METSÄNTUTKIMUSLAITOKSEN
SUONTUTKIMUSOSASTON TIEDONANTOJA
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JAAKKOINSUO EXPERIMENTAL AREA

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Jaakkoinsuo Experimental Area

After the Finnish National Board of Forestry had started systematic ditching activity for the utilization of peatlands for forestry purposes, it established in 1909 the Jaakkoinsuo Experimental Area in order to clarify the principles of forest drainage. The primary aim was to find out by means of experiments, how large a yield of wood can be achieved on sites with different nutrient contents and, further, how various drainage efficiencies and stand treatments affect the yield. The first ditchings at Jaakkoinsuo were carried out in 1909 and, since then, they have been extended for various projects. In 1923, the Jaakkoinsuo Experimental Area was placed under the Finnish Forest Research Institute, the activities of which commenced in 1918.

Jaakkoinsuo Experimental Area measuring 97.5 hectares is located at 62°04' N, 24°34' E. The mean altitude is 120 m above sea level. The bedrock of the area is largely composed of acid plutonic rocks and the minerogenic deposits are composed of Glacifluvial Drift. The thickness of the peat layer in the swamp area ranges from 0.3 to 3.5 m.

Mean values of some climatic factors:

- Mean annual temperature	3.4° C
- Mean temperature in July	16.8° C
- Mean temperature in February	- 8.4° C
- Sum of daily mean temperatures (> + 5° C) during the growing season	1220.0° C
- Average duration of growing season (≥ + 5° C)	164 days
- Annual precipitation	600 mm

The first experiments for determining tree growth after drainage were established as early as 1909 and further experiments have been established more recently. In addition, the following experiments have been established at Jaakkoinsuo: in 1926, experiments in which mineral soil was applied, in 1929 liming experiments and in 1937 ash fertilization experiments. Fertilization

experiments using common fertilizers were started in 1949. Strip width experiments as well as ecological experimental fields are also to be found in this area.

The excursion route begins at the part of the swamp poorest in nutrients. In general, the fertility improves throughout the course of the excursion route.

1. Sinking of the peat surface after drainage

There are several series of poles at Jaakkoinsuo, which reach down to the mineral soil. The height of the poles is adjusted by levelling. It is possible to find out by means of the pole series, how much the peat layers of different thicknesses have sunk as a result of drainage.

2. Ecological experiments in peatland forests

Here at Jaakkoinsuo as well as in the experimental area of Kivalo in Northern Finland close to the arctic circle, there are ecological experiments on a pine swamp and a spruce-birch swamp. The effect of the growth factors of trees and the differences in the degree of efficiency induced artificially in these factors on the total growth and the annual rhythm of growth has been studied in these experimental fields since 1960. The following growth factors have formed the primary objects of the research: ground water conditions, soil temperature, nutrient state of the ground, air temperature and air humidity. All these factors have been regulated artificially.

The ground water relations have been changed by regulating the drainage depth at 0, 10, 30, 50, and 70 cm from the ground surface on various plots. The ground temperature has been lowered by removing the snow from the plots throughout the winter, causing the ground to become deeply frozen. In spring, the snow has been spread back over the frozen ground and covered with straw in order to prevent the snow and frozen ground from thawing. It has been possible to keep the ground temperature at a higher than normal level by covering the soil with straw before the winter, thus

retarding freezing of the soil. The nutrient state of the ground has been regulated by means of various fertilizers. The air temperature has been raised by building plastic shelters around the sample trees and, further, by heating the shelters.

The diameter growth has been measured on the sample plots at intervals of 2-3 days by a banding method developed for these investigations. The height growth has also been measured. Further investigations have been made into the biological activity in the ground and the depth distribution of tree roots.

The results of the fertilized plots show (Appendix 2) that the greatest difference in tree growth is found between the plot of 0 cm and the plot of 10 cm. Concerning the depths of 10, 30, 50, and 70 cm there are no significant differences in the growth.

A clear positive correlation can be found between the drainage depth and tree growth on the unfertilized Sphagnum peat poor in nutrients. The growth is clearly the best on the sample plot where the drainage depth is 70 cm. In the peat soil very poor in nutrients the biological activity and the mobilization of scarce nutrient resources are most effective on the sample plot where the drainage depth is 70 cm.

