Influence of Almond Spur Characteristics on Productivity

Elizabeth Fichtner
UCCE Farm Advisor, Kings and Tulare Cos.
Vegetative Growth

Reproductive Production
All buds in the current year were formed the prior summer.
Shoot Growth and Development: 5 stages

- Endodormancy
- Bud Dormancy
- Growth Initiation
- Growth Cessation
- Growth Elongation
Endodormancy
“Rest Period”

A state of arrested development (late October-mid-December)

During Endodormancy:

- Buds will not emerge even during warm weather
- Buds are resistant to freeze and other stresses
Endodormancy

Growth Initiation

Ectodormancy

Bud Dormancy

Growth Cessation

Growth Elongation

Almond chilling requirement 300-600 hours below 45F.

Rest period over in CA by Jan 1
Ectodormancy

Beginning of shoot initiation

- Induced by external causes (i.e. unfavorable temperatures)
- Duration of warm temps needed for bud growth

No longer “arrested development”
Growth Initiation

Early bud growth based on (mostly localized) carbohydrate storage

Extension of pre-formed tissue

Approximately 3-10 leaves per spur
Approximately 8 leaves per vegetative shoot
Vegetative buds

Pointed
Triangular
Covered with dark brown fringed scales
Give rise to long shoots and spurs
Long vegetative shoot growth (~10 inches):
- prominent growth on young trees.
- on mature trees, develop under high vigor, low crop, or enhanced light interception (i.e. from broken branch)
Spurs arise on vegetative shoots.

Maintaining healthy spur populations is key to yield optimization.

Mature trees produce >80% of their total yield on spurs

- *Spurs always have a vegetative terminal bud, and lateral buds that can be vegetative or reproductive*
What is a spur?

- Short/compact shoots (0.5-2 inches)
- Grow from lateral buds on long shoots.
- Terminal extension of previous spur.
What is a spur?

- Have leaves and flowers/fruits.
- Almonds are borne on spurs
- 1-5 flower buds per spur
Spurs form on prior year’s wood

Spurs remain vegetative for 1-2 years prior to supporting floral buds.
Spur growth is short and stops by April/early May

**Young almond**: shoot growth uniform through summer.

Bud formation occurs in May/June

Transition to flower buds-mid August

Heat Dormancy of Vegetative Buds: July-September
Determination of spur dynamics influencing productivity

Key Principles:

1) Spurs are semi-autonomous with respect to carbon supply
   - rely on their own ability to provide and store nutrients.
   - localized source/sink relationship.

2) Process of supporting fruit to maturity demands a heavy carbohydrate load.
   - individual spurs tend to alternate bear
   - few flower the year after bearing
Determination of spur dynamics influencing productivity

- Studies follow tagged spurs over years
- Different parameters measured by different research groups.
  - Leaf number
  - Spur survival
  - Leaf area
  - Spur growth
  - Return bloom
  - Nut Set
  - Foliar N

ie: Lampinen, et al. 2011
Valdebenito, et al. 2017
Floral Density and Fruit Density on Spurs is positively related to prior year spur leaf area

Prior year spur leaf area

Only a fraction of flowers set fruit.

- Approximately 30% of flowers set fruit (up to 40%)

- In spur dynamics studies, set range: 18-36%

(Kester and Griggs, 1959)
(Tombesi, et al. 2017)
Bearing Spur

Non-Bearing Spur

Bearing Spurs

- Show earlier leaf fall
- Exhibit less spur growth
- Have lower foliar N concentration
- Have less starch
- Exhibit lower return bloom

Non-Bearing Spurs

- Smaller leaves

Hereema et al., 2009
Saa et al, 2017
Vandebenito, et al. 2017
Non-bearing spurs

- Leaves
- Spur
- ‘Porta Potty’
Non-bearing spurs

Over 80% of spurs are vegetative each year.

These spurs are producing the annual leaf area to support fruit production in a subsequent year.
Non-bearing spurs in previous season

Non-bearing spurs with > 50 cm² leaf area in prior season have over 80% probability of flowering the following year.
Non-bearing spurs in shaded position

Within the tree:

Nitrogen is re-allocated from spurs in shaded positions to those in light positions.

(De Jong and Doyle 1985, De Jong et al. 1989, Rosati et al. 1999).
Survival potential of bearing and non-bearing spurs

A) Spurs bearing fruit the prior year exhibit lower survival potential than non-bearing spurs with lower prior year leaf area.

B) Spurs with higher leaf areas the prior year exhibit similar survival potential, regardless of bearing status.

C) Survival of non-bearing spurs is not related to prior year light interception.

D) Bearing spurs are more likely to survive into following year if they are in a lighted position in the canopy.
Key Spur Facts:

Assume 100,000 spurs/mature tree

1. Spurs generally viable 3-5 years
2. A proportion of spurs die each year (approx: 5-27%)
   - Only 2/3 of spurs live beyond 3 years.
3. Bearing decreases probability of spur survival.
Management Goal: generate new spurs annually

- High Spur LA (~35,000)
- New Spurs (~10,000)
- Flowered but didn’t set fruit (~20,000)
- Resting Spurs (~85,000)

High Spur LA (Year n) (~35,000)

- Flowering (~35,000)
- Low Spur LA (Year n+1)
- Fruiting (~15,000)

- Non-Flowering (Year n+2...)
- Dead Spurs (~10,000)

Low light Low LA
Promotion of viable spur population

1) Manage water and nutrition.
   ● Consider that excess growth may enhance shading

2) Promote modest annual vegetative shoot growth
   ● new spurs grow on these shoots
   ● be patient; the spurs remain vegetative for 1-2 years and form on prior wood.

3) Prune to reduce shading
   ● Remove dead or overlapping branches that impede light interception.
Acknowledgements

Photos and content
B. Lampinen, UC Davis
S. Saa, Almond Board of CA

Questions?
Thank you Bruce Lampinen