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VIABILITY OF THE SEED OF ITCH GRASS (*ROTTBOELLIA COCHINCHINENSIS*) IN THE BURDEKIN DISTRICT

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CONTENTS

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1. INTRODUCTION

Itch grass, raoul grass, or guinea fowl grass emerged as a problem weed of sugarcane fields in the Burdekin district of north Queensland during the late 1970s - early 1980s. It is considered to be a native of tropical Asia, but has become endemic to many other tropical areas, and is a major weed of sugarcane in Eastern Africa, the Philippines, West Indies, Trinidad, Florida and Louisiana. Itch grass has been recorded in Colombia, Venezuela, Puerto Rico, New Guinea, Mississippi and Texas and has been described as rapidly becoming one of the world's worst weeds.

In the Burdekin canegrowing district, itch grass occurs in varying degrees of infestation over an assigned area of 1 600 ha. From the initial infestation on one farm in 1964, the grass has been recorded on 33 farms in the Pioneer Mill area, one in the Kalamia Mill area, and three in the Inkerman Mill area (see Map, Appendix 1).

Spread of the grass appeared to be most marked after the mid 1970s, although the reason for this is unclear. The initial itch grass infestation was considered to have been caused by contaminated legume seed. Recent spread has been attributed to cane harvesters, cane bins, laser levellers, slashers and other farm implements, vehicles, water, birds and animals.

Successful mechanical control of itch grass is dependent on well timed and efficient use of cultivation implements. The seed germinates rapidly after rain or irrigation, necessitating numerous efficient cultivations to reduce seedling numbers and to reduce the need for extensive and expensive labour involved in hand weeding. A range of broad spectrum herbicides will effect good control of the weed in fallow land. However the use of some pre-emergent herbicides after the hilling-up stage of young sugarcane gives fair control, but is not wholly effective, necessitating the need for ground patrols to detect and remove escapes.

The project described in this paper was initiated early in 1983 to determine the viability of itch grass seed under field conditions. It was reasoned that the results from the project could be used to define more clearly strategies necessary to effect efficient control of this weed.

2. LITERATURE REVIEW

2.1 Dormancy and viability

Millhollon (1965), Richards and Thomas (1970), Pamplona and Mercado (1974), Thomas and Allison (1975) and Pamplona and Imlan (1977) all reported the problem of dormancy of the seeds of *Rottboellia cochinchinensis* causing periodic emergence of seedlings in the field over extended periods, making control difficult using conventional methods.

Smart (1960) found no dormancy in seed of *Rottboellia cochinchinensis*. However Thomas and Allison (1975) found that seed did not germinate until five or six months after shedding, with 50-70% germinated by eight to nine months and 80% germinated by one year. Few viable seeds remained after four years and no seedlings emerged during the fifth season after shedding. Kranz (1977) stated that given adequate moisture, 4-8% of seed would germinate within three to four days after separating from the mother plant. The author further stated that the majority of husked seed exhibited a phase of dormancy and maintained viability in soil for two to three years.

Kranz (1977) reported that competition rapidly reduced seedling numbers from an establishment density of 1 670 plants m^{-2} with flowering commencing after eight weeks and seed shedding after 15 weeks. However Millhollon (1980) found continuous seed shedding from about six weeks after germination. Kranz (1977) reported as many as 1 180 inflorescences, totalling 20 600 fruits per plant, with a potential yield of 200 million seeds or 2 000 kilograms of seeds, per hectare.

Pamplona and Mercado (1981) reported the existence of at least five ecotypes of *Rottboellia cochinchinensis* in the Philippines. These researchers found the ecotypes differed in days to flowering, tiller numbers, spike number, spikelets/spike, and height. The dormancy of seed of the five ecotypes ranged from three months to one year or longer. It was argued that this difference was the result of a long period of adaption, both to the environment and to a particular crop association. Only one of the five ecotypes was found to have ratooning ability. The type found in the Burdekin district has this feature. The variations in dormancy and maturity attributes variously reported above, may have resulted in part from the existence of such *Rottboellia cochinchinensis* ecotypes.

3. EXPERIMENTAL DETAILS

A trial was established to determine the viability of itch grass seeds under field conditions in the Burdekin area of north Queensland.

