Effect of shoot meristem type on the likelihood of the shoot fruiting in subsequent years – New Zealand ‘Hass’ orchards

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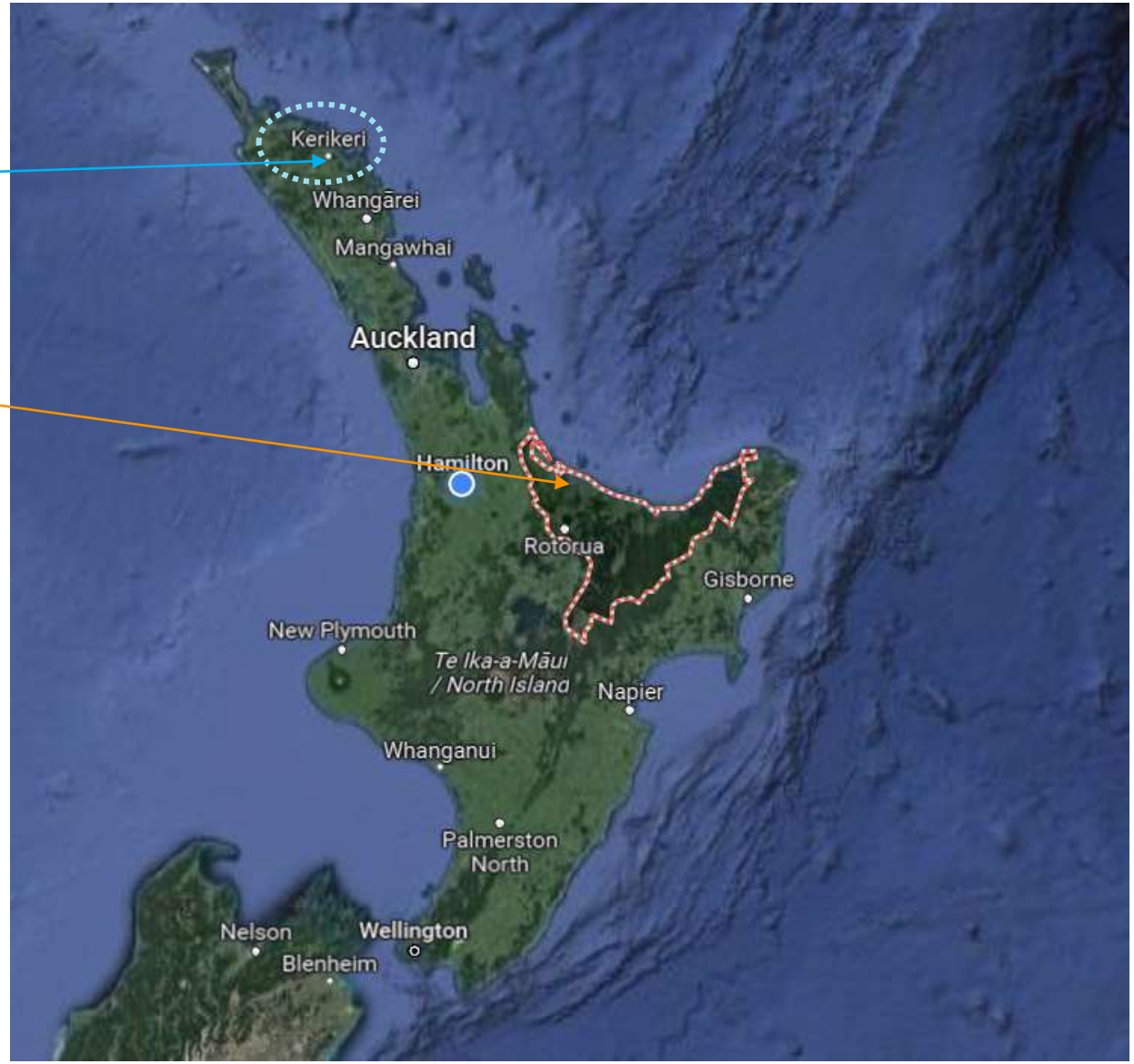
New Zealand ‘Hass’ orchards

Northland – Kerikeri

Bay of Plenty (BOP) –
- – Pukehina
- – Katikati



Google Maps/Google Earth

Current knowledge

- Heavy fruiting may cause lower reserves for the following seasons growth and future flower production
  - > fruit = less shoot growth and less flowers

- Percent fruit set is the same regardless of the number of flowers
  - less intensive flowering = fewer fruit

- Having a mix of shoot types is desirable to ensure high yields and regular cropping

Which shoots bear the fruit?

