BARLEY GRASS SEED VIABILITY STUDIES AT TWO SITES IN OTAGO

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Summary

Germination studies of barley grass (*Hordeum murinum*) seed were carried out on seed collected over three seasons at two sites in coastal and Central Otago. Greater quantities of seed but of lower viability were found in Central Otago, while the smaller numbers of seeds at the coastal Otago sites were offset by higher viability. It was concluded that barley grass eradication programmes based on the spring application of non-persistent grass killers such as paraquat or dichloropropionic acid were likely to fail through reinfestation from viable seed.

INTRODUCTION

THERE is little published information on the germination characteristics of barley grass (*Hordeum murinum*). Harris (1959) presented the results of one seed study in the 1958–9 germination season using seed gathered from the field. He found that there was a rapid decline from the high initial viability of fresh seed (90% or better) to 40% by the end of the winter period (July). Few seeds were found in November, but they were of high viability and were assumed to be from early ripening seedheads in the vicinity. He concluded that buried viable barley grass seeds in significant numbers do occur, and that they may last over one winter, but certainly no longer.

On the basis of this work, it was assumed that if, on any one property, one could completely control all germinated plants of barley grass in spring, then the weed would be eradicated on that property because there would be no carry-over of seed to perpetuate the nuisance. Two eradication programmes are known to have been attempted (Invermay and Rukuhia), but both failed for various reasons — *e.g.*, small areas not noticed and missed at spraying, poor kill of rank barley grass, and some re-infestation suspected after early spring spraying. One of the conclusions drawn from this work was that more specific knowledge was needed on the potential for reinfestation from spring germinating barley grass.

This report deals with results of three consecutive years' testing of barley grass seed taken from sites on the Taieri Plain (coastal Otago, a mild coastal climate with a well distributed 26 in. annual rainfall pattern), and on the Maniototo Plain (Central Otago, a semi-arid climate with a 17 in. annual rainfall showing a pronounced summer maximum and winter minimum).

EXPERIMENTAL METHOD

Seed was extracted from approximately ten turf samples each 36 sq. in., at about monthly intervals between March and November from the same area heavily infested with barley grass in any one year.

The seed was sorted and poor seed, consisting of empty glumes or discoloured and apparently empty glumes, was discarded. Good seed had clean, straw-coloured glumes enclosing a firm, apparently healthy, caryopsis.

Occasional checks on poor seed always indicated very low viability. During the 1964 sampling the numbers of poor seeds were recorded. The proportion of poor seeds is shown in Table 1.

TABLE 1: PERCENTAGE OF POOR QUALITY SEED, TAIERI AND MANIOTOTO, 1964

Maniototo		*Taieri*	
Date	*% Poor Seeds*	*Date*	*% Poor Seeds*
Jun. 11	34	Jun. 23	32
Jul. 17	42	Jul. 14	21
Aug. 11	81	Jul. 31	28
Sep. 7	86	Aug. 20	30
Sept. 23	90	Sep. 10	53
Oct. 20	89	Oct. 7	46
		Nov. 3	48

The number of seeds was so great at the 1963 Maniototo site that only 100 good seeds per sample were extracted until October 11, 1963, sampling when seed numbers dropped to an average 46 per sample. At Taieri also in 1963, from the first two samples (March 19, 1963, and April 2, 1963) only 100 good seeds per sample were extracted. By April 18, 1963, seed numbers were at more reasonable levels.

Apart from the above instances, all good seeds from each turf were counted and then tested for viability at the Department of Agriculture Seed Testing Station, Palmerston North. Viability was tested in a Copenhagen type germinator (8-hour day at 25°C — 16 hour night at 18°C).

