15 FARM MANAGEMENT ON PEAT SOILS

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15.1 Introduction

The area for agricultural land in the Netherlands amounts to two million hectares, table 1. It is composed of 60 % grassland, 34 % arable land and 4 % horticulture. Of the total area of agricultural land 17 % is situated on peat soil and mainly used as grassland, table 2 and 3. The total grassland area in the Netherlands comprises 1,2 million hectares. Fifty percent of it is found on sand, 27 % on peat and 20 % on clay soils. Roughly half of the peat soil areas are situated in the western part of the country and are mainly used as permanent grassland. This forms the western pasture district, fig. 1.

Some remarkable facts about the development of dairy farming in the Netherlands during the last two decades are given in table 4. It is interesting to note that despite a sharp decrease of over 60 % of the total number of dairy farms, the total number of dairy stock has increased with over 40 %, i.e. the total area of grassland has not increased, whilst the rate of stocking certainly has.

The number of milk cows per ha grassland has increased from an average of about 1.3 in 1960 to nearly 2.0 in 1979.

The cubicle house has gained rapid acceptance. At present about half of all our dairy cattle is housed in cubicle houses. The average number of dairy cattle per cubicle house is 65 as compared to 22 in other types of cowhouses.

The switch over to bulk milk is in full swing.

Table 1: Area of agricultural land according to land use in the Netherlands.

Pasture	1 210 000 hectares	60 % of total
Arable land	700 000 ha	34 % " "
Horticulture	80 000 ha	4 % " "
Others	40 000 ha	2 % " "
Total	2 030 000 hectares	100 %

Table 2: Area of agricultural land according to soil types.

Sands/sandy loams	820 000 hectares	40 % of total
Loams/clay loams	770 000 ha	38 % " "
Organic soils	340 000 ha	17 % " "
Others	100 000 ha	5 % " "
Total	2 030 000 hectares	100 %

Table 3: Area of grassland according to soil types.

Sands/sandy loams	600 000 hectares	50 % of total
Loams/clay loams	240 000 ha	20 % " "
Organic soils *)	330 000 ha	27 % " "
Others	40 000 ha	3 % " "
Total	1 210 000 hectares	100 %

*) 180 000 hectares or 15 % of the total pasture area in the Netherlands is situated in the western region.

Table 4: Development in dairy farming in the Netherlands during 1960-1980.

	1960	1970	1980
Number of dairy farms	183 000	116 000	70 000
Average number of dairy cows per holding	9	16	34
Average milk yield per cow in kg	4 200	4 390	5 000
Number of holdings with cubicle houses	-	830	18 000
Holdings with milking machines (% of total)	22 %	70 %	97 %
Holdings with milk cooling tanks (% of total)	-	3 %	62 %
Total cattle stock	3 500 000	4 300 000	5 100 000
Number of dairy cows	1 600 000	1 900 000	2 300 000
Total area of grassland in hectares	1 200 000	1 300 000	1 200 000

Figure 1: The western pasture district in the Netherlands.

Western pasture district

Eastern sands district

The frontispice photo (p. 2) is a typical example of a dairy farm in the western Netherlands. It is situated in the hamlet Teckop (cf. Figure 6 on p. 56).

15.2 Farm size

"Organic soils" in comparison to "mineral soils"

Because of the fact that more than 50 % of our grassland is situated on sands, it is of interest to compare some typical records of a sandy region to those of a peat soil area of the western pasture district. The average records of the dairy farms in the Netherlands are both compared to the records of the eastern part of the sandy soil district and to those of the peat soil area of the western pasture district (fig. 1). In both districts over 80 % of the area of cultivated land is used as grassland for dairy farming. One would expect a difference between holdings on mineral soils and holdings on organic soils. However these differences in farm practices are not significant. In general the peat grassland farms have a slightly better farm size and production volume (tables 5 and 6).

Table 5: Percentage of holdings on the basis of total milking stock in 1979.

Number of cows-in-milk per holding	Average for the Netherlands in %	Eastern sand area in %	Western grassland area (peat) in %
< 30	53	49	41
30 - 50	25	25	33
50 - 70	13	25	24
> 70	9	1	2

Table 6: Classification of the grassland holdings by size of farm in %.

