ALMOND ORCHARD DESIGN

Roger Duncan

UCCE Farm Advisor, Stanislaus County

ORCHARD DESIGN

- Planting patterns
- Variety choice & arrangement
- Tree spacing
  - Site vigor
  - Variety
  - Rootstock

THE DILEMA!

Utilize All Available Sunlight Early in Orchard Life Without Causing Early Shadeout and Premature Orchard Decline

TREE SPACING CONSIDERATIONS

- Site vigor
- Rootstock
- Variety
- Irrigation method
- Available equipment
- Grower personal preference
- Previously installed sprinkler lines
- How long do you need your orchard to last?

BENEFITS OF CLOSE PLANTINGS

- Full production sooner
- Closely spaced trees are smaller at maturity.
  - Easier to knock
  - Easier to spray / sanitize
  - Fewer worm rejects??
- If one tree dies, it hurts less

PROBLEMS WITH CLOSE PLANTINGS

- Higher costs
  - More trees
  - More microsprinklers
  - More backhoeing
  - More pruning??
  - More time / expensive to shake
- More shade out, sticks at harvest
- Shorter lived orchard
- Hazards to tractor driver (narrow rows)
- More disease?

ROOTSTOCK CHOICES

- Peach / Almond hybrids (Hansen, Bright's, Nickels, Titan, etc.)
- Peach (Nemaguard, Lovell)
- Interspecifics (Viking, Atlas)
- Plum (Marianna 26-24)

Most Vigorous

(wide spacing)

Least Vigorous

(close spacing)

VARIETY CHOICES

- Nonpareil - Vigorous, spreading
- Padre, Aldrich - Vigorous, upright
- Sonora, Price - Medium vigor
- Carmel, Wood Colony - Less vigorous

Wide Spacing

Close Spacing

Q: Do we need to plant all varieties on the same rootstock and at the same density?

A: No

COMMON SPACINGS

24’ x 24’ = 76 trees per acre

22’ x 22’ = 90 trees per acre

20’ x 22’ = 99 trees per acre

18’ x 22’ = 110 trees per acre

16’ x 22’ = 124 trees per acre

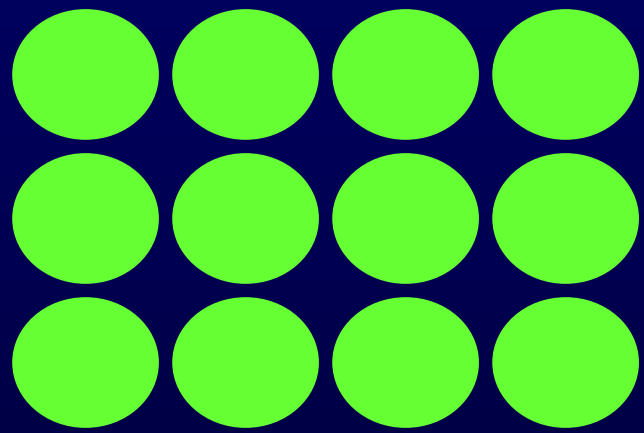
14’ x 21’ = 148 trees per acre

COMMON ORCHARD PATTERNS

- Square (i.e., 22’ x 22’)
- Rectangle (i.e., 22’ x 18’)
- Offset
- Hexagonal (a.k.a. triangle or diamond)
- Hedgerow (i.e., 11’ x 22’)

