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The effect of different dosages of aldicarb on the multiplication at small population densities of Globodera rostochiensis on potato in rotavated and non-rotavated plots

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Abstract

The effect of 0.35, 0.5, 0.7, 1, 1.4 and 2 g aldicarb/m^2, applied at planting time, on the multiplication of small densities of *Globodera rostochiensis* on potato was investigated in an experiment on sandy loam. The chemical was applied broadcast to the soil and rotavated into the top 15 cm on half the plots of each treatment. The plots were ridged three times, the first time immediately after the planting of the potatoes. Nematodes multiplied at the same rate in the top 20 cm of the soil on rotavated and non-rotavated plots treated with the same dosage of the chemical. The relation between log dosage and probit reduction of the multiplication rate in the top 20 cm after the plots had been levelled was linear between 0.35 g and 1.4 g aldicarb/m^2. The dosage-increase efficiency was 0.3 probit units per doubling of the dosage and the reduction of the multiplication rate at 0.5 g aldicarb/m^2 76%, whereas 2 g aldicarb/m^2 was not more effective than 1.4 g. However, multiplication rates in the centre of the ridges of rotavated plots were reduced by 96.5% at 1 to 2 g aldicarb/m^2 but only by about 60% below the furrows and by 60% to 80% below the ridges. The latter reduction was the greater the larger the dosage of the chemical.

The observations were in accordance with the supposition that multiplication of nematodes was totally inhibited in the top 20 cm of plots treated with 1.4 g and 2 g aldicarb/m^2 and that post-harvest populations there consisted entirely of non-hatched eggs of the pre-plant population. The poor performance of the chemical in the deeper layers of the soil makes application less effective in reducing population build-up than in preventing yield losses.

Additional keywords: Temik 10 G, nematodes, nematicide, soil treatment.

Introduction

According to Den Ouden and Van de Veer (1977) 0.5 g aldicarb/m^2 applied to the soil surface before planting potatoes and only mixed into the soil by the ridging reduced the rate of multiplication of *Globodera rostochiensis* by 45% to 79%. However, the program of containment of this nematode by chemical control and rotation with non-hosts and resistant potato varieties, requires an average reduction by a chemical treatment of 80%. Whitehead et al., (1973) obtained better results by rotavating the chemical into the soil than by applying it to the soil surface. Moreover, increasing the dosage might be worth considering if this increased the effect sufficiently. To investigate both aspects a field experiment was planned.

Materials and methods

In the experiment the effects of seven dosages of aldicarb (0, 0.35, 0.5, 0.7, 1.0, 1.4 and 2.0 g/m^2) on the maximum rate of multiplication of *Globodera rostochiensis* on potato were to be compared. All dosages were to be applied in two ways: broadcast to the soil surface without further incorporation of the chemical into the soil, and broadcast followed by rotavation of the top 15 cm of the soil. In both cases ridging would give an additional mixing of the chemical with the soil. Survival rates were to be measured with coefficients of variability not larger than 15% or, better (as log multiplication rates were expected to be distributed normally) log survival rates with a standard deviation < 0.05. As cyst densities had to be small (egg densities < 10 per g soil) to avoid density dependency of multiplication, sampling errors had to be stabilized by investigating appropriate amounts of soil from the different plots. According to earlier observations a sampling error of log cyst density < 0.10 could be expected if the sampled area was small (e.g. one m^2) and the samples were composed of several (possibly at least 5) lots of soil collected randomly (Seinhorst, 1973b), together at least 1.5 kg, containing at least 50 cysts (Seinhorst, in prep.). A sampling error of log density of 0.10 results in a standard deviation of log multiplication rate per plot of 0.14. To increase the accuracy of the determination of the general level of control obtained twice as many plots without chemical as plots treated with each dosage of the chemical were planned. If the sampling error were the only cause of variability then a s.d. of log survival rate of 0.17 would be obtained per treated plot. A s.d. of log survival rates of 0.05 would require 12 plots per treatment and 24 plots without chemical to be rotavated and the same numbers nonrotavated. However, the variability of egg counts might be noticeably greater than that of cyst counts and there might be a considerable plot to plot variation of multiplication rates. These can only be reduced by increasing the numbers of plots per treatment. Therefore, a field was chosen which could accommodate at least 25 rotavated and 25 non-rotavated plots per dosage of the chemical and 50 rotavated and 50 non-rotavated plots without chemical. This makes a total of 400 plots. This field was situated on a sandy loam in the northern part of the Netherlands. A preliminary sampling revealed that the infestation was patchy but that a large area with densities $<$ 10 eggs/g soil was available for the experiment. This area was divided into 576 plots of 2.25 $\times$ 1.35 m. A second sampling was done on 120 of these by taking 80 cores, one cm wide 20 cm long, from a rectangle of 1.5 $\times$ 0.7 m in the centre of these plots. Of the 1.5 kg soil collected per plot 600 g was investigated. On the basis of the numbers of cysts found in these samples a map of the distribution of cyst densities was made. An area with 456 plots, expected to contain between 5 and 80 cysts/kg soil, was chosen for the experiment. Quantities of soil expected to contain at least about 50 cysts were calculated for each plot. To simplify the collecting of the soil it was then decided that at least 1.5 kg soil per plot were to be collected as described above, but if these could be expected to contain fewer than 50 cysts, 2.5 kg or 5 kg were to be collected by taking seven about equal quantities of soil with a shovel.