Size of holdings in ha	Average for the Netherlands in %	Eastern sandy soils in %	Western grassland area (peat) in %
< 10 ha	31	32	16
10 - 20 ha	38	47	49
20 - 30 ha	20	16	26
> 30 ha	11	5	9

Table 6 and 7 show that the holdings on the peat grassland area are in general a bit larger. That owing to the fact that in former years tenant farming was undertaken more often in the western than in the eastern part of the country. Reason for this development is, that amongst others, the merchants of the commercial cities in Holland bought land in the West as an investment of their capital. Therefore it was impossible for the holding to be split up between the tenant farmer's successors. Consequently proportionally less small farms were established, table 6.

Table 5 gives an indication of the size of the production volume of the grassland holdings. No more than about 10 % of our grassland holdings has a herd of more than 70 cows-in-milk. In the western peat grassland areas the holdings are on average not only a little bit larger, but they also have a larger herd. On sandy soils the number of milking stock per ha* grassland has increased more than on peat soils, table 7. it appears reasonable to assume that the differences in load bearing capacity of these types of soil are the underlying cause for this.

Table 7: The average size of the farms and the number of milk cows in a sandy and in a peat region in 1974 and 1979.

	Eastern sandy district		Western pasture district (peat district)	
	1974	1979	1974	1979
Area under cultivation in ha	146 000	134 000	155 000	144 000
Number of holdings	11 000	9 000	9 500	8 000
Average size per holding	13	15	16	18
Average number of milk cows per holding	25	33	30	36

*) ha ≈ 2.5 acres.

15.3 Parcellation

The historically established parcelling pattern in the western peat area has often caused unfavourable conditions for the further development of the present family holdings. The farms are usually located on ribbon shaped developments with their lands stretching in long narrow lots at the back of the farms. This development pattern in the western peat area has resulted in holding lots having a length of 1250 to 2500 meters and a width of 40 to 100 meters. Many plots have a width of two lots. If it is desirable that the milking is done at home also during the grazing period, then over 60 % of the land should be near the buildings and the walking distance for the cattle should preferably be less than 1000 meters. In line with this, on average, 60 % of the farming area is around the building and the average walking distance is 1090 m. The average lot size is ± 1.3 ha. Characteristic for dairy farming in the western peat area is the large area of surface water belonging to the farm. On many holdings over 15 % of the total surface consists of water. The total area therefore in most cases is larger than the area used for farming. A farm of 16 ha may include some 2.5 ha of surface water and in the case of a 36 ha holding the surface water may cover up to 6 ha.

When analysing the farm's production the size of the truly productive farming area is always taken into account. Well maintained surface water requires much labour. On a farm with 6 ha surface water the ditches are cleaned by hand once in five years. Ditch cleaning and maintenance usually takes place at the beginning of the housing period and is frequently contracted out.

Because of the present ditch pattern it is impossible to reallocate the plots of the peat land holdings, especially so when the ditches are wide. For farmers in the sand region however, it is not as difficult to revise the parcelling and to improve the opening-up of an area.

15.4 Drainage

The water level of the ditches in the western part of the country is generally high. The drainage of the grasslands is therefore insufficient for about 50 % of the peatland area. Consequently, difficulties with respect

to the load bearing capacity of these grasslands arise frequently during the winter and springtime. On many farms it is impossible to spread the slurry during wet winters. Only when the upsoil is frozen it is possible to drive over the land for the distribution of the slurry. Spreading of too much slurry in too short a time during irregular frost periods may cause severe burning of the sod.

For good management of these farms, a large slurry pit is imperative. Additionally it may happen that the slurry cannot be distributed in time. Frequently in March and April the bearing capacity of the land is still insufficient for spreading the fertilizer. In order to be able to harvest the first crop of cut grass at the end of April, it is necessary to distribute the nitrogenous fertilizer around the middle of March. When during the grazing period the less well drained peatlands suffer from heavy rainfall, the bearing capacity of the grasslands, because of too high a groundwater level, becomes insufficient for grazing purposes and accessibility. Grazing losses can arise when, because of insufficient bearing capacity, the grazing of animals necessarely starts too late. Extra grazing losses may occur when the cattle is grazed on grass that is too long. Apart from these yield losses it is clear, that grazing on land with insufficient bearing capacity can cause trampling of the turf, which in turn causes deterioration of the structure of the soil, which results in problems concerning regrowth and a slow recovery of the sod density. Under such circumstances an increase of weeds and a decrease of production as a result there-of should be expected.

