$ %	$n = 59$

3.2. Amount of peat vs. colorimetric methods

The degree of decomposition was measured from the same 165 sedge *(Carex)* peat samples from Suolamminneva as the fiber content above applying pyrophosphate method for both fresh and dry peats. Correlation of these results with bulk density values were as follows:

$y = 58.30 + 0.870x_1$, $r = 0.608^{xxx}$,
$R^2 = 37.0$ %, $n = 165$
$y = 82.22 + 0.167x_2$, $r = 0.092^{ns}$,
$R^2 = 0.8$ %, $n = 99$

where:

y = bulk density per m^3
x_1 = pyrophosphate index fresh (dil. 1:10)
x_2 = pyrophosphate index dry

In the main material ($n = 501$) the correlation between pyrophosphate index (fresh, dil. 1:10) was $r = 0.525$, $R^2 = 27.6$ %; in the different peat groups (see chapter 3.1.) it varied from $r = 0.024$ (woody peats) to $r = 0.414$ (S and CS-peats).

When the NaOH-method was used for the representative submaterial ($n = 111$) the correlations with bulk density values by different wave lenghths were:

A-280 nm	$r = 0.339$	$R^2 = 11.5$ %
A-472 nm	$r = 0.311$	$R^2 = 9.7$ %
A-570 nm	$r = 0.329$	$R^2 = 10.8$ %
A-664 nm	$r = 0.322$	$R^2 = 10.4$ %
Ratio 280/472	$r = -0.206$	$R^2 = 4.2$ %
Ratio 472/664	$r = -0.285$	$R^2 = 8.1$ %

3.3. Amount of energy

3.3.1. Calorific analyses

It is well known that the various peat forming plants primarily have very different calorific contents. Therefore the peats from raised bog deposits (mainly *Sphagnum* peat) are considered separately from the aapa mire peats (mainly *Carex*) in Tables 2 and 3. Cor-

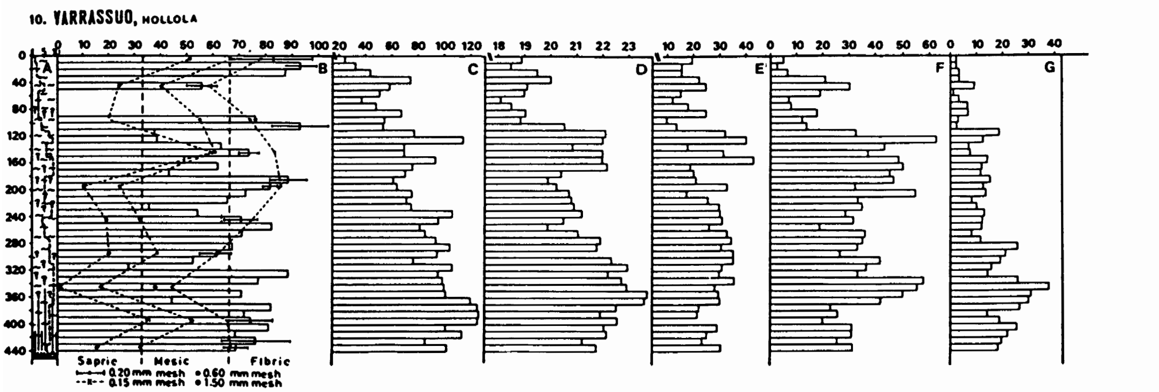

Fig. 4. Raised bog Varrassuo, Finland. Peat stratigraphy and humification in v. Post's scale (A), fiber content (B), bulk density (kg m^{-3}, C), water-free gross calorific value (MJ/kg, D), centrifuge (Gost) percentage (E), Pyavchenko's huminication percentage (F) and pyrophosphate index, % (G).

Kuva 4. Keidassuo, Varrassuo. Turpeen kerrosjärjestys ja maatumisaste v. Post'in mukaan (sarake A), kuituisuus (B), tiheys (kg/m³, C), vedetön kalorimetrinen lämpöarvo (MJ/kg, D), sentrifugimenetelmän (Gost) maatumisprosentti (E), Pjavtšenkon maatumissadannes (E) ja pyrofosfaatti-indeksi, % (G). mesh = seulatiheys.