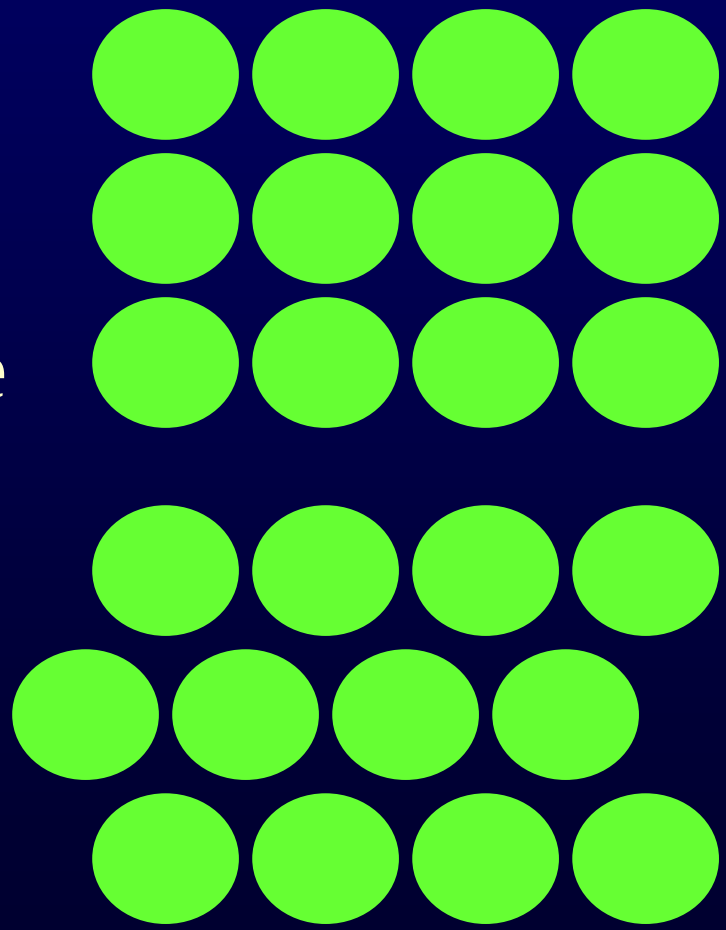
SQUARE vs. OFFSET ARRANGEMENTS

- Easiest to lay out and farm.
- Square planting is inefficient and results in crowding before canopy is filled.



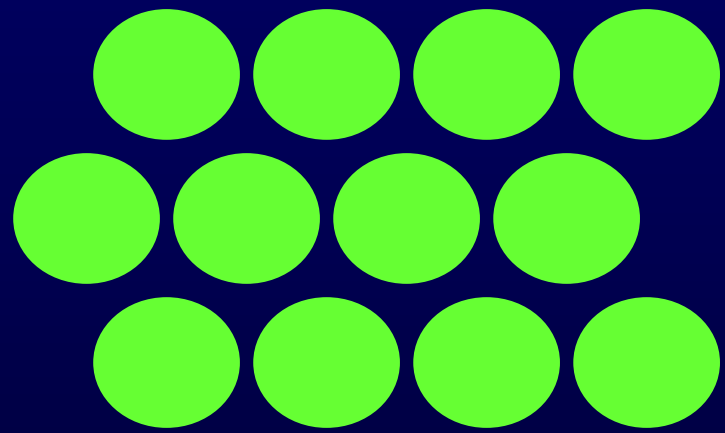
SQUARE vs. OFFSET ARRANGEMENTS

- Easiest to lay out and farm.
- Square planting is inefficient and results in crowding before canopy is filled.
- Offset planted trees are less crowded across rows as the orchard fills in.



