Can mesh netting reduce potato blight?

Summary
Potato blight is still one of the most devastating potato diseases in the UK. It is a fungus (*Phytopthora infestans*) that has the potential to completely destroy crops. It first infects the leaves, then the infection spreads to the tubers where they rot. Potatoes grown on a garden scale are just as susceptible to the disease as commercial crops.

Potatoes grown on a garden scale are just as susceptible to the disease as commercial crops. Growers often practice damage limitation by growing varieties with low susceptibility to the disease or growing early crops that can be harvested before blight infection pressure gets really high in late summer. Neither of these is completely satisfactory. There are very few varieties that are completely resistant to the disease, and the Sarpo varieties that show good resistance are not always widely available. Additionally, not everybody might want to grow just early varieties if they want to grow some main crop varieties for storing.

Some interesting work, done by Charles Merfield of the Future Crops Centre in New Zealand showed that covering potato crops with fine mesh netting could significantly reduce the incidence of potato blight. His work suggested that it was the exclusion of ultraviolet light by the netting that may be reducing the incidence of the disease. It is essential that fine mesh netting of less than 0.6 mm is used, otherwise the effects were not observed.

We often cover other crops such as brassicas with mesh netting, so this might work well, if we could use it to reduce blight on potato crops in gardens and allotments. We weren't sure if this would work in the UK, as Charles found the netting was effective against early blight (*Alternaria solani*) in New Zealand whereas it is late blight (*Phytopthora infestans*) that is prevalent in the UK.

We gave out fine mesh netting and Nicola seed tubers (Nicola is very susceptible to late blight) to gardeners around the UK and Ireland to see if the mesh netting had any effect against the disease. As luck would have it, there was very little blight around in 2020, and only 3 sites at County Wicklow, Lancashire and Dumfries & Galloway had more than moderate levels of infection. At 2 of these sites, the mesh netting resulted in a large reduction in blight infection but at the other site it had no effect at all.

The effects of the mesh netting on growth and yield of the crops was inconsistent, with it improving growth and yields in some cases but having a negative effect in others. A number of people noticed that rainfall did not penetrate this fine mesh netting and ran off the sides, so it is probable that the differences in growth and yield were down to different moisture levels. It is also possible that the reduction in blight at two sites may have been due to the netting preventing rainfall from wetting the leaves.

It is difficult to draw conclusions from these results, and the work would need to be repeated at a wider range of sites in a year with higher blight infection pressure to properly test whether mesh netting is an effective and practical way of reducing blight infection in UK potato crops.

Background

Potato blight is still one of the most devastating diseases, especially amongst organic growers in the UK. Although there are two types of blight, early blight (*Alternaria solani*) and late blight (*Phytophthora infestans*), it is late blight that is the most common in the UK, and the most damaging. Potato crops are most commonly infected through air borne fungal spores that come from other diseased potatoes or tomatoes. From early June onwards, it first appears as dark grey lesions on the leaves that can rapidly spread through the leaf canopy and eventually infect the tubers. It is best controlled through preventative measures such as growing resistant or tolerant varieties or by planting and harvesting the crop early. Any alternative preventative measures would be a useful addition to our ability to control the disease.

Fine grade mesh netting is an invaluable tool in organic growing, particularly for protection against insect pests and birds. Although it is made out of plastic, when it is well maintained, it can last for over 10 years, so can be considered a sustainable alternative to using insecticides.

In 2011, Dr.Charles Merfield, head of the Future Farming Centre in New Zealand discovered an unexpected benefit whilst testing mesh as a method of pest protection against the tomato potato psyllid. Not only did the mesh protect against the pest but the potatoes under the mesh had much lower levels of blight infection in the leaves. The same effect was observed in subsequent years, making it unlikely that this was an anomaly. The work showed that the type of netting is important; only mesh sizes smaller than 0.6 mm had a significant effect.

However there remain a lot of unanswered questions, such as exactly why it works (ultraviolet light levels are thought to play a role), and whether it is effective at controlling all types of blight. In New Zealand both early blight (*Alternaria solani*) and late blight (*Phytopthora infestans*) are common, whereas in the cooler damper climate of the UK, late blight is much more prevalent. Currently we are really not sure how effective the mesh is against the UK late blight, so further work needs to be done in this country.

Aims of this experiment

We wanted to see if mesh could be used to control potato blight in gardens around the UK. We compared the yields and levels of blight infestation in covered and uncovered crops. Fine grade mesh netting (0.6 mm grade) was supplied and seed tubers of the potato variety Nicola. This is a second early / early main crop variety that is popular as a salad variety despite being very susceptible to blight.

Methods

- The trial was conducted over the summer of 2020,
- Growers grew 2 plots, each with 6 tubers of the variety Nicola.
- One plot was covered with 0.6 fine mesh netting, and the other was left uncovered as a control.
- Plants were assessed on a weekly basis for blight infection using a modified scale devised by Cruickshank *et al*, 1982.
- In August, plants were dug up and harvested, and tubers weighed to assess yield.
- 17 people returned results. Initially it was intended to send out 50 packs, but sending out of materials was curtailed by the imposition of lockdown at the onset of the Covid 19 pandemic.

Results

Weather

The UK experienced a warm and dry spring until the end of May. June and July were more unsettled with periods of dull warm weather interspersed with sporadic rainfall.
The number of Hutton periods were recorded at Ryton using the 'Blightwatch' service. This is a way of using weather data to predict conditions when there is a high risk of blight.
A 'Full' Hutton Period occurs when the following criteria are met on 2 consecutive days:-

- Minimum air temperatures are at least 10°C
- Relative Humidity is 90% or above for at least 6 hours

The Blightwatch service sends an email alert when the above conditions are met.
We received Hutton alerts 12th, 13th, 18th & 19th June, 9th July and 16th & 17th August. Therefore, for much of the season, the weather conditions were not conducive to blight infection. Blight conditions may have differed in different parts of the country, but this was not recorded.

