LONGEVITY OF BARLEY GRASS SEED

P. J. RUMBALL

*Research Division, Department of Agriculture,
Palmerston North*

Summary

Barley grass (*Hordeum murinum*) seeds were planted out on sites in the Waikato, Hawke's Bay, North Canterbury and Central Otago districts in late summer. By early winter, germination and decay had accounted for most seeds although 25% remained viable in Central Otago. At the end of one year, all areas had nil or less than 0.5% viability.

INTRODUCTION

THE DYNAMICS of seed populations is of particular interest in the control of short-lived weed species. Some such work has been carried out in New Zealand on barley grass (*Hordeum murinum*).

Harris (1959) sampled seven barley grass habitats in the Manawatu on three occasions—July, November and March. He concluded that there was "virtually no carry-over of seed from year to year". Subsequently he found no evidence of short- or long-term dormancy in seed which had ripened on the plant (Harris, 1961). Meeklah (1966) collected data on size and viability of seed populations from sites in Central and Coastal Otago over a three-year period. Sampling occurred at various intervals between the seasons of seed fall. Relatively small numbers of viable seeds persisted until later spring in both areas.

Turf samples were taken to estimate seed numbers in both studies reported above. Such techniques did not overcome the difficulty of isolating seed of successive generations. No indications of accuracy were given. This could be expected to decline as the seed population falls to low levels.

In the study reported here, a known number of seeds in containers were planted out in a range of environments. Retrieval of these at intervals over one year gave additional information on the fate of barley grass seeds in the field.

EXPERIMENTAL

A single line of field-ripened barley grass seed was collected and machine dressed. Well-filled seeds were selected by eye and placed in lots of 100 in envelopes of absorbent paper. These in turn were placed in flattened covers of fine wire-cloth measuring 15 × 10 cm. Seeds could thus be in close proximity to soil particles with the seedlings unrestricted in their growth.

Two farms were selected in each of four regions—Waikato, Hawke's Bay, North Canterbury and Central Otago. Plots were pegged out on a stock camp and on an adjacent off-camp area. Twenty-four containers were buried in each plot to depths of about 3 cm.

It was intended to recover four replicates per plot at six intervals over a two-year period. So little seed remained after 12 months that all remaining containers were retrieved. Sampling intervals were thus one, two, six and twelve months after laying down in late February 1970.

For the first two samplings, all seeds were accounted for and classified into germinated, dormant or decaying groups. This could not be done subsequently with reasonable confidence, and interest was confined to those seeds retaining dormancy.

Paper envelopes could generally be removed bodily from their wire containers and placed directly on to germination pads. Viability of field dormant seeds was tested in a Copenhagen type germinator, with an 8-hour day at 25° C and a 16-hour night at 18° C.

A supply of seed was kept in "room storage" for comparison. For the 12-month period, the temperature range was 18 to 24° C and the relative humidity did not rise above 45%.

On three of the eight sites daily rainfall was recorded. For the rest, figures were taken from the closest official weather recording station.

RESULTS

The rainfall pattern on the eight sites is given in Table 1.

TABLE 1: RAINFALL PATTERN

Site	Soil Condition	Subsequent Rainfall (in.)		
	at Laying Down (Feb.)	1st Sampling (Mar.)	2nd Sampling (Apr-May)	3rd Sampling (Aug.)
WAIKATO				
Tokonui	Dry	4.06	2.55	
Waikeria	Quite Dry	3.72	2.02	
HAWKE'S BAY				
Rissington	Moist	6.21	2.26	
Sherenden	Moist	6.74	2.25	
N. CANTERBURY				
Domett	Dry	5.30	1.95	
Amberley	Dry	3.34	1.05	
C. OTAGO				
Gimmerburn	Dry	0.26	1.68	3.69
Maniototo	Dry			

Heavy autumn rains fell in the Waikato, Hawke's Bay and North Canterbury areas between laying down and the first sampling. The soil remained moist enough for germination until the following summer. In Central Otago the rains were delayed until early winter and from then on falls were light until mid-spring.

Germination, dormancy and decay figures for the seeds after one month are given in Table 2.

Seed stored inside over the period of the experiment remained dormant and declined in viability hardly at all (85.0 → 82.3%).

At the field sites in Waikato, Hawke's Bay and North Canterbury close to 70% of the potential germination occurred within three weeks of the soil becoming moist. A small proportion of seeds delayed germination for a few weeks but by early winter less than 1% in Waikato and Canterbury and about 4% in Hawke's Bay retained viability.

