the extreme north-west silver and red beech are also regenerating vigorously.

The maritime climate of Banks Peninsula and the Kaikoura coast allows a number of species to be present which are absent elsewhere in Canterbury. Some of these are otherwise found only in the extreme north of the South Island or in the North Island. They are listed by Laing (1919) and Martin (1920) and will not be discussed further. The number of screen frosts (about 50) is low here, and the rainfall of 40 to 60 in. is relatively high.

The Europeans felled and burned extensive areas of forest, especially on Banks Peninsula, the coastal lowlands near Christchurch, at Waimate, Geraldine, Alford Forest, Kowai Bush, Oxford, Mt. Grey, Kaikoura coast, and inland in the upper reaches of the Rangitata, Rakaia, Waimakariri, Hurunui and Waiau rivers and at Lake Ohau. Complete removal of forest occurred in many areas but remnants are present elsewhere. Selective felling removed *Dacrydium cupressinum*, *Podocarpus totara*, *P. hallii*, *P. spicatus* and *P. dacryiodides* in some otherwise intact forest. Grazing animals, especially domestic stock, deer, opossums and wallabies, have eaten out or made scarce some other species. The forest floor is bare of seedlings wherever animal populations are high. Many ferns have met this fate as have species of *Nothopanax* and *Coprosma*. Numbers of fern species have disappeared from Banks Peninsula. Other species such as *Cyathodes acerosa*, *Myrtus pedunculata* and *Drimys colorata* have been favoured by selective grazing.

The facts presented above, while disagreeing in some points of detail with the theories of Holloway (1954) about the forests of Canterbury, provide support for his main concepts.

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TEMPERATURE RESPONSE OF NATIVE SHORT TUSSOCKS

D. SCOTT

Plant Physiology Unit, Department of Scientific and Industrial Research, Palmerston North

This paper reports on the response to temperature of one clone of silver tussock (*Poa caespitosa*), one clone of Otago blue tussock (*Poa colensoi* var. *intermedia*), and two clones of fescue tussock (*Festuca novae-zealandiae*). The plants were grown in control climate cabinets.

The clones of silver and fescue tussock came originally from the Godley Valley (Lake Tekapo district) and included the stouter high altitude form of fescue tussock that may well be a distinct species (Connor pers. comm.). The clone of blue tussock came from Flagstaff Hill (Dunedin district).

Growth was compared at three mean temperatures of 80°, 60° and 42° F. The growth cabinets were run on 12 hour temperature cycles with 15°F. difference between "day" and "night", the "day" temperature being the higher. The light was of approximately 3500 ft. candles intensity at pot level and of approximately daylight spectrum.

The lights were on for 16 hours a day commencing one hour before the start of "day" temperatures. Relative humidity was in the range 70-95 per cent.

Each clone was represented by at least two plants. Measurements were made of the rate of elongation of the youngest leaf of a tiller which had appeared above the sheath of the older leaves. Twenty-five such leaves were labelled on each plant and their lengths measured at alternate three and four day intervals. The criterion of growth was the mean daily increase for these leaves. The characteristics of this method of measuring growth rate and the other methods mentioned in this article are fully described elsewhere (Scott in press). A comparison of the effects of different levels of temperature on rate of growth were obtained by placing the plants in one temperature regime for 2 to 3 weeks and then shifting them to a second temperature regime for a further 2 to 3 weeks. The comparison of growth rate at 60° and 42°F. was carried out 2 to 3 months after the comparison between the rate at 80° and 60°F.

There were differences in rate of growth between plants of the same clone under a constant environment but each plant responded similarly to a change of temperature. For example the ratio of growth rate at 60°F. to growth at 42°F. varied by less than ±4 per cent. for all plants of a clone. The growth rate of an individual plant was nearly constant at the same temperature for periods up to three weeks but determinations made on the same plant under the same conditions after an interval of three months differed by up to ± 15 per cent.

Figure 1 shows the growth rate of each of the clones expressed as a proportion of that at the temperature of maximum growth, i.e. 60°F. for fescue and silver tussock and 80°F. for blue tussock. Both silver and fescue tussock had an optimum temperature about 60°F., but whereas the growth rate of silver tussock fell rapidly at temperatures above and below this, fescue tussock still grew well at 80°F. There was little difference between the high and low altitude forms of fescue tussock though the former had a slightly greater growth at the lower temperatures. Otago blue tussock had the highest temperature optimum of the three species. At the temperature of maximum growth the mean rate of leaf elongation was 0.7-1.2 cm./day for fescue, 0.8-1.2 cm./day for silver and 0.9-1.6 cm./day for blue tussock.

These results were derived using the rate of leaf elongation as the growth parameter. Additional information was derived from trials using other growth parameters. Harvesting of whole plants (5-10 tiller size) of silver tussock at successive stages of the experiment showed that dry weight gain at 42°F. was 37 per cent. of that at 60°F.—a value almost identical with that obtained by the leaf elongation method. Micro-measurement of the basal perimeter of a plant of silver tussock of about 20cm. basal perimeter showed an increase of 0.20mm./day at 60°F. and 0.33mm./day at 42°F. This indicates that at a mean temperature of 42°F. either more or stouter leaves were formed but as shown previously their rate of elongation was less.