It is worth noting that the straw layer used in soil temperature experiments has improved the tree growth by eliminating the uptake of nutrients by the ground vegetation and by keeping the surface layer humid enough for the decomposition and mobilization activities of the soil microbes. (Appendices 2, 3, and 4).

The results of the experiments on temperature conditions show, among other things, that the time when growth commences is independent of the prevailing soil temperature and is determined solely by the increase in the temperature of the surrounding air in spring. Thus, on the plots where the soil has been covered by snow and the ground around the root systems has been entirely frozen, the growth starts at the same time as on the normal control plots. Similar results have been obtained from experiments in plastic shelters.

3. Production experiments (with different stand treatments)

The object of the experiment is to find out, how the various stand treatments affect the total yield and the growth of the tree stand. The experiment consists of three experimental plots. Plot 5a has been kept in an unthinned natural state. On plot 5c the stand has had light thinning treatments and on plot 5b heavy treatments. This explains why there is at present a naturally regenerated spruce stand on the plot 5b. This stand forms the second tree generation after drainage. The information given in Appendix 1 indicates that the largest total yield has been achieved on the plot which had no thinning treatments (5a). Technically, however, the stand is of very poor quality and so far, the cuttings have not produced any income. On the plots which had thinning treatments the stands are of good quality and several cuttings have produced income.

4. Production experiment (with different stand treatments)

The experiment consists of four experimental plots. Plots 7b and 8b have been kept in an unthinned natural state. On plots 7a and 8a the stands have had regular light thinnings. In this case, too, the information given in Appendix 1 indicates that the total yield of the unthinned plots (7b and 8b) has been larger than that of the plots which had thinning treatments.

5. Production experiment

The object of the experiment is to study the natural reforestation and the total yield of tree stands. At the time of ditching (in 1909) there were some small birches and willows growing in the area. After drainage a natural birch stand appeared in the area. Because the birch stand has had regular thinning treatments, a natural spruce stand has appeared in the under story. The last of the birches were cut in 1958. Technically, the spruce stand growing at present in the area is of very good quality.

The stand increment as well as the total yield of the area are very large as can be seen in Appendix 1.

6. Reforestation experiment using controlled burning

The object of the experiment is to study, how controlled burning may be applied in the reforestation of peatlands. The pine stand originally on the site was cut in 1956 and controlled burning was carried out in 1958. The stand has been naturally regenerated with seed from the surrounding forests. Because the dense birch stand almost suppressed the pine seedlings, the stand of birch seedlings has been controlled with a herbicide application.

7. Production experiment

The peatland site type on plot 23a is the most fertile site at Jaakkoinsuo. At the time of ditching (in 1909) there were some small-sized pines of poor growth growing in the area. It can be seen in Appendix 1, that the total yield after drainage has been very good and the annual mean growth after drainage has been calculated to be 7.6 solid m^3 per hectare. The experiment shows that even a swamp with a fairly thick peat layer can be made to produce very highly productive stands of large timber trees.

