

On the Natural Regeneration of Hiba (*Thujaopsis dolabrata*) Forest.

By

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Hiba (*Thujaopsis dolabrata*) is one of the most important conifers in Japan. It is widely distributed over Honshu (Japan Proper) and a part of Hokkaido, and its range covers from about 32° to 42°N. Lat. But its main forests are found chiefly in the north-east regions of Japan situated in about 41°N. Lat. In these regions Hiba grows on mountain slopes and takes a regular or selection-like form in pure or mixed stand. *Thujaopsis dolabrata*, *Fagus Sieboldi*, *Quercus grosseserrata* and *Magnolia hypoleuca* are the characteristic trees in mixture. Above all, Hiba forests in Tsugaru and Shimokita peninsulas are most conspicuous and are regarded as one of the most magnificent forests in Japan. They cover 12,580,000 ha. and their mean yield is 200 fm. per ha., which consists of 131 fm. of Hiba and 90 fm. of broad-leaved trees. Among these, if we take the best stands only, the volume amounts to 787 fm. per ha. The forests in these regions have been managed intensively from old times, the region being the only source of production of Hiba, which is the most durable timber among Japanese conifers. This short treatise on the regeneration of Hiba forest is obtained from the results of the experimentation and the investigation made in these forest regions.

Climatic characteristics of this locality are as follows: Mean annual air temp. 8.7°–9.0°C; Mean air temp. in growing season 16.4°–17.1°C; Record of absolute minimum temp. –19.5°C; Annual precipitation 1889 mm.; Drying season April–August; Mean wind velocity 2.79 m/sec; Max. wind velocity record 18.6 m/sec. N.N.E.

I. Reproductive Conditions of the Present Natural Forest.

With the view of studying the reproduction system of Hiba forest, the writer, first of all, made sure of the condition of the stands on which the present timber was established and also trace back the changes which the present stand has undergone ever since. For this purpose many sample plots were laid in the typical natural forests. After close studies were done on the composition of these sample plots, the plots were cut all over. The number of annual rings on the stumps was exactly calculated and also the breadth between every ring was exactly measured. The writer added, in estimating the age of each tree, the age suggested by the height of the stump and thus from these data made the efforts to determine the time at which the trees regenerated and also to ascertain the forest conditions under which the trees grew. The following is the summary of these studies.

Sample Plot No. 1. Hiba Pure Mature Stand.

Description of site:—Uchinappe, the first working cycle, Compartment 8; Area of sample plot 0.81 ha.; Elevation, 140 m. above sea level; Westwards slope, 12° to 25° dip; Tertiary, sandstone and shale; sandy loam; Thickness of duff 3 cm., Soil depth 18 cm.

This sample plot is one of the most fully stocked stands among the Hiba forests. The number of the stems is 498 per ha., the sum of the basal area being 67.9 m². per ha., the volume being 786.9 fm. per ha. The percentage of broad-leaved trees in mixture is only 4% of this stand in volume and is composed of these species such as *Quercus grosseserrata*, *Castanea sativa*, and *Magnolia hypoleuca*. Among these, *Quercus* and *Castanea* are all old mature trees, each diameter is 70 cm. or more.

The range of diameter-classes of Hiba extends from 8 to 72 cm. and that of height-classes extends from 4 to 32 m. But most of all, say 70% of all the trees, are from 38 to 70 cm. in diameter and from 21 to 30 m. in height. Such an aggregative distribution of diameter and height classes in these classes made this stand assume an almost even form such as seen in an even aged stand. (see table 1.)

According to the result of close examination of annual rings, the range of age-classes of Hiba

extends from 80 to 280 years old. But there is a great difference between the number of the trees in each age-class. About 72 % of all the trees investigated belongs to the age-classes extending 200 years old. (see table 2.) This result suggests that most trees of this stand were reproduced about 200 to 220 years ago with a 40 years' reproduction period, and that since then the reproduction has been almost interrupted. Such a way of regeneration explains itself the reason of the regular form of this stand.

The mixed broad-leaved trees are from 160 to 180 years old. From these ages it may be inferred that these broad-leaved trees were not reproduced at the same time with Hiba, but they grew up within a period of 20 to 40 years after the reproduction of Hiba.