All plots were sampled on 28 and 29 April, 1975 (further called 'spring sampling'), and nematode densities (cysts or eggs per unit weight of soil) 'initial densities'. Every sample was mixed well in the laboratory and then the cysts were extracted from a quantity of soil in which about 50 cysts were expected to occur. When fewer than 30 cysts were found more soil was investigated, if available. During the summer 18 plots of

the 456 planned originally, became unsuitable for further observations. Of the samples taken in spring on the remaining 438 plots 59 contained fewer than 30 and 15 fewer than 20 cysts.

Quantities of soil to be taken per plot after the potatoes had been lifted were calculated on the basis of multiplication rates on untreated plots determined by pilot samplings. Rates of multiplication on treated plots were derived with the help of expectations of the effects of the treatments based on the results of earlier pot and field experiments.

Rotavated and non-rotavated strips were planned as indicated in Fig. 1. These strips were then divided into blocks of eight plots. The eight treatments, (two untreated controls and six dosages of aldicarb) were distributed randomly in each block. The complete lay out was made on the original 576 plots and not adapted anymore afterwards, when a number of plots was not included in the experiment. Therefore, finally a number of blocks was incomplete and numbers of replications varied slightly from treatment to treatment, but this was of little consequence for the accuracy of the final results.

Aldicarb was applied as Temik 10 G, (3.5, 5, 7, 10, 14 and 20 g/m^2) with 10% active material) on 29 April and the rotavation was done on the same day. Potatoes (cv. Bintje) were planted on 2 May in rows 75 cm apart and at distances in the rows of 33 cm. A first ridging was done to cover the seed potatoes, immediately after the planting. The ridging was repeated twice at later dates.

The potatoes were lifted from 22 to 26 September, by which operation the plots were levelled again. Soil samples were taken from the levelled plots as described above. This sampling is called 'autumn sampling' and the nematode densities in the samples 'final densities'. Samples from different depths were taken on 20 untreated plots and on 7 plots per treatment of those treated with 1, 1.4 and 2 g aldicarb/m^2, all rotavated after the application of the chemical. One core, 10 cm wide, 40 cm long was taken from the center of each of these plots at equal distances from where the nearest four plants had been and one such core from between where two plants in a row had been. The cores were divided into pieces from 0–20 cm, 20–30 cm and 30–40 cm depth. These pieces were investigated separately.

Results

Sampling errors and standard deviations of log multiplication rates. The distribution of initial cyst densities in the field is given in Fig. 1. Cyst numbers were divided in classes with a ratio of upper to lower limit of 2 to 1. The clear zoning obtained even at small densities indicates that the standard deviation of log cyst counts probably was not more than about 0.08.

Plotting log cyst densities in rows of plots against the distance of the centres of the plots from that of the first plot in the row suggested a linear relation for several sequences of plots. Straight lines were fitted to the observations in 18 of such sequences with, in total, 163 observations. The deviations of measured log cyst densities from log densities according to these lines did not reveal dependency on cyst density. Sums of squares of these deviations divided by n–1 (n = number of observations) were calculated per sequence. The figures thus obtained can be considered maximum estimates of standard deviations of log density per sequence, due to sampling error. The average

Fig. 1. Distribution of cyst densities in the experimental field before planting. R = rotavated; NR = non-rotavated strips.

