

Report Prepared for the
Horticultural Development Council

FV 274
Cutworm development and survival:
a risk assessment and early
warning programme for growers.

Final Report

By

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ADAS
November 2006

Authentication

I declare that this work was done under my supervision according to the procedures described herein and that the report represents a true and accurate record of the results obtained.

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Authorisation

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Cutworm development and survival: a risk assessment and early warning system for growers

Project Number: FV 274

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Grower Summary

Headline

Cutworm development was monitored for 10 weeks in 2005 and again for 12 weeks in 2006. Assessments of the risk of damage were made on a weekly basis and spray warnings were issued as appropriate

Background

Cutworms are the caterpillars of certain moths, especially turnip moth. The mature caterpillars feed underground and are safe from insecticides, but the young larvae feed on the foliage of host crops where they are vulnerable to heavy rainfall as well as pesticides. By computing the rate of development of cutworms and integrating this with rainfall records it is possible to predict where and when the threat of cutworm damage has become sufficient to justify a pesticide treatment. In some years there is sufficient rain to keep the risk of cutworm damage at low levels without any treatment.

Results and Conclusions

11 cutworm reports were prepared between 2nd June and 4th August 2005 and 13 were prepared in 2006, spanning 25th May to 10th August. These were made available to HDC members on the Warwick HRI website in both years. See appendices for copies.

Overall, 2005 did not prove to be a high-risk year as far as cutworm damage is concerned. The areas of Britain at highest risk were central southern and south-eastern England (see map 2), particularly Hampshire and Sussex. Treatment of the most susceptible crops was recommended in these areas on about the 21st of July, but even in the highest-risk parts the cutworm survival index did not rise high enough to justify treatment of potatoes.

The risk in 2006 was greater than it had been in 2005, mainly as a consequence of the rainfall (a major cause of cutworm mortality) in 2006 being lighter, more sporadic and localised than it was in the previous year. The first recommendation to treat the most susceptible crops in vulnerable areas was made on 1st July, and during the month of July these recommendations were gradually expanded to less susceptible crops, including potatoes, over a greater geographical range. The risk of damage in some, southern, areas persisted into August.

Action Points for Growers

- During the 'cutworm season', between June and August, the cutworm forecasts should be consulted on a regular basis.
- Crops should only be treated against cutworm when the predicted risk of damage reaches the trigger level. In most years this will save the expense and potential environmental effects of routinely-applied treatments.

Expected Practical and Financial Benefits

- Minimisation of unnecessary treatment against cutworms saves both costs and possible environmental effects

Science Section

Background

- Cutworms are the larvae (caterpillars) of certain moths of the genus *Agrotis*, particularly *Agrotis segetum*, the turnip moth.
- Later-instar caterpillars feed underground and can cause severe economic damage to a wide range of crops by either severing them or excavating holes in roots.
- Susceptible crops include lettuce, leek, red beet, onion, carrot, leaf and flowerhead brassicas, swede, turnip, sugar beet, potato, strawberry and some ornamentals.
- Cutworm development rate and survival are influenced by temperature and rainfall respectively. The potential for damage is much greater in warm, dry summers than it is in cool, wet ones as the survival of young cutworms is significantly reduced by rainfall.
- Early instar cutworms (which feed above ground) can be controlled by the use of pesticides or irrigation if there is a significant risk of damage. The timing of treatment is critical and must be made between egg-hatch and the time when cutworms enter the soil half way through their development.
- The established ADAS cutworm forecasting system has been in operation for many years and uses meteorological and cutworm development data to predict the risk of cutworm damage in British crops.
- Using a forecasting system enables growers to treat crops when the risk of damage is high and to leave them unsprayed when the risk is low. This saves unnecessary use of pesticides and allows growers to comply with crop production protocols.

Summary

Individual weekly reports can be summarised as follows:

2005

- 2nd June. First turnip moths caught at the end of May. First hatch predicted for the second week of June
- 9th June. Turnip moths now caught in all areas. First hatch was on 11th June in the earliest area (Cams.)
- 16th June. Further cutworm hatch occurring or about to occur. Development proceeding rapidly in warm temperatures.
- 23rd June. Cutworms approaching third instar in earliest areas. Will be getting there by the end of the month in most areas. Rainfall expected.
- 27th June. Rainfall in Wales, and England south of a line Mersey-Wash, except for E Anglia, the south-east and Cornwall. These dry areas now at some risk of cutworm damage. Spray warning issued for these areas if there is no rain before the end of June.
- 30th June. Some localised rain. Immediate spray warning issued for the most susceptible crops in Kent, Sussex and parts of Hants, which remained dry.
- 7th July. Widespread rainfall. All spray warnings withdrawn.
- 14th July. Warm, dry weather encouraging further cutworm development. Cutworm risk increasing in Hants, Sussex and Berks.

- 21st July. Warning issued to spray the most vulnerable crops in Central S England and the Severn/Wye areas.
- 28th July. Heavy rain fell on 23-27th July, in time to negate spray warnings.
- 4th August. Further heavy rain sees the end to any cutworm risk for this season.

2006

- 25th May. Turnip moths caught in Cambs. and Norfolk. First egg hatch not expected for at least 2 weeks
- 1st June. Further moths caught, in Cheshire. Hatch still not expected for at least a week.
- 8th June. Moths still not trapped in all areas. Egg hatch starting in earliest areas.
- 15th June. Egg hatch more widespread. Expected in north by 19th June.
- 22nd June. No significant rainfall in most areas. Likelihood of first spray warnings by 3rd July.
- 30th June. Warning issued to spray the most vulnerable crops in central and southern England on or after July 1st.
- 4th July. Still no widespread, heavy rain. Spray warnings for most vulnerable crops extended to a wider geographical range. Warnings also issued to spray moderately-susceptible crops in the highest-risk areas.
- 7th July. Random heavy, localised rain showers complicate the forecast. Spray warnings extended both geographically and to the least susceptible crops in the highest risk areas.
- 14th July. Widespread light showers with much more localised heavy rain. Forecast now becoming complex. Possibility of second treatments to the most vulnerable crops raised.
- 21st July. No substantial rainfall since the previous forecast. Second treatments in some areas now a distinct possibility.
- 31st July. Substantial rainfall in many areas greatly decreases further risk. Second treatments still may be required in some localised areas.
- 4th August. Further heavy rain in north eliminates any further risk. In the south, some areas/crops remain vulnerable.
- 10th August. No further intervention feasible.

Note that the Appendices comprise copies of all weekly reports.

Horticultural Development Council
Cutworm Monitoring & Prediction, 2005.

Prepared by Mike Lole
ADAS Wolverhampton

Report No 1, 2nd June 2005

Background

Cutworm

“Cutworm” is the name given to caterpillars of certain Noctuid moths, in particular those of the turnip moth *Agrotis segetum*. The name derives from the habit of the older caterpillars of feeding underground, damaging plant roots and stems (including the storage organs that we use for food), sometimes so badly that the plant topples.

The adult moths lay eggs on plants or on pieces of litter and debris in the soil, usually from the end of May or early June. These hatch in around 8-24 days, depending on temperature. The young caterpillars seek out and feed on the aerial parts of plants. In a further 10-20 days, again depending on temperature, the caterpillars go through their second moult, becoming “third instar” caterpillars. It is at this point that they adopt the cutworm habit, becoming subterranean and feeding on roots etc.

Unhatched cutworm eggs and the older, subterranean caterpillars are largely invulnerable to the effects of the weather and insecticides. The two early caterpillar instars differ, however. If there is substantial rainfall (defined as 10mm or more of rain falling in showers of moderate intensity over a 24-hour period) whilst these caterpillars are feeding above ground then this causes high mortality among them. They are also vulnerable to insecticides whilst feeding on the foliage.

Crop Susceptibility

Crops differ in their susceptibility to cutworm damage. The most vulnerable are lettuce, leek and red beet. Young lettuce and leek plants are easily bitten through by cutworms, and though beet plants may survive an attack the bulbous root is rendered unmarketable by cutworm feeding. Moderately susceptible crops include brassicas, carrot, celery, parsnip and sugar beet. The least susceptible of those vulnerable to damage are onion, potato, swede and turnip.

The Cutworm Model

The cutworm model is a computer programme that uses weather data to predict the rate of development of turnip moth eggs and caterpillars. It also predicts the level of rain-induced mortality among the early-instar caterpillars. The weather data used cover 600 sites in the whole of Great Britain, so that local differences in weather can be reflected in the forecasts of development that are used in the model.

Rate of development and the level of rain-induced mortality must both be known if a rational choice is to be made about the need for insecticide treatment of vulnerable crops. The cutworm model is therefore an important tool for the grower.

Moth Activity

The activity of adult moths is monitored by ADAS, Warwick HRI and STC in order to provide information on when oviposition may be taking place. In 2005, traps are being run in Lincolnshire, Cambridgeshire, Hampshire, Shropshire, Yorkshire and Warwickshire.

Current Situation

To date turnip moths have been caught in Cambridgeshire, (w/e 27/05/05), Warwickshire (w/e 31/05/05) and Yorkshire (w/e 31/05/05). On past form, moths are likely to be caught in the remaining traps in the next 7 days.

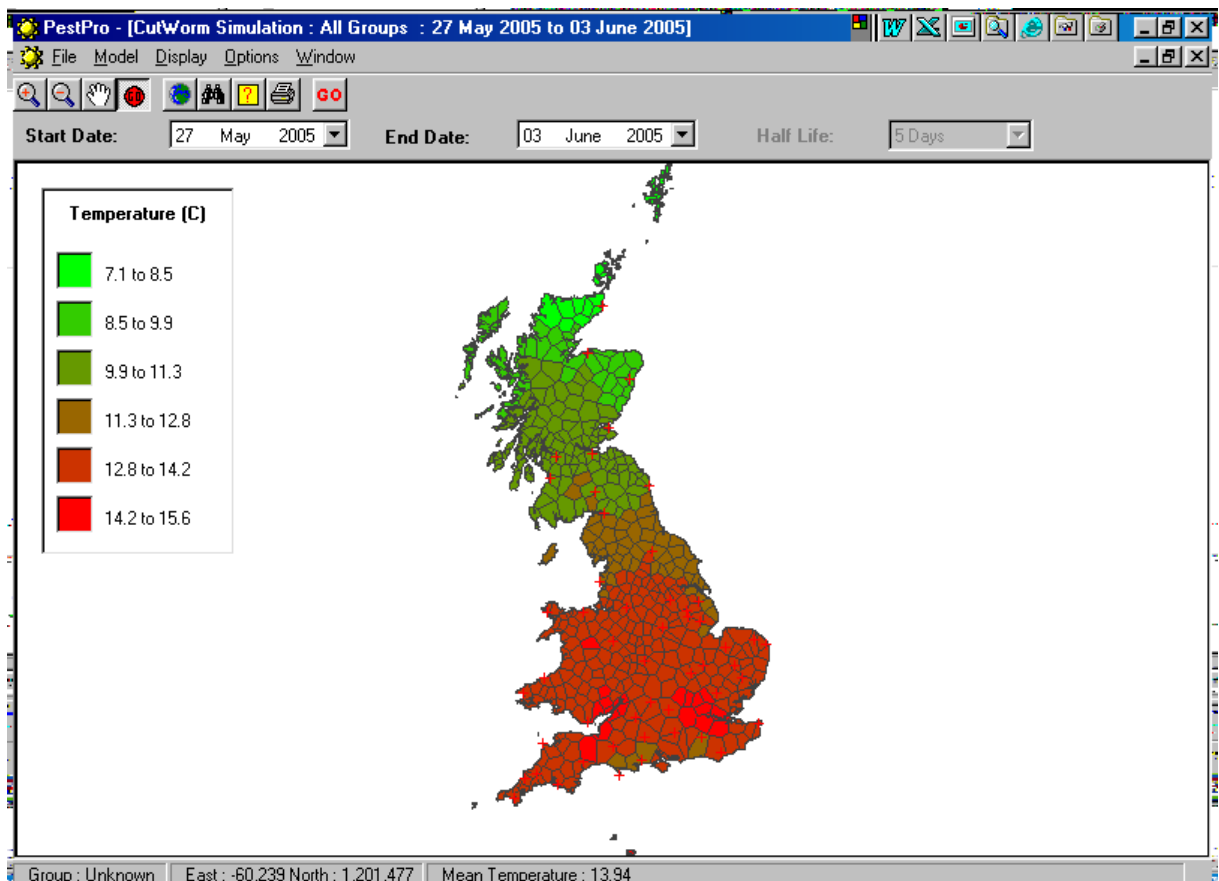
Assuming that the Cambs moths began laying eggs on the day the first one was trapped, the earliest-laid eggs have by now completed over half their development and, given similar temperatures to those applying currently, will begin to hatch in about 10 days. Temperatures are currently highest around the Thames and Severn estuaries (see map below) so this is where the earliest hatches may occur.

Temperature and rainfall after hatching are important as these dictate both the speed of development of the larvae and the mortality of the young instars.

Action

No action will be necessary for at least a fortnight. We will however produce weekly updates on the cutworm situation from now until August 2005.

Mean daily temperatures, 27th May –2nd June 2005



Horticultural Development Council
Cutworm Monitoring & Prediction, 2005.

Prepared by Mike Lole
ADAS Wolverhampton

Report No 2, 9th June 2005

The 'Background' section is repeated from last week's report, for those who missed it. If you have already seen this go straight to the 'Current Situation' section.

Background

Cutworm

"Cutworm" is the name given to caterpillars of certain Noctuid moths, in particular those of the turnip moth *Agrotis segetum*. The name derives from the habit of the older caterpillars of feeding underground, damaging plant roots and stems (including the storage organs that we use for food), sometimes so badly that the plant topples.

The adult moths lay eggs on plants or on pieces of litter and debris in the soil, usually from the end of May or early June. These hatch in around 8-24 days, depending on temperature. The young caterpillars seek out and feed on the aerial parts of plants. In a further 10-20 days, again depending on temperature, the caterpillars go through their second moult, becoming "third instar" caterpillars. It is at this point that they adopt the cutworm habit, becoming subterranean and feeding on roots etc.

Unhatched cutworm eggs and the older, subterranean caterpillars are largely invulnerable to the effects of the weather and insecticides. The two early caterpillar instars differ, however. If there is substantial rainfall (defined as 10mm or more of rain falling in showers of moderate intensity over a 24-hour period) whilst these caterpillars are feeding above ground then this causes high mortality among them. They are also vulnerable to insecticides whilst feeding on the foliage.

Crop Susceptibility

Crops differ in their susceptibility to cutworm damage. The most vulnerable are lettuce, leek and red beet. Young lettuce and leek plants are easily bitten through by cutworms, and though beet plants may survive an attack the bulbous root is rendered unmarketable by cutworm feeding. Moderately susceptible crops include brassicas, carrot, celery, parsnip and sugar beet. The least susceptible of those vulnerable to damage are onion, potato, swede and turnip.

The Cutworm Model

The cutworm model is a computer programme that uses weather data to predict the rate of development of turnip moth eggs and caterpillars. It also predicts the level of rain-induced mortality among the early-instar caterpillars. The weather data used cover 600 sites in the whole of Great Britain, so that local differences in weather can be reflected in the forecasts of development that are used in the model.

Rate of development and the level of rain-induced mortality must both be known if a rational choice is to be made about the need for insecticide treatment of vulnerable crops. The cutworm model is therefore an important tool for the grower.

Moth Activity

The activity of adult moths is monitored by ADAS, Warwick HRI and STC in order to provide information on when oviposition may be taking place. In 2005, traps are being run in Lincolnshire, Cambridgeshire, Hampshire, Shropshire, Yorkshire and Warwickshire.

Current Situation

Turnip moths are now being caught in nearly all of the monitored sites and it is reasonable to assume that egg-laying is now occurring in all areas. June 2nd is acceptable as the date when turnip moth egg-laying began generally in the UK this year.

In Cambs moths were detected earlier than other areas and, assuming that they began laying eggs on the day the first one was trapped, the earliest-laid eggs (27th May) have by now almost completed their development. These are likely to begin hatching at the weekend (11th June). In most of the rest of the UK, assuming egg-laying began on June 2nd, the first caterpillars will not hatch for a further 9 or 10 days from now (ie about 18th June) as cooler night-time temperatures have slowed development.

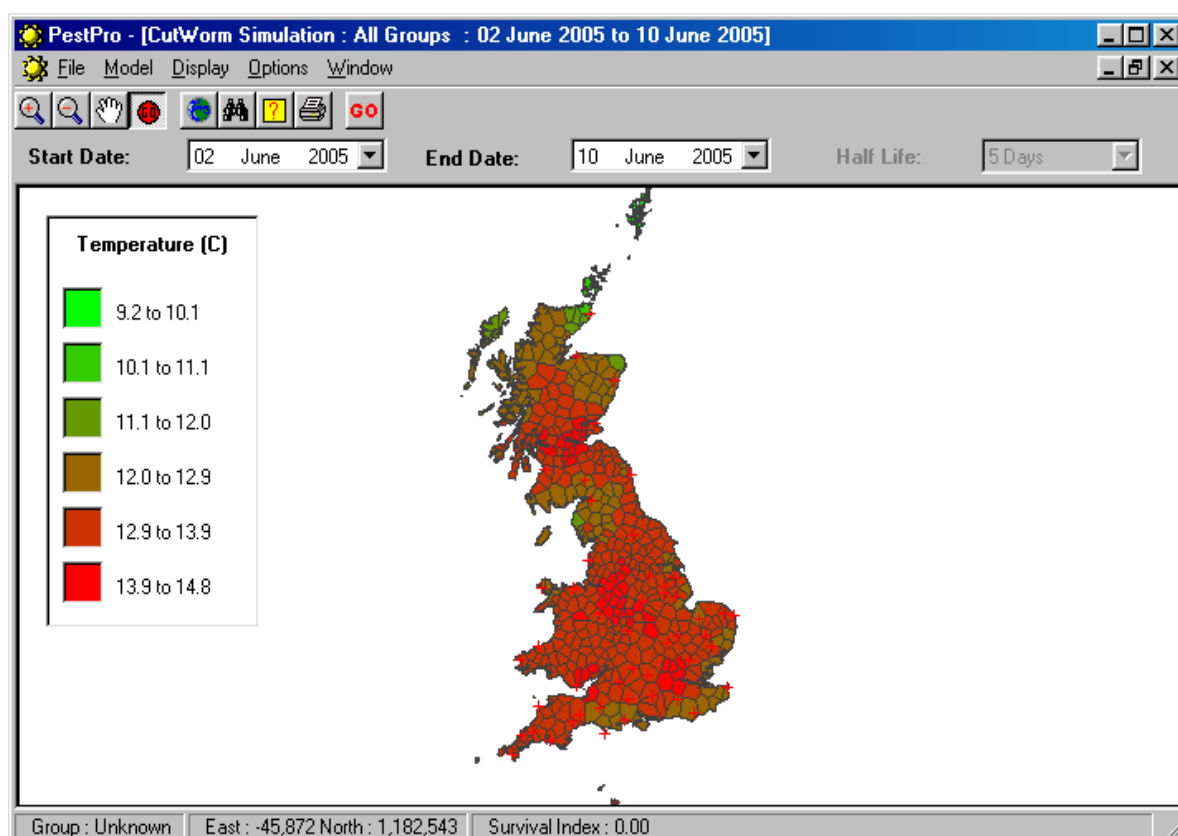
Temperature and rainfall after hatching are important as these dictate both the speed of development of the larvae and the mortality of the young instars. Once hatching has begun in earnest we will be looking for rainfall events to reduce survival of young caterpillars and obviate the need for treatments. As yet, however, rainfall is irrelevant to survival.

Action

No action is necessary this week.

The next update on the cutworm situation will be produced on 16th June, by which time widespread egg hatch could be imminent.

Mean daily temperatures, 2nd June –10th June 2005



Horticultural Development Council
Cutworm Monitoring & Prediction, 2005.

Prepared by Mike Lole
ADAS Wolverhampton

Report No 3, 16th June 2005

Current Situation

This assessment is based on the assumption that turnip moth egg-laying began in Cambs. on 27th of May this year, and that by June 2nd egg-laying began generally in the UK.

The earliest-laid eggs (27th May, Cambs.) have completed their development and began to hatch on the 11th June. In the six days that have passed since then, the young caterpillars will have completed about a third of their development (approx. 32%) and, given similar temperatures, will begin to reach the invulnerable third instar stage by the end of this month. In most of the rest of the UK, assuming egg-laying began on June 2nd, the first caterpillars should be hatching on about the 17th June, or later where temperatures have been cooler (see map below).

The recent rainfall in Cambs. fell after cutworms had begun to hatch, but only amounted to 3 or 4mm and was not therefore sufficient to influence survival greatly. It requires at least 10mm of good steady rain to cause significant mortality in young caterpillars.

In the rest of Britain the rainfall that occurred recently will not have influenced cutworm survival as the eggs had not hatched at the time that it fell. Unhatched eggs are not vulnerable to rain.