Shoot tagging and tracking

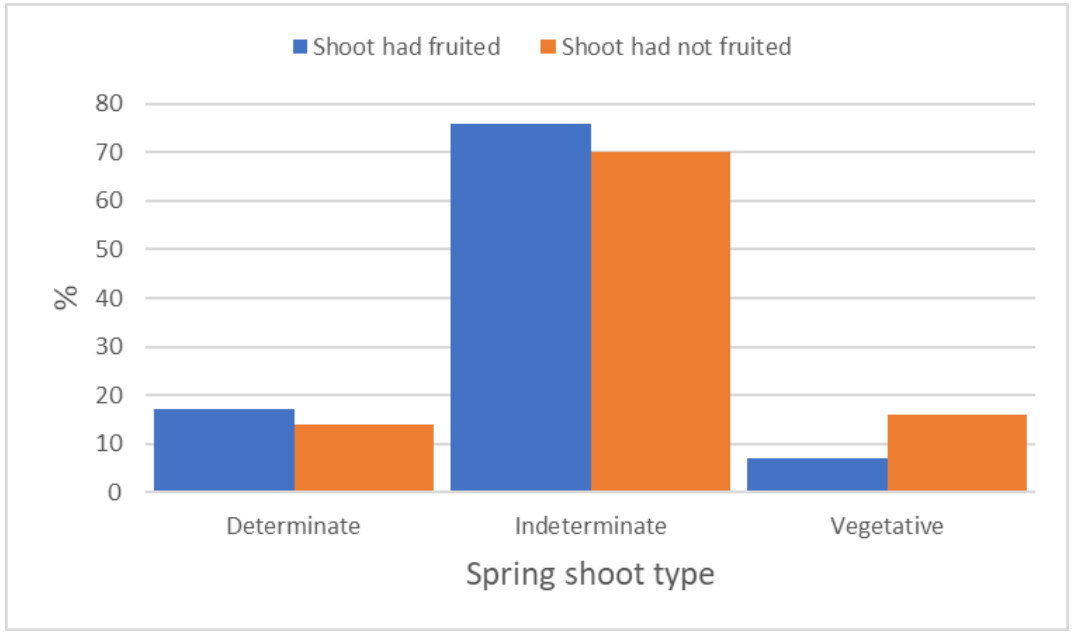
Indeterminate inflorescence on shoot
= Indeterminate shoot

Determinate inflorescence on shoot
= Determinate shoot

Vegetative growth on a shoot
= Vegetative shoot

Pilot study on shoot fate

- Five trees in a single orchard in the BOP were tagged and tracked for two growing cycles (each summer to summer)



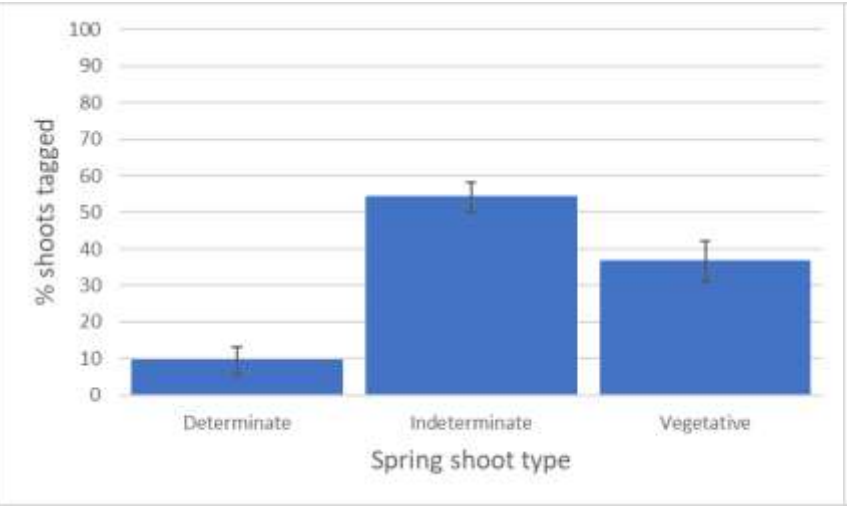
- Growing Cycle one
  - In spring, indeterminate shoots were more prevalent, with similar percentages of determinate and vegetative
  - Same distribution regardless of whether the shoot had previously borne a fruit or not
- Overall we found that determinate shoots are more likely to go on to bear a fruit than indeterminate
- After two seasons, the predominate shoot type was an indeterminate shoot that didn't fruit that developed into an indeterminate shoot that didn't fruit

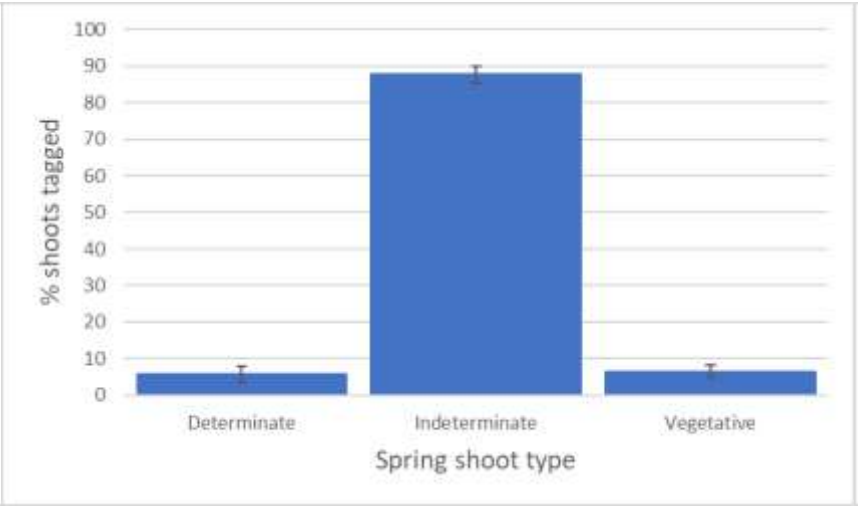
Shoot fate over consecutive seasons – revisited

