Table 1. Baseline assumptions for each region, represented by a single county’s enterprise budget

|  |  |  |  |
| --- | --- | --- | --- |
|  | Tulare County | Siskiyou County | Imperial County |
| Subsequent crop, fertilizer credit from alfalfa | Tomatoes, 170 | Wheat, 80 | Wheat, 80 |
| Planting rate | 25 lb/ac | 20 lb/ac | 20 lb/ac |
| Irrigation source, ground/surface water | 50/50 | 50/50 | 0/100 |
| Well depth (note: NRCS says CA state average is 236 feet) | 500 feet (Mike said 300-1,500 feet, gets deeper as you move west, he thought 500 feet might be a good estimate for Tulare) | 150 feet | NA |
| Amount of water applied | 8 ac-in establishment,  64 ac-in/year production | 4.5 ac-in establishment,  24 ac-in/year production | 18 ac-in establishment,  84 ac-in/year production |
| Establishment irrigation type, efficiency | Sprinkler, 80% | Pivot, 80% | Sprinkler, 80% |
| Production irrigation type, efficiency | Flood, 70% | Pivot, 80% | Flood, 70% |
| Role of pump (see pump table) | Before drip (filter and pressure reg), before sprinkler (probably contracted out) regardless of water source | Pump from river or ground for flood, add’l pump for drip (to go through filter and control pressure in lines), one pump for all other application types | Pump into sprinkler or drip system, no pumps for flood irrigation. |
| Irrigation pump energy source, work conversion efficiency | Diesel, 30% | Diesel, 30% | Diesel, 30% |
| Fertility | 200 lb/ac MAP at establishment | 300 lb/ac MAP at establishment, 25 gal 10-34-0 each production year | 200 lb/ac MAP and 250 lb/ac potash at establishment, 75 lb/ac MAP and 250 lb/ac potash each production year |
| Stand life | 3 years | 6 years | 3 years (Irrigation guy didn’t like this number, but it’s the enterprise budget value) |
| Number of harvests | 9 (2 haylage, 7 hay) | 3 | 12 (3 green chop, 9 hay) |
| Dry matter harvested | 8 dry Mg/ha | 3 dry Mg/ha Giuliano says 4.5-7.5, unsure if this dry or not | 8 dry Mg/ha (Ali didn’t like this number, but it is what is in the enterprise budget) |
| Pesticide application method | Tractor | Tractor, could do through irrigation system | Tractor/aerial |
| Average number of field passes per year | 11 | 6.8 | 16 |

Table 2. Scenarios – note all changes are individually made to the base scenario (i.e. no stacking of scenarios has been done).

|  |  |
| --- | --- |
| Name | Description |
| All ground water | All water requirements are assumed to be met using water pumped at 25 psi from 150 foot deep well |
| All surface water | All water requirements are assumed to be met using water pumped at 25 psi from a surface source |
| Deficit irrigation | (Tulare only)  Water use is decreased from 64 ac-in per year to 51 ac-in per year (based on Ottman and Putnam), no July and August harvests of hay resulting in only 7 harvests instead of 9. Hay yields are reduced from 10 Mg ha-1 per year to 7 Mg ha-1 per year. All other field activities are assumed to remain the same. |
| Stand life extension | Stand life is increased by one-third (3 to 4 years in Tulare, 6 to 8 years in Siskiyou) |
| Double pump pressure | Pump pressure is doubled from 25 psi to 50 psi |
| Double well depth | Well depth is doubled from 150 to 300 feet, larger the range the more impactful this assumption |
| Eliminate pesticides | Eliminate passes and embedded energy |
| Electrify irrigation | Change energy source for pumping irrigation water to electric (90% work conversion efficiency). |
| Electrify harvest operations | Change harvest operations energy source to electric. |
| Electrify field operations | Change all operations except harvest to electric. |
| Change from flood/sprinkler irrigation to drip irrigation | Here we assume you have to apply more water than the crop actually needs due to water losses from the irrigation type. Efficiencies are flood < sprinkler < drip (70%, 80%, 90%). |
| Eliminate insecticides | Eliminate passes and products |
| Eliminate herbicides | Eliminate passes and products |
| Surface water, gravity fed irrigation (no irrigation energy used) | (Tulare only) |
| No leaching-derived N2O emissions | N2O from volatilization provides wet and dry climate values (used dry climate values). The fraction leached is set at 0.24 ‘in wet climates’, but the leaching/runoff derived N2O has only a static value (0.011 of the amount leached). May need to rerun everything eliminating this component (I don’t think California has a nitrogen leaching problem?) |
| Pasture carbon credit | From California Healthy Soils, specific to each county |
| No carbon credit | From California Healthy Soils, specific to each county |
| Eliminate fertilizer offset | The crop following alfalfa will require less nitrogen compared to if it followed another annual crop. Many studies don’t take this credit into account. |

Ottman and Putnam (??) deficit irrigation with alfalfa: What are the economics? <https://alfalfa.ucdavis.edu/+symposium/2017/PDFfiles/Ottman%20Mike.pdf>

IPCC 2019 refinement https://www.ipcc-nggip.iges.or.jp/public/2019rf/vol4.html

Pump table

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| county | water\_source | irr\_type | Surface source, pump psi | Ground source, pump psi |
| tulare | surface | flood | 0 | 50 |
|  |  | drip | 30 | 80 |
|  |  | sprinkler | 50 | 100 |
| siskiyou | surface | flood | 50 | 50 |
|  |  | drip | 80 | 80 |
|  |  | sprinkler | 50 | 50 |
|  |  | wheel line | 40 | 40 |
|  |  | pivot | 40 | 40 |
| imperial | surface | flood | 0 | - |
|  |  | sprinkler | 50 | - |
|  |  | drip | 30 | - |