The present condition of reproduction of this stand is very imperfect. Except in small patches on the ridges and upper slopes, one cannot find the advance growth. Greater part of forest floor is kept clean with layer of litter, except a thin growth of tolerant brushes growing on it. The advance growth of Hiba can be found in small patches of about 40 m². in average, and in total they cover 11% of the whole area. The young seedlings in these patches are 1.3 in number per m². and from 0.15 to 5 m. in height. The age of these seedlings extends from 22 to 65 years, but most part of these, say 58% of all, are 40 years old. From this fact, it may be inferred that the present reproduction took place 160 years after the last reproduction, and it was completed within the period of 40 years. Moreover it is worth while to mention that in these patches of the advance growth of Hiba any kind of broad-leaved trees can hardly be seen.

Sample Plot No. 2. Hiba Pure Two-storied Stand.

Description of site: Uchimappe, the second working cycle, Compartment 5; Area of sample plot 1.5 ha.; Elevation, 120 m. above sea level; Southwards slope, 12° dip; Underlying rocks and soil are the same as those of sample plot no. 1.

This stand is purely composed of Hiba trees with two distinct crown canopies. The number of the stems is 1205 per ha., nearly 50% of which is occupied by the trees smaller than 8 cm. in diameter. The sum of the basal area is 57.4 m². and its volume amounts to 647.7 fm.

The range of diameter-classes of this stand extends from 6 to 70 cm., of which, however, the trees of 6 to 8 cm. and 25 to 50 cm. diameter-classes occupy a greater part. Of the total number of the trees, the former class occupies 51% and the latter class 34%. In accordance with such partially distributed number of the stems in diameter-classes, crown canopy is also distinctly divided into two stories; the one is about 20 to 23 m. high and the other 5 to 6 m. high. (see table 1.)

According to the result of a close examination of annual rings, the range of age-classes extends from 40 to 260 years old, and the number of the trees in age-class is just like that in diameter-class, divided into two definite groups. The one is the group of age-classes of 160 to 200 years old and the other is that of age-class of 40 to 60 years old. The number of the trees which belong to the first group amounts to 30% and that of the second group occupies 63% of the total number of the trees.

From this result it may be inferred that most of the trees composing the upper canopy were reproduced about 160 to 200 years ago, and that the trees belonging to the lower canopy began to be reproduced about 40 to 60 years ago and was secured within 40 years.

From the above mentioned we can recognize that reproduction in this stand occurred with an interval of 140 years and that the last reproduction proceeded under the shelter of seed trees.

If we compare the condition of reproduction of sample plot no. 1 with that of no. 2, we can see that these two plots are exactly the same as regards to the occurrence and the continuance of reproduction, however, the results are very different. The cause of the incompleteness of reproduction in sample plot no. 1 must be attributed to the fact that the canopy of the stand was relatively too close when the reproduction began. This assumption would easily be accepted when we compare the present growing stocks of the two sample plots.

Sample Plot No. 3. Selection-like Stand of Hiba with Broad-leaved trees.

Description of site:—Ôhata working cycle, Compartment 45; Area of sample plot 0.5 ha.; Flat bottom and its surrounding slope; Andesite, Layer of litter and humus 3 cm. deep, Surface soil 10—15 cm. deep, Depth of soil 50—60 cm.

This is a selection-like stand, with Hiba predominating and mixed with some broad-leaved trees such as Beech and Oak. The number of the stems is 832 per ha., of which Hiba being 594, broad-

leaved trees 238, and the number of the stems greater than 38 cm. in diameter is 80. The sum of the basal area is 37.8 m². per ha. and the volume 366 fm. per ha. Proportion of mixture in basal area is 61% of Hiba versus 39% of broad-leaved trees. Characteristic broad-leaved trees in mixture are as follows: *Fagus Sieboldi*, *Quercus grosseserrate*, *Styrax Obassia*, *Prunus Grayana*, *Ilex dubia* var. *macropoda*, *Fraxinus longicuspis*, *Acer palmatum*, *Cornus controversa*, and *Alnus incana* var. *sibirica*.

The range of diameter-classes extends from 6 to 100 cm. and the number of the stems in diameter-classes is just like that of the selection stand. If we sum up the trees in such diameter-classes, viz. 16—24 cm., 26—36 cm. and 38 cm. over, and calculate the percentage of basal area of these classes, we obtain the following numerical values: 20, 34, 44. These are nearly equal to those numerical values which are commonly used to denote the normality of composition of selection stand.

The range of age-classes of Hiba extends from 60 to 260 years old. If we trace the frequency curve to determine the representation and distribution of age-classes, we obtain an undulating curve with three crests. These crests gradually descend as the age-classes advances. From this frequency curve one can recognize that reproduction took place at intervals of 50 to 60 years, and that reproduction was secured in a period of 20 years.

