



# Defending vegetables in organic production from BMSB: Attraction and retention using trap crops

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# BMSB in Organic Production

- Organic insecticides are of limited value (Lee et al., 2014)
- Few options for management of stink bugs in organic production



# Trap Cropping in Organic Peppers

- Trap cropping with some success for other stink bugs  
(Mizell et al. 2008)
- Sunflower and sorghum very attractive to BMSB (Nielsen unpublished data)
- Potentially good trap crop



# Aims of Trap Crop Project

- 1) Use harmonic radar to:
  - evaluate retention time of trap vs. cash crop
  - elucidate distance moved from release point
- 2) Evaluate SB damage in plots with/without a trap crop



# Note About Harmonic Radar

- Marine radar device
- Reflected signals from tag are received and translated into sound



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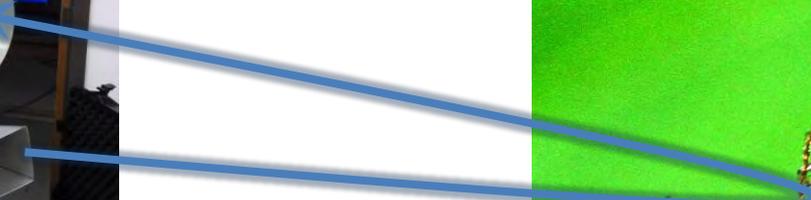
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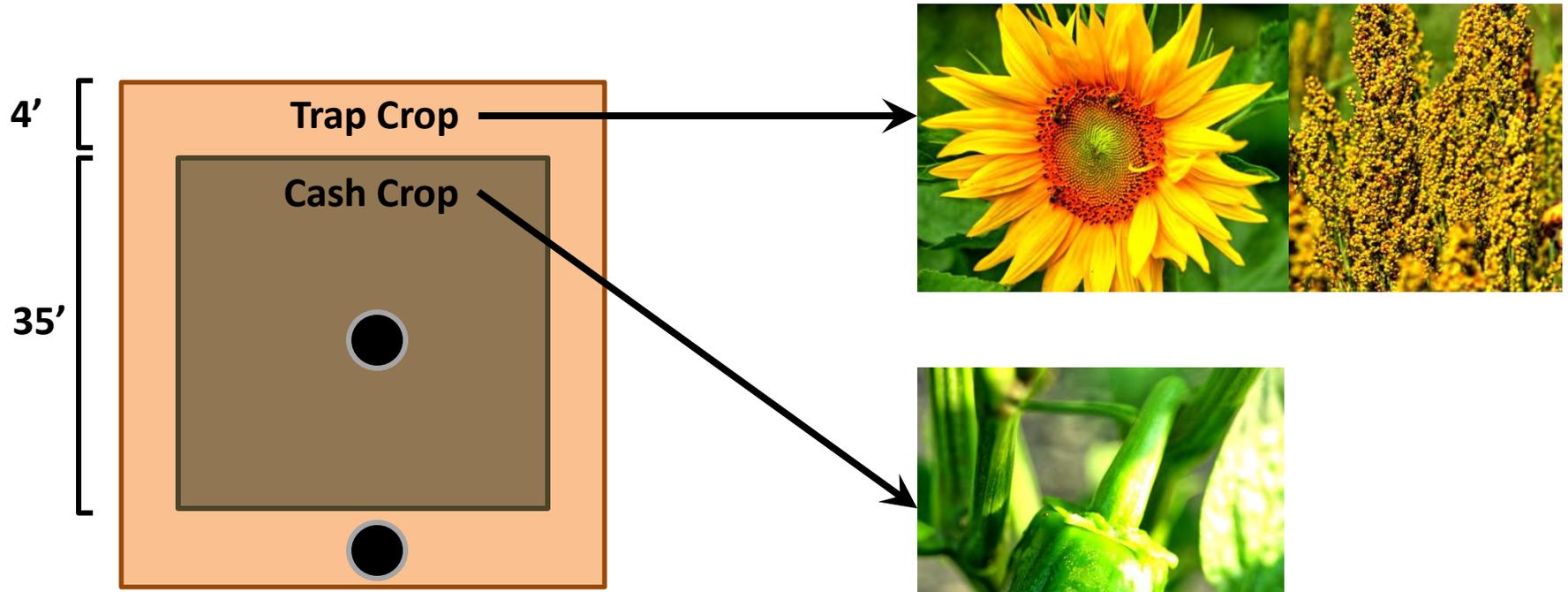


## Range

2 – 15 m depending on conditions



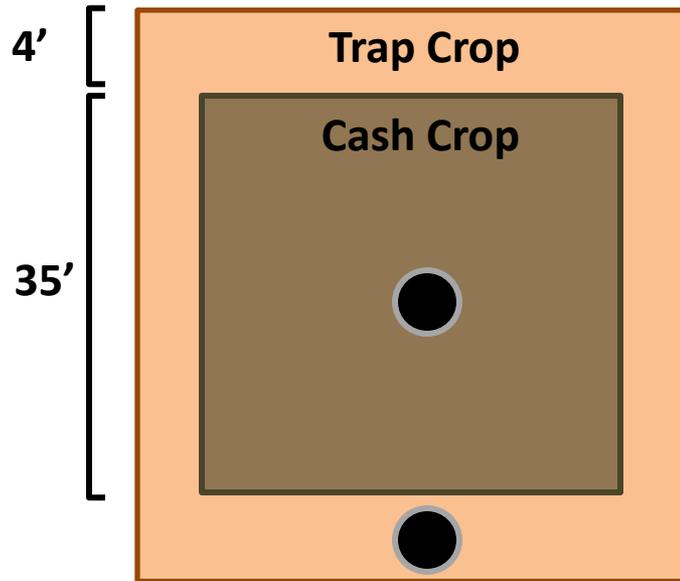
# Trap Crop Experimental Design



● 1 doubly tagged BMSB adult released



# Trap Crop Experimental Design



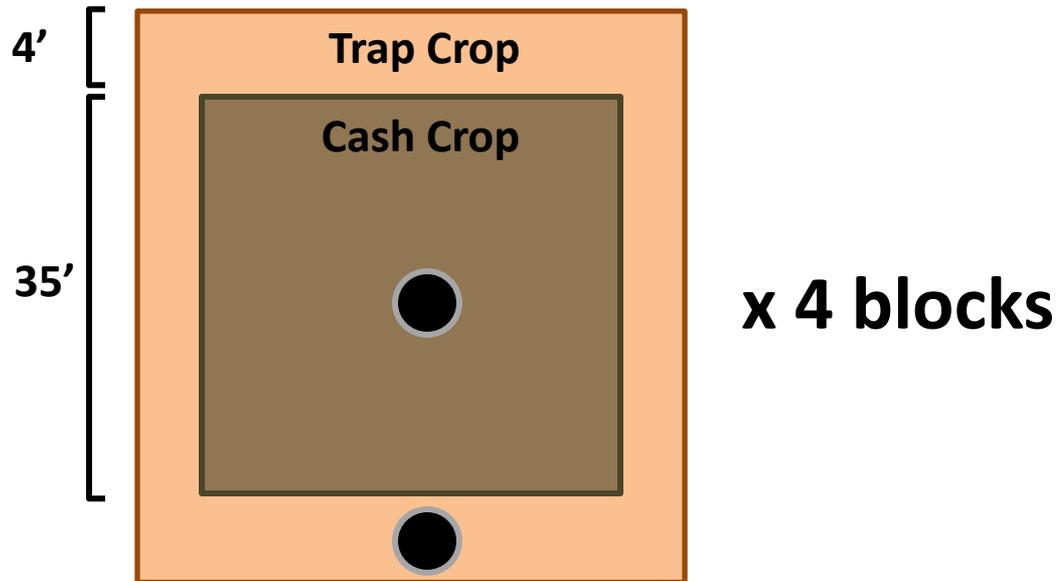
● 1 doubly tagged BMSB adult released



Post-Release Sampling

-----  
1 hr → 3 hrs → 6 hrs → 24 hrs

# Trap Crop Experimental Design



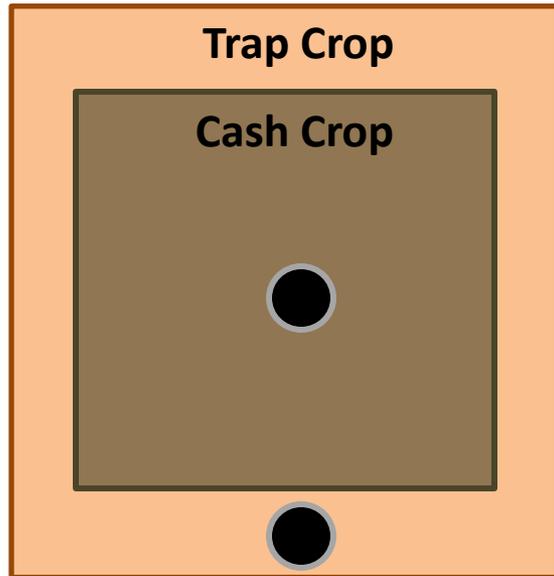
● 1 doubly tagged  
BMSB adult  
released



