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 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 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 at -18ºC
  - 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