1978

Investigations of ryegrass toxicity.

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1978 - SUMMARY OF RESULTS OF FIELD EXPERIMENTS

INVESTIGATIONS OF RYEGRASS TOXICITY

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Effect of burning on the production of galls.

Experiment : 78KA13

Location : J. Griffith, Gnowangerup

Aim : To determine the effect of autumn burning of pastures, with different cropping histories, on the production of galls, their colonisation by bacteria and the level of toxicity in the subsequent ryegrass pasture.

Treatments : Burning was done on March 9, 1978, on 4 blocks each comprising plots with the following pasture histories:

1. Cropped 1975, pasture 1976-77.
2. Cropped 1975, pasture 1976-77, burnt February 1977.
3. Cropped 1976, pasture 1977, burnt February 1977.
4. Cropped 1977, burnt February 1977.

An equal number of plots were left unburnt.

Methods : Absolute temperatures were recorded during the burn using heat sensitive crayons marked vertically on asbestos sheets (45 x 15 cm) standing in the pasture.

In December 1978, the mature ryegrass seed was collected from each plot and the numbers of galls containing nematodes and those colonised by bacteria were estimated. Analysis of variance was used to detect significant differences.

Results : Temperature profiles for plots with different pasture histories, are shown in the Figure. The numbers of galls present in the pasture after burning are given in the following table.

Analyses of the results showed that burning significantly reduced the number of toxic galls (those colonised by bacteria). The degree of reduction was not significantly different between areas having different cropping histories. Analysis of the termperatures recorded during the burnings showed that the maximum heights above the ground at which each temperature was recorded were significantly different on plots with different pasture histories between 200 and 280°C.

Comments

The results show that burning in autumn will reduce the number of toxic galls in a subsequent pasture by an average 75%. Furthermore, the heat generated on areas with different pasture histories did not differ within the range that apparently affected survival of the bacterium. This was reflected by the comparable reduction in toxic galls on all burnt areas irrespective of their previous cropping histories.

The trial also showed a significant natural decline of the numbers of galls for each succeeding year of pasture following a crop. Numbers of galls in pastures 2 and 3 years after cropping were approximately 50% and 60%, respectively, lower than the number present in the first year after crop. This agrees with observations that pastures are most toxic the first year after cropping and the risk of toxicity declines considerably in subsequent years.

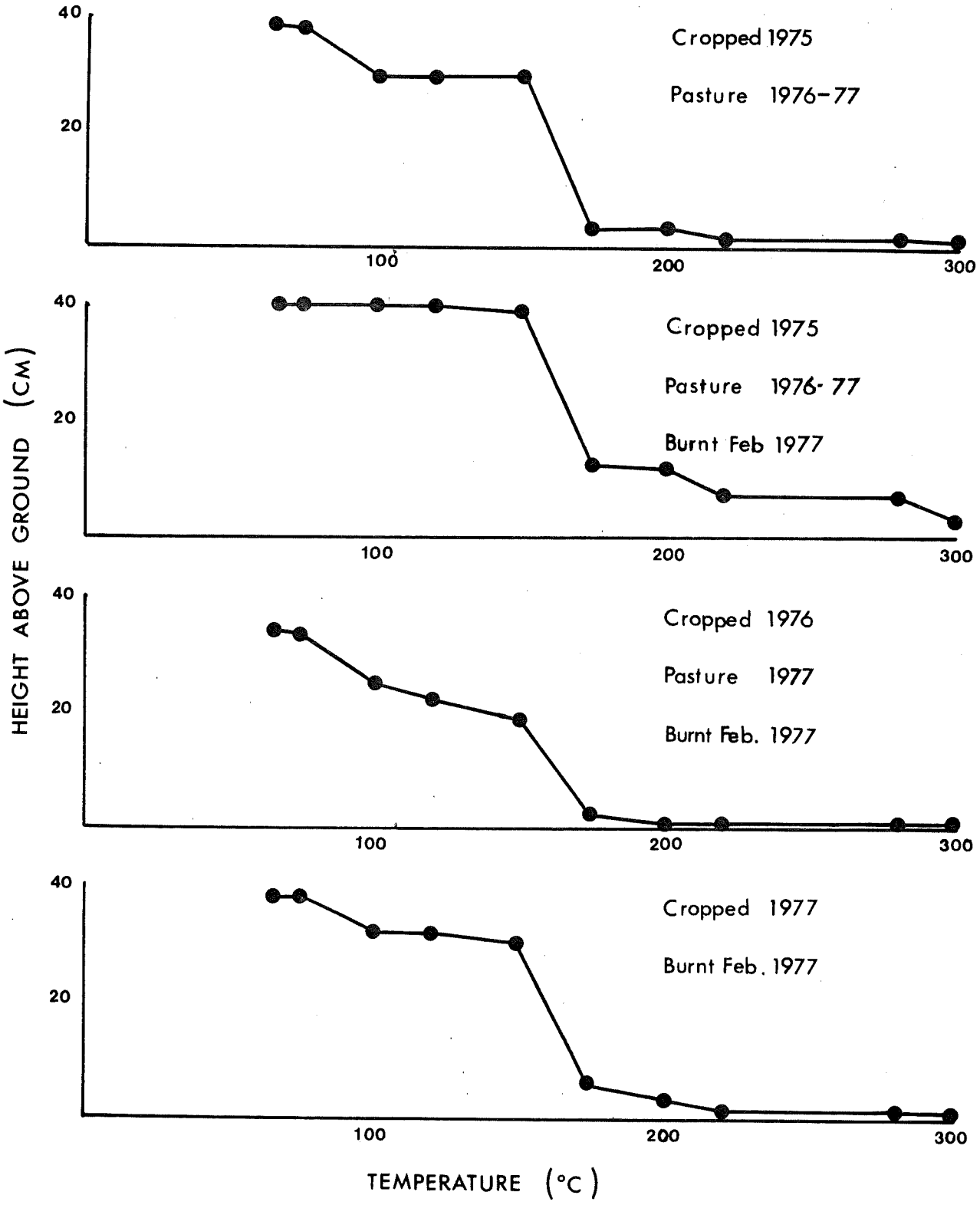
We can conclude from these results, that burning in autumn considerably reduces the risk of toxicity in subsequent pastures and is of greatest benefit in the year following cropping.

