# Questions about the Role of Seed Bug Herbivory in Production coming from Interior Lodgepole Pine Seed Orchards


## Operational approach

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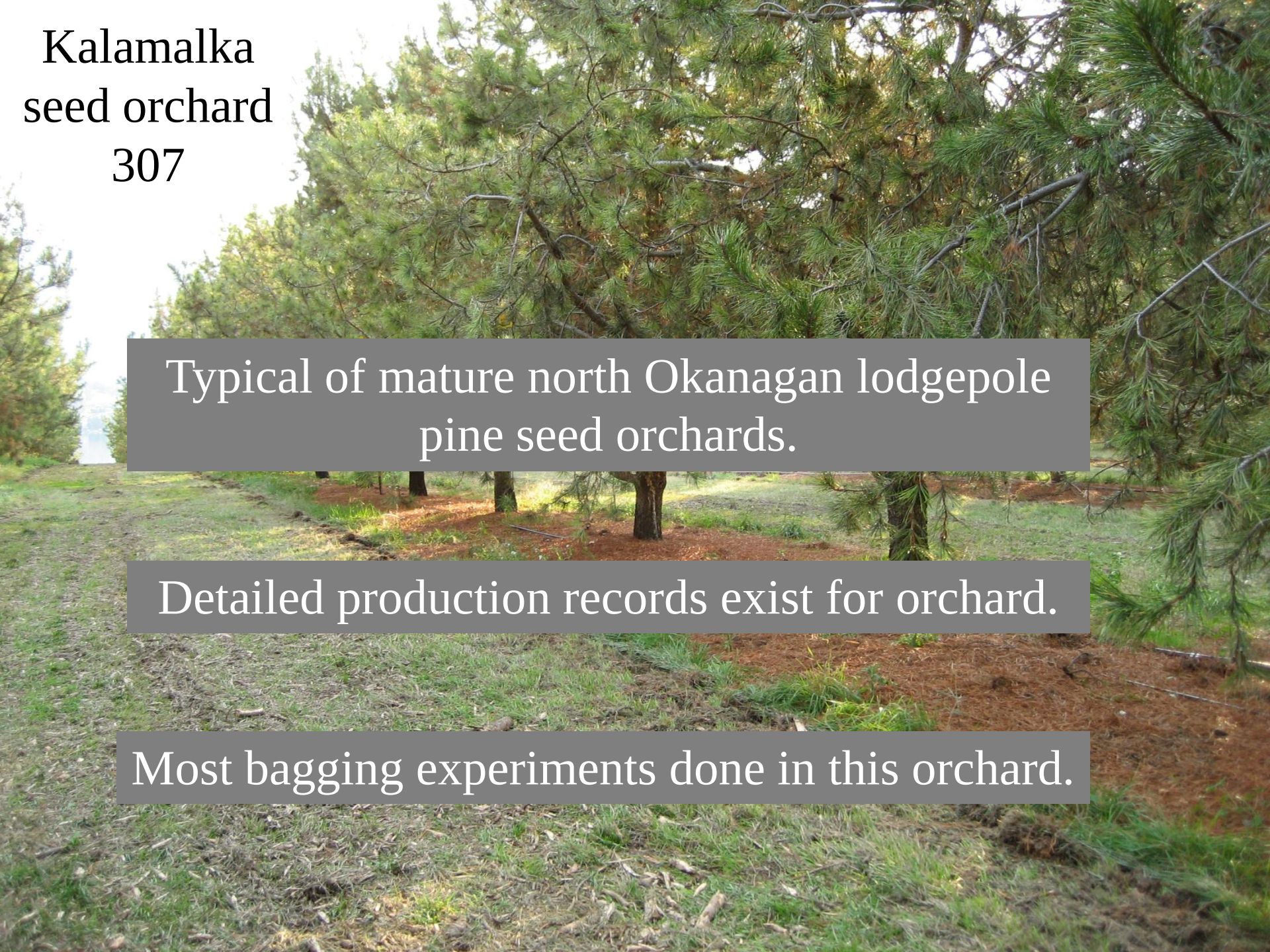
*Leptoglossus occidentalis*,
the western conifer seed bug
*Photo by Penny Major*


Kalamalka seed orchard 307
Typical of mature north Okanagan lodgepole pine seed orchards.
Detailed production records exist for orchard.
Most bagging experiments done in this orchard.