Temperature after hatching is important as this dictates the speed of development of the young caterpillars. The warmer spell that is currently being predicted is likely to accelerate the rate of development.

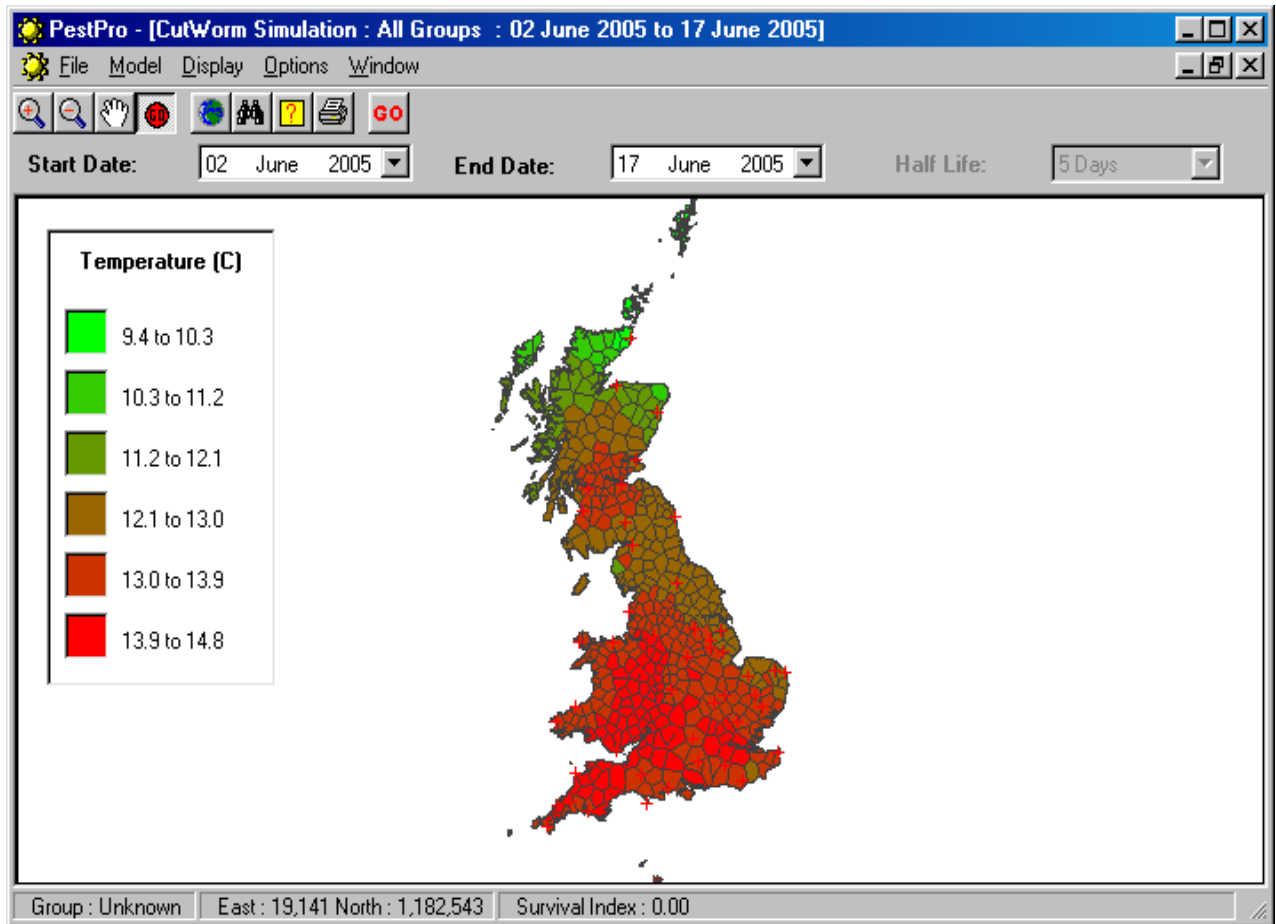
Rainfall affects the mortality of the young instars. Now that hatching has begun rainfall events will be monitored closely as these reduce survival of young caterpillars and obviate the need for treatments.

Action

No treatment action is likely to be necessary for at least 2 weeks. However, growers in all areas should now be monitoring their local rainfall on a daily basis. To give localised coverage this forecast uses data that is to some extent interpolated, and locally-gathered data is likely to be more accurate for specific locations.

The next update on the cutworm situation will be produced on 23rd June, by which time egg hatch will have occurred in most areas and development of caterpillars will be underway. Ensure that you see this forecast.

Mean daily temperatures, 2nd June –17th June 2005



Horticultural Development Council
Cutworm Monitoring & Prediction, 2005.

Prepared by Mike Lole
ADAS Wolverhampton

Report No 4, 23rd June 2005

Current Situation

This assessment is based on the assumption that turnip moth egg-laying began in Cambs. on 27th of May this year, and that by June 2nd egg-laying began generally in the UK.

The earliest-laid eggs (27th May, Cambs.) have completed their development and began to hatch on the 1st - 12th June. The first of these caterpillars will begin to reach the third instar stage by 24th June, at about the same time as eggs laid on the 2nd of June in the warmest parts of Britain (the south-east around London: see map 1). These later-laid eggs began to hatch from the 17th June.

Temperatures have been high since hatch and the young caterpillars have been developing at about 8-9% per day, giving a time of 11 or 12 days from hatch to reaching the third instar stage. This means that for most of Britain third instar larvae will not start to appear before about the 28th June.

It is usual to issue warnings to treat the most vulnerable crops against cutworms when about 5 days-worth of egg-batches have hatched and are about to reach the third instar. This will not be before 27th June in any area and in the majority will not be until the beginning of July.

Rainfall at the critical time between egg-hatch and the third instar, underground-feeding stage can significantly affect the survival of young cutworms. There was heavy rain (causing localised flooding) in a swathe of England stretching from Shropshire and Cheshire in the south-west, through E.Lancs, W. Yorks and N Yorks to the N.Yorks/Durham coast (see map 2) on the 19th of June. This was probably too early to greatly affect survival as most eggs in these areas had yet to hatch at the time. However, there is further rain expected throughout the British Isles on Friday and Saturday this week and this could have much greater significance.

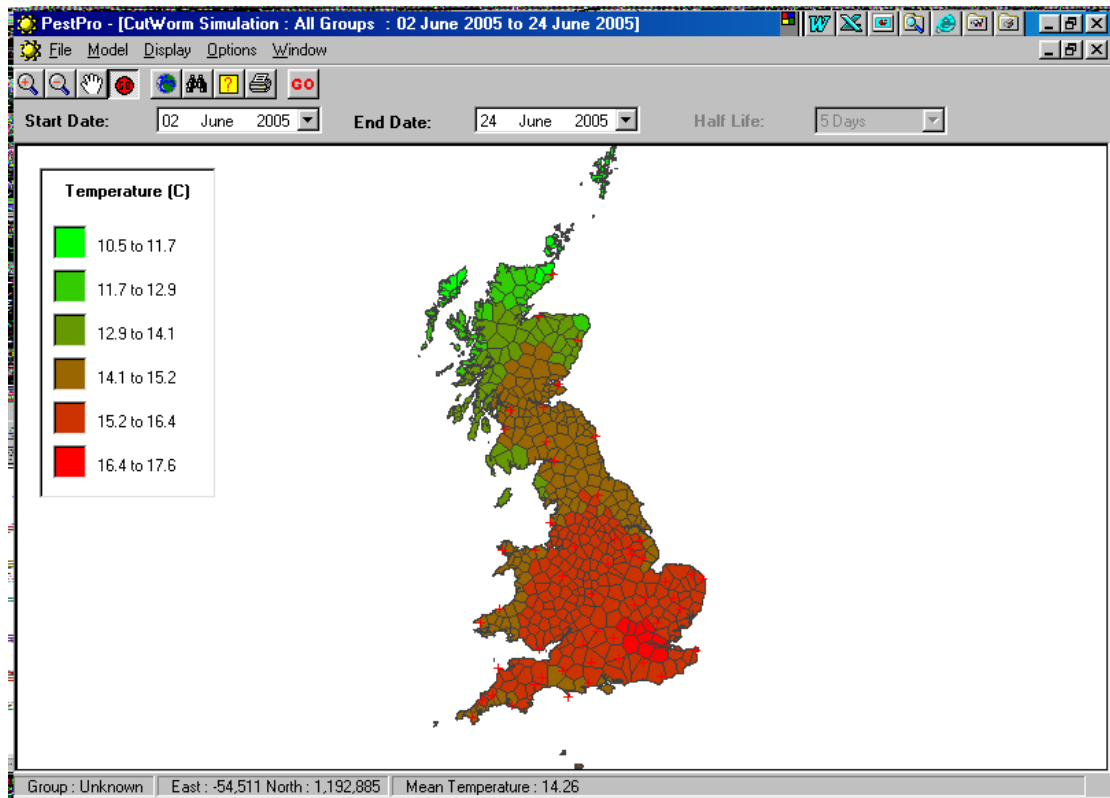
Action

No treatment action is likely to be necessary in any area until 28th June at the earliest, and in the majority of Britain none will be necessary until the 1st of July or later. If there is significant rainfall the need for treatment will be postponed.

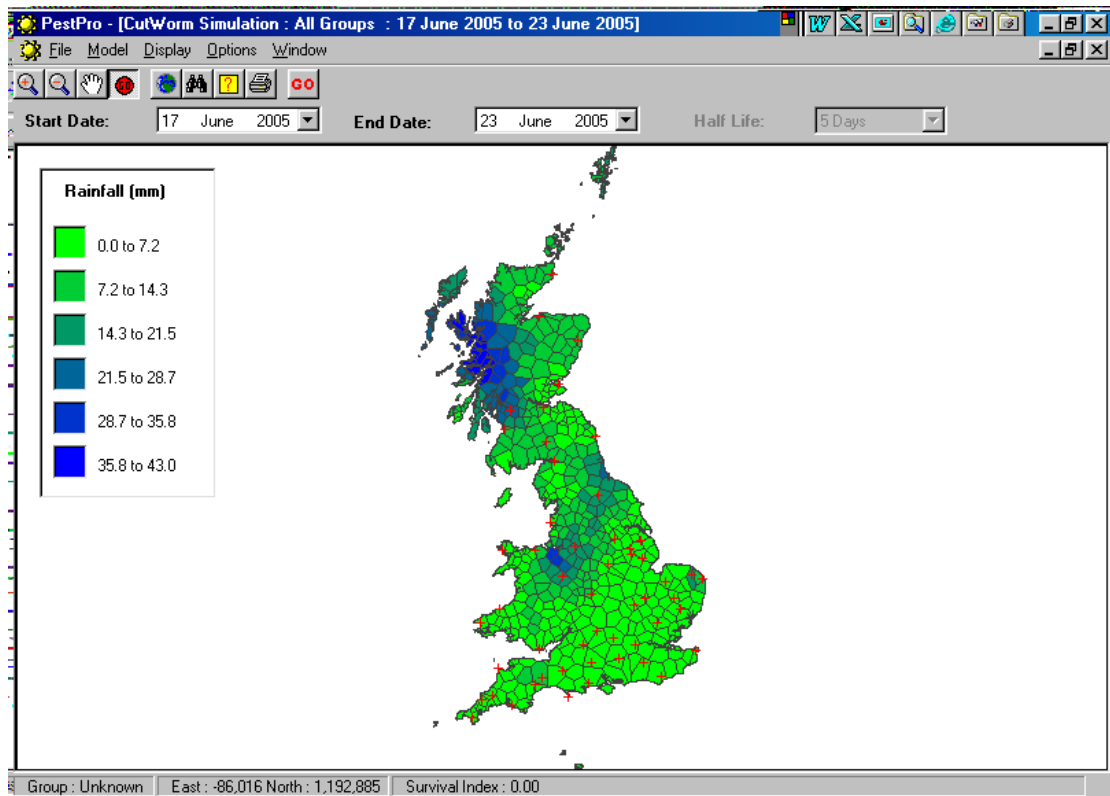
Growers in all areas should now be monitoring their local rainfall on a daily basis. To give localised coverage this forecast uses data that is to some extent interpolated, and locally-gathered data is likely to be more accurate for specific locations.

A further assessment of the situation will be made on 27th June, when the effect of any rain in the meantime can be taken into account. A further update will be produced at this time. Ensure that you see this forecast.

Map 1 Mean daily temperatures, 2nd June –24th June 2005



Map 2 Rainfall, 17th – 23rd June



Horticultural Development Council
Cutworm Monitoring & Prediction, 2005.

Prepared by Mike Lole
ADAS Wolverhampton

Report No 5, 27th June 2005 – Interim Update

Current Situation

This assessment is based on the assumption that turnip moth egg-laying began in Cambs. on 27th of May this year, and that by June 2nd egg-laying began generally in the UK.

The earliest-laid eggs (27th May, Cambs.) have completed their development and began to hatch on the 1st - 12th June. The first of these caterpillars began to reach the third instar stage by 24th June, at about the same time as eggs laid on the 2nd of June in the warmest parts of Britain (the south-east around London). These later-laid eggs began to hatch from the 17th June.

Temperatures have been high since hatch and the young caterpillars have been developing at about 8-9% per day, giving a time of 11 or 12 days from hatch to reaching the third instar stage. This means that for most of Britain third instar larvae will not start to appear before about the 28th June.

It is usual to issue warnings to treat the most vulnerable crops against cutworms when about 5 days-worth of egg-batches have hatched and are about to reach the third instar. This will not be before 27th June in any area and in the majority will not be until the beginning of July.

Rainfall at the critical time between egg-hatch and the third instar, underground-feeding stage can significantly affect the survival of young cutworms. There was heavy rain (causing localised flooding) in a swathe of England stretching from Shropshire and Cheshire in the south-west, through E.Lancs, W. Yorks and N Yorks to the N.Yorks/Durham coast (see map 2) on the 19th of June. This was probably too early to greatly affect survival as most eggs in these areas had yet to hatch at the time. However, heavy rain fell in Wales and in England south of a line between the Mersey and the Wash, excepting East Anglia, the South-East and Cornwall, (see map 1) on Friday or Saturday, which will have had a strong influence on cutworm survival in those areas.

Areas of Southern England that did not get the weekend's rainfall are now at risk of cutworm damage.

Action

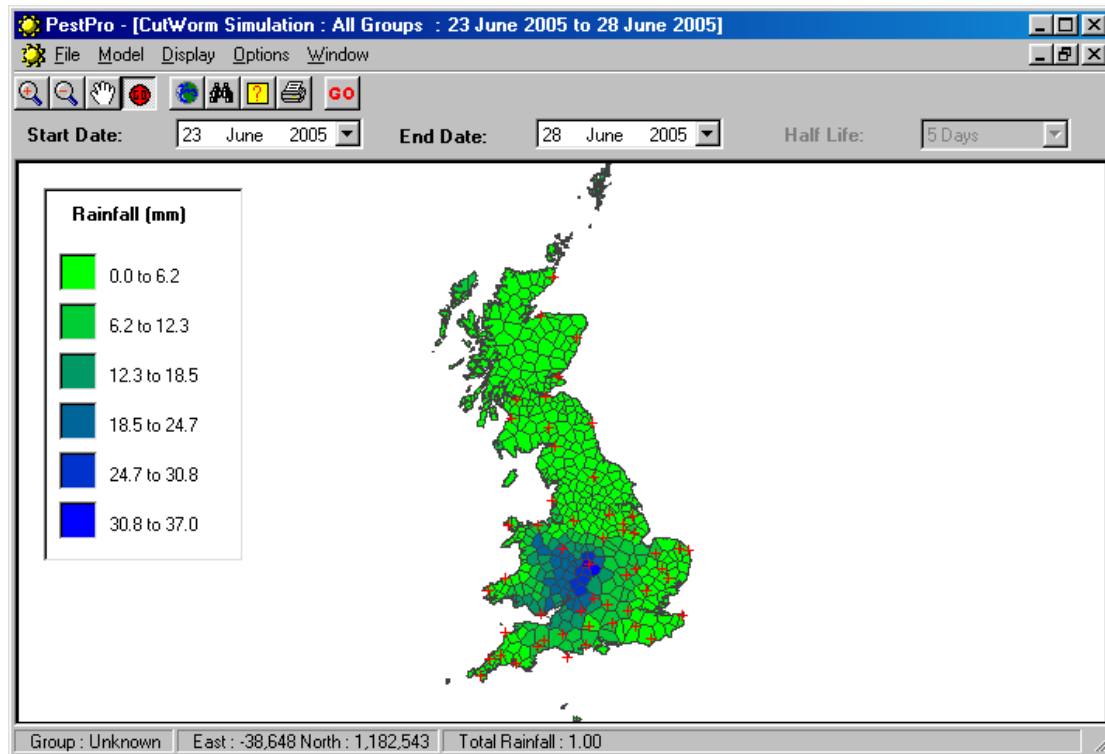
The most susceptible crops (lettuce, leeks, red beet) grown in the areas of Norfolk, Suffolk, Lincolnshire, Essex, Cambs, Herts, Kent and Sussex are now at risk of cutworm damage if they did not get at least 10mm of rain on Friday or Saturday, unless they are irrigated (at least 20mm irrigation) or they have been sprayed with an insecticide that kills caterpillars in the last 10 days. Unirrigated, unsprayed, very susceptible crops in these counties should be treated against cutworms in the next three days.

In the rest of Southern England treatment is not yet necessary, due either to the rain that fell or because development of cutworms has been slower in cooler conditions.

Cooler conditions in Northern England and Scotland have also delayed development in these areas and treatment is not yet required.

The situation will be reviewed again on Thursday, 30th June.

Map 1 Rainfall, 23rd June – 28th June 2005



Horticultural Development Council
Cutworm Monitoring & Prediction, 2005.

Prepared by Mike Lole
ADAS Wolverhampton

Report No 6, 30th June 2005

Current Situation

Slightly cooler temperatures have slowed the development of cutworm larvae slightly, but in most areas of Britain the first larvae of the third instar (the invulnerable underground-feeding stage) have just begun to appear, or are about to, or would be about to if the recent rainfall had not caused mortality of the developing caterpillars.

Rainfall at the critical time between egg-hatch and the third instar, underground-feeding stage can significantly affect the survival of young cutworms. Britain now divides into three distinct risk areas based on recent rainfall events (see Map 1):-

- i) Area 1: Those parts of south-east England that did not get substantial rainfall on either the 24th or the 29th June, including Kent, Sussex and parts of Hampshire.
- ii) Area 2: Wales, and England south of a line approximately Preston-Leeds-Hull, excluding the area of south-east England described above
- iii) Area 3: England north of the Preston-Leeds-Hull line and the whole of Scotland

Area 1 has had no substantial rainfall during June and increasing numbers of cutworms are reaching the third instar stage (see Map 2).

Area 2 had significant rainfall on 24th and/or 29th of June which will have caused significant mortality of developing caterpillars, reducing the risk of damage at present.

Area 3 has had some rainfall, but not enough to cause 100% mortality of developing cutworms. However, temperatures have been cooler in this area and cutworm development is less forward than it is in the south-east.

Some rainfall is forecast for the weekend.