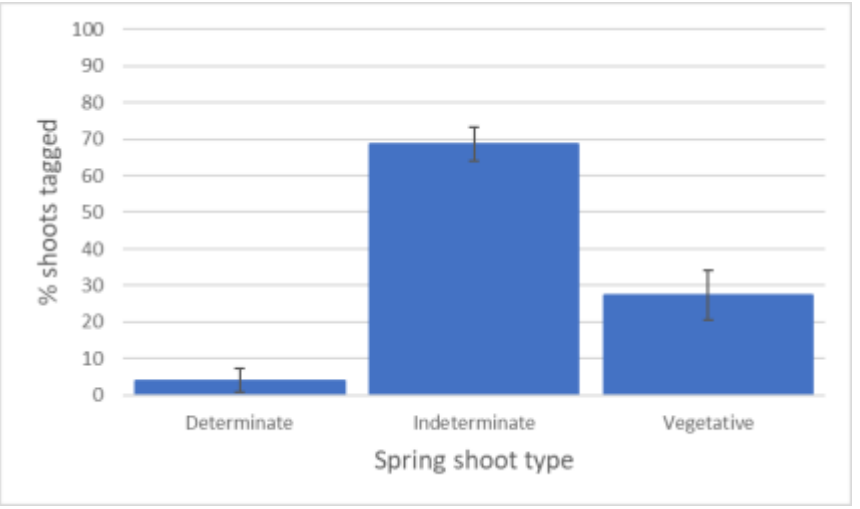
- Five trees monitored at new BOP orchard, which were harvested prior to flowering, and four trees at Northland orchard, which were harvested after flowering
- Tagged shoots over three growing seasons to determine shoot fate over consecutive seasons (summer to summer)
  - Summer
    - Presence of fruit in summer
    - Shoots that produced summer flush
  - Spring
    - Presence of fruit at flowering
    - Distance from fruit to shoot meristem
    - Shoot inflorescence type
    - Shoot termination and death
    - Recorded ordinal quarter
- A total of 35,000 shoots were tagged with more than 100,000 individual observations collected

What is the distribution of shoot types in spring?

New BOP orchard







Spring 2019

- Determinate: Indeterminate: Vegetative (D:I:V)
- Approx 2:10:8
- Flower intensity light-medium

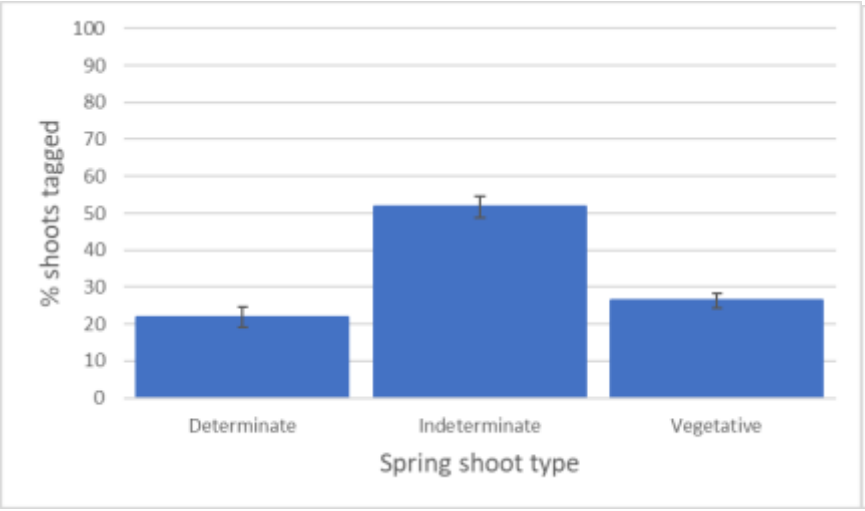
Spring 2020

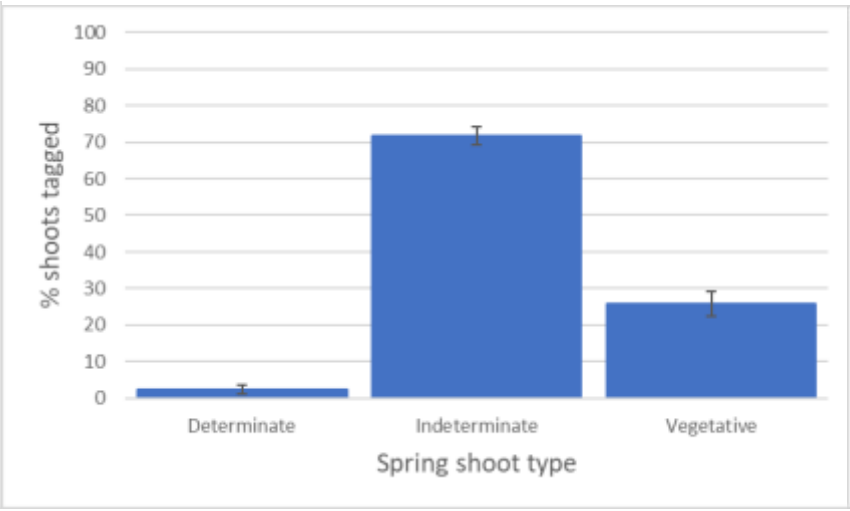
- D:I:V
- Approx 1:18:1
- Flower intensity light-medium