The site was located on a soil type representative of much of the canegrowing area, and on which large populations of itch grass had become established.

The trial involved four different treatments and was established to cover a three year period of seed testing. Late in the program an adjustment was made to allow one treatment - shelf stored seed, to be tested for four years.

The trial was established on the Burdekin Sugar Experiment Station where it could be monitored closely and serviced easily.

3.1 Trial design

The trial consisted of four replicates of a randomised complete block design.

3.2 Site description

Soil: UM 5.42 (Northcote, 1974) with a silty loam A Horizon to 400 mm.

3.3 Treatments

1. Seed stored on office shelf.
2. Seed stored on soil surface.
3. Seed stored at depth of 15 cm.
4. Seed stored at depth of 30 cm.

3.4 Seed

Some 28 800 seeds were required to set up all treatments for the trial. What appeared to be freshly shed seed was collected from a field at Airville in March 1983 using a vacuum cleaner to facilitate the bulk collection. Individual 'seeds' were tested by squeezing them to determine whether a seed was present under the large exterior husk.

In groups of 50, seeds were then placed in fibreglass gauze bags (100 mm x 50 mm) to retain the seeds in groups but allow free movement of air and water. Sufficient numbers of seed packets were made to allow 200 seeds per treatment (1 packet of 50 from each replicate) to be forwarded to Brisbane for germination testing each month over a period of three years.

4. ESTABLISHMENT DETAILS

Four trenches (one per replicate) were dug to the required 30 cm depth and the packets of seed for treatment 3 were installed. The trenches were then backfilled to 15 cm and the treatment 2 seeds put in place. Following filling of the trenches the treatment 1 seeds were placed in position on the soil surface. A large frame with a fibreglass gauze mesh was then placed over the trial area to prevent seeds being removed by birds or rats.

The office stored seed was placed on a shelf in a cupboard where it was subjected to normal temperature conditions.

5. SAMPLING

At monthly intervals one packet of 50 seeds was removed from each treatment and replicate. In the case of the buried seeds this was achieved by gradually working from one end of each trench until a packet of seed was located.

6. ASSESSMENT

Each month, 200 seeds from each treatment were forwarded for germination testing to the laboratories of the Agricultural Standards Branch of the Queensland Department of Primary Industries at Indooroopilly in Brisbane.

Germination tests were conducted in paper and cloth towelling at an alternating temperature regime of 20°C to 35°C for 21 days. At the completion of the germination test, any ungerminated seed was examined for viability using tetrazolium staining.

At a late stage in the experiment no shelf seed was sent for testing during the 33rd, 34th and 35th months. Instead, the seeds from these months was used to extend the testing of shelf stored seed until the 48th month, by testing on the 40th, 44th and 48th months.

7. RESULTS

The initial viability of the seed exceeded 90%. However, at the commencement of the trial the seed was mainly dormant but this dormancy rapidly broke down within the first four months.

The results of the germination tests are shown in Table 1.

Insofar as the shelf stored seed is concerned, it can be seen that it maintained a high germination percentage for almost the whole of the extended period, showing a fall-off only at the 48th month of testing (Figure 1). Earlier declines in germination were offset by increases in the percentage of dormant seed - probably caused by minor undetected variations in germination test conditions.

Surface stored seed showed low germination in the first two months of testing. This rose to a peak of 71% in the fourth month with a rapid deterioration occurring thereafter. However, odd seeds continued to germinate up until the 22nd month (Figure 2).

Seed stored at the 15 cm level also reached a peak germination of 67% at the fifth month. Seeds germinated for a longer period than did surface seed, the last noted germination taking place on the 28th month (Figure 3).

There appeared to be no set peak period for germination of seed stored at 30 cm. Instead there was a relatively constant germination of 15-20% for 17 months. Thereafter, there was a rapid drop, with the last viable seeds germinating after the 27th month (Figure 4).

8. CONCLUSIONS

The results from this trial indicate that if a two year fallow could be carried out on affected cane fields, the problem of itch grass infestations could be largely eliminated. Very few plants would germinate after this time, and provided a stringent roguing campaign was carried out after sugarcane was replanted, the few likely escapes of germinated itch grass should be able to be physically removed and destroyed.

