

*In a nutshell*

*A trial rainwater harvesting system, combined with a precision irrigation system, provided 99% water self-sufficiency at the NIAB EMR WET Centre*

## Assessing the potential of rainwater harvesting to improve local water security for the soft fruit sector

### Background

The security of water supply for irrigation of soft fruit is a critical issue for the sector, particularly for southeast England where water scarcity is worst.

In the future, it is unlikely that significant additional water abstractions will be available to support growth in the sector. The New Authorisation process means that growers currently face uncertainty over total licensed abstraction quantities and 'hands-off flow' restrictions that would apply in summer seasons.

Interest from growers in rainwater harvesting and water storage has been increasing as a possible way to supplement water supplies, but there not much data available on the performance of such systems.



Figure 1 The Haygrove Pioneer polytunnels with automated roof venting and rain gutters at the WET Centre

### Overview of the research

A trial (see box 1) was set up and conducted at the NIAB EMR Water Efficient Technology (WET) Centre during the 2018 growing season to examine the performance of a polytunnel rainwater harvesting system in combination with [NIAB EMR's Precision Irrigation Package \(PIP\)](#). The trial was funded by Kent County Council (KCC).

Box 1 Details of the trial setup at the NIAB EMR WET Centre.

<b>The polytunnel system</b>	 <ul style="list-style-type: none"> <li>• Four 50m x 8.5m Haygrove Pioneer polytunnels with automated roof vents and rainwater collection gutters</li> <li>• Total area covered ≈ 0.172 ha</li> </ul>	 <ul style="list-style-type: none"> <li>• Collected rainwater channelled to a 10m<sup>3</sup> sump tank</li> <li>• Water was pumped to a 150m<sup>3</sup> above-ground storage tank using two submersible pumps with a combined capacity of 560 l/min.</li> </ul>	 <ul style="list-style-type: none"> <li>• Junebearer crop of 10,500 Malling™ Centenary strawberry plants</li> <li>• Planted on 04/04/2018</li> <li>• End of cropping 27/07/18</li> </ul>	 <ul style="list-style-type: none"> <li>• Netafim irrigation system</li> <li>• 5 Netafim pressure compensated 1.2 L / ha emitters per bag</li> <li>• Fertigation via a Netafim Nutrigation™ rig.</li> </ul>
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### What proportion of irrigation demand can be supplied by harvested rainfall?

Average annual rainfall for East Malling site (Kent) is 647.9mm. However, only 602mm fell in 2018 and there was a period of 56 days without any rainfall during June and July.

The results showed that 95% of the rain falling on the WET Centre polytunnels was collected in the sump tanks for pumping to storage. However, the amount actually stored depends on the volume of available storage. The 150m<sup>3</sup>

storage tank was full at the start of the season (1<sup>st</sup> April 2018). A further 86m<sup>3</sup> was harvested during the growing season of April, May, June and July. Potentially, 171m<sup>3</sup> (995m<sup>3</sup>/ha) could have been harvested over these four months if more storage volume had been available, as rainfall exceeded irrigation demand during April and May.

The theoretical <sup>1</sup> value of self-sufficiency in 2018		
Harvested rainwater m <sup>3</sup>	Pre-season (stored)	150
	During the growing season	86
	Total harvested	236
Irrigation (m <sup>3</sup> )	Irrigation applied	239
	Surplus / Deficit	-3
Percent Self-sufficiency		99%

A total 239m<sup>3</sup> of irrigation water was applied to the crop (1,390m<sup>3</sup>/ha) over the growing season using the highly efficient PIP. Harvested rainwater provided 99% (236m<sup>3</sup> of the irrigation demand).

A preliminary analysis of past years suggests a combination of highly efficient irrigation and rainwater harvesting could have given self-sufficiency in all years since 2000 for both Junebearer and Everbearer crops.

### What are the benefits of this system?

The estimated capital cost of this rainwater harvesting system is £32,000/ha with an estimated capital payback period of 4-6 years, based on a comparison with mains water at £1.37/m<sup>3</sup>.

However, depending on local circumstances, a new mains water supply can also incur substantial charges for 'network reinforcement' from water companies and this has not been

considered. Other benefits include improved humidity control, water quality, better vehicle access, reduced runoff, less sediment pollution, and less dependence on abstraction licenses. The combination of precision irrigation and rainwater harvesting may offer nearly complete self-sufficiency for irrigation water.

### Are there any downsides or risks?

Capital cost is an obvious issue. Cheaper methods of rainwater harvesting are already used by growers, such as collecting rainwater runoff from membranes laid beneath polytunnel leg-rows. However, these methods have a much lower collection coefficient of 40% - 70%, depending on field slope and other factors.

Roll out of this trial rainwater harvesting system should consider potential effects on the environment and water resources. During the growing season, this system could bring benefits such as reduced risk of soil loss and suspended sediment in waterbodies. System design would normally allow some overflow during heavy rainfall, which can be combined with nature based drainage measures (e.g. sediment traps, constructed wetlands and floral interventions) that "slow the flow" back into the environment but also bring other benefits (e.g. increased biodiversity).

Since farmers generally remove polytunnel polyethylene sheets during the winter, groundwater recharge would not be significantly affected. However, autumn soil moisture deficits could potentially be slightly greater where rainwater harvesting has been used and may lead to a slight delay to the start of aquifer recharge.

### Next steps

Monitoring of the NIAB EMR trial will continue. Further analysis and reporting is planned on self-sufficiency during drought. KCC will be developing a design tool for polytunnel rainwater harvesting systems that allows parameters to be adjusted to reflect individual farm conditions. This tool will be made available to farmers and their consultants.

<sup>1</sup> Some rainwater was lost due to a minor problem with the pumps and the polytunnel auto-venting system. Both problems were easily rectified and the 21m<sup>3</sup> that was lost has been discounted from this analysis.