Whole Orchard Recycling Practice Review

Healthy Soils Program

CDFA OFFICE OF ENVIRONMENTAL FARMING & INNOVATION

Environmental Farming Act

Science Advisory Panel Meeting

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Whole Orchard Recycling: Basics

- Pioneered in California by UC Cooperative Extension
- Entire orchard is normally chipped to 2" chips.
- Chips are incorporated into soil to at least 6".
- Services have evolved in recent years, and adoption is now in 10,000s of acres.
- Currently used in almond and walnut orchards in San Joaquin and Sacramento Valleys.
- Explored and modeled by CDFA and CARB in white paper in 2019-20, defining practice benefits, costs, and requirements for HSP incentives.

Photo Credits: Brent Holtz, UCCE

Whole Orchard Recycling: HSP Requirements Background

In January 2020, Whole Orchard Recycling was approved by the EFA Science Advisory Panel with the following requirement:

"Following woodchip incorporation, land must be fallowed or replanted with trees within 3 years."

- **"…consistent with the HSP grant term of 3 years":** HSP incentive requirements only extend past 3 years for incentivized permanent plantings, such as hedgerows.
- **"…and with DNDC modelled conditions"**: Orchard replanting was the basis of the field research used for validating the DNDC ("DeNitrification-DeComposition") model.
- **"…and with DNDC modelled conditions"**: Orchard replanting gave optimal GHG benefits (high carbon sequestration and minimal N_2O increase) in DNDC modeling.
- **"…and with DNDC modelled conditions"**: Dry fallow had little effect on final GHG results in DNDC modelling, which was in line with expectations.

Also, in 2020:

- Orchard acreage was expanding rapidly.
- CDFA received no reports of planting annual crops after WOR. It was assumed that chips in the soil would interfere with seeding and with nutrient provision to annual crops in the first 3 years.

Whole Orchard Recycling: Considerations for Revision

Stakeholder feedback has increasingly requested that annual cropping be allowed.

Entering into Practice:

- UCCE is working (successfully) in annual systems in post-WOR fields (Leinfelder-Miles and co-workers, planting beans).
- Annuals are believed to alleviate nematode pressure before orchard replanting (Holtz, B., in email).
- Cover cropping following WOR is proposed by some HSP applicants, but was left in a gray zone by the requirement language.

Non-GHG sustainability benefits:

- WOR can be expected to increase water retention in annual systems, as it has in perennials.
- WOR can be expected to improve soil health metrics beyond soil organic carbon, as it has in perennials.

Intensifying drought:

- Return of drought makes perennial planting more risky.
- Annual cropping reduces dust vs. dry fallowing, so discouraging it seems undesirable.

Whole Orchard Recycling: DNDC Modelling of Annual Cropping

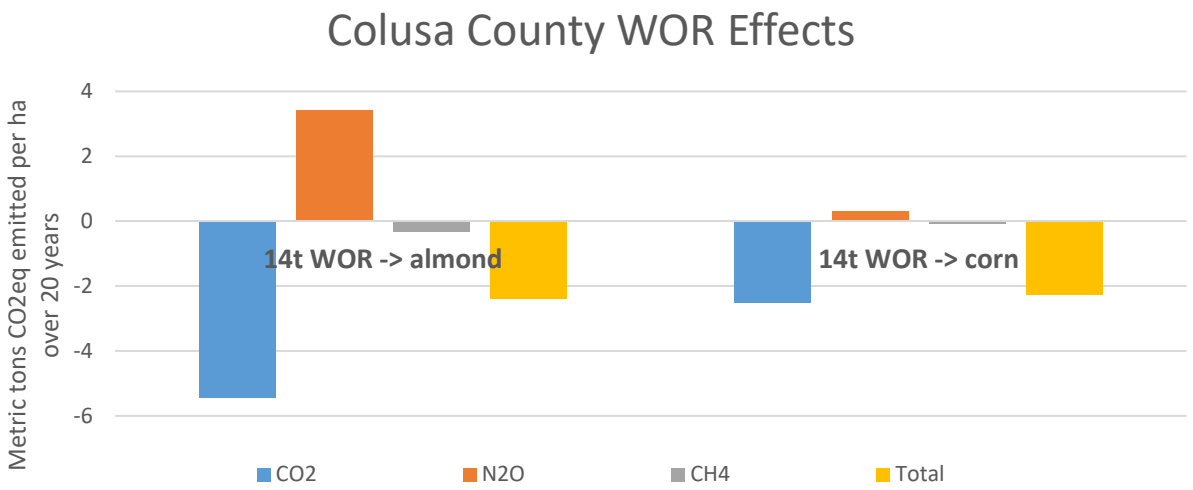
Would annual crops after WOR still offer overall GHG benefits, making it acceptable for HSP incentives?

