

**Codling Moth “no biofix” Two-Stage Model Documentation**  
**USPest.org at Oregon State University and the Oregon IPM Center**  
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A new model at USPest.org for codling moth egg hatch, abbreviation “clp”, combines the Jones et al. (2013) “no biofix” model, with the traditional Brunner and Hoyt (1987) model. The Jones et al. (2013) algorithm uses latitude and elevation to estimate the degree-days needed to predict biofix (first consecutive capture of codling moth in pheromone traps). Then the date of this prediction (stage one) is used with the traditional model to predict later events (stage two). This two-stage model is performed automatically, and is intended to save pest managers time and effort.

This model may be an improvement over the practice of using pheromone traps to determine biofix because:

- Low populations can make trapping first males rather uncertain
- Time and expense of trapping is not convenient (very labor intensive to check traps daily)
- Mating disruption uses same pheromones normally used for trapping (traps less efficient)
- Apples and pears are often grown in topographically varied regions (e.g. Hood River, Oregon), so biofix can vary greatly even within a few miles

Since degree-day models are run from nearby weather stations, we use the Jones et al. 2013 formula to make use of the station latitude and elevation to calculate degree-days for biofix, and weather data to predict the date for biofix.

This new version of the model should simplify codling moth decision making. If you wish to use the no-biofix prediction of the model start date with the Knight 2007 model, simply run the former and plug in the predicted biofix into the latter. Both the Brunner and Hoyt and Knight models are very popular, the former more so.

We recommend that you test the predicted biofix dates thoroughly (compare predictions to the biofix predicted using pheromone traps) to see if it works for your needs. The model was developed using data from several states in the US: CA, IL, MI, MO, NC, NY, OH, OR, PA, UT, WA, and WV, as well as Denmark, England, and Switzerland. Please use with caution; read all disclaimers about using models at your own risk, etc! Please refer to the Jones et al. (2013) publication at [https://uspest.org/wea/Jones\\_2013\\_codling\\_moth\\_CM-biofix.pdf](https://uspest.org/wea/Jones_2013_codling_moth_CM-biofix.pdf) for more guidelines on how the model was constructed and tested and how to use it. Please send your feedback on how we can improve our open source, public services at any time. Emails are the preferred form of feedback (see our home page at <https://uspest.org/wea>).