Post-Release Sampling

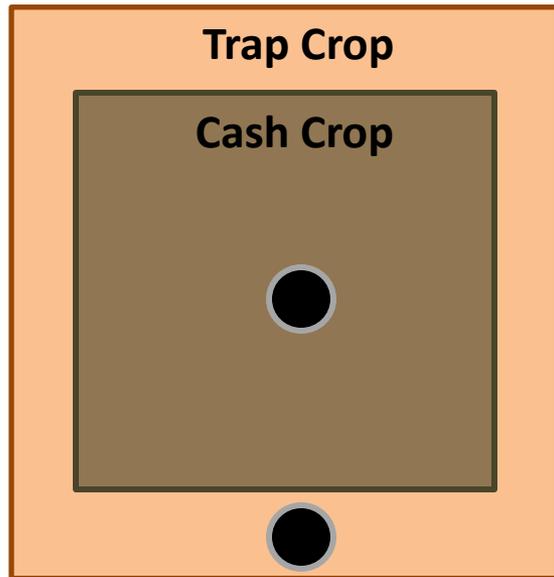
1 hr → 3 hrs → 6 hrs → 24 hrs

# Trap Crop Experimental Design



**Flowering**  
x 12 reps per time period

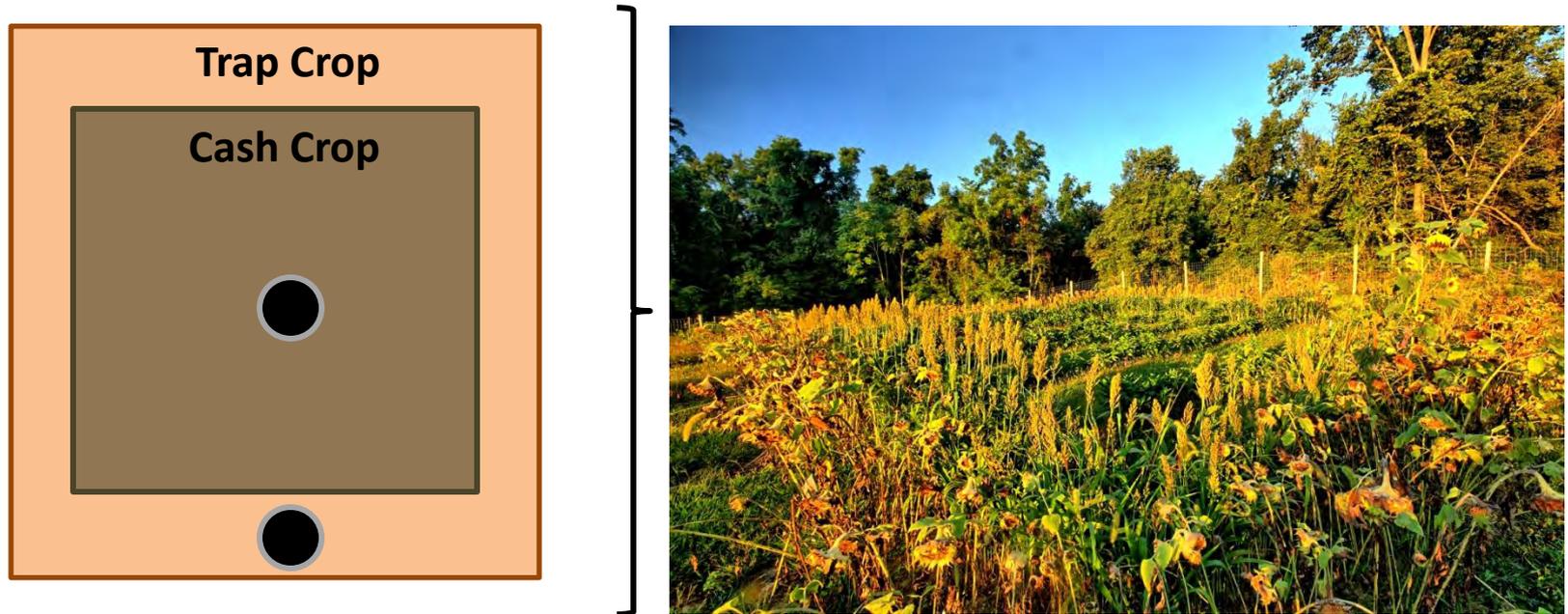
# Trap Crop Experimental Design



**Fruiting**

x 16 reps per time period

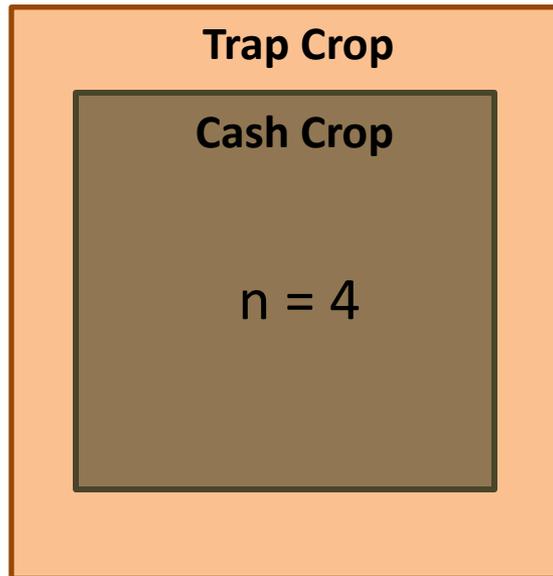
# Trap Crop Experimental Design



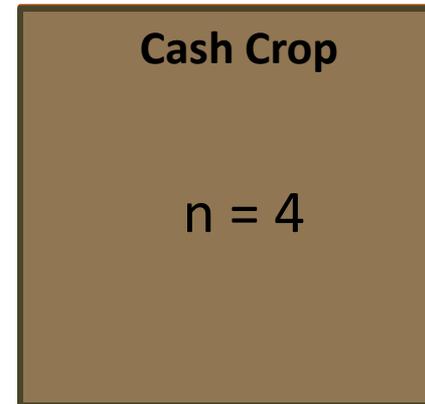
**Post-harvest**  
x 12 reps per time period