Action

The most susceptible crops (lettuce, leeks, red beet) grown in the dry Area 1 (Kent, Sussex and parts of Hampshire) are now at risk of cutworm damage unless they are irrigated (at least 20mm irrigation) or they have been sprayed with an insecticide that kills caterpillars in the last 10 days. Unirrigated, unsprayed, very susceptible crops in these counties should be treated against cutworms in the next three days. If there is no substantial rainfall by the time of the next report then it may become necessary to treat moderately-susceptible crops (brassicas, carrot, celery, parsnip, sugar beet). We will assess this and the risk to the least susceptible crops (potato, onion, swede, turnip) in the next report

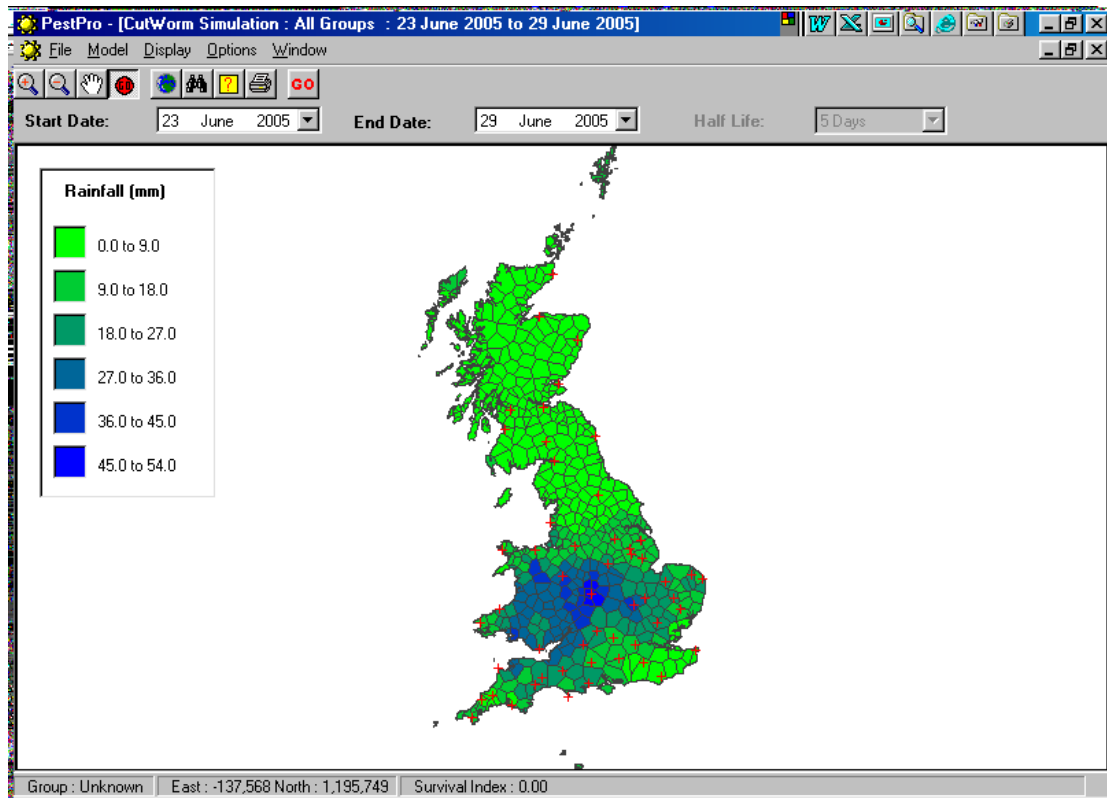
In Area 2 rainfall-induced mortality of developing caterpillars has removed the need for any treatments against cutworms for at least a week. No treatment is therefore recommended in these areas at present. This will be reviewed in the next report

In Area 3 development has been slower and there has been some rainfall-induced mortality. Treatment is not therefore immediately necessary but the most vulnerable

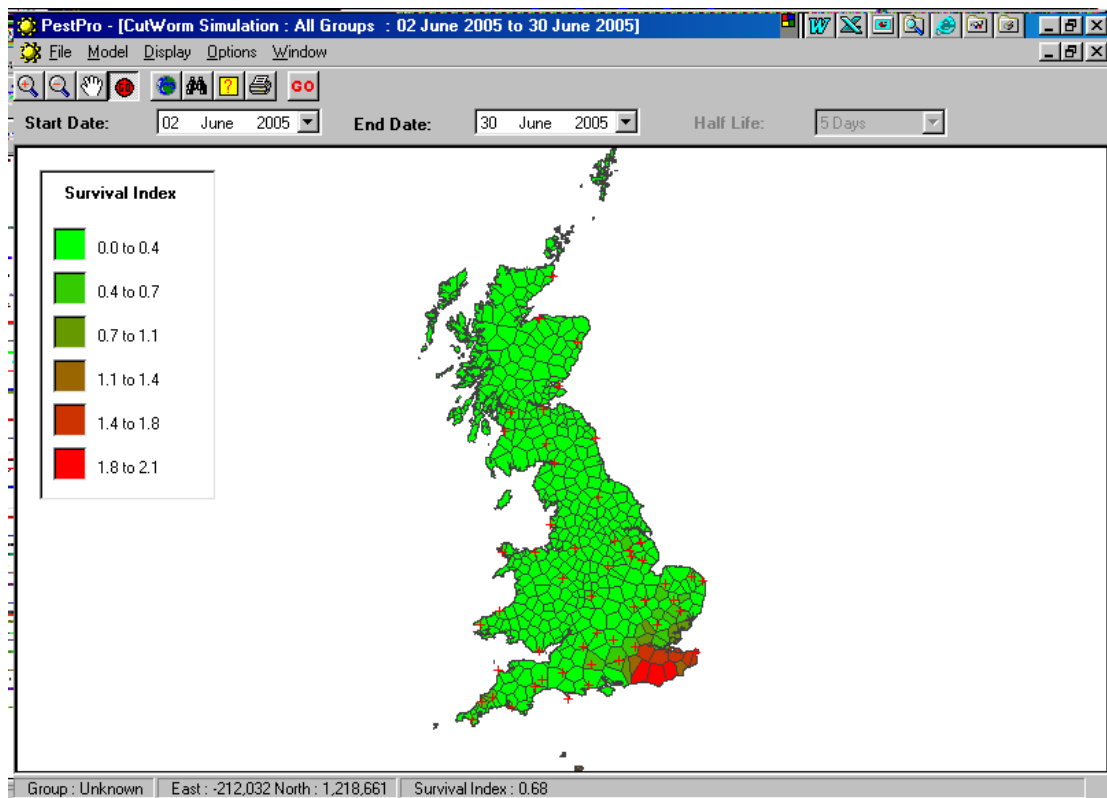
crops in this area may be at risk by the time of the next report. We will assess this at that time.

The situation will be reviewed again on Thursday, 7th July.

Map 1 Rainfall, 23rd June – 29th June 2005



Map 2 Cutworm survival index, 30th June 2005



Horticultural Development Council
Cutworm Monitoring & Prediction, 2005.

Prepared by Mike Lole
ADAS Wolverhampton

Report No 7, 7th July 2005

Current Situation

Rainfall has dominated the weather scene for the past 12 days, with significant rain events in all areas since 24th June, particularly during June 28th – 30th and July 4th – 6th (see Map 1). Accompanying temperatures have also been a lot lower than they were in mid June. The cooler temperatures have slowed the development of cutworms, but more importantly the rainfall will have caused major mortality of the 1st and 2nd instar caterpillars that are foliar feeders.

The rain was very timely and few cutworms will have escaped one or other of the storms, the exceptions being in Kent and Sussex where the rain did not fall until 3 or 4 days-worth of egg batches had reached the third instar stage (see Map 2).

The widespread nature of the rain now means that the rainfall areas described last week are irrelevant and can now be ignored.

Action

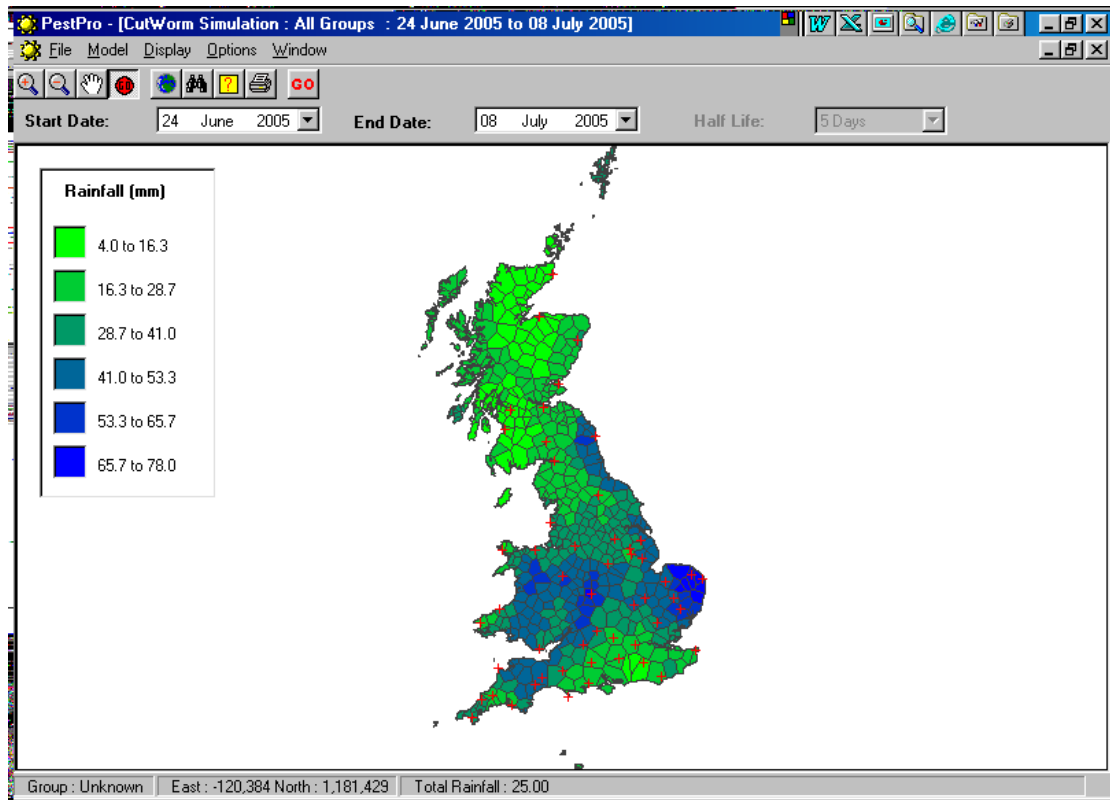
By now, the most susceptible crops (lettuce, leeks, red beet) grown in Kent, Sussex and parts of Hampshire, which was the high-risk area last week, should have been sprayed against cutworms or will have had substantial rainfall, obviating the need for treatment.

It should not have been necessary to treat any other crops before the rainfall arrived.

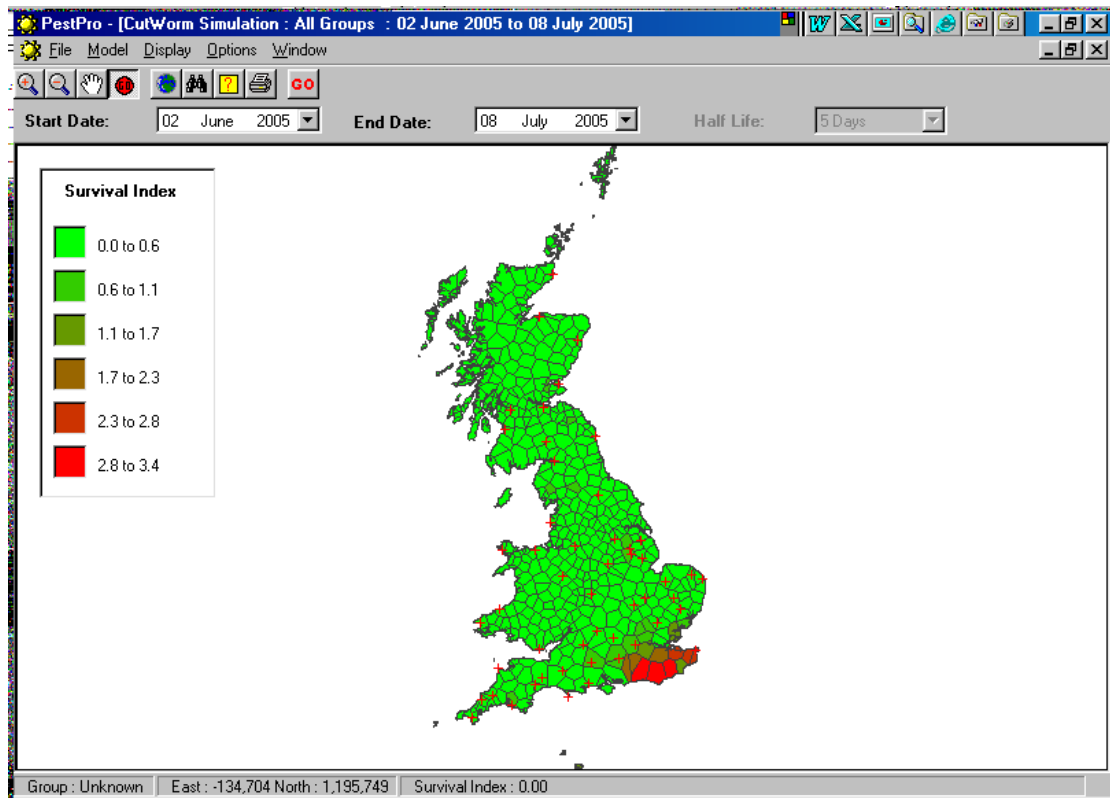
There is no need to consider treating any crops against cutworms for at least 7 days, ie. by the time of the next report.

The situation will be reviewed again on Thursday, 14th July.

Map 1 Rainfall, 24th June – 8th July 2005



Map 2 Cutworm survival index, 8th July 2005



Horticultural Development Council
Cutworm Monitoring & Prediction, 2005.

Prepared by Mike Lole
ADAS Wolverhampton

Report No 8, 14th July 2005

Current Situation

We have seen a return to warm, dry weather over most of Britain since the time of the last report (7th July). With the exceptions of parts of central northern England, East Anglia and the south-east (see map 1) there has been no significant rain since July 4th – 6th. Temperatures have also been high, with 30°C being recorded in places during this week.

At current temperatures, development of newly-hatched cutworms to the third instar stage, when they are invulnerable to rainfall and insecticides, is taking about 10 days. This means that the caterpillars which hatched just after the rain of 4/5th July are beginning to reach third instar now, and in areas where there has been no rain since 5th July the risk of cutworm damage is now beginning to accumulate.

The risk is most advanced in the areas where less than 10mm of rain fell on 4/5th July, particularly parts of Hampshire, Sussex and Berkshire (see map 2).

The current forecast is for cooler weather over the next few days but there is no widespread, significant rain expected.

Catches of adult moths have decreased in the last week and it can be assumed that egg-laying after this week will not be significant.

Action

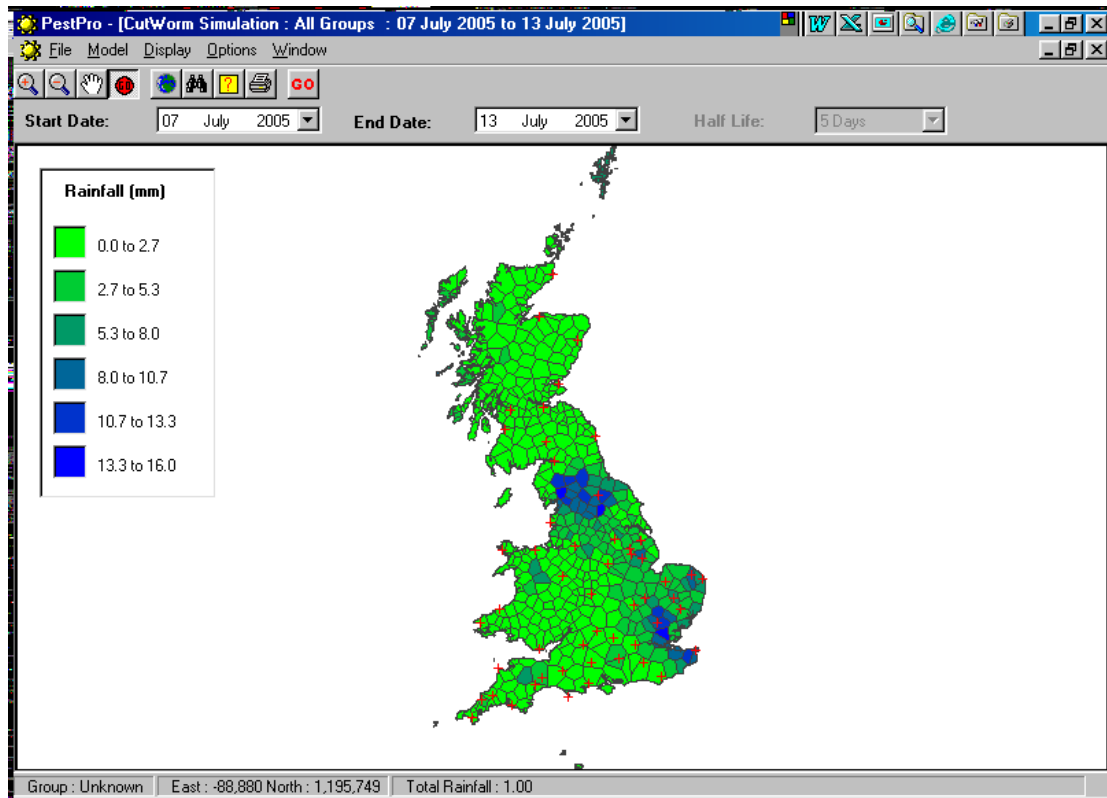
There is no general need for cutworm sprays at present but the risk of damage is increasing, particularly in parts of southern and south-west England (see map 2). In these areas it may be necessary to spray the most susceptible crops (lettuce, leeks, red beet) early next week if there is no significant rainfall (10mm plus) in the meantime. Crops that are irrigated (20mm or more) or that have been treated with an insecticide that will kill caterpillars in the last week will not need treating. It will be necessary to consider the need for treatment of the less susceptible crops, including carrots, swedes, turnips and potatoes, at the time of the next report.

The situation will be reviewed again on Thursday, 21st July.

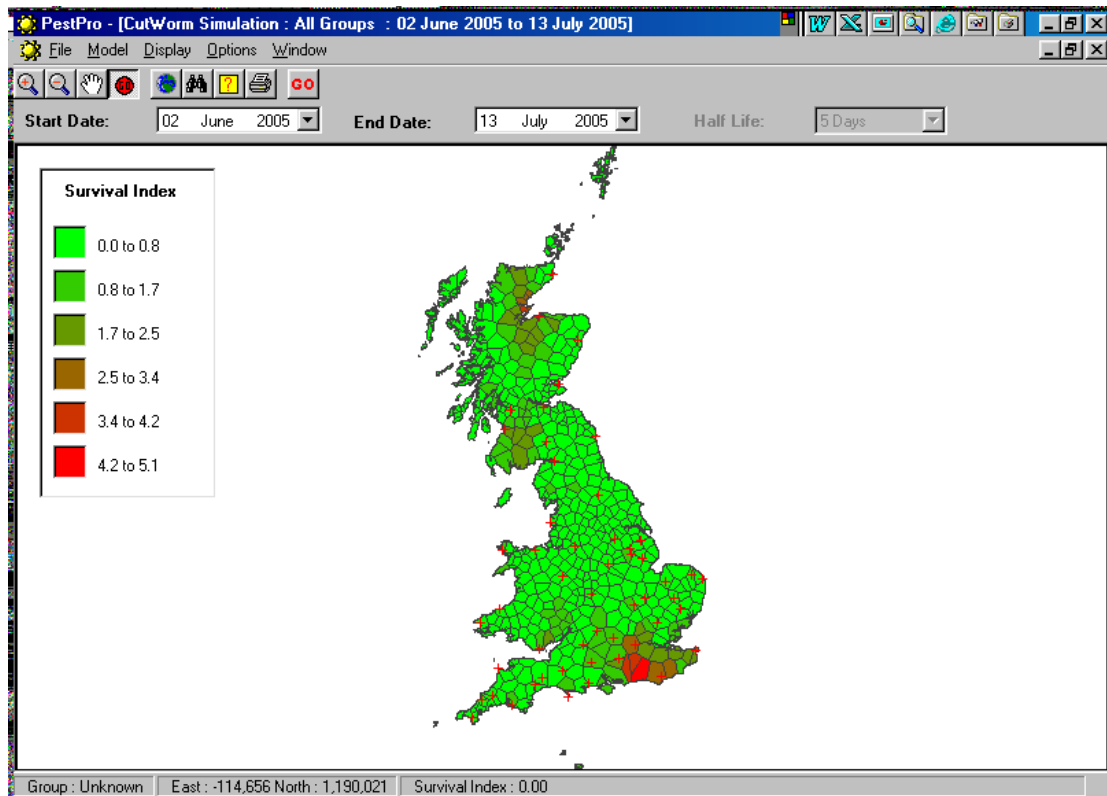
PLEASE NOTE:

This report is compiled using weather data from a wide range of sites throughout Britain and is intended to give a general guide to the risk of cutworm attack based on this information. However, it is not possible to predict the risk of damage in individual fields from the data available. If your individual situation does not fit with the information used to compile this report (eg local rainfall events differing from the general picture) then alternative action may be necessary.

Map 1 Rainfall, 7th – 13th July 2005



Map 2 Cutworm survival index, 13th July 2005



Horticultural Development Council
Cutworm Monitoring & Prediction, 2005.

Prepared by Mike Lole
ADAS Wolverhampton

Report No 9, 21st July 2005

SPRAY WARNING IMMINENT

Current Situation

The weather has remained largely dry over much of England, Wales and eastern Scotland for the last two weeks, with no significant rain since July 4th – 6th in many areas (see map 1 for exceptions). Temperatures have also been high, though slightly less so in the last few days.

At current temperatures, development of newly-hatched cutworms to the third instar stage, when they are invulnerable to rainfall and insecticides, is taking from 10 to 17 days, with the warmest conditions in central England south of Yorkshire, particularly the home counties and around the Severn estuary. Caterpillars which hatched just after the rain of 4/5th July have been reaching the third instar in increasing numbers and the survival index is currently increasing quite rapidly.

The survival index is highest, and therefore the risk of cutworm damage greatest, in central southern England and in the Severn/Wye area (see map 2).

