U.S.D.A. FOREST SERVICE
RESEARCH PAPER NC-27
1969

THE Influence of Light, Moisture, and Seedbed on Yellow Birch Regeneration

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U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE

Contents

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1969. The influence of light, moisture, and seedbed on yellow birch regeneration. U.S.D.A. Forest Serv. Res. Pap. NC-27, 12 p., illus. N. Cent. Forest Exp. Sta., St. Paul, Minn.

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The Influence of Light, Moisture, and Seedbed On Yellow Birch Regeneration

Carl H. Tubbs

Yellow birch (*Betula alleghaniensis* Britton) has traditionally been one of the most valuable species in the northern hardwood forest. Its high value has led to many attempts to increase its numbers by planting or seeding or by manipulation of the overstory. Many of these attempts have not been successful.

Yellow birch is found on a variety of sites covering a wide range of moisture conditions and soil types. Although in the Lake States it is nearly always found where northern hardwoods grow, its numbers are generally low. In Wisconsin, Curtis (1959) reported yellow birch to be of greatest importance in wet-mesic stands of mixed hardwood-conifer and on mesic sites dominated by sugar maple. Westveld (1933) found yellow birch universally present on every soil type investigated but found little indication of a soil preference in the Upper Peninsula of Michigan. Linteau (1948) suggested that yellow birch acts both as a pioneer and a member of the climax forest.

The species is adaptable to a wide range of conditions, but the apparent lack of preference for certain soils or environments unfortunately leaves the forester without a point on which to focus attempts to increase the proportion of yellow birch.

Silvical and silvicultural studies have led to conflicting ideas of environmental requirements for regeneration. Godman and Krefting (1960), reviewing these studies, found that overstory recommendations ranged from 30 to 70 percent of full sunlight. Seedbed recommendations emphasized the necessity of seedbed disturbance of some sort, although recommended types of disturbance differed.

These authors showed in their own trials of heavy cutting and scarificaton that, while establishment was excellent on scarified areas where mineral soil was exposed, growth was poor. Subsequent studies of shade requirements showed that moderate (50 percent) shade would be desirable. In a later publication, Godman (1959) pointed out that where the water table remained near the surface, yellow birch establishment was adequate on undisturbed litter.

The ubiquitous occurrence of yellow birch and variety of recommended environments reported by silvicultural studies suggested that seedbed requirements vary depending on light intensity and moisture conditions. To test this hypothesis, a study was designed to show the response of yellow birch regeneration to a variety of environments.

Methods, Materials, and Measurements

The study area was in a small forest opening on the Upper Peninsula Experimental Forest near Skandia, Michigan. Two sites were simulated: a well-drained site and an imperfectly drained site where the water table remains near the surface. The latter was an attempt to duplicate a field condition described by Godman (1959). On each of these sites four light conditions and eight seedbed types were studied. Light conditions were full sunlight and 30, 50, and 75 percent shade. The seedbeds were of four general classes of forest floor material: (1) humus from a nearly pure old-growth upland sugar maple stand, (2) humus from a nearly pure stand of old-growth hemlock, (3) rotten hemlock logs, and (4) humus and upper horizons of a podzol soil occurring under a mixed hardwood-conifer stand. This latter material was subjected to the following treatments: (1) litter burned,[1] (2) litter removed with a rake, (3) litter covered with a 1-inch sawdust mulch (hemlock sawdust), (4) humus removed leaving the leached, sandy A_2 horizon, and (5) undisturbed.

Humus seedbeds generally resembled a matted mor. Sugar maple stands, from which seedbeds were taken, had thin humus horizons (2 inches) while the hemlock and mixed hardwood stands were characterized by a thick humus accumulation (4 to 12 inches). The textural class of the A_2 mineral soil seedbed was sand.

Seedbed samples were cut out of the forest floor in 3-square-foot sections, 5 inches thick, and laid randomly in rows under the various degrees of shade (fig. 1). Seedbeds were isolated from each other by 2 inches of sand. Shade was provided by green plastic screening supported box-like over the beds. On the imperfectly drained site the water table was held near the surface by using subirrigation. On the well-drained site the water table was allowed to fluctuate naturally.

