

Birch Yellowing Syndrome - Potting Experiment

Introduction

The unique "yellowing syndrome" affecting white birch trees in the Sudbury area appears to affect most but not all trees on any given site. It was noted in many instances that two trees of the same age and size and growing less than one meter apart could display greatly different symptom severity. An experiment was undertaken in 1983 to determine if the possible causal agent(s) or contributing factor(s) to this unique foliar symptom was located in the soil. This experiment is described below.

Methods

During the summer of 1982, a site was located in the Sudbury area where the yellowing syndrome was affecting small white birch. The area selected was located along Highway 17 East and is shown in Figure 3. Approximately 50 of each affected and unaffected white birch seedlings were tagged with coloured flagging tape to distinguish between the two types.

In the spring of 1983, 30 of each tree type (affected and unaffected) were transplanted into 20 cm, 4.5 L plastic pots. Soil from the immediate area from where the tree was growing was used in the transplant procedure. Care was taken when the trees were dug up to minimize root damage and to obtain as much of the root system as possible. On the same day, 30

healthy, green (non-chlorotic) white birch seedlings from a control area (Burwash Industrial Farm) were potted in their native soil in the same manner as described above. The location of the control site is shown in Figure 4.

Fifteen of the potted trees of each type (Highway 17 East affected, unaffected, and Burwash) were placed into the ground in their own pots at both the Highway 17 East site and the Burwash (control) site. Spacing between pots was approximately 5 cm.

On July 27, 1983 the potted birch at the Highway 17 East site was rated for crown condition and percent chlorosis. The Burwash potted birch were also observed for foliar symptoms.

Results and Discussion

The results of the July evaluation of potted birch trees at the Highway 17 East site are presented in Table 17. Crown condition was expressed as a numerical rating from one to six; one being a very healthy tree exhibiting excellent form, growth, foliar retention, and colour; whereas a rating of six represents a dead tree. The crown condition was best in the Burwash birch seedlings (≈ 2) followed by the unaffected Highway 17 East (≈ 3) and lastly the affected Highway 17 East (≈ 4). This is reflected in the tree survival with the Burwash potted trees having 100% survival while the Highway 17 East unaffected and affected had 93% and 80% survival respectively.

In 1983, the greatest amount of foliar chlorosis occurred on the trees which were collected at the Highway 17 East site. These trees had displayed marginal chlorosis in the field in the summer of 1982. Five of the six trees that were affected had between 20% and 35% marginal chlorosis on their foliage. Of the originally healthy Highway 17 East birch left at the Highway 17 East site in 1983, six trees displayed chlorosis but to a much lesser extent. Only one tree from the Burwash collection placed at the Highway 17 East site exhibited any degree of chlorosis and this chlorosis was very minor in nature (1%) not necessarily the same cause. The potted seedlings at the Burwash site were not rated individually for crown condition or % chlorosis, however, it was clear from casual observations that only the affected Highway 17 East collections placed at Burwash had any degree of chlorosis.

Discussion

It is too early to draw any conclusion from this experiment due to the fact that the seedlings suffered from some degree of transplant shock and droughty conditions in 1983. Preliminary results indicate that the syndrome-affected trees are micro-site specific. The potted birch from Burwash were virtually chlorosis free. Some limited syndrome chlorosis did however develop on foliage of a few trees that did not have the symptom present in the previous year. This suggests that some factors in the soil may be responsible for the symptom. The potted trees at both sites will continue to be monitored to determine if any changes in symptom development occur.

Birch Yellowing Syndrome Transect Study

Introduction

Marginal chlorosis on young white birch foliage in the Sudbury area has been observed to display a great amount of variability on any given site. Severity also varies according to positions on the hillsides. Trees on the tops of slopes often appear more chlorotic than trees growing in lower areas. To document this variability a site was selected where the white birch yellowing syndrome was present. A transect was set up on a hillside to study this phenomenon. The following describes this preliminary study.

Methods

The study location was selected along Highway 69 North near Little Stobie Mine (Figure 5). This site consisted of a south east facing, moderately steep hillside. There were frequent rock outcrops with occasional pockets of sandy soil over bedrock existing in catchments along the slope. The vegetation on the site was primarily made up of a young stand of scattered white birch with patches of grass, blueberry and various lichens and mosses.

