

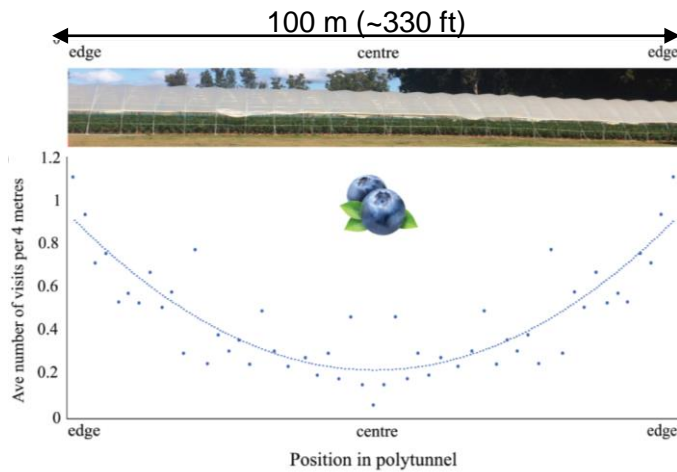


# Blueberry Pollination in Polytunnels

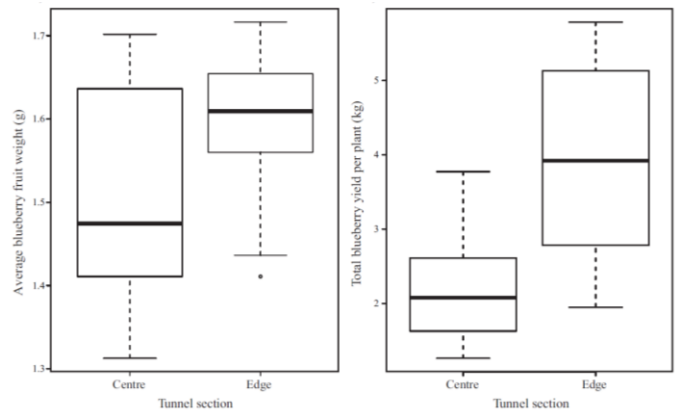
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- Protected culture using polytunnels is increasing. In Chile, polytunnels have been shown to increase accumulated yields by 44% and advance harvest timing by 14 days compared to open-field production (Retamal-Salgado et al., 2015).
- Polytunnels modify temperature, humidity, light (intensity and wavelength), and airflow.
- Bees navigate using the sun as a compass. Tunnels can interfere with this process resulting in reduced foraging and bees sometimes failing to return to their colonies, but this is species dependent.
- Middle sections of tunnels experience greater pollination deficits (**Figs. 1 and 2**; Hall et al., 2020), especially in long tunnels and with an “unattractive” crop.



**Fig. 1.** Average number of visits per 4-m section (13 ft) of tunnel by honey bees along a polytunnel in Australia. Reproduced from Hall et al. (2020) *J. Econ. Entomol.*



**Fig. 2.** Average berry mass (left) and yield (right) of blueberry based on position in a polytunnel in Australia. Reproduced from Hall et al. (2020) *J. Econ. Entomol.*

- Little is known about behavior, performance, and response of insect pollinators in polytunnels and how to optimize pollination in polytunnel systems.
- However, bees can use visual landmarks, instead of solar information, when necessary (Dyer and Gould, 1981; Menzel and Greggers, 2015). Visual landmarks can help bees navigate within and between tunnels when present (De la Luz, personal observations).

# Suggestions on Optimizing Pollination in Polytunnels:

- Avoid UV-absorbing plastics when possible.
- Stock “healthy” honey bee hives at an appropriate density (e.g., 2.5-4 hives per acre). A good rule of thumb is 8 frames with ~20,000 honey bees with frames full of brood in all stages.
- Lift tunnel edges as much as possible, leave ends open during bloom, and ventilate to modify air temperature for your pollinator species.
- Place honey bee colonies near tunnel ends so they can fly in and out of the tunnel.
- Use landmark signals at tunnel edges and within tunnels to help bees navigate (**Fig. 3**). Research indicates that large, boldly colored circles that are centrally placed with distinct images made up of a symmetric pattern of bars are highly effective visual cues for honey bees (Horridge, 2009). Landmarks are most effective when there is high contrast between the background and symbol, with yellow and purple being highly efficacious.
- Avoid really long tunnels (>330 ft). Otherwise, consider distribution of hives in tunnels. If placing hives inside tunnels, move them in during the day and rotate out with new hives every 2 weeks to maintain strong foraging populations
- Honey bees will be disoriented in tunnels and there will be forager mortality, but usually pollination is sufficient (Goodwin, 2012).
- Talk with your beekeeper about supplementing honey bee nutrition when placed in tunnels.
- Use of non-honey bee species (e.g., bumble bees, hoverflies, stingless bees) may be supplemented, but information on efficacy is limited.
- Bumble bees more adapted to tunnels (Goodwin, 2012), but availability of managed bumble bees limited in western US. In addition, bumblebees may not work under very high temperatures that can occur under tunnels.



**Fig. 3.** Example of a landmark signal. What is not visible to the human eye is the border painted using UV paint. Photo by De la Luz.

## References

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