Mesh reduced blight at a few sites

Of the 17 sites, 9 had no infection, 5 had low levels (blight score of 3 or less), 3 had high levels (blight score of 6 or more) (Table *1*).
The low levels of blight were at Bedfordshire, Devon, Warwickshire, Worcestershire and Surrey. The high levels were at Dumfries and Galloway, Lancashire and County Wicklow (Ireland), all on the west side of the UK and Ireland, where the climate is wetter and more conducive to blight.

Table 1 Blight infection at the trial sites

Area	Peak blight score on uncovered plot	Peak blight score on covered plot	Effect
Lancashire	8	1	Large reduction
County Wicklow	6	1	Moderate reduction
Dumfries and Galloway	8	8	No effect
Bedfordshire	3	2	Very small reduction
Devon	2	1	Very small reduction
Warwickshire	2	2	No effect
Worcestershire	3	2	Very small reduction
Surrey	3	2	Very small reduction

At the sites where there were high levels of infection, mesh netting resulted in a very large reduction in blight infection at one site, a moderate reduction at one site, and had no effect at the other site. At the sites where there were low levels of infection, mesh netting either resulted in a very small reduction or no effect. At these sites, we would not consider these differences to be real. Blight scores are subjective, and as the mesh only reduced the blight score by 1, this could easily fall within human error or subconscious bias.

These results are not consistent, and there needs to be further investigation at a wider range of sites, in a year with higher blight pressure.

Merfield et al (2018) observed a consistent effect in New Zealand, with a reduction in blight score from 7 to 2 with some of the mesh treatments over a number of years. Although they did not confirm the type of blight infection in a laboratory, a visual inspection by an expert deemed the infection most likely to be *Alternaria solani* (early blight). This disease is less common in the UK, and most blight that is observed is late blight, *Phytopthora infestans*.

The effect on early blight was due to the mesh netting modifying the environment. Measurements showed a small increase in temperature and a resultant decrease in relative humidity. The effects of mesh netting on temperature and humidity are complex and vary according to the climate and the mesh size (Tanny, 2013). Wider mesh sizes used for shade netting can result in a cooling effect, whilst finer netting reduces air flow and can result in a rise in temperature. Humidity can rise or fall, depending on climatic conditions, but if absolute moisture content remains the same, a rise in temperature will result in a fall in relative humidity, contrary to expectation.

The temperature and humidity effects observed by Merfield et al (2018) were considered too small an effect to explain the differences in blight infection, and the effects were thought to be through differences in the netting blocking ultra-violet light. Consistent with this, the materials that blocked UV light most had the largest effect in reducing blight. Merfield had previously observed that excluding UV light reduced early blight infection (*Alternaria solani*). There is plenty of work that shows that excluding UV light can reduce infection from some types of pests and diseases (Raviv and Antignus, 2004). However, there has been very little work on the effects of UV light on late blight (*Phytopthora infestans*).

A common observation among participants was that even heavy rain struggled to penetrate the mesh, and most ran off the sides. This may have reduced the wetting of the leaf surface, reducing the survival and proliferation of any blight spores.

Mesh had inconsistent effects on the growth of the plants.

A greater proportion of the uncovered crops grew vigorously compared to the covered crops (Table *2*).

Table 2 Effect of netting on the growth of the potato plants

Vigour	Uncovered (% of sites)	Covered (% of sites)
Moderate	29	41
Vigorous	71	59

However, when you asked people to observe whether mesh had a positive or detrimental effect, the effects were mixed with an equal mix of people observing a positive effect at some sites but a negative effect at others (Table 3):

Table 3 Observations on effects of netting on growth

Effect of mesh netting on plants	% of growers
Grew much worse	12
Grew slightly worse	23
No difference	18
Grew slightly better	29
Grew far better	18

It would be good to know the reasons behind these inconsistent effects. Some of them could be accounted for by rainfall. The earlier half of 2020 was very dry, so the reserves of water in the soil would be depleted. Any rainfall that fell in June and July would be much needed to achieve reasonable growth, so, in some cases, the reduction in growth could be explained by the cover preventing rainfall from reaching the soil. Often, even when garden plots are watered, not enough is applied or available to meet the demands of the plants, so these differences between treatments may have manifested themselves differently under different watering regimes.

Mesh reduced yield at many sites

On average, yields were reduced by growing plants under netting, from a plot yield of 3668g for the uncovered plots to 2875 g for the covered plots.

However the effects were not the same at each site. At 64% of sites covering with netting reduced yield, but at 36% of the sites, it increased it. These yield effects were only consistent with the effects observed on growth in just over half of the cases.

It is likely that the differences in yield could be partly explained by the mesh having different effects under different watering regimes, rainfall and soil types. Mesh can sometimes reduce water loss by plants, which could account for the increase in yields in some cases.

Conclusions and Recommendations

It was difficult to judge the effectiveness of the mesh covers as a measure against blight, as there were generally very low levels of blight infection at most sites. At the 3 sites that did have any level of infection, there was a noticeable reduction in the disease at 2 of the sites, but no effect at the third.

There would need to be more extensive work done to evaluate the effectiveness of the covers at a wider range of sites, in years with higher blight pressure. Observations suggest that the fine mesh covers prevent rainfall from entering, but whether this is the mechanism that prevents blight needs to be investigated further. This also needs to be balanced against the plants receiving enough water. Ideally, a drip system would efficiently water the soil surface without wetting the leaf surface, but it is likely that most gardeners would not consider it worthwhile putting in the time and resources to set this up.

References

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