DevTreks –social budgeting that improves lives and livelihoods

Capital Input Calculations

Last Updated: September 05, 2018; First Released: November 29, 2012

Author: Kevin Boyle, President, DevTreks

Version: DevTreks 2.1.6 (1*)

A. Introduction

This reference summarizes basic cost calculations for machinery, irrigation, and general capital Inputs (**2***).

B. Data URLs

These examples derive from examples found in the References. Many of those examples had to be adapted to the requirements of each calculator. The club, Core Sample Economics Datasets, owns this data (if needed, switch default clubs).

The Calculators explained in this reference can be found at:

https://www.devtreks.org/agtreks/preview/crops/linkedviewgroup/Machinery Calculators Group/10/none/

The examples explained in this reference can be found at:

https://www.devtreks.org/agtreks/select/crops/inputgroup/Calculator Examples/2126771346/none

http://localhost:5000/agtreks/select/crops/inputgroup/Calculator Examples/2126771346/none

This reference used the cloud deployment (Version 2.0.0) to document calculations. The *Calculator and Analyzer* tutorial provides additional information about how calculators work. Make sure to read the footnotes before testing the calculations.

C. Base versus Budget Inputs and Outputs

Most Input and Output calculators generate a composite price, and sometimes a unit of measure (i.e. the food nutrition calculators). Examples of composite prices are the operating cost prices in the examples below. The Input's Operating cost price is a composite of repair, fuel, labor, and lube costs. The price and unit become part of a Budget's Inputs and Outputs through a relational database link between an Input or Output base table and the Budget's Inputs and Outputs (**3***). These prices and units can't be changed in the Budget.

The same is not true with Input and Output amounts. No relational database link exists between the base Input or Output's amount and the Budget's amount (**4***). However, not all Input and Output amounts can be changed in the Budget. Amounts can't be changed in a Budget's Inputs and Outputs when the base Input or Output uses a calculator that sets an amount for the base Input and Output. Examples include the machinery calculators. In these cases, the base Input or Output's calculator is rerun in certain Budget calculators. Examples include all of the net present value calculators. The Input and Output amounts in the net present value calculations come from rerunning base Input and Output calculators. This behavior is by design –some amounts, such as machinery or food nutrition, should be calculated by calculators and not by hand.

Use the "Times" property of Input and Outputs in Budgets, to further adjust Input and Output amounts. For example, many food calculations are run using a base Input amount of 1 slice of bread (or actual serving size). To account for 2 slices of bread in a food operation, such as a sandwich, set the bread's "Times" property to "2". If the calculator's author has done their job properly, the base Input or Output calculation attributes (i.e. food nutrition attributes) will be multiplied by the "Times" to come up with accurate operation calculations. Always check calculations to ensure the accuracy of these calculations and inform the calculator author of any discrepancies.

How can you tell whether or not base Input or Output calculators are being rerun, and their amounts can't be manually changed? Check the documentation for the base calculator –if it changes an amount, it will be rerun. Alternatively, check the calculations in the calculators used in Budgets. Manual Input and Output changes won't appear when base calculators are setting those properties.

D. Machinery Calculator (5*)

This example explains the various calculations found in the Agricultural Machinery Calculator. The equations used will be referenced from the Hallam et al (AAEA) reference. This calculator is appropriate for agricultural machinery and may be appropriate for some construction machinery.

Stand Alone vs. Joint Calculations

When machinery calculations are first run on Inputs, the implements being pulled by a power Input, such as a tractor, are not known. Similarly, the power Input being used by implements may not be known. The resultant calculations should be interpreted as ‘untypical’ cost calculations. They can be made more ‘typical’ by changing some of the parameters, such as speed, width, maximum pto HP, and equivalent pto horsepower, based on typical accompanying machinery.

When the Inputs are combined into operations or components and net present value calculators are run, calculations are rerun, accounting for the interrelationships between power and nonpower Inputs. Power Inputs set maximum PTO horsepower properties while nonpower Inputs set equivalent PTO horsepower and field capacity properties. The resultant calculations can be interpreted as ‘typical’ cost calculations. DevTreks does not allow manual adjustment of calculations within Budgets. The time that may be spent adjusting and readjusting the calculations is not justified –we recommend spending the time with the calculations in the base Inputs.

Options

Four options, as shown in the image below, can be set for carrying out calculations:

Capacity: allows the services (and costs) generated by machinery to be set on an area or material basis. The default option, hours/acre, places machinery costs on an hours/acre basis (i.e. if the machinery carries out 0.20 hours of work per acre, costs will be based on 0.20 hours of Output).

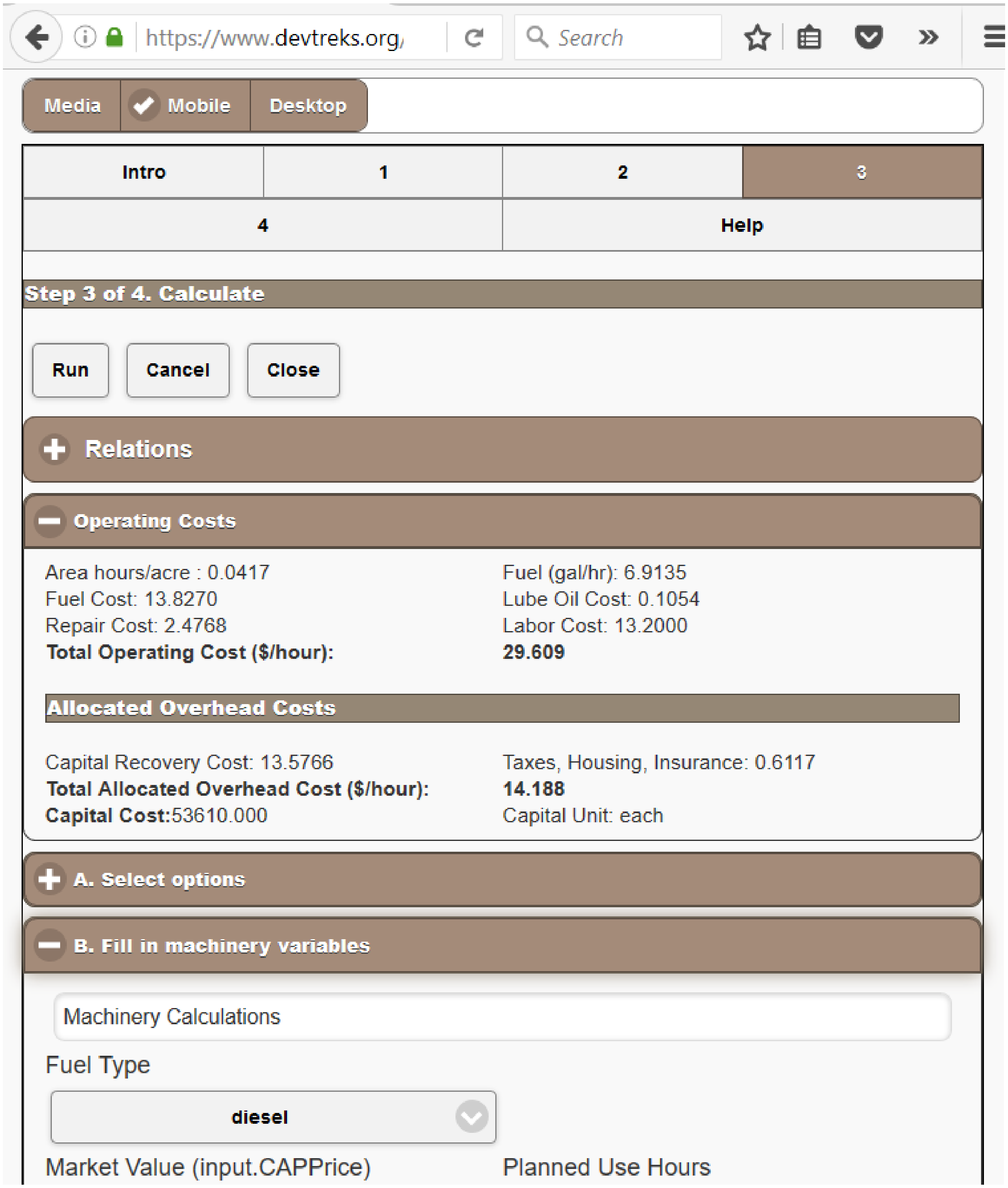
Vary Time and Output: allows costs and/or Outputs to vary over time; refers to the specific AAEA equations being used. The last option, employing equation 6.A3, is not believed to work correctly in version 1.

Inflation: allows inflation to be included in final calculations; most of the AAEA equations found under the *Vary Time and Output* options offer these as optional ways to carry out the calculations

Fuel: permits fuel to be calculated on an enterprise or operation basis.

Example 1. Tractor New, Stand Alone

This tractor is an example of a stand-alone tractor.



Capacity Option: Area (hours/acre)

Vary Cost and Time Option: Costs Do Not Vary Over Time

Inflation Option: Do Not Use Inflation

Fuel Option: Base on Operation

Area *(hours/acre)* (equation 5.6):

*.0417 (hours per acre capacity) = 1 / (20.00 (speed) * 10 (width) * 0.99 (field efficiency)) / 8.25)*

Fuel (*gal/hr*) (equation 5.21).

.099 (fuel multiplier) = .52 (70(eqiv. pto hp)/140(max. pto hp)) + .77 - (.04* ((738 *(70/140)) + 173)^0.5))*

*6.91 (gal/hr) = 70 (eqivalent pto hp) * .099 (fuel multiplier)*

Fuel Cost (per hour use) (the price for diesel fuel is one of the price constants set in the calculator)

*$13.83 = 6.91 * $2/gal for diesel*

Lube and Oil Cost (per hour use): (equation 5.22; the price for oil is one of the price constants set in the calculator)

Amount: .0351 gal/hr **=** *0.00021 * 140 (horsepower)) + .00573*

*$0.11 = $3.00/gal oil * .0351 Lube Amount*

Labor Cost (per hour use)

Amount 1.1 = 1 + (10 Labor Adj / 100)

*13.20 = 12.00 machinery labor per hour * 1.1 Labor Amount*

Repair Cost (per hour use): (equation 5.8 and example on pages 5-15 and 5-15)

*$58,971 (initial list price) = $53,610 (market value) * 1.10 (list price adjustment)*

*$14,860.69 (total cumulative repair costs) = .007 (rf1) * $58,971 (list price) * ((6,000 (eff. life) / 1,000))^2.0(rf2))*

$2.47 (avg. repair and maintenance cost per hour) = $14,860.69 / 6,000 (eff. life)

Total Operating Cost per Hour

$29.61 = 13.83 Fuel + 0.11 Lube + 13.20 Labor + 2.48 Repair

Capital Recovery Cost (per hour use): (equation 6.7 or 6.10)

Effective Life: 20 = 6,000 Useful Life Hours / 300 Planned Use Hours

Capital Recovery Factor .080 = use .05 real rate and 20 Years

*$4072.99 (annual cap. rec. cost) = $53,610 (market value) - ($7,566 (salvage value) / (1.05 real rate)^20 (eff life)) * .080 CRF*

$13.58 (cap. recov. cost per hour) = $4072.99 / 300 (annual hrs. use)

Taxes, Housing and Insurance (per hour use): (table 6.7)

Amount: .065 = .002 (taxes) + .002 (housing) + .0025 (insurance)

Salvage Value $2,851.55 = factors: $7,566 Salvage Value, 20 Year Life, .05 real rate