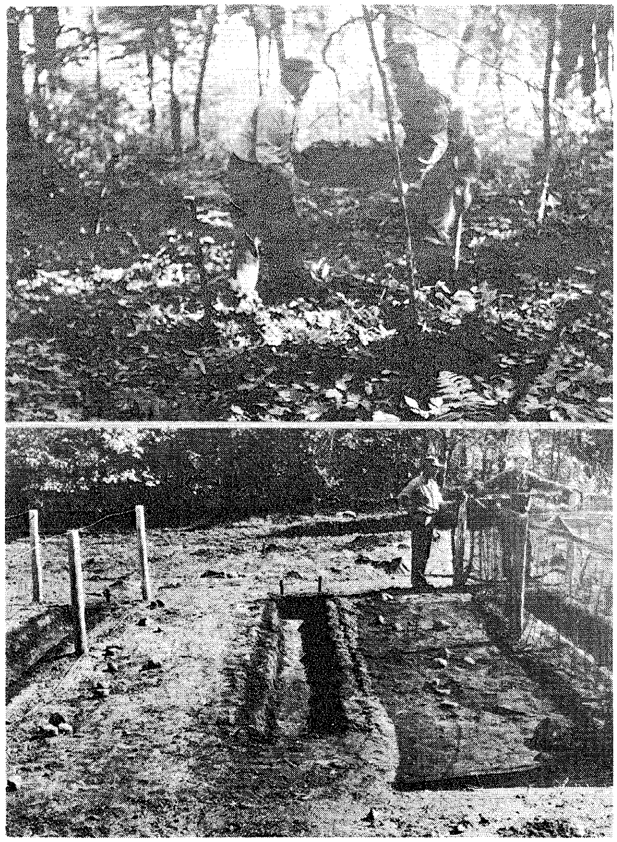

FIGURE 1. — Blocks were lifted from the surface of the forest floor, transported to the seedbed study area, and placed in trenches. In the bottom photo, the trench on the left is being screened for shading. (F-504372-504371)

Two samples of each seedbed type were subjected to each combinaton of moisture and shade conditions. There were 8 seedbeds, 4 light intensities, and 2 moisture levels in 2 blocks totalling 128 plots.

In November 1961, 200 seeds collected from a single tree were placed on one-third of each bed. Seed placed on the remaining two-thirds were not counted but equal volumes were placed on each seedbed. The counted-seed portion was used to determine germination and mortality while the remaining portion was used for height-growth and seedling production measurements. Height of the five tallest seedlings in each bed was measured at the end of the first growing season. These seedlings were then tagged and height growth was observed periodically throughout the 1963 season. Competing vegetation was clipped at regular, short intervals.

[1] *Burning was done with a blow torch. The L layer was totally decomposed but the moist F and H layers were not visibly affected.*

On one replication, gravimetric moisture samples were taken periodically and air and ground-surface temperatures were recorded as well. Soil moisture of the organic seedbeds was measured by weighing baskets of the seedbed material. These containers were 4-inch-square plastic berry baskets cut to 1½-inch depth and lined with nylon netting fine enough to prohibit movement of humus but not fine enough to inhibit moisture movement.

A block of the seedbed the size of the basket was carefully cut out and placed in the basket. The basket was then replaced in the resulting hole. At weekly intervals from June through August each basket was removed and weighed. Material was dried and weighed during the following winter.

Tests of the reliability of the basket samples were made by sampling with a core sampler on two different dates. The correlation coefficient between basket and core samples was 0.84.

Surface temperatures were measured on selected days with thermistors; air temperatures were continuously observed by means of a recording thermograph in a weather shelter; and minimum and maximum thermometers were read daily in each shade condition.

Results

Temperature and Moisture

Temperature and moisture within the various environments generally followed predictable patterns. In full sunlight, mineral soil surfaces (A_2 horizon) were much cooler than organic surfaces on which temperatures as high as 150° F. were recorded. Temperatures were higher above the organic material, too: at 2 cm. above the organic material, temperatures rose to 128° compared to 100° F. for the A_2. At 10 cm., differences were slight.