The current forecast is for temperatures to remain warm over the next few days. Some rain is predicted in Britain on Saturday/Sunday but the distribution and severity of this rainfall is in some doubt.

Action

The risk of damage is increasing, particularly in parts of in central southern England and in the Severn/Wye area (see map 2). In these areas there is a case for spraying the most susceptible crops (lettuce, leeks, red beet) immediately, if they have not already been treated. The need for treatment of the less susceptible crops in these areas, including carrots, swedes, turnips and potatoes, will depend on what rainfall events occur over the coming weekend (23/24 July). If there is 10mm of rain or more then this will obviate the need for treatment. Otherwise, the risk of damage to carrot, swede and turnip will justify treatment against cutworms on Monday or Tuesday. Potatoes are slightly less susceptible but again, if there is no rain in the areas of southern England and Wales that are at the highest risk level (map 2) then potato crops in these areas should be treated against cutworms by Wednesday or Thursday.

Crops that are irrigated (20mm or more) or that have been treated with an insecticide that will kill caterpillars in the last two weeks will not need treating.

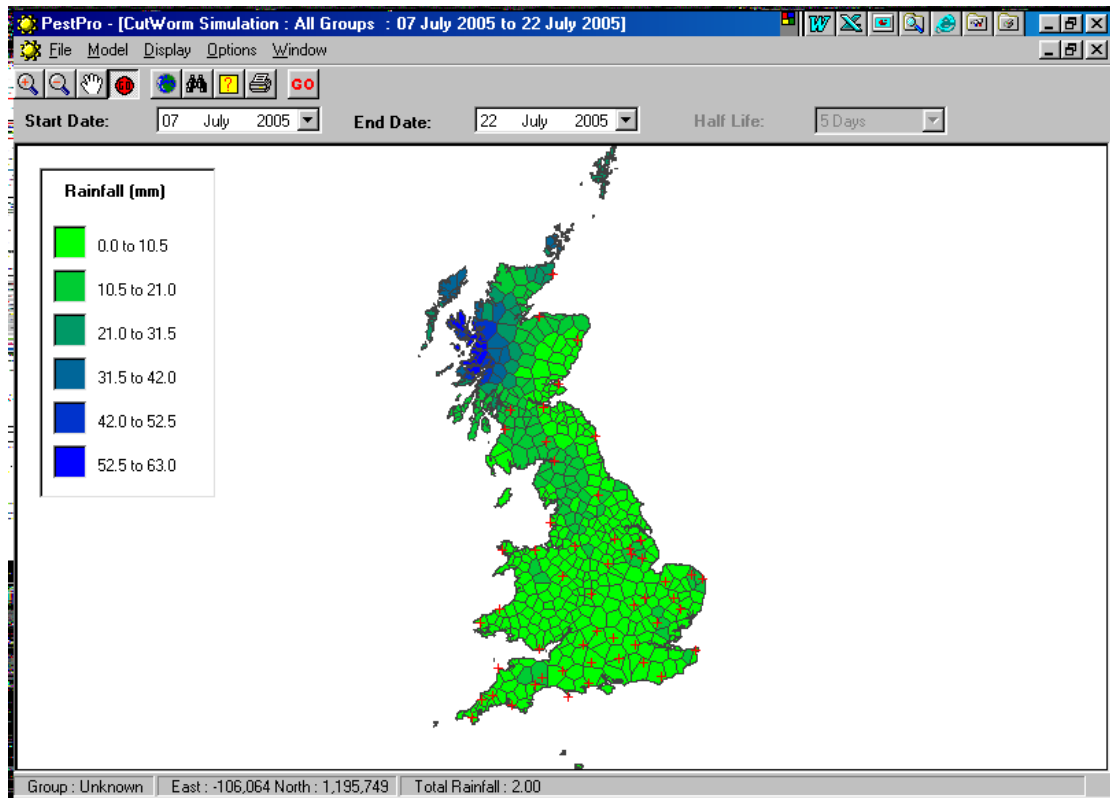
The situation will be reviewed again on Thursday, 28th July.

PLEASE NOTE:

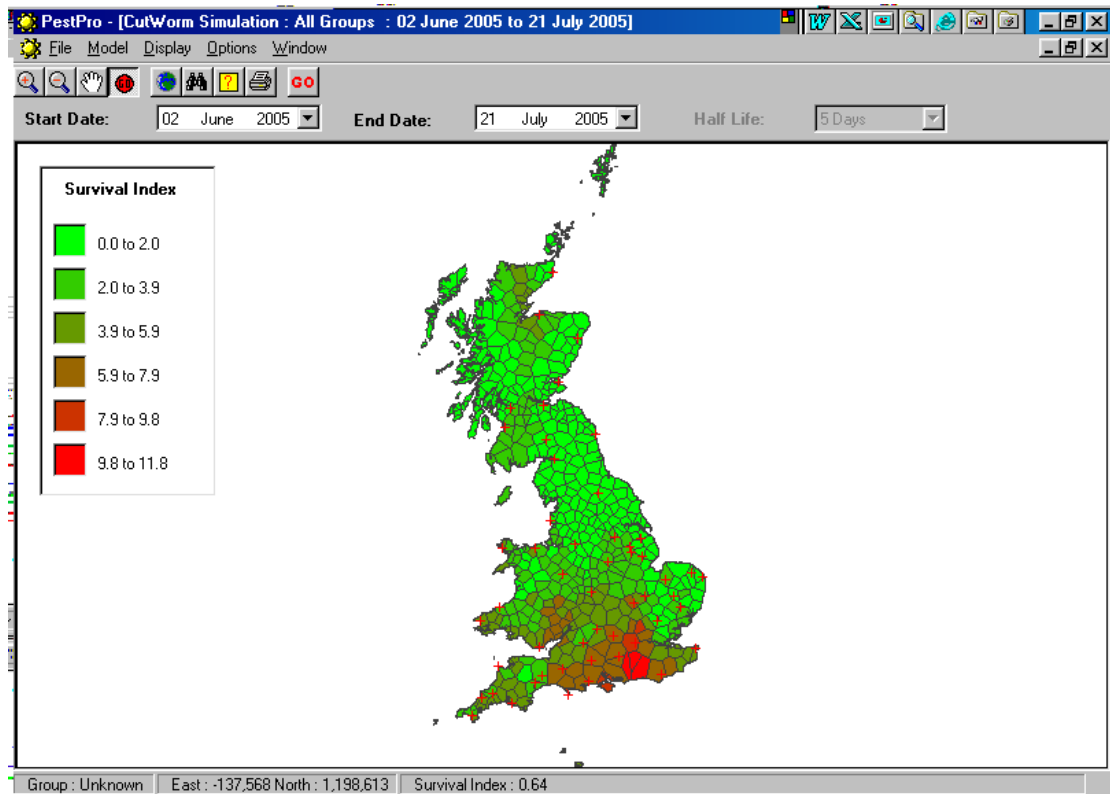
This report is compiled using weather data from a wide range of sites throughout Britain and is intended to give a general guide to the risk of cutworm attack based on this information. However, it is not possible to predict the risk of damage in individual

fields from the data available. If your individual situation does not fit with the information used to compile this report (eg local rainfall events differing from the general picture) then alternative action may be necessary.

Map 1 Rainfall, 7th – 22nd July 2005



Map 2 Cutworm survival index, 21st July 2005



Horticultural Development Council
Cutworm Monitoring & Prediction, 2005.

Prepared by Mike Lole
ADAS Wolverhampton

Report No 10, 28th July 2005

Current Situation

The advent of heavy rain over the southern half of Britain during 23rd to 27th July (map 1) will have had a major effect on cutworms in this area, causing high mortality to 1st and 2nd instar caterpillars. Northern Britain missed out on this rain, but the rain that fell in the south on the 27th and 28th July is now moving north as this report is being written and it seems that this rain will preclude the need for any cutworm treatment in the north. Temperatures have plummeted with the advent of the rain and this will have slowed the development of eggs and young larvae.

The current forecast is for showery rain to continue over the next few days.

Action

The heavy rain in Wales and in England south of a line from the Mersey to the Humber will have caused high mortality to developing cutworms in this area and has removed the need for any treatments to control cutworms. Further rain has fallen on the 27th in this area. Only larvae hatching after the 28th are likely to have escaped the rain, and the eggs that will have produced these larvae would have been laid on about the 17th of July. By this time, egg-laying will have been minimal, so the risk of further damage will be very small.

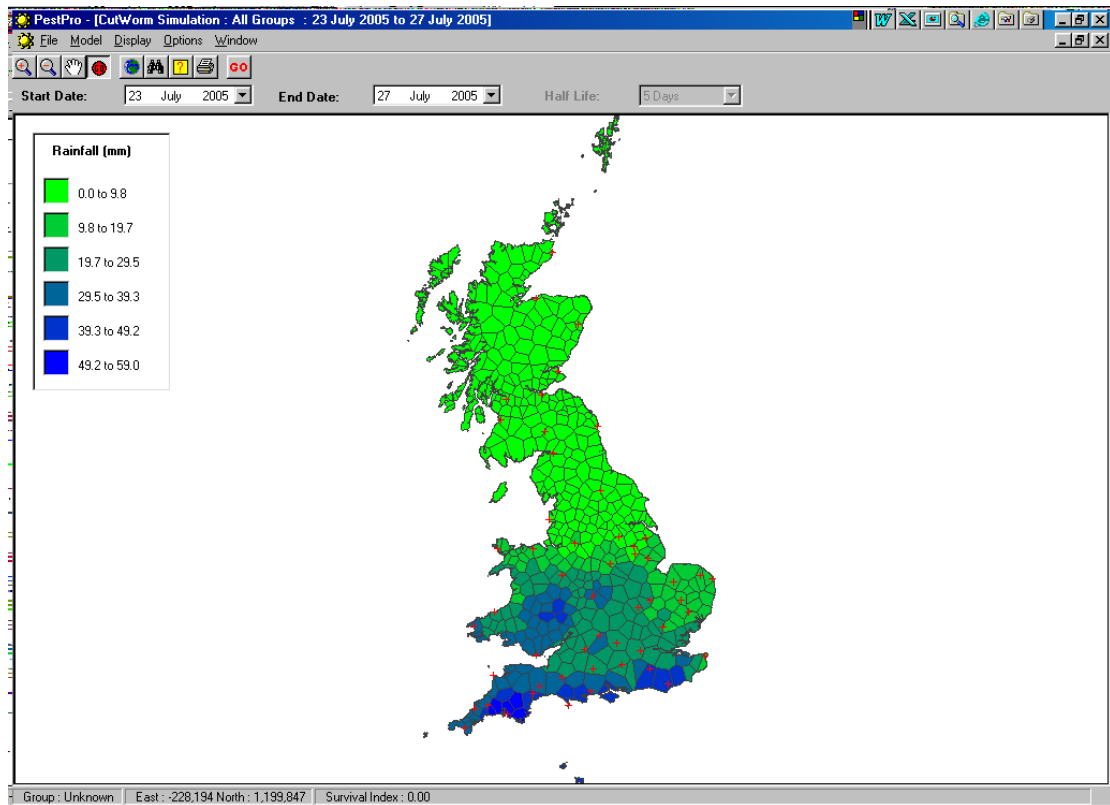
Britain north of the Mersey-Humber line missed out on the rain of 23/24/25th July and as a consequence the cutworm index in these areas has been rising steadily (map 2), though in general it has not yet reached the levels that might trigger a pesticide treatment. However, it seems that the heavy rain of the 27th/28th is moving north into these areas, which will render pesticide treatments unnecessary. On this assumption, no spray warning will be issued this week for this area.

The situation will be reviewed again on Thursday, 4th August, when the record of the rainfall of 28th July and subsequent days will be available and will be taken into account. It is likely that this will be the final report for 2005.

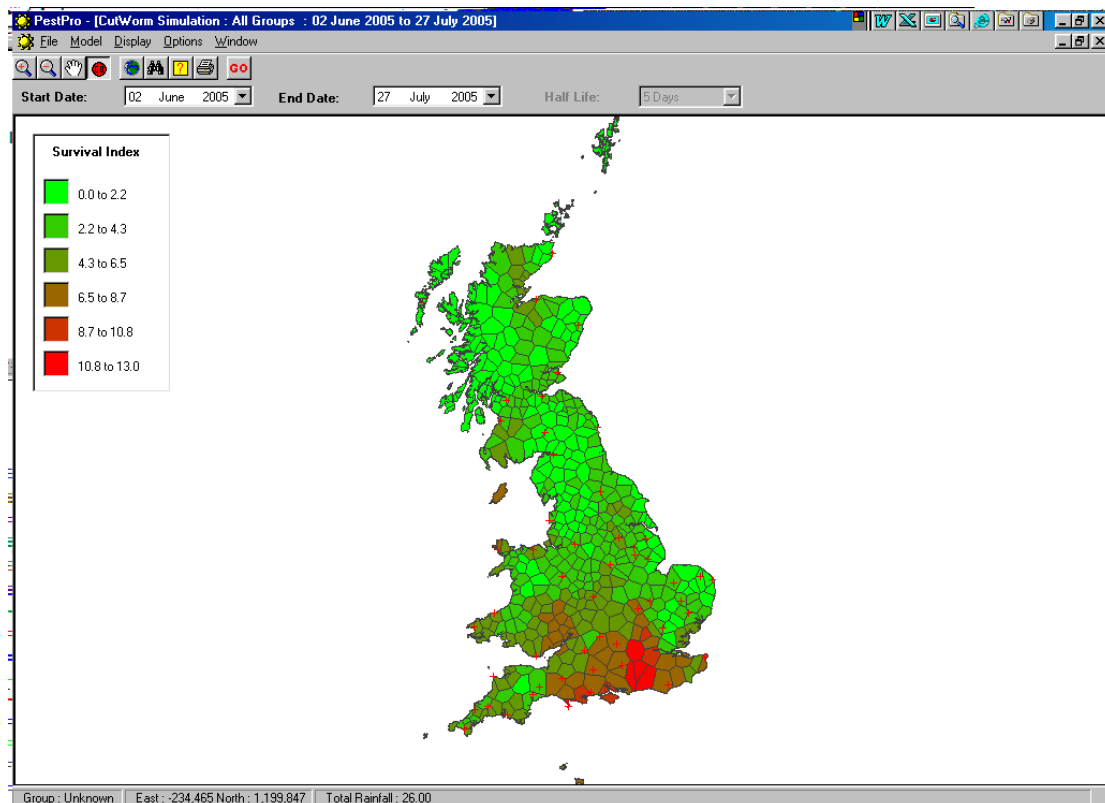
PLEASE NOTE:

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Map 1 Rainfall, 23rd – 27th July 2005



Map 2 Cutworm survival index, 27th July 2005



**Horticultural Development Council
Cutworm Monitoring & Prediction, 2005.**

Prepared by Mike Lole
ADAS Wolverhampton

Report No 11, 4th August – Final Report, 2005

Current Situation

At least 15mm of rain has fallen over the whole of England and Wales in the period from July 22nd to August 3rd, with most areas having a good deal more than this (eg 60mm+ in parts of Sussex, south Devon and Pembrokeshire) (Map 1). This has effectively put an end to any further risk of cutworm damage in England and Wales in 2005.

Scotland had rather less rain in the above period, but lower temperatures (which slow cutworm development) and previous rain events, taken together, mean that there is also a negligible further risk of cutworm damage in Scotland in 2005.

Action

No further action on cutworms is likely to be necessary in Great Britain in 2005.

Summary

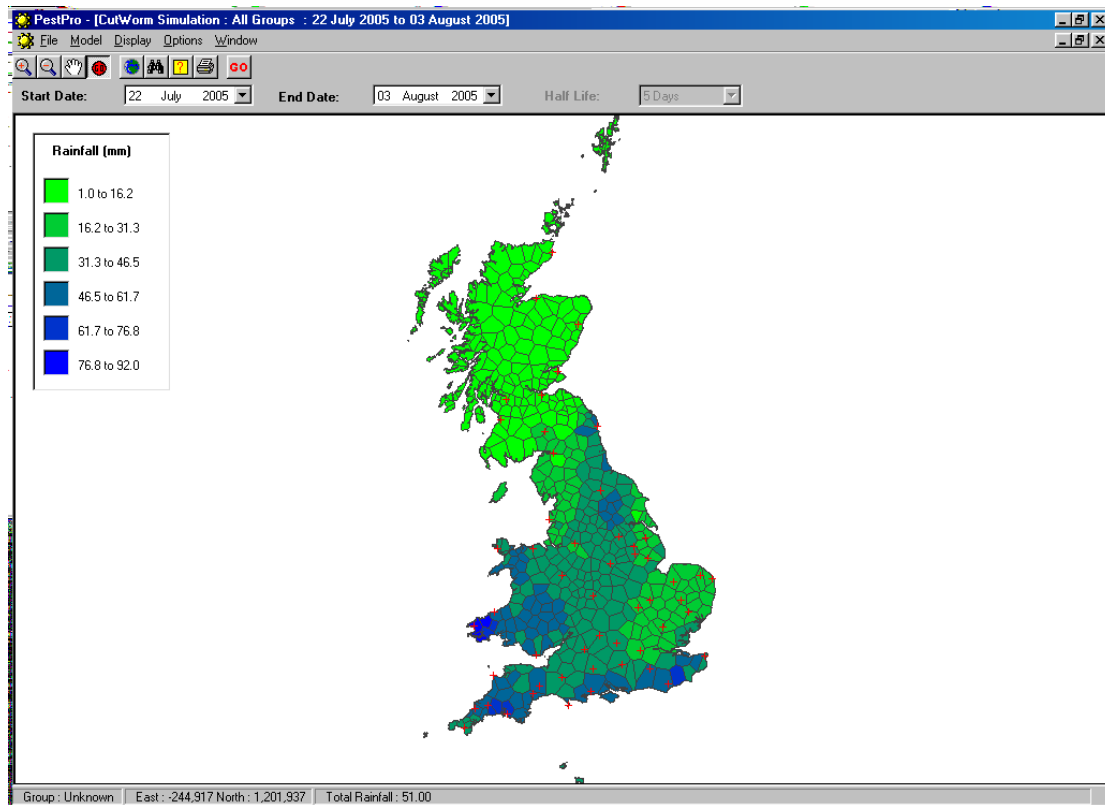
Overall, 2005 has not proved to be a high-risk year as far as cutworm damage is concerned. The areas of highest risk were central southern and south-eastern

England (see map 2), particularly Hampshire and Sussex. Treatment of the most susceptible crops was recommended in these areas on about the 21st of July, but even in the highest-risk parts the cutworm survival index did not rise high enough to justify treatment of potatoes.

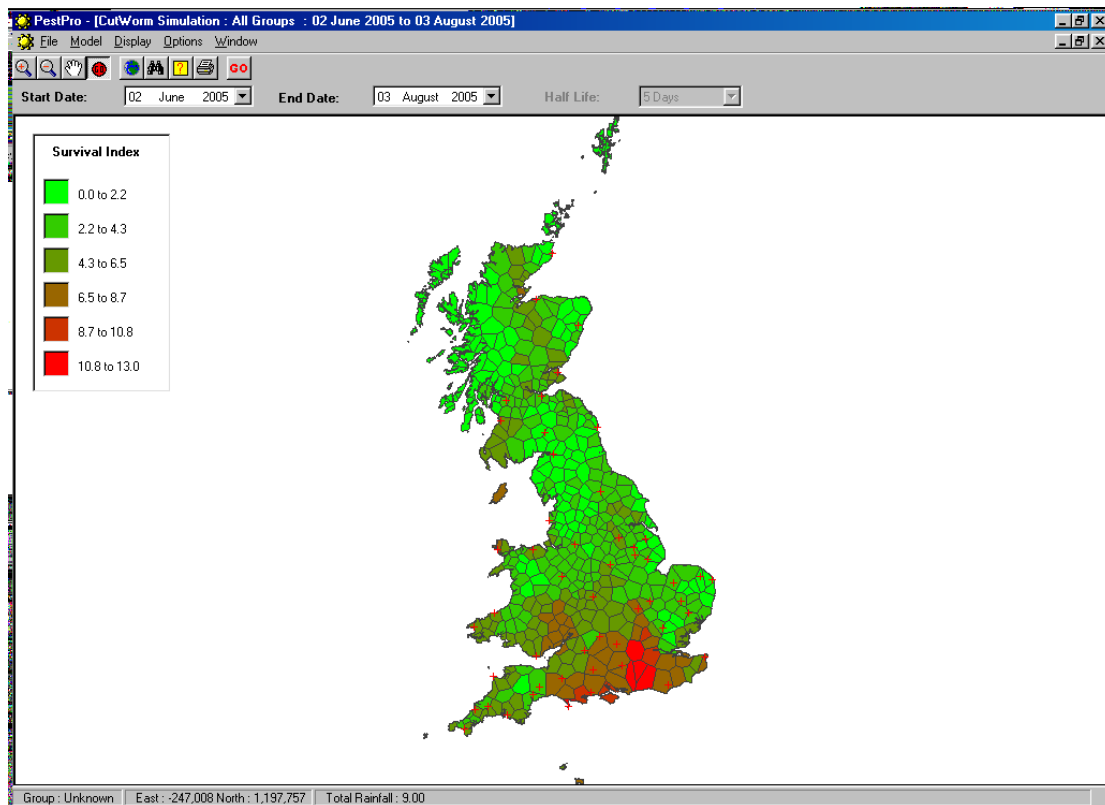
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Map 1 Rainfall, 22nd July – 3rd August 2005



Map 2 Cutworm survival index, to 3rd August 2005



Horticultural Development Council
Cutworm Monitoring & Prediction, 2006.