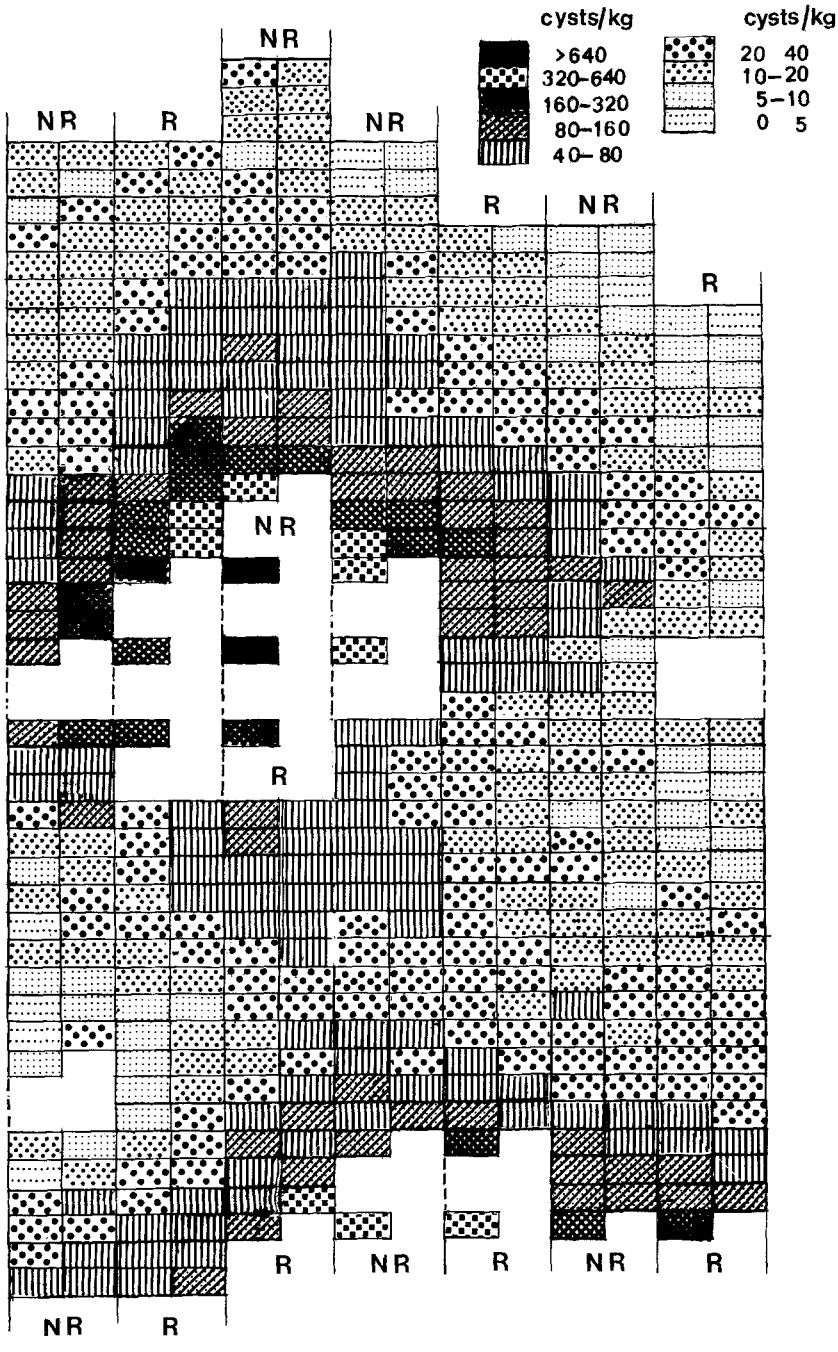

Fig. 1. Verdeling van cystedichtheden over het proefveld voor het poten. R = gefreesde, en NR = niet gefreesde stroken.

standard deviation was 0.0724, equivalent to a coefficient of variability of cyst counts of about 16%. This result and Fig. 1 indicate that the adaptation of the sampling procedure to expected densities had yielded the intended result. A similar treatment of log egg densities per plot resulted in a standard deviation per plot of 0.105. However, numbers of eggs/cyst were smaller in certain parts of the field than in others. Moreover, they were density dependent, perhaps by coincidence. This precludes the use of average numbers of eggs per cyst and per treatment as a better estimate of the true numbers of eggs per cyst than actual counts. Multiplication rates were, therefore, calculated for each plot as ratios between final and initial egg densities. They were independent of initial density (Fig. 2) and so was their variability at initial densities < 7 eggs/g (about 50 cysts/kg) soil (Fig. 2). The distribution in the field of the deviations per plot of log multiplication rates from averages per treatment was not random, but the frequency distributions of the deviations on untreated plots and plots treated with 3.5 and 5 g Temik 10 G/m^2 (223 observations) and on plots treated with 7, 10, 14 and 20 g Temik 10 G/m^2 (214 observations) were both close to normal. The standard deviations of log multiplication rates rotavated or non-rotavated $\sqrt{(\Sigma s^2/n)}$ were 0.282 and 0.221 respectively (s = s.d. within treatments, n = number of treatments). The probability that they are not different is 0.05. Standard deviations for rotavated and non-rotavated plots were equal, 0.251. Hardly any or no new cysts were formed in the plots treated with 14 g and 20 g Temik 10 G/m^2 (average final cyst density 1.02 times initial cyst density. This suggests that final egg populations at these treatments (density 0.25 times initial density) consisted (almost) entirely of eggs of the initial population, that did not hatch. Then the standard deviation of the difference between log final and log initial egg densities (log multiplication rate) would consist of components due to sampling error and to the variability of the hatching. If the s.d. of initial log egg density was 0.105, as calculated before, then that due to final sampling error and variability of hatching would be 0.194. The great differences in nematode densities between ridges and furrows (Fig. 4) could have made the sampling method applied in almost all plots (collecting seven about equal quantities of soil to make a total of 5 kg soil per plot) inadequate. The variability of the ratio between numbers of eggs/cyst in the final and initial populations suggests that also differences between plots or groups of plots in hatching rate could have increased total variability of multiplication rates.