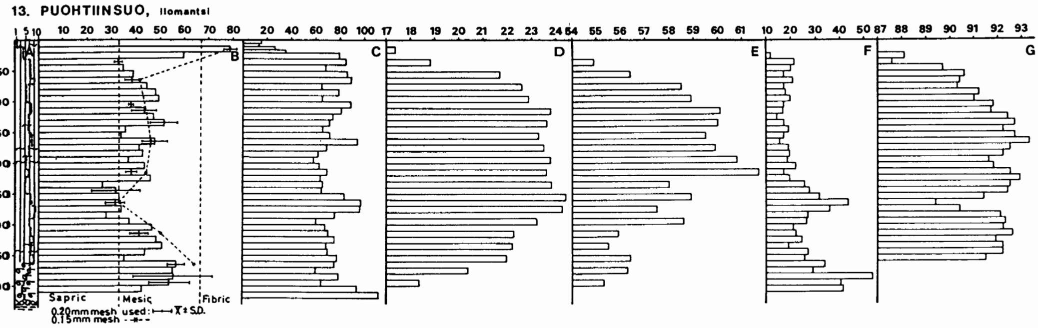

Fig. 5. Aapa mire Puohtiinsuo, Finland. Peat stratigraphy and humification in v. Post's scale (A), unrubbed fiber content (B), bulk density (kg m^{-3}, C), ash-free carbon % (E), pyrophosphate index (F) and the moisture content (% wwt, G).

Kuva 5. Aapasuo, Puohtiinsuo, Ilomantsi. Turpeen kerrosjärjestys ja v. Postin maatumisaste (A), jauhamaton kuituisuus % (B), tiheys (C), vedetön kalorimetrinen lämpöarvo (D) tuhkaton hiilipitoisuus (E), pyrofosfaatti-indeksi (F) ja kosteussadannes (G). mesh = seulatiheys.

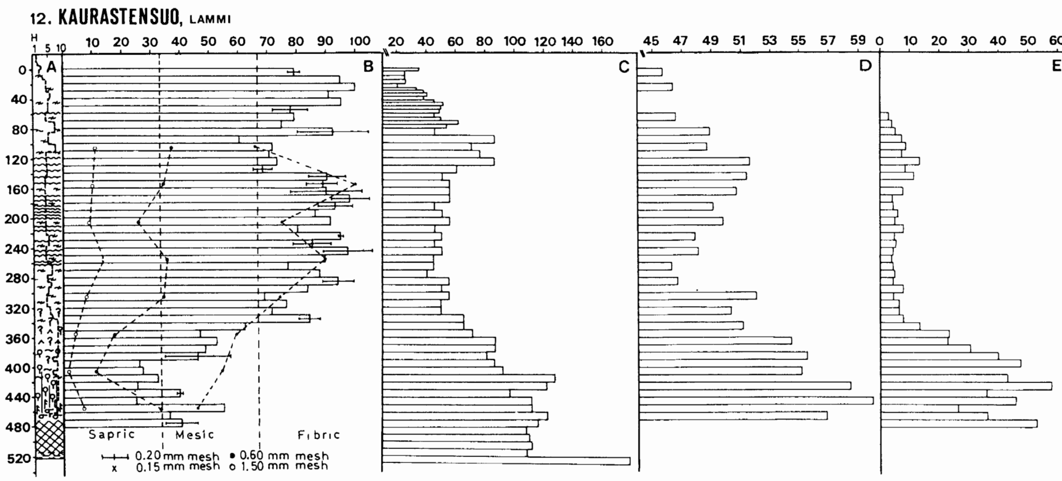

Fig. 6. Raised bog Kaurastensuo, Finland. Peat stratigraphy and humification in v. Post's scale (A), fiber content (B), bulk density (kg m^{-3}, C), ash-free carbon content (D) and pyrophosphate index (E).