Even though shading reduced surface temperature on the organic beds, temperature in excess of 110° F. occurred under shade on the well-drained site (table 1). Temperature tended to rise and fall less rapidly under shade than it did in the open.

Table 1. — *Undisturbed mixed hardwood leaf surface temperatures on the well-drained site on a clear day*

(In degrees F.)

Time	Full sunlight	50 Percent shade	75 Percent shade
3:45 p.m.	127	95	90
5:21 p.m.	102	92	89
8:23 p.m.	57	59	62
11:35 p.m.	55	56	59
5:00 a.m.	50	53	57
7:35 a.m.	75	75	67
10:47 a.m.	110	103	95
Noon	125	115	110
1:59 p.m.	90	110	108
3:30 p.m.	85	95	100
4:15 p.m.	90		95

On the imperfectly drained site, organic surface temperature in full sunlight rose to about the same height as on the well-drained site but somewhat later (approximately ½ hour) and remained above 120° for about 2½ hours in contrast to the drier situation where temperature remained above 120° for only 45 minutes.

Temperature measurements on a similar clear day on A_2 mineral soil show about the same pattern but at a lower level (table 2). During the day, temperature was lower on the imperfectly drained sites but at night was slightly higher than on the well-drained site.

Freezing temperature was recorded at the weather station in each month of the growing season except July. Minimum thermometers located 2 feet high under three of the shade conditions indicated that increasing shade density increased the minimum temperature readings. Temperatures below freezing were recorded five times under 25 percent shade, four times under 50 percent shade, and once under 75 percent shade.

Precipitation patterns differed for the 2 years of the experiment. During 1962, about 6 inches of rain fell from June through August. The same period in 1963 produced over 9 inches (table 3).

Rainfall under each shade condition was measured during the first growing season. Usually the densest shade resulted in the least throughfall.

Table 2. — A_2 mineral soil surface temperatures by drainage class, time of day, and degree of shade on a clear day

(In degrees F.)

Shade (percent)	Noon		Midnight		4:00 a.m.	
	Well-drained	Imperfectly drained	Well-drained	Imperfectly drained	Well-drained	Imperfectly drained
0	101	91	60	62	63	65
30	89	88	62	64	64	65
50	86	80	61	59	63	60
75	82	79	63	64	65	65

Table 3. — Growing-season precipitation

Month	1962		1963		Normal
	Rainfall	Days rain recorded	Rainfall	Days rain recorded	Rainfall
	Inches	Number	Inches	Number	Inches
June	1.79	12	4.16	16	3.62
July	1.09	9	2.38	12	3.16
August	3.15	12	2.82	12	3.24
Total	6.03	33	9.36	40	10.02

1/ Michigan State University Experiment Station, Chatham, Mich. (10 miles east of the Upper Peninsula Experimental Forest).

The imperfectly drained site averaged twice as much seedbed moisture as the well-drained, and moisture content was more uniform on the imperfectly drained site both by time and treatment except for the full sunlight treatment which generally resulted in much lower moisture. Moisture content fluctuated greatly on the well-drained site but was higher under shade ~~(fig. 2)~~.

Germination

Clearcut differences in germination between degrees of shade, seedbeds, and moisture indicated that germination was favored by the cooler, moister environments (table 4).

The imperfectly drained site had the most germination. The mineral-soil seedbed proved to be the best for germination on the well-drained site. But on the imperfectly drained area four other seedbeds had higher germination under one or more of the shade conditions.

Least germination occurred in full sunlight; only the A_2 supported even a moderate amount of germination in this environment. Moderately heavy shade was best for germination on the well-drained site while lighter shade was best on the imperfectly drained site (fig. 2). This is particularly true of disturbed seedbeds on the latter site.