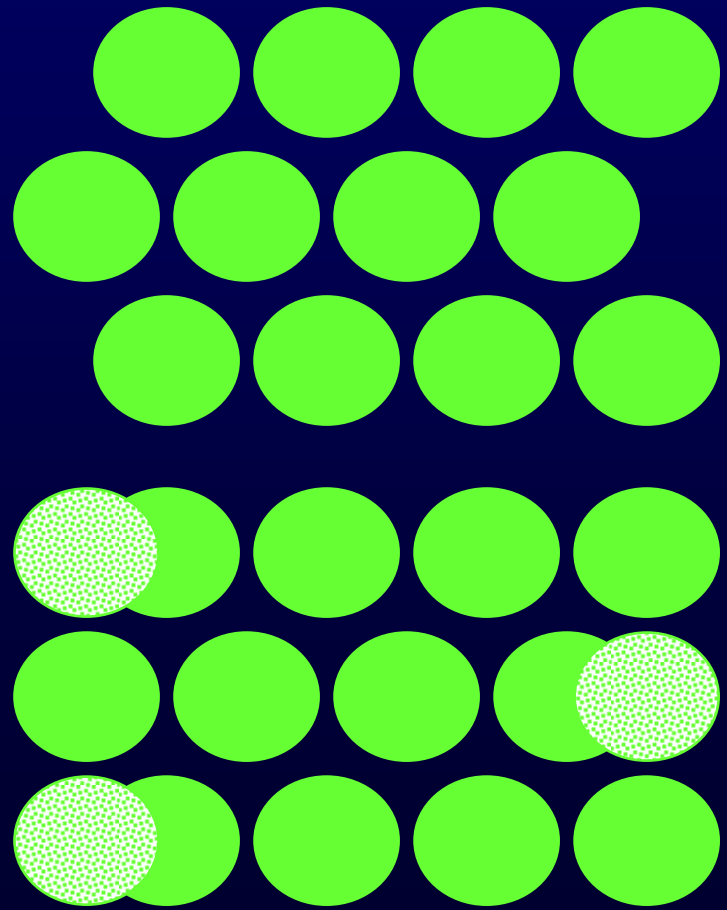
OFFSET ARRANGEMENTS

- Offset planting results in one fewer tree per row.



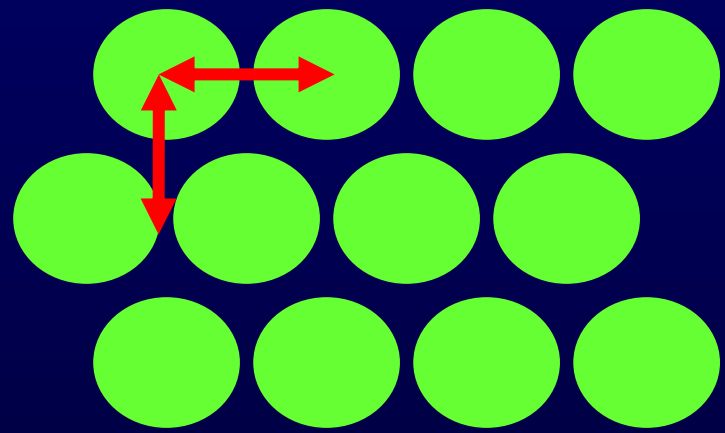
OFFSET ARRANGEMENTS

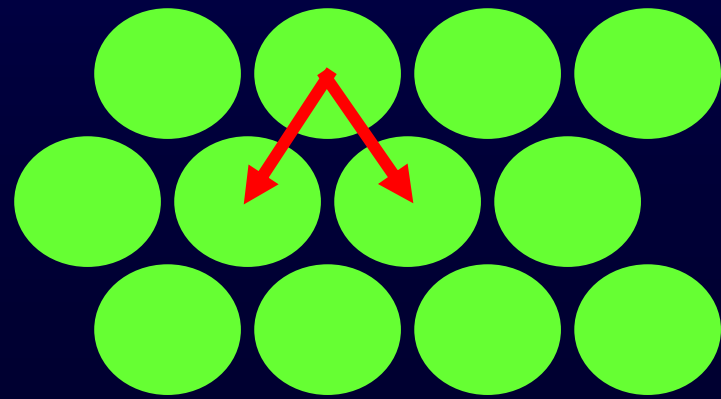
- Offset planting results in one fewer tree per row.
- Can double-plant outside row.