Kuva 6. Keidassuo, Kaurastensuo. Turpeen kerrosjärjestys ja v. Post'in maatumisaste (A), kuituisuus (B), turpeen tiheys (C), tuhkaton hiilisadannes (D) ja pyrofosfaatti-indeksi, % (E). mesh = seulatiheys.

relations have been calculated between the energy content in dry matter (MJ/kg) and in *in situ* volume (MJ/m^2) vs. different measures for the humification of peat.

3.3.2. Carbon content of peat

To some degree the calorific analyses might be replaced by carbon analyses, since these parameters in peat usually are very closely correlated. For instance, Tolonen et al. (1982) presented a linear correlation r = 0.921, n = 70. Hence, the ash-free carbon content of peat as measured from 330 samples is compared with the different properties in Table 4.

Corresponding correlation matrixes for the individual peat groups, once again, resulted in a great variation but all the correlation coefficients were lower than those in the total material with only one exception. In woody peats (n = 40) the correlation between the carbon content and Pyavchenko's humification percentage was r = 0.816, R^2 = 66.6 %.

Table 2. Raised bog peats (n = 43). Coefficient of determination (R^2) in correlation analyses between the energy content of peat and some properties measured.

Taulukko 2. Keidassuoturpeet (n = 43) selvityskertoimet (R^2) turpeen lämpöarvon ja eräiden maatumisasteen määritystapojen (ks. taul. 1) välisissä korrelaatioanalyyseissä.

	v. Post.	Centr. %	Pyav. %	Fiber %	Pyrof.i. (%)	Bulk d.
MJ/kg	0.71	0.40	0.44	0.16	0.63	0.71
MJ/m³	0.56	0.37	0.27	0.10	0.58	0.99

Table 3. Aapa mire peats (N = 63). Coefficient of determination (R^2) in correlation analyses between the energy content of peat and some properties measured.

Taulukko 3. Aapasuoturpeet (n = 63) selvityskertoimet (R^2) turpeen lämpöarvon ja eräiden maatumisasteen määritystapojen (ks. taul. 1) välisissä korrelaatioanalyyseissä.

	v. Post	Fiber, unrubb.	Fiber, rubb.	Pyrof. fresh	Pyrof. dry	Bulk d.
MJ/kg	0.46	0.27	0.42	0.07	0.21	0.03
MJ/m³	0.06	0.14	0.14	0.14	0.01	0.95

Table 4. Correlation of the ash-free C-content (% dwt^{-1}) to other methods in different peats (n = 330) from virgin Finnish mires (100 · R^2 given). Color 1 = Pyroph. index dil 1:2, Color 2 = the same, dil. 1:10.

Taulukko 4. Selvityskertoimet (100 × R^2) turpeen hiilipitoisuuden ja eräiden muiden ominaisuuksien välisissä korrelaatioanalyyseissä (vrt. taul. 1) erilaisilta luonnontilaisilta soilta Suomessa (näytteitä 330).

v. Post	Fiber	Centr.	Pyav.	Color 1	Color 2	Water %	Bulk d.
24.9	37.0	40.6	40.8	35.0	29.4	27.1	19.6

Table 5. Squared correlation coefficients (R^2 · 100) for some relationships in Finnish peats (n = 111). 1 = ash-free C % dwt^{-1}, 2 = ash-free C content kg m^{-3}. N_1-N_4 colorimetric absorbance by NaOH method, wave lengths being 280, 472, 570 and 664 nm, P_{10} = Pyrophosphate index (dil. 1:10), w = moisture content % wwt, Bd = bulk density (dry).

Taulukko 5. Selvityskertoimet (100 × R^2) tuhkattoman turpeen hiilipitoisuuden ja eräiden muiden ominaisuuksien välisessä korrelaatioanalyyseissä. 1 = hiilipit. per kuivapaino, 2 = hiilipit. per m^3, N_1—N_4 = absorbanssi NaOH-menetelmällä aallonpituuksin 280, 472, 570 ja 664 nm, P_{10} = pyrofosfaatti-indeksi kun laim. 1:10, w = kosteussadannes märkäpainosta, Bd = turpeen tiheys (kuivamassa/maastotilav.).

