# ALMOND ORCHARD DESIGN

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# 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**

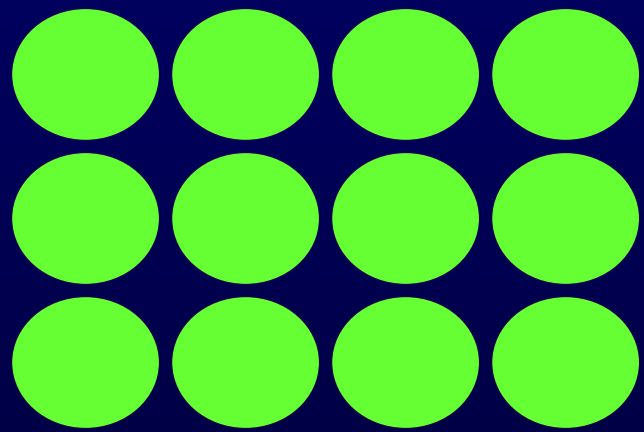
14’ x 21’ = 148 trees per acre

# 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’)

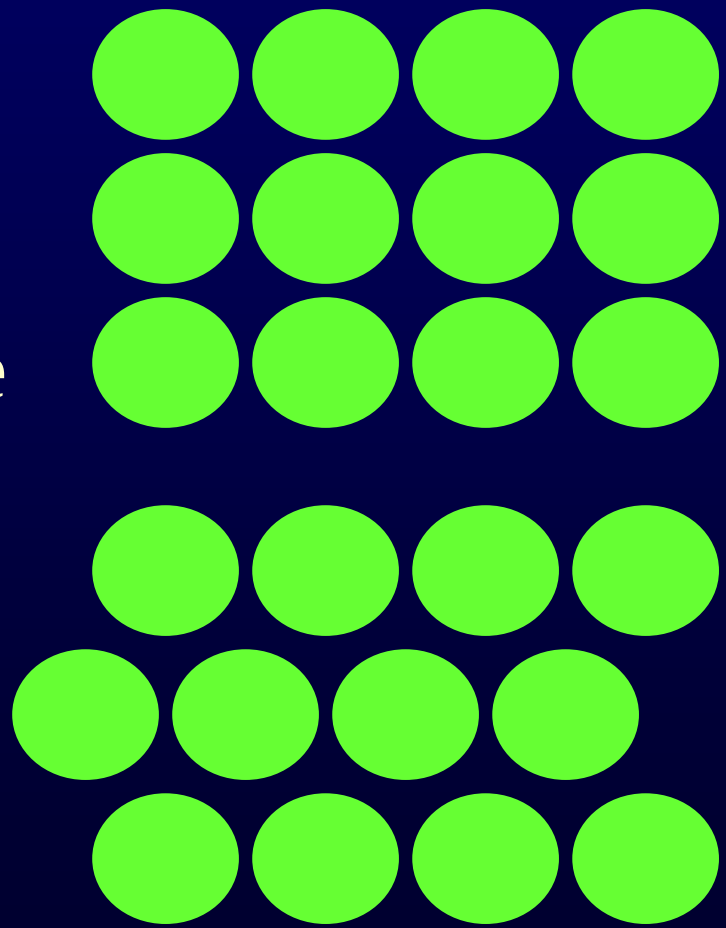
# SQUARE vs. OFFSET ARRANGEMENTS

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



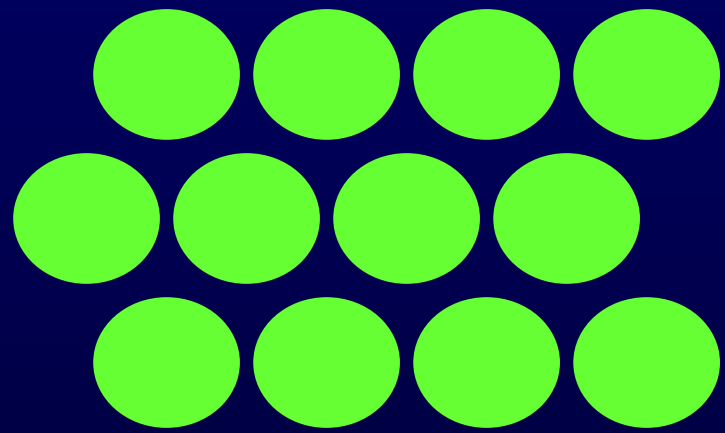
# SQUARE vs. OFFSET ARRANGEMENTS

- 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.



