An Overview of the Kiwifruit Pollen Industry, and Future Opportunities

Outline

- Kiwifruit Growing
- Pollination of Kiwifruit
- Artificial Pollination
- Pollen Collection and Storage
- Current Issues

- Future Pollination Opportunities
- Amphasys

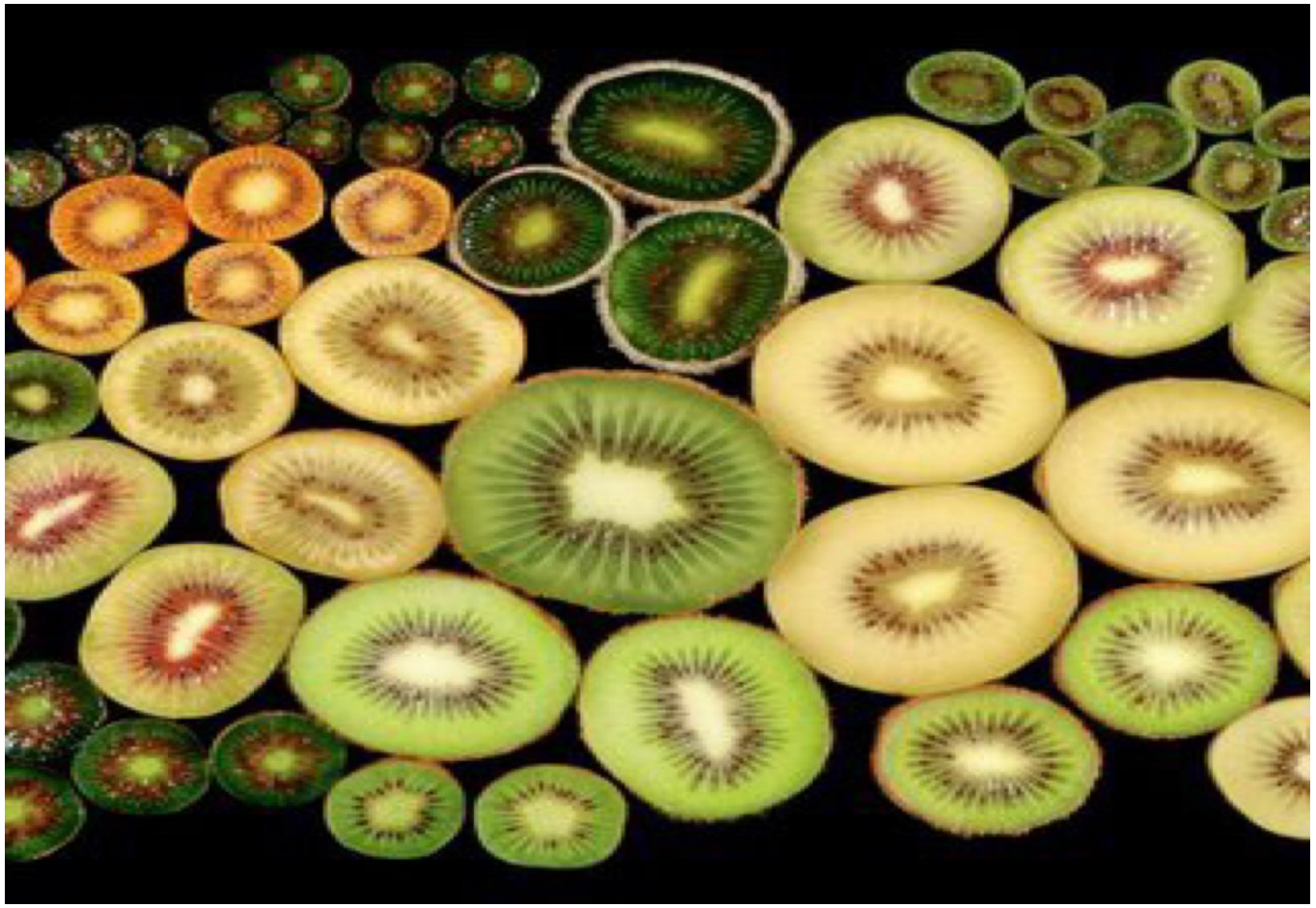
Kiwifruit

- Kiwifruit make up less than 1% of the current worldwide fruit bowl
- Important economical crop in the EU (France, Italy, Greece), New Zealand, China, Chile, and the Middle East (Turkey, Iran, Georgia).

- Commercial kiwifruit cultivars are typically dioecious (greens, yellows, reds and novels).
- Female plant carries all the fruit, (typically 25-70 ton per Hectare)
- Male plants (pollen) needed for fruit set

- Male plants typically make up 8-15% of any given orchard or planted hectare

Kiwifruit Cultivars



Pollination of Kiwifruit

- Kiwifruit typically have a simple flower, no nectar reward, male and female plants produce pollen (female pollen is inert, non viable)
- Male plants are typically distributed at equal distance from each other in the orchard
- Ploidy on male plant important (higher the ploidy the better fruit shape and size is (generally)
- Pollination is carried out by pollinators and by wind typically
  - Honey bees
  - Bumble bees
  - Mechanically (ventilators), wind
  - Artificial

Males and Females…necessary evil

Kiwifruit Flowers

Pollinators

Bumblebee Hives

Artificial Pollination

- Better pollination, better fruit
  - Pollination impacts fruit set
  - Pollination impacts fruit shape
  - Pollination impacts fruit fruit size
  - Pollen ploidy makes a difference

  - " If you get everything else wrong on the orchard, make sure you get pollination right"

Pollen Collection and Storage

- Pollen can be collected from male plants, or from entirely male orchards
- Kiwifruit pollen is typically robust (for pollen)