C	v. Post	Fiber	Ctr.	Pyav.	N_1	N_2	N_3	N_4	P_{10}	W %	Bd.	ash
1	34	33	37	33	37	39	6	30	13	28	27	16
2	24	32	42	24	14	18	2	20	28	52	99	11

For the submaterial of 111 samples (see Chapter 2) there were some further measured properties available (Table 5).

There are relatively few comparisons published about the relationships between the fiber content and v. Post's scale and between the results of colorimetric methods and v. Post's scale in Finnish peats (see Raitio & Huttunen 1976). Some average values (Figs 6 and 7) for a representative set of mires and peat types attempt to illustrate these relationships.

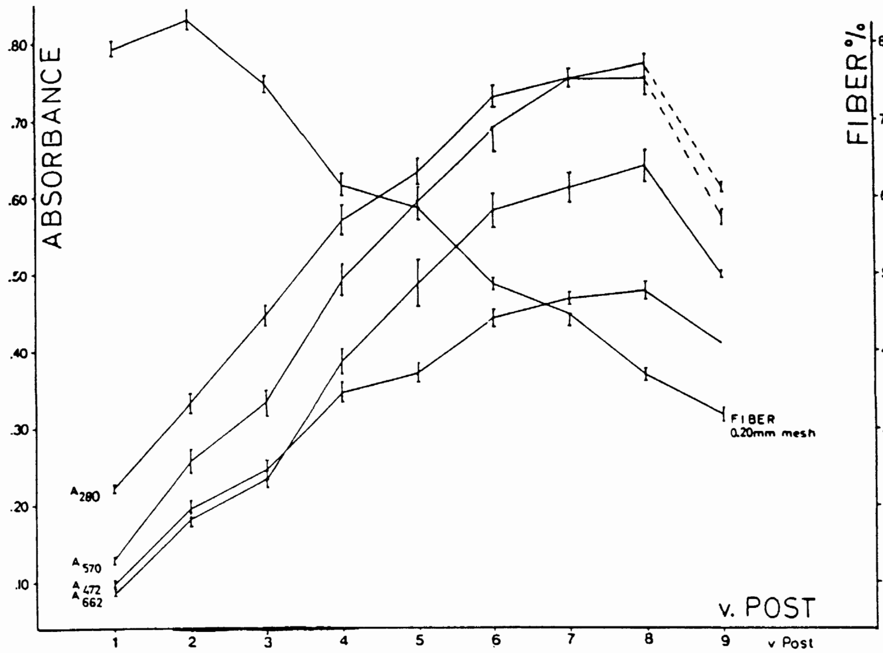

Fig. 7. Comparison of colorimetric NaOH-method (absorbance left) and unrubbed fiber content (% scale right) with v. Post's scale (means and S.D. given) in 111 representative peat samples from eight peatlands (Nos 1—8 in Fig. 1) in Finland.

Kuva 7. Vertailu v. Post'in maatumisasteen ja kolorimetrisen NaOH-menetelmän (asteikko vasemmalla) sekä jauhamattoman kuituisuuden kesken (keskiarvot ja normaalipoikkeama esitetty). Aineistona 111 edustavaa turvenäytettä soilta 1—8 (vrt. kuva 1) eri puolilta Suomea.