It is difficult to contemplate this length of fallow in the normal cane farm rotation. However it is possible to organise a 12 month fallow without serious inconvenience, eg old ratoon blocks due for ploughout and fallow in October-November in a particular year are not normally replanted until April-May the following year. Harvest and ploughout of these fields can be brought forward to June-July, fallowed and then replanted the following July without loss of rotation or area.

Since any seed would probably have been shed in February-March before the cane was harvested, there would have been more or less an effective period of 16 months from seed shedding to replanting. It can be seen that this period covers the most intense period of seed germination, and would in itself provide a useful tool in any strategy being devised for itch grass control.

If eradication were the ultimate target with this strategy, the same stringent patrolling and roguing activities would need to be carried out to enable any escapes of germinated itch grass to be destroyed.

9. RECOMMENDATIONS

Because of the results obtained from this itch grass seed viability trial, the use of a compulsory 12 month fallow period has been used in legislation framed for the control of the pest in the Burdekin canegrowing area. The use of labour for regular field patrols is being used by canegrowers and the Ayr Cane Pest and Disease Control Board in an endeavour to completely eliminate itch grass from cane fields.

If at all possible, affected fields should be fallowed for two years. In most cases this should result in complete elimination of the pest. This tactic should be used on farms outside the Burdekin area, in particular where only a block or two on a farm is involved. This would have the effect of cleaning the infestation up before it became a danger to other growers in the area.

10. ACKNOWLEDGMENTS

Acknowledgment is made of the assistance of Mr J Butler, Seed Technologist, Agricultural Standards Branch, Queensland Department of Primary Industries, Indooroopilly, for the conduct of seed germination tests over the period of the trial, and for his valued and relevant comments in the preparation of this report.

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TABLE 1

PER CENT GERMINATION OF ITCH GRASS SEEDS OVER 48 MONTH TRIAL

MONTH	SHELF				SURFACE				15 CM				30 CM			
	REP 1	R2	R3	R4	R1	R2	R3	R4	R1	R2	R3	R4	R1	R2	R3	R4
1	14	14	2	5	2	–	6	–	20	52	14	22	18	22	22	22
2	14	12	20	10	14	8	14	10	8	12	–	2	–	–	4	–
3	18	14	20	40	28	30	18	30	28	4	50	14	2	2	12	–
4	46	60	68	72	58	88	62	76	68	56	70	52	18	32	20	10
5	52	36	44	42	64	76	64	70	74	38	76	78	14	20	32	2
6	68	76	76	86	32	26	20	26	80	14	–	2	16	2	18	14
7	60	68	54	56	42	8	8	6	4	–	–	–	6	2	–	–
8	90	88	88	84	6	6	–	–	–	–	–	–	–	–	–	–
9	86	78	88	88	2	–	–	–	–	–	–	–	–	–	–	–
10	32	18	20	26	–	–	–	–	–	–	–	2	20	14	34	24
11	100	88	90	88	2	12	40	–	22	22	–	12	26	–	12	4
12	86	88	90	84	–	–	–	–	–	22	28	2	–	–	12	8
13	84	86	84	76	–	–	–	–	2	18	4	4	8	–	14	2
14	78	74	86	72	–	–	–	–	20	–	22	38	8	30	6	14
15	82	80	86	44	–	–	–	–	14	13	23	3	19	4	8	9
16	86	84	86	78	–	–	–	–	8	–	6	12	22	4	10	16
17	72	78	80	72	–	2	–	–	–	4	–	–	18	4	–	10
18	90	86	78	72	–	–	–	–	2	–	–	–	4	6	6	–
19	92	84	88	86	–	4	–	4	–	–	–	–	–	–	–	2
20	36	46	62	62	–	–	–	–	–	–	–	–	2	–	2	–
21	74	68	64	82	2	–	2	–	–	–	–	–	–	–	–	–
22	80	70	72	82	–	–	2	–	–	2	–	–	4	–	–	–
23	82	78	90	80	–	–	–	–	–	2	–	–	–	2	–	–
24	76	92	78	90	–	–	–	–	–	–	–	–	–	4	–	–
25	90	86	92	86	–	–	–	–	–	–	–	–	6	–	–	–
26	86	74	80	72	–	–	–	–	4	–	2	2	–	–	–	–
27	72	68	82	76	–	–	–	–	2	4	–	–	6	–	–	1
28	68	82	78	90	–	–	–	–	–	–	1	–	–	–	–	–
29	74	76	80	94	–	–	–	–	–	–	–	–	–	–	–	–
30	78	86	68	80	–	–	–	–	–	–	–	–	–	–	–	–
31	88	80	78	86	–	–	–	–	–	–	–	–	–	–	–	–
32	80	62	66	76	–	–	–	–	–	–	–	–	–	–	–	–
33	/	/	/	/	–	–	–	–	–	–	–	–	–	–	–	–
34	/	/	/	/	–	–	–	–	–	–	–	–	–	–	–	–
35	/	/	/	/	–	–	–	–	–	–	–	–	–	–	–	–
36	78	76	76	78	–	–	–	–	–	–	–	–	–	–	–	–
40	60	84	68	86	/	/	/	/	/	/	/	/	/	/	/	/
44	66	58	60	76	/	/	/	/	/	/	/	/	/	/	/	/
48	10	26	4	32	/	/	/	/	/	/	/	/	/	/	/	/

