Spray free potato production with mesh crop covers

Potatoes are something of a magnet for pests and diseases. As a result they can require a lot of agrichemical applications. However, the future of pesticides looks increasingly problematic with the growing issue of resistance; consumers becoming increasingly 'resistant' to sprays and looking for spray free produce; and legislators reappraising older chemicals resulting in their loss. It is therefore very clear that non-chemical alternatives are becoming vital.

With the wide range of pests and diseases that potatoes attract it appears something of an impossibility to find a non-chemical control for them all. However, ongoing research at the BHU Future Farming Centre is discovering that mesh crop covers have the potential to control all insect pests and also blight.

Mesh crop covers were developed in Europe to keep pests off crops, but not heat up like frost cloths do. As the name suggests they are a woven mesh, from plastic thread similar to fishing line, so they are very strong. They also have much longer life than frost cloth, with a 10 year guarantee common in the EU, and even then, growers can get 15 years out of a sheet if they are looked after. They come in a range of hole sizes from as small as 0.3 mm to over 1 cm allowing them to keep out pests as small as thrips to as big as deer, i.e., they work for pretty much all insect and vertebrate pests. They are now in widespread across Europe, with about 100,000 ha use in. Over the two decades they have been in use manufactures and growers have well and truly figured out how best to manage them, with sheet sizes ranging from 3 x 50 meters to 40 x 200 m. It is therefore straight forward to cover hundreds of hectares of crops on individual farms.

In 2011 I was asked to solve the TPP problem for organic growers. I thought mesh covers would be a pretty sure bet to control TPP, but, the obvious concern was it would exacerbate blight to the point of crop destruction. Having worked the max hole size to keep TPP out (0.6 mm) I did a quick and dirty test of the mesh by chucking four 10 x 10 m squares of mesh on a field of spuds. 2011 was a good blight year for Canterbury, and the uncovered and untreated crop was dead with blight down to the ground. I was therefore utterly amazed when I took the covers off to find green haulm underneath - with blight spots to be fair - but clearly much more healthy than the dead haulm surrounding it (Figure 1).

Figure 1

Having got such a totally unexpected result, the following year, a second trial checked two types of contrasting mesh for blight and TPP control and measured temperature, humidity and *Phytophthora infestans* spore numbers under and outside the mesh to see if they differed. Answer, no! So, while the mesh did an excellent job of controlling TPP with an increased total yield of 23% at 43 t/ha and a 125% increase in marketable yield (tubers >

125 g), none of the measurements were the cause of much lower blight levels under the mesh than out. So what was causing the blight control?

Back in the 1990s, in the UK, scientists who were researching the effects of altering the light spectrum in polytunnels on crops, pests and diseases had some pretty stunning results including that blocking UV light inhibited some plant diseases such as grey mould (*Botrytis cinerea*). Could a spectral filter effect of the mesh be the cause of the blight control? A third years trials of a range of both mesh and plastic covers with contrasting UV transmission found a clear correlation between low levels of UV light and low levels of foliar blight (Figure 2). Surprisingly the level of foliar TPP symptoms showed exactly the same correlation, i.e., blocking UV light inhibited TPP.

FIGURE 2 TO BE INSERTED

Figure 2. Correlation between UVA and UVB levels and blight symptoms on potato foliage.

However, in other field trials of mesh, aphids got through the mesh, because they are much smaller than TPP, especially the juveniles. So, a single small piece of mesh with 0.15 x 0.35 mm holes was tested to see if it was aphid proof, by planting potatoes underneath and around the mesh to create a green bridge. Not only did no aphids get through the mesh, the levels of blight were exceptionally low despite the mesh running with water and creating high humidities (Figure 3 a&b).

Figure 3. (a) left, foliage from under mesh (b) right, foliage from untreated control.

Even more astounding was the yield of 54 t/ha (Figure 4), which on the face of it is not great considering the Canterbury average is 60 t/a, but, the plot was on its third year of cropping, under organic conditions, had not had any fertilisers, and it was irrigated erratically, which should of resulted in a poor yield, not 54 t. As a comparison, the best previous yields in mesh trials under organic conditions were 11 t/ha lower with a full fertiliser programme and regular irrigation.

Figure 4. Left, yield from 0.15 × 0.35 mm hole mesh 54 t/ha, right, from untreated control 8 t/ha

Further work is required to understand what caused this effect and if it is repeatable, but, the hypothesis is, that as the potato likes it climate mild and wet, but normally if the climate is wet they get blight, the 0.15 mm mesh may be creating an optimal climate for potatoes - wet, sheltered from wind, and, protected from blight and all insect pests.

If this is correct, mesh would have the ability to control all potato insect pests, blight, and increase yield, allowing the production of potatoes without insecticides and fungicides - just what high paying consumers want.

As part of the ongoing work a field trial at Lincoln, Canterbury is currently comparing three mesh hole sizes, 0.3, 0.4 and 0.7 mm against a full monty fungicide and insecticide regime and a null control. A field day will be held around mid to late march towards the end of the trial and will be notified through Potatoes NZ and FAR newsletters and on the FFC website www.bhu.org.nz/future-farming-centre.

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