The effect of autumn burning on the number of galls produced in the subsequent ryegrass pasture.

Pasture history			Number of galls/10 g threshed ryegrass seed		
Year last cropped	1977 burn	1978 burn	Nematode	Bacterial	Total
1975	-	-	148.3	93.5	242
1975	-	+	116.3	9.5	126
1975	+	-	68.3	74.6	135
1975	+	+	86.3	28.7	116
1976	+	-	85.5	78.2	164
1976	+	+	67.0	10.0	77
1977	+	-	253.8	89.7	343
1977	+	+	163.8	36.2	200
l.s.d. (0.05)			78.9	51.6	86.3

TEMPERATURES RECORDED DURING BURNING OF PASTURES

WITH DIFFERENT CROPPING HISTORIES IN MARCH 1978



Effect of the nematicide, Nemacur, on the development of toxicity in ryegrass pasture.

Experiment	:	78KA15
Location	:	F. Quartermaine, Katanning. Paddock cropped 1976. Sand over clay. Long history of reygrass toxicity.
Aim	:	A single spray of Nemacur, at rates of 2 l/ha, or more, between 4 and 8 weeks after the opening rain in a season controlled the nematode, Anguina sp. and prevented the development of toxicity in ryegrass (77KA22). An experiment was done to confirm these results and also to see whether lower rates of nematicide would give good control and finally, to gain further information on selecting the best time to spray.
Treatments	:	Phenamiphos (Nemacur) was applied at 4 rates (0, 1, 2 and 3 l/ha) x 8 times of application, at intervals of 2 weeks following opening rains, which corresponded to May 17, May 31, June 15, June 28, July 12, July 26, August 10 and August 23.
Methods	:	Nematicide was applied with a hand spray. Stock was excluded during the growing season. The numbers of galls containing nematodes or colonised by bacteria were estimated per 10 g ryegrass seed harvested at maturity.
Results	:	The following figure shows the total number of galls present in seed harvested from the experiment. A significant reduction occurred with each rate of nematicide and a significant interaction between rate and time of spray was reflected by the marked control on or about July 26 and particularly at the higher rates. Reduction of galls containing nematodes and those colonised by bacteria were comparable. The following table shows the relative numbers of galls containing nematodes or colonised by bacteria from plots treated on July 26.

Comments

Applications of Nemacur at rates of either 2 or 3 l/ha on July 26 gave comparable reductions of approximately 90% in the numbers of galls by comparison with unsprayed controls. The rate of 1 l/ha was less effective, giving an average reduction of approximately 43%. This degree of control at rates of 2 or more l/ha could be expected to prevent pasture from becoming toxic. However, at this low rate the correct timing of spraying is obviously critical. In 1978, the optimum time for spraying coincided with the commencement of larval emergence from galls and initial colonisation of ryegrass plants (78KA14, 78KA31).