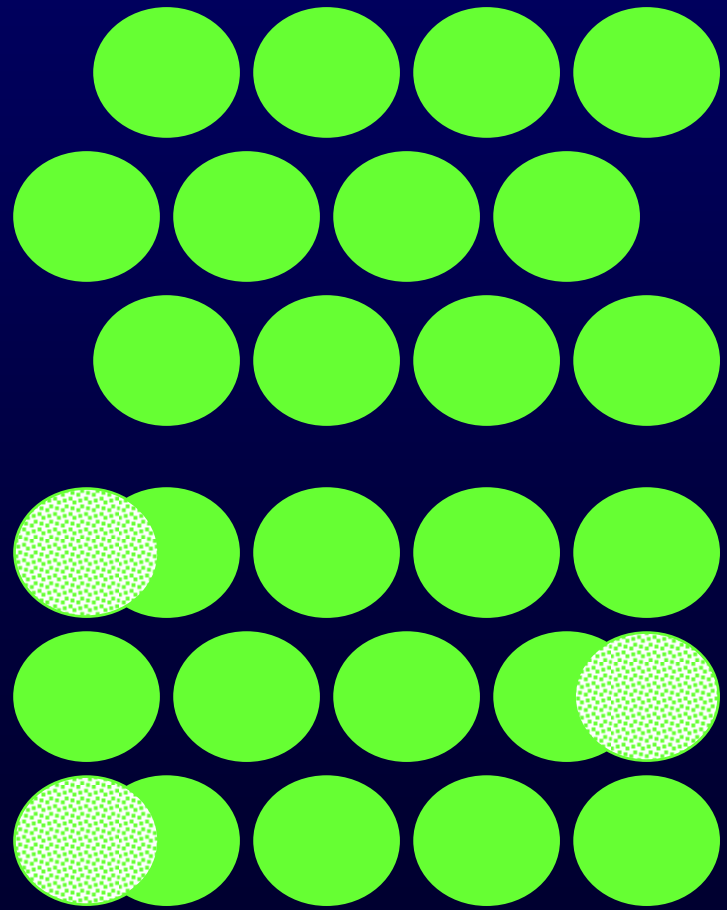
# OFFSET ARRANGEMENTS

- Offset planting results in one fewer tree per row.



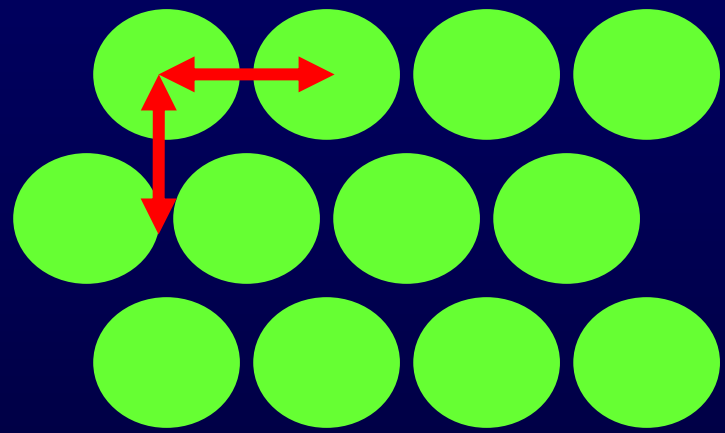
# OFFSET ARRANGEMENTS

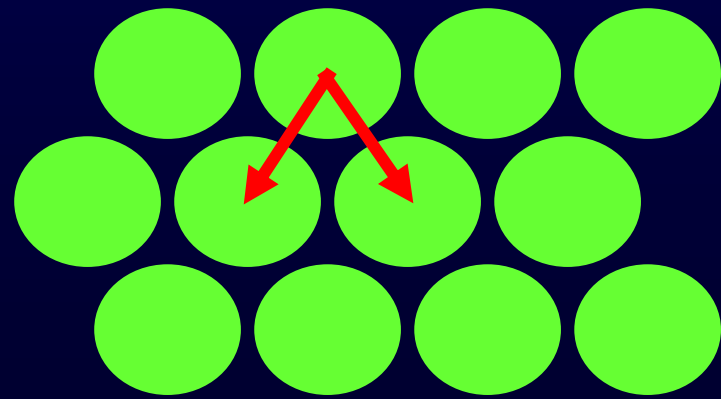
- Offset planting results in one fewer tree per row.
- Can double-plant outside row.