OFFSET VS DIAMOND ARRANGEMENTS

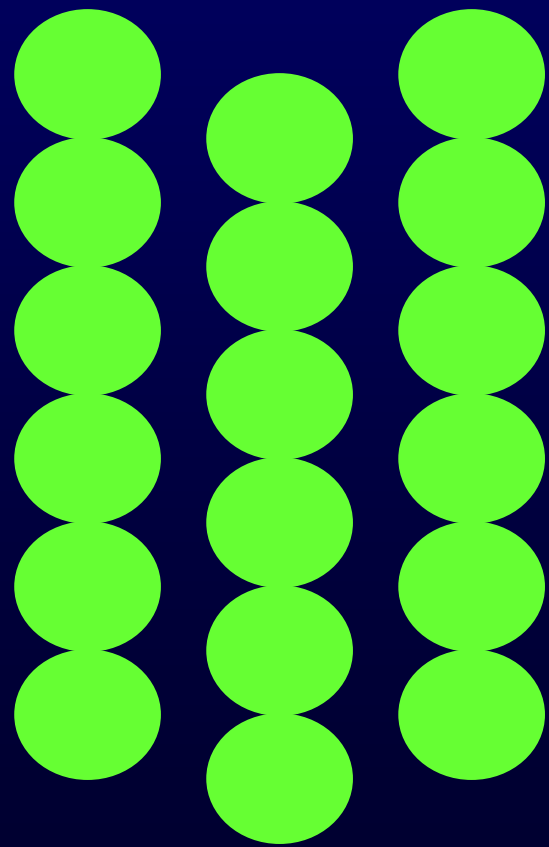
- Diamond is most efficient design.
- 24’x24’ square = 75 trees / a
- 24’x24’ diamond = 87 trees / a
- Rows are 20.8’ feet apart in a 24’ diamond.





OFFSET RECTANGLE

- Because we need room for equipment, space between rows is usually larger than space between trees
- More trees per acre without narrow drive rows.
- Crowding down row may become problem.
- Bees tend to fly down rows rather than across rows.



VARIETY ARRANGEMENT & BLOOM SEQUENCE

VARIETY ARRANGEMENT

- Desirable to maximize yield of main variety.
  - i.e., 50% Nonpareil, 25% each of 2 pollinators.
- Arrange varieties to maximize pollination

OLD TREE PATTERNS

OLD: DOUBLE ROWS

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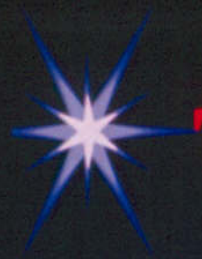

TYPICAL VARIETY PATTERNS

SINGLE ROWS

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LESS COMMON PATTERNS

Alternate varieties down row:

ABABABABABABABABABABA
BABABABABABABABABABAB

or

ABABABABABABABABABABA
CACACACACACACACACACAC

ALTERNATING VARIETIES DOWN THE ROW

- Because bees tend to fly down tree rows, alternating varieties in the same row can increase yields up to 15% compared to two varieties in their own rows.
- Choose varieties that can be harvested together
  - Butte & Padre
- Or have distinctly different harvest dates
  - Nonpareil & Monterey or Fritz.

Variety Arrangement Makes a Difference in Yield

- Three almond varieties:
  - may offer better pollination
    - better bloom overlap
    - diversification
  - require a third harvest operation
  - are problematic for small growers who hire contractors to harvest their crop

Growers must choose between:

- potentially lower yields with 2 varieties

OR

- extra expense / hassle of third harvest

Question:

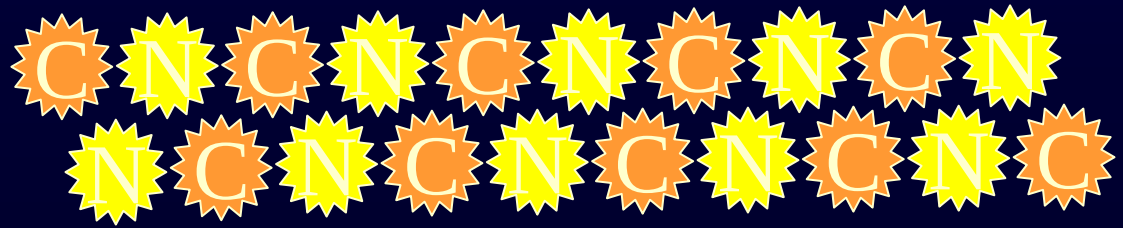
Can alternating two varieties down the same row produce yields similar to standard planted arrangements of three varieties?