# Trap Crop Damage

With Trap Crop



Without Trap Crop



**vs.**



**Mature fruit harvested weekly:**

**28 Jul – 14 Sept**

**100 plants/plot**

# Trap Crop Damage



**Rating Class 0 –**  
Undamaged



**Rating Class 1 –**  
Minor Injury



**Rating Class 2 –**  
Major Injury

**Mature fruit harvested weekly:**

**28 Jul – 14 Sept**

**100 plants/plot**

# Trap Crop Statistics

- 2 ANOVAs

- Retention time =  $\mu + \text{Release Crop} + \text{Period} + \varepsilon$

- Distance Moved =  $\mu + \text{Release Crop} + \text{Period} + \varepsilon$



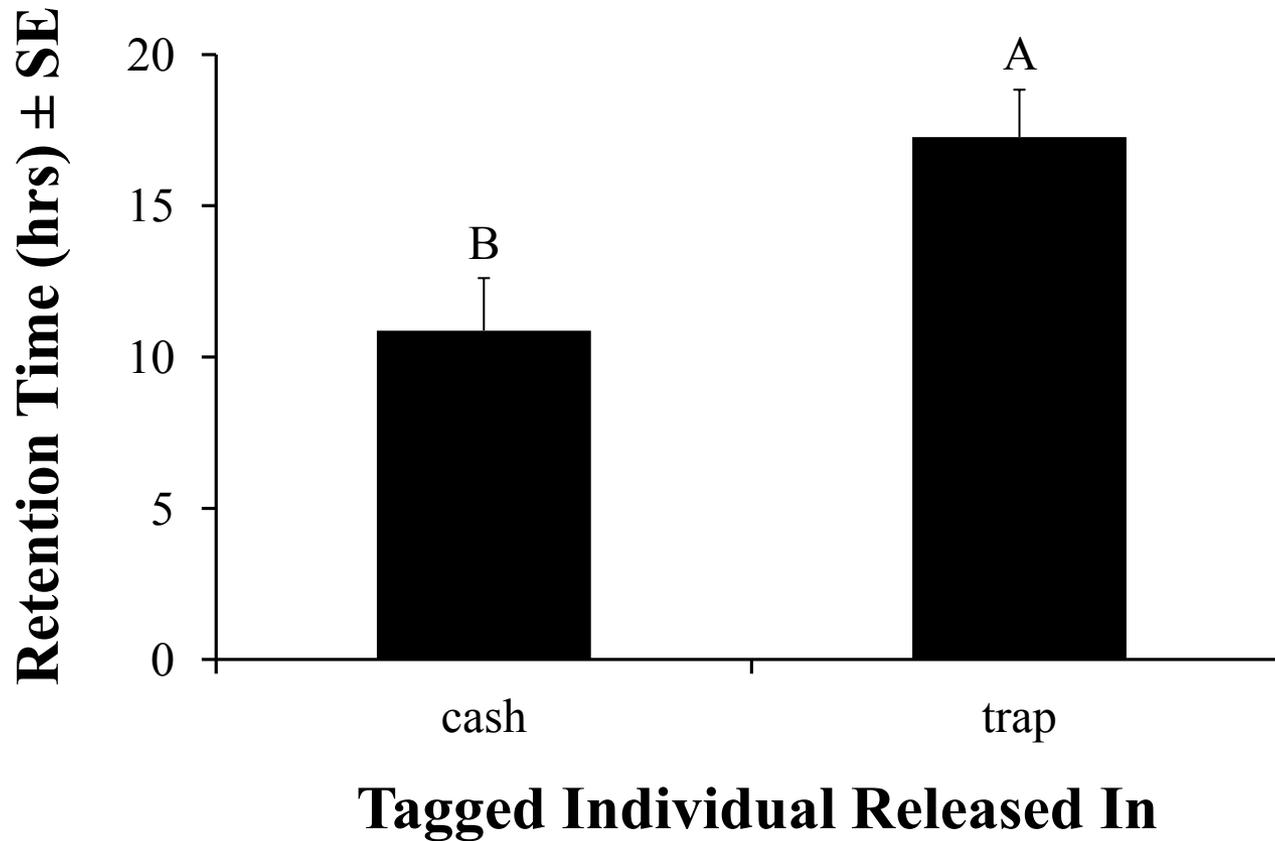
# Trap Crop Statistics

- Tukey's HSD for pairwise comparisons
- Chi-square test for expected locations based on surface area
- T-tests for damage measures