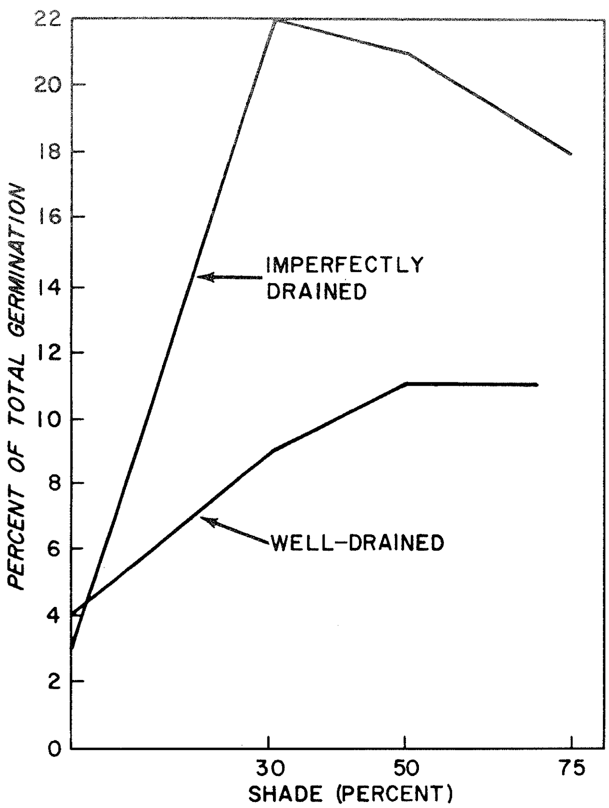

FIGURE 2. — Total germination by shade and drainage.

Mortality

A continuation of the cool, moist environment was necessary to prevent seedling mortality early in the first growing season. In general, the same seedbed, light, and moisture conditions that favored germination also resulted in the lowest mortality.

Thirty percent of the seedlings died during the first growing season. Mortality was highest shortly after germination: 70 percent of the total mortality occurred before the first of July. The chief causes of early mortality appeared to be heat and drought; the most severe mortality was on seedbeds in full sunlight (table 5). Thus the lower temperatures of the mineral soil beds may have been responsible for the better survival here than on organic seedbeds during the period shortly after germination.

Insects and frost also contributed to mortality during the first growing season. Insects damaged 20 percent of seedlings before the first of July and were directly responsible for minor losses. Probably insects weakened plants which were subsequently killed by extremes of temperature or moisture. Several periods of freezing at night occurred during the spring but caused only minor losses.

About 60 percent of the seedlings remaining at the end of the first growing season were dead at the end of the second growing season. Of these, only 20 percent died during the main part of the second growing season; 80 percent of the mortality occurred between growing seasons and shortly after the start of the second season, apparently caused by frost.

Frost damage occurred in the fall before plants had become dormant[2] and again in the spring immediately after buds began flushing. In general, frost damage was least under moderate shade although result are variable. Except for seedlings growing in full sunlight, damage was less on the imperfectly drained site than on the well-drained (table 6). The type of seedbed did not influence this general pattern; however, seedlings growing on rotten logs and on mineral soil suffered little frost damage.

It is interesting to note that under full sunlight and 30 percent shade, frost-damaged seedlings grew better than those not damaged (table 7). Under the heavier shades, frost-damaged seedlings grew about the same or slightly less than undamaged seedlings.

Survival under shade the second year was similar to that of the first with best survival under moderate shade except that seedlings on mineral soil were essentially the only survivors in full sunlight. However, losses on mineral soil were substantial in the rest of the environments. Survival on this seedbed was next to lowest.

[2] *The first year terminal buds were not set on most seedlings. However, the second year the top bud on approximately half of the seedlings appeared to have become dormant. Variation in dormancy did not appear to be related to environment.*

Table 4. — Yellow birch germination by shade and seedbed, 1962

(In numbers)