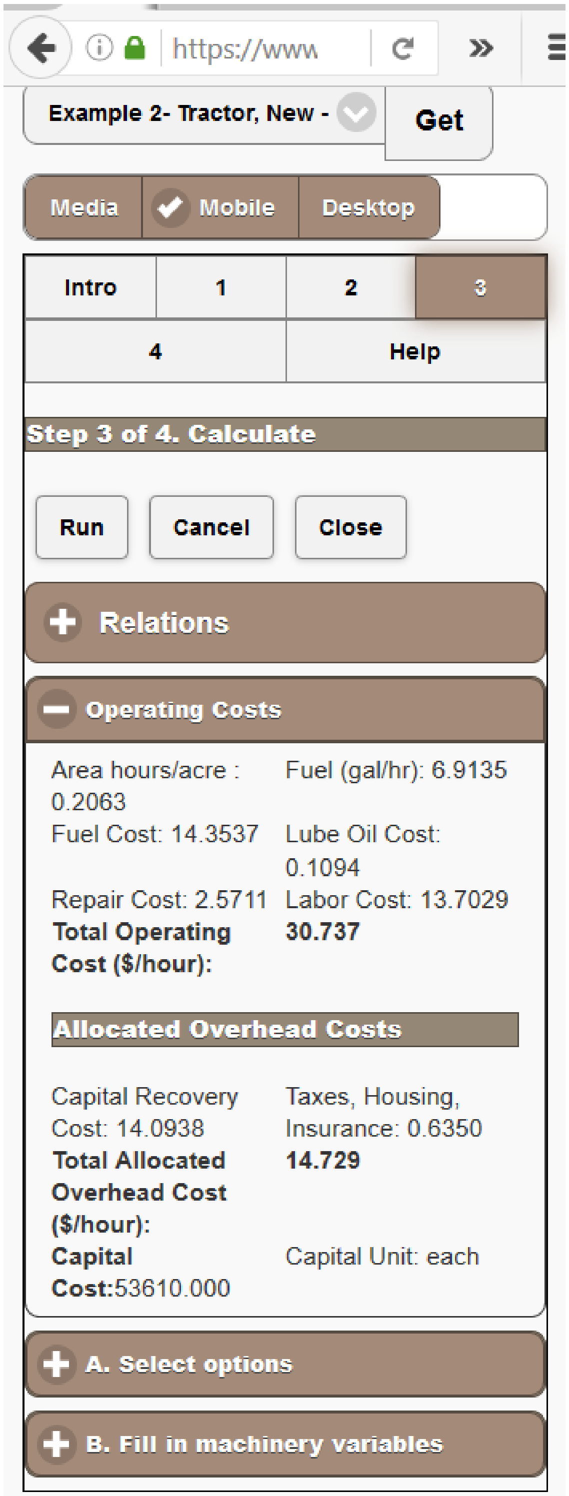
*Total Annual Cost: 183.50 = (($53,610,000 Market value + $2,851.55 Salvage Value / 2) * .0065)*

THI Cost per hour: $0.61 = 183.50 / 300 Planned Use Hours

Total Allocated Overhead Cost per Hour

14.19 = 13.58 Cap Recovery + .61 THI

Example 2. Tractor New, Implement Adjusted


https://www
Example 2- Tractor, New -
Get
Media
Mobile
Desktop
Intro
1
2
3
4
Help
Step 3 of 4. Calculate
Run
Cancel
Close
Relations
Operating Costs
Area hours/acre : 0.2063
Fuel (gal/hr): 6.9135
Fuel Cost: 14.3537
Lube Oil Cost: 0.1094
Repair Cost: 2.5711
Labor Cost: 13.7029
Total Operating Cost ($/hour):
30.737
Allocated Overhead Costs
Capital Recovery Cost: 14.0938
Taxes, Housing, Insurance: 0.6350
Total Allocated Overhead Cost ($/hour):
14.729
Capital Cost:53610.000
Capital Unit: each
A. Select options
B. Fill in machinery variables

This is the same tractor as example 1, but the machinery parameters are adjusted based on 'average' implements being pulled, and inflation is allowed for the first year.

Capacity Option: Area (hours/acre)

Vary Cost and Time Option: Costs Do Not Vary Over Time

Inflation Option: Use Inflation First Year

Fuel Option: Base on Operation

Area *(hours/acre)* (equation 5.6):

*.2063 (hours per acre capacity) = 1 / (5.00 (speed) * 10 (width) * 0.80 (field efficiency) / 8.25)*

Fuel (*gal/hr*) (equation 5.21).

.099 (fuel multiplier) = .52 (70(eqiv. pto hp)/140(max. pto hp)) + .77 - (.04* ((738 *(70/140)) + 173)^0.5))*

*6.91 (gal/hr) = 70 (eqivalent pto hp) * .099 (fuel multiplier)*

Fuel Cost (per hour use) (the price for diesel fuel is one of the price constants set in the calculator)

*$14.36 = 6.91 * $2/gal for diesel * 1.038 inflation rate*

Lube and Oil Cost (per hour use): (equation 5.22; the price for oil is one of the price constants set in the calculator)

*Amount: .0351 gal/hr = 0.00021 * 140 (horsepower)) + .00573*

*$0.11 = $3.00/gal oil * .0351 Lube Amount * 1.038 inflation rate*

Labor Cost (per hour use)

Amount 1.1 = 1 + (10 Labor Adj / 100)

*13.71 = 12.00 machinery labor per hour * 1.1 Labor Amount * 1.038 inflation rate*

Repair Cost (per hour use): (equation 5.8 and example on pages 5-15 and 5-15)

*Discounted List Price: $61,217 = $58,971 * 1.038 inflation rate*

*$15,426 (total cumulative repair costs) = .007 (rf1) * $61,217 (list price) * ((6,000 (eff. life) / 1,000))^2.0)*

$2.57 (avg. repair and maintenance cost per hour) = $15,426 / 6,000 (eff. life)

Total Operating Cost per Hour

$30.74 = 14.36 Fuel + 0.11 Lube + 13.71 Labor + 2.57 Repair

Capital Recovery Cost (per hour use): (equation 6.7 or 6.10)

$4.072.99 (annual cap. rec. cost) = $53,610 (market value) - ($7,566 (salvage value) / (1.05)^20 (eff life)) / (1 - (1 / (1.05)^20) / .05)

*$4228.15 = $4,072.99 * 1.038 inflation rate*

$14.09 (cap. recov. cost per hour) = $4.228.15 / 300 (annual hrs. use)

Taxes, Housing and Insurance (per hour use): (table 6.7)

Amount: .065 = .002 (taxes) + .002 (housing) + .0025 (insurance)

Salvage Value $2,851.55 = factors: $7,566 Salvage Value, 20 Year Life, .05 real rate

*Total Annual Cost: 183.50 = (($53,610,000 Market value + $2,851.55 Salvage Value / 2) * .0065)*

*THI Cost per hour: $0.64 = 183.50 / 300 Planned Use Hours * 1.038 inflation rate*

Total Allocated Overhead Cost per Hour

14.73 = 14.09 Cap Recovery + .64 THI

Example 3. Tractor, 140 HP New

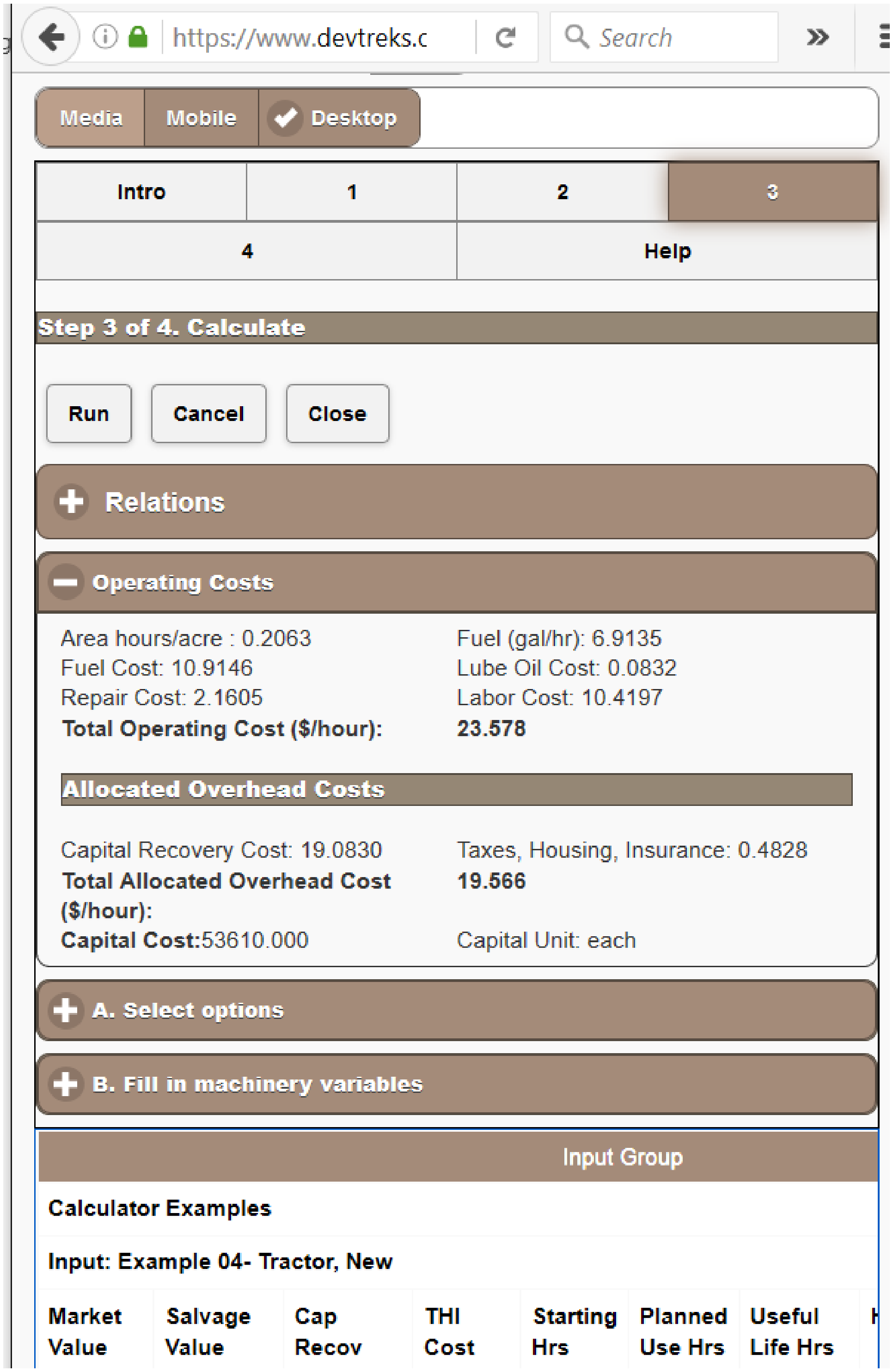
This tractor is the same one as in example 2 except for the following changes in the options being used:

Capacity Option: Area (hours/acre)

Vary Cost and Time Options: Costs Vary Over Time

Inflation Options: Use Inflation all years

Fuel Options: Base on Operation



***Area** (hours/acre)* (equation 5.6; if the tractor is pulling an implement, the area (i.e. the Input quantity used in Budgets) should be adjusted to match the implement):

*.2063 (hours per acre capacity) = 1 / (5.00 (speed) * 10 (width) * 0.80 (field efficiency) / 8.25)*

Fuel (*gal/hr*) (equation 5.21).