The variability of the multiplication rates in untreated plots is the same as that in plots treated with 3.5 g and 5 g Temik 10 G/m^2, Therefore, this variability was not increased by differences between plots in effect of the chemical due to differences in either external conditions or (irregular) distribution of the chemical in the soil. The differences in variability of multiplication rates between plots treated with small and those treated with large dosages of Temik could only be due then to considerable differences between different parts of the field in multiplication itself.

Multiplication rates and average numbers of eggs per cyst in the final populations within treatments were the same on rotavated and non-rotavated plots except for an unexplained difference of both at 10 g Temik 10 G/m^2 (Fig. 3). If this exception is ignored each dosage of the chemical can be considered to have been applied with the same average result to slightly more than 50 plots, whereas there were over 100 untreated plots. The standard deviations of multiplication rates mentioned above then lead to one of survival rates at the small dosages of the chemical of $\sqrt{(0.282^2/50 + 0.282^2/100)} = 0.049$ and one of these rates at the large dosages of the chemical of

Fig. 2. Relation between log *Pi* and log *Pf/a* per treatment. *Pi* = initial egg numbers/g soil, *Pf* = final egg numbers/g soil. log *a* = average log *Pf/Pi* per treatment.

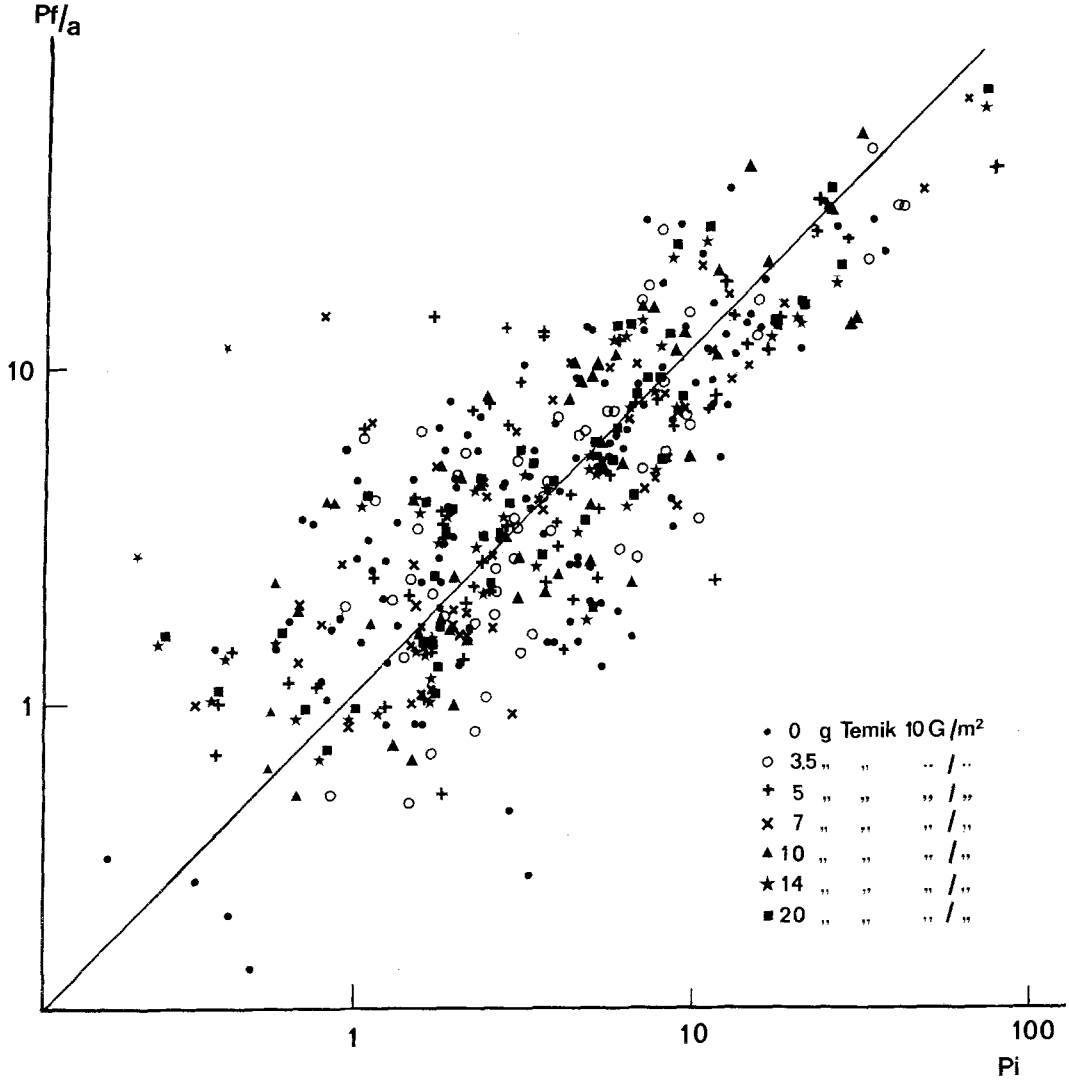

Fig. 2. Betrekking tussen log Pi en log Pf/a per behandeling. Pi en Pf = eieren per g grond voor het poten en het rooien, log a = gemiddelde log Pf/Pi per behandeling.

$\sqrt{(0.221^2/50 + 0.282^2/100)} = 0.042$ (coefficients of variability about 11% and 9.5% respectively). This is the accuracy aimed at according to the introduction. The difference between the multiplication rates at the smallest and the three largest dosages of the chemical is highly significant (probability that they are equal < 0.001). It lies in reason then that multiplication rates at 5 and 7 g Temik 10 G/m^2 are intermediate between 3.5 and 10 g/m^2.

Yields. Average tuber weights/m^2 for each treatment are given in Fig. 5.