Shade (percent)	Rotten hemlock log	Undisturbed hemlock duff	Undisturbed sugar maple	Mixed hardwood-conifer humus: Undisturbed	Mixed hardwood-conifer humus: Burned	Mixed hardwood-conifer humus: Raked	Mixed hardwood-conifer humus: Hemlock sawdust mulch	Mixed hardwood-conifer humus: A_2 horizon	Total
WELL-DRAINED									
0	11	1	1	1	4	4	0	25	47
30	4	17	5	16	3	4	15	37	101
50	26	17	8	2	5	4	8	57	127
75	10	23	3	42	7	11	9	21	126
Total	51	58	17	61	19	23	32	140	401
IMPERFECTLY DRAINED									
0	2	4	2	3	2	7	4	12	36
30	39	18	12	29	68	22	22	36	246
50	50	39	8	55	41	9	4	33	239
75	62	32	26	18	11	15	13	26	203
Total	153	93	48	105	122	53	43	107	724
Grand total	204	151	65	166	141	76	75	247	1125

Table 5. — First-year seedling mortality, by shade and seedbed, 1962

(In percent)

Shade (percent)	Rotten hemlock log	Undisturbed hemlock duff	Undisturbed sugar maple	Mixed hardwood-conifer humus: Undisturbed	Mixed hardwood-conifer humus: Burned	Mixed hardwood-conifer humus: Raked	Mixed hardwood-conifer humus: Hemlock sawdust mulch	Mixed hardwood-conifer humus: A_2 horizon	Average all seedbeds
WELL-DRAINED									
0	91	100	100	100	75	75	0	52	68
30	25	25	60	27	0	25	43	18	28
50	15	24	12	100	100	0	25	32	24
75	10	35	0	37	100	36	89	59	44
Average	31	29	30	27	74	35	50	35	35
IMPERFECTLY DRAINED									
0	(1/)	0	100	33	0	43	100	25	42
30	48	33	27	11	80	0	15	14	37
50	9	11	12	28	5	11	0	10	12
75	37	10	48	28	10	15	0	35	28
Average	29	24	38	20	47	11	16	19	26

1/ Data incomplete.

Table 6. — Yellow birch injured from fall 1962 and spring 1963 frosts, by shade and site

(In percent)

Shade (percent)	Well-drained		Imperfectly drained	
	Moderate injury	Severe injury	Moderate injury	Severe injury
0	64	21	62	30
30	41	34	36	13
50	51	38	30	22
75	67	33	34	22
Weighted average	53	35	38	20

Seedling Production

After 2 years, seedling production on the imperfectly drained site was twice that on the drier area (table 8); under imperfectly drained conditions numbers were greatest under 30 percent shade on disturbed beds. Other seedbeds showed variability but in general produced more seedlings under 50 to 75 percent shade (fig. 3).

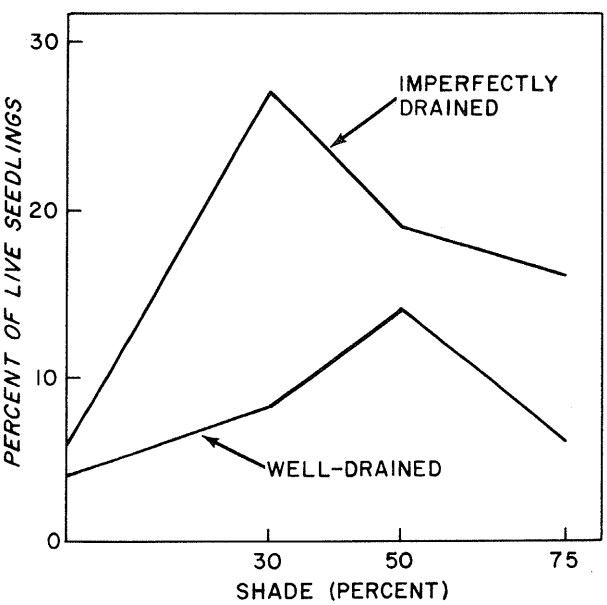

FIGURE 3. — Live seedlings remaining after the second growing season by site and shade.

Table 7. — Average growth (1963) of seedlings by degree of frost damage

Shade (percent)	None	Moderate	Severe
0	0.46	0.56	0.52
30	.72	.79	.85
50	.68	.67	.61
75	.68	.59	.67

About one-third of the seedlings were found on mineral soil beds. However, mineral soil did not support significantly more seedlings in several environments — its superiority appeared to be limited to the drier, less shaded environments.