.099 (fuel multiplier) = .52 (70(eqiv. pto hp)/140(max. pto hp)) + .77 - (.04* ((738 *(70/140)) + 173)^0.5))*

*6.91 (gal/hr) = 70 (eqivalent pto hp) * .099 (fuel multiplier)*

Fuel Cost (per hour use) (the price for diesel fuel is one of the price constants set in the calculator)

*$13.83 = 6.91 * $2/gal for diesel*

*$4148 (initial fuel cost per year) = $13.82 * 300 (hours of use per year)*

This initial seed cost will then vary over the remaining life of the tractor based on the methods shown in equation 5.18 and table 5.4 to yield:

$10.91 Fuel Cost per Hour

Lube and Oil Cost (per hour use): (equation 5.22; the price for oil is one of the price constants set in the calculator)

Amount: .0351 gal/hr **=** *0.00021 * 140 (horsepower)) + .00573*

*$0.11 = $3.00/gal oil * .0351 Lube Amount*

*$31.62 = 0.105 * 300 (hours of use per year)*

This initial seed cost will then vary over the remaining life of the tractor based on the methods shown in equation 5.18 and table 5.4 to yield:

$.083 Lube Oil Cost per Hour

Labor Cost (per hour use)

Amount 1.1 = 1 + (10 Labor Adj / 100)

*13.20 = 12.00 machinery labor per hour * 1.1 Labor Amount*

*$3,960 = 13.20 * 300 (hours of use per year)*

This initial seed cost will then vary over the remaining life of the tractor based on the methods shown in equation 5.18 and table 5.4 to yield:

$10.42 Labor Cost per Hour

Repair Cost (per hour use): (5.18 and table 5.4)

*Discounted List Price: $61,217 = $58,971 * 1.038 inflation rate*

*$15,426 (total cumulative repair costs) = .007 (rf1) * $61,217 (list price) * ((6,000 (eff. life) / 1,000))^2.0)*

$2.57 (avg. repair and maintenance cost per hour) = $15,426 / 6,000 (eff. life)

*$31.62 = 0.105 * 300 (hours of use per year)*

This initial seed cost will then vary over the remaining life of the tractor based on the methods shown in equation 5.18 and table 5.4 to yield:

$2.16 Repair Cost per Hour

Total Operating Cost per Hour

$23.58 = 10.91 Fuel + 0.08 Lube + 10.42 Labor + 2.16 Repair

Capital Recovery Cost (per hour use): (equation 6.7 or 6.10)

$5.725.90 (annual cap. rec. cost) = $53,610 (market value) - ($7,566 (salvage value) / (1.09)^20 (eff life)) / (1 - (1 / (1.09)^20) / .09)

$19.08 (cap. recov. cost per hour) = $5.725.90 / 300 (annual hrs. use)

Taxes, Housing and Insurance (per hour use): (table 6.7)

Amount: .065 = .002 (taxes) + .002 (housing) + .0025 (insurance)

Salvage Value $2,851.55 = factors: $7,566 Salvage Value, 10 Year Life, .05 real rate

*Total Annual Cost: 189.33 = (($53,610,000 Market value + $2,851.55 Salvage Value / 2) * .0065)*

THI Cost per hour: $0.63 = 183.50 / 300 Planned Use Hours

*183.50 = 0.61 * 300 (hours of use per year)*

This initial seed cost will then vary over the remaining life of the tractor based on the methods shown in equation 5.18 and table 5.4 to yield:

$.48 THI Cost per Hour

Total Allocated Overhead Cost per Hour

19.57 = 19.08 Cap Recovery + .48 THI

Example 4. Tractor, 140 HP Used

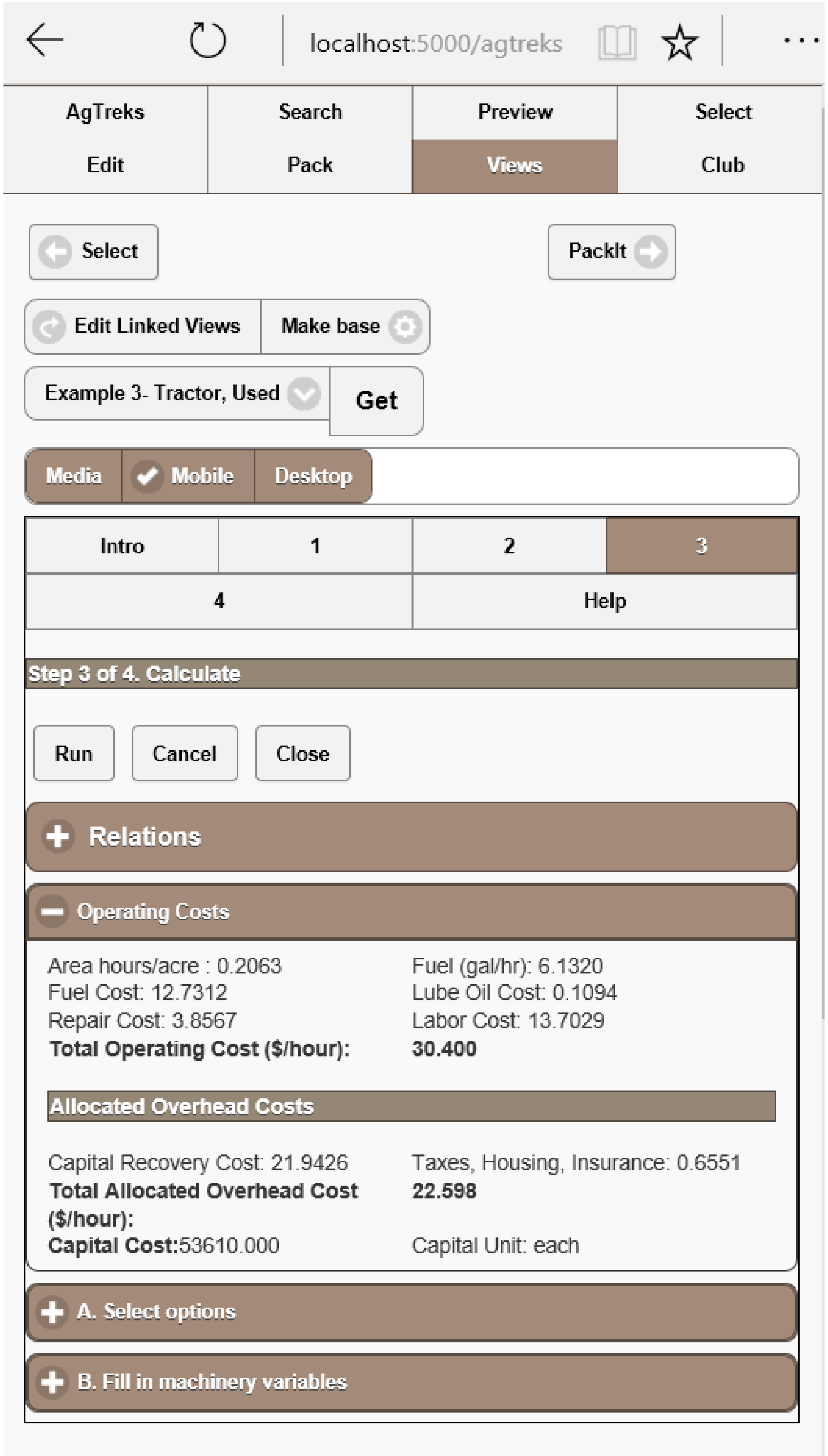
This is the same tractor as example 2 except it is used and uses a different fuel calculation. These calculations come from the localhost:5000 deployment. The cloud deployment uses a $33, 745 Market Value for the tractor (which is consistent with the AAEA reference).

Capacity Option: Area (hours/acre)

Vary Cost and Time Options: Costs Do Not Vary Over Time

Inflation Options: Use Inflation first year

Fuel Options: Base on Enterprise



***Area** (hours/acre)* (equation 5.6):

*.2063 (hours per acre capacity) = 1 / (5.00 (speed) * 10 (width) * 0.80 (field efficiency) / 8.25)*

Fuel (*gal/hr*) (equation 5.21).

*6.13 (gal/hr) = .06 * 140 (pto max hp) * .73*

Fuel Cost (per hour use) (the price for diesel fuel is one of the price constants set in the calculator)

*$12.73 = 6.13 * $2/gal for diesel * 1.038 inflation rate*

Lube and Oil Cost (per hour use): (equation 5.22; the price for oil is one of the price constants set in the calculator)

Amount: .0351 gal/hr **=** *0.00021 * 140 (horsepower)) + .00573*

*$0.11 = $3.00/gal oil * .0351 Lube Amount * 1.038 inflation rate*

Labor Cost (per hour use)

Amount 1.1 = 1 + (10 Labor Adj / 100)

*13.70 = 12.00 machinery labor per hour * 1.1 Labor Amount * 1.038 inflation rate*

Repair Cost (per hour use) : (equation 5.8 and example on page 5-30)

*$58,971 (initial list price) = $53,610 (market value) * 1.10 (list price adjustment)*

*$3,856.70 (cumulative repair costs, 10yrs) = .007 (rf1) * $58,971 (list price) * ((3000 (starting hrs) / 1,000))^2.0) * 1.038 Inflation Rate*

*$15,426.81 (cumulative repair costs, 20yrs) = .007 (rf1) * $58,971 (list price) * ((6000 (useful life) / 1,000))^2.0) * 1.038 Inflation Rate*

$3.88 (avg. repair and maintenance cost per hour) = ($15,426.81 - $3,856.70) / 3,000 (remaining life)

Total Operating Cost per Hour

$30.40 = 12.73 Fuel + 0.11 Lube + 13.70 Labor + 3.86 Repair

Capital Recovery Cost (per hour use): (equation 6.7 or 6.10)

$6341.21 (annual cap. rec. cost) = $53,610 (market value) - ($7,566 (salvage value) / (1.05)^10 (eff life)) / (1 - (1 / (1.05)^10) / .05)

*$6582.78 = $6342 * 1.038 inflation rate*

$21.94 (cap. recov. cost per hour) = $6582.78 / 300 (annual hrs. use)

Taxes, Housing and Insurance (per hour use): (table 6.7)

Amount: .065 = .002 (taxes) + .002 (housing) + .0025 (insurance)

Salvage Value $4,644.87 = factors: $7,566 Salvage Value, 10 Year Life, .05 real rate

*Total Annual Cost: 189.32 = (($53,610,000 Market value + $4,644.87 Salvage Value / 2) * .0065)*

*THI Cost per hour: $0.66 = 189.32 / 300 Planned Use Hours * 1.038 inflation rate*