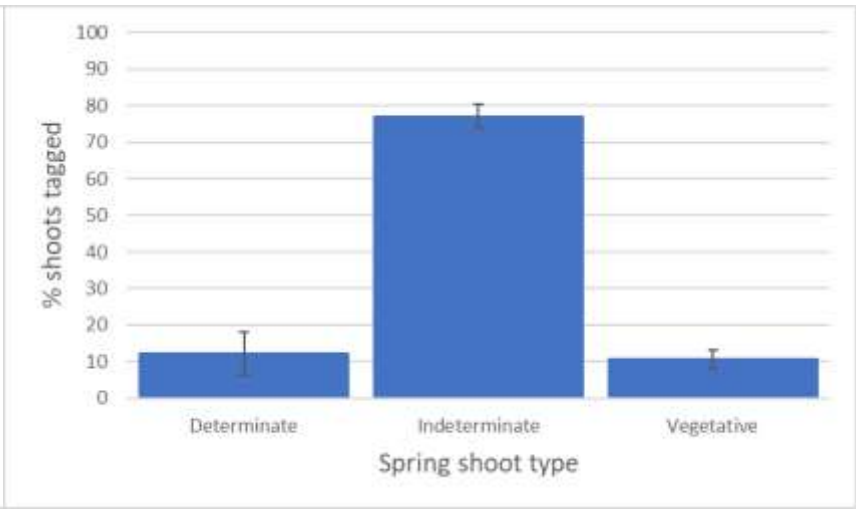
Spring 2021

- D:I:V
- Approx 1:14:5
- Flower intensity light-medium

Northland orchard







Spring 2019

- Determinate: Indeterminate: Vegetative (D:I:V)
- Approx 2:5:3
- Flower intensity light-medium

Spring 2020

- D:I:V
- Approx 0:7:3
- Flower intensity light-medium

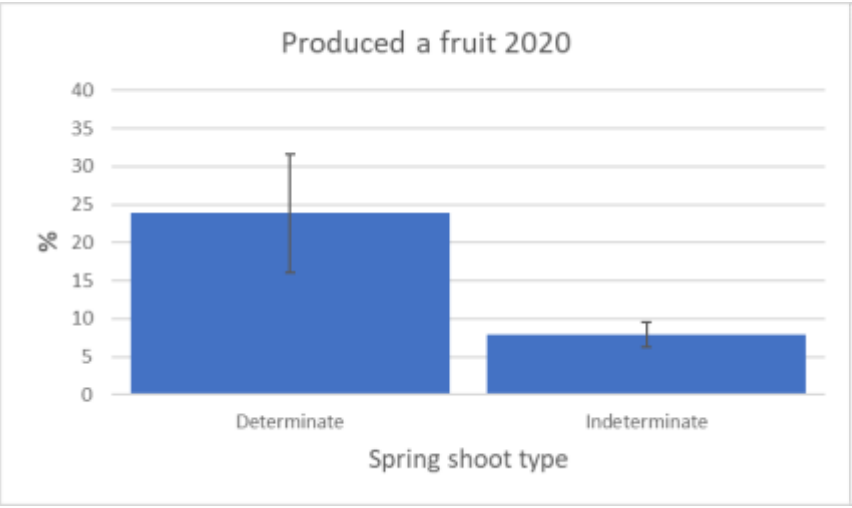
Spring 2021

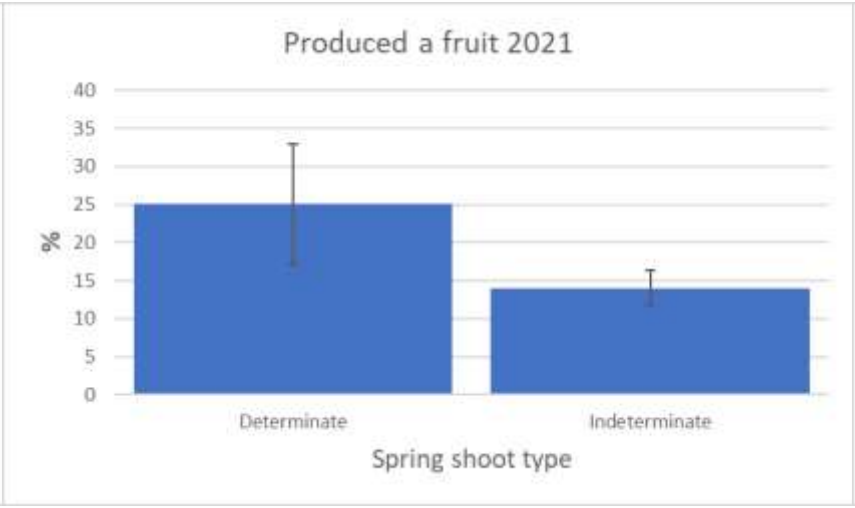
- D:I:V
- Approx 1:8:1
- Flower intensity light-medium

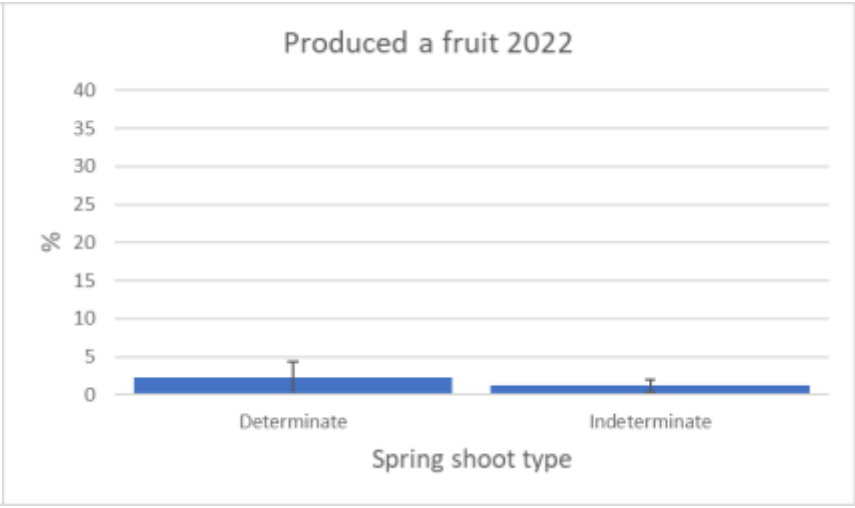
What type of inflorescence is more likely to bear fruit?