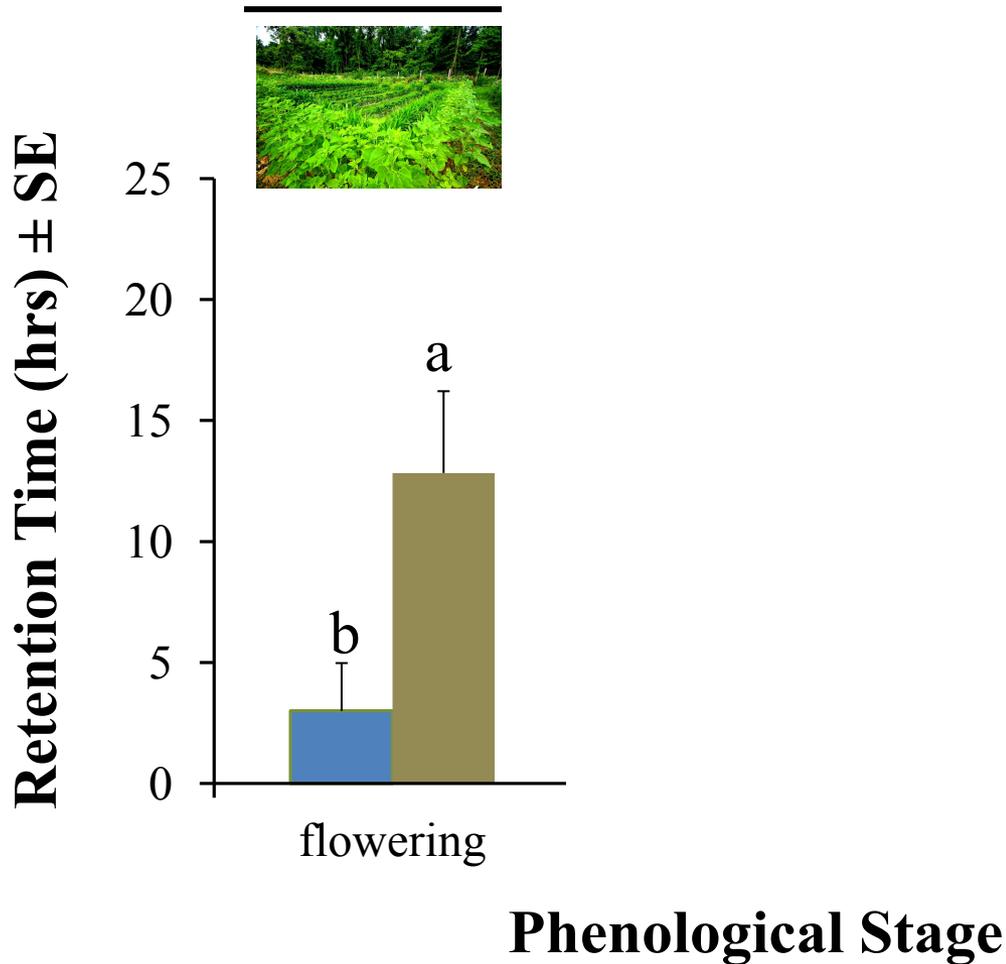
# Retention Time

**ANOVA**  
**Release Location**  
 $F_{1,74} = 11.4$   
 $P < 0.0012$



# Retention Time

**B**



**ANOVA**

**Release Location**

$F_{1,74} = 11.4$

$P < 0.0012$

**Sampling Period**

$F_{2,74} = 18.2$

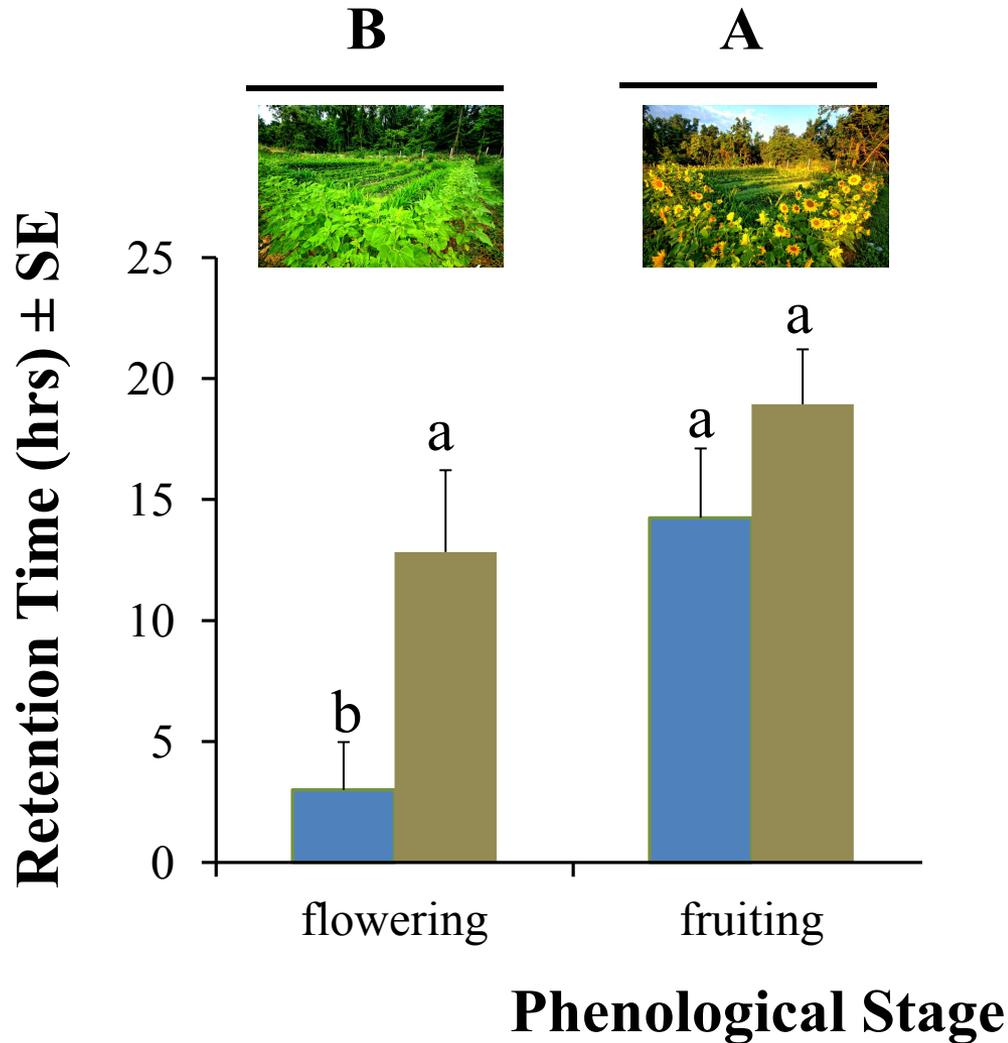
$P < 0.0001$

**Tukey's HSD**

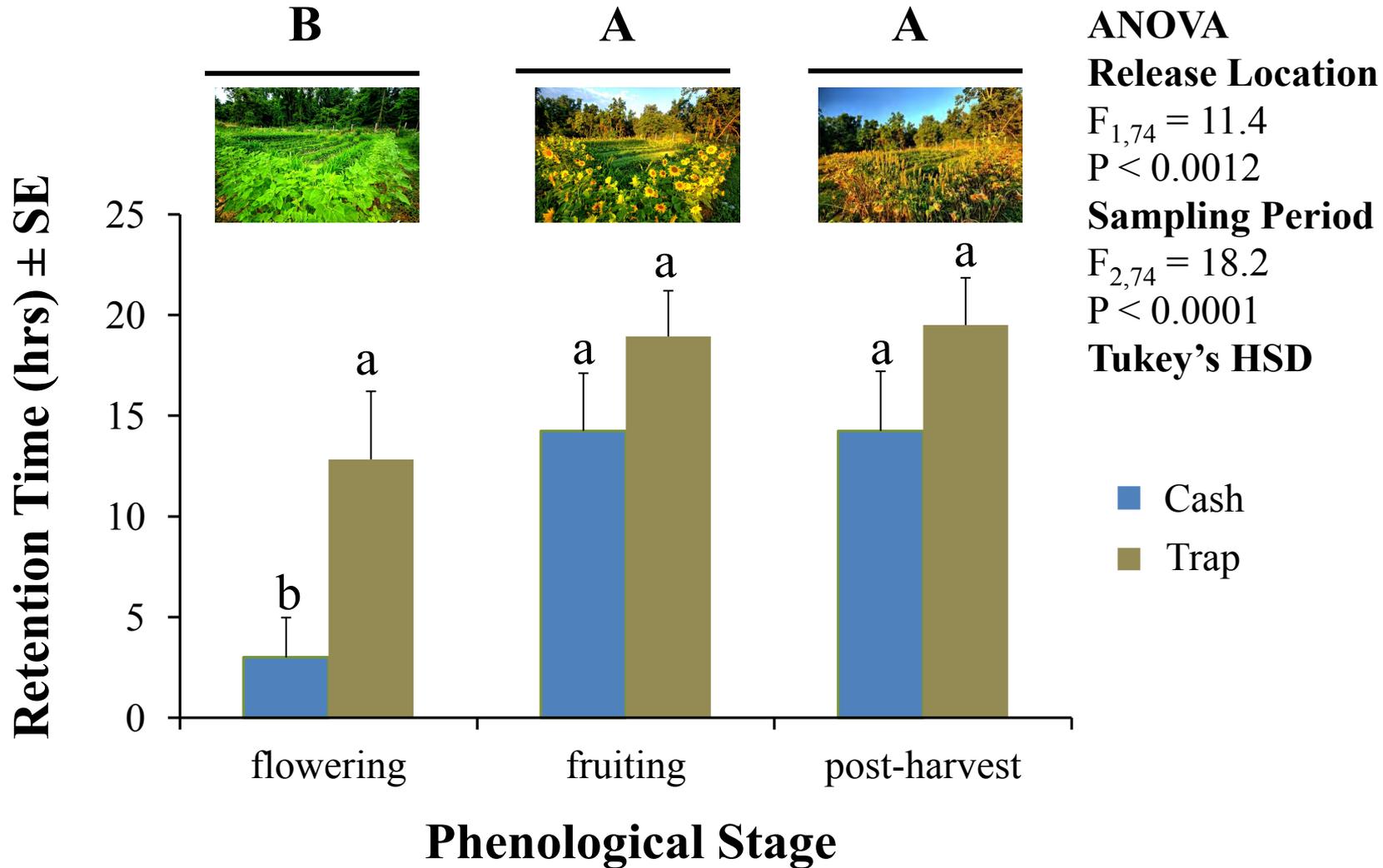