Harvesting may be slowed down due to insufficient bearing capacity. Also the necessity of fast transport of the cut grass for silage in order to prevent the cut product from decaying on the field, can result in serious damage to the turf. The grass drying period for silage lasts longer on wetter lots. Proper grassland management is difficult when grassgrowth becomes irregular. This happens especially on less well drained peatlands. The problems as mentioned above i.e., caused by insufficient bearing capacity, as a result of too high groundwater level, do not in general occur as frequently on sandy soils.

15.5 Harvesting

On peat soil farms hay winning is predominant over silage. Of the cut area in the peatland district about 40 % is gathered as hay. In the sand soil region this amounts only to 20 %. The reason for this is firstly the lack of sufficient storage capacity on the farm yard, which are small in general and secondly the fact that because of insufficient bearing capacity of the soil it is difficult to find suitable silage pits. During the winter season excess of water can spoil the silage. In addition, the silage pit may be inaccessible for driven transport. In the peatland region about 50 % of the cut grass area is used for silage. In the sandy soil area this amounts to 70 %.

15.6 Farm profits

A comparison of the characteristic farm profits is given in table 8. For 1978/1979, taken from the beginning of the grazing period of 1978 until the end of the housing period of 1979, which date in terms of bookkeeping is on the 31th of April, the average results for the Netherlands of the larger and smaller grassland holdings are compared to the average results of the peat soil pasture region and the sandy soil region. Also taken into account are the average results of the pilot farms of the agricultural economics research institute.

Table 8 shows the possibilities, as well as the differences between these areas. The pilot farms indicate the possibilities. During the last ten years the aim has been to increase the size of the farms. Especially the pilot farms in the Netherlands have increased their area under cultivation. In general, the large farms have a higher level of return on labour and thus a larger family income (table 8), especially the pilot farms. Returns on labour means: the difference between the returns and the total expenditure of the holding (based on tenancy).

It is clear that an increase in size of the holdings has been the most effective way to increase the family income. Also an increase in livestock units per ha, as on the pilot farms, may have the same result. The lower milk yield per dairy cow on the smaller farms should be seen in the light of a lower standard of selection on milk production of the dairy herd.

Table 8: Financial results and farm profits of large and small grassland farms in the Netherlands, in the western peat pasture district, in the eastern sand district and of the pilot farms of the Agricultural Economics Research Institute.

1978 - 1979	Average for the Netherlands		Large dairy farms on		Small dairy farms on		Average on pilot farms
	Large holdings	Small holdings	Peat soil	Sandy soil	Peat soil	Sandy soil	
Farm size in ha	27	15	25	22	16	15	29
Number of milk cows	58	24	51	52	25	25	76
Milk cows per ha	2.17	1.62	2.04	2.43	1.61	1.79	2.64
Livestock per ha	2.82	2.36	2.64	3.15	2.18	2.49	3.28
Milk yield per cow in kg/year	5 435	4 938	5 240	5 640	4 886	4 938	5 877
Milk yield per farm in kg/year	317 763	119 835	267 000	296 000	122 000	125 000	445 000
In guilders per milk cow: milk yield	3 350	2 974	3 151	3 408	2 932	2 990	3 629
In guilders sales and increment	818	1 105	773	872	900	962	783
In guilders total proceeds	4 168	4 079	3 924	4 280	3 832	3 953	4 412
In guilders feed costs	1 148	1 103	1 107	1 278	1 040	1 060	1 195
In guilders balance: proceeds minus feed costs	3 020	2 976	2 817	3 002	2 792	2 893	3 217
Return on labour	45 227	19 178	29 040	46 315	19 419	20 293	90 000
Cutting in %	157	110	122	149	118	105	143
Kg of concentrates per cow	2 370	2 258	2 165	2 773	2 030	2 150	2 358
Kg N per ha	327	234	222	356	200	254	410
Kg P_2O_5 per ha	8	23	15	26	32	-	-
kg K_2O per ha	3	18	12	31	96	-	-

The participation in milk control is proportionally less on smaller farms. On the whole, the peat soil pasture district is lagging behind slightly in comparison to the sandy soil district. The number of checked dairy cows in the peat soil pasture area is almost 15 % less than in the sandy soil area. The difference in number of dairy cows and livestock units per ha is partly due to the lesser bearing capacity of the peat soil pasture. However, the practice of retaining a number of young stock and the fattening up of young herd for slaughter has always been a traditional difference between the regions.