Prepared by Mike Lole
ADAS Wolverhampton

Report No 1, 25th May 2005

Background

Cutworm

“Cutworm” is the name given to caterpillars of certain Noctuid moths, in particular those of the turnip moth *Agrotis segetum*. The name derives from the habit of the older caterpillars of feeding underground, damaging plant roots and stems (including the storage organs that we use for food), sometimes so badly that the plant topples.

The adult moths lay eggs on plants or on pieces of litter and debris in the soil, usually from the end of May or early June. These hatch in around 8-24 days, depending on temperature. The young caterpillars seek out and feed on the aerial parts of plants. In a further 10-20 days, again depending on temperature, the caterpillars go through their second moult, becoming “third instar” caterpillars. It is at this point that they adopt the cutworm habit, becoming subterranean and feeding on roots etc.

Unhatched turnip moth eggs and the older, subterranean cutworms are largely invulnerable to the effects of the weather and insecticides. The two early caterpillar instars differ, however. If there is substantial rainfall (defined as 10mm or more of rain falling in showers of moderate intensity over a 24-hour period) whilst these caterpillars are feeding above ground then this causes high mortality among them. They are also vulnerable to insecticides whilst feeding on the foliage.

Crop Susceptibility

Crops differ in their susceptibility to cutworm damage. The most vulnerable are lettuce, leek and red beet. Young lettuce and leek plants are easily bitten through by cutworms, and though beet plants may survive an attack the bulbous root is rendered unmarketable by cutworm feeding. Moderately-susceptible crops include brassicas, carrot, celery, parsnip and sugar beet. The least susceptible of those vulnerable to damage are onion, potato, swede and turnip.

The Cutworm Model

The cutworm model is a computer programme that uses weather data to predict the rate of development of turnip moth eggs and caterpillars. It also predicts the level of rain-induced mortality among the early-instar caterpillars. The weather data used covers 600 sites in the whole of Great Britain, so that local differences in temperature and rainfall can be reflected in the forecasts of development that are used in the model.

Rate of development and the level of rain-induced mortality must both be known if a rational choice is to be made about the need for insecticide treatment of vulnerable crops. The cutworm model is therefore an important tool for the grower.

Moth Activity

The activity of adult moths is monitored by ADAS, Warwick HRI and Consultants in order to provide information on when oviposition may be taking place. In 2005, traps are being run in Lincolnshire, Cambridgeshire, Norfolk, Hampshire, Shropshire, Cornwall and Warwickshire.

Current Situation

To date turnip moths have been caught in Cambridgeshire and Norfolk (from 22/05/06). From past history, moths are likely to be caught in the remaining traps in the next 7 days, but this remains to be tested.

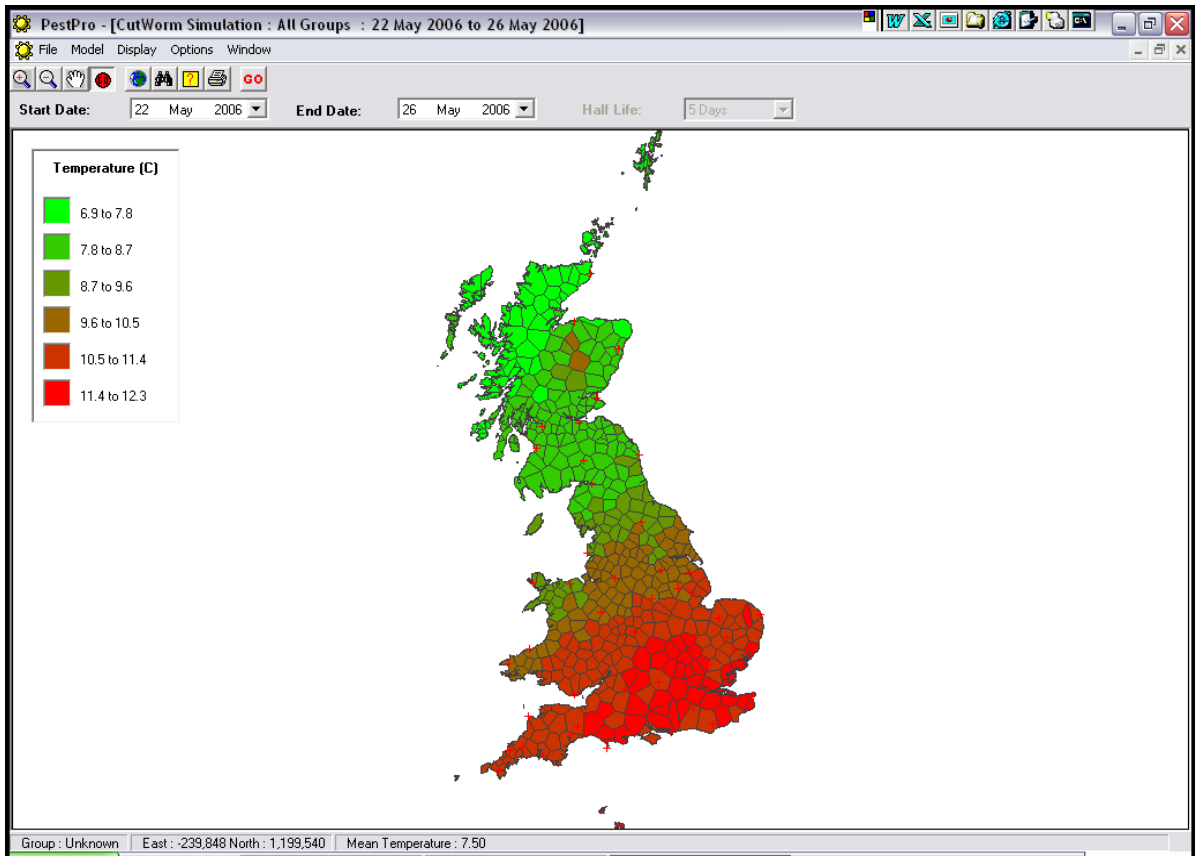
Egg development at current temperatures, even in the warmest, southern areas (see map) is very slow, running at 4-5% per day. Assuming that the moths began to lay eggs on the day the first one was trapped, the earliest-laid eggs have by now completed only about 20% of their development and, given similar temperatures to those applying currently, will not begin to hatch for about 2 weeks.

Temperature and rainfall after hatching are important as these dictate both the speed of development of the larvae and the mortality of the young instars.

Action

No action will be necessary for at least three weeks. We will however produce weekly updates on the cutworm situation from now until August 2006.

Mean daily temperatures, 22nd – 25th May 2005



Horticultural Development Council
Cutworm Monitoring & Prediction, 2006.

Prepared by Mike Lole
ADAS Wolverhampton

Report No 2, 1st June 2006

Background (**repeated from last week's report**)

Cutworm

“Cutworm” is the name given to caterpillars of certain Noctuid moths, in particular those of the turnip moth *Agrotis segetum*. The name derives from the habit of the older caterpillars of feeding underground, damaging plant roots and stems (including the storage organs that we use for food), sometimes so badly that the plant topples.

The adult moths lay eggs on plants or on pieces of litter and debris in the soil, usually from the end of May or early June. These hatch in around 8-24 days, depending on temperature. The young caterpillars seek out and feed on the aerial parts of plants. In a further 10-20 days, again depending on temperature, the caterpillars go through their second moult, becoming “third instar” caterpillars. It is at this point that they adopt the cutworm habit, becoming subterranean and feeding on roots etc.

Unhatched turnip moth eggs and the older, subterranean cutworms are largely invulnerable to the effects of the weather and insecticides. The two early caterpillar instars differ, however. If there is substantial rainfall (defined as 10mm or more of rain falling in showers of moderate intensity over a 24-hour period) whilst these caterpillars are feeding above ground then this causes high mortality among them. They are also vulnerable to insecticides whilst feeding on the foliage.

Crop Susceptibility

Crops differ in their susceptibility to cutworm damage. The most vulnerable are lettuce, leek and red beet. Young lettuce and leek plants are easily bitten through by cutworms, and though beet plants may survive an attack the bulbous root is rendered unmarketable by cutworm feeding. Moderately-susceptible crops include brassicas, carrot, celery, parsnip and sugar beet. The least susceptible of those vulnerable to damage are onion, potato, swede and turnip.

The Cutworm Model

The cutworm model is a computer programme that uses weather data to predict the rate of development of turnip moth eggs and caterpillars. It also predicts the level of rain-induced mortality among the early-instar caterpillars. The weather data used covers 600 sites in the whole of Great Britain, so that local differences in temperature and rainfall can be reflected in the forecasts of development that are used in the model.

Rate of development and the level of rain-induced mortality must both be known if a rational choice is to be made about the need for insecticide treatment of vulnerable crops. The cutworm model is therefore an important tool for the grower.

Moth Activity

The activity of adult moths is monitored by ADAS, Warwick HRI and Consultants in order to provide information on when oviposition may be taking place. In 2006, traps are being run in Lincolnshire, Cambridgeshire, Norfolk, Hampshire, Shropshire, Cornwall and Warwickshire.

Current Situation

To date small numbers of turnip moths have been reported in Cambridgeshire and Norfolk (from 22/05/06) and Cheshire (31/05/06). Normally, the moths appear in most areas within a few days of each other, but this year the continuing cool, wet weather seems to be prolonging emergence.

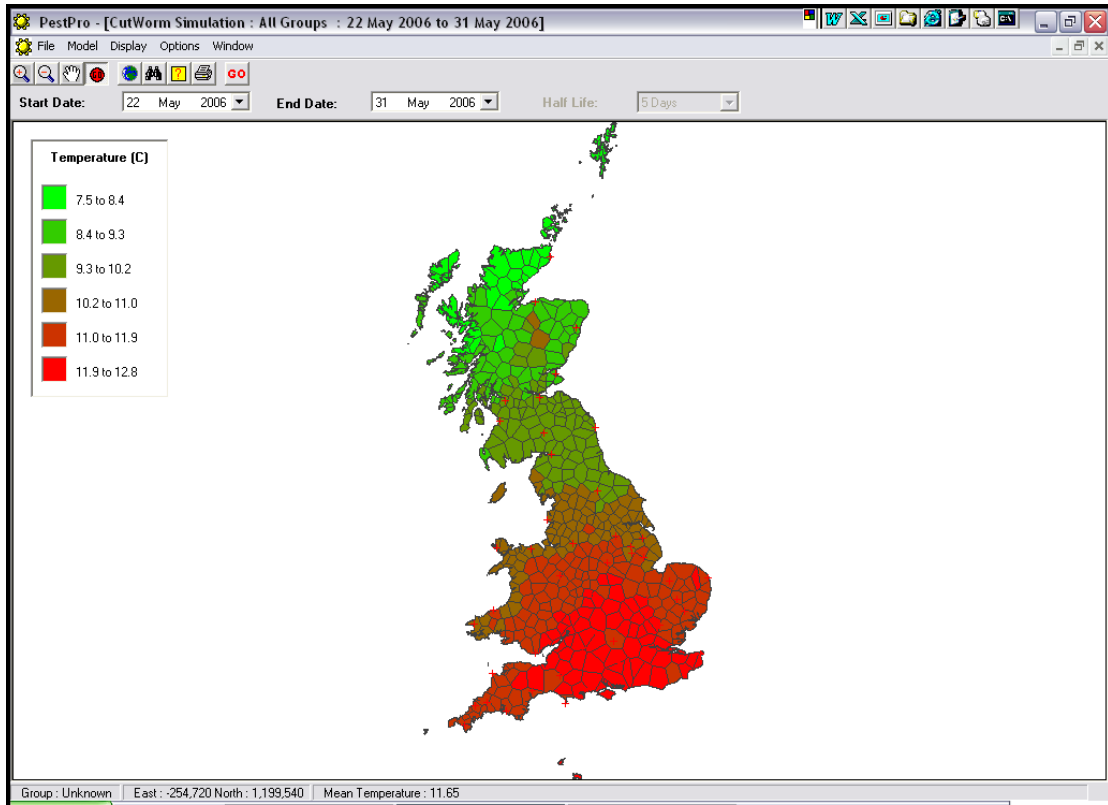
Egg development at current temperatures, even in the warmest, southern areas (see map) remains very slow, and is still running at 4-5% per day. Eggs that were laid on the day the first moths were trapped will only just have completed half their development by June 1st. There is warmer weather predicted, which should accelerate development, but hatching of even the earliest-laid eggs not likely to start for at least another week.

Temperature and rainfall after hatching are important as these dictate both the speed of development of the larvae and the mortality of the young instars.

Action

No action will be necessary for at least two weeks. We will produce further weekly updates on the cutworm situation from now until August 2006. The next report should be available on Friday, June 9th.

Mean daily temperatures, 22nd May – 31st May 2006



Horticultural Development Council
Cutworm Monitoring & Prediction, 2006.

Prepared by Mike Lole
ADAS Wolverhampton

Report No 3, 8th June 2006

Current Situation

In the period since the last report the number of turnip moths caught in the traps situated in Cambridgeshire, Norfolk, Warwickshire and Cheshire, all of which had reported small numbers of moths in previous weeks, increased significantly. However, traps in some other areas (e.g. Lincs, Yorks) have yet to record their first catch. This drawn-out, patchy emergence complicates a national forecast, but that is sometimes the way that nature works. We are continuing to monitor for turnip moths in the appropriate areas as the forecasts rely to some extent on accurate information about moth activity.

Since the time of the last report, a week ago, temperatures have in general been on the rise, and this has accelerated the rate of development of turnip moth eggs. Development was running at 4-5% but has now risen to 8-9% per day. Eggs that were laid on the day the first moths were trapped (22nd May in Cambs and Norfolk) are by now completing their development and the first young larvae may be beginning to hatch. Egg-laying in other areas was behind this and no hatch is expected elsewhere for some days.

Once caterpillars begin to hatch they become vulnerable to rainfall, which can knock them off the plants and cause mortality. Temperature at this time is also important, as it affects the rate of development of the young caterpillars and therefore influences how long they remain as foliar feeders, which is the stage vulnerable to rainfall.

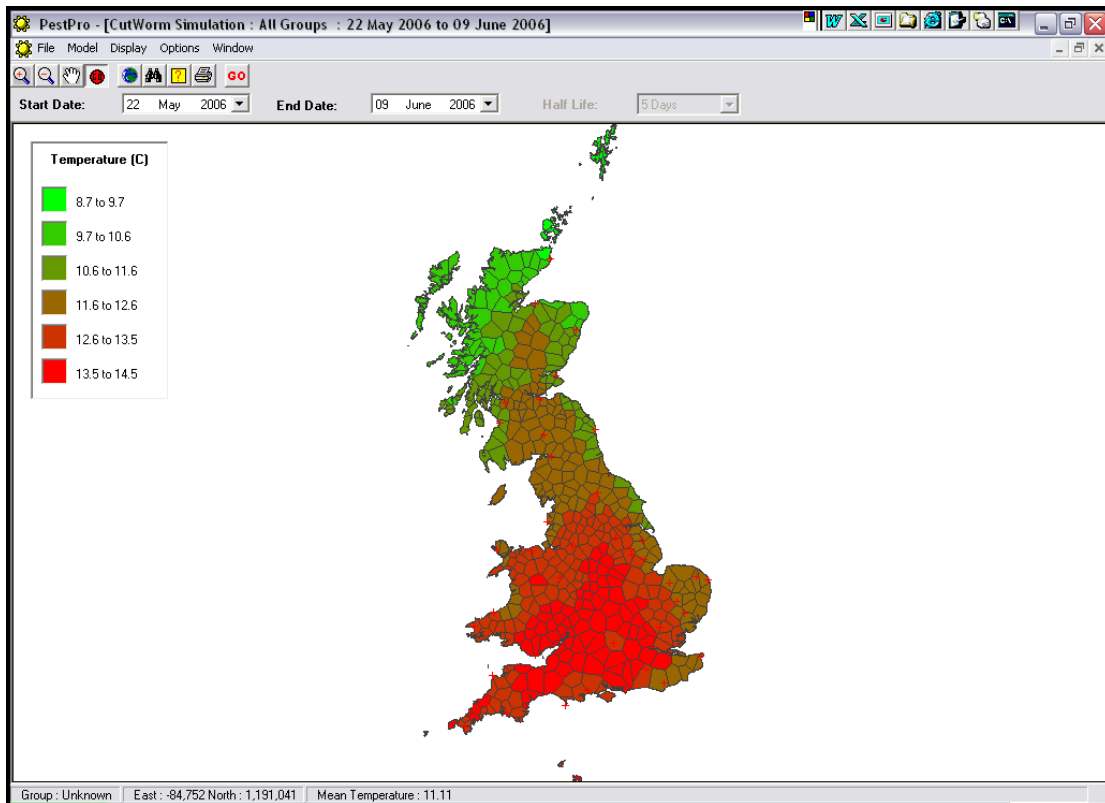
We will continue to monitor temperature and rainfall over subsequent weeks. The warmest areas at present are the south-west of England, south-east Wales and central southern England (see map below)

Action

No action is necessary at present and none is likely to be necessary anywhere for at least two weeks.

We will produce further weekly updates on the cutworm situation until August. The next report should be available on Friday, June 9th.

Mean daily temperatures, 31st May – 7th June 2006



Horticultural Development Council
Cutworm Monitoring & Prediction, 2006.

Prepared by Mike Lole
ADAS Wolverhampton

Report No 4, 15th June 2006

Current Situation

Last week I reported an upsurge in the number of turnip moths caught in the traps situated in Cambridgeshire, Norfolk, Warwickshire and Cheshire. This week, significant numbers have also been trapped in Yorkshire. Results of trapping remain patchy with no moths so far in our Lincs or Norfolk traps. There may be reasons other than late emergence for the lack of turnip moths in these traps, e.g. low populations in the vicinity of the traps.

I think, overall, that we have enough information to decide the dates on which the first significant batches of eggs will have been laid, for the purposes of this prediction programme. I will assume these dates are as follows: For central and southern England, roughly south of a line from the Wash to the Mersey, the operative date will be June 2nd. For the remaining, northerly, areas, the operative date will be June 9th.

Generally, in the last week the average temperature increased daily, reaching a peak on the 12th that was as high as 30°C in some places. There were some heavy local rain events, e.g. parts of Hampshire and Wiltshire getting as much as 50mm on the 10th, though most areas remained dry. Since the 12th, temperatures have dropped back and many places have seen some rain, in variable, relatively low quantities. In higher temperatures development of turnip moth eggs and the young caterpillars is rapid. In the most forward areas of central southern England batches of eggs laid on the operative date, the 2nd June, have now hatched and some of the young cutworms have completed about a third of their development. Further north, eggs laid on the 9th will begin to hatch by about Monday 19th June.

Now that young caterpillars have begun to hatch they are vulnerable to rainfall, which can knock them off the plants and cause mortality. We will therefore be looking at rainfall events with great interest from now on. Temperature at this time remains important, as it affects the rate of development of the young caterpillars and therefore influences how long they remain as foliar feeders, which is the stage vulnerable to rainfall.