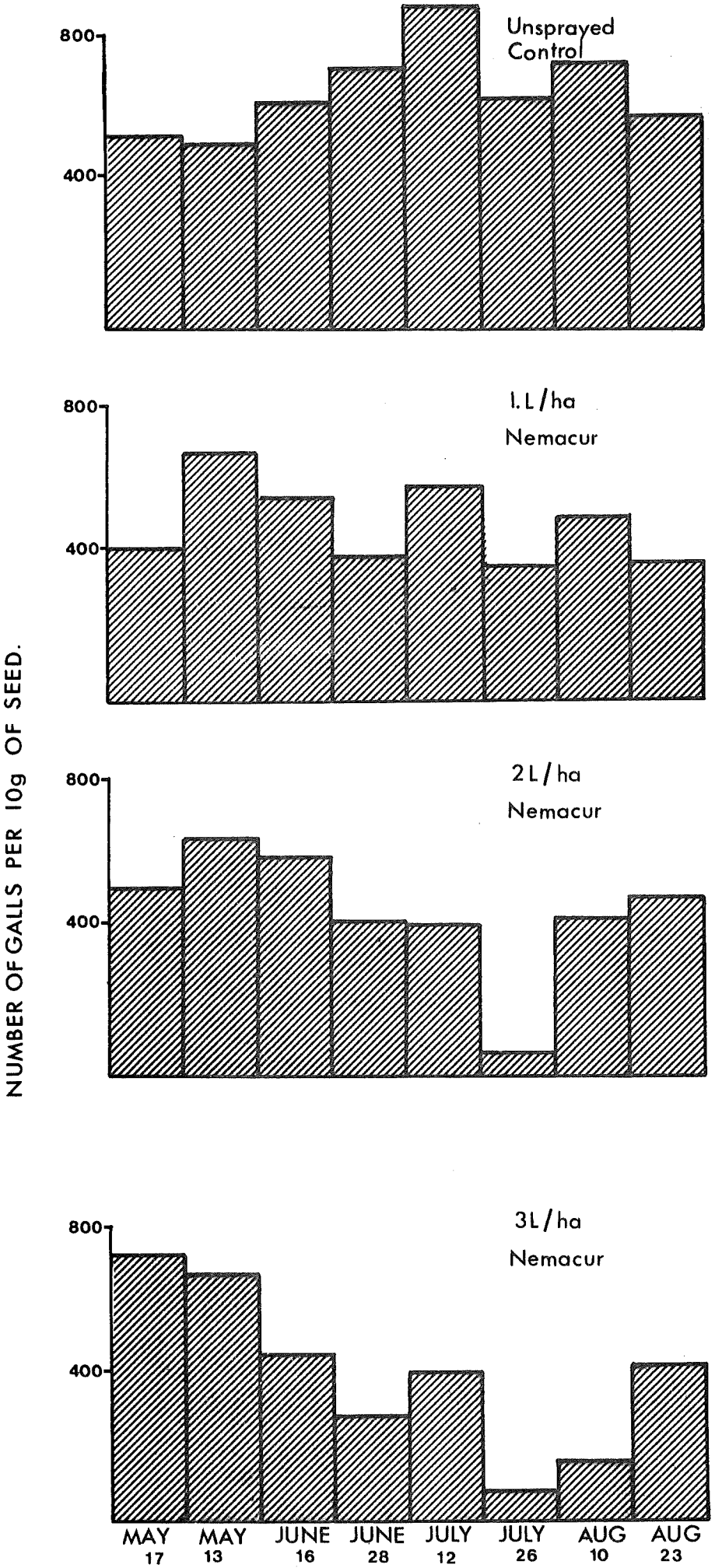
Effect of phenamiphos on the development of galls in ryegrass pasture sprayed on July 26.

Numbers of galls per 10 g harvested ryegrass seed	Rate of nematicide (l/ha)			
	0	1	2	3
Galls containing nematodes	346	283A (31)B	28 (92)	44 (87)
Galls colonised by bacteria	272	121 (55)	31 (89)	36 (87)
Total number of galls	618	359 (42)	59 (90)	79 (87)

A absolute numbers.

B per cent reduction in numbers compared with untreated control.

PLOTS AND PLOTS SPRAYED ONCE WITH NEMACUR AT EITHER 1, 2 OR 3 L/ha.



Survival of Anguina sp and emergence from galls.