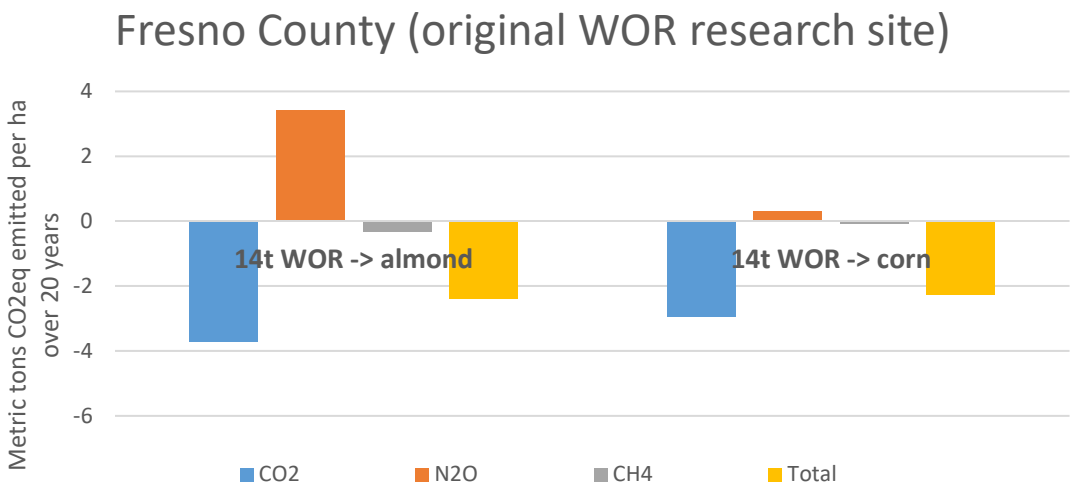
CDFA undertook modeling:

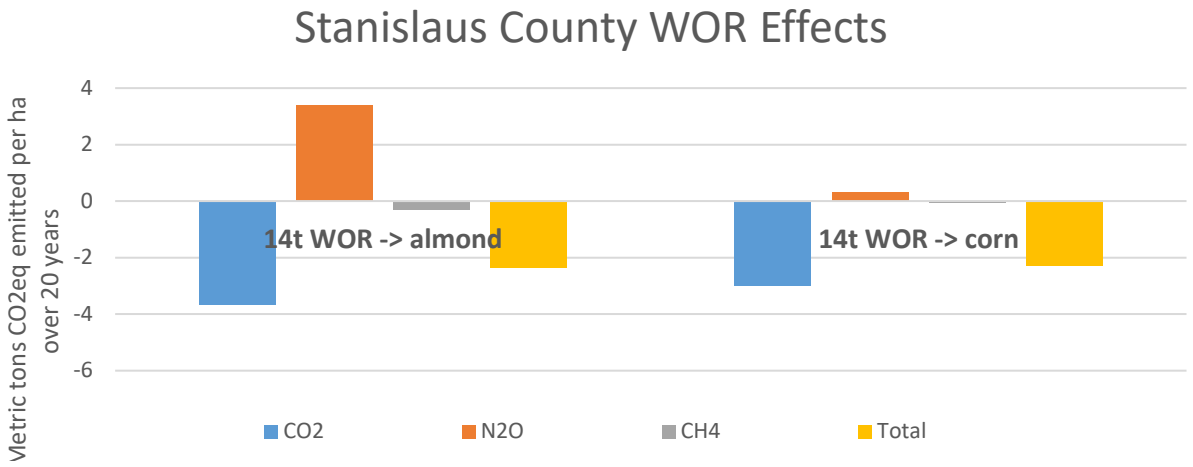
- Grain corn was chosen as the annual test crop
  - Uses high N rates (higher N_2O emissions, making it conservative)
  - Relatively high tillage rates (lowering soil organic carbon sequestration, making it conservative)
  - Well characterized by literature
  - Similar to silage corn (for which less data is available for model parameterization)
  - Relatively wide distribution, including silage corn, overlapping well with almond distribution