New BOP orchard – fruit harvested prior to flowering

- BOP orchard pilot study found that determinate shoots were more likely to bear a fruit.

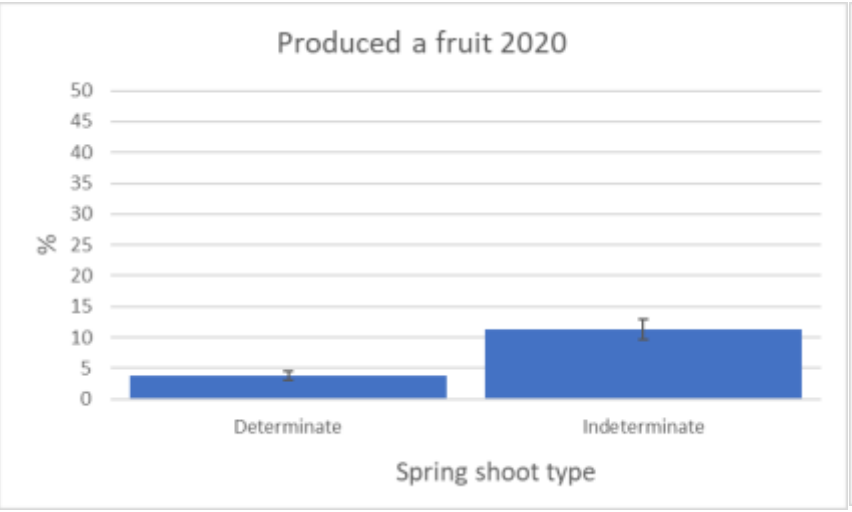


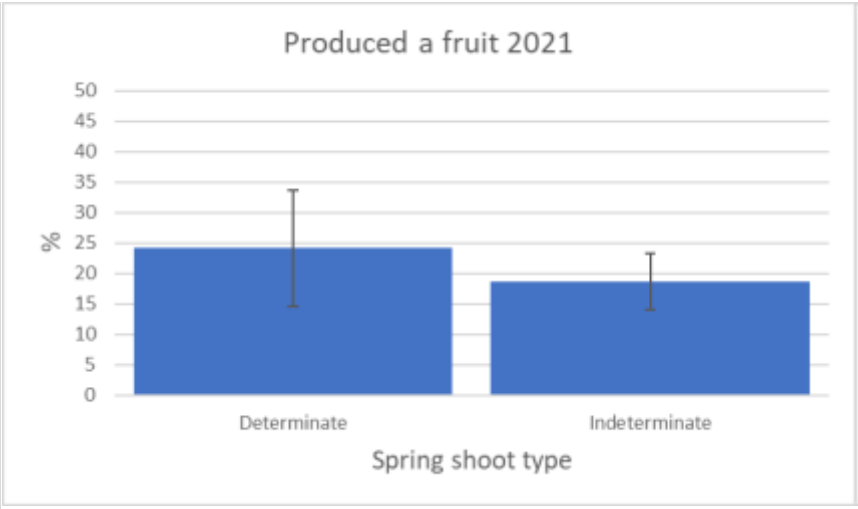




- Determinate shoots were more likely to bear a fruit ($p<0.001$)