Total Allocated Overhead Cost per Hour

22.59 = 21.94 Cap Recovery + .66 THI

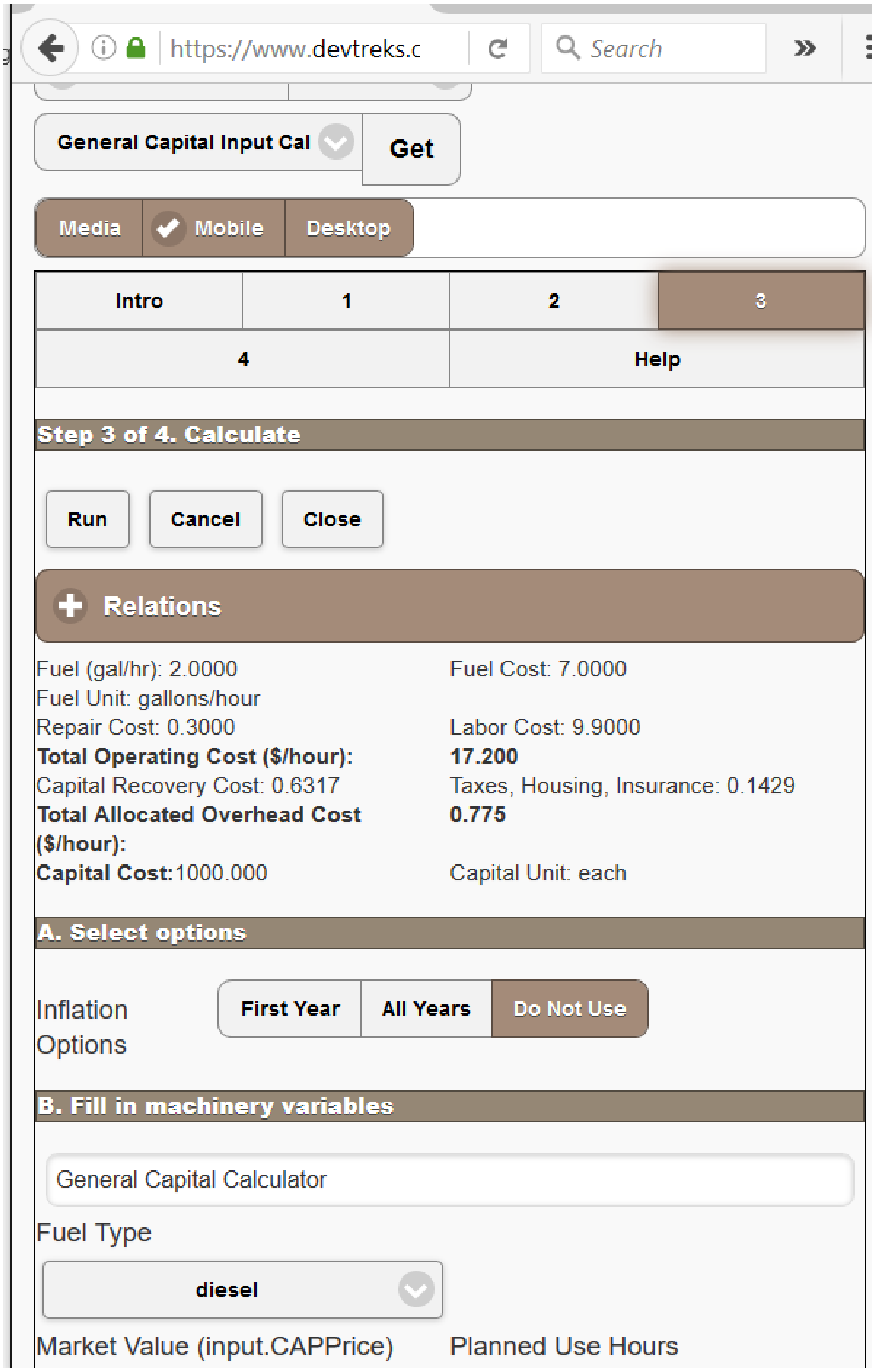
Example 5. Row Cultivator, New

This example can be found in the AAEA reference. It has not been documented in this reference and therefore is left as an exercise for the reader to calculate. The machinery parameters can be found on both the cloud and localhost sites.

E. General Capital Calculator

This example explains the calculations found in the General Capital Calculator. This calculator computes power, repair, and labor costs as operating costs, capital recovery costs and taxes, housing and insurance costs are treated as allocated overhead costs. The calculator is appropriate for capital Inputs that need simple calculations. Joint calculations are not run with this calculator.

Example 1. General Capital Input



Operating Costs

Power (per hour use) Diesel fuel, diesel fuel price, rated energy use, and energy efficiency are set in the calculator.

*Amount: 2 gal/hour = 2.5 gal/hour Rated Energy Use * (80 Energy Efficiency Rating / 100)*

*Cost: $7.00 = 2 gal/hour * $3.50/gal for diesel*

Labor (per hour use) Labor type, labor price, and labor adjustment are set in the calculator. Labor Amount Adjustment can be used to account for set up, clean up, and transport labor costs.

*Amount: 1.1 hour = 1 hour Regular Labor Type + (1 hour Labor * (10 Labor Amount Adjustment / 100))*

*Cost: $9.90 = 2 gal/hour * $9.00/hour for regular labor*

Repair (per hour use) Market value (Input.capprice), planned use hours, and repair and maintenance percent are set in the calculator.

Repair and Maintenance Percent 3% = 3 / 100 (can be entered as 3 or .03)

*Cost: $0.30 = ($1,000 Market Value * .03 Repair and Maintenance) / 100 Planned Use Hours per Period*

***Operating Cost per Hour:** $17.20 = $7.00 Fuel Cost + $9.90 Labor + $0.30 Repair*

Allocated Overhead Costs

Capital Recovery (per hour use) Interest rates, market value, planned use hours, useful life hours and starting hours are set in the calculator.

Years Effective Life: 17 = (2,000 (Useful Life hours) - 300 (Starting hours))) / 100 Planned Use Hours

Discounted Salvage Value: $58.23 = use following factors to discount: 17 years, $75 Salvage Value, 1.5% real rate

Annual Cap. Rec. Cost: $63.17 = use following factors: 0.0671 Capital Recovery Factor *$1,000 (Market Value), $58.23 (Discounted Salvage Value) , 17 Years Life, 1.5% real rate.*

Cap. Recov. Cost per hour $0.63 = $63.17 / 100 (annual hrs. use)

Taxes, Housing and Insurance (per hour use) Rates for each are set in the calculator.

Amount: .027 = .009 (taxes) + .009 (housing) + .009 (insurance)

*THI Cost per hour: $0.14 = (($1,000 Market value + $58.23 Salvage Value / 2) * .0027) / 100 Planned Use Hours*

Allocated Overhead Cost per Hour: *$0.78 = $0.64 Capital Recovery + $0.14 THI*

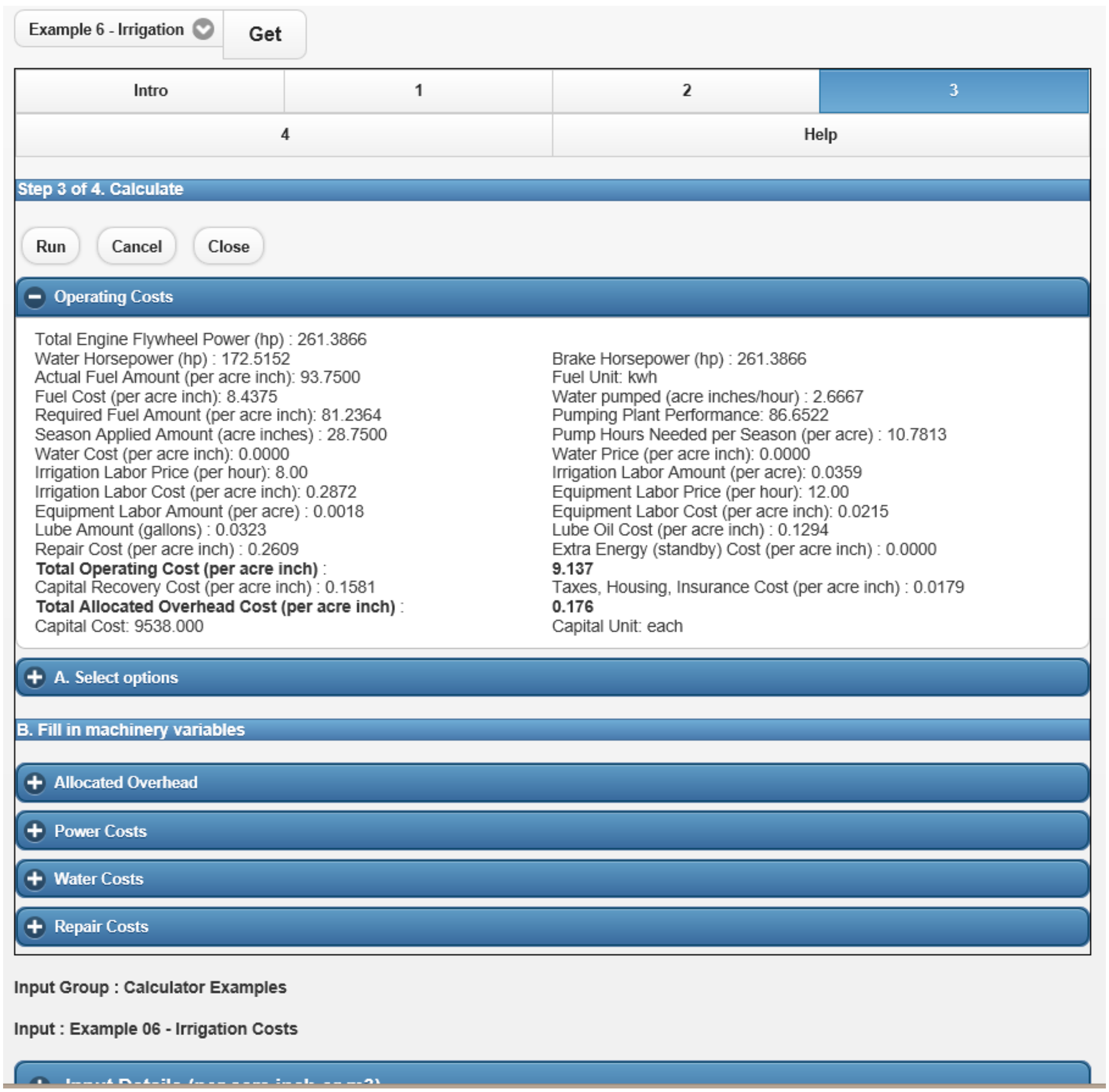
F. Irrigation Calculator

These examples explain the calculations found in the Irrigation Calculator. This calculator computes power, water, repair, and labor costs as operating costs. Capital recovery costs and taxes, housing and insurance costs are treated as allocated overhead costs. The calculator is appropriate for irrigation power Inputs that need complete cost calculations. This calculator sets an Input's OCAmount, OCPrice, AOHAmount, and AOHPrice. Version 1.6.3 recalculated allocated overhead costs based on per acre rather than per hour calculations.

