THE ECOLOGY OF CALIFORNIAN THISTLE

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Possibly because of its widespread distribution, Californian thistle (*Cirsium arvense*) is known by many names. In New Zealand it is usually called Californian thistle or Canadian thistle. In other countries it is called creeping thistle, field thistle, corn thistle and Canada thistle.

Californian thistle is a perennial plant that extends by means of underground stems from which arise roots and aerial stems. The underground stems may extend considerable distances and contain food reserves which enable the plant to survive over the dormant winter period and during periods of drought. The above ground parts which may reach a height of 5ft. or so die back to ground level each autumn. The plant is dioecious, that is, the male and female organs are produced on separate plants. This fact is of some importance when considering control measures.

Of European origin, Californian thistle was introduced into New Zealand at least 70 to 80 years ago, its rapid spread creating much attention and concern. While there is no certainty as to when it was introduced it appears from reports that this took place about 1870 to 1880. In 1894 it was stated, "It is believed to have been introduced into New Zealand about sixteen years ago, and about nine or ten years since began to force itself on the notice of settlers. It may now be found in most parts of the colony, especially of the South Island, and is rapidly spreading in the North Island also." [1].

In 1901 it was reported of a farmer in South Otago that "he had spent over £150 this season in dealing with the weed on some 3000 acres, mostly swamp land." [2]. It was stated that he had been fighting against this weed for 20 years and that it was still steadily gaining ground. This also points to its introduction having taken place before 1880.

The fact that the spread of Californian thistle was regarded seriously is shown by the fact that in 1894 the Government "offered a bonus of £250 for an effective eradicator." [3].

Detailed information is lacking on the question of both where Californian thistle was first introduced and where its most rapid spread took place. Although attention was first focussed on it in the South Island it does not necessarily follow that it was there that the first introduction took place. The general position is, however, stated in an 1895 report: "Californian thistle appears to me to be the most important weed with which farmers have to deal, the difficulty of eradication being so great. It is to be found in places nearly all over the South Island and it has practically taken possession of hundreds of acres of good land in the Inch-Clutha and Clutha district generally and is gradually spreading everywhere . . ." [4].

At about the same time it must, however, have still been somewhat of an uncommon novelty in some areas. If it had not been so, the following method of control which was stated to be effective would certainly not have been considered worth reporting. The method of control was this "to raise a small dam round the patch and flood it, letting the water lie until the roots rot. I have seen this tried and where the water was one foot deep there was no sign of the thistle." [5]. This report came from the very dry district of Kurow.

It is apparent that by 1901 Californian thistle had become widespread in both islands. It was "firmly established" in Tauranga, "one of the principal weeds" in New Plymouth and "prevalent" in the Hunterville

district. In some districts such as Auckland, Gisborne, South Wairarapa, Wellington and Nelson it was uncommon while in the Whangarei area it was quite unknown.

The fear of Californian thistle is demonstrated by the fact that about 1900 one farmer sold his farm at quite a low price on account of the trouble that he had experienced with the thistle.

It is of considerable interest to note one report which, relating to an infestation in Marlborough, states: "The Californian thistle has been growing for the past nine years, to my knowledge, on the Seymour's embankment in grass pasture, and is disappearing year by year, being fed very close." [6]. This is an indication, but without explanation, that sowing down to pasture tends to reduce the amount of Californian thistle, at least to some extent.

Subsequent reports show clearly that Californian thistle had spread to such an extent that its control, let alone eradication, was almost impossible.

In 1901 the Noxious Weeds Act was passed and it is likely that the spread of Californian thistle had much to do with its enactment. Nevertheless, in spite of the efforts of inspectors and farmers, and these efforts were very considerable, the weed continued to spread.

At the present time California thistle is dispersed throughout most districts throughout the country. An interesting exception is North Auckland where it is still uncommon.

Early efforts to control Californian thistle relied firstly on the prevention of seeding by cutting down the flowering stems, and secondly on various cultivation methods aimed at the killing of the underground stems. Many other methods, particularly by means of chemicals, were tried. Common salt, if applied heavily enough, killed the thistle. Sulphuric acid, copper sulphate, carbolic acid, sodium arsenite and probably many other chemicals were tried without success. In later years sodium chlorate was advocated for the control of relatively small patches.

One practice that was used in arable districts consisted of the avoidance, when ploughing, of patches of thistle and the covering of these with straw at or after threshing time.

About 1910 much interest was taken in the control of the thistle by means of one or more fungi. While this was initially regarded as a "forlorn hope" [7] experiments were carried out for a number of years in the hopes that some beneficial results would ultimately be secured. By 1915 these experiments had shown the way in which the disease could be introduced but spectacular kills could not be assured.