The range of age-classes of mixed broad-leaved trees extends from 45 to 160 years old. In this case we can trace the frequency curve of age-classes having four crests at 30 years' intervals. If we compare these two curves, i.e. the curves of Hiba and broad-leaved trees, we can see that the crests of the both curves never coincide, but always occur one after another having certain correlation. This fact shows that the broad-leaved trees were not reproduced at the same time with Hiba and that their reproduction was secured before and after that of Hiba. In this case, if we can assume that cutting was done at the time when the broad-leaved trees were reproduced in the stand and further if we can infer the grade of cutting from the number of the broad-leaved trees which appeared under cover of the stand, we can infer, from the fact shown by the reproduction and distribution of age-classes, that reproduction cuttings were made at intervals of 30 years, and that the grade of the successive cuttings was not the same, the first cutting being made reservedly, while the second done to a considerable extent. The first cutting was intended to reproduce the Hiba seedlings under cover of the stand, not too open, probably to be caused by chiefly cutting broad-leaved trees in mixed stands. The second cutting was done to stimulate the growth of seedlings after the reproduction of Hiba was secured. In this case Hiba was chiefly selected to be cut and this gave a chance to the broad-leaved trees of reproducing abundantly.

II. General Condition of Reproduction in Experimental Stands.

Experimental plot No. 1. Hiba Pure Natural Stand.

Description of Site:—Uchimappe, the first working cycle, Compartment 8; Experimental area 0.8 ha.; Site factors are just like those of sample plot no. 1.

This experimental plot is laid in the stand, described in the preceding section, i. e. sample plot no. 1. In 1917 the first reproduction cutting was made for the purpose of shelterwood system. Composition of the stand left standing is as follows: Number of stems is 165 per ha. Sum of basal area is 34.5 m²., volume is 377.3 m³. Percentage of the mixed broad-leaved trees amounts to 5.6 in volume. Mean size of Hiba timber left standing is 49 cm. in breast high diameter and 26 m. high with a long clean bole of 15.6 m. The total area of its crown amount to 37% of the whole experimental plot.

According to the examination done in 1924, the ground had been covered with dense growth of brush and weeds. Only in some patches protected from direct sunlight by the shelter of seed trees, Hiba seedlings had been reproduced. But such patches were not more than 9.5% of the total area.

Of course good cropped seed-years appeared in this stand three times since the reproduction cutting was made. But these crops did no good to reproduction, outside the sheltered patches under cover, owing to the unfavourable condition of the ground for germination and for the continued life of the young growth. Such an unfavourable condition was due to the dense growth of brush and weeds and it appeared in this stand already within 4 years after the reproduction cutting was made. The number of brush and broad-leaved young growth occupying the ground is 20 per m². and the frequency of *Hydrangea scandens*, one of the most frequently found trailing plants is 94. During this experiment, sowings with soil preparation were made frequently, but vainly, under such ground con-

ditions.

Experimental plot No. 2. Hiba Pure Natural Stand.

Description of site:—Uchimappe, the second working cycle, Compartment 3; Experimental area 1.0 ha.; South-westerly slope, 30° dip; Underlying rocks and soil are the same as those of exp. plot. no. 1.

This plot is chiefly composed of small sized trees with 24 to 36 cm. in diameter, and is fully stocked and has no undergrowth except a thin growth of tolerant plants and some advance growth. In 1924 the first reproduction cutting was made in view of shelterwood system, and the stand took the following dimension: Number of trees is 705 per ha. Sum of basal area is 63.5 m².

According to the examination of this stand 8 years after the reproduction cutting was made, the reproduction is satisfactory. The number of Hiba young growth is 22 per 10 m². and most of all are 5 years old, i.e. the seedlings of the previous seed year. Besides the advance growth of Hiba broad-leaved trees also have sprung up in this stand, but not so abundantly as in sample plot no. 1. They amount to 31 in number per 10 m². Weeds and trailing plants also are not abundant, and even the most conspicuous species such as *Disporum smilacinum* and *Rhus Toxycodendron* var. *vulgaris* have only 9 in frequency. In the most part of the forest floor, say 67% of the area, there is little or no undergrowth and the floor is maintained in good condition for the ready germination of the seed and the continued life of the young growth.

Experimental plot No. 3. Hiba Broad-leaved trees Mixed Stand.

Description of site.—Kanita Working cycle, Compartment 66; Experimental area 0.59 ha.; South-westerly slope, 24° dip; Clay slate and clay loam, Site quality good.