Fig. 3. Relation between log dosage of Temik 10 G and A: % reduction (probit scale) of the multiplication rate of *G. rostochiensis* in the top 20 cm of the soil; ○, ● and full line: as measured in the experiment; broken line: presumed relation at a multiplication rate in untreated plots of 25. B. Numbers of eggs/cyst in final populations.

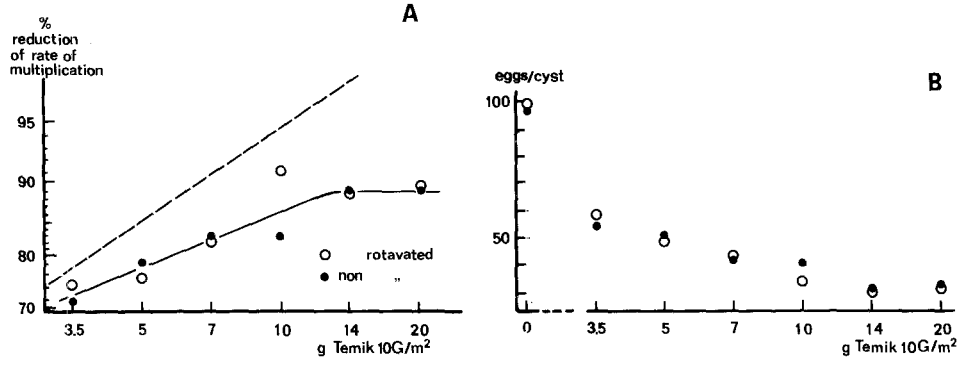

Fig. 3. Betrekking tussen log dosis Temik 10 G en: A: % vermindering (probit schaal) van het vermenigvuldigingsgetal van G. rostochiensis in de bovenste 20 cm van de grond; ○, ● en getrokken lijn: zoals gemeten in veldproef, gebroken lijn: veronderstelde betrekking bij een vermenigvuldigingsgetal op onbehandelde veldjes van 25. B: aantallen eieren/cyste na het rooien van de aardappelen.

Additional samplings to investigate the distribution of G. rostochiensis within plots at different depths

Egg densities found at different places and depths in a plot in autumn (p) were expressed as proportions of the egg density found in the same plot in spring (q). Averages per treatment of these proportions for each place and depth, $(\Sigma p/q)n_t$ (n_t: numbers of plots per treatment), were then divided by the average of the ratios in the untreated plots at 0–20 cm depth between two plants in a ridge, $(\Sigma p_r/q)n_u$. The figures thus obtained, $\{(\Sigma p/q)n_t\}/\{(\Sigma p_r/q)/n_u\}$, ($n_t$ and n_u: numbers of observations summed of treated and untreated plots, respectively) are multiplication rates per treatment place and depth expressed as proportions of the average multiplication rate at 0–20 cm depth between two plants in a ridge in untreated plots. The samples from the top 20 cm in the centre of the plot consisted of soil from the ridge down to a certain depth and the original soil below the furrow between this depth and 20 cm depth. To estimate the densities in the latter soil it was assumed that the depth of the furrow was 12 cm below the soil surface after the levelling of the ridges. If now nematode densities below the furrow, in the ridge and in the center of the plot were x, a and b respectively (a and b as determined by the second sampling in autumn), then $8x + 12a = 20b$. Relative densities at the different treatments calculated in this way are given in Fig. 4. A tentative distribution of egg densities in different places and layers after different treatments was derived from these figures (Fig. 4).