8. Production experiment

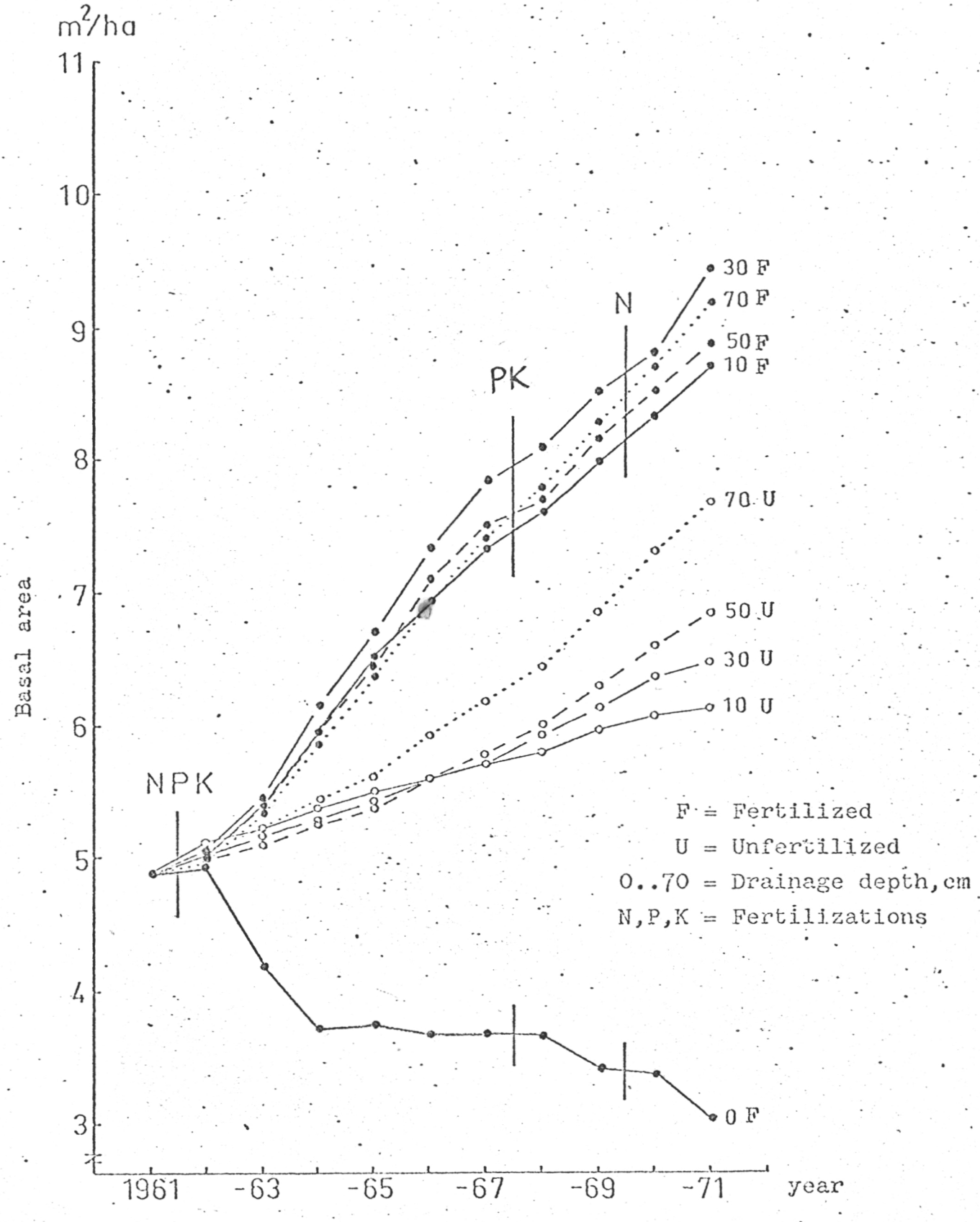
At the time of ditching, plot 15a was an entirely treeless swamp. However, up to now, it has produced 248 m^3 of wood and the present stand consists of large timber trees of fairly good quality. The importance of the nutrient content of the site for wood production after drainage can clearly be seen in Appendix 1. The total yield and the growth of the stand on plot 23a are nearly twice those of plot 15a.

Production experiments

Site No.	Sample plot No.	Original peatland site type x)	Peat layer, m	Site quality index (1..6)	Tree stand in 1972					Total production
					Pine	Spruce	Birch	Total	Annual increment	
					solid m^3./ha					
3	5a	CPS	0.4	3	5	99	161	265	4.3	324
	5b	CPS	0.5	3		29		29	2.7	287
	5c	CPS	0.6	3	76	19	46	141	5.6	- xx)
4	7a	CPS	0.4	3	80	23	82	185	6.3	291
	7b	CPS	0.4	3	135	24	133	292	5.8	346
	8a	CPS	0.4	3	190	7	32	229	7.5	310
	8b	CPS	0.3	3	166	42	74	282	7.2	316
5	26	HCSS	0.3	2		181		181	10.4	412
7	23a	FPS	1.0	1	200	10	55	265	7.2	471
8	15a	(open)CS	0.8	4	136		32	168	3.5	248