Northland orchard – fruit harvested after flowering



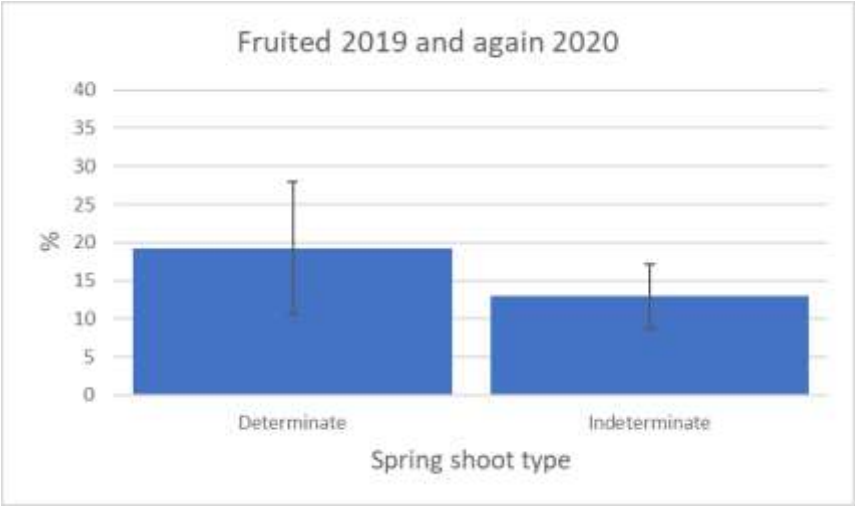


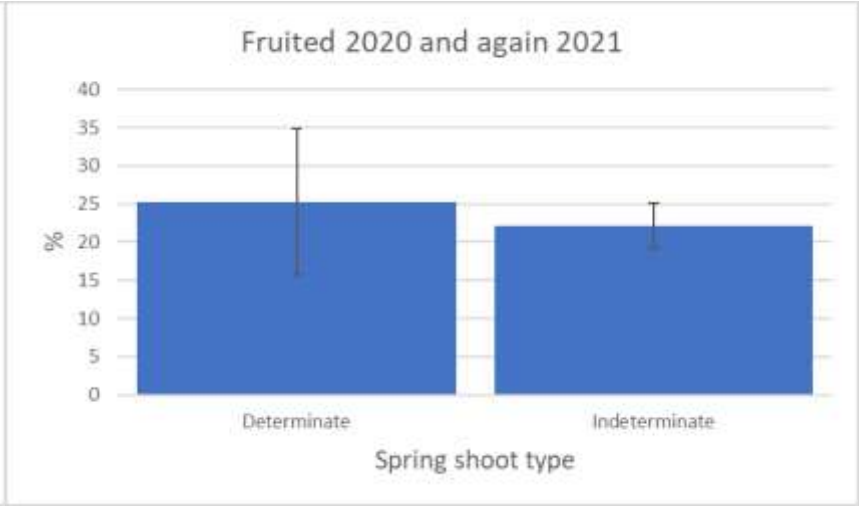
- Year one indeterminate shoots were more likely to bear a fruit
- Year 2 and 3, shoot type did not influence the likelihood of an inflorescence bearing a fruit

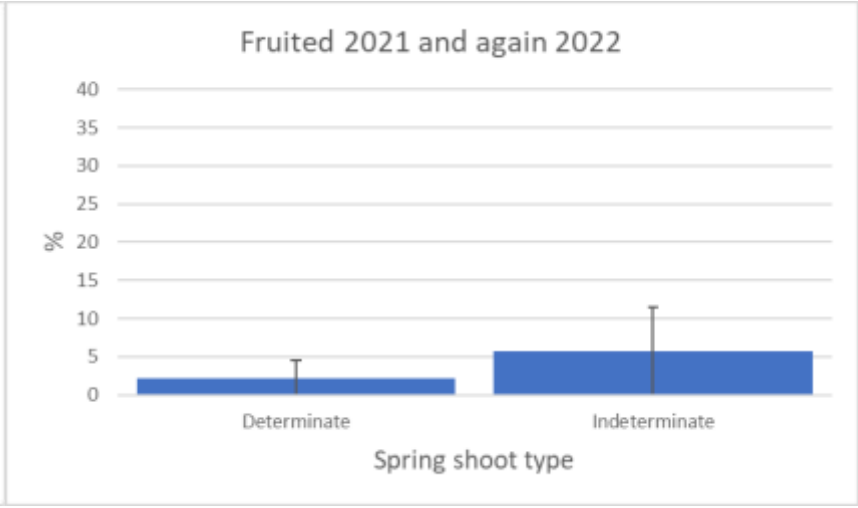
Can a shoot bear a fruit in consecutive years?