Discussion

The average multiplication rate of *G. rostochiensis* on untreated plots was 2.35. This is much smaller than the average for this nematode in the Netherlands. Late planting of

Fig. 4. Cross section of ridge and two furrows with post-harvest egg densities of *G. rostochiensis* at four different treatments on rotavated plots. All Figures between brackets: densities below furrow before lifting of potatoes and levelling of plots, calculated from densities found in top 20 cm after levelling of plots. Dotted lines: presumed density isograms with, in italics, associated relative egg densities.

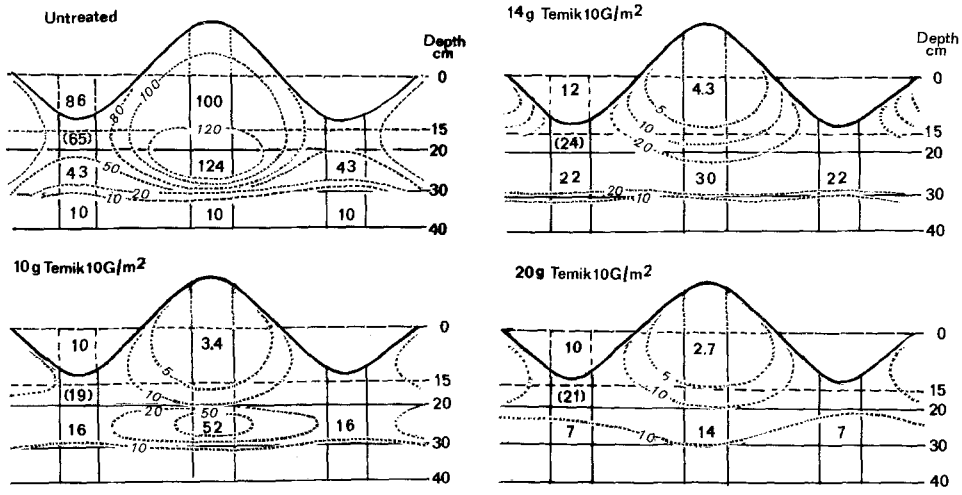

Fig. 4. Dwarsdoorsneden door rug en twee voren van met vier doses aldicarb behandelde gefreesde veldjes met bevolkingsdichtheden van G. rostochiensis na het rooien van de aardappelen. Alle cijfers zijn relatieve dichtheden van eieren berekend zoals beschreven in tekst. Cijfers tussen haakjes: dichtheden onder de voren voor het rooien van de aardappelen en het gelijk maken van de veldjes, berekend uit de dichtheden in de bovenste 20 cm van de veldjes na het gelijk maken. Stippellijnen: veronderstelde dichtheidsisogrammen met, schuin gedrukt, de bijbehorende dichtheden.

the potatoes (caused by the considerable amount of preparation required by the experiment) and a dry period during the summer (Table 1) could have kept multiplication small.

The reduction of the multiplication rate obtained by 5 g Temik 10 G/m^2 in the top 20 cm of the soil. 78% (Fig. 3), is equal to the greatest reduction obtained by Den Ouden and Van de Veer (1977) with the same dosage. Apparently the effect of the chemical was not reduced by the external conditions that kept multiplication low.

The dosage-increase-efficiency (Seinhorst, 1973a) was only 0.3 probit unit per doubling of the dosage between 3.5 g and 10 g Temik 10 G per m^2. The effects of 10 g, 14 g and 20 g of the chemical per m^2 were virtually the same. The small dosage-increase-efficiency in this experiment suggests that the chemical did not act uniformly against the whole nematode population. Fig. 4 helps to reveal the nature of this lack of uniformity. In untreated soil the largest nematode density was found below the ridges (i.e. below the 20 cm depth level in Fig. 4). The density in the upper 10 cm below the furrow (12–22 cm depth according to Fig. 4) was 78% of that in the ridge (i.e. above the 20 cm depth level in Fig. 4). In the plots treated with 10 g, 14 g and 20 g Temik 10 G per m^2 densities in the ridge were 3–4% of those in the ridge of untreated plots, but in the top 10 cm below the furrow about 20% of the latter density. Apparently increasing the dosage of the chemical from 10 g/m^2 to 14 g and 20 g/m^2 did not increase its effect on

Table 1. Precipitation (mm) at Dokkum (12 km from location of experimental field) in 1975.

	April	May	June	July	August
1–10	28.8	33.1	18.3	5.4	0
11–20	32.7	17.0	9.7	47.6	16.0
21–30/31	9.0	4.0	8.8	24.6	58.6

Tabel 1. Neerslag (mm) te Dokkum (12 km van het proefveld) in 1975.

the nematode population in the top 20 cm of the soil either in the ridge or below the furrow.