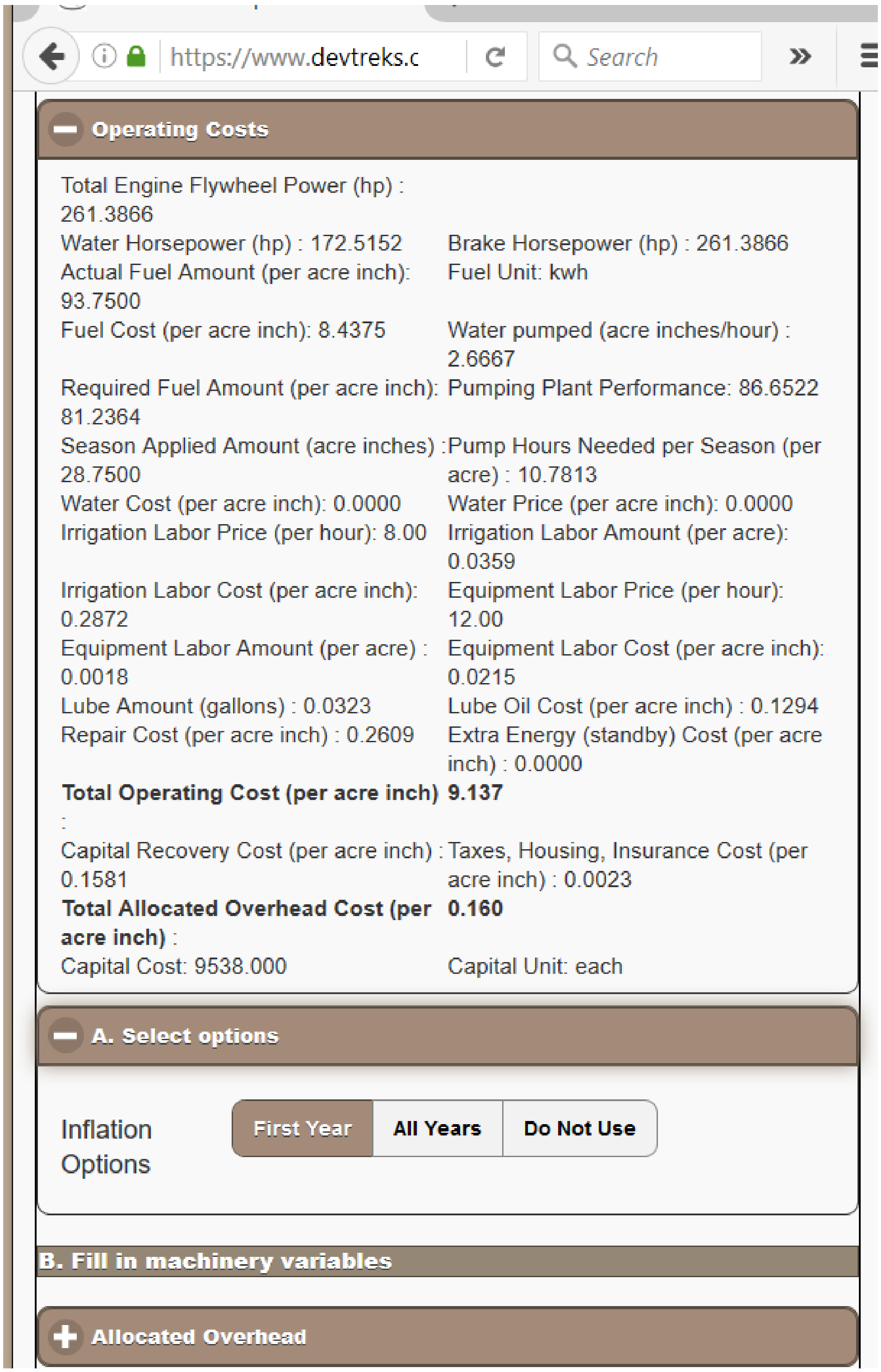
In this example, the 2014 calculations are in the top image and the 2016 calculations are in the bottom image. No changes were made to the source, but changes were made to the allocated overhead cost parameters. The author stopped trying to figure out the exact differences to make the point –how important is it to fine tune calculations involving cents? Calculations must be accurate, but the accompanying video mentions that common sense has to be used with these types of engineering calculations –they're unlikely to ever be perfect. It's better for a social network to define the calculator parameters to use in these types of calculations, rather than having individual club members spend too much time fine-tuning calculations.

Example 1. Electric Motor, Flywheel Energy Use (refer to the Guerrero et al reference)

2014 calculations:



2016 calculations:


https://www.devtreks.c

Search

Operating Costs

Total Engine Flywheel Power (hp) : 261.3866

Water Horsepower (hp) : 172.5152	Brake Horsepower (hp) : 261.3866
Actual Fuel Amount (per acre inch): 93.7500	Fuel Unit: kwh
Fuel Cost (per acre inch): 8.4375	Water pumped (acre inches/hour) : 2.6667
Required Fuel Amount (per acre inch): 81.2364	Pumping Plant Performance: 86.6522
Season Applied Amount (acre inches) : 28.7500	Pump Hours Needed per Season (per acre) : 10.7813
Water Cost (per acre inch): 0.0000	Water Price (per acre inch): 0.0000
Irrigation Labor Price (per hour): 8.00	Irrigation Labor Amount (per acre): 0.0359
Irrigation Labor Cost (per acre inch): 0.2872	Equipment Labor Price (per hour): 12.00
Equipment Labor Amount (per acre) : 0.0018	Equipment Labor Cost (per acre inch): 0.0215
Lube Amount (gallons) : 0.0323	Lube Oil Cost (per acre inch) : 0.1294
Repair Cost (per acre inch) : 0.2609	Extra Energy (standby) Cost (per acre inch) : 0.0000
Total Operating Cost (per acre inch) :	**9.137**
Capital Recovery Cost (per acre inch) : 0.1581	Taxes, Housing, Insurance Cost (per acre inch) : 0.0023
Total Allocated Overhead Cost (per acre inch) :	**0.160**
Capital Cost: 9538.000	Capital Unit: each

A. Select options

Inflation Options: First Year | All Years | Do Not Use

B. Fill in machinery variables

Allocated Overhead

Operating Costs

Power. Power and energy parameters are set in the calculator.

*Total Dynamic Pumping Head 569.3 = 550 (Static Head) + (30 Pressure Head * 2.31 PSI Constant) + 0 Friction Head + 0 Other Head*

*Water HP 172.52 = 1200 Flow Rate * (569.3 Dynamic Pump Head / 3960 Constant)*

*Brake HP 261.39 = 172.52 Water HP / ((66 Pump Efficiency / 100) * (100 Gear Drive Efficiency / 100))*

Engine Flywheel Power 261.39 = 261.39 Brake HP + 0 Extra Power 1 + 0 Extra Power 2

Pump Capacity 2.67 acin/hour = 1200 Flow Rate / 450 GPMToAcreInchConversionFactor

*Note: Metric: 336.6 m3/hour = 1200 Flow Rate * 0.278 LitersPerSecondToM3ConversionFactor*

Fuel (per acre inch or m3)

Horsepower Use per Hour: 261.39 Engine Flywheel Power

Metric HP Use per Hour: 194.92 = 261.39 Engine Flywheel Power (assumes Kw) / 1.341 KwToHPConversionFactor

*Fuel Amount per Acre Inch Formula: kw /ac inch = HP * 2545BTU/HP-HR * kw/dbBTUs(BTUs) * 1/EngineEfficiency * 450/GPM*

*Fuel Amount Required: 81.24 kw/ac in = 261.39 Engine Flywheel Power * (2545 / 3412) * (1 / (90 / 100)) * (450 / 1200)*

Fluids Metric: Step 1. Converts gallons to liters

Fluids Metric Step 2. Converts liters per acin to liters per m3: 5 liters per m3 = 20 liters used per ac in / 102.8 cubic m3 per ac in

Fuel Amount Actually Used per Hour: 250 kw/hr

Fuel Amount Used per Unit Water: 93.75 kw/acin = 250 kw/hour / 2.67 Pump Capacity (acin/hour)

*Pumping Plant Performance: 86.65 = (100 * 81.24 kw/acin Required) / 93.75 kw.acin*

*Fuel Cost: $8.44 per acre inch = 93.75 kw/acin * $0.09 kwH*

Lube Oil Costs (per acre inch or m3)

Lube Amount = 0.086 gal per hour (see machinery cost examples above)

Lube Amount per acin: 0.032 = 0.086 (gal/hr) / 2.67 Pump Capacity (acin/hour)

*Lube Oil Cost per acre inch: .13 = 0.032 * $4.00 gallon*

Water Costs (per acre inch or m3)

Season Water Applied 28.75 acin = (25 acin Season Water Need – 5 acin Season Water Extra Credit + 3 acin Season Water Extra Debit) / (80 Distribution Uniformity/ 100)

*Water Cost per acre inch $0 = (28.75 acin * $0.00 Water Price (per acin)) / 28.75 acin*

Pump Hours per ac (ha) 10.78 = (28.75 acin / 2.67 Pump Capacity (acin/hour))

Labor (per acre inch or m3)

*Total Season Labor Hours: 160 hours = 8 Irrigation Times * 10 hours Duration per Set * 2 Hours Labor Used per Set*

*(Note: Planned Use Hours can be derived from Irrigation Time * Duration per Set)*

Labor Hours per Acre (ha) 1.032 = 160 hours / 155 Net Irrigation Acres

Labor Amount per Acre Inch 0.036 = 1.032 / 28.75 AcIn Applied

*Labor Cost per Acre (ha) $8.26 = 1.032 hours * $8.00 Hour Machinery Selected Type*

Water Labor Cost per Acre Inch: $0.287 = $8.26 / 28.75 AcIn Applied

*Equipment Labor Amount per Acre Inch: 0.002 = 0.036 Labor Amount per AcIn * (5 Labor Adjustment/100)*

*Equipment Labor Cost per Acre Inch: $0.02 = .0002 * $12.00 Machinery Labor Cost per Hour*

Repair (per acre inch or m3)

Repair Cost per Acre Inch: 0.261 = $7.5 Repair Cost per Net Acre (ha) / 28.75 AcIn Applied

If Repair and Maintenance Is Used Instead

Repair Cost per Net Acre (ha) = Market Value / ((RandM Percent / 100) / (Irrigation Net Area)

Repair Cost per Acre Inch = Repair Cost per Net Acre / Season Acre Inch Applied

Extra Energy (per acre inch or m3)

Extra Energy Cost per Acre Inch $0 = $0 Extra Energy Cost per Net Acre / 28.75 AcIn Applied

Operating Cost per Acre Inch: *$9.14 = $8.44 Fuel Cost + $0.13 LubeOil + $0.29 Water Labor $0.02 Equipment Labor + $0.26 Repair + $0 Extra Energy + $0 Water Cost*

Operating Cost per Acre (ha) *$274.85 = $9.56 * 28.75 Applied AcIn*

Allocated Overhead Costs

Capital Recovery (per acre inch or m3) Interest rates, market value, planned use hours, useful life hours and starting hours are set in the calculator**.**

Years Effective Life: 15 = (2,250 (Useful Life hours) - 0 (Starting hours))) / 150 Planned Use Hours

Capital Recovery Factor: 0.078 based on 15 Years, .02 real rate

Discounted Salvage Value: $743.01 = use following factors to discount: 15 years, $1000 Salvage Value, 2.0% real rate

Annual Cap. Rec. Cost: $684.47 = use following factors: 0.078 Capital Recovery Factor *$9,538 (Market Value), $743.01 (Discounted Salvage Value) , 15 Years Life, 2.0% real rate.*

*Inflation Adjusted: $704.61 = $684.47 * 1.0294 Inflation Rate*

Cap. Recov. Cost per acre $4.54 = $704.61 / 155 (Net Irrigation Acres)

Cap Recovery Cost per Acre Inch $0.16 = $4.54 ($/ac) / 28,75 (acin/ac)

Taxes, Housing and Insurance (per acre inch or m3) Rates for each are set in the calculator.