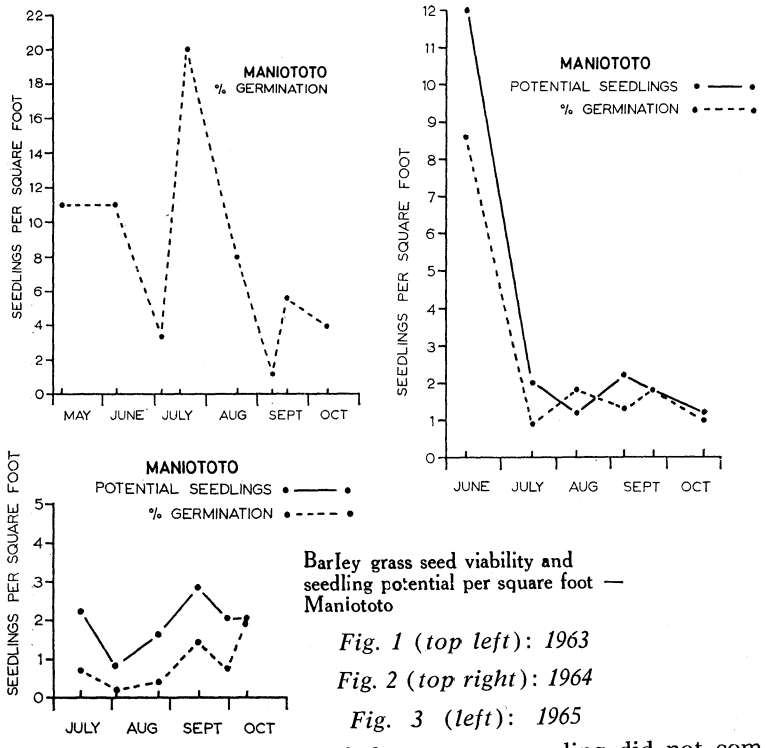
Only the final germination results at 28 days are considered in this report, there being little difference from interim (14 days) while abnormal growths were negligible.

RESULTS

Germination Capacity

Figure 1 shows the average final germination % for the 1963 Manioto site. In this it can be seen that germination is very low, commencing at 5% and reaching very low levels before the final sampling in October which averaged 2% final germination (there is no explanation for the anomalous result of July 19). Figures 2 and 3 show 1964 and 1965 values, respectively for Maniototo sites. Apart from a peak of 8% commencing in June, 1964, all values for these two years are extremely low, ranging between 1 and 2%.

Final germination values for Invermay (Figs. 4, 5 and 6) are considerably higher. During the first year (1963), sampling commenced in March soon after maximum seed fall. Germination capacity tended to rise as the winter months approached, reaching a peak in June, dropping during the mid-winter months, and rising again with the onset of spring. This pattern is similar in the years 1964