The red and white cattle of the sandy soil district is more in demand for slaughter than the black and white cattle of the peat soil region.

The slightly larger size of the average farms in the peat soil pasture district compensates for the smaller stocking rate per ha. Therefore the average number of dairy cows is about the same for both regions.

In general, more on the farm produced roughage per animal is available on peat soil, because of the smaller rate of stocking per ha grassland. Consequently a smaller amount of concentrated feeds need to be bought. The grass production of the peat soil grassland is, moreover, higher than the production of the sandy soil grassland. The reason for this is the subsequent delivery of nitrogen by the peat soil (table 9).

The optimum annual nitrogen application per ha grassland is approximately 420 kg (table 10). Because of this subsequent nitrogen delivery by the peat soil itself, a nitrogen gift reduced by about 100 kg per ha will be sufficient. This difference in nitrogen application is shown in the average farm profits.

Table 9: Lowest and highest yield in kg dry matter per ha grassland averaged over the period of 1964 until 1968.

Type of soil	Largely pastures		Kg N at highest yield
	lowest yield	highest yield	
Sand	8 750	13 300	450
Peat	9 600	13 050	300

(from Boxem, 1973)

Table 10: Recommended nitrogen gift (kg N per ha)

	Pastures	Cutting
First cut	80 - 40*	120 - 80*
2nd and 3rd cut	80	100
4th and 5th cut	60	80
Later cuts	40	

*) Plots that are pastured or cut last.

The fertilizer requirements of phosphate and potash are more than adequately covered with a stocking rate of 2.5 milkcows with young stock per ha (table 11).

Table 11: Supply and removal of phosphate and potash on a dairy farm with a stocking rate of 2.5 milkcows with young stock per ha and 130 % cutting, in kg P_2O_5 and K_2O.

	P_2O_5 in kg		K_2O in kg	
Supply per milkcow with young stock:				
- on the basis of 2500 kg of concentrated feeds	37.5		37.5	
- on the basis of roughage by cutting 130 %	11.2		35.2	
Total		48.7		72.7
Removal per milkcow:				
- through 5500 kg milk	11.5		9.9	
- through 200 kg gain in weight	3.4		0.4	
Total		14.9		10.3
Total left over in the slurry		33.8		62.4
Supply per ha with 2.5 milkcows with young stock		84.5		156
Removal through losses of slurry*		5		13
Rests a nett supply per ha of:		79.5		143
Required amount per ha grassland for pasturing and 130 % cutting		55		120

*) on cattle tracks

Therefore, the pilot farms set a good example by not buying any phosphate and potash fertilizer. In practice however, the unequal spreading of the slurry on the farming area, as a result of the poor accessability caused by the lack of bearing capacity of the peat soil, causes local shortages. To compensate for this local shortage of slurry, fertilizer is in fact purchased unnecessary.

In general, it can be said that the farm profits in the sandy soil region are slightly better than those in the peat soil region. Improvements can be made on both, as is shown by the data of pilot farms. The difference in farm profits are a consequence of the historical development and the limitations in possible use of the soil. Of old, the peat soil pasture district is exclusively exploited as grassland and mainly used for dairy farming. Formerly butter and cheese were made on most of the farms. Often pigs were kept simultaniously to make use of the side product: whey This is not so any more.

Since world war II the farms have tended to specialize in the production of milk only. The processing of the milk into cheese, butter etc. is nowadays left to be done by the milkfactories.

In the sandy soil region the modern development into exclusive dairy farming - especially since world war II - has become even more pronounced, due to the disappearance of the mixed farm. Now the still available arable land serves only for the growing of roughage, mostly maize for silage.

The management of holdings on sandy soil is in general more efficient, due to the more radical changes in set up. On sandy soils the latest developments in specialisation have been adopted more rapidly. The circumstances have made the peat soil holdings more conservative than the sandy soil holdings.

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15.7 Literature

Ausems, W.F., 1980
Veenweidebedrijven in West-Nederland. Een onderzoek naar mogelijkheden tot inkomensverbetering.
Regionaal Onderzoek Centrum voor de Rundveehouderij "Zegveld".