# “The Bag Effect”

Lodgepole pine cones enclosed without insects inside fine-mesh fabric bags through their second year of development produce significantly (20-80%) more filled seeds per cone (FSPC) than cones on the same ramets left exposed through the identical time period.

Yes

# “The Bag Effect”

*“To assess the impact of L. occidentalis feeding, the mean FSPC for treatment 13 (the insect exclusion control) was assumed to be the potential value for every cone in the absence of L. occidentalis feeding.”*

Strong, W.B. 2006. Seasonal changes in seed reduction in lodgepole pine cones caused by feeding of *Leptoglossus occidentalis* (Hemiptera: Coreidae). The Canadian Entomologist, 138: 888-896.

This is the Seed Bug Model.

Seed bug-caused losses in lodgepole pine is the most important pest issue in BC seed orchards.

No Economic Threshold for control decisions.

2006

No seed bug density: crop damage relationship has ever been established for this cropping system.

Seed bug management is not done on IPM principles.

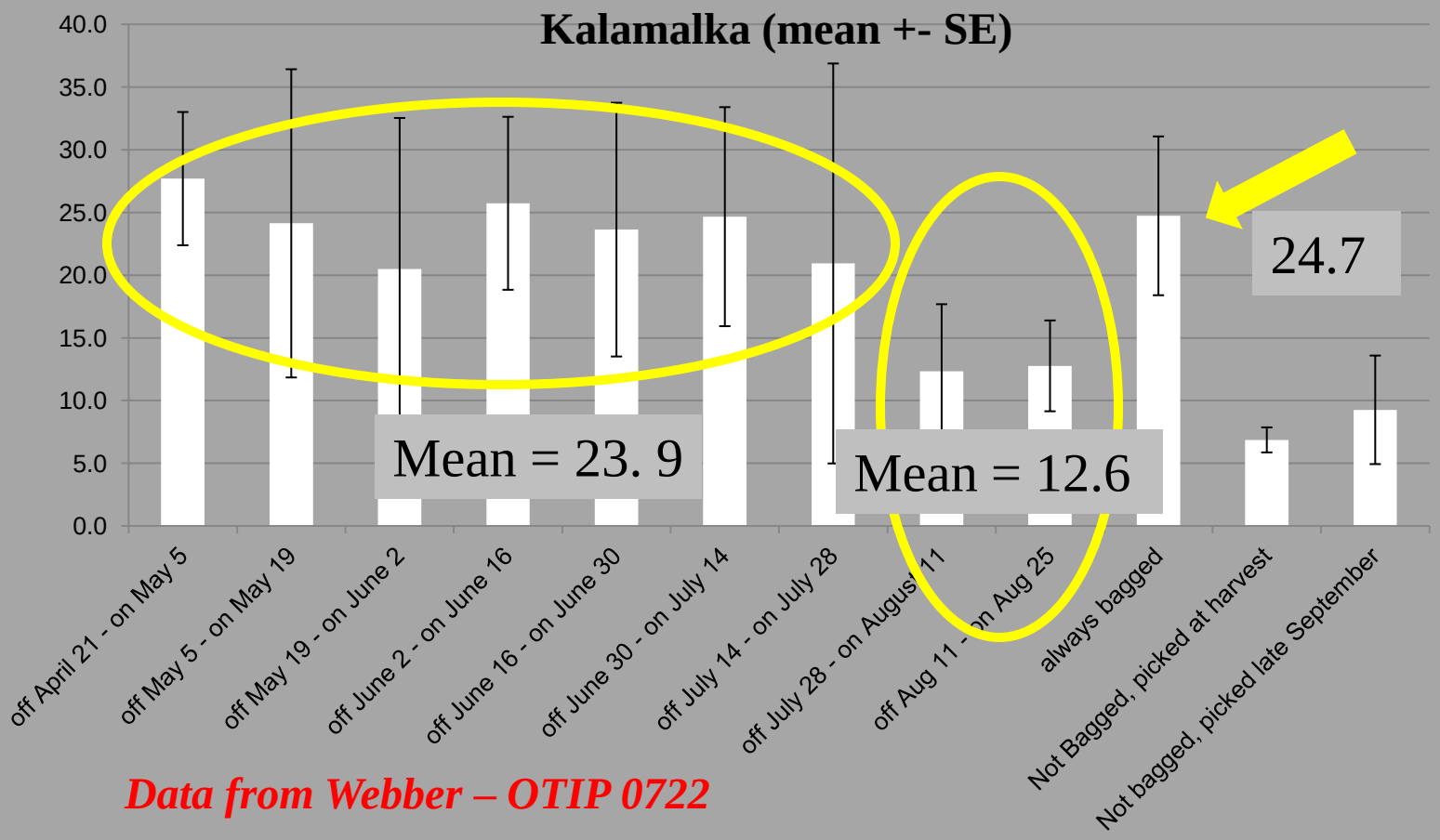
**Sprays applied, FSPC values from Tree Seed Centre data, FSPC values for the same years from exclusion bagging trials (in brackets) and proportional reductions of FSPC for Kalamalka lodgepole pine Orchard 307 for 2001 to 2010.**

