THE EFFECT OF FERTILISERS AND PASTURE COMPETITION ON GORSE GROWTH AND ESTABLISHMENT

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Summary

White clover *(Trifolium repens)* gave better suppression of establishing gorse *(Ulex europaeus)* than ryegrass *(Lolium perenne)*. Gorse responded strongly to phosphate and less so to potash. Nitrogen and lime retarded gorse seedling growth while established plants showed a positive response to nitrogen but not to lime.

INTRODUCTION

Although gorse *(Ulex europaeus)* is a most aggressive and persistent scrub weed species on much steep, low fertility country where the climate is moist and mild, remarkably little is recorded about its response to the management practices imposed on the introduced pasture species with which it occurs. Almost all practical gorse control recommendations stress the importance of a vigorous pasture as a defence against gorse invasion but apparently no detailed studies of competition effects have previously been undertaken. Similarly, although it is generally accepted that gorse regeneration is of little consequence under high fertility conditions, no information was available about the effect on gorse of applied fertiliser in low fertility situations. Trials to obtain information on these aspects of the gorse-pasture relationship are described in this report.

EXPERIMENTAL

Pasture competition and defoliation study.

Gorse seed which produced approximately 150 seedlings/m^2 was sown on 17.2.72 with ryegrass *(Lolium perenne)* seed at rates of 0, 5, 10, 20 and 40 kg/ha and with white clover *(Trifolium repens)* seed at 0, 1, 2, 4 and 8 kg/ha in separate ryegrass and clover trials. Subtreatments of (a) frequent trimming (pasture species and gorse seedlings mown to 1 to 2 cm at approximately weekly intervals to simulate grazing) and (b) lenient trimming (ryegrass or clover cut to just above the gorse at 2 to 3 week intervals) were superimposed on all seeding rate treatments of both pasture species. Gorse seedlings were counted and assessed for growth at approximately three month intervals during the one year term of the trial.

Fertiliser response trials.

The response of gorse to fertiliser was studied in a series of factorial trials in which combinations of phosphate (54 kg P/ha), potash (150 kg K/ha), nitrogen (66 kg N/ha plus 33 kg N/ha where indicated) and lime (3000 kg/ha ground limestone) were used throughout. The response of seedling gorse to these elements was examined in a container trial using a low fertility Horotiu sandy loam (pH 5.0, Ca 1, K 3, P 1) into which gorse seed was sown on 12.2.73 and in a field trial on the same soil to which fertiliser treatments were applied with gorse seed sown in 17.4.73, (in both trials 66 kg N/ha applied at sowing plus 33 kg/ha in September 1973). Seedling growth was weighed, measured or pointed at intervals during the succeeding year.

Mature gorse responses were also measured in a trial where the fertilisers were applied on 7.9.73 to 18 month old, 0.5 m high gorse plants growing in containers of low fertility Horotiu sandy loam and in a companion field trial with regrowth gorse on low fertility Komata clay loam (pH 5.5, Ca 3, K 8, P 1). To determine responses new growth on four branches from each plant was measured and weighed approximately three and a half and seven months after treatment.

Fertiliser x pasture competition trials.

In a factorial trial on low fertility Horotiu sandy loam phosphate, potash, nitrogen and lime at rates as above were applied when a mixture of gorse seed, ryegrass seed (20 kg/ha) and white clover seed (2 kg/ha) was sown on 17.4.73. An additional 33 kg N/ha was applied 3.9.73. Pastures and the gorse seedlings in them were mown to obtain yield data until the trial was terminated by dry conditions in December 1973. Gorse seedlings were counted in winter and spring.

RESULTS

The relative effects on gorse seedling survival of ryegrass and white clover competition under frequent close cutting and under lenient cutting are given in table 1.

TABLE 1: EFFECT OF PASTURE SPECIES COMPETITION AND DEFOLIATION ON SEEDLING GORSE (GORSE SOWN 17.2.72)

Ryegrass seed (kg/ha)	*Percent survival (100 = seedlings at 21.3.72)*					
	Frequent trim			*Lenient trim*		
Counted:	*21.8.72*	*21.11.72*	*14.2.73*	*21.8.72*	*21.11.72*	*14.2.73*
0	70	44	40 aA	92	61	50 aA
5	37	27	24 bB	56	43	37 bB
10	22	16	15 bB	35	20	18 cBC
20	24	14	13 bB	36	22	20 cBC
40	23	15	14 bB	23	9	7 dC
White clover (kg/ha)						
0	82	43	41 aA	80	52	48 aA
1	70	29	9 bB	71	30	12 bB
2	57	9	2 bB	63	26	10 bB
4	48	8	0 bB	62	20	5 bB
8	47	2	0 bB	52	19	4 bB

Under frequent close trimming ryegrass competition reduced the number of basal side shoots on surviving gorse plants by approximately 60% with only slight differences between the seeding rates, while clover competition even at the lowest rate of seeding almost completely inhibited basal branching. Lenient trimming of both ryegrass and clover prevented the development of basal shoots by the young gorse plants but those which survived into the summer were able to develop lateral branches higher on the primary stem.

As ryegrass vigour declined in the late spring the sward became much more open on both frequent and leniently trimmed treatments and offered little competition to gorse, so that at all ryegrass seeding rates the mortality of gorse after November was negligible.