■ Cash

■ Trap

# Retention Time



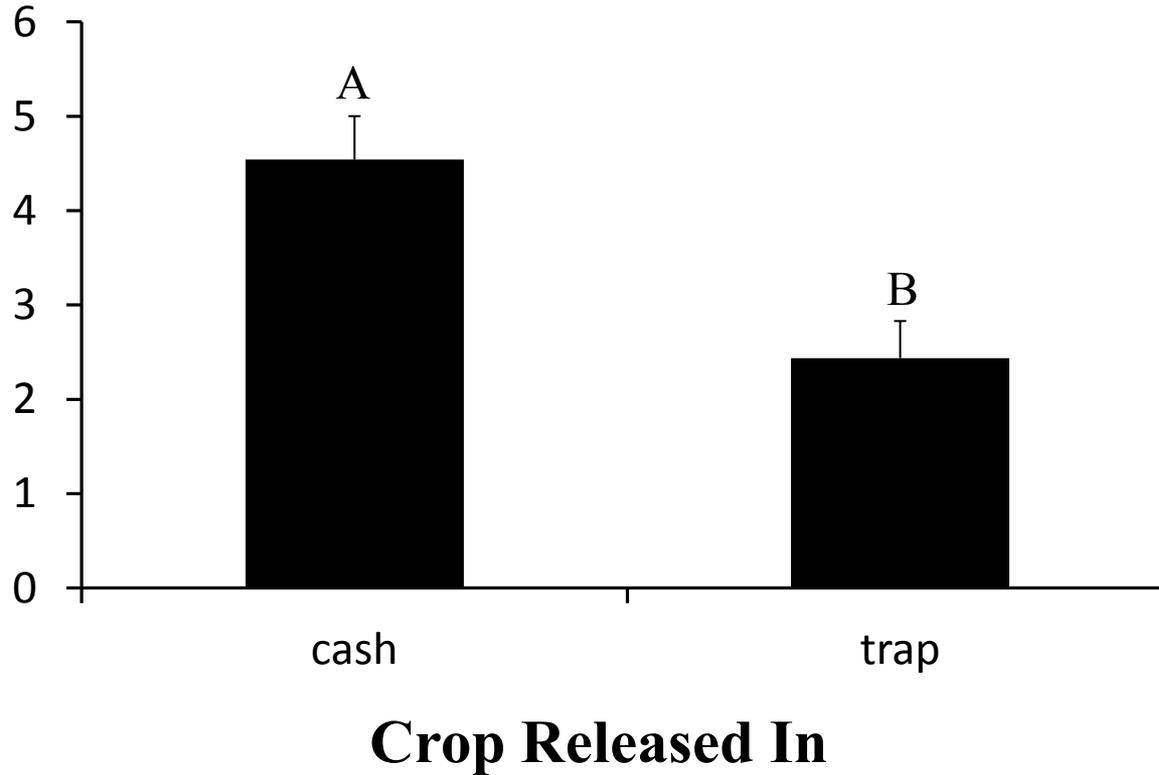
# Retention Time



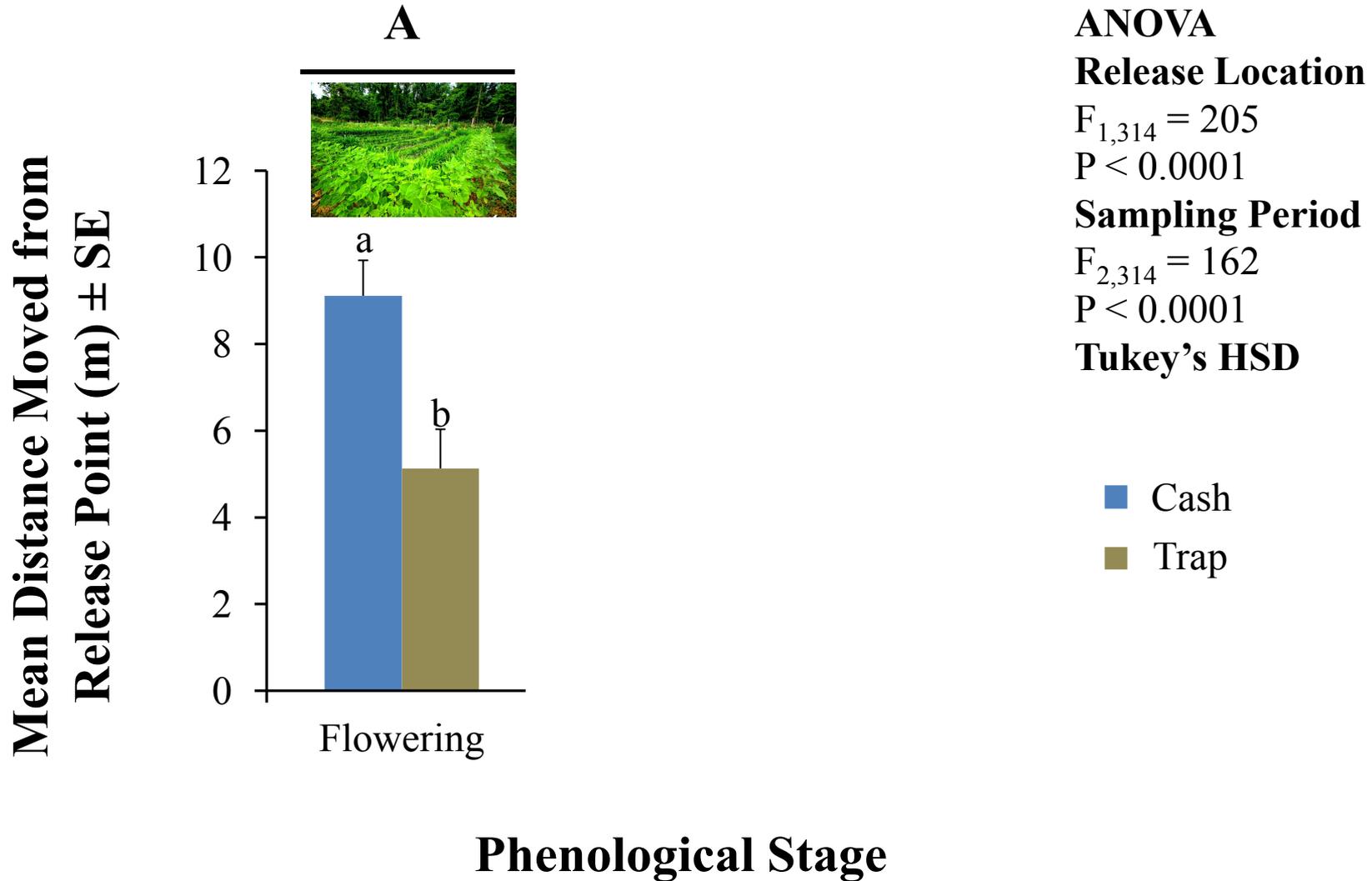
# Distance Moved

**ANOVA**  
**Release Location**  
 $F_{1,314} = 205$   
 $P < 0.0001$   
**Tukey's HSD**

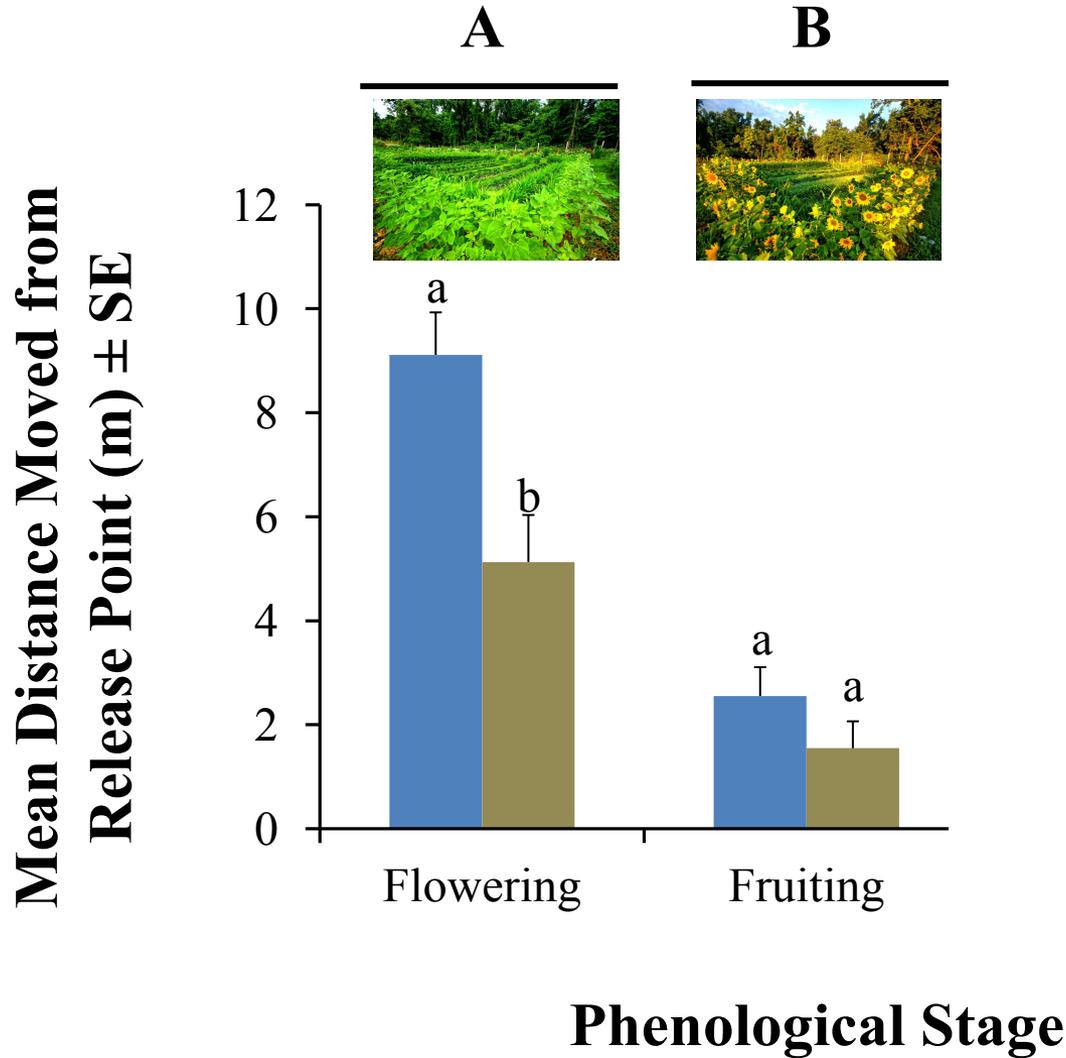
**Mean Distance Moved from  
Release Point (m)  $\pm$  SE**