This plot is a Hiba broad-leaved tree mixed stand, with Hiba predominating. The stand is fully stocked, with no undergrowth but a thin growth of tolerant brushes. In 1911 reproduction cutting was made in view of shelterwood system. In this case, suppressed trees were chiefly selected for removal, most parts of Hiba, the dominant trees, and mixed broad-leaved trees being left standing. After the cutting, the stand retained the timber of 850 in number per ha. and the basal area of 49.9 m². Percentage of the broad-leaved trees in mixture is 11 of the whole basal area.

According to the examination which was undertaken 14 years after the cutting was made, reproduction of Hiba was satisfactory and its number amounted to 637 per 100 m². The range of the age of these seedlings extended from 5 to 12 years old. From these ages of the seedlings we can see that reproduction was established 2 years after the reproduction cutting was made and that until now the reproduction has been in progress. Besides the Hiba seedlings brush and weeds also had sprung up in the area, but their number was not so great. The number of young growth of broad-leaved trees and shrubs amounted to 45 per 10 m². Among the weeds, *Carex Morrowii* was the most frequently found species, its frequency amounting to 40. Most part of the forest floor was kept in a good condition for reproduction.

Experimental plot No. 4. Mixed Selection-like Stand of Hiba and Broad-leaved Tree.

Description of site:—Ôhata Working cycle, Compartment 41; Experimental area 11.79 ha.; South-easterly slope, 20°—45° dip; Andesite, Depth of soil 50—60 cm., Depth of surface soil 10—15 cm., Depth of duff 3 cm.

This is a mixed selection-like stand of Hiba and broad-leaved trees, with Hiba predominating. The number of stems is 872 per ha., of which the number of the trees greater than 38 cm. in diameter is 138. The range of the diameter-classes extends from 10 to 78 cm., and its representation and distribution in diameter-classes characterize the nature of the selection stand. (see table 3) In 1925 selection cutting was made and the stand came to have the following dimensions:—Number of stems is 649 per ha. Sum of basal area is 35.2 m². Total volume is 290.8 fm. Percentage of Hiba in mixture is 85 in basal area.

According to the examination undertaken 5 years after the cutting was made, annual growth of the stand left standing was 9.8 fm. per ha. and the number of the seedlings was 741 per 100 m², which consisted 576 Hiba seedlings and 165 broad-leaved tree seedlings.

III. Reproductive Habits of Hiba.

Seed Production. Some trees bear seeds every years, but abundant crops of all the trees throughout the range occurs every 5 years. In this seed year Hiba usually produces not only full seed

crops but also of high quality. According to the investigation during the past 15 years, Hiba produced, in average every seed year, 1,097 cones per tree (that is 38,500 seeds per tree), and their germination percentage was always more than 40. On the other hand, during off years Hiba produced only 19 cones with less than 10% germinable seeds. In this connection the seeds obtained in off years contribute very little to the reproduction of a stand.

Establishment of Seedling and its Propagation.

In fully stocked regular stand reproduction is hindered by a deep layer of litter and humus. But if we open the stand for reproduction by a light thinning, namely the thinning of the trees equal to 20% of the whole stand in volume, the ground obtains within 1 or 2 years without any special preparation a good condition, favourable for germination and continued life of seedlings. By this time, seed trees also get abilities to bear seeds abundantly.

In selection stand, if it maintains the volume of about 320fm. per ha., the stand is always kept in a good condition for reproduction. According to a close examination, there are many patches in these stand that have 2,000 seedlings or more in 1 m². and there are cases where 110 seedlings per 1 m². grew up on the average of all stand. Such seedlings can survive if the stand is not too much opened and the ground is free from dense growth of vegetable covers. Otherwise seedlings die out entirely. Once the ground is covered with an unbroken grass sod, it does not altogether hinder the germination of seeds, but the sprung up seedlings do not survive any longer on account of the unfavourable environmental factors or of the mechanical obstacles, caused by vegetable covers. It seems that such unfavourable conditions will last for not less than 20 years.

Besides the natural seeding stated above, Hiba also regenerates most easily through "fukujo". In case a Hiba seedling is compelled to live in a too fully stocked stand for a long time, it comes to have a crown shaped like an umbrella. By the lengthening of its side branches, finally it comes to touch some of them on the ground. When they are covered partially with litter and humus, and roots have developed at the buried parts of the branches, shoots will grow into independent plants. Such growth is called "fukujo". In the present natural forests one can frequently find such young growth. This cause may be attributed to the fact that the method of handling forests in the past gave a chance of growing to such a young growth and that the climatic factors, especially a great deal of deep snow, accelerated the rooting action of branches. According to the investigation in some sample plots, the present young growth has such a proportion: self-sown seedling 38% v. "fukujo" 62%.