| Year | Sevin sprays applied | Operational FSPC (FSPC for bagged cones) | Proportional FSPC losses |
|---|---|---|---|
| 2010 | 0 sprays | 6.3 (20.2) | 69% |
| 2006 | 5 sprays | 8.1 (17.1) | 53% |
| 2004 | 3 sprays | 10.0 (18.4) | 46% |
| 2009* | 1 spray | 13.4 (22.4) | 40% |
| 2001 | 3 sprays | 15.7 (25.7) | 39% |
| 2002 | 3 sprays | 16.3 (25.8) | 37% |
| 2003 | 2 sprays | 14.7 (22.7) | 35% |
| 2007 | 2 sprays | 10.4 (15.9) | 35% |
| 2008 | 1 spray | 8.9 (15.5) | 34% |
| 2005 | 2 sprays | 12.1 (15.0) | 19% |

Losses of over one-third of the crop were recorded in nine of ten years – despite spray programs targeting seed bugs being implemented in all but one of these years.

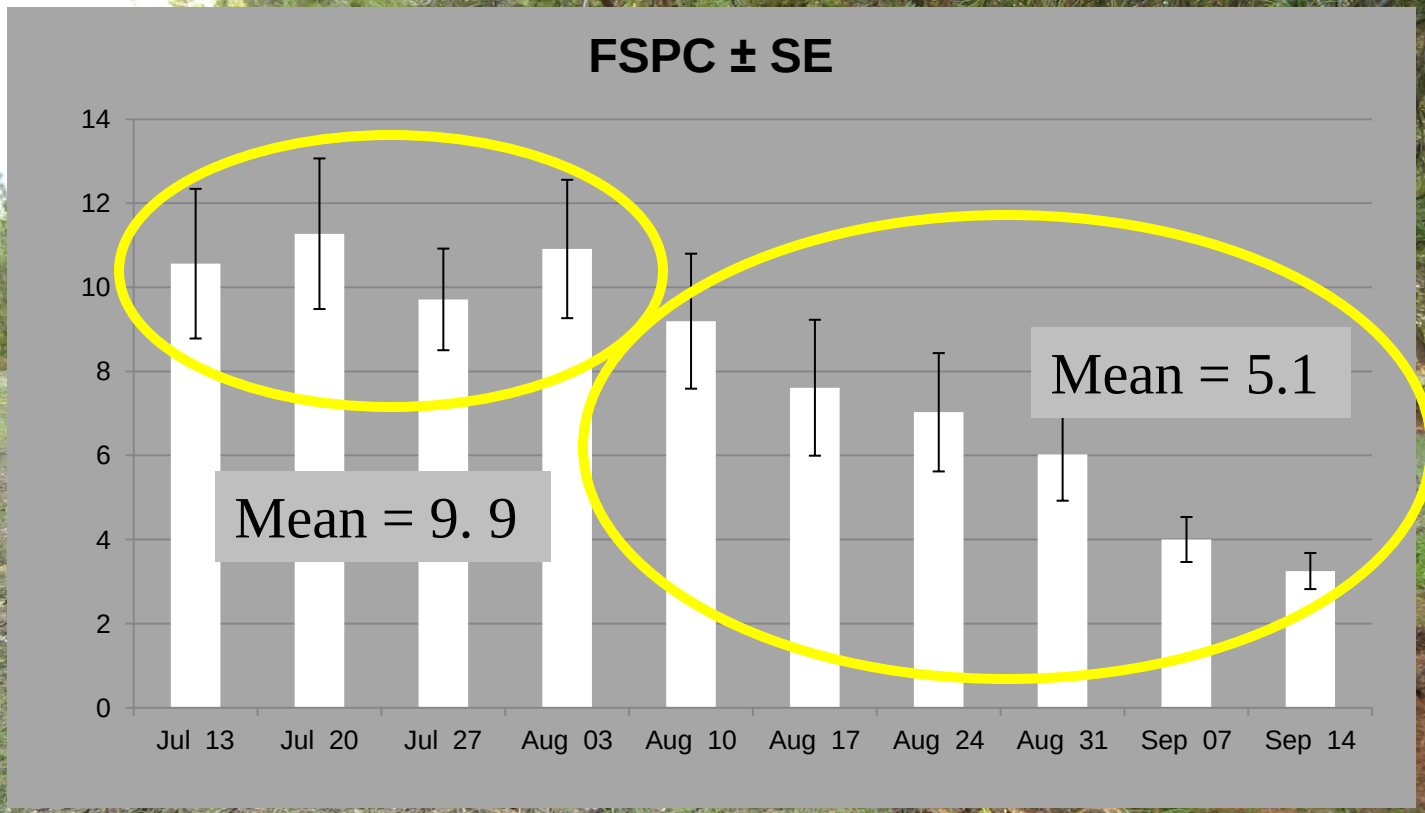
Spray programs never got FSPC yields anywhere near what they ‘should’ be, based on the Seed Bug Model.