Amount: .0155 = .005 (taxes) + .0055 (housing) + .005 (insurance)

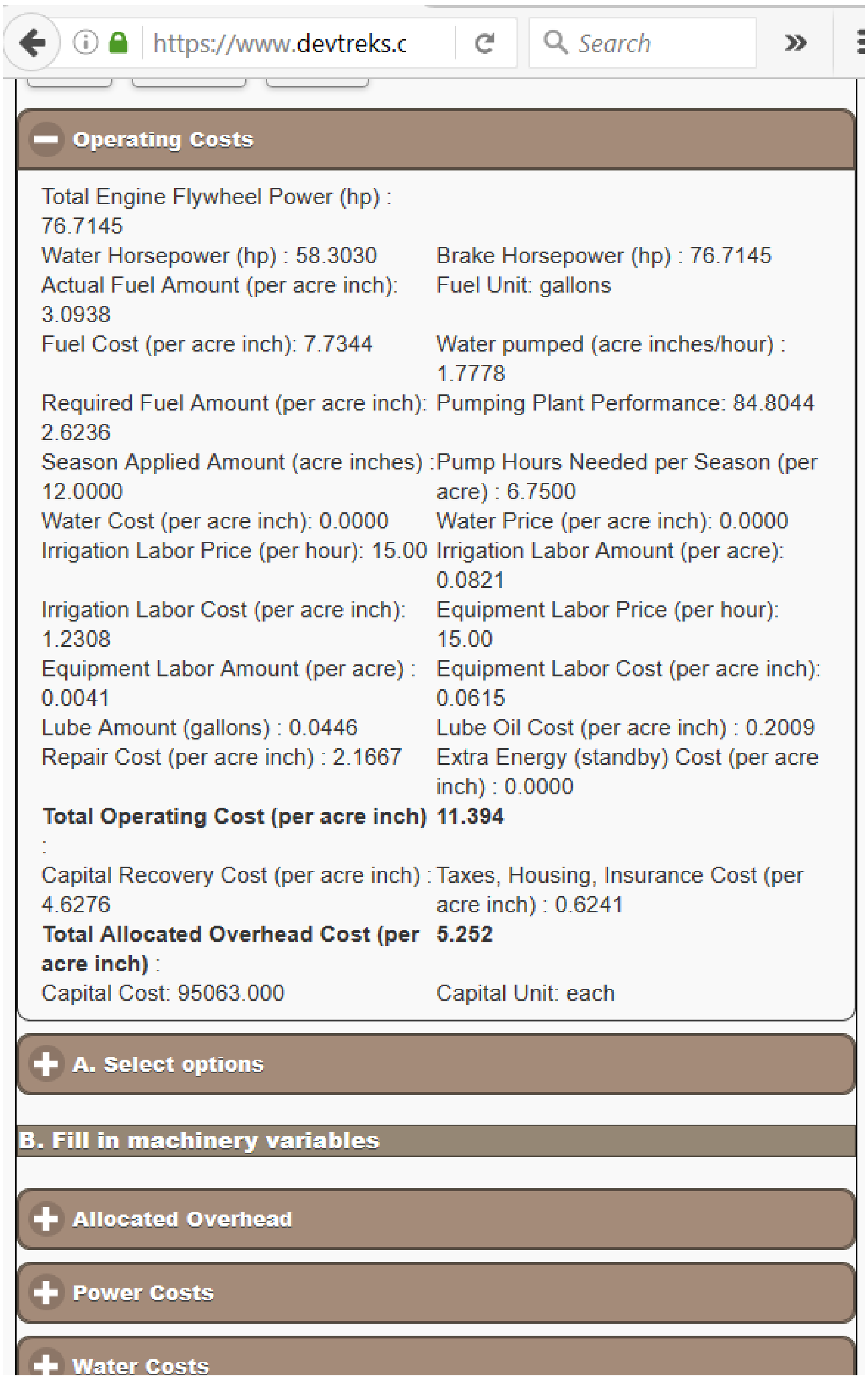
THI Cost per Acre: $0.51 = $79.68 THI Cost per Year (see machinery formulas) / 155 (Net Irrigation Acres)

THI Cost per Acre Inch $0.02 = $0.51 ($/ac) / 28.75 (acin/ac)

Allocated Overhead Cost per Acre Inch: *$0.18 = $0.16 Capital Recovery + $0.02 THI*

Allocated Overhead Cost per Acre: *$5.18 = $0.18 * 28.75 Applied AcIn*

Example 2. Center Pivot, Diesel Engine, Water HP (see Figure 5 in the Martin et al reference)



Operating Costs

Power. Power and energy parameters are set in the calculator.

*Total Dynamic Pumping Head 288.6 = 150 (Static Head) + (60 Pressure Head * 2.31 PSI Constant) + 0 Friction Head + 0 Other Head*

*Water HP 58.3 = 800 Flow Rate * (288.6 Dynamic Pump Head / 3960 Constant)*

*Brake HP 76.71 = 58.3 Water HP / ((80 Pump Efficiency / 100) * (95 Gear Drive Efficiency / 100))*

Engine Flywheel Power 76.71 = 76.71.39 Brake HP + 0 Extra Power 1 + 0 Extra Power 2

Pump Capacity 1.78 acin/hour = 800 Flow Rate / 450 GPMToAcreInchConversionFactor

*Note: Metric: 336.6 m3/hour = 1200 Flow Rate * 0.278 LitersPerSecondToM3ConversionFactor*

Fuel (per acre inch or m3)

Horsepower Use per Hour: 76.71 Flywheel Power

*Fuel Amount Per Acre Inch Formula: kw /ac inch = HP * 2545BTU/HP-HR * kw/dbBTUs(BTUs) * 1/EngineEfficiency * 450/GPM*

*Fuel Amount Required: 2.55 gal diesel/ac in = 76.71 Engine Flywheel Power * (2545 / 138690) * (1 / (31 / 100)) * (450 / 800)*

Fuel Amount Actually Used per Hour: 5.5 gal/hr

Fuel Amount Used per Unit Water: 3.09 gal/acin = 5.5 gal/hour / 1.78 Pump Capacity (acin/hour)

*Pumping Plant Performance: 82.57 = (100 * 2.55 gal/acin Required) / 3.09 gal/acin*

*Fuel Cost: $7.73 per acre inch = 3.09 kw/acin * $2.50 per gallon diesel*

Lube Oil Costs (per acre inch or m3)

Lube Amount = 0.079 gal per hour (see machinery cost examples above)

Lube Amount per acin: 0.045 = 0.079 (gal/hr) / 1.78 Pump Capacity (acin/hour)

*Lube Oil Cost per acre inch: .20 = 0.045 * $4.50 gallon*

Water Costs (per acre inch or m3)

Season Water Applied 12.0 acin = (12 acin Season Water Need – 0 acin Season Water Extra Credit + 0 acin Season Water Extra Debit) / (100 Distribution Uniformity/ 100)

*Water Cost per acre inch $0 = (12.0 acin * $0.00 Water Price (per acin)) / 12 acin*

Pump Hours per ac (ha) 6.75 = 12.0 acin / 1.78 Pump Capacity (acin/hour)

Labor (per acre inch or m3)

*Total Season Labor Hours: 128 hours = 8 Irrigation Times * 16 hours Duration per Set * 1 Hours Labor Used per Set*

*(Note: Planned Use Hours can be derived from Irrigation Time * Duration per Set)*

Labor Hours per Acre (ha) .98 = 128 hours / 130 Net Irrigation Acres

Labor Amount per Acre Inch 0.082 = 0.98 / 12.0 AcIn Applied

*Labor Cost per Acre (ha) $14.77 = 0.98 hours * $15.00 Hour Machinery Selected Type*

Water Labor Cost per Acre Inch: $1.23 = $8.26 / 12.0 AcIn Applied

*Equipment Labor Amount per Acre Inch: 0.004 = 0.82 Labor Amount per AcIn * (5 Labor Adjustment/100)*

*Equipment Labor Cost per Acre Inch: $0.06 = .0004 * $15.00 Machinery Labor Cost per Hour*

Repair (per acre inch or m3)

Repair Cost per Acre Inch: 2.17 = $26 Repair Cost per Net Acre (ha) / 12.0 AcIn Applied

If Repair and Maintenance Is Used Instead

Repair Cost per Net Acre (ha) = Market Value / ((RandM Percent / 100) / (Irrigation Net Area)

Repair Cost per Acre Inch = Repair Cost per Net Acre / Season Acre Inch Applied

Extra Energy (per acre inch or m3)

Extra Energy Cost per Acre Inch $0 = $0 Extra Energy Cost per Net Acre / 12.0 AcIn Applied

Operating Cost per Acre Inch: *$11.39 = $7.73 Fuel Cost + $0.20 LubeOil + $1.23 Water Labor $0.06 Equipment Labor + $2.17 Repair + $0 Extra Energy + $0 Water Cost*

Operating Cost per Acre (ha) *$136.73 = $11.39 * 12.0 Applied AcIn*

Allocated Overhead Costs

Capital Recovery (per acre inch or m3) Interest rates, market value, planned use hours, useful life hours and starting hours are set in the calculator.

Years Effective Life: 15 = (1,950 (Useful Life hours) - 0 (Starting hours))) / 130 Planned Use Hours

Capital Recovery Factor: 0.078 based on 15 Years, .02 real rate

Discounted Salvage Value: $2303.01 = use following factors to discount: 15 years, $3,100 Salvage Value, 2.0% real rate

Annual Cap. Rec. Cost: $7,219.06 = use following factors: 0.078 Capital Recovery Factor *$95,063 (Market Value), $2302.01 (Discounted Salvage Value) , 15 Years Life, 2.0% real rate.*

Cap. Recov. Cost per acre $55.53 = $7,219.06 / 130 (Net Irrigation Acres)

Cap Recovery Cost per Acre Inch $4.63 = $55.53 ($/ac) / 12 (acin/ac)

Taxes, Housing and Insurance (per acre inch or m3) Rates for each are set in the calculator.

Amount: .0155 = .005 (taxes) + .0055 (housing) + .005 (insurance)

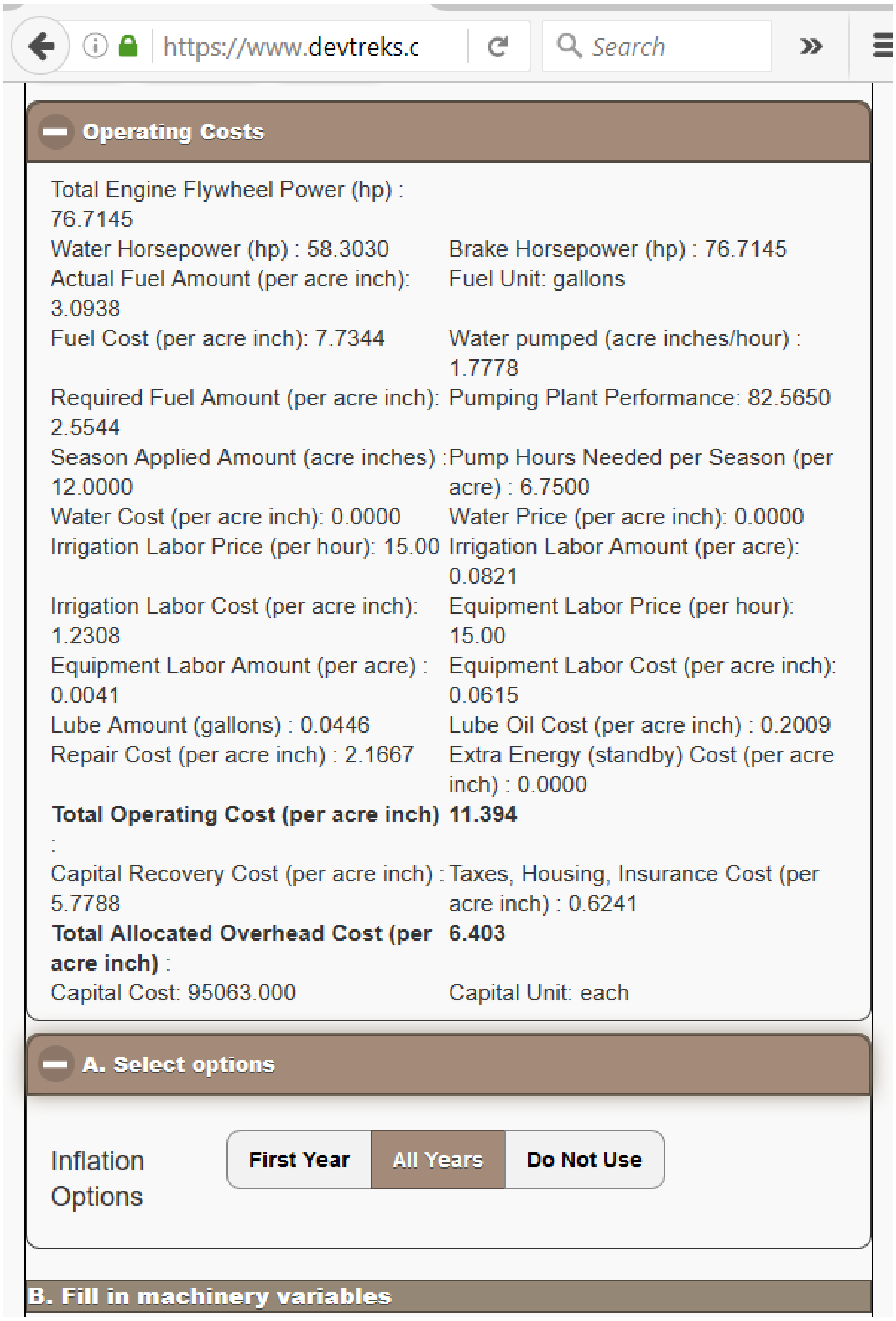
THI Cost per Acre: $7.45 = $973.66 THI Cost per Year (see machinery formulas) / 130 (Net Irrigation Acres)

THI Cost per Acre Inch $0.62 = $7.45 ($/ac) / 12 (acin/ac)

Allocated Overhead Cost per Acre Inch: *$5.25 = $4.63 Capital Recovery + $0.62 THI*

Allocated Overhead Cost per Acre: *$63.0 = $5.25 * 12.0 Applied AcIn*

Example 3. Center Pivot, Diesel Engine, Flywheel Energy, All Inflation (see Figure 5 in the Martin et al reference)



Operating Costs

Power. Power and energy parameters are set in the calculator.