In addition to its direct competitive effect the dense succulent clover cover produced a moist micro-climate extremely favourable to the development of a stem rot fungus identified by Plant Diseases Division, D.S.I.R., as *Rhizoctonia* spp which attacked and destroyed many gorse plants under both cutting regimes.

Tables 2 and 3 respectively show the responses to fertiliser of seedling and mature gorse.

TABLE 2: GORSE SEEDLING RESPONSE TO FERTILISER (WEIGHT, HEIGHT AND NUMBER OF BRANCHES AS PERCENT OF NIL FERTILISER, MEAN OF 16 REPLICATIONS, GORSE SOWN 12.2.73)

	Assessed 22.6.73		*Assessed* 2.2.74		
Element	*Weight*	*Height*	*Weight*	*Height*	*Branches*
Phosphate	185**	156**	245**	136**	242**
Potash	107	102	115*	100	100
Nitrogen	94	96	135**	118**	106
Lime	96	95	102	101	97

* response significant at 5%.
** response significant at 1%.

TABLE 3: MATURE GORSE RESPONSE TO FERTILISER (WEIGHT OF NEW GROWTH AND HEIGHT AS PERCENT OF NIL FERTILISER MEAN OF 16 REPLICATIONS)

	Assessed 20.12.73	*Assessed* 4.4.74	
Element	*Weight*	*Weight*	*Height*
Phosphate	111	123**	111*
Potash	100	104	101
Nitrogen	100	105	104
Lime	100	100	100

* response significant at 5%.
** response significant at 1%.

Nitrogen applications completely inhibited nodulation of seedling gorse and greatly reduced the size and number of nodules on mature gorse.

Table 4 shows the mean pasture production for the May to August and September to November periods from pastures sown on 17.4.73, and also the mean numbers of gorse seedlings present at counts on 9.7.73 and 26.10.73.

On a section of the trial where pasture was less severely affected by the drought conditions gorse survival through the summer under a variety of fertiliser treatments was good, even on plots where nitrogen applications had earlier caused severe mortality.

TABLE 4: EFFECT OF FERTILISERS ON PASTURE-GORSE COMPETITION (PASTURE GREEN YIELDS (kg/ha) AND GORSE SEEDLING NUMBERS/m^2

		May-August		*September-November*	
Phosphate		— P	+ P	— P	+ P
pasture		1000	5700	5900	8600
gorse		40	19	28	18
Potash		— K	+ K	— K	+ K
pasture		4700	5500	6400	8000
gorse		28	31	21	25
Nitrogen		— N	+ N	— N	+ N
pasture		4400	5800	5000	9500
gorse		32	28	31	16
Lime		— L	+ L	— L	+ L
pasture		5200	4900	6900	7600
gorse		31	28	25	21
Phosphate x Nitrogen		— P	+ P	— P	+ P
pasture	— N:	900	4800	4200	5700
	+ N:	1000	6500	7600	11400
gorse	— N:	35	21	35	26
	+ N:	45	18	22	9

DISCUSSION

Table 1 shows that, except at the highest rate of ryegrass seeding, frequent close trimming had an appreciably more severe effect on gorse survival than had lenient trimming, even though the latter regime by allowing the pasture species to overtop the gorse until well into the spring, represented a more extreme competitive situation for the gorse plants. Ryegrass competition although fairly severe during the winter-early spring period was ultimately, considerably less damaging to the development gorse plants than was competition from clover.

Because frequent trimming reduced and equalised grass competition, increases in the rate of ryegrass seeding had a relatively slight and non significant effect on gorse seedling mortality, but where trimming of the competing ryegrass was lenient the effects of grass competition were significantly increased by higher rates of ryegrass seeding. However, under both trimming regimes the seasonal decline in the competitive vigour of ryegrass which coincided with the late spring acceleration in gorse growth, allowed surviving gorse plants to make relatively unrestricted growth through the summer.

In contrast, because of limited growth, white clover caused only about half the gorse mortality of ryegrass during the winter period but had much more severe competitive effects throughout the spring and summer. This sustained competition, combined with the effects of fungi for which clover provided a favourable micro-climate, eliminated gorse in situations of extreme competition and repeated defoliation. Where clover trimming was lenient some gorse plants were able to survive the fungal attack and were sufficiently vigorous to grow ahead of the competing clover.

Tables 2 and 3 show that gorse exhibits fairly typical legume responses to fertilizer. Phosphate very markedly increased weight, height and density, particularly in the seedling and juvenile stages, while potash gave an increase in plant vigour with little effect on height or density. Nitrogen completely inhibited nodulation in seedlings and initially retarded growth but established plants rapidly adapted to utilise the applied nitrogen and, especially at the juvenile stage, responded very significantly to it. The initial development of gorse seedlings was appreciably retarded by lime but the growth of established plants was unaffected by this element.

Data from the fertilizer x pasture competition trial, summarised in table 4, has provided some useful preliminary information about the inter-relationship of gorse, pasture and fertilizer in a low fertility situation. The P x N interaction section of the table indicates that where nitrogen is particularly deficient in the spring, even the fairly high rate of phosphate used in this trial was unable to maintain pasture competition at a level adequate to suppress further gorse seedling invasion. This is of interest as it suggests a reason for the persistant re-invasion by gorse of low fertility sites.

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