According to Hague and Pain (1970) *G. rostochiensis* eggs do hatch when potatoes are grown in soil treated with aldicarb but the juveniles do not enter the roots of the plants, possibly because they are disoriented (Kerstan and Röpke, 1977). However, a certain proportion of the population does not hatch, even when potatoes are grown. This proportion can be expected to be smaller in the ridges where root density is large, than below the furrows where the root system is sparser. The final population in the top 20 cm of the plots treated with 10, 14 and 20 g Temik 10 G/m^2 might consist entirely of eggs of the initial population that did not hatch. Calculations based on this assumption and depths of the furrows of 12 cm and 10 cm below the soil surface after levelling the ridges are given in an Appendix. According to these calculations hatching rates in the ridges were 90% and 90% and below the furrows 41% and 51% at the two depths of the furrows, respectively. The average multiplication rates in the top 20 cm of the untreated plots were calculated to have been 2.58 and 2.55 (2.5 according to the initial and final samplings of the entire square meter plots). Almost 20% of the eggs of the initial population then did not hatch.

If a certain proportion of the initial egg population does not hatch the effect of a treatment reducing the activity of hatched juveniles, expressed as the ratio between multiplication rates (ratios between final and initial egg densities) on treated and untreated plots, is greater the larger the multiplication rate on untreated plots. The reductions of the latter that would have been obtained in this experiment if this multiplication rate had been 25 are indicated in Fig. 3. The dosage-increase-efficiency would have increased to 0.47 probit units per doubling of the dosage and a reduction of the multiplication rate by 85% would have been obtained with 5 g Temik 10 G/m^2 (76% in this experiment).

The densities below the ridges and furrows (between 20 and 30 cm below the soil surface after the levelling of the ridges) in plots treated with 10 g Temik 10 G/m^2 were about 40% of those below the ridges and furrows of untreated plots. They probably were smaller at the larger dosages of the chemical (Fig. 4), but then they would have been still larger at the smaller dosages. Therefore, as also found by Whitehead et al. (1973), mixing Temik 10 G through the top layer of the soil was much less effective against multiplication of potato cyst nematodes in deeper layers than in the top 20 cm of the soil. This may not be of great importance if the treatment is intended to prevent a considerable loss of yield at large initial nematode densities. If, however, it should keep population density small population build up below 20 cm depth cannot be ignored.

The absence of an effect of rotavation on the activity of the chemical (contrary to

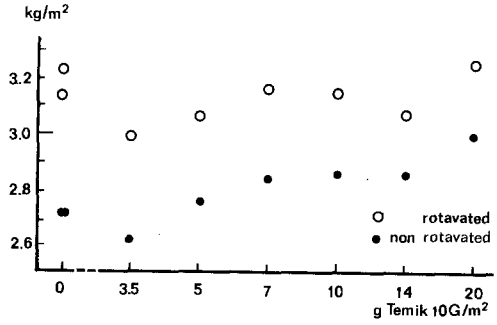

Fig. 5. Yields (kg/m²) of potato tubers at the different treatments.

Fig. 5. Knolopbrengsten (kg/m²) bij de verschillende behandelingen.

what was found by Whitehead et al., 1973) may indicate that the soil was in a favourable condition to obtain a good distribution of the Temik 10 G by ridging only. However, rotavation increased tuber yields considerably (Fig. 5). Yields on non-rotavated plots are also slightly higher at the large than at the small dosages of the chemical. The average yield per plot at densities < 10 eggs/g soil on untreated plots was only very little larger than the average over all plots. Therefore, the increase must have had another cause than eliminating potato cyst nematode attack.

Experiments at very small densties require investigation of large quantities of soil (2.5 tons in the experiment described here). At larger densities multiplication rates are density-dependent. No method for the statistical treatment of such multiplication rates and for the calculation and comparison of rates of reduction to be derived from them is available yet, unless one could rely on an equal reduction of multiplication rates at all initial nematode densities.

In addition to these difficulties the moisture content of the soil cannot be controlled in field experiments. Therefore, its effects on the activity of chemicals can only be derived (with some difficulty) from data of field experiments done in several years. All these objections against field experiments suggest that a better way of investigating the effect of chemicals that are active during the growth of the plants should be devised . A simulation of the spatial arrangements in the field with well-mixed soil with a small *G. rostochiensis* density, protected against natural precipitation and with a sprinkler installation to imitate rain would be such a way.

Appendix

Let the distance between the top of the ridges and the bottom of the furrows be 24 cm (soil depth to the level of 20 cm below the surface after levelling the ridges: 32 cm at the centre of the ridges and 8 cm below the furrows, as in Fig. 4). Relative nematode densities are then as indicated in Fig. 6. The average density in the ridges of the treated plots is 3.4 and just below the furrows 21.5. If, further, the proportion of eggs that hatched in the centre of the ridges was a and below the furrows b the multiplication rates of hatched juveniles, both in the ridges and below the furrows, p in untreated and 0 in treated plots and r is a proportionality factor, then $1-a+ap = 100r$, $1-a = 3.47r$, $1-b+bp = 65r$ and $1-b = 21.5r$. Solving these equations results in $r = 0.0277$ $a = 0.90$ $b = 0.41$ and $p = 2.95$.