*Total Dynamic Pumping Head 288.6 = 150 (Static Head) + (60 Pressure Head * 2.31 PSI Constant) + 0 Friction Head + 0 Other Head*

*Water HP 58.3 = 800 Flow Rate * (288.6 Dynamic Pump Head / 3960 Constant)*

*Brake HP 76.71 = 58.3 Water HP / ((80 Pump Efficiency / 100) * (95 Gear Drive Efficiency / 100))*

Engine Flywheel Power 76.71 = 76.71.39 Brake HP + 0 Extra Power 1 + 0 Extra Power 2

Pump Capacity 1.78 acin/hour = 800 Flow Rate / 450 GPMToAcreInchConversionFactor

*Note: Metric: 336.6 m3/hour = 1200 Flow Rate * 0.278 LitersPerSecondToM3ConversionFactor*

Fuel (per acre inch or m3)

Fuel Use per Hour: 4.66 gal/hr = 58.3 Water HP / 12.5 (diesel fuel energy constant)

Fuel Amount Required: 2.62 gal/acin = 4.67 Fuel Use per Hour / 1.78 Pump Capacity acin/hr

Fuel Amount Actually Used per Hour: 5.5 gal/hr

Fuel Amount Used per Unit Water: 3.09 gal/acin = 5.5 gal/hour / 1.78 Pump Capacity (acin/hour)

*Pumping Plant Performance: 84.80 = (100 * 2.62 gal/acin Required) / 3.09 gal/acin*

*Fuel Cost: $7.73 per acre inch = 3.09 kw/acin * $2.50 per gallon diesel*

Lube Oil Costs (per acre inch or m3)

Lube Amount = 0.079 gal per hour (see machinery cost examples above)

*Lube Cost per Acre $0.36 = 0.079 * $4.50 gallon oil*

Lube Amount per acin: 0.045 = 0.079 (gal/hr) / 1.78 Pump Capacity (acin/hour)

*Lube Oil Cost per acre inch: .20 = 0.045 * $4.50 gallon*

Water Costs (per acre inch or m3)

Season Water Applied 12.0 acin = (12 acin Season Water Need – 0 acin Season Water Extra Credit + 0 acin Season Water Extra Debit) / (100 Distribution Uniformity/ 100)

*Water Cost per acre inch $0 = (12.0 acin * $0.00 Water Price (per acin)) / 12 acin*

Pump Hours per ac (ha) 6.75 = 12.0 acin / 1.78 Pump Capacity (acin/hour)

Labor (per acre inch or m3)

*Total Season Labor Hours: 128 hours = 8 Irrigation Times * 16 hours Duration per Set * 1 Hours Labor Used per Set*

*(Note: Planned Use Hours can be derived from Irrigation Time * Duration per Set)*

Labor Hours per Acre (ha) .98 = 128 hours / 130 Net Irrigation Acres

Labor Amount per Acre Inch 0.082 = 0.98 / 12.0 AcIn Applied

*Labor Cost per Acre (ha) $14.77 = 0.98 hours * $15.00 Hour Machinery Selected Type*

Water Labor Cost per Acre Inch: $1.23 = $8.26 / 12.0 AcIn Applied

*Equipment Labor Amount per Acre Inch: 0.004 = 0.82 Labor Amount per AcIn * (5 Labor Adjustment/100)*

*Equipment Labor Cost per Acre Inch: $0.06 = .0004 * $15.00 Machinery Labor Cost per Hour*

Repair (per acre inch or m3)

Repair Cost per Acre Inch: 2.17 = $26 Repair Cost per Net Acre (ha) / 12.0 AcIn Applied

If Repair and Maintenance Is Used Instead

Repair Cost per Net Acre (ha) = Market Value / ((RandM Percent / 100) / (Irrigation Net Area)

Repair Cost per Acre Inch = Repair Cost per Net Acre / Season Acre Inch Applied

Extra Energy (per acre inch or m3)

Extra Energy Cost per Acre Inch $0 = $0 Extra Energy Cost per Net Acre / 12.0 AcIn Applied

Operating Cost per Acre Inch: *$11.39 = $7.73 Fuel Cost + $0.20 LubeOil + $1.23 Water Labor $0.06 Equipment Labor + $2.17 Repair + $0 Extra Energy + $0 Water Cost*

Operating Cost per Acre (ha) *$136.73 = $11.39 * 12.0 Applied AcIn*

Allocated Overhead Costs

Capital Recovery (per acre inch or m3) Interest rates, market value, planned use hours, useful life hours and starting hours are set in the calculator.

Years Effective Life: 15 = (1,950 (Useful Life hours) - 0 (Starting hours))) / 130 Planned Use Hours

Capital Recovery Factor: 0.096 based on 15 Years, .05 nominal rate

Annual Cap. Rec. Cost: $9014.93 = use following factors: 0.096 Capital Recovery Factor *$95.063 (Market Value), (Discounted Salvage Value uses nominal rate), 15 Years Life, 5.0% nominal rate. The nominal rate reflects the Inflation option of All Years.*

Cap. Recov. Cost per acre $69.35 = $9014.93 / 130 (Net Irrigation Acres)

Cap Recovery Cost per Acre Inch $5.78 = $69.35 ($/ac) / 12 (acin/ac)

Taxes, Housing and Insurance (per acre inch or m3) Rates for each are set in the calculator.

Amount: .0155 = .005 (taxes) + .0055 (housing) + .005 (insurance)

THI Cost per Acre: $7.45 = $973.66 THI Cost per Year (see machinery formulas) / 130 (Net Irrigation Acres)

THI Cost per Acre Inch $0.62 = $7.45 ($/ac) / 12 (acin/ac)

Allocated Overhead Cost per Acre Inch: *$6.40 = $5.78 Capital Recovery + $0.62 THI*

Allocated Overhead Cost per Acre: *$76.8 = $6.40 * 12.0 Applied AcIn*

G. Machinery Timeliness Penalty Calculators

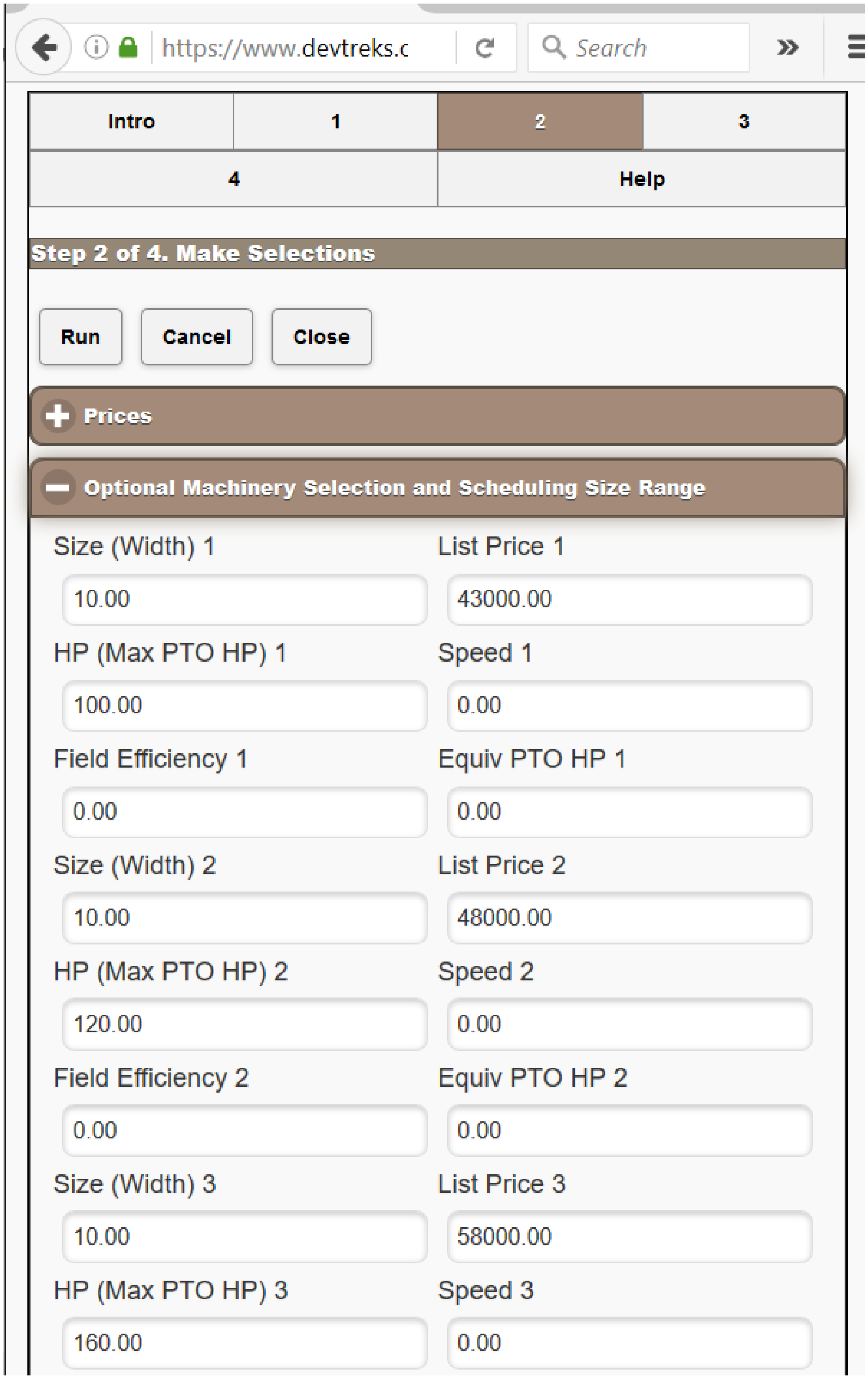
An important goal in machinery management is to select and schedule machinery that is appropriate for the work being performed. The wrong machinery can lead to project overruns and the loss of Output yield and revenue. Timeliness Penalty calculators compute penalties for combinations of machinery that result in Output (crop) yield loss. These penalties can be analyzed by completing two calculators:

1) Machinery Calculator, Step 2, Size Ranges
2) Net Present Value Timeliness Penalty Operation or Component Calculators.