TABLE 2: FATE OF SEED AFTER ONE MONTH

	<i>Camp</i>	<i>Off-Camp</i> (% Means $\pm$ SE)	<i>Farm</i>	<i>Region</i>
A. GERMINATION				
Tokonui	81.0	70.3	75.6 (2.5)	
Waikeria	78.8	82.3	80.5 (1.6)	
Waikato				78.1 (1.6)
Rissington	81.8	82.3	82.0 (2.9)	
Sherenden	60.5	77.3	68.9 (8.2)	
Hawke's Bay				75.4 (4.5)
Domett	66.5	67.5	67.0 (2.2)	
Amberley	80.5	77.3	78.9 (1.3)	
N. Canterbury				72.9 (2.0)
Gimmerburn	4.3	0.3	2.3 (2.1)	
Maniototo	1.3	2.5	1.9 (1.3)	
C. Otago				2.1 (1.0)
	56.8 (6.1)	57.4 (5.9)		
B. DORMANCY				
Waikato	3.5 (0.8)	1.3 (0.5)		2.4 (0.6)
Hawke's Bay	15.8 (7.2)	2.8 (0.4)		9.3 (3.9)
N. Canterbury	0.9 (0.4)	1.1 (0.5)		1.0 (0.3)
C. Otago	82.9 (11.5)	83.9 (3.1)		83.4 (4.0)
	27.0 (6.7)	22.3 (6.4)		
C. DECAY				
Waikato	16.0 (2.3)	22.5 (2.7)		19.3 (1.9)
Hawke's Bay	13.1 (2.8)	17.5 (2.2)		15.3 (1.8)
N. Canterbury	25.6 (2.9)	26.5 (2.3)		26.1 (1.8)
C. Otago	9.4 (3.1)	14.8 (3.6)		12.1 (2.4)
	16.2 (1.7)	20.3 (1.5)		

A different pattern emerged in Central Otago where autumn rains were delayed. After one month germination was only 4% but after two months it had risen to about 58%. A spring emergence increased it to 65%. At the final sampling in January one seed of the original 200 still remained dormant.

As indicated in Fig. 1, variability within regions was relatively high and tended to increase with time. The source of this lay mainly between containers within habitats, rather than between habitats or between farms. There is some indication that a higher proportion of seeds decayed in the off-camp habitat but the difference was not statistically significant.

DISCUSSION

The machine dressing of the seed, their close proximity between layers of absorbent paper and the burial of containers in shallow depressions may have tended to produce a germination rather more rapid and complete than would have occurred naturally. Conversely, the protection from macro- and micro-organisms given the seeds by the container could have contributed to their longevity.

FIG. 1: Seed dormancy.

In all areas a small proportion of seeds remained dormant over the autumn-winter period. At the end of one year out of a sample of 4,800, one and 26 seeds remained viable at North Canterbury and Central Otago, respectively. Germination within habitats tended to be highly variable. Containers just 12 in. apart could range from nil to complete germination.

A 0.2% solution of KNO_3 was used in the laboratory to stimulate germination of these seeds. A similar procedure plus a chilling treatment of 5°C for four days was found necessary for some of the seed collected from Otago soils by Meeklah in 1966. It appears, then, as if mechanisms may operate in the field to induce dormancy in a small proportion of barley grass seed for periods of at least one year.

There are indications from the Otago results that soil moisture and temperature interact to control the pattern of germination. The soil remained dry until late autumn-early winter by which time it became cold. A quarter of the seed lay dormant over the winter to produce the only observed spring crop of seedlings. In many localities odd plants of barley grass may be observed flowering until mid-winter. It is likely that seed so produced would germinate in the early spring.

Australian research on the *Hordeum leporinum* barley grass type is relevant to the New Zealand situation. Smith (1968) subjected seed to a variety of storage and germination treatments. He concluded that high soil surface temperatures in summer could induce temporary dormancy even in the presence of abundant moisture. McGowan (1970) compared patterns of field germination of a number of annual grasses in north-east Victoria. For barley grass, 99% of the year's germination had occurred by the end of May one year and by the end of June the next. However, over the summer-autumn each period of rains tended to prompt a germi-

nation response. It seemed as though very little seed was carried over from one year to the next or, indeed, lasted beyond mid-winter.

The trial results reported here by and large intensify the picture that has emerged from similar studies in New Zealand and Australia.

ACKNOWLEDGEMENTS

Thanks are due to G. C. Atkinson, F. C. Allen, T. J. Smallridge, F. A. Meeklah, H. McRobb and R. B. Mitchell all of Field Research Section, Department of Agriculture, for assistance with field work. Seed Testing Station, Palmerston North, carried out seed viability tests.

REFERENCES

- Harris, G. S., 1959: *Proc. 12th N.Z. Weed Control Conf.*: 85.
——— 1961: *N.Z. J. agric. Res.*, 4: 253.
Meeklah, F. A., 1966: *Proc. 19th N.Z. Weed & Pest Control Conf.*: 121.
McGowan, A. A., 1970: *Aust. J. exp. Agric. Anim. Husb.*, 10: 401.
Smith, D. F., 1968: *Aust. J. exp. Agric. Anim. Husb.*, 8: 478.