# 2010 Bags on-off-on Trials




*Data from Webber – OTIP 0722*

# 2011 Timing of Harvest Trials




Bagged all season = 12.2

# Total cones harvested and calculated amounts of seed lost to seed bugs in Orchard 307 from 2001 to 2010

**Seed loss based on volumetric estimate of cone numbers from Tree Seed Centre data, and calculated FSPC deficits for the same years from the Seed Bug Model.**

| Year | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|
| Number of cones harvested (X 1,000) | 679 | 778 | 654 | 527 | 308 | 444 | 792 | 452 | 348 | 338 |
| Seed lost (X 1,000) | 6,790 | 7,391 | 5,232 | 4,427 | 893 | 3,996 | 4,356 | 2,983 | 3,132 | 5,374 |

# “Costing out” the 2010 losses

Number of seeds lost (from Seed Bug Model)
= 5,374,000

Time period to lose seeds = 30 days

Maximum daily seed bug herbivory rate
= 5 seeds per day

Minimum number of seed bugs required to cause loss:
5,374,000 / 30 days / 5 seeds/day =

35,826 seed bugs, eating their daily max every day for 30 days.

# “Costing out” the 2010 losses

- Orchard 307 has about 1,600 ramets, so there should be about 22 seed bugs on every ramet, feeding on cones every day for the entire month of August.

- Staff members spent at least 175 hours per week in 307 picking the cones full time through August.

- While pickers saw seed bugs, there were no reports of seeing them in the numbers that the Seed Bug Model predicts must have been there to cause the FSPC losses.

# Where are the Seed Bugs?

No seed bug density : crop damage relationship has ever been established for this cropping system.

Pesticide treatments have never raised yields to anything close to what is predicted by the Seed Bug Model.

# Where are the Seed Bugs?

FSPC losses of about 50% of the crop occur every year in August, requiring populations of thousands of seed bugs to be actively feeding through this entire period ...

Where do they come from?

Why have they never been seen in the numbers predicted by the Seed Bug Model?

Bag effect ≠ Seed bug feeding exclusion.

# Further Developments

Patrick von Aderkas & colleagues are examining seed samples taken through the decline period.

Mike Carlson & colleagues are looking at the relationship between seed set, area of origin of the orchards, temperature and seed declines.

Ward Strong is looking for evidence of the role of in-cone temperatures and seed bug herbivory in seed declines.

Gary Giampa is designing a picking system to maximize yields coming from Orchard 307.

Jim Corrigan is developing a method to detect seed bug feeding on individual lodgepole pine seeds.


Thank You!