Modesto Junior College Orchard:

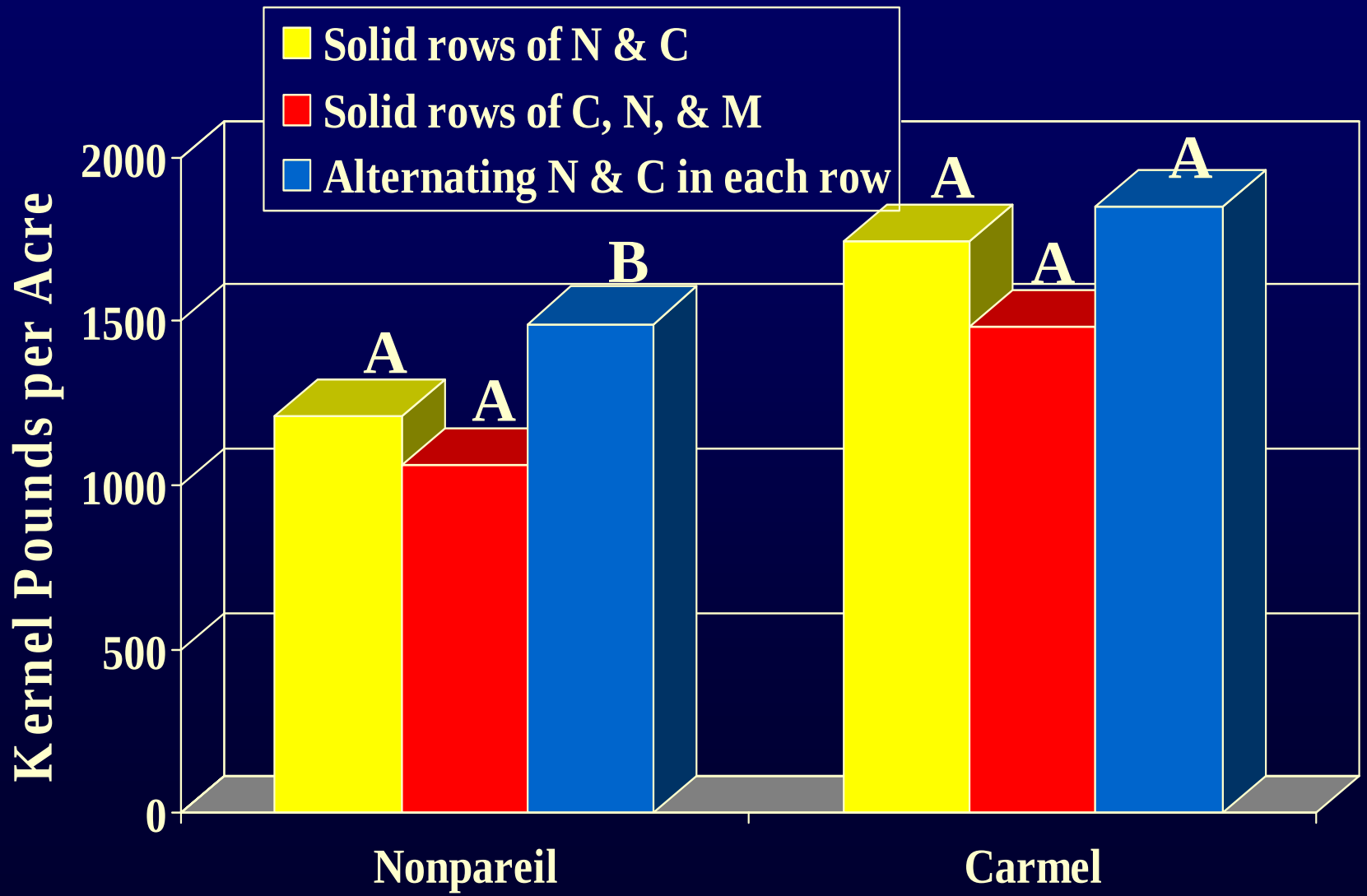
- Solid rows of Nonpareil & Carmel

- Solid rows of Nonpareil (50%), Carmel (25%), & Monterey (25%)