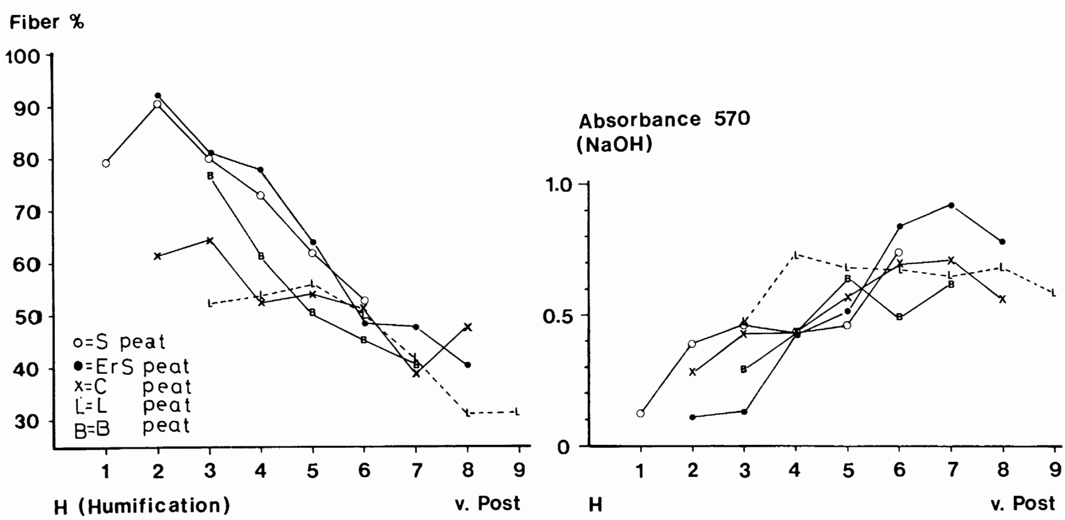

Fig. 8. Comparison of some properties of peat in different peat types of Finland. Material same as in Fig. 6.

Kuva 8. Turpeen kuituisuussadanneksen (vas.) ja kolorimetrisen maatumisastetunnuksen (NaOH uute, 570 nm) vertailu viiden turvelajiryhmän osalta kuvan 7 aineistossa. S = rahkaturpeet, ErS = tupasvillaturve, C = saraturpeet, L = puuturpeet, B = ruskosammalturpeet.

4. DISCUSSION

4.1. Estimating the dry matter yield in peatlands

Boelter (1969) presented for peats in northern Minnesota a high correlation ($R^2=0.85$) between bulk density and fiber content of peat as measured by 0.1 mm mesh. In the present study the corresponding correlation for peats in Finland is much lower ($R^2=0.33$ or often even less). For the same relationship in two raised bog profiles in Finland Raitio and Huttunen (1976) found $R^2=0.32$ and $R^2=0.40$, respectively. A close linear relationship between bulk density and the von Post humification degree was resulted from the study by Silc & Stanek (1977) for woody peats of Ontario ($R^2=0.88$) and even higher correlations by Päivänen (1969, 1973) for surface peats of drained Finnish peatlands both in *Sphagnum, Carex* and woody peats.

Studies by e.g. Korpijaakko (1975), Tolonen and Saarenmaa (1979), Saarenmaa (1980), Mäkilä (1980) and Korpijaakko *et al.* (1981) showed, however, that in deeper peat layer of both virgin and drained peatlands there is remarkable residual variation in the bulk density values not explainable by v. Post's method. The squared correlation coefficients found for the linear regression bulk density vs. v. Post's method varied from 0.50 to 0.57 for *Sphagnum* peats to 0.005 to 0.06 for Carex peats.

Nor could the degree of decomposition percentages by the centrifuge method or by Pyavchenko's method serve as a basis for predicting the dry peat yield in peatlands of Finland (Tolonen & Saarenmaa 1979). In all their individual peat type groups the correlations remained below $R^2=0.47$. Since also the colorimetric methods examined in the present study gave only weak bulk density estimates (the highest R^2 being 0.40), one can state that reliable prediction of dry peat yield from *in situ* deposits can not be done by means of humification data, alone, but their water contents also must be known.

4.2. Estimating the energy yield in peatlands

As seen in Tables 2 and 3 the correlation of the calorific value of peat per dry weight with the results by the methods in determining the degree of decomposition was stronger in *Sphagnum* than in *Carex* peats. In the latter group all the correlations resulted were below $R^2=0.47$. On the other hand, the data for *Sphagnum* peats came from one single peatland in S. Finland.