Assuming soil depths to the level of 20 cm below the surface after leveling the ridges

of 30 cm in the ridges and 10 cm below the furrows changes relative densities below the furrow of untreated plots to 72 and of treated plots to an average of 17.9. Then again $1-a+ap = 100r$ and $1-a = 3.47r$ but $1-b+bp = 72r$ and $1-b = 17.2$. Solving these equations results in $r = 0.0275$, $a = 0.904$, $b = 0.51$ and $p = 2.93$.

It is not known which proportions of the top 20 cm of the plots after the levelling of the ridges consisted of soil with the density measured in the former furrows and of soil with the densities measured in the former ridges. However, the relative post-harvest density in the top 20 cm of the untreated plots could not differ much from the average between the two densities: $(100 + 86)/2 = 93$. The average multiplication rate in these plots would then have been $93r = 2.58$ and 2.55 for the two values or r calculated. Applying the same assumptions to the treated plots yields an average proportion of eggs of the initial population that did not hatch of $14.2r/2 = 19.6\%$ and 19.5%.

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Samenvatting

Het effect van verschillende doses aldicarb op de vermenigvuldiging van Globodera rostochiensis bij lage dichtheden op aardappel op wel en niet gefreesde percelen

Het effect van 0,35, 0,5, 0,7, 1, 1,4 en 2 g aldicarb/m^2, toegediend vlak voor het poten, op de vermenigvuldiging van *Globodera rostochiensis* op aardappel werd onderzocht in een veldproef op zavel. Het middel werd breedwerpig over de oppervlakte van de grond verdeeld. Daarna werd de helft van de met elke dosis behandelde en van de onbehandelde veldjes gefreesd tot 15 cm diepte. Er werd drie maal aangeaard. Er was geen verschil in de vermenigvuldiging van de aaltjes in de bovenste 20 cm van de grond tussen wel en niet gefreesde veldjes met dezelfde dosis van het middel. De betrekking tussen log dosis van het middel van probit vermindering van het vermenigvuldigingsgetal van het aaltje ten opzichte van onbehandeld in de bovenste 20 cm van de grond was rechtlijnig tussen 0,35 g en 1,4 g aldicarb/m^2. Het effect van dosisvergroting was 0,3 probit eenheid per verdubbeling van de dosis en de vermindering van het vermenigvuldigingsgetal bij 0,5 g aldicarb/m^2 77%. Het effect van 1,4 g en 2 g aldicarb/m^2 was gelijk. De resultaten zijn in overeenstemming met de veronderstelling, dat in de met 1,4 en 2 g aldicarb/m^2 behandelde veldjes de vermenigvuldiging van de aaltjes in de bovenste 20 cm van de grond geheel was verhinderd. Met een voor praktische toepassing aanvaardbare dosis aldicarb kon een sterke vermeerdering van aardappelcystenaaltjes beneden 20 cm onder de oppervlakte van de grond niet worden voorkómen. Daardoor is de bruikbaarheid van dit systemische nematicide (en van overeenkomstige middelen) in een bestrijdingssysteem, dat streeft naar het (zeer) laag houden van dichtheden van aardappelcystenaaltjes, problematisch.

References

Hague, N. G. M. & Pain, B. F., 1970. Some observations on the effect of 'Temik' on the potato cyst celworm, *Heterodera rostochiensis* Woll. Pl. Path. 19: 69–71.

Kerstan, U. & Röpke, S., 1977. Einfluss von Systemnematiziden auf das Verteilungsmuster der Larven von *Heterodera schachtii* im Wurzelbereich. 3. Vortragstagung zu Aktuellen Problemen der Phytonematologie (Manuscriptdruck) pp. 104–129, Rostock.

Ouden, H. den & Veer, R. F. van de, 1977. The effect of some systemic nematicides on the control of *Heterodera rostochiensis* in the field. Neth. J. Pl. Path. 83: 129–137.

Seinhorst, J. W., 1973a. Dosage of nematicidal fumigants and mortality of nematodes. Neth. J. Pl. Path. 79: 180–188.

Seinhorst, J. W., 1973b. The combined effects of dichloropropane-dichloropropene mixture injected into the soil and of dazomet applied to the soil surface. Neth. J. Pl. Path. 79: 194–206.

Whitehead, A. G., Tite, D. J., Fraser, Janet E. & French, Eileen M., 1973. Control of potato cyst nematode, *Heterodera rostochiensis*, in three soils by small amounts of aldicarb, Du Pont 1410 or Nemacur applied to the soil at planting time. Ann. appl. Biol. 74: 113–118.

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