Fig.1. Percent Germination of Shelf Stored Seed.

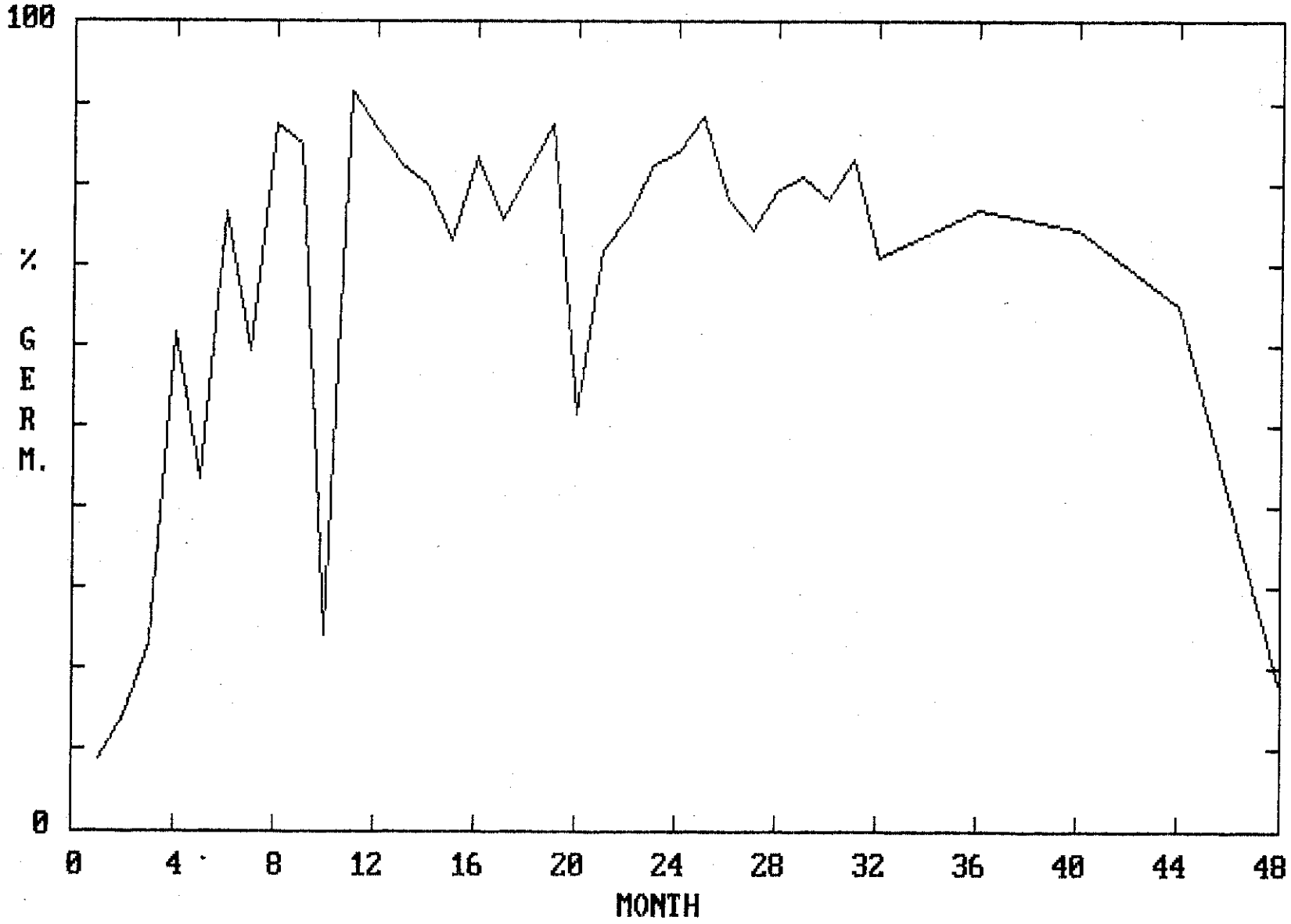


Fig.2. Percent Germination