Boxem, Tj., 1973
Stikstofbemesting en bruto opbrengst van grasland.
Stikstof, nr. 73 (mei), pp. 536-545.

L.E.I., 1980
Bedrijfsuitkomsten in de Landbouw (BUL). Jaarboek 1975/76 t/m 1978/79.
Landbouw Economisch Instituut, Afd. Landbouw, nr. 3.94, april

L.E.I., 1980
Landbouwcijfers 1980
Landbouw Economisch Instituut, april.

Prinsen, L., 1980
Het aantal ligboxenstallen per 1 januari 1980.
Bedrijfsontwikkeling, 11: 5 (mei); pp. 467-470.

Stichting voor Bodemkartering, 1965
De bodem van Nederland.

Van den Eijnden, J.J.M., 1980
De begeleiding van de melkwinning.
Bedrijfsontwikkeling, 11: 12 (dec.); pp. 1139-1142.

Van Wallenburg, C., 1969
Bodemkundige aspecten van de draagkracht van veenweide-gebieden.
De Buffer, 15: 3; pp. 61-66.

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16 REVIEW OF CHAPTER 15:
A COMPARISON WITH SOME DATA FROM SCHLESWIG-HOLSTEIN

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Developments as shown by Mr. Schneider can be seen similar to those in Schleswig-Holstein: livestock increases and the number of cattle in the land is rising. Preferred also will be cubicle stable houses.
42.4 per cent of the agricultural area in Schleswig-Holstein (total 1.1 million hectare) have been registered to be permanent grassland. It is spread about in the lowlands, the prehistorical river basins. Groundwater in the winter always is near the surface of the soil, in summer time it goes down about 60 to 100 centimeters. Also the permanent grassland we find on clay, on loam and on sandy soils.
During the last twenty years we have noticed a remarkable change in using the soils (Table 1).

Table 1. Grassland* and milk cows** in Schleswig-Holstein (see Figure 1)

Site	permanent grassland		milk cows	
	1979	since 1970	1979	since 1970
Marsch (Holocene)	19.3%	- 1.1%	12%	-
Geest (Pleistocene, older periods)	58.3%	+ 4.2%	60%	+ 8%
Hügelland (Pleistocene, younger periods)	22.4%	- 3.0%	28%	- 8%
Schleswig-Holstein, total	100.0%	-	100%	-
Absolute figures	467968 hectares		511000 cows	

