

initially to botanical change by selectively killing carpet grass and hence favouring the more productive paspalum. Under local conditions, species such as white clover which are actively growing during peak frond emergence in spring may be useful in favourable years. Summer-growing legumes such as 'Siratro' (*Macroptilium atropurpureum*) and 'Archer' Dolichos (*Macrotyloma axillare*) may also aid in control of bracken and increase pasture productivity. Oversowing and topdressing should be tested with and without the aid of herbicides for bracken control in non-arable areas.

#### SOME FACTORS INFLUENCING THE GERMINATION OF SLENDER THISTLES

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It has been generally accepted that seeds of slender thistles (*Carduus pycnocephalus* and *C. tenuiflorus*) germinate in autumn, winter and spring and, therefore, chemical control measures, if applied in the autumn or winter, would need to be repeated in the spring. Alternatively, if spraying is delayed until the spring, the plants which germinated in the autumn are well established and are not readily controlled with the commonly recommended phenoxy herbicides. Further, the rates necessary to give worthwhile control cause severe damage to pasture legumes.

Laboratory studies have explored some of the factors (moisture, temperature, light) which control seed germination in slender thistle. When fresh seed (approx. 1 month old) is imbibed it germinates rapidly at 10 and 20°C in light but not at 30°C in light, where a delay mechanism prevents germination for 20-30 days. This mechanism probably protects the seed from germinating as a result of summer thunderstorms when seedling survival is not likely due to subsequent moisture stress.

Fresh seed, imbibed and kept in the dark, does not germinate at 20 and 30°C and has a low germination at 10°C. This seed will remain dormant for over 1 year if kept imbibed in the dark and this dormancy is broken on exposure to light or if seeds are mechanically damaged by pricking.

Seed which has been stored dry for several months germinates well in either light or dark at all temperatures from 6° to 36°C and, in many cases, all viable seed will germinate. It would be expected, therefore, that when the autumn rains occur, seeds in the soil would become imbibed and most would germinate. Field studies have shown that germination occurs immediately after the autumn rains but up to 50% of the seeds in the soil may be dormant even though they are fully imbibed. This dormancy can be broken by removing the seed coat and hence it is not embryo dormancy. It is also removed by pricking, by drying and reimplantation and, to some extent, by treatment with gibberellic acid and ethylene. In contrast to fresh seed imbibed and kept in the dark it is of note that this dormancy is not broken by exposure to light.

In a year of normal rainfall distribution these dormant seeds would remain imbibed during winter, spring and early summer and dry out during summer. This drying out probably damages their coats thus allowing germination when they are reimplanted in the autumn. In field studies extending over 2 years, no seedlings have been observed in the field in either winter or spring and it is quite clear that virtually all germination occurs immediately after the autumn rains. There is some other germination in summer after thunderstorms, probably from seeds more than 1 year old.

It is clear that the most practical time to attempt chemical control of slender thistle is about 1 month after the autumn break when all seeds which are going to germinate for the year have germinated. Ideally, the chemical used should kill seedling thistles but not seedling sub. clover and grass. Low rates of diquat meet this requirement.