# OFFSET VS DIAMOND ARRANGEMENTS

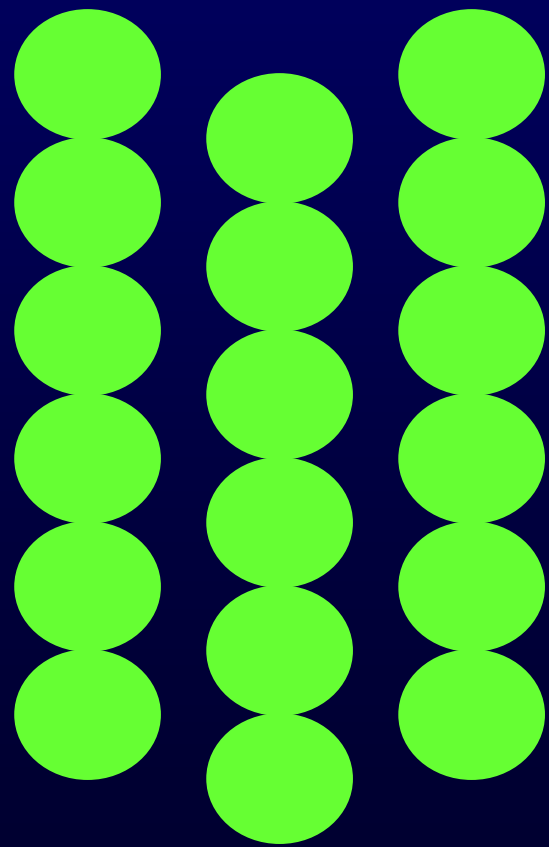
- Diamond is most efficient design.
- 24’x24’ square = 75 trees / a
- 24’x24’ diamond = 87 trees / a
- Rows are 20.8’ feet apart in a 24’ diamond.





# 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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BBBBBBBBBBBBBBBBBBBBBBBBBB

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# TYPICAL VARIETY PATTERNS

## SINGLE ROWS

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BBBBBBBBBBBBBBBBBBBBBBBBBBBB

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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

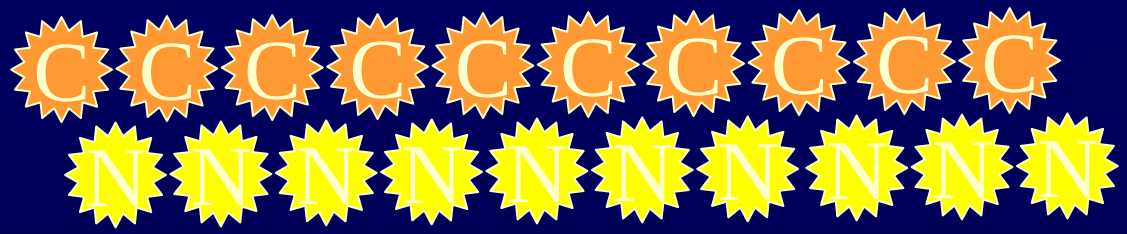
- extra expense / hassle of third harvest

# Question:

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

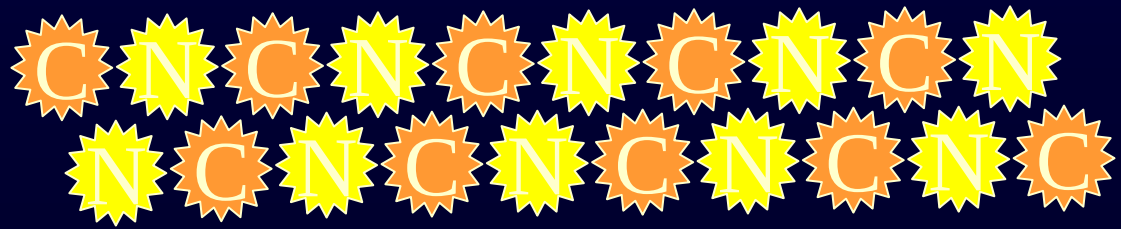
# Modesto Junior College Orchard:

- Solid rows of Nonpareil & Carmel

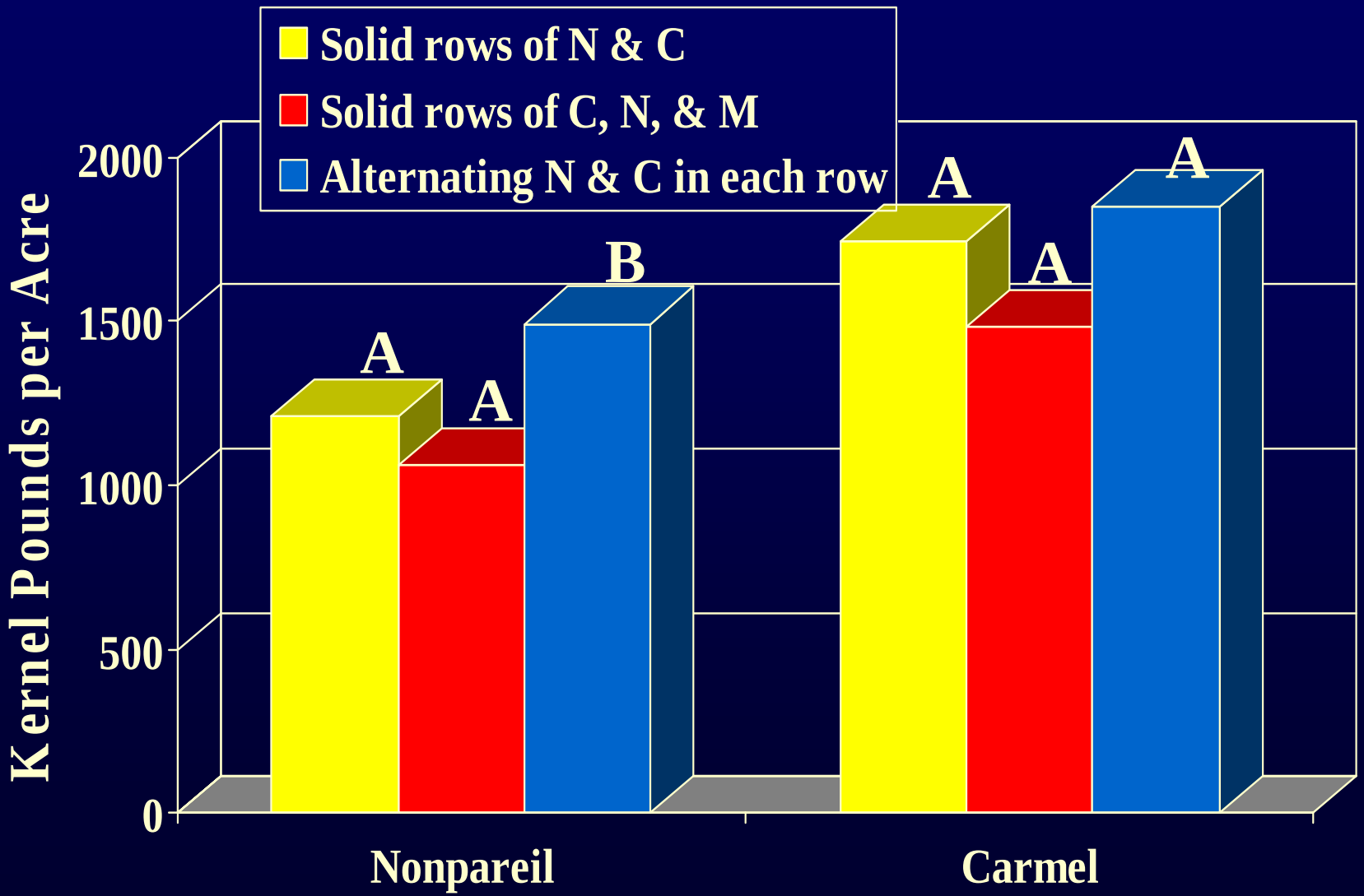



- Solid rows of Nonpareil (50%), Carmel (25%), & Monterey (25%)