# Distance Moved



# Distance Moved



**ANOVA**  
**Release Location**

$F_{1,314} = 205$

$P < 0.0001$

**Sampling Period**

$F_{2,314} = 162$

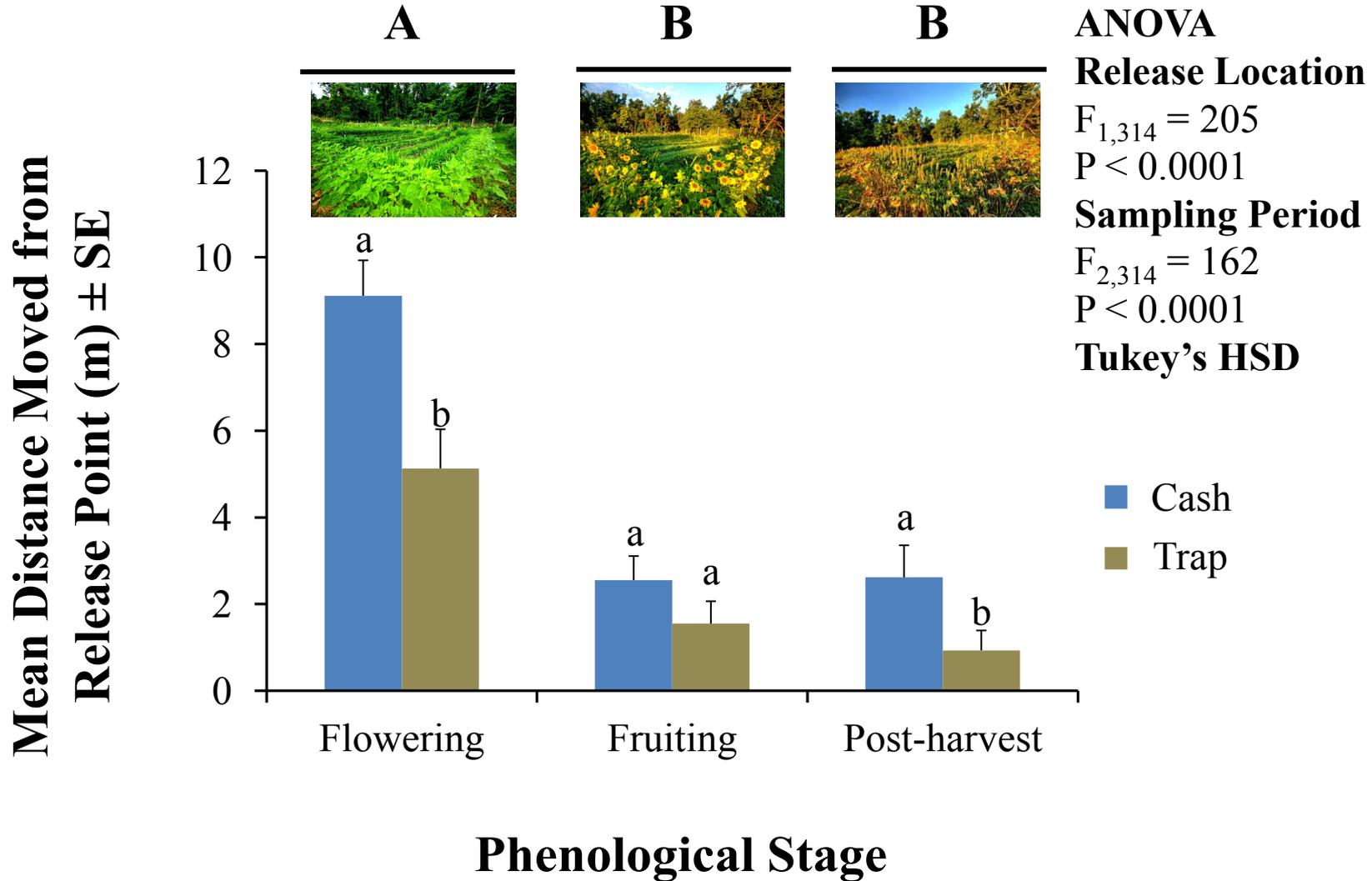
$P < 0.0001$