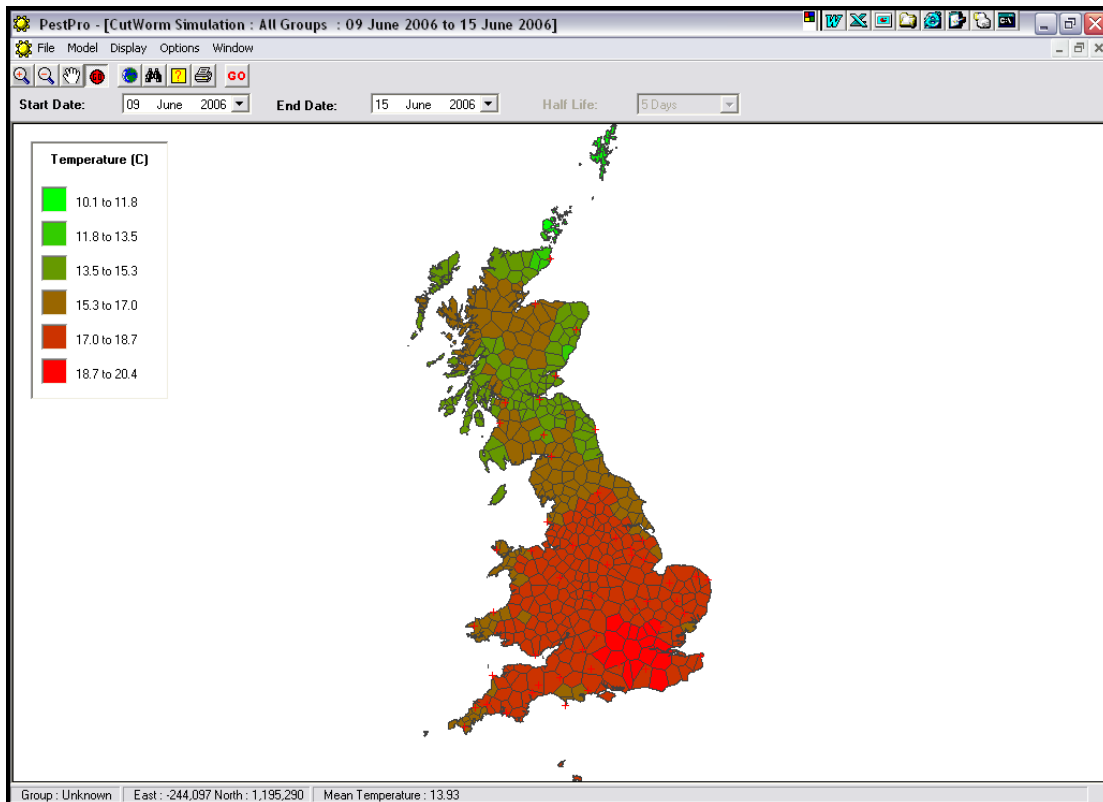
We will continue to monitor temperature and rainfall over subsequent weeks. The warmest areas at present are the south-west of England, south-east Wales and central southern England, especially the Home Counties (see map below).

Action

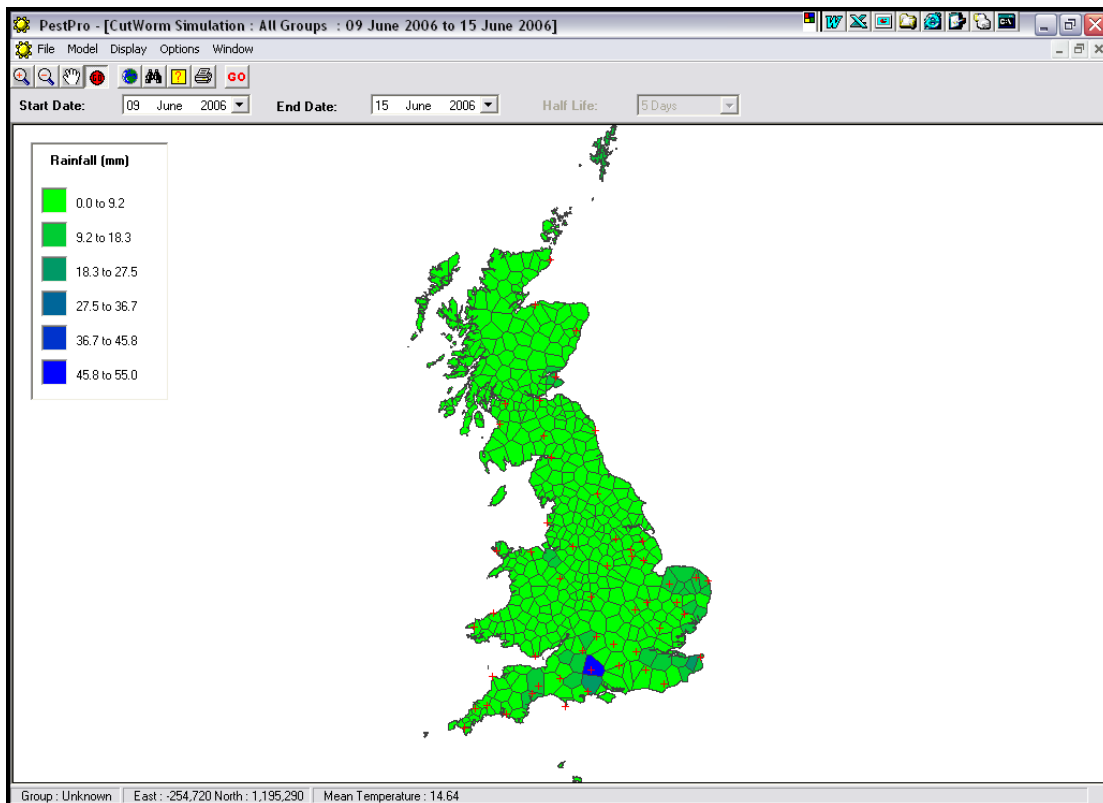
No action is necessary at present. However, cutworms developed from eggs laid in southern and central England on June 2nd will begin to reach the underground-feeding stage, when they are invulnerable to rainfall or pesticides, by the time that the next report is due, and it will be necessary to consider the need for treatment at that date.

The next weekly update report should be available on Friday, June 23rd.

Mean daily temperatures, 9th – 15th June 2006



Rainfall, June 9th – 15th 2006.



Horticultural Development Council
Cutworm Monitoring & Prediction, 2006.

Prepared by Mike Lole
ADAS Wolverhampton

Report No 5, 22nd June 2006

Current Situation

Last week, elevated turnip moth numbers were reported in some of our pheromone traps. This week, numbers have remained at the same sort of levels in those traps, and moths are now being caught in traps where we did not previously record them, e.g. Lincs and Norfolk.

There is therefore no need to revise last week's assumptions about the dates on which the first significant batches of turnip moth eggs were laid. These dates are as follows: For central and southern England, roughly south of a line from the Wash to the Mersey, the operative date is June 2nd. For the remaining, northerly, areas, the operative date is June 9th.

Temperatures in the last week have not been as high as the previous week, so the rate of development of turnip moth eggs and young cutworms has slowed somewhat. Rainfall in most areas has not been heavy, consisting of a few millimetres of rain which tends to have fallen in light showers. This is insignificant as far as effects on cutworm survival are concerned. There are exceptions; rain has been heavier in Lancashire, North Yorkshire and all points north of these counties, enough to exert some effect on mortality of developing cutworms (though few have actually reached the vulnerable stage in these areas).

In the most forward areas of central southern England batches of eggs laid on the operative date, the 2nd June, have hatched and the first of the young cutworms have completed about three-quarters of their development. These caterpillars continue to develop at about 6-7% per day, so they will begin to reach the underground-feeding third instar stage by about the 28th June, rainfall in the meantime permitting. Further north, eggs laid on the 9th began to hatch on about 18th June.

We will continue to monitor temperature and rainfall over subsequent weeks. The current forecast is for moderate temperatures and some showery rain. The warmest areas at present are western East Anglia, the south-east part of the Midlands and the Home Counties (see map below).

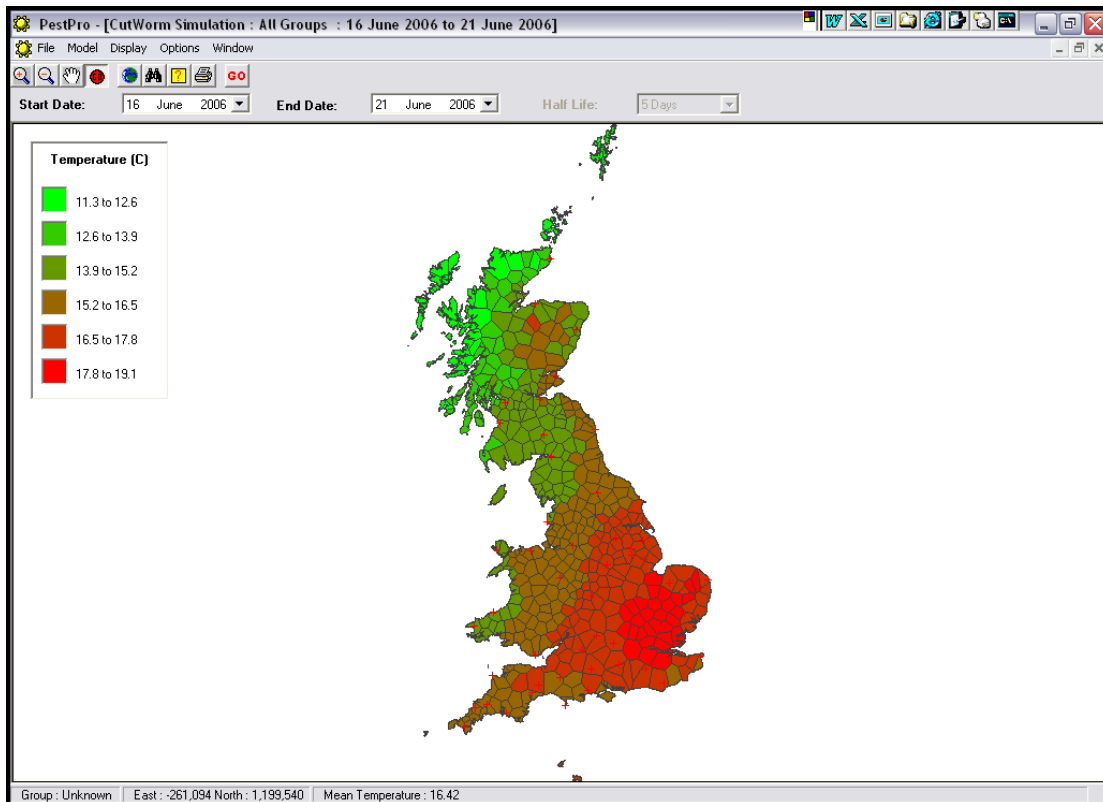
Action

There is no need to get the sprayer out at this stage.

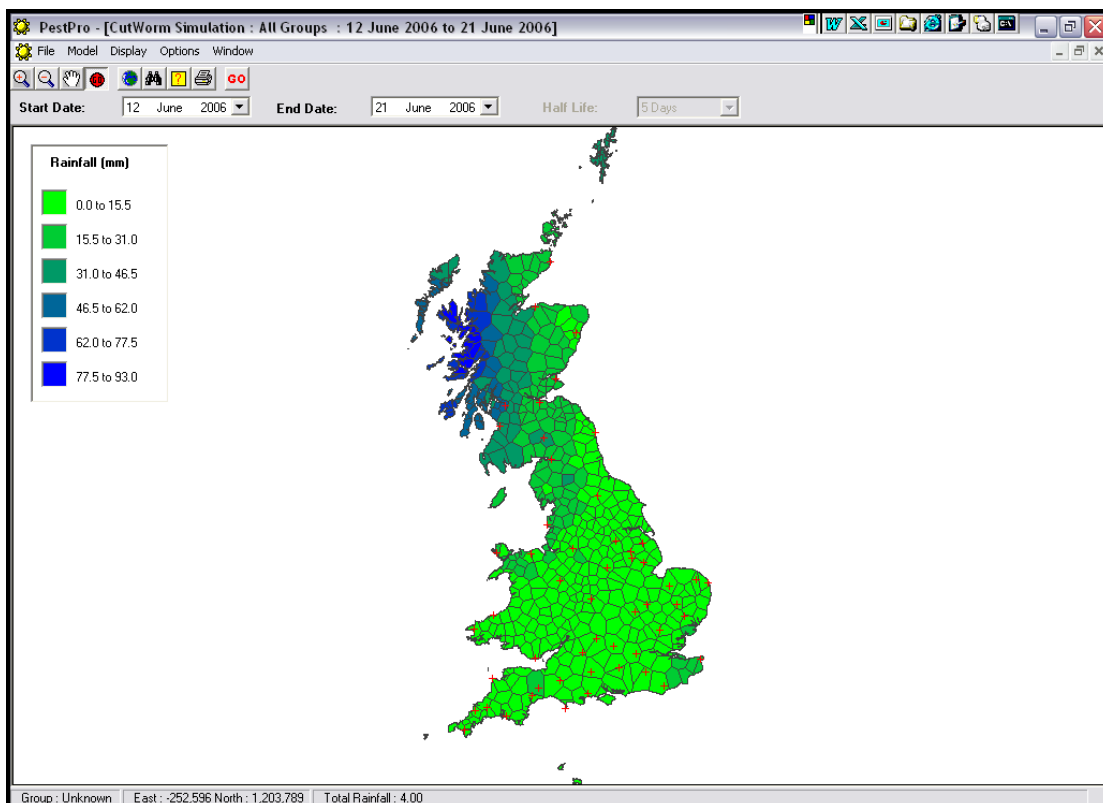
However, treatment of the most susceptible crops (lettuce, leek, red beet) is normally recommended when 5 days-worth of turnip moth eggs have survived through to the third instar cutworm stage. If temperatures remain similar to current levels and there is no substantial rainfall in the meantime, this is likely to happen in southern areas of England by about the 3rd July. The next cutworm report is due on the 29th June, which is very timely. Growers should ensure that they have early access to the next cutworm report.

We have had reports from growers that they are currently being recommended to treat crops such as potatoes with insecticides to prevent cutworm damage. ADAS would not endorse this. There is no need to use insecticides on even the most susceptible crops for at least a week, and potatoes are not the most susceptible crop. Unnecessary insecticide usage is not only wasteful but it may also compromise the beneficial effects of natural enemies in crops.

Mean daily temperatures, 16th – 21st June 2006



Rainfall since the start of egg hatch, June 12th.



Horticultural Development Council
Cutworm Monitoring & Prediction, 2006.

Prepared by Mike Lole
ADAS Wolverhampton

Report No 6, 30th June 2006

Current Situation

The assumption is that significant egg-laying by turnip moths started when the numbers in pheromone traps began to increase markedly. The dates on which this occurred in 2006 are as follows: For central and southern England, roughly south of a line from the Wash to the Mersey, - June 2nd; for the remaining, northerly, areas, - June 9th.

Whilst temperatures have not been particularly high in the past week they have been climbing steadily, and the development of turnip moth eggs and young cutworms has continued at a steady pace – probably slightly faster than anticipated in last week's report. Rainfall has occurred in most areas, but it has been very unevenly distributed and often quite light, insufficient to have much effect on the survival of the young caterpillars.

In the most forward areas of central southern England batches of eggs laid on the operative date, the 2nd June, hatched from the 12th June (and continue to do so). The first of the young cutworms to reach the 3rd instar stage (the underground-feeding stage that is invulnerable to rainfall and insecticides) did so on about the 23rd June and more are doing so on a daily basis. Further north, eggs laid on the 9th began to hatch on about 18th June and are currently approximately two-thirds of the way through their development to the third instar.

As previously, we will continue to monitor temperature and rainfall over the coming weeks and we will assess the influence of the weather on cutworm development. The current 5-day general forecast is for increasing temperatures and little rain.

Action

Accumulating numbers of cutworms reaching the third instar dictate that it is necessary to issue a spray warning for the crops most susceptible to cutworm damage (lettuce, leek, red beet) in the areas greatest at risk.

The high-risk areas are shown on the first map below, the deeper the red, the higher the risk. This area could be described as England south of the Humber-Mersey line, excluding: the south-west; Cheshire/Shropshire/Staffordshire; the Lincolnshire coast; Norfolk/Suffolk and the Essex coast; Kent/Sussex. The exceptions are generally because these areas have had significant rainfall since the young cutworms hatched from the egg (see second map), which has lowered survival rates and hence the risk of damage.

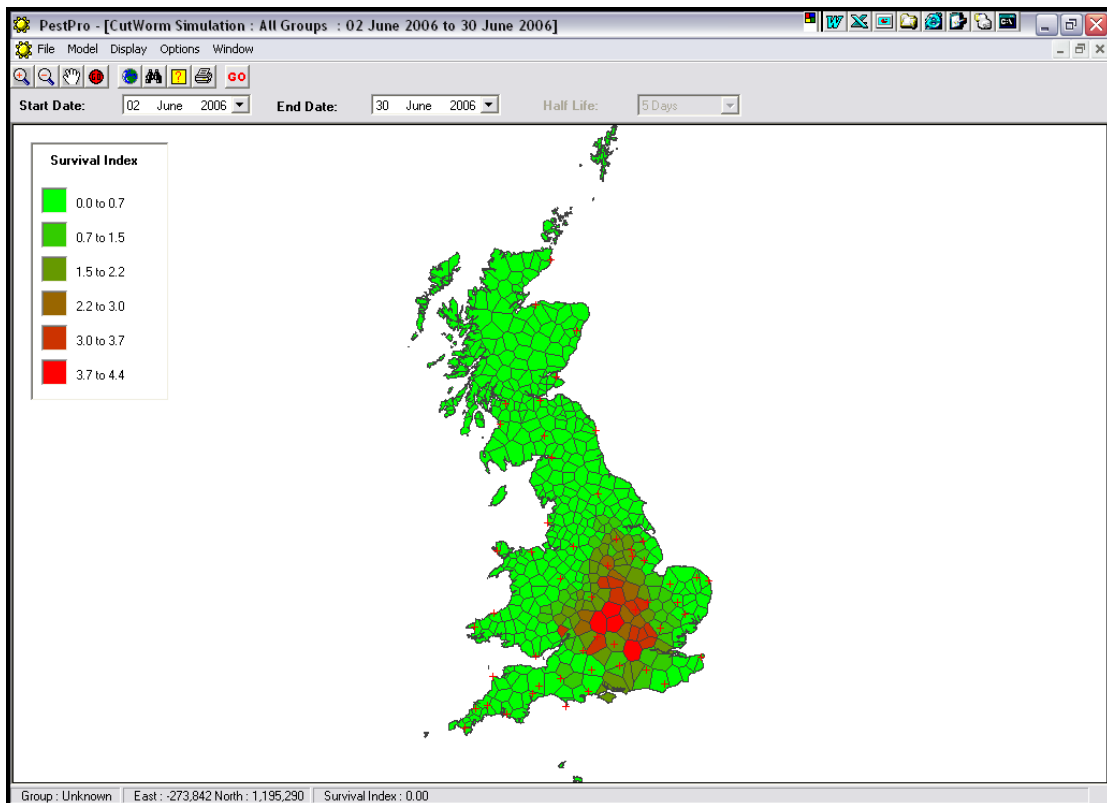
The most susceptible crops in the high-risk areas should be treated with an insecticide which will control cutworms, on or after July 1st. There are exceptions to this. Crops that are being irrigated (20mm irrigation at least once a

fortnight), or that have had an insecticide that will kill caterpillars in the past 10 days, will not require treatment.

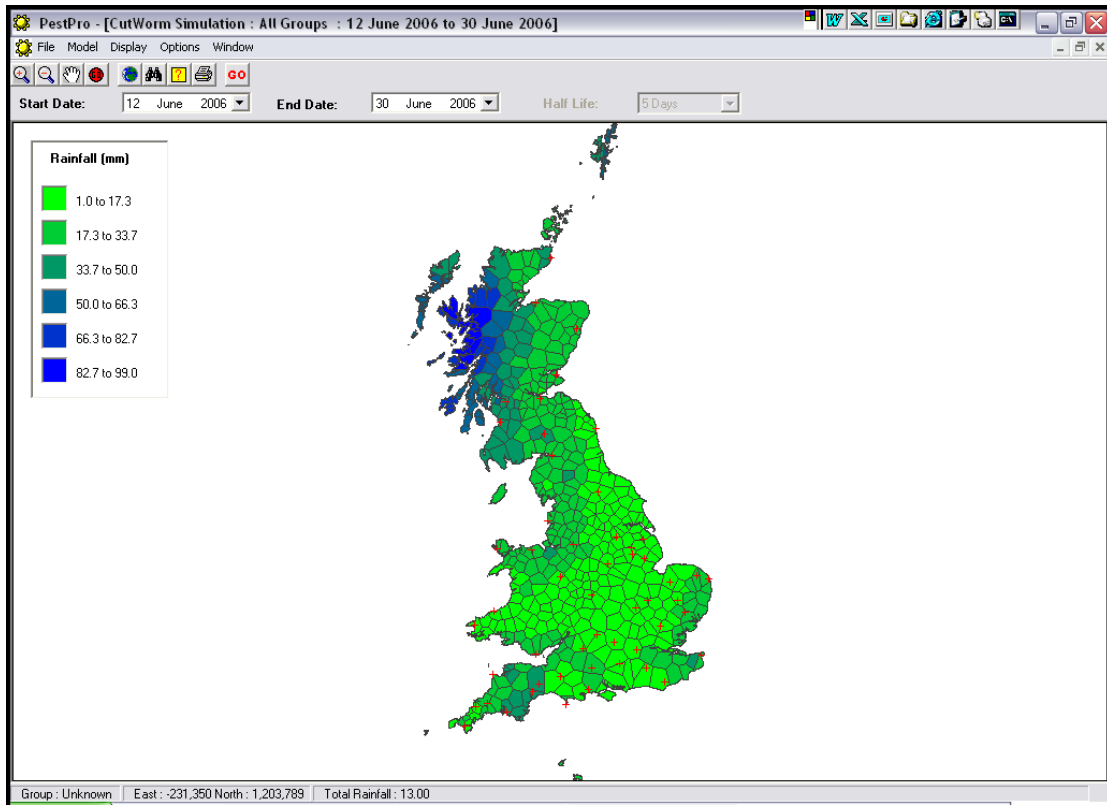
At this stage, there is no need to treat less-susceptible crops (brassicas, carrot, celery, parsnip, sugar beet, onion, potato, swede and turnip) in the high-risk area, nor to treat any crops outside this area. However, the situation continues to develop and will be monitored closely. If appropriate, an interim report may be prepared on Tuesday, 4th July. Otherwise, the further risk of cutworm damage will be assessed in the next weekly report, issued on Friday 7th July.