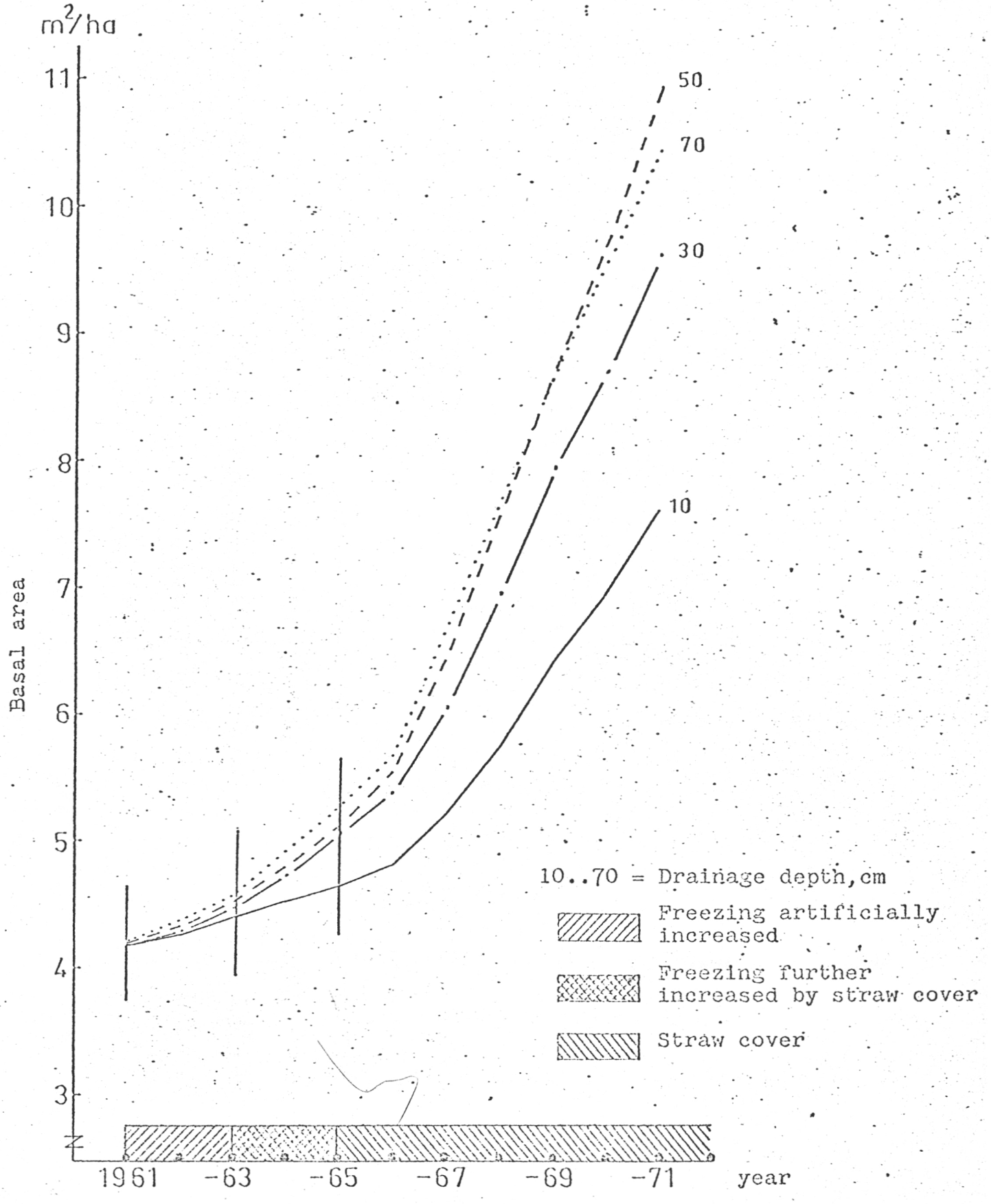
x) C = sedge (Carex)-rich
PS = Pine swamp
H = Herb-rich
SS = Spruce swamp
F = Fen-like

xx) Sample plot has been established in 1963



Development of the basal area of tree stand on the Jaakkoinsuo pine swamp experimental area.