**Tukey's HSD**

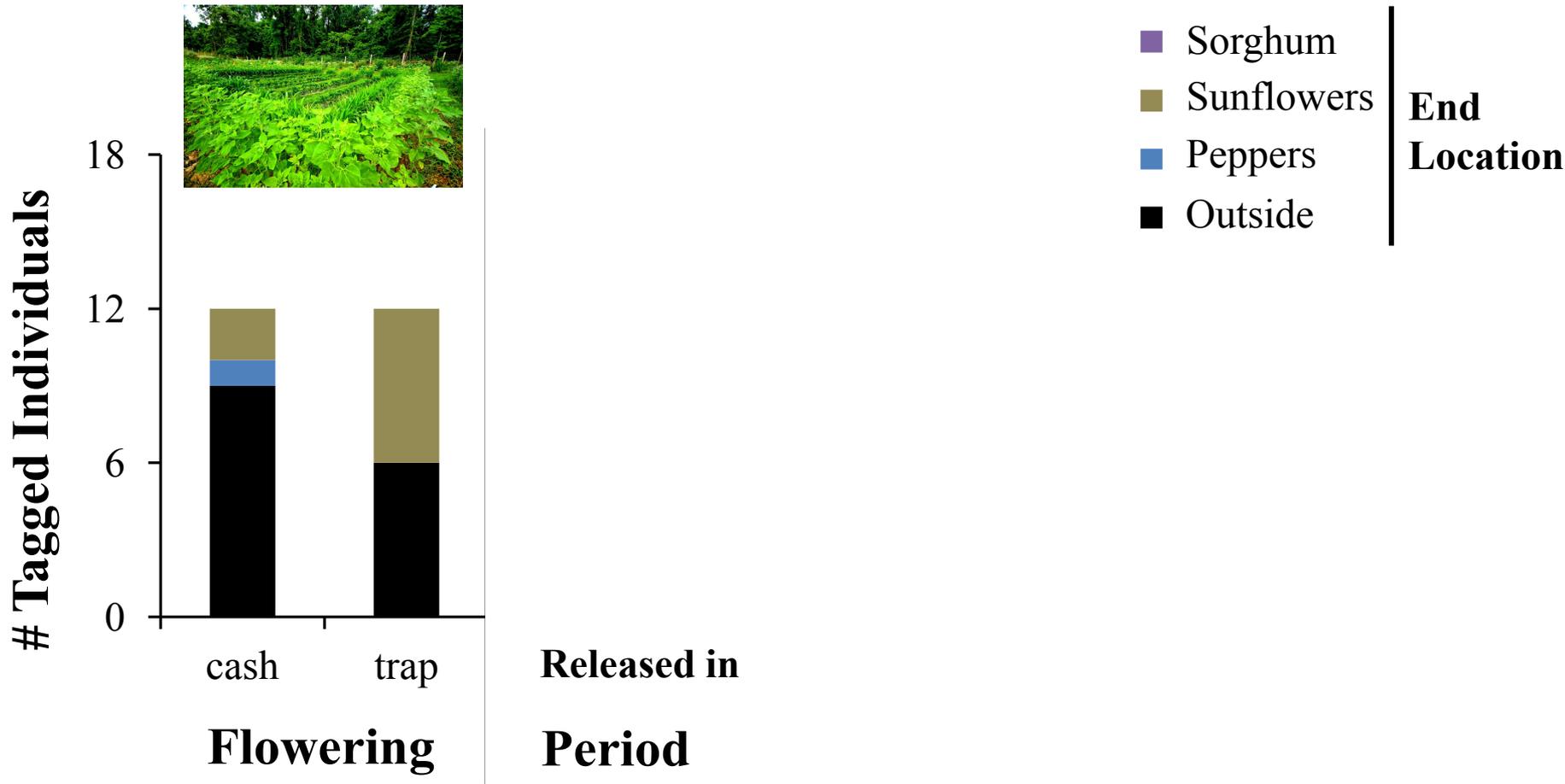
■ Cash

■ Trap

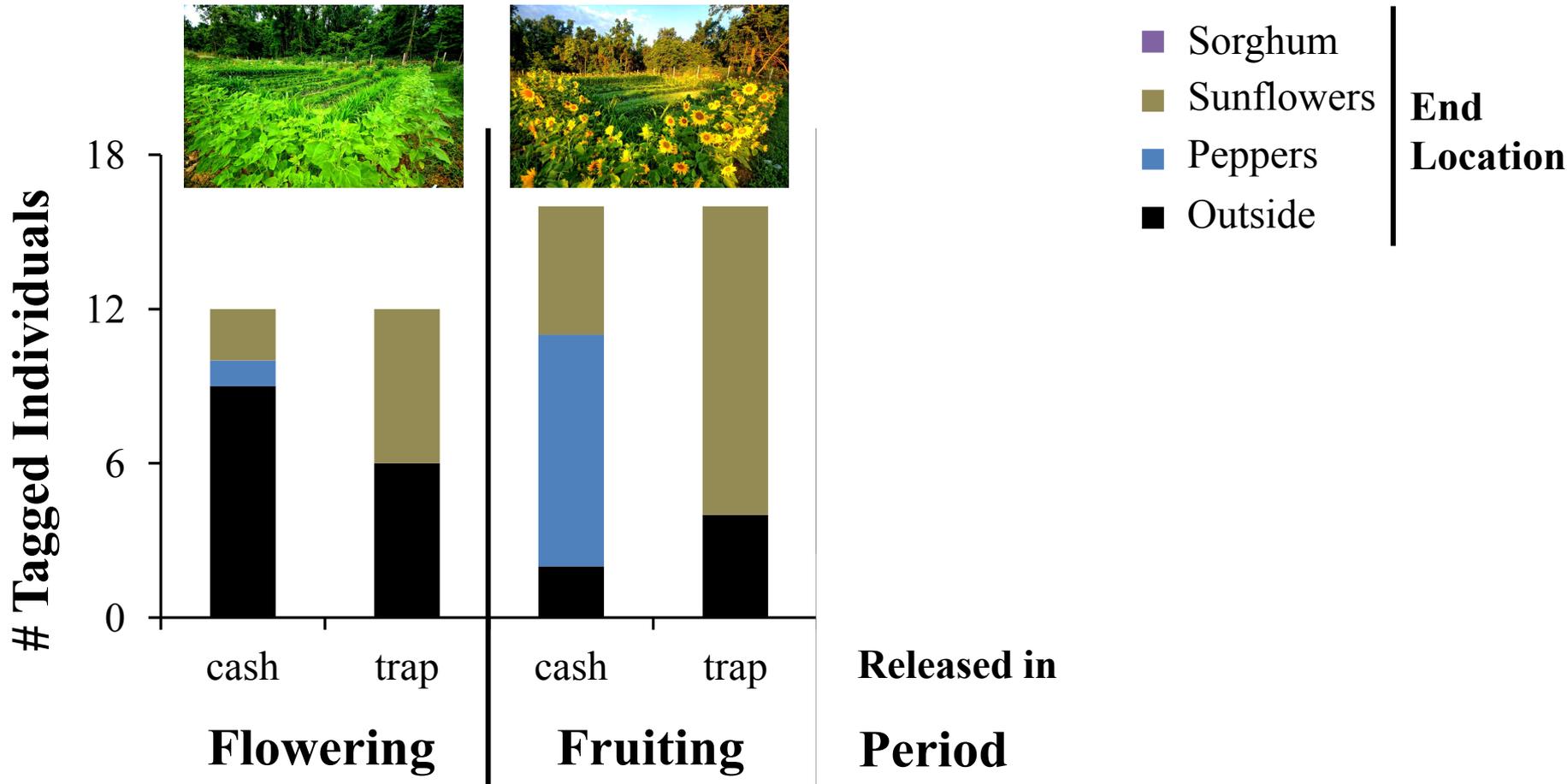
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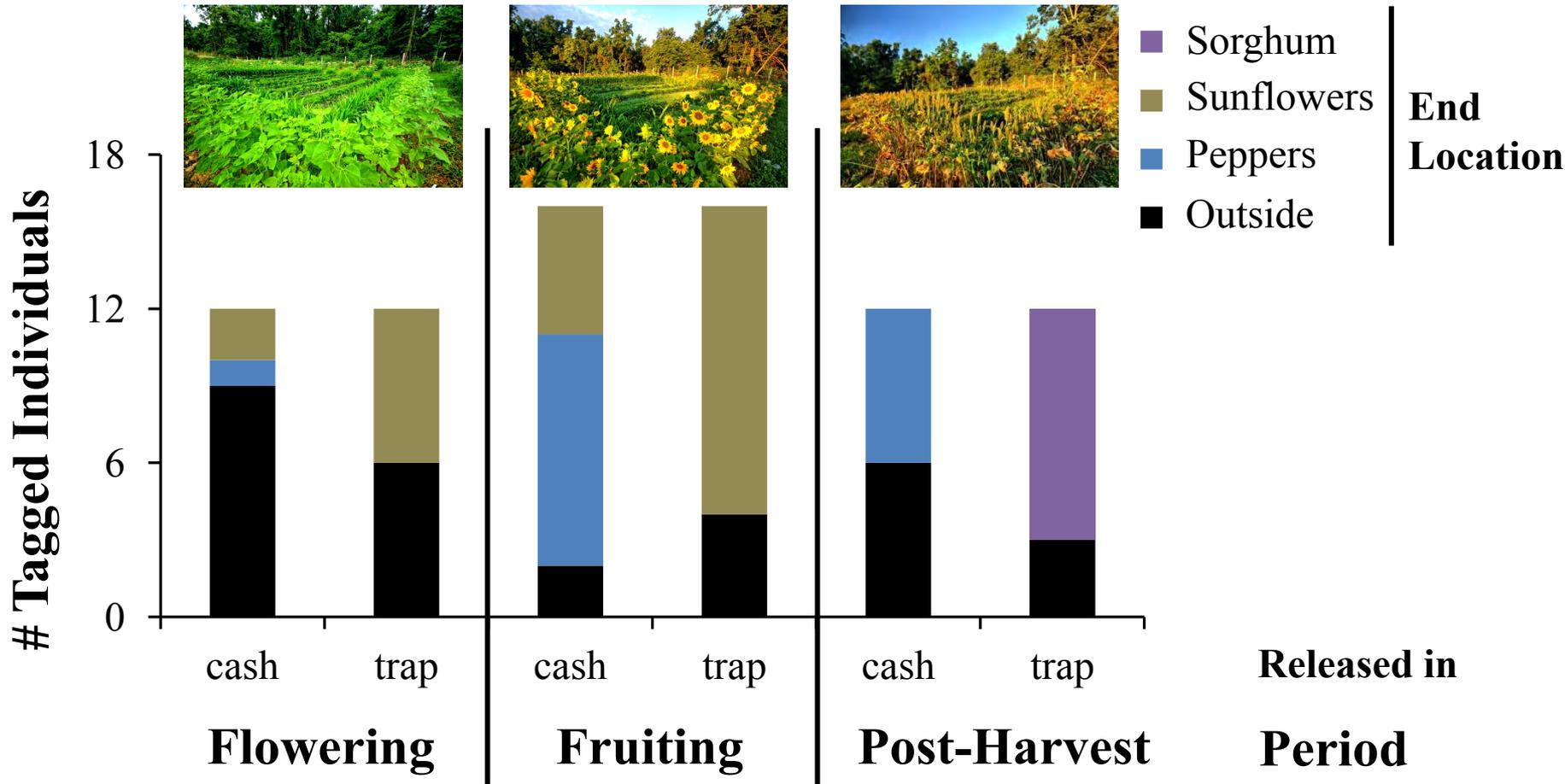
# End Location of Tagged BMSB