* additional grass production from arable land: 87330 hectares

** the average figure per hectare: 0.92 (cows)

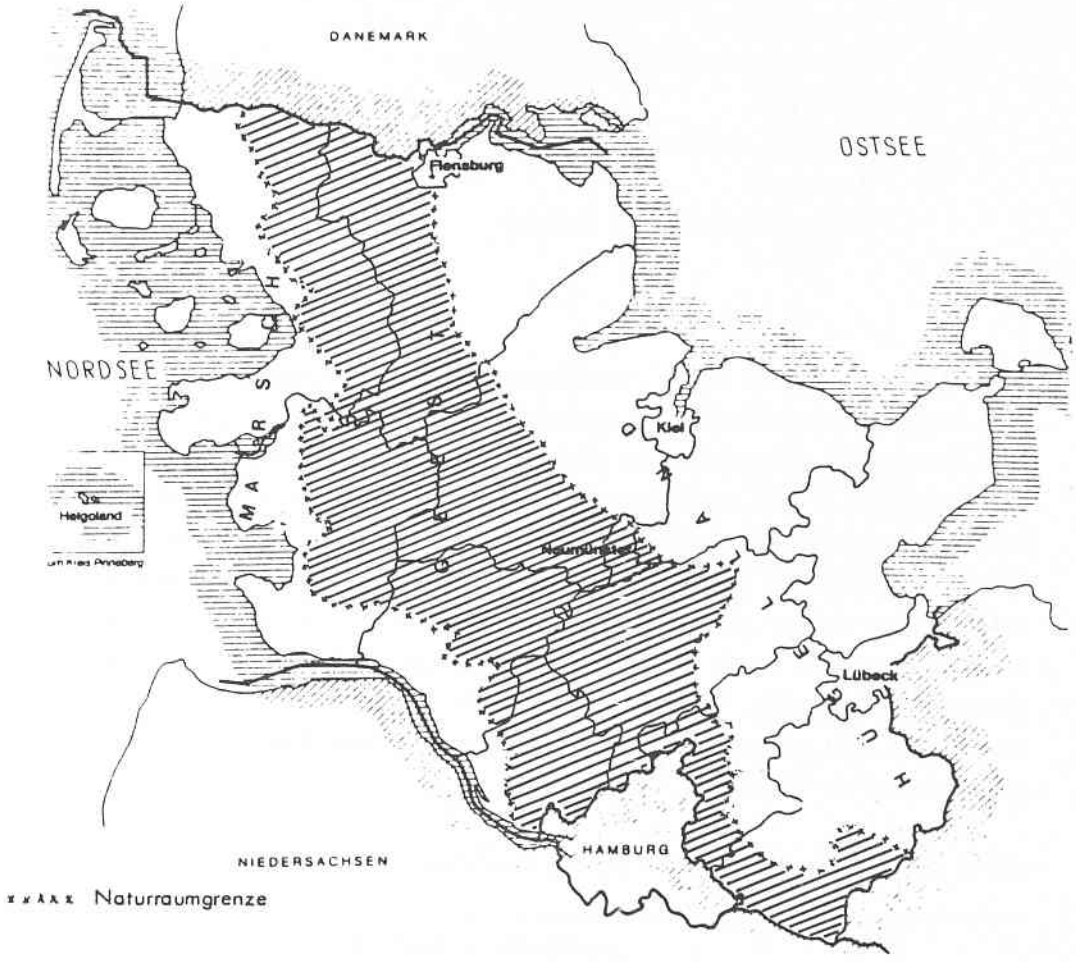

Figure 1. Federal State Schleswig-Holstein. Left: *Marsch* (Holocene), middle: *Geest* (Pleistocene, older periods), right: *Hügelland* (Pleistocene, younger periods).

As growing grains is more profitable, the better soils no longer are to be used for grass production. On the other hand grains disappear from inferior land. There nowadays we see grass, and somewhat corn for silage on mineral soils. Producing milk only there is lucrative.
30-35 per cent of this permanent grassland (that is 130.000 hectares) is covering the reclaimed peat areas. Each peat bog has a certain ecological character, which is realized even after draining and reclamation took place. The exact quote of the reed bogs related to the moss bogs we do not know; mainly there are reed bogs, contrary to the situation in Niedersachsen (Low Saxony).
From the permanent grassland in Schleswig-Holstein we cannot present such a good work of illustrative statistical materials like Mr. Schneider produced for The Netherlands. We looked out for a few test farms, observed by the Chamber of Agriculture in our land, to be characterized with the following particulars:

a) most of the farm grassland is found on peat soils,
b) relative long time in these farms book-keeping is practised,
c) the economic data may be evaluated by special experts from the Chamber.

This means too, that the farms chosen can be classified: we say *Futterbaubetriebe* (fodder-producing farms). The latest official judging paper dealing with the economic situation of the Schleswig-Holstein farms (results from 1979/80) Burchardi states:

> the *Futterbaubetriebe* - about 65 per cent of the actual number of farms - exist in unfavourable regions, practising intensive diary on smaller parcels with relatively high manpower. In comparison with the other farm types this groups exists on the lowest level with regard to income, so again in this year, when the income decreased by 15% to DM 24.000 per agricultural labourer. This we do regret.

You may consider the economic situation in Schleswig-Holstein at all: yield and income figures are the lowest in Western Germany! You can calculate, that nowadays no more intensity is required, not at all on the peat soils.

Some data from the *Futterbaubetriebe*, mainly on peat soils, are listed against the data from Mr. Schneider (Table 2).