Barley grass seed viability and seedling potential per square foot — Maniototo

Fig. 1 (top left): *1963*

Fig. 2 (top right): *1964*

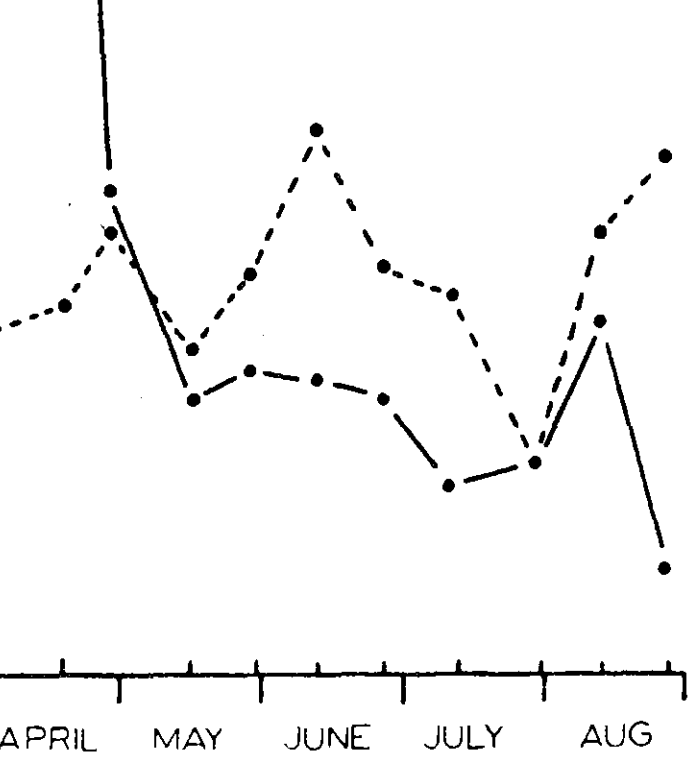
Fig. 3 (left): *1965*

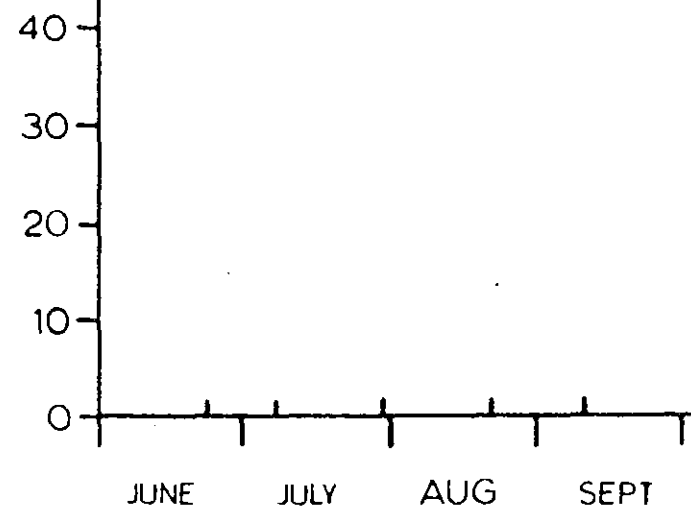
and 1965, although in both of these years sampling did not commence until after the autumn germination had occurred. In all three years at Invermay, germination was as high in spring as in the previous autumn — that is, about the 60% level.

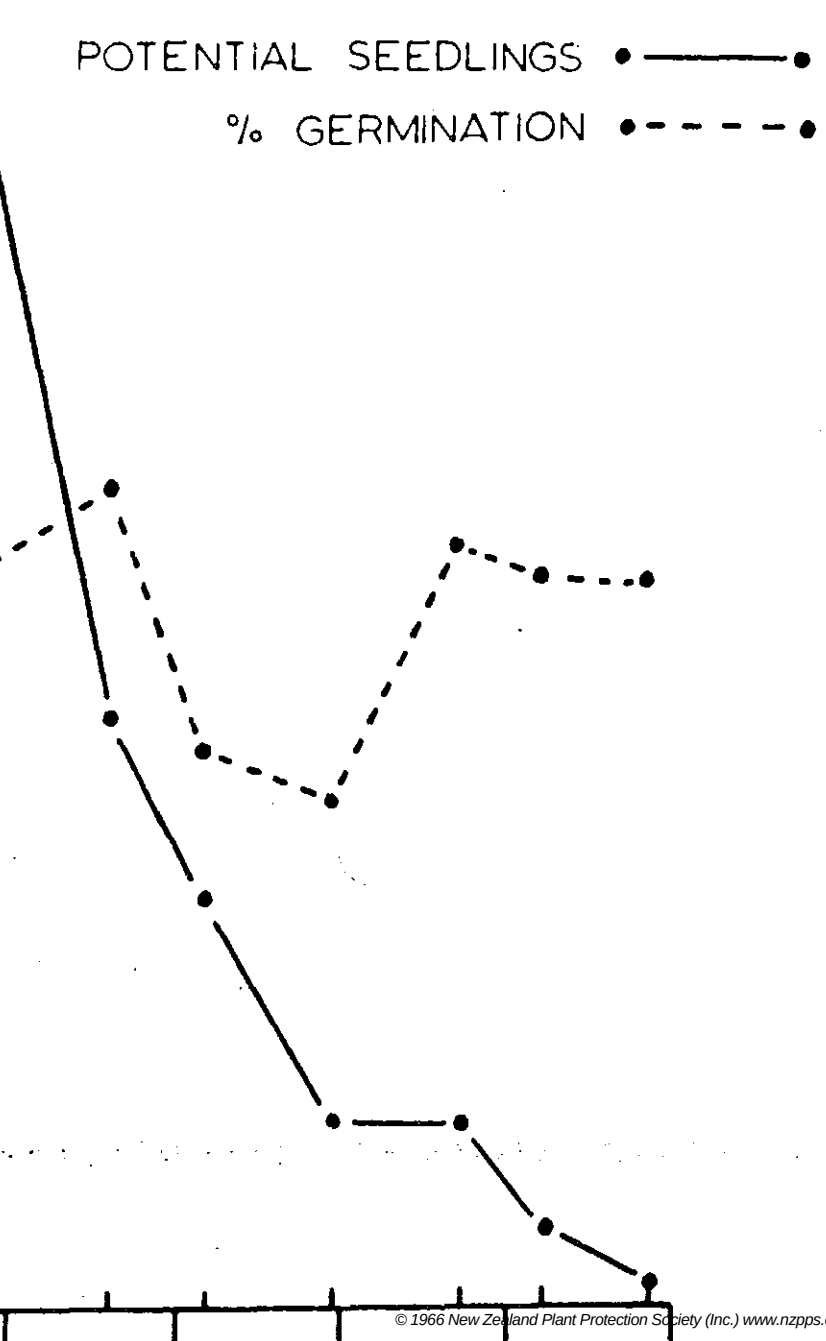
Seedling Potential

On the 1963 Maniototo site, good seed numbers from sample areas were over 400 sq. ft; thus seed numbers were not recorded except for one occasion (August 18, 1963) when a typical sample area was fully recorded and yielded over 4,000 apparently good seeds per square foot.