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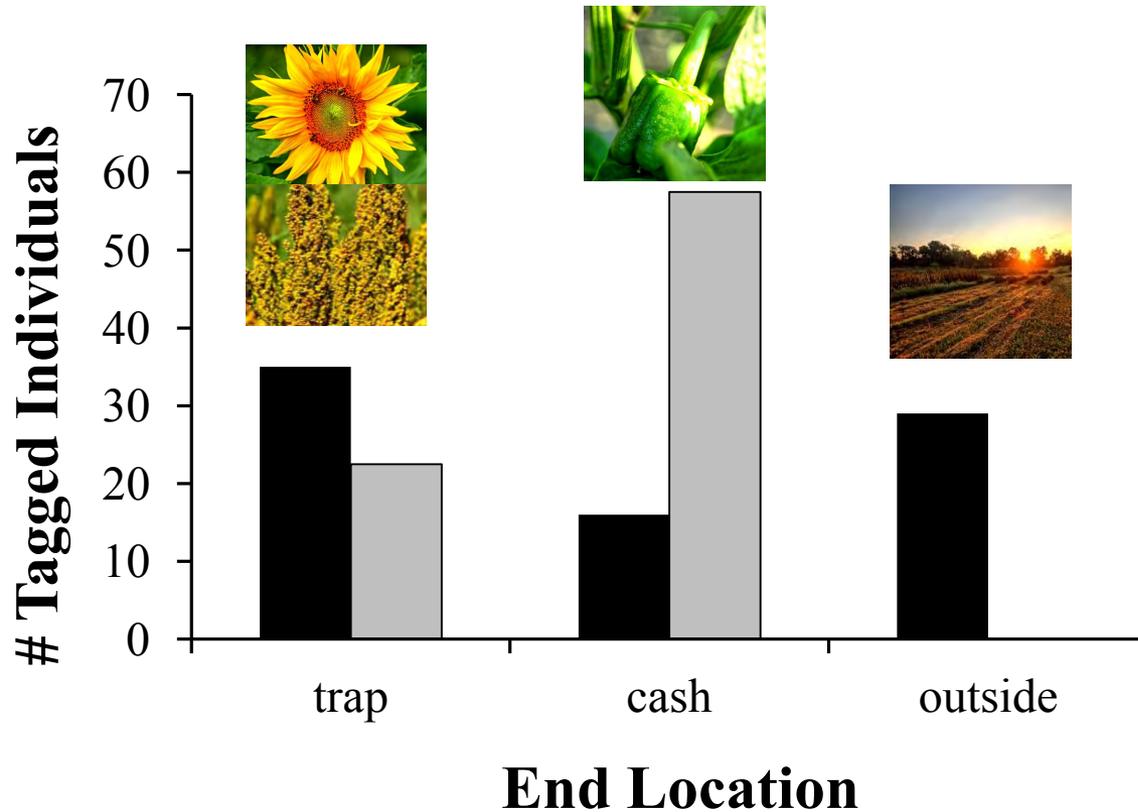
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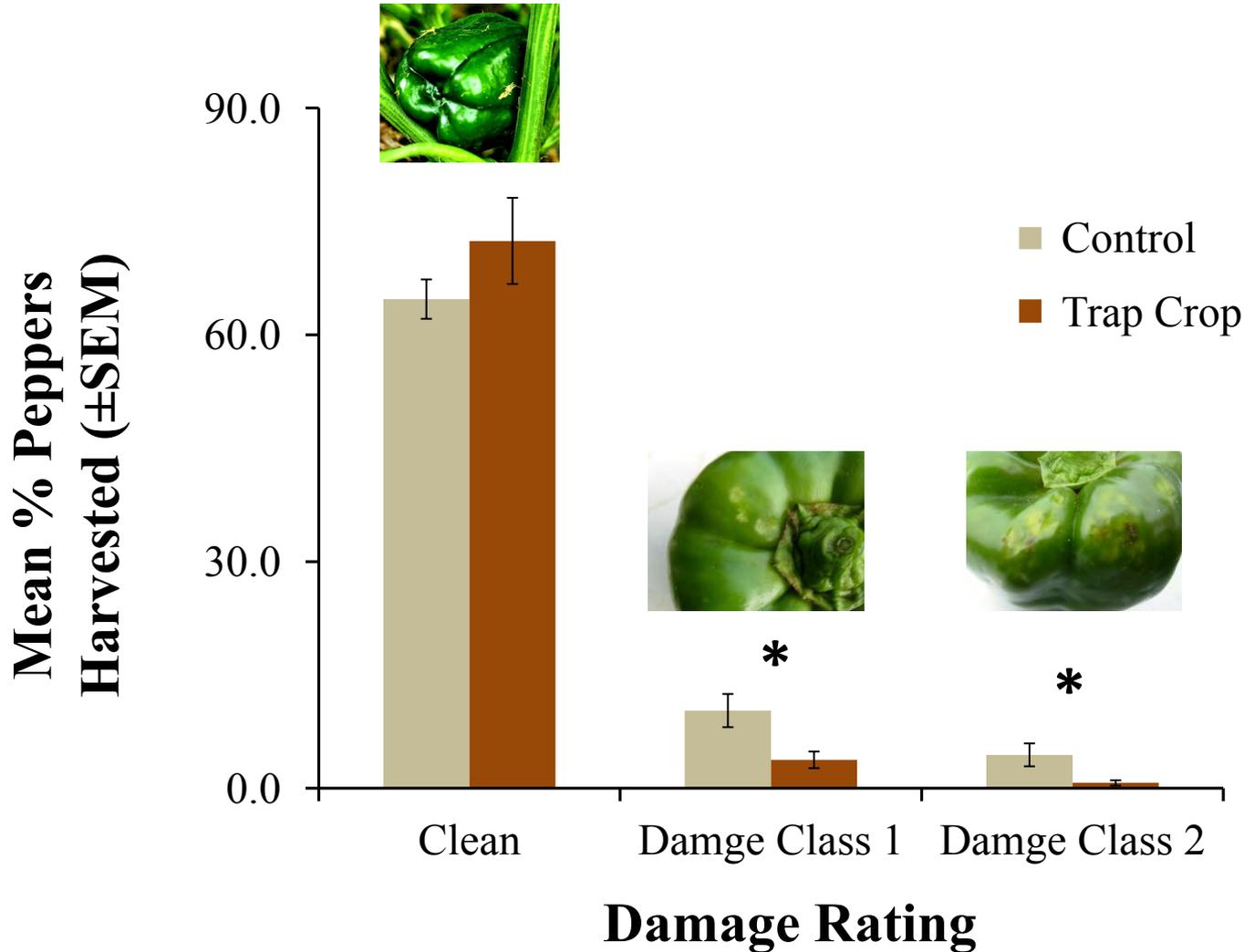
# Expected Location Based on Surface Area of Each Habitat

**Surface area**  
71.9% - cash  
28.1% - trap

**$\chi^2$ -test**  
 $\chi^2 = 876.8$   
 $P < 0.0001$



# Stink Bug Damage



**T-Test**

**Clean**

$$t_{1,314} = -1.296$$

$$P < 0.0001$$

**Damage Class 1**

$$F_{1,314} = 205$$

$$P < 0.0001$$

**Damage Class 2**

$$F_{2,314} = 162$$

$$P < 0.0001$$

**Tukey's HSD**

# Summary

- Retention time is greater for the trap crop
- Distance moved is less for the trap crop
- Switching occurs from pepper to the trap crop but not vice versa
- Attractiveness of the crops is modulated by phenology
- Damage is less in plots with trap crops than without



# Conclusions & Future Directions

- Trap cropping may be a good alternative cultural control
- May need to switch out sorghum or plant earlier
- Investigate trap cropping in combo with killing agent

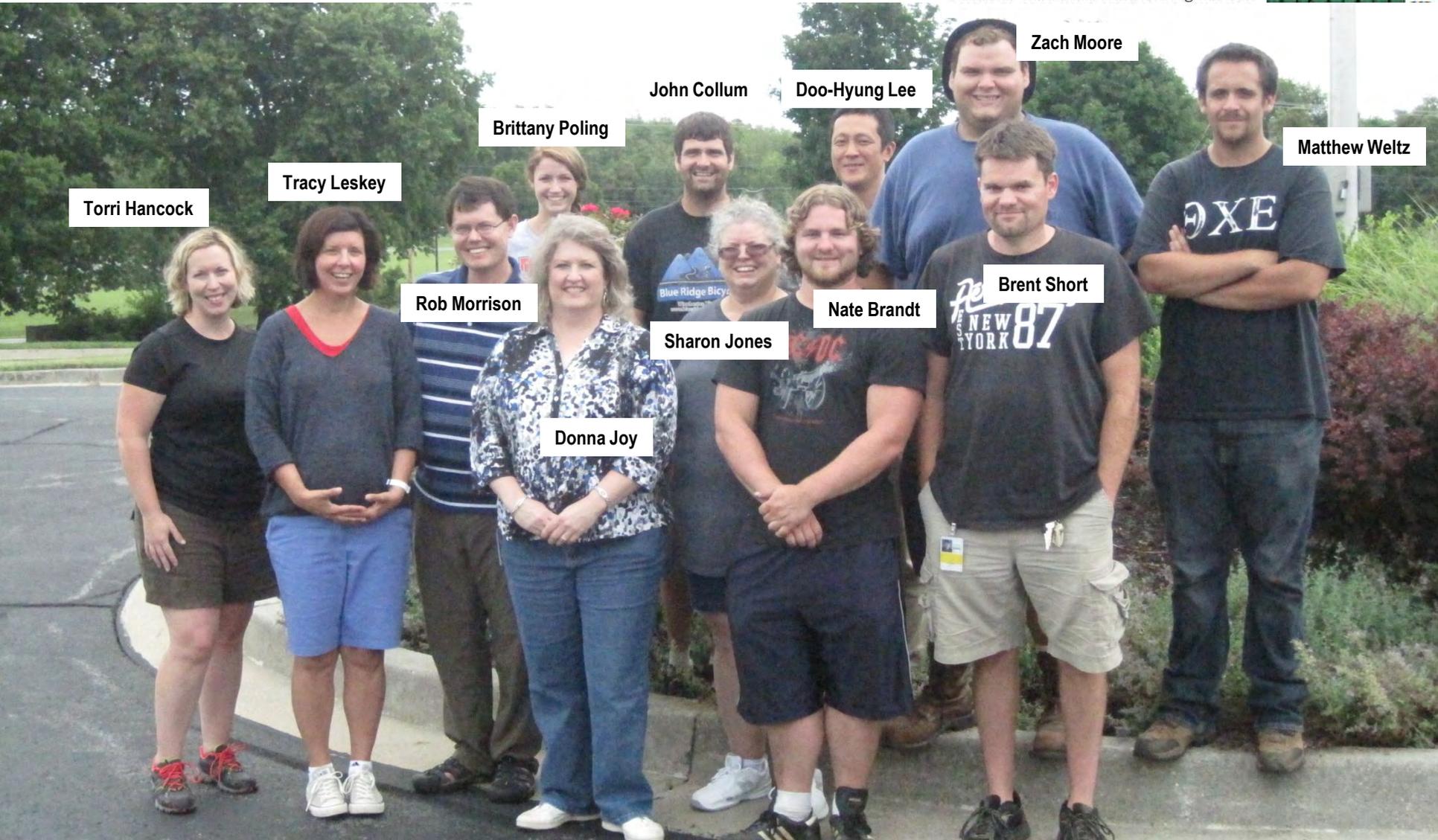


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# Thank you for your attention!



In the field one morning...