In the study of Tolonen *et al.* (1982) calorific value vs. v. Post data from individual peatlands (mainly raised bogs) from Canada possessed very high correlations but when combined, the coefficient of determination fell below 30 %.

In a relatively large material (n = 491) from Toholampi area, W. Finland (Ostrobothnia) Mäkilä (1980) obtained a linear regression equation between the v. Post's degree and the gross calorific value with a correlation coefficient $R^2=0.26$. For his *Sphagnum* and *Carex* peats the corresponding figures were $R^2=0.47$ and $R^2=0.04$, respectively. Correlations reported by Levesque and Mathur (1979) and in the present study (Table 4) for the relationship of carbon content to different measures of humification degree are in good agreement with the results of Mäkilä (1980) about the explanation capacity of the v. Post's humification scale for the heating value of peat.

Thus, it is likely that the possibilities to predict the energy content of peat per dry weight greatly vary from peatland to peatland, and have great difficulties in sedge mires, especially, as regards the conventional methods discussed in this paper. More firm and more universal basis for indirect energy inventories will hopefully be available with the new electronic laboratory (Pohjola *et al.* 1980) and field moisture probe (Tiuri and Toikka 1982) methods currently under development in Finland. The potentials of the latter equipment seem promising for both *Sphagnum* and *Carex* peat deposits especially if the quantity and the quality parameters are combined and the energy yield of peat deposits expressed in calorific values per unit *in situ* peat volume (MJ/m^3) as seen in Tables 3—5.

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TIIVISTELMÄ:

VIIDEN YLEISESTI KÄYTETYN MAATUMISASTEEN MÄÄRITYSMENETELMÄN KÄYTTÖKELPOISUUS POLTTOTURPEEN MÄÄRÄN JA ENERGIAPITOISUUDEN ARVIOIMISEEN SUOMESSA

On tunnettua, että maamme soiden ja niiden turpeiden kasvitieteellinen ja fysikaalinen rakenne vaihtelee laajoissa rajoissa. Siksi luotettava turpeen saannon arvioiminen vaatisi paljon turpeen tiheystietoja tavallisesti jo yhdenkin suon puitteissa ja suon energiasisällön määrittäminen vielä hyväksytyt tarkkuusvaatimukset täyttäviä lämpöarvoanalyysejä. Molemmat ovat aikaa vieviä ja/tai kalliita. Tämänvuoksi on molempiin tavoitteisiin pyritty epäsuorasti nopeiden kentälle ja laboratorioon kehitettyjen maatumisasteen määritysmenetelmien avulla (ks. esim. Day et al. 1979). Tässä tarkastellaan viiden erilaisen menetelmän (ynnä niiden joidenkin muunnosten) käyttöarvoa mainittuihin tarkoituksiin. Menetelmät ovat v. Post'in maatumisaste, Pjavtšenkon maatumissadannes, kuituisuus (= amerikkalainen märkäseulonta), sentrifugi menetelmä (neuvostoliittolainen Gost standardi) ja kolorimetrinen menetelmä (etenkin natriumpyrofosfaattiliuoksin).

Mainituista menetelmistä kolmen ensinmainitun käyttökelpoisuutta turpeen saannon (turpeen tiheyden) arvioimiseen on pohdittu aikaisemmin (Tolonen & Saarenmaa 1979). Aineisto on pääasiassa kuvassa 1 esitetyiltä 13 suolta, jotka edustavat erilaisia soita ja melko tasaisesti kaikkia pääturvetyyppejä (vrt. kuvat 2—6). Turpeen tiheyden ja useimpien maatumisastemääritysten osalta tutkittujen näytteiden kokonaismäärä on 435, mutta lämpöarvomääritysten osalta vain 106. Aineistoa on täydennetty tarkoilla turpeen hiilipitoisuusanalyyseillä (menetelmä: Salonen 1979), joita aineistossa on 330 (Taul. 1).