Experiment : 78KA14

Location : F. Quartermaine, Katanning

Aim : To study populations of Anguina sp. in the soil over a period of two years by monitoring the emergence of larval from galls, and their activity and survival in soil, and ralating these measurements to patterns of colonisation of plants and also to climate.

Methods : Nylon mesh bags (approximately 30 mm x 30 mm), each containing 5 nematode galls, were randomised over 8 blocks (52 per block) and lightly covered with soil in a paddock with a known history of toxicity. One gall bag was collected from each block at intervals of two weeks during the growing season and the contents of larvae were counted.

A soil core 60 mm in diameter and 75 mm deep was taken from beneath each gall bag at the same time of sampling. The soil cores were divided into 3 layers - the top 25 mm, 25-50 mm and 50-75 mm, from which larvae were extracted and counted.

Results : The following figure shows the average number of larvae remaining in galls from each sampling during the 1978 growing season.

The table shows the average number of larvae recovered from the soil at different depths. No larvae were recovered from the soil on any other sampling date.

Comments

The results show that emergence of larvae from galls commenced during the last half of July, approximately ten weeks after the first significant opening rains. Emergence continued during the next 10 weeks, the average number of larvae in the galls dropping from 1260 to 23. At the end of the season, approximately 2% of the original nematode population remained viable within the galls. Further sampling during the 1979 season is planned to determine whether this residual population survives over summer and is capable of infecting ryegrass for a second season.

Larvae were recovered from soil only during the period they were also emerging from galls. The numbers recovered also varied considerably, suggesting their stay in the soil is of a very short duration. These results suggest the nematode has a very short soil phase, moving quickly onto the aerial parts of plants after leaving the galls. During the soil phase only a low proportion move any distance down the profile, with 95.6, 2.5 and 1.9 per cent of the nematodes being recovered from the top 25 mm, 25-50 mm and 50-75 mm layers, respectively. After the larvae stop

Comments (cont)

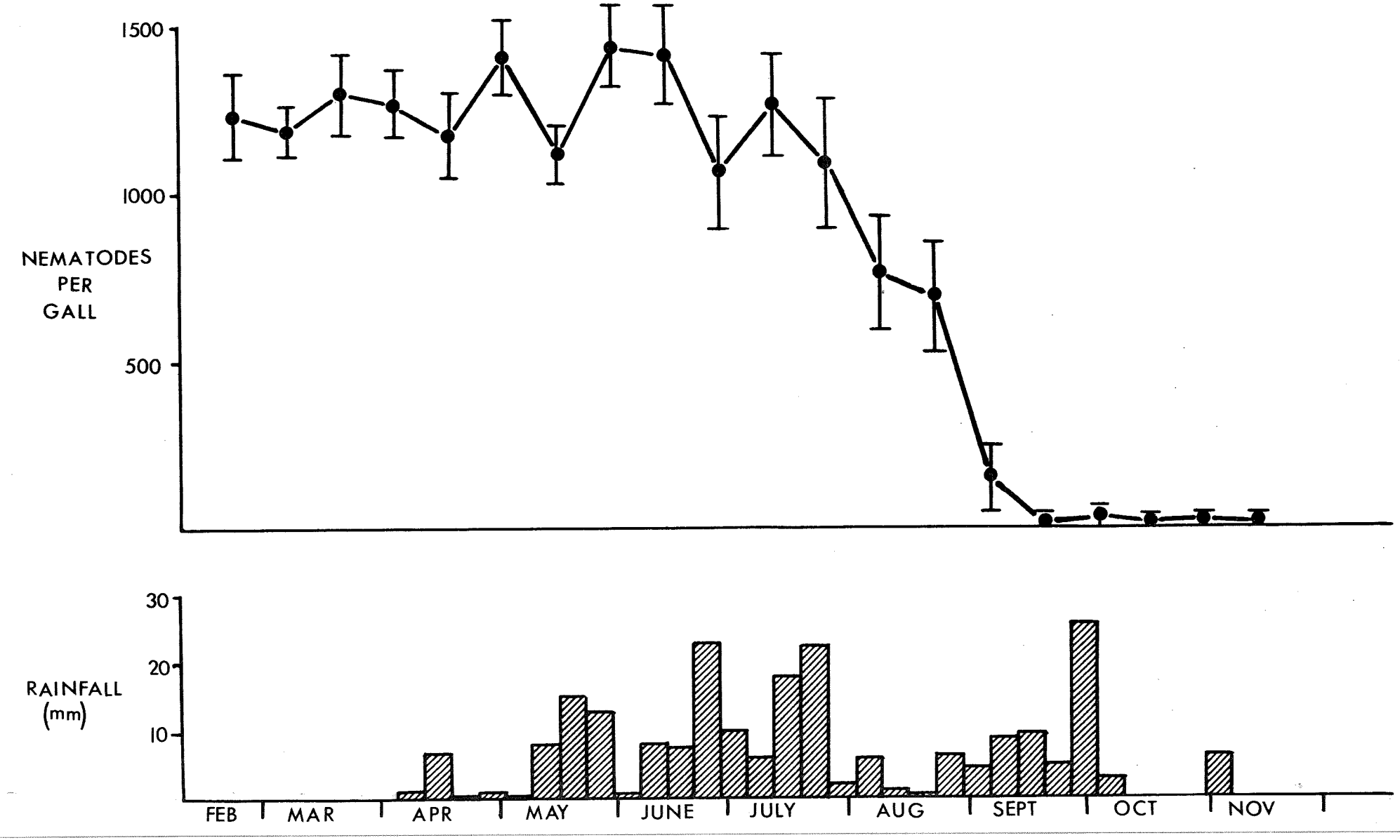
emerging from galls they can no longer be recovered from the soil, which suggests they will not oversummer in the soil outside of a gall.