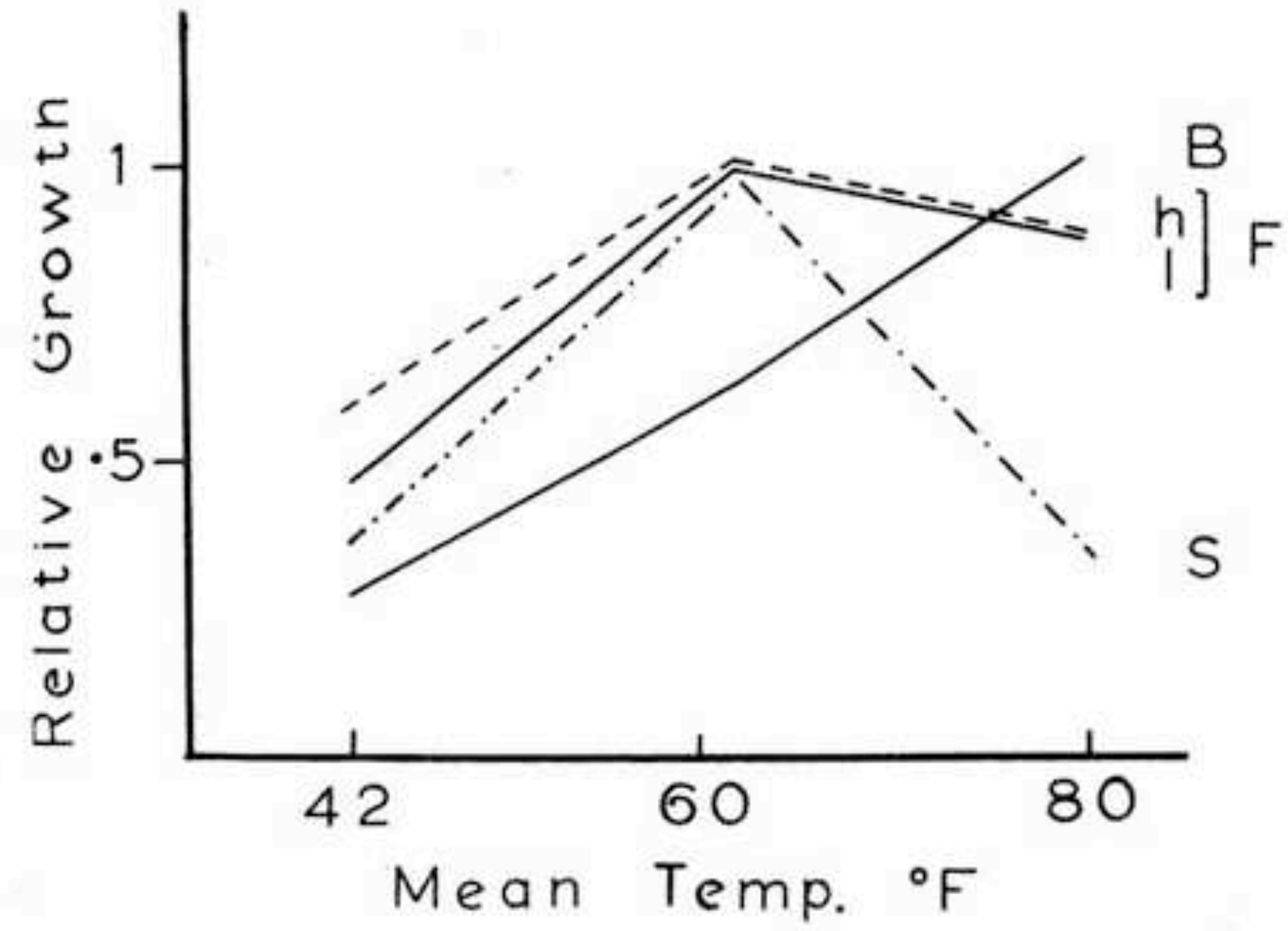

FIGURE 1. *Influence of temperature on rate of leaf elongation. B = blue tussock, F = high (h) and low (l) altitude forms of fescue tussock, S = silver tussock. Probable error of any point ±5%.*

This is supported by a further observation on one plant of each of the three species that were left in the cabinets of mean temperature of about 60°F. for 2 to 3 months. After this period all plants were much longer-leaved than similar plants that had been kept outside during a winter in Palmerston North.

While it is not safe to base too many ecological implications on the results from the four clones studied, the indication that silver tussock has much narrower temperature tolerance than fescue tussock might have been expected from consideration of the pattern of occurrence of both species in many areas. Also the high temperature optimum of the blue tussock is in keeping with its importance in low altitude vegetation of Central Otago.

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