In the following years, seed numbers per sample were low enough to be recorded; thus, by combination with the germination percentage, the potential number of viable seedlings per square foot has been estimated (see Figs. 2, 3, 4, 5 and 6). A typical pattern emerges for both Invermay and Maniototo in all years, in that a very high peak seedling potential in late autumn rapidly falls (usually in July) to much lower levels. At Invermay, the seedling potential continues to fall over the winter months with a slight rise in spring (*i.e.*, about September). This tendency for a slight rise in seedling potential can, in fact, be seen on all sites for the three years sampled. However, while potential patterns are similar for Taieri and Maniototo, the fall is largely due to different reasons: (a) A drop in germination in the Maniototo; and (b) A drop in numbers of good seeds in the Taieri.







Barley grass seed viability &
seedling potential per squar
Invermay

Fig. 4 (top left):

Fig. 5 (top right):

Fig. 6 (left): 19

TABLE 2: CLIMATIC DATA FOR MANIOTOTO AND TAIERI

	Rainfall — Monthly Av. (in.)		*Temperature — Av. Daily Min. (°F)*	
	Maniototo	*Taieri*	*Maniototo*	*Taieri*
Jan.	2.2	2.4	40	44
Feb.	1.9	2.5	40	43
Mar.	1.5	2.7	37	40
Apr.	1.5	2.2	33	37
May	1.2	2.2	27	31
Jun.	1.1	2.4	24	29
Jul.	0.9	2.0	22	28
Aug.	1.1	1.5	24	28
Sep.	1.1	1.5	28	32
Oct.	1.7	1.8	32	36
Nov.	1.5	2.8	36	40
Dec.	1.9	2.6	39	43
Year	17.6	26.5	32	36

However, this may partly be a characteristic of the sites chosen for sampling rather than the effect of climate on plant density or seed yield per plant. Even so it is reasonable to assume that the nature of the Maniototo climate, plus the more open nature of the swards there, results in much lower seed deterioration or wastage through bacterial or fungal rots: in addition, there is much less bird life there, thus losses in this sphere could be lower. Furthermore, it has also been noted that any organic matter on the soil surface is very slow to break down, so this may mean that there is a carry-over of seeds from year to year, in which case this could be the reason for major differences in mean seed viability between the Taieri and the Maniototo.

However, the fact that viable seeds may be present as late as the end of October is most important.

In Central Otago, as typified by the Maniototo area, this indicates that present Department of Agriculture recommendations for control of barley grass in lucerne are reasonably sound, in that spraying should be delayed until the lucerne is coming away in spring and has 2 to 4 in. of growth. This generally occurs in late September/early October, by which time seedling potential is at a very low level. Although there is still chance of some seedling reinfestation, it would appear most probable that competition and shading by the developing lucerne crop would reduce or eliminate the chance of any remaining barley grass seed germinating or developing in the base of the crop.

On the other hand, it is probably unlikely that barley grass in lucerne stands would germinate any later than early to mid-October because the shading from lucerne 4 to 6 in. high would be great enough to discourage germination.

In coastal districts as typified by the Invermay area, it would appear highly probable that in some seasons there is considerable potential for reinfestation from viable seed as late as September or even October. Because application in coastal districts is usually directed against infestations on stock camps, shelter belts, etc., there is little subsequent competition from desirable pasture species. Thus, it may be that greater attention should be paid to control of the barley grass by cultivation in late spring to destroy estab-

lished plants, bury viable seed and also to establish desirable pasture species by drilling or broadcasting. Alternatively, herbicides with longer residual effect could be used.

CONCLUSIONS

(1) Viable barley grass seed may persist in coastal Otago until the September-October period.

(2) In Central Otago more substantial quantities of seed may persist, but of extremely low viability and a very low potential for seedling reinfestation in late spring.

(3) Because of the above findings, eradication programmes based on the spring application of non-persistent grass killers such as paraquat or dichloropropionic acid are likely to fail through reinfestation from viable seed.

ACKNOWLEDGEMENTS

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REFERENCE

Harris, G. S., 1959: *Proc. 12th N.Z. Weed Control Conf.*: 85.