Table 2. Financial results of grassland farms in The Netherlands and in Schleswig-Holstein.
The Netherlands: dairy farms on sand and peat (78/79)
Schleswig-Holstein: dairy farms on peat-soil and from mixed regions (*Geest*, almost sand and peat in each farm)

country	The Netherlands		Schleswig-Holstein	
site	sand	peat-bog	peat	mixed
land use intensity	high	high	(rel.high)	moderate
Farm size in ha	22	25	40	45
Number of milk cows	52	51	48	33
Milk cows per ha	2.34	2.04	1.18	0.73
Livestock per ha	3.15	2.64	3.09	2.00
Milk yield per cow in kg/year	5640	5240	5330	4873
Milk yield per farm in 1,000 kg/year	293	267	255	158
in guilders/in german marks*				
Milk yield per cow	3408	3151	3251	2973
Sales and increment per cow	872	773	829	768
Total proceeds per cow	4280	3924	4080	3741
Feed costs per cow	1278	1107	906	685
Balance: proceeds minus feed costs	3022	2817	3174	3056
dt concentrates per cow	27.7	21.7	21.6	16.3

* 1980/81: value 0.90:1.00

Some trends are similar:

more cattle in the land, increasing production of milk, more concentrates.

The differences are:

our farms are relatively large, the structure of livestock is more

traditional, young cattle stays in the stock; income may differ because prices vary from season to season (fertilizer, food, etc.).

All the other statements about soil- and water regimes pointed out for the management on peat soils in The Netherlands correspond with the essential conditions for the peat farms in our country.

Concerning the grassland advisory work, done by a few experts, it is very important to maintain the level achieved to date concerning the optimal production. Therefore it is necessary to keep up the sward quality by elaborated methods and to improve the knowledge about manuring or fertilizing the pastures and the meadows and about seeding the proper species into the grassland.

In the lowland swards we prefer sodseeding with intensively tested and ecological adapted species out of the European grass range. Only the following species are qualified for this:

Lolium perenne - Perennial Ryegrass

Phleum pratense - Timothy Grass

... and until now: no other grass!

Suitable machines are ROTASEEDER and VREDO.

You may see three examples to this problem in Table 3, sodsown species there are marked.

More experience with the draining of peat and with the control of the water-level is desirable.

Trouble - we must confess - is building up with increasing slurry quantities to be re-used being a considerable source of nutritive substances. The farms ought to have some profit of it. Unfortunately just the swards on the peat soil do suffer more and more! The plant composition is breaking down, weeds then increase and consequently the bearing capacity decreases. Having learned this, farmers no longer want to bring out slurry on the peat grassland, they have better experiences on the sandy soils.

Slurry banks and slurry pools are not yet in use. Not yet solved either is the problem of evaluating the nitrogen efficiency when slurry is spread out upon the sward.

Table 3. Composition of Grassland-Swards on typical Low-Grounds in Schleswig-Holstein. Noted in meadows and mown pastures before cutting the first time in 1981 (9.6-10.6.81) Species in % of the total sward.

nr. of experiment	1	2	3
location	Tielenhemme	Tielenhemme	Ahrenviöl
soil	clay above peat	peat, somewhat silty	peat
soil moisture	temporary moist	moist	temporary moist
using of grass land	mow-pastures	mow-pastures	meadow
Lolium perenne	38*	10*	34*
Phleum pratense	9	+	15*
Dactylis glomerata	+		11*
Festuca arundinacea			1*
Agrostis prorepens	5	5	+
Alopecurus geniculatus	8	20	+
Glyceria fluitans	+		5
Holcus lanatus	1	2	1
Deschampsia caespitosa	+	20	+
Poa trivialis	9	25	13
Festuca pratensis	6	2	8
Poa pratensis	9	10	7
Agropyron repens	1	3	
Poa annua	+	1	
Bromus mollis	2		+
Trifolium repens	2	+	
Ranunculus repens	3	1	3
Taraxacum officinalis	3	+	1
Ranunculus acer	+	+	+
Cardamine pratensis	+	1	+
Stellaria media	+	+	
Cerastium caespitosum	+		+
Rumex acetosa		+	+
only found once			
in experiment 1:	Urtica dioica, Cirsium arvense, Rumex crispus, Polygonum amphibium terrestre, Potentilla anserina, Plantago major, Achillea millefolium		
in experiment 3:	Caltha palustris, Lychnis flos cuculi		

* On clay-covered peat: main part from sod-seeding
On peat-soils: only from sod-seeding (not seen in the sward before sod-seeder had worked)

Literature

Burchardi, 1981. Die Lage der schleswig-holsteinischen Landwirtschaft im Wirtschaftsjahr 1979/80. In: Landwirtschaft 1981, Gemeinschaftsdienst der schleswig-holsteinischen Sparkassen- und Giroorganisation.