On September 2, 1981, a transect line was established on a south east facing rocky hillside starting from the highest part of the hill and extending to the bottom. This was accomplished by running a tape measure along a compass

bearing of 176° down the entire slope of the hill. Measurements of the following parameters were taken along a 2 meter strip east of the transect line: height, ground level diameter and foliar marginal chlorosis percent of each white birch tree. Basal area (cm^2) was calculated along the transect from the diameter measurements utilizing the following formula $\text{Basal Area} = \frac{D^2}{4}$ where D is diameter in centimeters (Avery 1967). Soil depth profiles were taken at half meter intervals along the transect.

Results

Measurements of soil profile depths along the transect line and plotted in Figure 6. Soil depth was quite variable throughout the entire length of the transect. As is the case for much of Sudbury's rocky landscape, soil exists in pockets with little or no soil over bedrock at the top of a slope or hill. The top half of the slope has soil only in small pockets that range from 1 cm to 39 cm in depth. A deeper and more consistent soil base was encountered in the lower portions of the slope where there was much less exposed bedrock. Soil profiles were found up to 64 cm in depth. This pattern can be attributed to erosion associated with surface runoff and little vegetation cover to retain the runoff.

The distribution of white birch seedlings along the transect follows much the same pattern as soil depth along the

transect (Figure 7). Only 36 trees were tallied in the top 30 meters of the transect strip compared to 126 trees in the bottom 30 meters. Seeds are likely to be washed down the tops of hills with spring runoff increasing chances of seed germination and colonization on the lower slopes and bottom of the hills.

Height of the birch trees along the transect varied considerably from the shortest tree at 12 cm in height to the tallest at 230 cm. Numbers of trees within the four established height classes (<75 cm, 75 - 100 cm, 100 - 150 cm and >150 cm) occurring within each five meter section of the transect strip are represented in Figure 8. The shortest height class (<75 cm) is present at all 5 meter intervals except at the very top and the very bottom of the hill. The majority of trees of this height class as well as the 75 - 100 cm class were found on the lower slope of the hill between 30 and 45 meters from the top of the hill.

The 75 - 100 cm height class trees were absent for the first 20 meters down the transect from the top of the hill and the 101 - 150 cm height class trees were not found within 10 meters of the top of the hill. The greatest number of trees in this latter height class were distributed on the lower slope between 26 and 55 meters from the top of the hill. Trees >150 cm in height was scattered but the greatest numbers were growing at the bottom 10 meters of the transect.

Tree diameter distribution followed much the same pattern as height class. Numbers of trees within four diameter classes (<4 cm, .4 - .7 cm, .8 - 1.2 cm and >1.2 cm) that were measured within each five meter section of the transect are shown in Figure 9. The greatest number of trees were noticed in the (.4 - .7 cm) diameter class. The small class diameter trees (<.4 >.7 cm) were mainly distributed from the middle of the hill to near the bottom.

Although the larger diameter class trees (>.8 cm) are scattered along the transect, the greatest concentration is present near the bottom of the hill. This is also reflected in the basal area which is much higher in the lower section of the transect (Figure 10).

Relative percent chlorosis according to four categories (0 - 5%, 6 - 15%, 16 - 40% and >40%) observed on trees within each five meter interval along the transect is presented in Figure 11. Percent chlorosis on the foliage of the white birch was highly variable throughout the transect. The greatest number of trees were tallied in the 16 - 40% chlorosis class (61) followed closely by the 0 - 5% class (54), then the 6 - 15% class (45) and lastly with only three trees with >40% chlorosis. There does not appear to be a distinct pattern relating amount of chlorosis to tree size or position on the hill. There was however between the 51 and 55.5 meter intervals (10 meters from the bottom of the hill), a high number of moderate to severely (16 - 40%) chlorotic trees which made up 86% of the trees tallied along that

interval. General reconnaissance usually revealed that the more chlorotic trees tend to be on the tops of ridges which is contrary to the above results. While undertaking a study on birch leaf miner, Declerk (personal comm.) observed that there was a significant difference between the marginal yellowing of both small and medium sized white birch that were growing on lower sloped sites as opposed to ridge top sites. She found that trees growing on the ridges had more chlorosis.

The Sudbury White Birch Transect Study involved only one transect. It is felt that because of the variability of the measured parameters, particularly percent chlorosis, that additional transects would have to be established before certain trends may be clearly delineated.