Height Growth

More moisture on the imperfectly drained site resulted in greater height growth, especially during the first growing season. The second year the superiority of the imperfectly drained site was less and differences between seedbeds also diminished, particularly among the organic seedbeds (table 9). Increased height growth the second year on the well-drained site may have been due to the greater precipitation that year.

Seedbed effect differed according to moisture treatments the first year. Seedlings growing on hemlock logs, mulched mixed-hardwood-conifer, and A_2 horizon on the imperfectly drained site grew no faster than those on the well-drained site. While several explanations are possible, it appears that the corresponding seedbeds on the well-drained site were adequately supplied with moisture.

Although height growth was generally best under 30- and 50-percent shade, two distinct height-growth/shade patterns developed during the experiment (fig. 4). Seedlings growing on well-drained mineral soil and on burned mixed-hardwood litter grew better under full sunlight than under any shade. In contrast, on the imperfectly drained site,

Table 8. — Yellow birch seedlings remaining after the 1963 growing season

(In numbers)

Shade (percent)	Rotten hemlock log	Undisturbed hemlock duff	Undisturbed sugar maple	Mixed hardwood-conifer humus: Undisturbed	Burned	Raked	Hemlock sawdust mulch	A_2 horizon	Total
WELL-DRAINED									
0	0	1	2	5	3	1	2	63	77
30	3	26	15	25	12	8	15	37	141
50	11	14	23	12	8	24	15	136	243
75	0	13	21	30	6	6	1	4	81
Total	14	54	61	72	29	39	33	240	542
IMPERFECTLY DRAINED									
0	0	7	6	3	1	13	1	63	94
30	6	55	17	46	66	91	93	98	472
50	20	62	52	64	40	16	6	72	332
75	59	67	22	33	26	5	11	55	278
Total	85	191	97	146	133	125	111	288	1176
Grand total	99	245	158	218	162	164	144	528	1718

Table 9. — Average total height of 5 tallest 2-year-old yellow birch, 1963

(In feet)

Shade (percent)	Rotten hemlock log	Undisturbed hemlock duff	Undisturbed sugar maple	Mixed hardwood-conifer humus: Undisturbed	Burned	Raked	Hemlock sawdust mulch	A_2 horizon	Average
WELL-DRAINED									
0	— 1/	—	—	0.66	1.45	0.90	0.47	.66	.83
30	0.94	1.00	1.03	1.29	.96	1.12	1.23	.28	.98
50	1.11	.98	1.21	1.10	1.18	.99	1.16	.25	1.00
75	—	.47	.95	1.36	1.02	.92	—	.11	.81
Average	1.03	.82	1.06	1.10	1.15	.98	.95	.33	.91
IMPERFECTLY DRAINED									
0	—	.88	.76	1.01	.69	.98	.74	.20	.75
30	.85	1.64	1.15	1.64	1.84	.80	1.55	.72	1.27
50	.90	1.48	1.18	1.50	1.39	.62	1.04	.24	1.04
75	.46	1.30	.91	1.39	1.56	1.15	1.04	.26	1.01
Average	.73	1.33	1.00	1.39	1.37	.89	1.09	.36	1.02

1/ No survival.

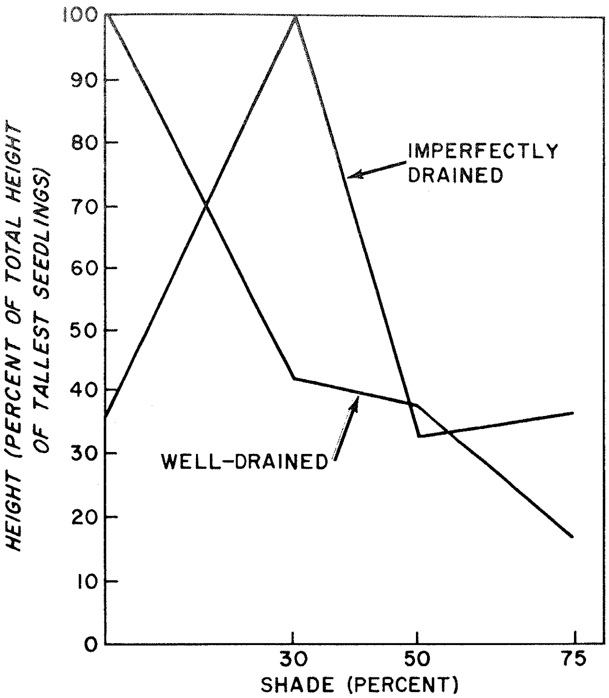

FIGURE 4. — Percent total height of tallest seedlings on A_2 seedbed by moisture and shade.