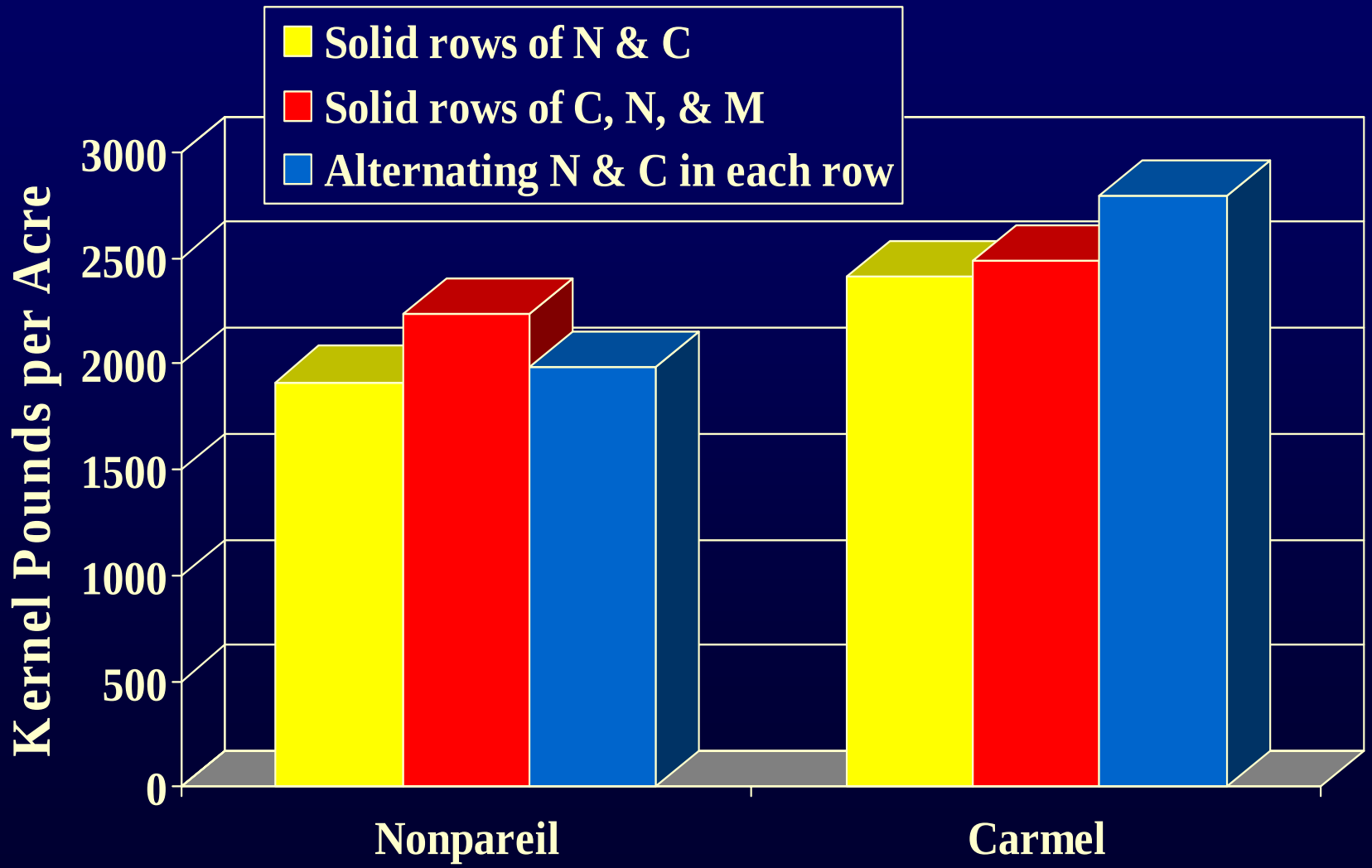

- Nonpareil & Carmel alternated down same row



# 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?