New BOP orchard

- Pilot study found that a floral shoot that had fruited can bear a fruit again

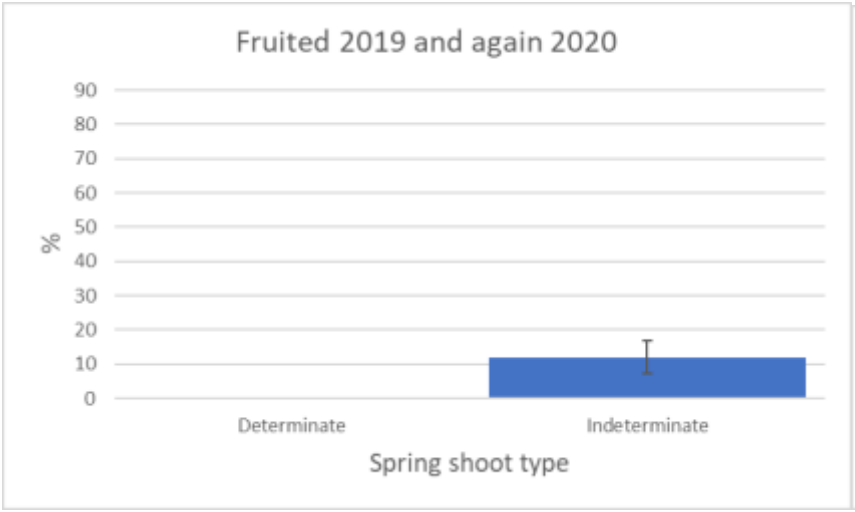


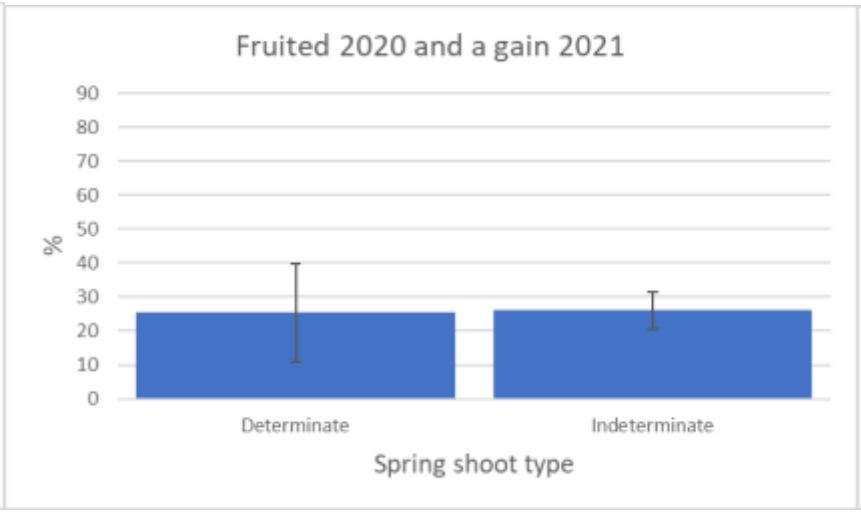


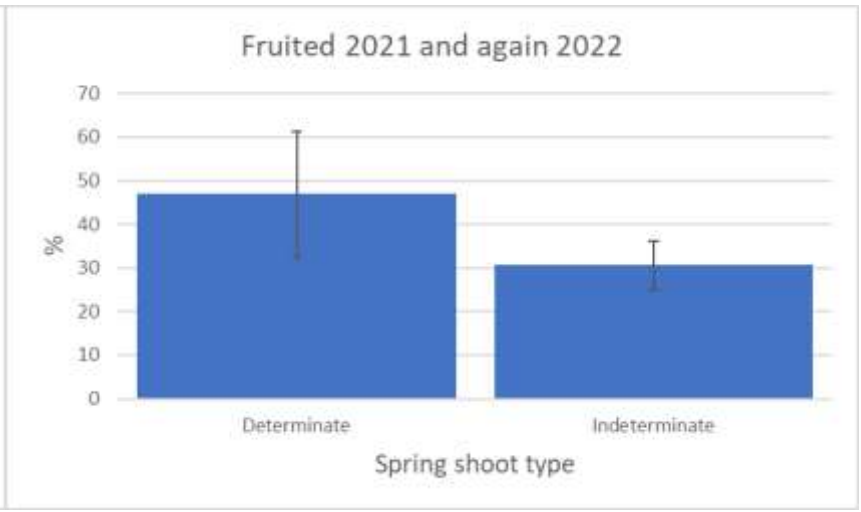


- Determinate and indeterminate shoots that grew from a shoot which had borne a fruit were equally likely to bear a fruit again

Northland orchard

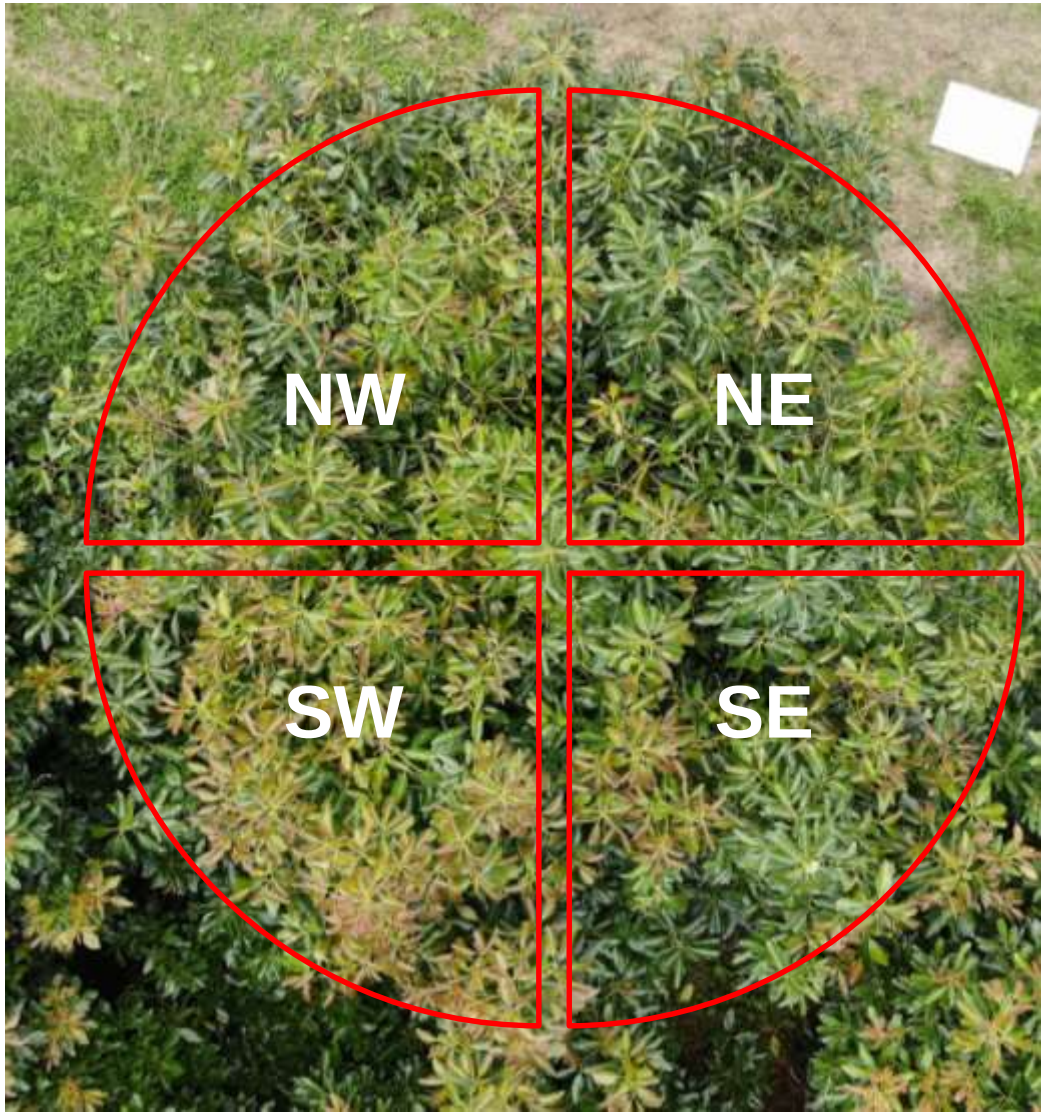






- Determinate and indeterminate shoots that grew from a shoot which had borne a fruit were equally likely to bear a fruit again (only in the second and third seasons)

Over consecutive seasons is there a ordinal quarter where fruit are more likely to grow?