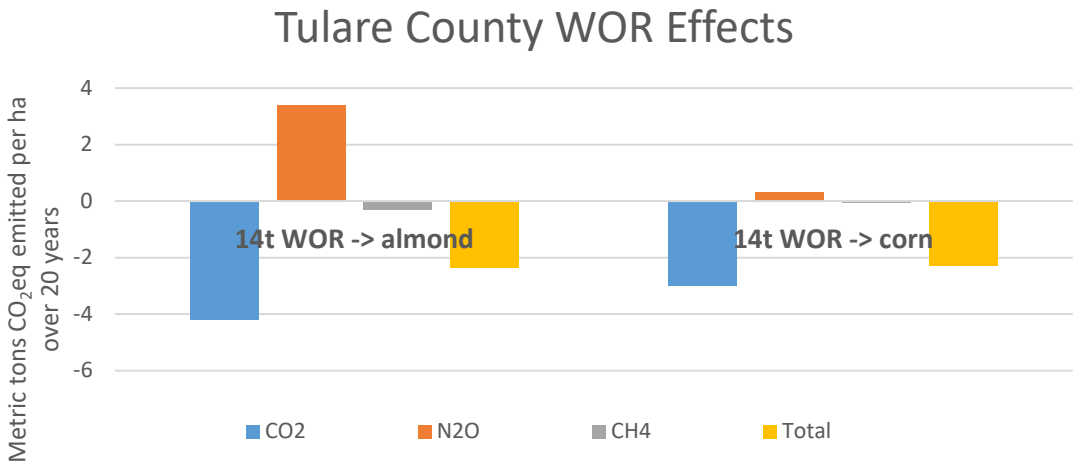
- Modelling Parameters followed our procedure from 2019-20:
  - 20 years of modelled effects (monocropping grain corn).
  - County average soil parameters.
  - Daily local CIMIS weather records for 2008-2017 for Years 1-10, then repeated for Years 11-20.
  - Irrigation adjusted for local needs.
  - Nitrogen fertilization held constant at industry standard (310 kg N/ha/yr = 277 lbs N/acre/yr).
  - 14 ton/acre of woodchips applied, reflecting minimum seen in WOR candidate crops (prunes), which is about ½ that seen in almonds.

Whole Orchard Recycling: Modelled GHG Emissions









In DNDC simulations, Corn planting after WOR shows substantial benefits in soil organic carbon sequestration, with only small increases in N_2O emissions.

Whole Orchard Recycling: Suggested Requirements

CDFA and CARB staff recommend striking the post-WOR field use restriction, leaving the following requirements:

- WOR can only be incentivized in orchards whose trees are at least 10 years of age (DNDC modelled conditions, to ensure minimum biomass is reached for carbon sequestration).
- ~~Following woodchip incorporation, land must be fallowed or replanted with trees within 3 years (consistent with the HSP grant term of 3 years and DNDC modelled conditions).~~
- Orchards must be chipped and incorporated in place on the field in which they were grown (for verification and DNDC modelled conditions).
- The WOR practice shall not be implemented in soils with Soil Organic Matter greater than 20% (DNDC modelled conditions).
- Chips must be evenly distributed throughout the orchard (consistent with DNDC modelled conditions). If a service provider is contracted, their commitment to spread the wood chips must be in the contract/invoice for verification purposes.
- Chips must be incorporated into the soil to at least 6 inches depth (DNDC modelled conditions).

Questions or Comments?

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