Average number of larvae of Anguina sp. recovered from the soil at different depths during the growing season.

Soil layer	Date of sampling					
	Aug 9	Aug 23	Sept 6	Sept 27	Oct 4	Oct 18
0-25 mm	108	804	708	3	186	1242
25-50 mm	42	6	30	1	0	0
50-75 mm	12	36	0	0	0	12

AVERAGE NUMBER OF NEMATODE LARVAE PER GALL.

VERTICAL LINES SHOW STANDARD ERRORS OF THE MEANS.



Study of populations of Anguina sp. on plants.

Experiment : 78KA31

Location : F. Quartermaine, Katanning

Aim : To study plant - parasite relations of Anguina sp. on ryegrass. To relate the nematode life cycle, changes induced in the host, colonisation by bacteria and development of toxicity to plant development and climatic conditions.

Methods : An experimental area sprayed with a total herbicide was sown with ryegrass at intervals of 4 weeks to produce several generations of uniform age coinciding initially with opening rains and subsequently, intervals of 4 weeks.

One plot within each of 4 blocks was sprayed 7 days prior to each sowing. Each plot was sown at each of 30 points at 20 cm centres with 6 ryegrass seeds and 6 galls containing nematodes. After germination the plants were thinned to one pen point. After germination development of each plant was recorded at weekly intervals using leaf counts and the Romig scale. One plant from each plot was collected at intervals of two weeks during the vegetative growing period and at weekly intervals during the period of gall development.

The numbers of nematode and their locations within the plants were recorded at each sampling together with the stage of gall development.

Results : Only the first two generations of ryegrass sown established successfully and these germinated 10 days and 60 days after the opening rains, respectively. As only old plants germinated at later sowings, the e were not sampled.

The first generation germinated on May 24, commenced tillering approximately 5 weeks later on June 28 and produced on average 9.6 tillers per plant by October 4. The second generation germinated approximately 4 weeks later on August 9 and produced an average of 14.8 tillers by October 4. For both generations head emergence was first observed on September 20. Galls were produced on developing heads prior to emergence.

First colonisation of the plants by nematodes occurred on both generations on July 27. The duration of tillering corresponded with the period larvae emerged from galls, with no new tillers being produced after September 27

Results (cont) : corresponding to the time when emergence of larvae from the galls was completed (See 78KA14).

Examination of individual tillers showed that on average 90% of nematodes colonising the plants were found around the growing point while the remaining few were found in decreasing numbers between successively older leaves. These results indicate that most of the colonisation of individual tillers occurs as they emerge when they are at the one to two leaf stage. The nematodes subsequently induce galls in the developing heads.

Detailed studies of gall development are still continuing on preserved material.

Comments

These results show that the period of emergence of larvae from galls is synchronised with tiller production, ensuring that all tillers are liable to infection irrespective of when the plant germinates. Furthermore, the sequence of tiller production ensures that larvae emerging from galls have continuous access to the growing points on young tillers before they become unsheathed by numerous leaves. Even tillers that fail to develop because of adverse climatic conditions can become colonised. Frequently, some of these will resume development when climatic conditions are more favourable. As a result even those tillers that develop after emergence of larvae from galls is complete can still become toxic. This would also apply to new growth on plants treated with herbicide during the season.