Further, it would be worthy of special mention that Hiba readily propagates by green cuttings. Actually there are many examples that the blanks upon which trees are not yet reproduced after reproduction cuttings or the tracts impossible to natural reproduction may be restocked by this method of cuttings. From old times, it is well known that people in the province of Noto regenerated Hiba forests by planting the green cuttings under the shelter of canopy. By this management they have already been able to establish three new varieties and used to select the special variety to answer the purpose of reforestation.

Growth of Hiba.

A Hiba seedling grows very slowly, and even in the most favourable growing condition under the natural reproduction, it attains not more than 28 cm. in height when 10 years old. Such a slow growth in its juvenile stage still continues for so many years that it takes for it 50 years to attain the size of 9 cm. in diameter and 7.5 m. in height even in the favourable condition. But this habit of growth, on the other hand, characterizes its tolerance under the shade. The young growth sticks to life tenaciously, struggles along for 20 to 30 years under the shade of the forest if it has once gained a foothold in the stand, and passes to the remarkable degree, the power of recovering and growing in a prosperous and normal manner which follows its release from such suppression. Once passed this stage of slow growth, Hiba begins its vigorous growth and this continues to advanced age. So it is common that it attains the size of 70 cm. in diameter when it is 205 years old and shows, even in this advanced age, mean annual growth of 0.37 cm. during the last 10 years. Such characters in growth and tolerance under the shade make this tree one of the most suitable timber to be raised under the system of natural reproduction.

VI. Summary.

1. Most of the Hiba trees standing in regular stands were reproduced at the same time during the

last 180 to 200 years, which is comparatively a short period. Mixed broad-leaved trees sprung up chiefly in the stand after the reproduction of Hiba was secured.

2. In the mixed selection-like stand of Hiba and broad-leaved trees, Hiba was chiefly reproduced every 60 years and mixed broad-leaved trees took the chance of its reproduction before and after that of Hiba.

3. It may be assumed that the handlings in regular stand of the past are just like those of the shelterwood system of the present. When about 150 or 140 years of age, the fully stocked regular stand had its crown canopy opened reservedly by the first cutting. Reproduction proceeded under the protective shelter of the trees left standing and a removal cutting was made after 40 years. By this removal cutting the broad-leaved trees were reproduced plentifully in the stand. These broad-leaved trees were cut by improvement cutting and the stand again came to take a regular form.

4. It may be assumed that, in the mixed selection-like stand of Hiba and broad-leaved trees, selection cuttings were made every 30 years, as will be stated below.

First of all, under the first selection cutting, the most part of the broad-leaved trees and a few old and large Hiba trees of the main stand were removed with a view to reproducing Hiba. This cutting resulted in the reproduction of Hiba over the ground under the protective shelter of the trees left standing. And the 30 years after the first selection cutting a more severe one was made chiefly of Hiba timber, to stimulate the growth of advance growth. This cutting gave the broad-leaved trees a chance to spring up again in this stand. These broad-leaved trees were again selected for removal after 30 years as have stated above. Thus in this stand selection cuttings were made at intervals of 30 years, a conservative cutting chiefly of the broad-leaved trees being alternated with a more severe cutting chiefly of Hiba.

5. Hiba forest regenerated very satisfactorily not only under the shelterwood system but also the selection system. Handlings by these systems agree with their reproductive habits of this species. For this management, however, it is necessary that the stand should be fully stocked and the ground maintained in the favourable condition for reproduction when the reproduction cutting is made. It is impossible to reproduce Hiba seedlings by natural reproduction under such a condition in which the ground is covered with a dense growth of brush and weeds which may grow when the reproduction cutting is made comparatively heavily. With regard to this fact, such present natural Hiba forests as have the opened canopies and dense vegetable covers are not fit for the management by natural reproduction.

6. In seed-years, which occurred every 5 years, Hiba produced, on the average, 1,097 cones per tree with more than 40 in germination percentage. In off years, on the other hand, it produced on the average only 19 cones per tree with less than 10 in germination percentage. So the seeds of off years contribute very little to the reproduction of a stand.