- 2 types of pollen collection typically
  - Flower collection and anther milling
  - Vacuum collection

- Both methods have merit based on climate, cost, volume
  - 1 Person is able to collect 1kg per day typically
  - Cost of 1kg of pollen ranges by country and availability from 1000-3000 euro (crop value 25-70,000 euro)

Artificial Pollination…The inventors

Hand Held Machines

Pollen Handling and Storage

- Pollen is kept in the deep freeze -18°C
  - Can be stored for several years if needed (5% per year reduction in viability)
- Daily amount needed is removed from freezer
- Lycopodium used as a carrier, and marker added….or….
- Pollen applied wet with carrier nutrient solution

- Pollination usually carried out in the morning (flower is moist)
- Pollen viability decreases relatively slowly over time (10% per day)

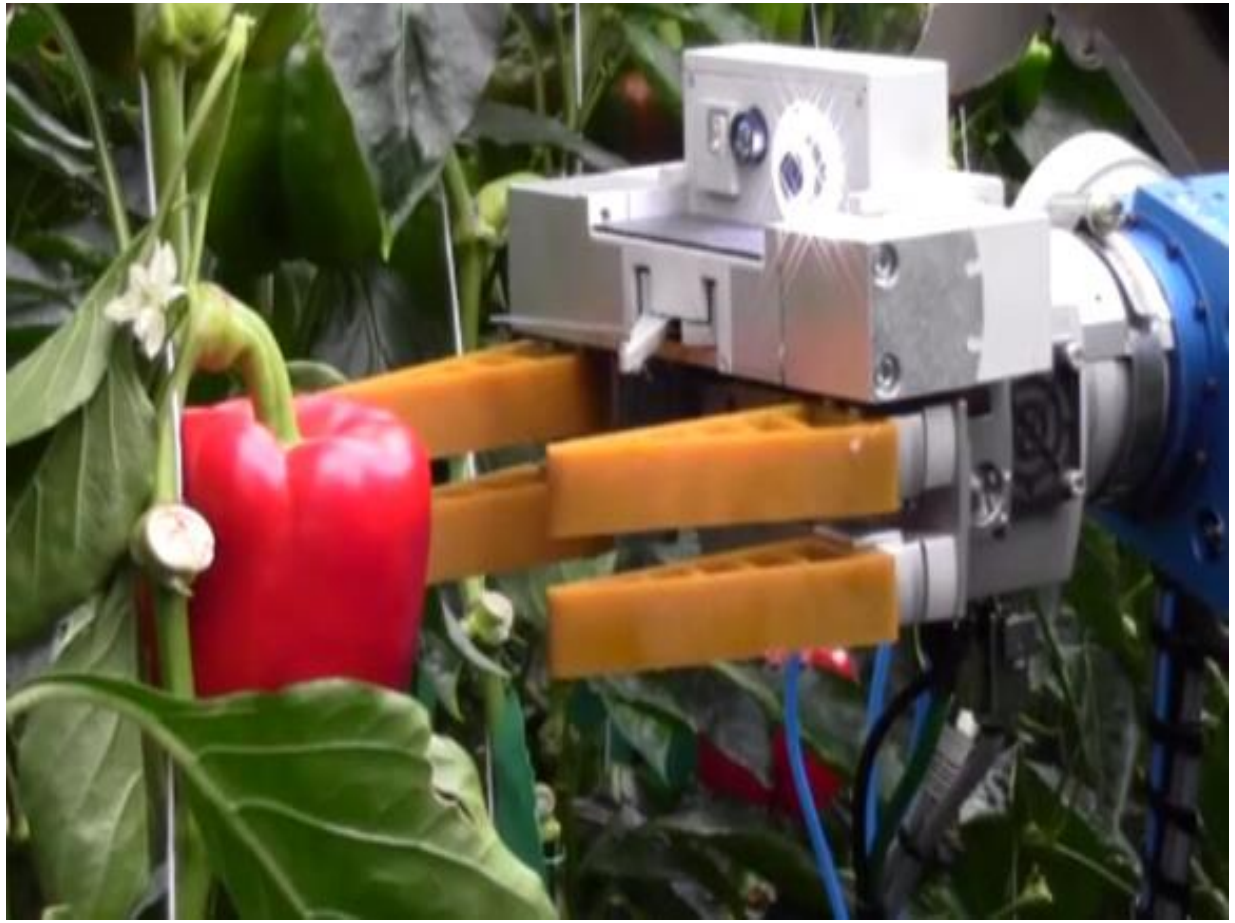
Current Issues for Kiwifruit Pollination

- Synchronisation of males in different growing regions
  - The best male?
- Disease (Bacterial Plant Diseases) typically moved or carried in the pollen
  - Psa
- Bees and horticulture
  - Pesticide use
  - Hive disease and the strength of hives
- Search for more yield per hectare
  - Reduce males inside orchard
  - Separate male orchards on poorer/waste land sites

The Future…

More females…no males

The future not so far away



Future Orchards…

- New ‘high value’ varieties, hard to grow in an outside environment
- Increased yields, less defects, and therefore higher returns
- Less reliance on people, move to higher tech roles
- Move to protected structure cropping
- Maleless orchards, (Males are a waste of space)
- Artificial pollination needed, even on varieties not requiring pollination
- Pollen sourcing, disease, ploidy

Amphasys…

- Early stage of collaboration
  - Pollen viability real time (typically 48 hours currently)
  - Ploidy of pollen
- Uses for the Kiwifruit Industry
  - Assessing harvesting and processing impacts on viability of pollen in real time
  - Blending of lines
  - Ploidy for targeted cropping or breeding, as well as male selection
    - Choose the best male, with the highest ploidy, with the highest pollen viability
- Challenges
  - Kiwifruit pollen typically robust, good enough approach with outside cropping