It should be pointed out that omission of recommended treatments may not result in significant cutworm damage. The forecast is based on likely survival rates of cutworms and is not quantitative, as there is no satisfactory method of estimating populations. High survival rates of a small population may not result in significant damage.

Cumulative cutworm survival, 2nd – 30th June 2006



Rainfall since the start of egg hatch



Horticultural Development Council
Cutworm Monitoring & Prediction, 2006.

Prepared by Mike Lole
ADAS Wolverhampton

Report No 7, 4th July 2006

Current Situation

The increasingly warm and dry weather experienced by much of southern England since the issue of the last report (29th June) has necessitated the issue of an interim cutworm report. The last report indicated that the most susceptible crops in the highest-risk areas should be treated; it is now necessary to widen this spray warning to take in additional crops and/or geographical areas.

In the most forward areas of central southern England batches of eggs laid on the operative date, the 2nd June, hatched from the 12th June (and continue to do so). The first of the young cutworms to reach the 3rd instar stage (the underground-feeding stage that is invulnerable to rainfall and insecticides) did so on about the 23rd June and more are doing so on a daily basis. Further north, eggs laid on the 9th began to hatch on about 18th June and are now beginning to complete their development to the third instar.

The current 3-day general forecast is for continuing high temperatures and scattered thundery rain.

Action

Cutworms continue to reach third instar dictate and in the current weather conditions it is necessary to widen the spray warning issued on 29th June. The area at risk has continued to expand and the spray warning now also applies to some crops at moderate risk in these areas.

The high-risk areas are shown on the first map below, the deeper the red, the higher the risk. (N.B. ignore the part of the map north of the Mersey/Humber line: egg-laying was later here and the map exaggerates the risk in these areas). The high-risk area could be defined as England south of the Humber-Mersey line, excluding: the south-west; Cheshire; central and coastal Suffolk/Essex. Central Wales is also at risk. The exceptions are generally because these areas have had significant rainfall since the young cutworms hatched from the egg (see second map), which has lowered survival rates and hence the risk of damage.

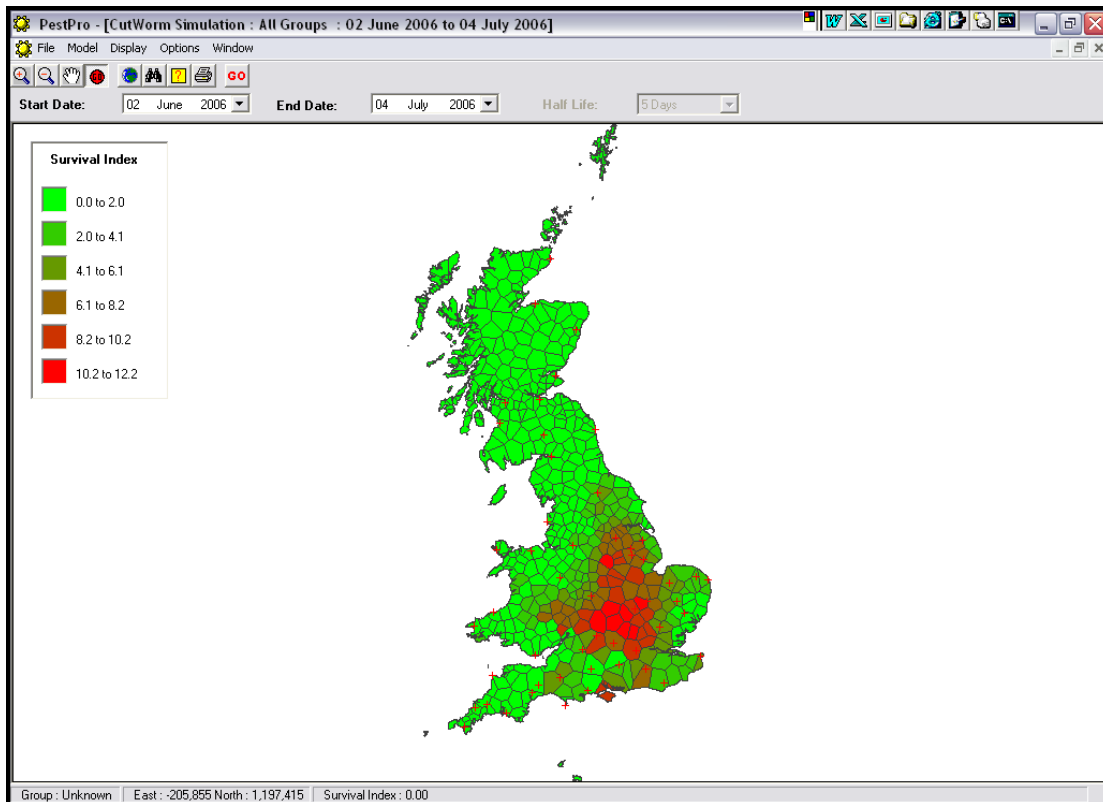
The most susceptible crops (lettuce, leeks, red beet) in the high-risk area should be treated with an insecticide which will control cutworms, as soon as possible. Moderately-susceptible crops (brassicas, carrot, celery, parsnip, sugar beet) in the centre of this high-risk area (coloured red/brown on the map) should also be treated. NB There are exceptions to this. Crops that are being irrigated (20mm irrigation at least once a fortnight), or that have had an insecticide that will kill caterpillars in the past 10 days, or that receive 10mm or more of rainfall, will not require treatment.

At this stage, there is no need to treat the least-susceptible crops (onion, potato, swede and turnip) in the high-risk area, nor to treat any crops outside this area. However, the situation continues to develop and unless there is significant rainfall in

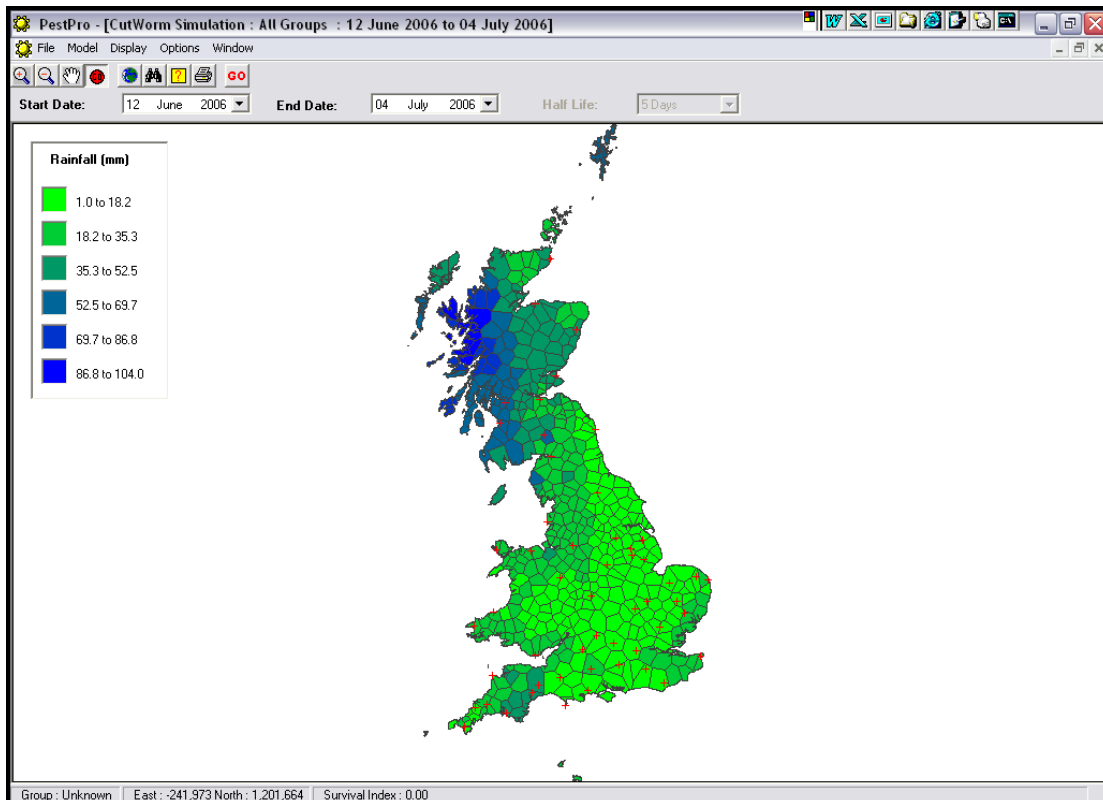
the next few days this situation is likely to change. A further report will be issued on Friday, 7th July.

It should be pointed out that omission of recommended treatments may not result in significant cutworm damage. The forecast is based on likely survival rates of cutworms and is not quantitative, as there is no satisfactory method of estimating populations. High survival rates of a small population may not result in significant damage.

Cumulative cutworm survival, 2nd June – 4th July 2006



Rainfall since the start of egg hatch, June 12th.



Horticultural Development Council
Cutworm Monitoring & Prediction, 2006.

Prepared by Mike Lole
ADAS Wolverhampton

Report No 8, 7th July 2006

Current Situation

As cutworm development continues the situation is becoming very fragmented and complex. This is due to a lack of rainfall in some areas, with heavy, localised rainfall in others, almost at random. Since heavy rain is a major mortality factor in young cutworms the presence or absence of rain is crucial in deciding whether a crop should be sprayed.

To recap recent reports, spray warnings have been issued in the last week for the most susceptible and moderately-susceptible crops (lettuce, leek, red beet, brassicas, carrot, celery, parsnip, sugar beet) in the high –risk area of central and southern England.

Since the interim report produced on 4th July there has been sporadic, sometimes heavy, rain in some areas. This will have caused high mortality. Where this rain did not fall the risk of cutworm damage is still increasing.

The current 3-day general forecast is for cooler temperatures and further scattered showers.

Action

In those areas that have not received a rain event consisting of at least 10mm rain in the past week, cutworms continue to reach the third instar, underground-feeding stage. The accumulated cutworm survival in these areas now means that there is a growing risk of damage to even the least-susceptible crops in these areas.

The high-risk areas are shown on the first map below, the deeper the red, the higher the risk. The high-risk area could be defined as England south of the Humber-Mersey line, excluding: the south-west; Cheshire; central and coastal Suffolk/Essex. Central Wales is also at risk. The exceptions are generally because these areas have had significant rainfall since the young cutworms hatched, which has lowered survival rates and hence the risk of damage. The Vale of York has missed most of the recent rain and cutworm survival in this area is also now significant, though egg-laying began later here.

The most susceptible crops (lettuce, leeks, red beet) and moderately-susceptible crops (brassicas, carrot, celery, parsnip, sugar beet) in the high-risk area should already have been treated with an insecticide which will control cutworms (except as detailed below). The least susceptible crops (onion, potato, swede, turnip) in the centre of this high-risk area (coloured red/brown on the map) should also now be considered for treatment early next week (w/b 10th July). The most susceptible crops (see above) in the Vale of York should also be considered for treatment.

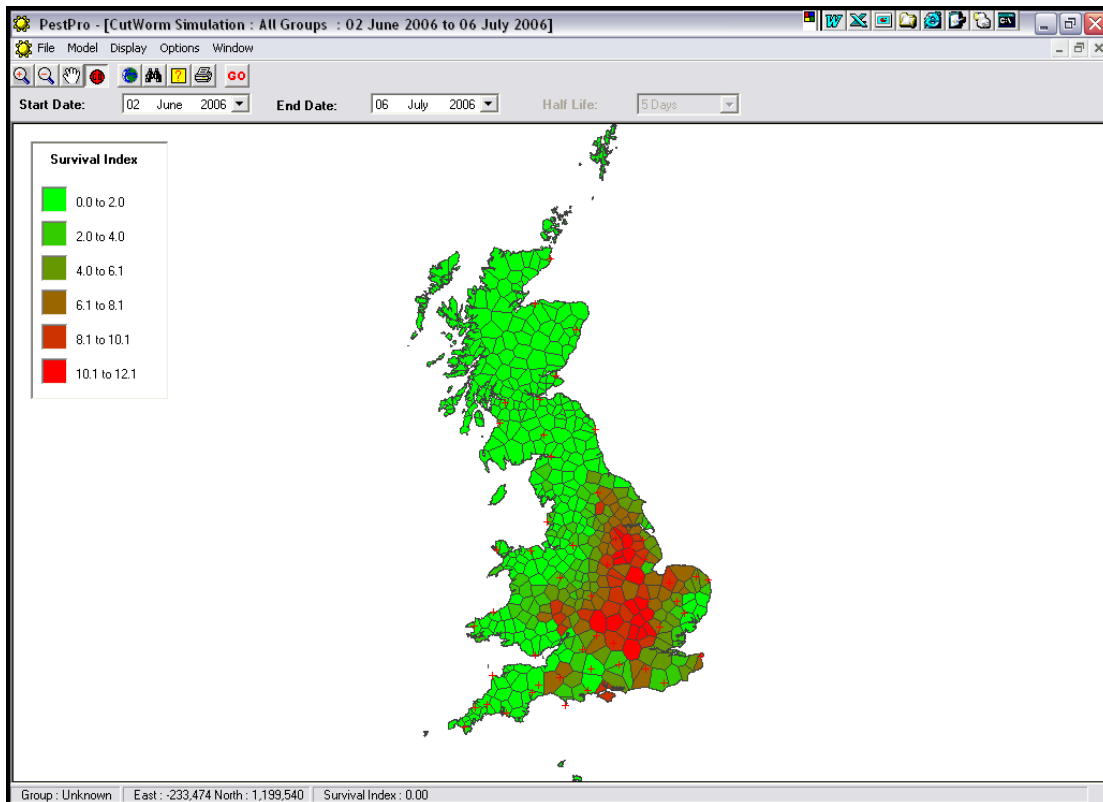
N.B. As ever, there are exceptions to this. Crops that are being irrigated (20mm irrigation at least once a fortnight), or that have had an insecticide that will kill

caterpillars in the past 10 days, or that receive 10mm or more of rainfall before the spray date, will not require treatment. The recent general rain pattern is shown in map 2.

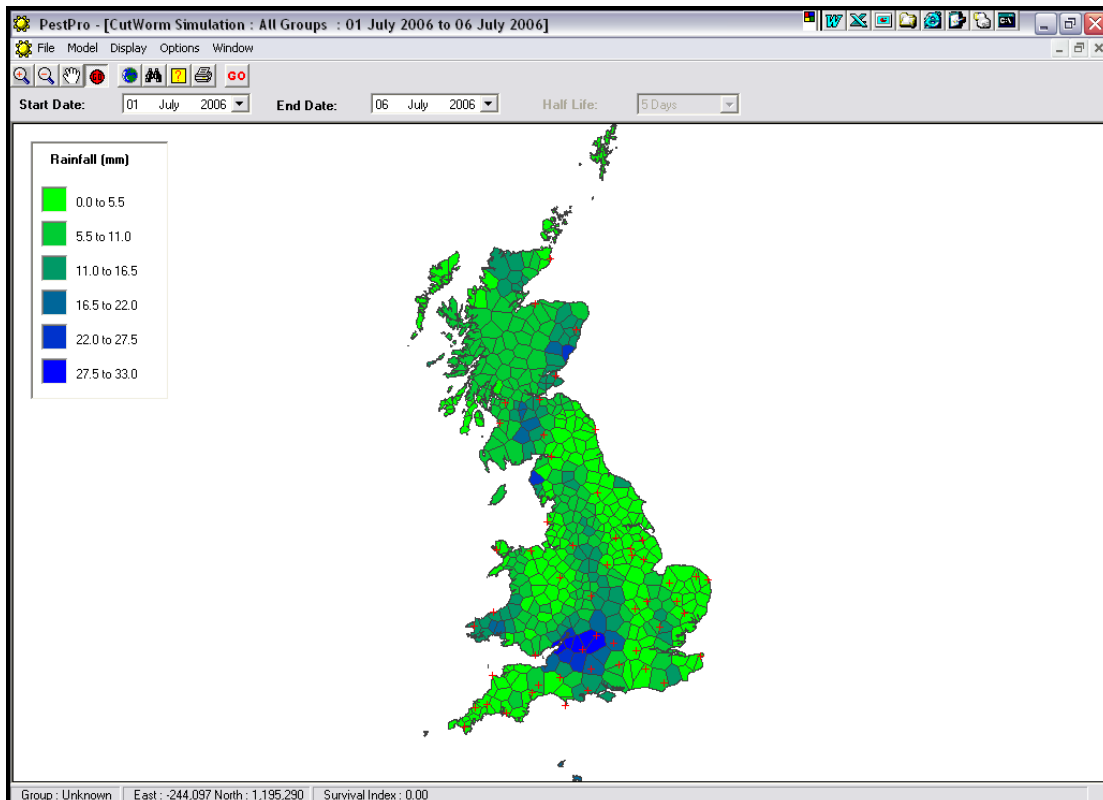
The situation continues to develop. A further report will be issued on Friday, 14th July.

It should be pointed out that omission of recommended treatments may not result in significant cutworm damage. The forecast is based on likely survival rates of cutworms and is not quantitative, as there is no satisfactory method of estimating populations. High survival rates of a small population may not result in significant damage.

Cumulative cutworm survival, 2nd June – 6th July 2006



Rainfall, 1st – 6th July.



Horticultural Development Council
Cutworm Monitoring & Prediction, 2006.

Prepared by Mike Lole
ADAS Wolverhampton

Report No 9, 14th July 2006

Current Situation

There has been no nation-wide substantial rainfall in the past week, so the cutworm development situation remains complex. Many areas did see some rain, but this was frequently in the form of multiple small showers which will have not contributed greatly to cutworm mortality. The exceptions to this are (approximately) the counties of Somerset, Avon, Gloucestershire, Wiltshire, Worcestershire and Warwickshire, and the western parts of East Anglia, most of which had around or above 10mm rain on 5/6 July.

Spray warnings have been issued in the last two weeks. By now, the following should have been treated:

- i) unirrigated highly-susceptible crops (lettuce, leek, red beet) in England, from Yorks and Lancs (inclusive) southwards, and central Wales, except those that have received a heavy local rain event (10mm plus)
- ii) unirrigated moderately-susceptible crops (brassicac, carrot, celery, parsnip, sugar beet) in England, south of the Mersey/Humber line, and central Wales, except those that have received a heavy local rain event (10mm plus)
- iii) unirrigated least-susceptible crops (potato, swede, turnip, onion) in the highest-risk area of Lincs, Notts, Leics, Rutland, Cambs, Herts, Bucks, Beds, Northants, Berks and W.Sussex, except those that have received a heavy local rain event (10mm plus).

Rainfall since 5th July is shown on the accompanying map.

The current 5-day general forecast is for continuing fine, warm, dry weather.

Action

In those areas that have not received a rain event consisting of at least 10mm rain in the past week, cutworms continue to reach the third instar, underground-feeding stage. Cutworm survival in these areas is continuing and the risk of damage to untreated crops is consequently greater.

Crops as detailed above should already have been treated. Those in these categories left untreated should be sprayed or irrigated (20mm or more) as soon as possible.

The remaining susceptible crops in England (Yorks & Lancs southwards) and central Wales should be treated in the next 5 days (but see exceptions below).