The Finnish Forest Research Institute
The Department of Peatland Forestry



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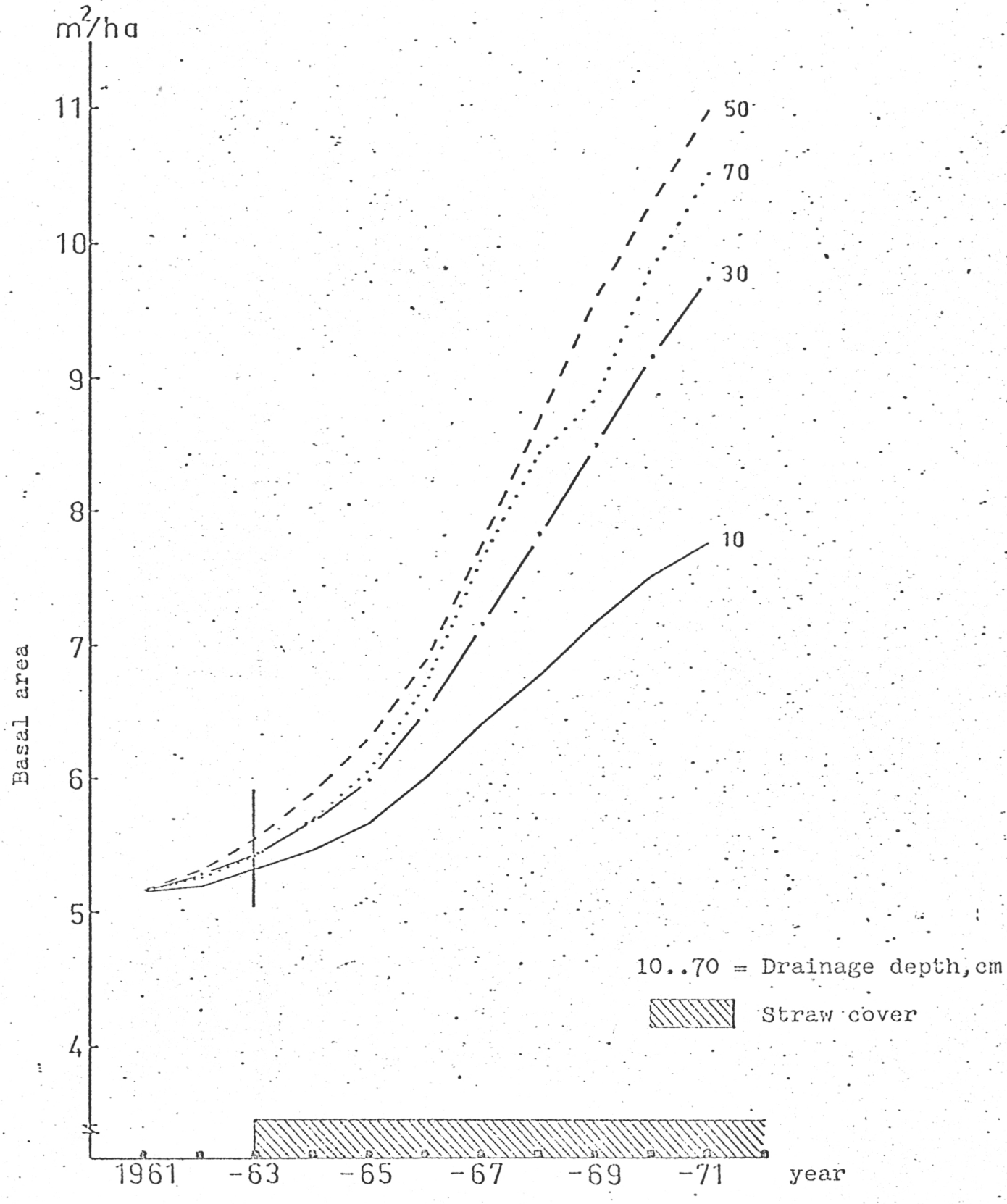

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H u i k a r i, O. 1972. Metsäntutkimuslaitoksen suontutkimusosaston (metsänparannuksen tutkimusosaston) tutkimusohjelman laadinta sekä tutkimustehtävät ja budjettiesitys vuodelle 1973. MTL mpt. 1/1972. 124 s.

H u i k a r i, O. 1972. H-kulttuuri. MTL mpt. 2/1972. 19 s.

P a a v i l a i n e n, E. 1972. Lannoitteiden lentolevityksen tasaisuudesta. MTL mpt. 3/1972. 8 s.

V e i j a l a i n e n, H. 1972. Hillasato kesällä 1972 eräillä suontutkimusosaston koekentillä. MTL mpt. 4/1972. 38 s.

P a a r l a h t i, K. 1972. Jaakkoinsuo Experimental Area. MTL mpt. 5/1972. 9 s.