Kaikkien testattujen maatumisastemenetelmien ja turpeen tiheyden sekä energiasisällön (kuiva-ainetta kohti) välillä oli selvä lineaarinen riippuvuussuhde. Sen voimakkuutta tutkittiin regressio- ja korrelaatioanalyysien avulla.

Turpeen tiheyden suhteen tulokset olivat erittäin hyvin sopusoinnussa aikaisemmin maassamme esitettyjen tulosten kanssa siltä osin kuin vertailuaineisto koski koko turvekerrosta eikä vain soiden pintaosia. Yhteisiksi johtopäätöksiksi sekä ojittamattomien että ojitettujen soiden turpeen saannon ennustamisesta maatumisastemenetelmien avulla voitaneen siten esittää seuraavaa: v. Postin menetelmä korreloi huomattavasti paremmin turpeen tiheyden kanssa rahkaturpeissa (r^2 = 50—57 %), kuin saraturpeissa (r^2 = 0.5—6 %). Turpeen kuituisuuden ja tiheyden välinen korrelaatio oli vieläkin heikompi (rahkaturpeissa r^2 = 33—40 %, saraturpeissa r^2 = 7 %).

Kolorimetrinen menetelmä ei yleisesti päässyt näinkään korkeisiin lukuihin: suuren aineiston (n = 501) pyrofosfaatti-indeksin ja turpeen tiheyden välinen korrelaatio oli r = 0.608 (r^2 = 37 %) ja eri turvelajiryhmissä selityssadannes jäi vielä paljon tätäkin alhaisemmaksi. Kun myöskin Pjavtshenkon laboratoriomenetelmän ja turpeen tiheyden välinen korrelaatio, vaikkakin erittäin merkittävä, oli käytännön kannalta liian alhainen (r^2 = 47 % ylimmillään, mutta useasti paljonkin pienempi), joudutaan toteamaan, ettei turpeen saantoa voida ilman suurta erehtymisriskiä tehdä yhdenkään näistä perusteella, vaan turpeen vesipitoisuus pitäisi myöskin olla tiedossa.

Turpeen energiapitoisuuden ja tutkittujen menetelmien riippuvuussuhteen selvittämiseen omaa aineistoa oli paljon vähemmän ja rahkaturpeiden osalta täyden vertailun tekemiseen vain yhdestä turvepatsaasta.

Lineaariregression korrelaatiot olivat odotetusti korkeammat rahkasuossa kuin sarasoissa (Taulukko 2 ja 3), 16—71 % rahkaturpeessa ja 7—46 % saraturpeessa. Suuremmin aineistoin on tutkittu etenkin v. Post'in maatumisasteen ja lämpöarvon välistä korrelaatiota (Mäkilä 1980, Tolonen et al. 1982). Se oli rahkaturpeissa parempi (r^2 = 30—49 %) kuin saraturpeissa (r^2 = 4—21 %).

Hiilipitoisuus/maatumisastetarkastelu tuki edellä saatuja tuloksia (Taulukot 4 ja 5): selityssadannes (R^2) vaihteli 24.9—40.6 % kokonaisaineistossa (n = 330). Yksityisissä turveryhmissä korrelaatio jäi tätäkin alhaisemmaksi kaikissa muissa tapauksissa paitsi puuturpeiden osalta Pjavtšenkon maatumisasteen suhteen (R^2 = 67 %, n = 40).

Näin ollen ainoastaan karkeaan suunnitteluun mahdollisesti riittävä suuntaa-antava tieto turpeen määrästä ja/tai energiasisällöstö on saatavissa käytettäessä mitä tahansa testatuista viidestä maatumisastemenetelmästä. Tiedon tarkkuus on sarasoissa selvästi heikompi kuin rahkaturvekerrostumissa. Näyttääkin siltä, että ainoat nopeat, mutta silti edellä käsiteltyjä keinoja usein monin kertaisesti luotettavammat menetelmät soittemme turve- ja energiamäärien kartoittamiseen löytyvät uusien elektronisten kenttä- ja laboratoriomenetelmien puolelta (ks. Pohjola et al. 1980, Tiuri & Toikka 1982).