of Surface Stored Seed.

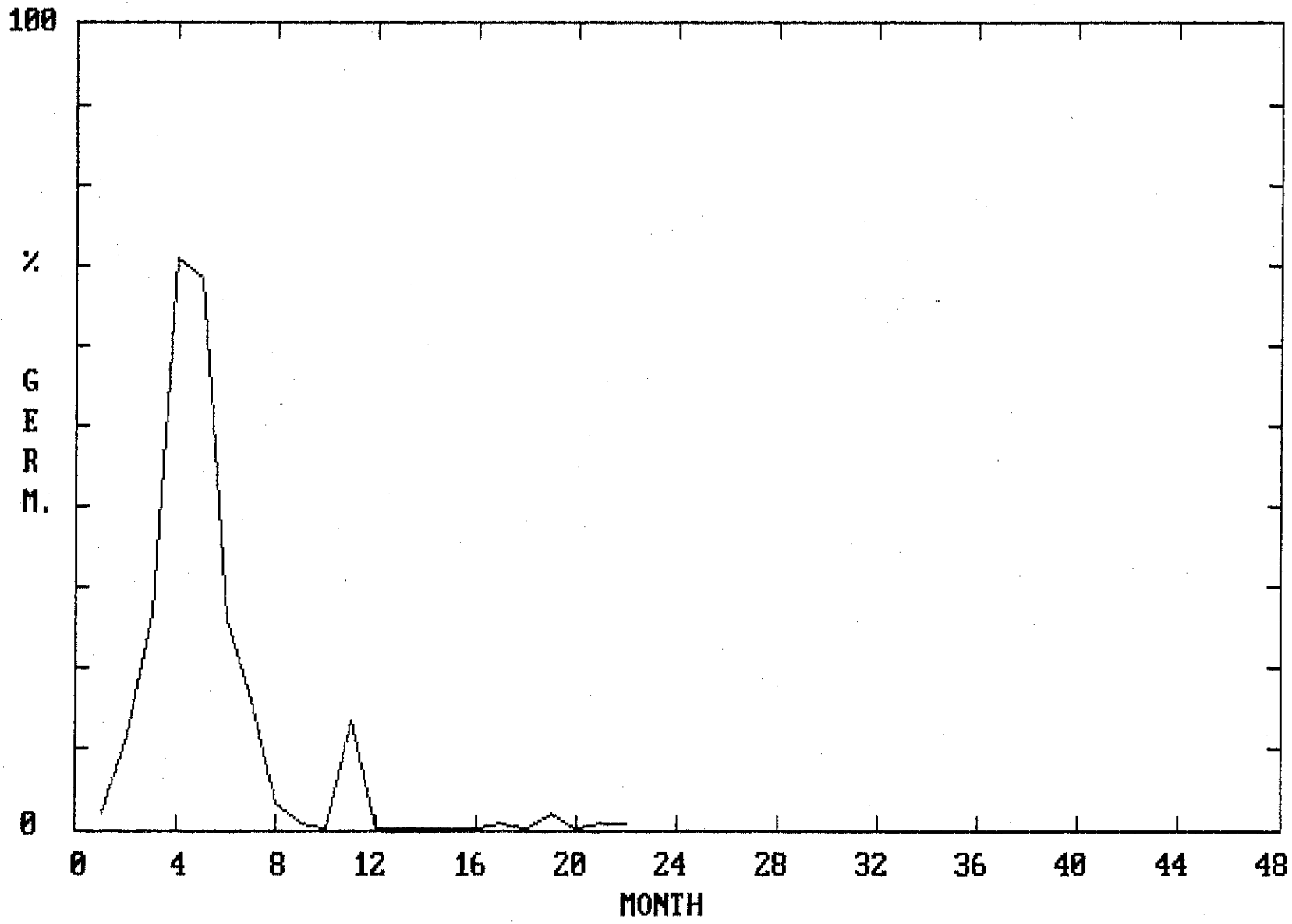


Fig.3. Percent Germination of 15cm Stored Seed.