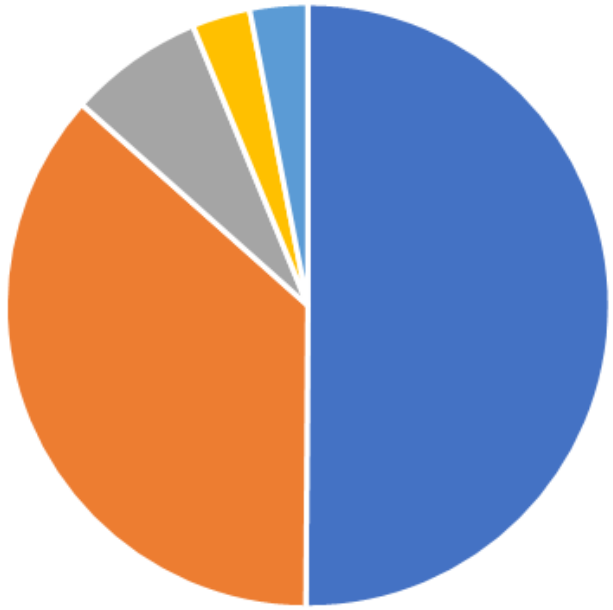
New BOP orchard and Northland orchard

- No consistent difference among the ordinal quarters in terms of location of fruit

What are the predominant shoot types over three seasons?

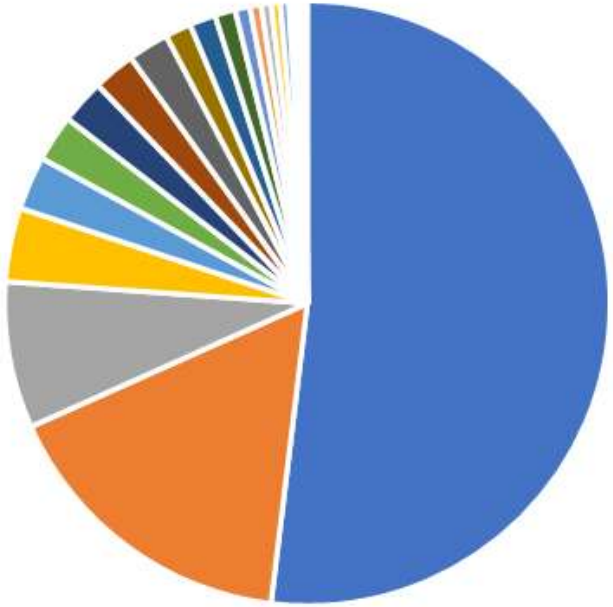
New BOP orchard

2019-2020



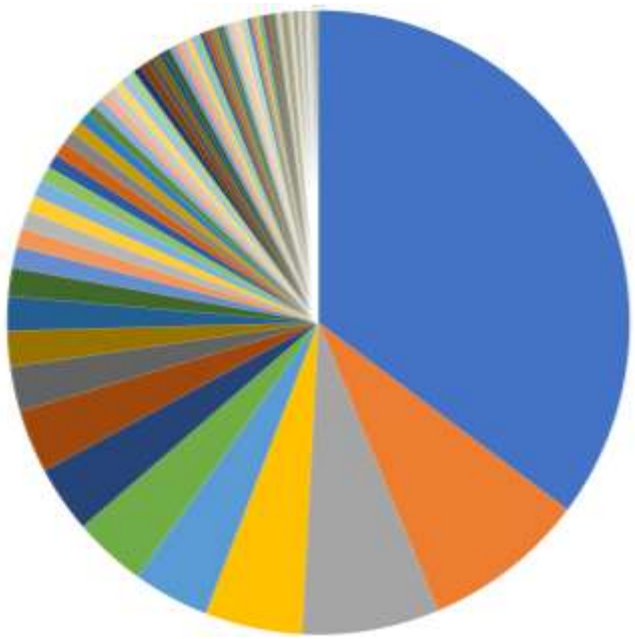
- 50% Indeterminate shoots that didn't fruit
- 36% Vegetative
- 7% Determinate shoots that didn't fruit
- 3% Indeterminate shoots that fruited
- 3% Determinate shoots that fruited

2019-2021



- 52% Indeterminate shoots that didn't fruit → indeterminate shoots that didn't fruit

2019-2022



- 35% Indeterminate shoots that didn't fruit → indeterminate shoots that didn't fruit → indeterminate shoots that didn't fruit

Take home messages

- Shoot types in spring were predominantly indeterminate.
- The likelihood of determinate shoots bearing a fruit was greater in the BOP orchard, in which fruit were harvested prior to flowering.
- A shoot that had borne fruit can bear a fruit again.
- Predominantly indeterminant shoots that didn’t bear fruit, → indeterminate shoots didn't bear fruit → indeterminate shoots didn’t bear fruit.

Going forward

- How to apply this knowledge to develop new management practices.
- What type of shoots would re-grow if indeterminate floral shoots, that are most likely to be perpetually unfruitful, are removed?
- How much of the crop comes from shoots produced in the summer flush?
- Number of fruit borne on the different inflorescence types
- Which sequential shoot combinations are more likely to result in shoot termination or death.

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Thank you

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