

NOTES ON THE 1949 BEECH SEEDING

By A. L. POOLE

"That a large seed output may be essential for the survival of a species is shown by *Fagus sylvatica*. Commonly seedlings of this tree only persist in Britain in "mast" years when the number of progeny is so large that after the depredations of field mice and other enemies there still remains a residue that survive, whereas in the intervening seasons between the "mast" years the seedlings are entirely destroyed by their natural enemies." (Salisbury 1942).

A prolific flowering in the spring of 1948 was recorded in New Zealand throughout many parts of the range of *Nothofagus* except for the species *N. menziesii*. This flowering was particularly heavy in the Wellington-Wairarapa region. Certain areas in this district have subsequently been followed for seed-set and regeneration, and a number of records, necessarily disconnected, have also been collected or obtained from observers for other parts of the country. The following are notes of these records and of relevant observations.

The flowering of a plant is not necessarily followed by seed-set. For instance it has been recorded for the European beech, with which our southern beeches can be compared in flowering, seeding and regeneration habits, that prolific flowering is not necessarily followed by heavy seeding. Weather at the time of pollen-shed can affect pollen dispersal and so forth. *Nothofagus* flowers appear to be subject to frost damage, for mountain beech flowers at Tarndale, North Canterbury, growing almost at the limits of altitude and rainfall for this species, had flowering shoots killed by frost in November, 1947. J. T. Holloway (in litt.) also recorded that flowers of *N. menziesii* in Southland were destroyed by frost in 1947.*

Although the development of cupules and nuts normally follows flowering, in poor flowering seasons nuts of New Zealand *Nothofagus* are mostly empty. On the other hand in the good season of 1948-9 a proportion of the nuts, ranging up to seventy per cent on some trees, but from thirty to forty per cent on most trees, contained seed.

In New Zealand we have as yet no standard by which we can compare the relative weight of a beech seed crop as is done in Europe where foresters speak of full, half or quarter masts or crop failures. In size or weight of crop it is interesting to note that the beech shows a greater fluctuation than does any other European forest tree. Hartig (from Dengler 1935) quotes figures for a twenty year period

* In the *N. cliffortioides* forests bordering the northern and western slopes of Mt. Ruapehu an abundant flowering occurred throughout in October-November, 1948. Frosts of sufficient severity to kill new season's growth on small *Pinus laricio* at 2,800 ft. occurred during this period. Later it was observed that no seed formed above about 2,500 ft. Below this level seed was produced on *N. cliffortioides*, *N. solandri*, *N. fusca* and *N. menziesii*.—Ed.

from 1874-93 for Prussian forests, during which time masts occurred every six to eight years, or an artificial yearly average of 16.2% of a full mast. Further, outstanding masts occurred three times in the 19th century and in these years the crop was double that of any other year. In a good mast year beech was estimated to shed 522 seeds per square meter—436 seeds per square yard.

In the Wellington and Wairarapa districts the 1948 flowering was followed by what would seem to have been a good seed crop for *N. truncata* and *N. solandri* and a lighter crop for *N. fusca*. Cupules and nuts could readily be scraped from the forest floor under seed trees of the first two species. In the Wairongomai forest, west Wairarapa, J. Sansom (unpublished data) measured the seed fall. As an example of the data obtained a mixed *N. solandri*, *N. truncata* stand of trees with an average d.b.h. of 15 inches yielded the following fall of seed in a tray 1.5 sq. meters in area :

<i>Nothofagus solandri</i> seed	3,661	per sq. meter		
<i>Nothofagus truncata</i> seed	4,188	„	„	„
Undetermined seed	1,434	„	„	„
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Total seed	9,283	„	„	„

The total weight of seed was 79 gm. per square meter or the equivalent of about 700 lb. per acre. Although much greater in number of nuts this is a somewhat lighter crop than that quoted for European beech which works out at 117 gm. per square meter. The comparison is approximate only because both figures need to be adjusted for percentages of full and empty nuts.

In beech forests near the coast *N. solandri* and *N. truncata* seed commenced to germinate shortly after it fell in the late summer and continued to do so until late winter, after which little further germination occurred. The month of November could be regarded as the time when the peak number of seedlings were present ; i.e. after more or less complete germination and before dry weather began to kill seedlings off. It was then possible to gain some idea of the effectiveness of the seed fall for regeneration. Seed was to be seen germinating in all manner of places such as the axils of *Astelia* and kie kie leaves. Where it had accumulated on the ground in pockets by washing or blowing, patches containing over 100 seedlings per sq. ft. were to be seen ; but normally germination was much sparser than this—ranging from nil to about a dozen or so to the square foot depending upon ground cover and so forth.