In 1927 Dr. G. H. Cunningham summarised the results and pointed out that, at best, the artificial spread of fungi was likely to affect only 50 per cent. of the treated plants in the following year. His conclusion read "that with our present knowledge and technique it is not possible to use in the economic control of weeds and insects fungi which occasionally attack them under natural conditions . . . The evidence produced indicates that it is but a waste of time to proceed with experiments along these lines." [8].

About 1916 there commenced the advocating of sowing lucerne on areas infested with the thistle. This advice was widely given and was undoubtedly sound for areas where lucerne could be grown successfully.

At about the same time it was becoming more generally recognised that sowing to pasture was a good procedure and also that the weed was most feared in districts where it had not yet become abundant.

As a weed becomes more and more firmly established and widespread opinions often tend to be modified. This is due to the fact that a plant

may be a serious pest in one district and a relatively useful one in another. In 1917 the opinion was expressed of grassland of extremely poor carrying capacity that the control of Californian thistle is not advisable because "thistles on such land, provided they will continue to grow, do more good than harm and may finally lead to the production of quite fair grass land." [9] This referred particularly to the depleted land of Central Otago.

Californian thistle is now accepted as one of the common thistles and as a permanent problem. Interest in its control has, however, revived very greatly in the last few years because recently developed chemicals have rendered its control both physically possible and financially profitable. These two conditions did not apply previously.

Means of Spread

There is little doubt that Californian thistle was introduced and spread throughout the county as an impurity in agricultural seeds. Some people consider that its seed will not germinate. Unfortunately this is contrary to fact.

Because the down is rather insecurely attached to the seed, it is unlikely that the wind has played a major part in its distribution. Its major means of dispersal has undoubtedly been as an impurity in seed, hay and chaff. In 1911 it was considered that at least 50 per cent. of the alsike imported into New Zealand contained seed of this weed. Analysis showed that 5 samples of alsike contained from 3 to 32 seeds of Californian thistle per pound. [10].

In 1918 an instance was given of a line of dogstall which, if sown at the rate of 3lb. per acre, would introduce 4 seeds per square yard of Californian thistle. [11].

Right from the early days up to the present time the sowing of "dirty seed" has been blamed as the main reason for the distribution of Californian thistle.

Farming in the South Island can be divided very roughly into 3 phases. First, the phase of grazing the natural grassland. Second, the phase of cropping and short-lived pasture. Third, the phase of longer-lived pasture and less cropping.

It was unfortunate that Californian thistle was introduced before or during the second phase, because this style of farming was ideally suited to its spread both by seed and vegetatively. The constant cultivation kept the soil loose and enabled the thistle, not only to be spread by implements, but also to increase much more rapidly underground. In addition, the areas in crop with the absence of grazing enabled the thistle to set seed without interference.

On the other hand in more recent years when pastures have tended to stay down longer and to carry more stock Californian thistle has become more manageable. There are many instances recorded where under good pasture Californian thistle has virtually disappeared. Competition from both the pasture plants and the stock has been greater. In addition the consolidation due to both the trampling by animals and the longer duration of the pasture has reduced its rate of spread underground. The present position with regard to Californian thistle appears to be that it is likely to remain a major pest on arable land. On grassland it is likely to become a decreasing nuisance where the soil compacts readily but it is probable that it will remain a pest of grassland on soils that do not compact or that are not capable of carrying good pasture.

Control measures for any weed should aim at the weakest points in its life cycle. For Californian thistle the points appear to be these:—

1. Reduced chance of establishment from seed in a good dense sward.
2. The fact that it dies down to ground level each winter.

3. The fact that the tighter the soil packs the less is the chance of the thistle extending.
4. The susceptibility of the thistle to modern weed killers.

References

- (1) Annual Report N.Z. Department of Agriculture, 1894, p. 64.
- (2) Annual Report N.Z. Department of Agriculture, 1901, p. 147.
- (3) Annual Report N.Z. Department of Agriculture, 1894, p. 66.
- (4) Annual Report N.Z. Department of Agriculture, 1895, p. 2.
- (5) Annual Report N.Z. Department of Agriculture, 1894, p. 38.
- (6) Annual Report N.Z. Department of Agriculture, 1901, p. 113.
- (7) New Zealand Journal of Agriculture, vol. 1, p. 214.
- (8) New Zealand Journal of Agriculture, vol. 34, p. 251.
- (9) New Zealand Journal of Agriculture, vol. 14, p. 472.
- (10) New Zealand Journal of Agriculture, vol. 2, p. 133.
- (11) New Zealand Journal of Agriculture, vol. 16, p. 369.