these seedbeds produced the tallest seedlings under moderate (30- to 50-percent) shade. The other seedbed conditions consistently produced taller seedlings under moderate shade regardless of the moisture.

To attempt an explanation of this moisture and interaction seedling dry weights were recorded and a few morphological features of leaves were measured on plants growing on the A_2 horizon under two shade and moisture conditions. The imperfectly drained mineral-soil seedbed produced plants with leaves generally larger than those of seedlings growing on the well-drained site. Leaf thickness was relatively insensitive to shade on the imperfectly drained site while the reverse was true of the well-drained site.

Using leaf area per gram of seedling (dry weight) as a measure of efficiency of production, we found that although shade has an influence (leaf areas/gram of dry weight doubled or tripled from no shade to 75 percent shade), the largest differences in leaf area per gram dry weight (14 fold differences) resulted from the difference in moisture.

Discussion

Unfortunately, germination tests were not repeated during the second and wetter year of the experiment but it seems reasonable to suppose that cloudy, cool, and wet years might result in good germination and survival in environments that were less than favorable in this study. It is likely that this factor also contributes to the ubiquitousness of the species.

The relatively high survival in full sunlight on the A_2 mineral soil had also been recorded in a study reported by Linteau (1948). This droughty environment probably resulted in a condition long known to nurserymen as "hardening." Plants subjected to drought or prolonged chilling are known to be more resistant to both drought and cold injury. Plants developing in full sunlight are usually considered to be more resistant to heat injury than those grown in shade (Gatherum, *et al.* 1963). The results of these adaptations may be masked by the physical environment, however. For example, one would have expected higher mortality on the imperfectly drained site, particularly under shade. Although these moist conditions should have resulted in less "hardy" plants, high moisture and shaded conditions reduced the occurrence and the intensity of extreme temperatures. The deepest shade (75 percent), however, apparently produces seedlings that are least likely to survive.

Some studies have shown frost to be a negligible factor in yellow birch survival (Godman and Krefting 1960) while others (Linteau 1948) have found frost to be serious. The apparent contradiction may be due to variation in moisture regimes. This study indicates that a wet-mesic site location might be expected to reduce damage, probably by reducing the intensity and duration of frost in contrast to a more mesic site. Although our study does not show this, it is well known that relatively wet, cool, environments delay plant growth in the spring which may additionally help protect yellow birch seedlings on wet mesic sites.

Seedlings on undisturbed seedbeds on the imperfectly drained site seemed to require more shade than those on disturbed seedbeds. Undisturbed seedbeds with leaf litter are known to reduce both germination and early survival (Koroleff 1954). Part of the explanation may be that reduced temperatures and evaporation rates caused by increased shade help offset the effect of the undisturbed litter.

The two height-growth patterns recorded in this study have also been observed in field studies. Height growth of seedlings growing on an imperfectly drained area (Godman and Krefting 1960) on mineral soil was favored by shading. In field studies on well-drained sites (Linteau 1948 and Jarvis 1957), best height growth of yellow birch was in full sunlight. Variations in height growth by moisture conditions have also been observed by Wang (1965).