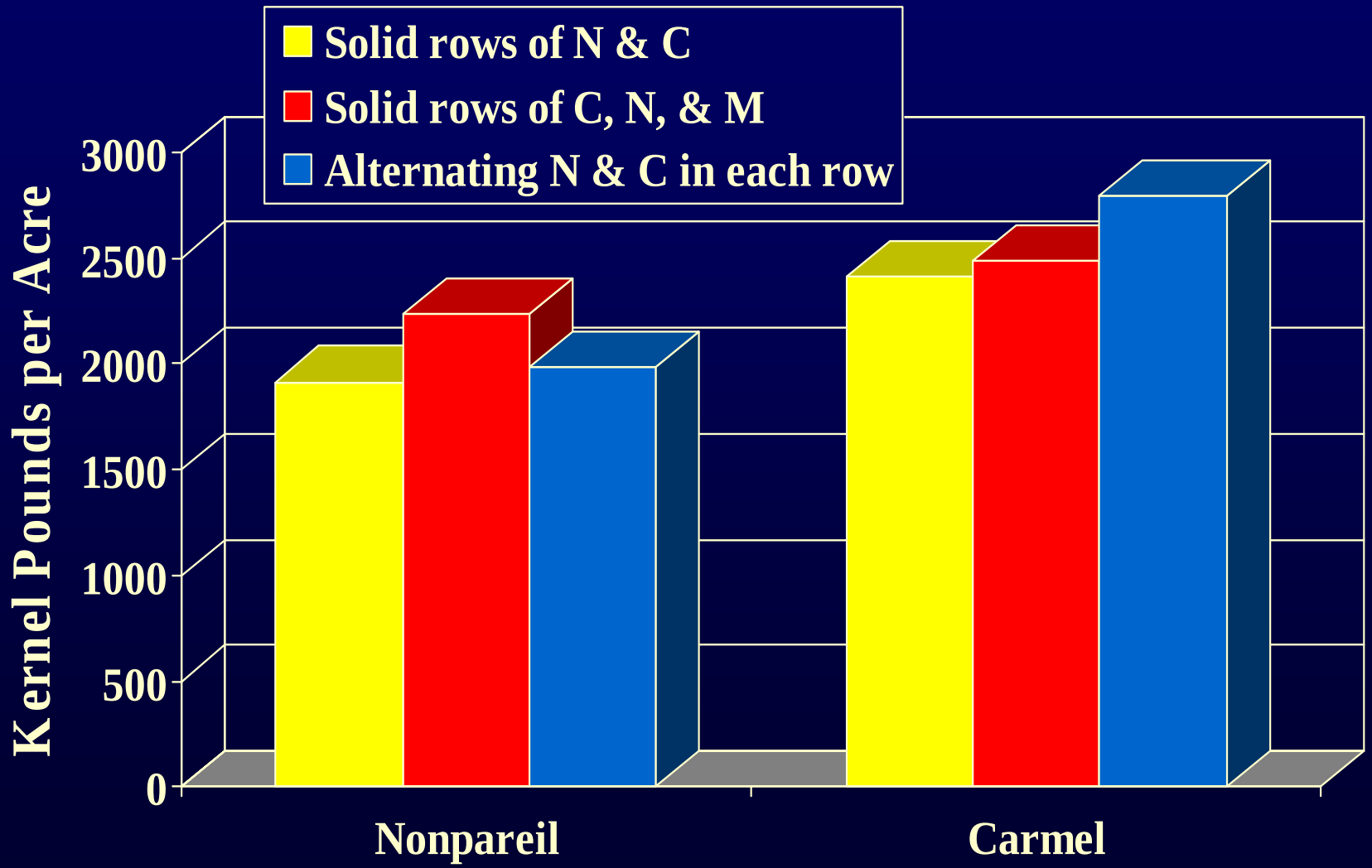
- Nonpareil & Carmel alternated down same row



Yield Comparison of Three Planting Configurations for Nonpareil and Carmel Almonds, 2003
4th leaf



Yield Comparison of Three Planting Configurations for Nonpareil and Carmel Almonds, 2004
5th leaf



Differences not significant at $P < 0.05$

Conclusions:

- Yields were higher in one variety in one of two years where varieties alternated down the rows

- Having three varieties has not increased Nonpareil or Carmel yields (2 years)

Parting thoughts...

- Alternating varieties down the same row will lead to an increase in yields in some years, probably most obvious in years with poor bee activity (2005?)
- If varieties are harvested together (Butte & Padre), why not?
- Varieties that are harvested or farmed separately may be problematic.

Thank you for your attention

Questions?