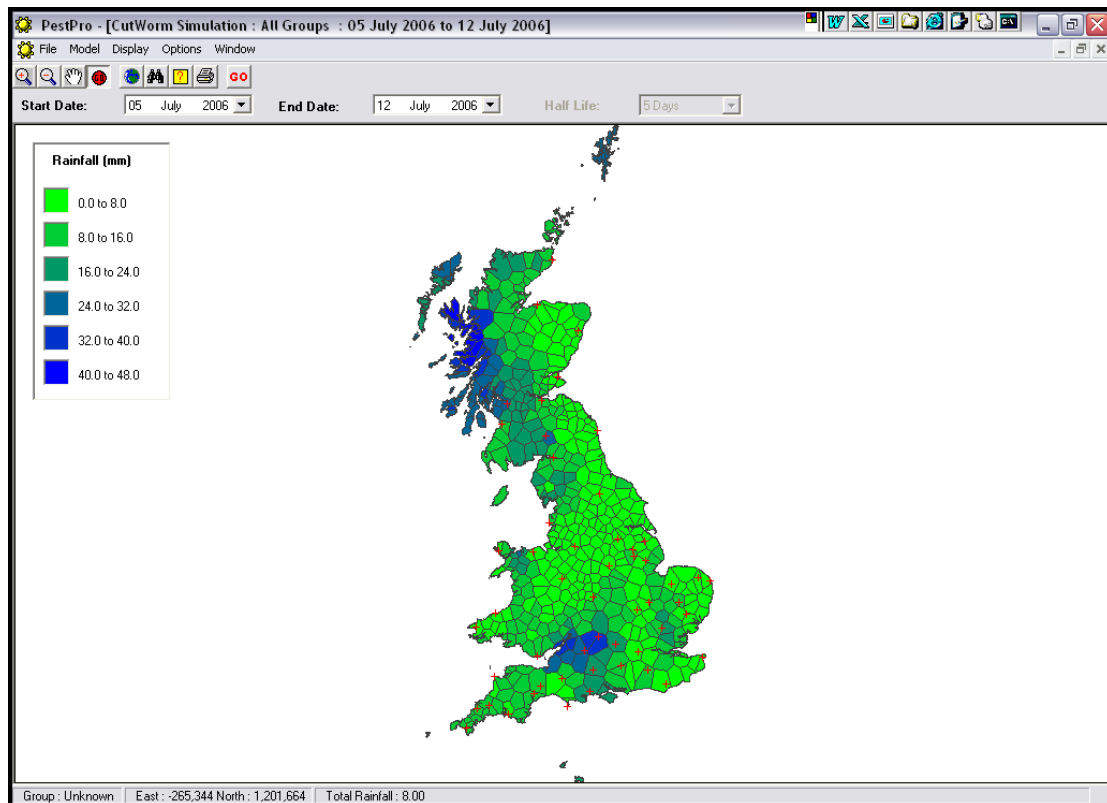
N.B. Crops that are being irrigated (20mm irrigation at least once a fortnight), or that have had an insecticide that will kill caterpillars in the past 10 days, or that receive 10mm or more of rainfall before the spray date, will not require treatment.

If the dry weather continues then consideration may need to be given for second treatments against cutworms. At present, second treatments on the most susceptible

crops will need to be applied at a minimum of 16 days after the first ones, if the weather stays warm and dry. The interval for moderately-susceptible crops is currently 21 days and for the least-susceptible crops it is 26 days. A further report will be issued on Friday, 21st July.

It should be pointed out that omission of recommended treatments may not result in significant cutworm damage. The forecast is based on likely survival rates of cutworms and is not quantitative, as there is no satisfactory method of estimating populations. High survival rates of a small population may not result in significant damage.

Rainfall, 5th – 12th July.



Horticultural Development Council
Cutworm Monitoring & Prediction, 2006.

Prepared by Mike Lole
ADAS Wolverhampton

Report No 10, 21st July 2006

Current Situation

In the continuing absence of substantial rainfall other than in isolated patches the risk of cutworm damage remains high in untreated or unirrigated susceptible crops throughout most of England and central Wales (see map 1). Scotland and Cumbria are at the lowest risk of damage, and the coastal areas of Wales and most of the West Country are also at a lower risk than the rest of England and Wales. Until substantial rain falls the risk of damage to crops will continue to increase and it may be necessary to consider follow-up treatments to some crops.

Rainfall since 5th July is shown on the accompanying map (map 2).

The current 5-day general forecast is for continuing fine, warm, dry weather.

Action

Unirrigated (20mm or more) crops in the high-risk areas should already have been treated against cutworms. There is now a need to consider when re-treatment might be required. Larval development is currently taking about 11 days, so a potentially-damaging population could build up in the most susceptible crops (lettuce, leek, red beet) in as little as 16 days after the previous treatment. The comparable figure for moderately-susceptible crops (brassica, carrot, celery, parsnip, sugar beet) is 21 days after the previous treatment, and for the least susceptible crops (potato, swede, turnip, onion) the figure is 26 days.

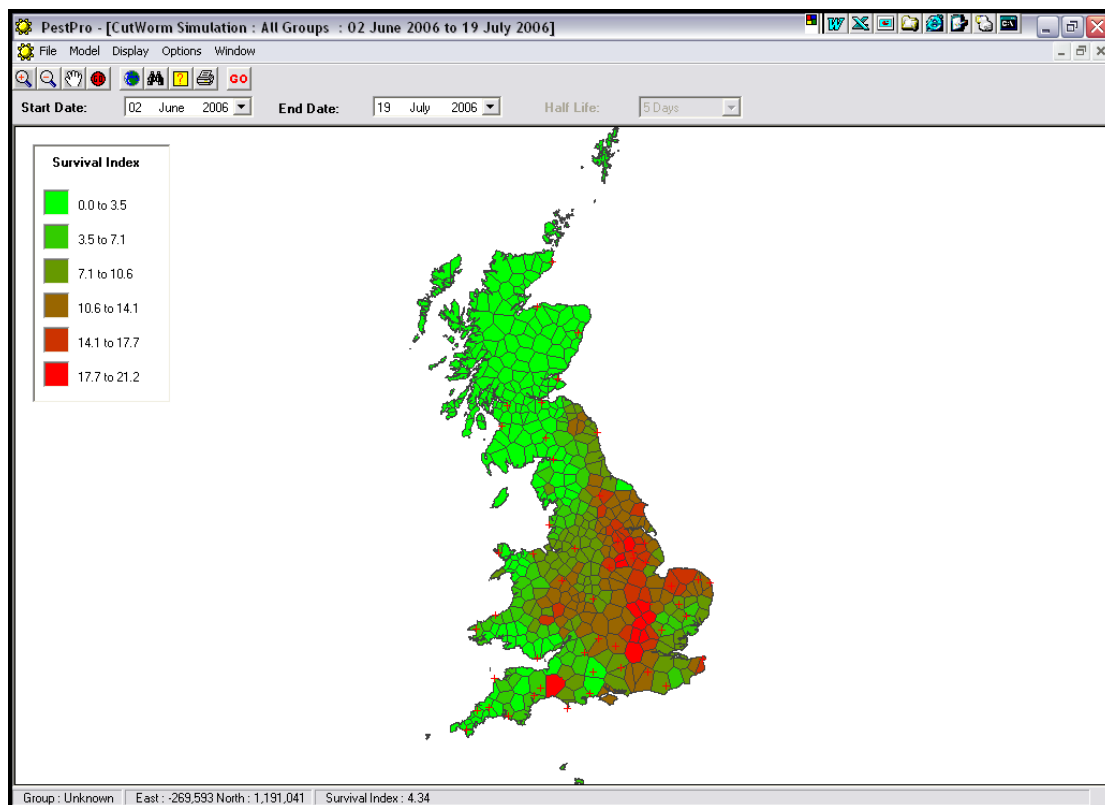
If there is no substantial rainfall (10mm +) in the meantime, it will be necessary to consider re-treating crops at the appropriate interval after the previous treatment.

N.B. Crops that are being irrigated (20mm irrigation at least once a fortnight), or that have had an insecticide that will kill caterpillars in the period since the last treatment, or that receive 10mm or more of rainfall before the spray date, will not require treatment.

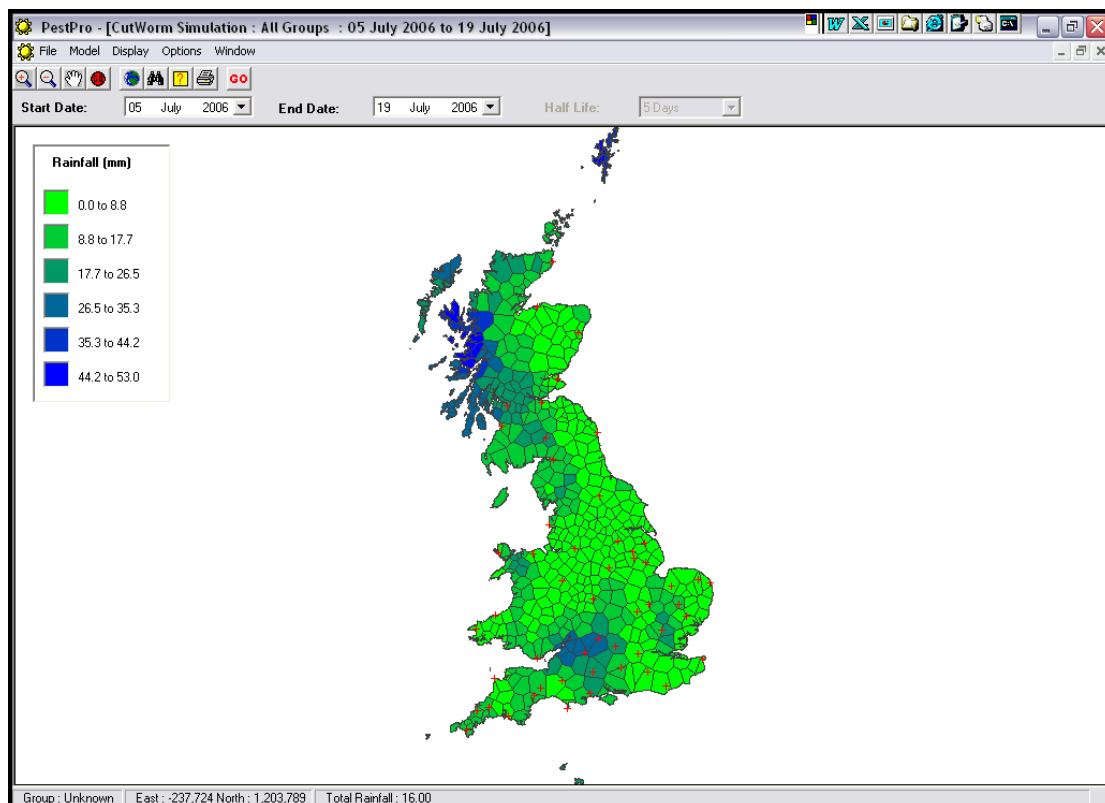
A further report will be issued on Friday, 28th July.

Omission of recommended treatments may not result in significant cutworm damage. The forecast is based on likely survival rates of cutworms and is not quantitative, as there is no satisfactory method of estimating populations. High survival rates of a small population may not result in significant damage.

Cutworm survival index as at 20th July 2006



Rainfall, 5th – 19th July.



Horticultural Development Council
Cutworm Monitoring & Prediction, 2006.

Prepared by Mike Lole
ADAS Wolverhampton

Report No 11, 31st July 2006

Current Situation

Substantial rainfall has fallen at the end of last week in many areas (though not nationwide). In the areas that had the rain the mortality of young cutworms on the foliage of plants will have been substantial and there will be no need for treatment. In the remaining areas there is still some risk of damage to untreated crops.

The numbers of turnip moths caught in traps has been declining since mid-July, and this can be taken as the signal that significant egg-laying has ceased at that point.

The current general forecast is for cooler, less humid weather with further rainfall.

Action

Unirrigated (20mm or more) crops in the areas that did not get the recent rainfall (10mm +) should already have been treated against cutworms, but may still need re-treatment. Larval development is currently taking 8 - 11 days, depending on temperature, so a potentially-damaging population could build up in the most susceptible crops (lettuce, leek, red beet) in about 16 days after the previous treatment. The comparable figure for moderately-susceptible crops (brassica, carrot, celery, parsnip, sugar beet) is 21 days after the previous treatment, and for the least susceptible crops (potato, swede, turnip, onion) the figure is 26 days.

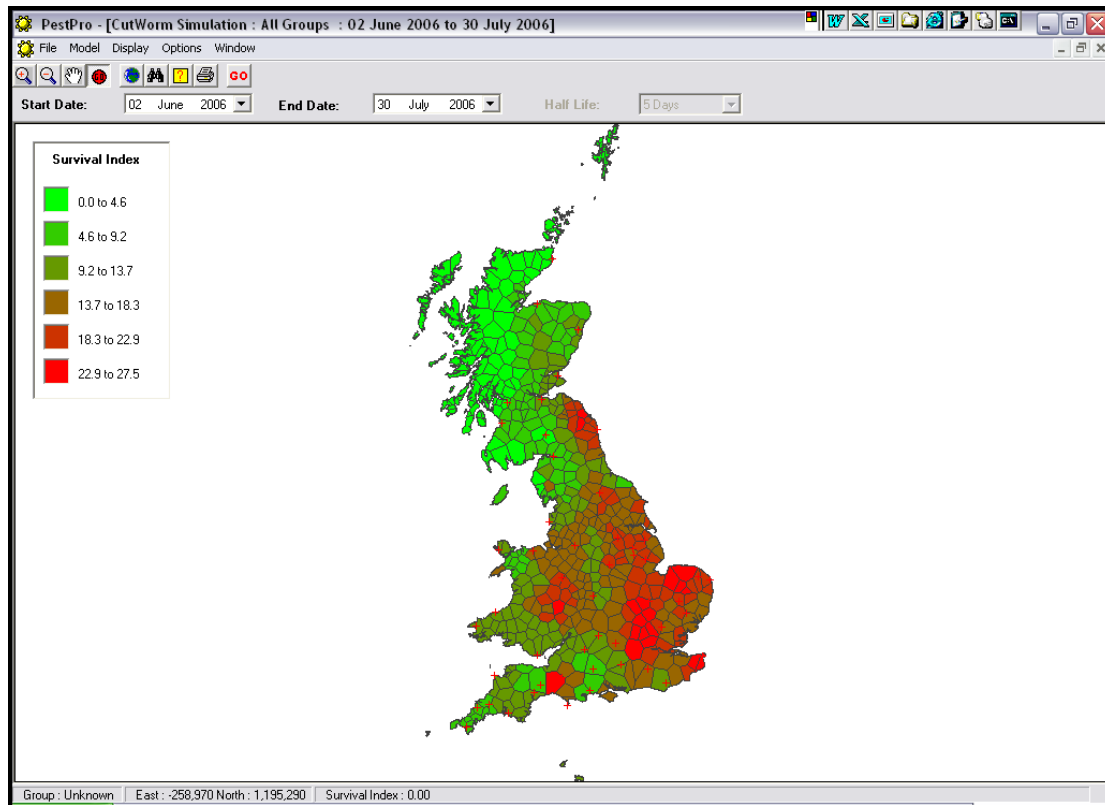
If there is no substantial rainfall (10mm +) in the meantime, it will be necessary to consider re-treating crops in the 'dry' areas at the appropriate interval after the previous treatment.

N.B. Crops that are being irrigated (20mm irrigation at least once a fortnight), or that have had an insecticide that will kill caterpillars in the period since the last treatment, or that have received 10mm or more of rainfall before the spray date, will not require treatment.

Omission of recommended treatments may not result in significant cutworm damage. The forecast is based on likely survival rates of cutworms and is not quantitative, as there is no satisfactory method of estimating populations. High survival rates of a small population may not result in significant damage.

A further report will be issued on Friday 4th August. This will consider whether there is any further substantial risk of cutworm damage this season.

Cutworm survival index as at 30th July 2006



Horticultural Development Council
Cutworm Monitoring & Prediction, 2006.

Prepared by Mike Lole
ADAS Wolverhampton

Report No 12, 4th August 2006

Current Situation

Heavy rainfall has fallen in the last few days in all areas north of a line Liverpool – Ipswich. In these areas the mortality of young cutworms on the foliage of plants will have been substantial. Since any cutworms present will have developed from eggs laid on or before 16th July, and we can assume that no significant egg laying has taken place after this time (according to trap catch data), there is no further risk of cutworm damage in the north this year.

In the remaining areas south of the Liverpool – Ipswich line there is still some local risk of damage to untreated crops.

There has been an upturn in turnip moth catches in some traps in the last week. This probably indicates that there has been a partial second generation of moths. This does not occur every year and in general this second generation is considered to be of little significance.

Action

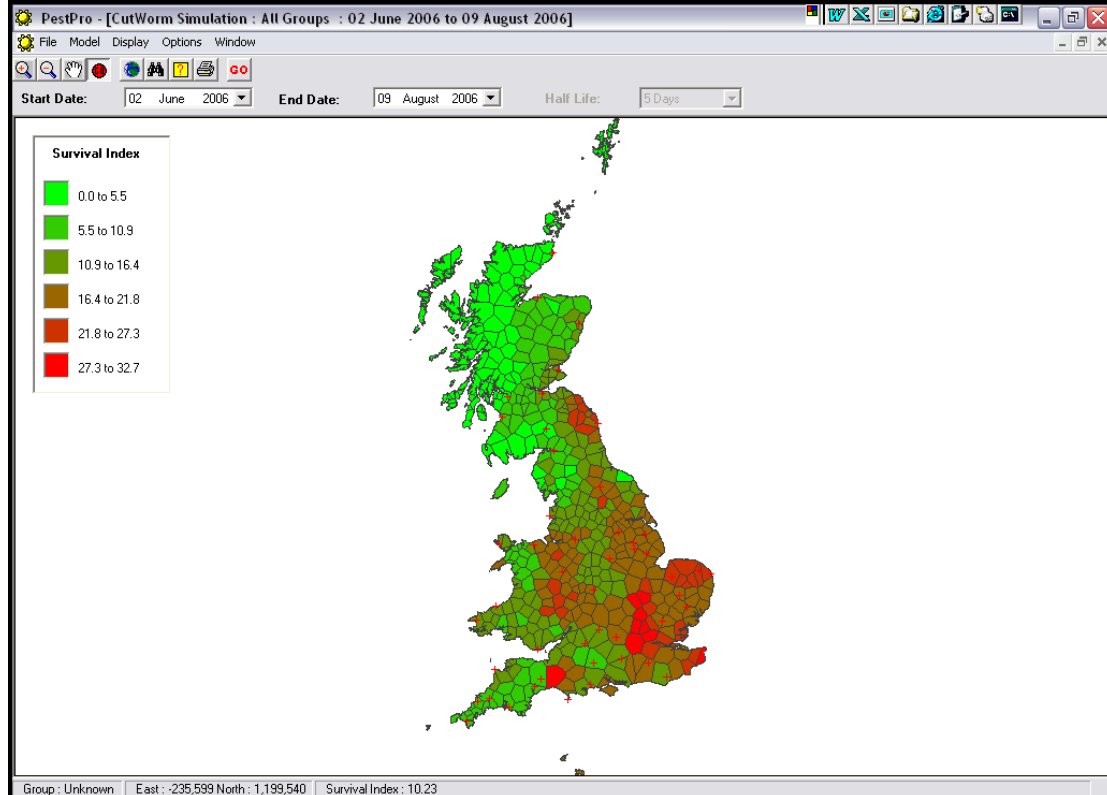
No further action on cutworms will be necessary in the area north of the Liverpool – Ipswich line.

Unirrigated (20mm or more) crops in areas that have not had rainfall or treatment since about 21st July may still need re-treatment, but there should be few crops in this category. The highest-risk areas include the Welsh borders, Hants/Wilts/Somerset/Dorset and Kent to Essex around the Thames estuary. The risk is, however, comparatively small and no treatment should be necessary, even on the highest-risk crops, unless at least 16 days has elapsed since the previous rainfall event or treatment. Any crop irrigated or treated since July 23rd will not need further treatment.

N.B. Crops that are being irrigated (20mm irrigation at least once a fortnight), or that have had an insecticide that will kill caterpillars in the period since the last treatment, or that have received 10mm or more of rainfall before the projected spray date, will not require treatment.

Omission of recommended treatments may not result in significant cutworm damage. The forecast is based on likely survival rates of cutworms and is not quantitative, as there is no satisfactory method of estimating populations. High survival rates of a small population may not result in significant damage.

A final report for this season will be issued on Friday 11^h August.



Horticultural Development Council
Cutworm Monitoring & Prediction, 2006.

Prepared by Mike Lole
 ADAS Wolverhampton

Final Report, No 13, 10th August 2006

Current Situation

The assumption (based on trap catches of moths) is that turnip moths effectively ceased laying eggs by July 16th this year. The last eggs, i.e. those laid on the 16th, will have hatched on the 22nd July or thereabouts, becoming vulnerable to rainfall, irrigation or pesticides until about August 3rd, when they will have reached the invulnerable underground-feeding stages.

It is therefore now past the stage where any meaningful intervention can be made this year.

Action

No further action on cutworms will be necessary in 2006.

Summary

This has not been a straightforward year for cutworm prediction. The main natural regulator of cutworm activity, substantial rainfall (defined as a single rain event of 10mm or more) has been unpredictable, often localised and sporadic, making assessment of the risk of damage to crops rather complex. There has undoubtedly been a substantial risk of cutworm damage to crops in many areas of England (see map 1 below).

The overall population of the turnip moths may have grown in 2006, perhaps increasing the risk of crop damage in 2007. We shall have to see. Total rainfall since the date of first egg hatch is illustrated in Map 2.

Map 1. Cutworm survival index, 2006.

Map 2. Total rainfall since first hatch of turnip moth eggs, 2006. The drier areas are those where the risk of cutworm damage is highest.