The general similarity between characteristics of plants subjected to high light levels or low soil moisture suggests that either of these factors may result in the same response by the plant. For example, Henckel (1964) citing work by Konaren pointed out that the development of xeromorphic characteristics could be stimulated by deficiencies of phosphorus or moisture or high light levels. If physiological phenomena controlling plant size are similarily governed, this might provide an explanation for the two growth patterns observed. For example, photosynthetic capabilities of sun and shade leaves usually vary in predictable patterns (Kramer 1958): sun leaves are more productive under high light intensities than shade leaves. The relatively more shade-like leaves produced on the imperfectly drained site of this study thus may have been less efficient in full sunlight than the more sun-like leaves of the well-drained site, at least on the mineral A_2. Our preliminary study of some features of the leaves of yellow birch seedlings grown on the mineral A_2 suggests that this may be part of the reason for height growth reduction of seedlings grown under the influence of a high water table in full sunlight.

The results of this study provide an explanation for the heavy stocking of yellow birch observed by foresters and ecologists along forest roads and logging skid trails. Road building and logging open the canopy resulting in partial shade, destroy advance growth of tolerant seedlings, and expose mineral soil which results in good germination. Optimum growth, however, often depends on the plant's ability to root in the humus and most often the birch closest to the edge separating forest and disturbed conditions seem to be the most successful. Data from Godman and Krefting (1960) illustrate this further: they show that partially scarified areas resulted in more large birch than those totally scarified. The partly scarified area resulted in a greater amount of the humus-mineral soil edge which probably provided both a good environment for germination and for growth. In this connection, it should be mentioned that several investigators have noted the beneficial effects of humus-mineral soil mixtures on germination and growth (Godman and Krefting 1960; Tubbs 1963; and Wang 1965) and on root-shoot ratios (Tubbs and Oberg 1966).

Several authors have considered site disturbance the key factor in explaining the occurrence of yellow birch (Winget *et al.* 1965). The results of this study show that seedbed disturbance may usually be necessary for regeneration on well-drained sites but not on imperfectly drained sites if overhead light is available. Future development of seedlings may be retarded in the wettest situations, however, since species lists from Curtis (1959) show that both importance values and constancy fall drastically proceeding from wet-mesic to wet forests. Braun (1950) indicated a similar pattern in forest communities of the Tahquamenon Wilderness of Upper Michigan.

Summary — Conclusion

The hypothesis that seedbed requirements of yellow birch can vary with changes in light intensity and moisture conditions has been supported by this experiment. In addition, it was found that requirements changed with each stage of development.

Seedbed requirements for good germination were variable depending on light and moisture:

Site	Shade: Full sun	Moderate shade	Heavy shade
Well-drained	Mineral soil	Mineral soil	Heavy and organic
Imperfectly drained	Mineral soil	Both mineral and organic	Both mineral and organic

First year mortality was primarily due to heat and drought. Although results were variable full sunlight was detrimental on all seedbeds but the mineral A_2 seemed to provide a consistently better environment for survival under this shade condition. Least heat-and-drought caused mortality occurred under moderate shade on the imperfectly drained site.

Frost was the most serious cause of mortality thereafter. Seedbed was not a major factor but shade and moisture conditions influenced damage. Least damage occurred under moderate shade on the imperfectly drained site.

The combined effects of germination and survival resulted in highest production of seedlings on the A_2 mineral soil on the well-drained site particularly under moderate shade while on the imperfectly drained site several other seedbed, light combinations come close to equaling or surpassed A_2 production. Best production was under moderate shade for any seedbed. The A_2 was the only successful seedbed in full sunlight on either site.

Height growth was best on organic seedbeds. On these seedbeds moderate shade was generally necessary for best growth. The imperfectly drained site produced the tallest seedlings on these seedbeds under moderate shade. Maximum growth occurred on burned mixed-hardwood-conifer seedbeds under moderate shade on the imperfectly drained site. On mineral soil seedlings grew best in full sunlight on the well-drained site while shade was necessary for best height growth on the imperfectly drained site.

Yellow birch can germinate, survive, and grow satisfactorily in a number of environments. Its potential includes exposed sites as well as those that are cool, moist, and shaded. Seedbed disturbance is necessary on drier sites or during dry periods while partially shaded wet-mesic situations offer the necessary cool, moist environment without seedbed disturbance. Seedbed disturbance also is required during years of normal or subnormal precipitation when full sunlight prevails regardless of moisture conditions of the site.

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