7. Under the shelterwood system, it is proper to leave the trees which occupy 50 m². in basal area per ha. after the first reproduction cutting is made and to handle the forest during the period of regeneration of 30 years. In every 7 to 10 years within this period light thinnings for reproduction are repeated untill the final cutting is made in the stand. It may be expected that by this time the density of the trees left standing will have decreased to 23 m². in basal area per ha.

8. Under the selection system, it is desirable, as the standard yield, that the stand should maintain the density of 30 m². in basal area and the volume of 350 fm. per ha. Then we can not only regenerate the stand satisfactorily but also satisfy the economical demands of management by obtaining the annual yield of 8 to 9 fm. in volume per ha.

Table No. 1. Composition of the stand.

Diam. class cm.	Plot no. 1			Plot no. 2		Plot no. 3			
	Numb. stems		Basal area in %	Numb. of stems	Basal area in %	Numb. of stems			Basal area in %
	Hiba	Hard wood				Hiba	Hard wood	Total sum	
6—14	10	—	0.1	667	2.3	272	69	341	7.4
16—24	67	3	3.5	95	5.6	180	83	263	20.8
26—36	140	—	16.5	235	31.4	90	58	148	31.4
38—50	200	—	44.0	169	42.4	44	20	64	24.2
52—70	59	—	23.7	39	18.3	8	4	12	9.4
72—	14	4	12.1	—	—	—	4	4	6.9
abs. per ha.	490	8	m ² . 67.9	1205	m ² . 57.5	594	238	832	m ² . 37.8

Table No. 2. Distribution of age classes.

Age class years	Plot no. 1			Plot no. 2		Plot no. 3			
	Hiba		Hard wood	Hiba		Hiba		Hard wood	
	Numb. stems			Numb. stems		Numb. stems		Numb. stems	
	Abs.	%	Numb. stems	Abs.	%	Abs.	%	Abs.	%
40	—	—	—	296	31.7	—	—	1	1.6
50	—	—	—	—	—	—	—	5	8.5
60	—	—	—	262	28.1	3	1.2	16	27.1
70	—	—	—	—	—	12	4.8	23	39.0
80	4	1.0	—	—	—	29	11.6	6	10.2
90	—	—	—	—	—	54	21.6	1	1.6
100	3	0.8	—	1	0.1	29	11.6	3	5.1
110	—	—	—	—	—	5	2.0	—	—
120	2	0.5	—	2	0.2	5	2.0	1	1.6
130	—	—	—	—	—	13	5.2	2	3.4
140	5	1.3	—	9	1.0	24	9.6	—	—
150	—	—	—	—	—	25	10.0	—	—
160	25	6.3	2	74	7.9	19	7.6	1	1.6
170	—	—	—	—	—	10	4.0	—	—
180	54	13.6	3	163	17.5	6	2.4	—	—
190	—	—	—	—	—	4	1.6	—	—
200	145	36.4	—	87	9.3	4	1.6	—	—
210	—	—	—	—	—	3	1.2	—	—
220	140	35.2	—	33	3.5	3	1.2	—	—
230	—	—	—	—	—	1	0.4	—	—
240	14	3.5	—	5	0.5	—	—	—	—
250	—	—	—	—	—	—	—	—	—
260	3	0.8	—	1	0.1	1	0.4	—	—
270	—	—	—	—	—	—	—	—	—
280	3	0.8	—	—	—	—	—	—	—
Sum	398	100	5	933	100	250	100	59	100

Table No. 3. Composition of the stand after the first reproduction cutting was made.

Dia. class cm.	Plot no. 1			Plot no. 2		Plot no 3			Plot no. 4			
	Numb. stems		Bas. area in %	Numb. stem	Bas. area in %	Numb. stems		Bas. area in %	Numb. stems		Bas. area in %	
	Hiba	Hard wood				Hiba	Hard wood		Hiba	Hard wood	Hiba	Hard wood
10-14	2	—	—	10	0.1	70	10	1.9	210	33	7.9	7.0
16-24	1	3	0.5	211	11.9	239	19	15.4	158	24	15.9	14.4
26-36	22	—	5.7	326	52.8	140	12	24.3	117	15	28.8	21.9
38-50	83	—	42.6	158	35.2	122	7	42.1	56	9	27.1	25.1
52-70	37	—	29.2	—	—	—	12	5.0	21	3	17.3	14.1
72—	12	3	22.5	—	—	9	—	11.3	2	2	3.0	17.6
Abs. per ha.	157	6	34.5 m ²	705	63.5 m ²	690	60	49.0 m ²	563	86	30.0 m ²	5.1 m ²