In *N. fusca* forests at the southern end of the Tararua Range germination commenced about November, and was in the main much sparser than that of *N. solandri* and *N. truncata*. The germination in quantity of *N. menziesii* seedlings was recorded only from a few areas in the southern Tararuas.

In the places examined the flowering in the beech forests of Nelson and Marlborough did not appear to extend much above 2,000 ft. altitude. It was followed by a moderate set and at nut fall it was possible to collect from the forest floor. *N. fusca* in this district also appeared to have a light crop. In the northern part of the West Coast flowering was good. One farmer at Inangahua Junction whose house was surrounded by beech forest was familiar with good flowering seasons because then "the pollen came down so thickly on the roof as to colour the tank water." This had happened in the spring of 1948. Evidently seed set did not follow for it has been reported by forest officers from different parts of the coast that little or no germination of seed followed in the spring of 1949. J. T. Holloway stated (in litt.) that good to prolific germination took place in beech forests at Cora Lynn in the Upper Waimakariri. Earlier in the season heavy crops of nuts were seen at isolated places along the Canterbury foot-hills.

Reports from various localities in the beech forests of the Ruahines, Kaimanawas and adjacent districts indicate that a good germination of seed occurred throughout with the exception of *N. menziesii* which probably did not flower.* Two areas in the Inland Patea between these ranges were examined in detail. One known as the Tikitiki Bush at about 3,000 ft. on the Ngamatea Station consists of an island of beech surrounded by tussock. *Nothofagus cliffortioides* is the dominant tree with *N. fusca* in the gullies and on the flattish ridges. The presence of dense seedling, sapling and pole stands shows that regeneration has from time to time been very heavy. In January, 1950, the new season's seedlings of both species, possessing three to four leaves, were growing throughout the forest wherever trees were large enough to throw seed. For example a mature stand of mountain beech with close on four hundred stems per acre had on the floor an average of just over half a million seedlings from one to three feet high. Under these seedlings, dense as they were, this season's plants in numbers of one hundred and twenty to one hundred and sixty per square foot were present. In mixed mountain beech-red beech stands the number of new seedlings reached the same figures in limited patches only. This patchiness could be related to seed production and seed fall or to the condition of the forest floor for germination. It is often noticeable in beech forests that the reproduction of red beech is in patches, often corresponding to light wells.

In another isolated forest, Boyd's Bush on the Timahanga Station to the east of Ngamatea, fresh beech regeneration was present in the same amount as in the Tikitiki Bush. A mountain beech stand at 3,500 feet elevation was identical with that described above.

* Plentiful seeding and subsequent germination of *N. menziesii* has been observed in Rangataua State Forest, south of Mt. Ruapehu, in 1949.—Ed.

Further north at Tairua, Ranger Guthrie (in litt.) early in the season reported a heavy seed crop on *N. truncata*.

In the record of the 1948 southern beech flowering (Poole 1948) it was mentioned that the European beech around Christchurch and Wellington had also flowered well. Nut development followed but it was found that these contained a very low percentage of seed. Local observers in Canterbury attributed this to dry weather following flowering. The phenomenon however should be interpreted with caution because European beech trees are used arboriculturally in New Zealand and therefore frequently occur as isolated specimens. Isolated trees of both *Fagus* and *Nothofagus* around Wellington set no more than 1% of seed. A particularly interesting example, a *Nothofagus menziesii* tree which happened to be the only one of the species to flower in the Wellington Botanical Gardens, flowered exceptionally heavily and nuts developed, but in several hundred examined no seed had set and no germination of seed has occurred under the tree. The explanation of this would seem to be that the species concerned are self-sterile; European workers also think that *Fagus sylvatica* is partly self-sterile (P. C. Nielsen, Denmark, in litt.).

The natural enemies of southern beech seed have been added to since European settlement in New Zealand thus no doubt affecting regeneration. The crops of two quail taken at Lake Hawea by the Department of Internal Affairs in June, 1949, were filled mostly with mountain beech seed. Other instances of depredations on germinating seed have been recorded.

In the forests kept under observation the 1948 flowering was followed by a negligible or very sparse flowering in 1949, and apart from a few planted trees around Nelson and four malformed mountain beech trees noted by J. T. Holloway no records of good flowering in 1949 have been heard of.

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