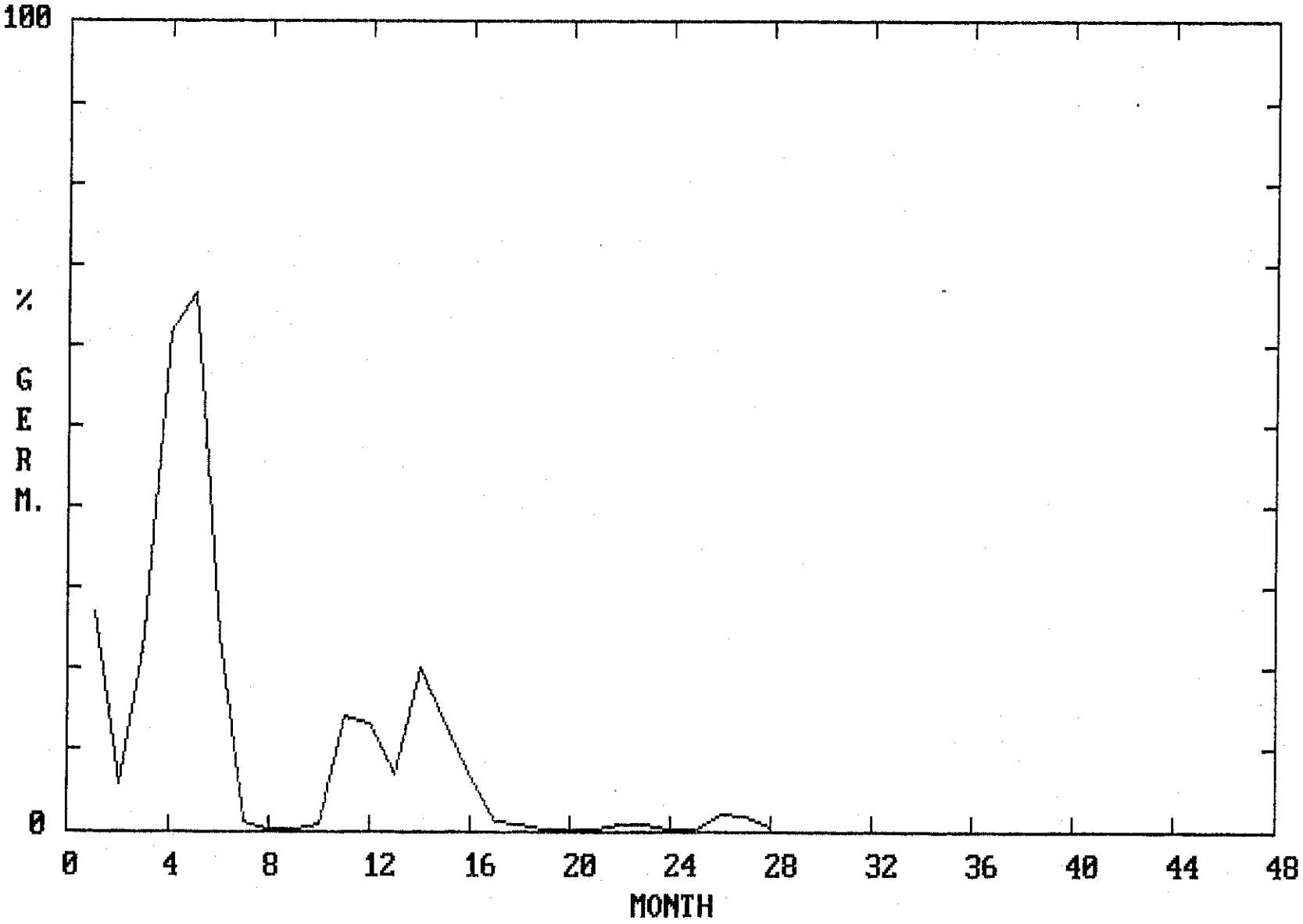
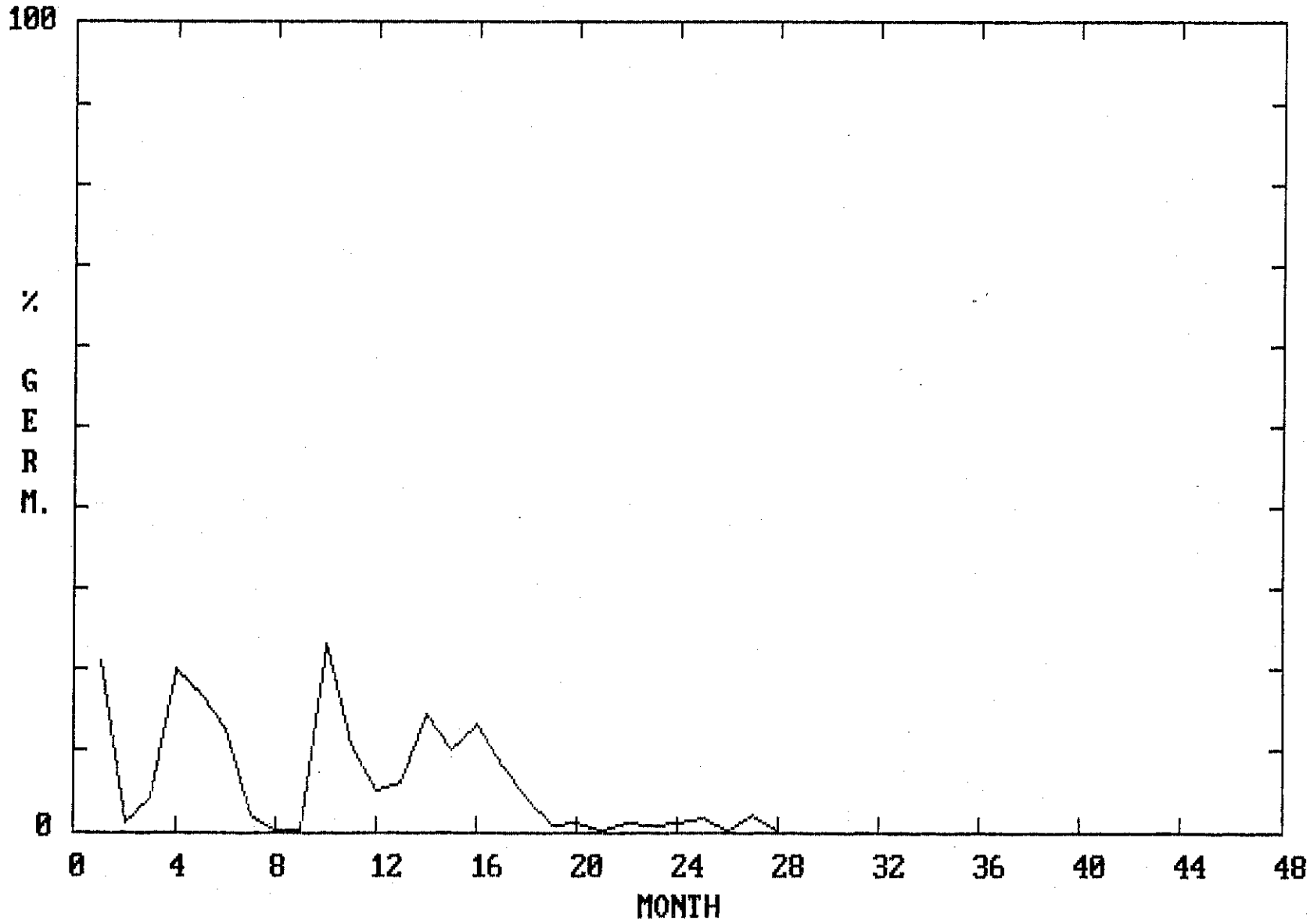


Fig.4. Percent Germination of 30cm Stored Seed.



APPENDIX 1

ITCH GRASS INFESTATIONS IN THE BURDEKIN AREA