This example can be found at:

https://www.devtreks.org/agtreks/preview/crops/inputseries/Example 1- Tractor, New Calculators/2147379775/none

Step 2 of the Machinery Calculator allows the List Price, Speed, Width, Efficiency, Maximum PTO, and Equivalent PTO, properties of machinery Inputs to have 5 feasible variations:


https://www.devtreks.c
Search
Intro
1
2
3
4
Help
Step 2 of 4. Make Selections
Run
Cancel
Close
Prices
Optional Machinery Selection and Scheduling Size Range
Size (Width) 1
10.00
List Price 1
43000.00
HP (Max PTO HP) 1
100.00
Speed 1
0.00
Field Efficiency 1
0.00
Equiv PTO HP 1
0.00
Size (Width) 2
10.00
List Price 2
48000.00
HP (Max PTO HP) 2
120.00
Speed 2
0.00
Field Efficiency 2
0.00
Equiv PTO HP 2
0.00
Size (Width) 3
10.00
List Price 3
58000.00
HP (Max PTO HP) 3
160.00
Speed 3
0.00

These machinery properties are used to calculate timeliness penalties for combinations of machinery Inputs, each with up to 5 of these feasible variations, which are calculated using Timeliness Penalty Calculators and Analyzers. The calculators can be used instead of running regular Operation and Component Net Present Value (NPV) calculators. They are used to calculate yield penalty properties when machinery operations, or components, cannot be completed by targeted dates. The calculators return standard NPV results and summaries of the revenue penalties.

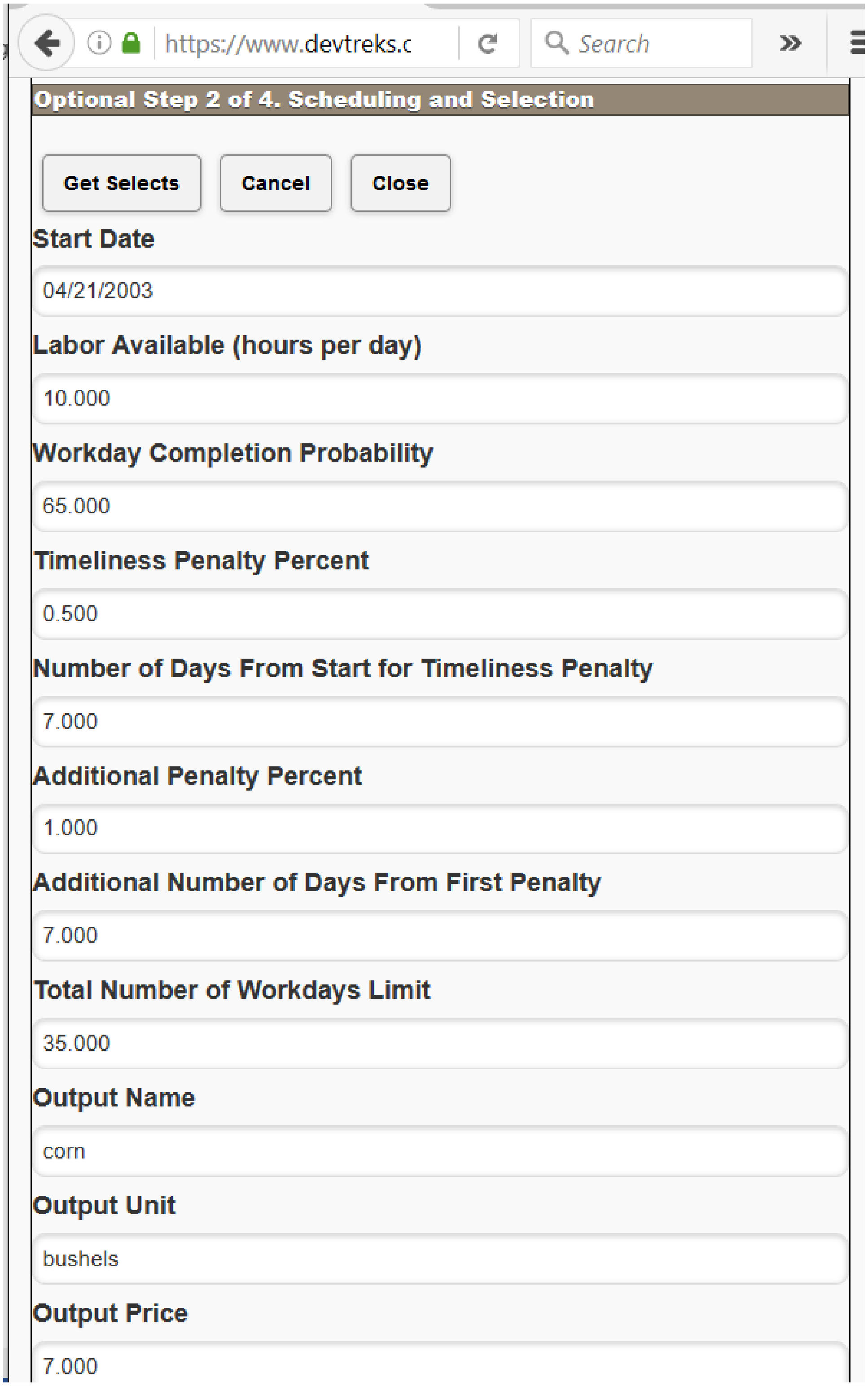
Example 1. Plant corn

This example can be found at:

https://www.devtreks.org/agtreks/preview/crops/operation/Plant, Corn Grain, medium tractor, Example 1/2091544225/none

http://localhost:5000/agtreks/preview/crops/operation/Plant, Corn Grain, medium tractor, Example 1/2091544225/none

Step 2 of the Operation/Component NPV Timeliness Penalty calculator has the following penalty properties:


https://www.devtreks.c
Search
Optional Step 2 of 4. Scheduling and Selection
Get Selects
Cancel
Close
Start Date
04/21/2003
Labor Available (hours per day)
10.000
Workday Completion Probability
65.000
Timeliness Penalty Percent
0.500
Number of Days From Start for Timeliness Penalty
7.000
Additional Penalty Percent
1.000
Additional Number of Days From First Penalty
7.000
Total Number of Workdays Limit
35.000
Output Name
corn
Output Unit
bushels
Output Price
7.000

Output Price

7.000

Output Yield

155.000

Composition Unit

acre

Composition Amount

1.000

Output Times

1.000

Operation Group : Seeding and Planting, corn

+ Operation Group Details

Operation : Plant, Corn Grain, medium tractor, Example 1

+ Operation Details

Total OC Cost : 16,811.11	Ann OC Cost : 16,811.11
Total OC Int : 729.26	
Total AOH Cost : 3,312.36	Ann AOH Cost : 3,312.36
Total AOH Int : 143.69	
Total CAP Cost : 0.00	Ann CAP Cost : 0.00
Total CAP Int : 0.00	
Total Cost : 20,123.47	Ann Cost : 20,123.47
Total Int : 872.95	
Incent Cost : 20,123.47	Ann Incent Cost : 20,123.47

Input : Grain Drill, Most Common Spacing, Plain, 15-17 Openers

These properties are defined as follow:

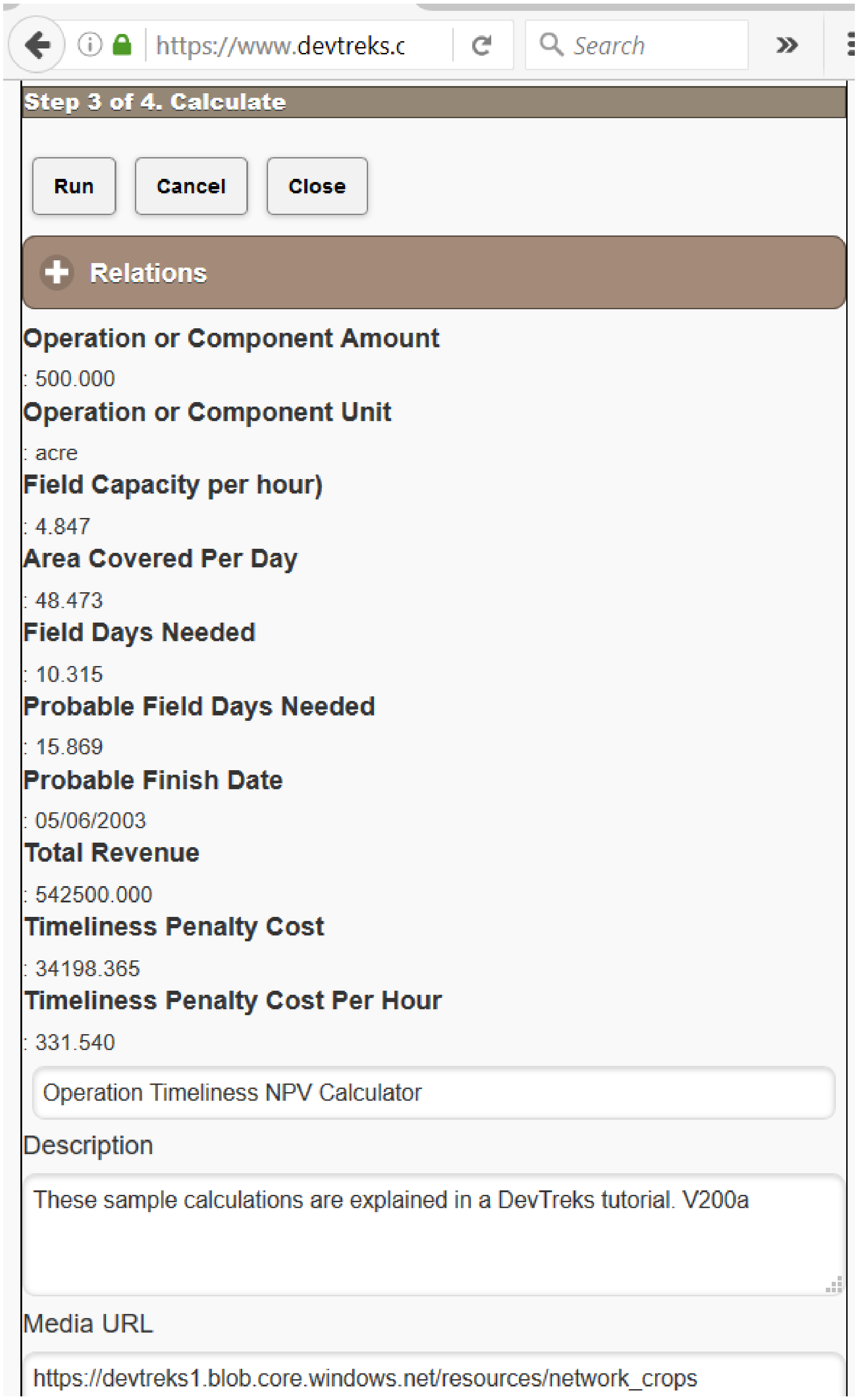
- **Start Date**: The targeted starting date for a machinery operation. This date should coincide with the machinery Input dates but does not generally coincide with the

Operation/Component.Date. The latter date is usually an end of calendar year date that is used to set discounted costs.

- **Labor Available (hours per day):** The number of hours per day available for running the machinery operation.
- **Workday Completion Probability:** The number of days while the machinery is operating that are suitable for completing field work (i.e. when weather will not allow field work).
- **Timeliness Penalty Percent**: The yield reduction per day when the operation cannot be completed on time.
- **Number of Days from Start for Timeliness Penalty**: The number of days from the start date when the first yield penalty kicks in.
- **Additional Penalty Percent**: An additional yield penalty when the operation can't be completed by the next property.
- **Additional Number of Days from First Penalty**: The number of days from the first yield penalty's "Number of Days from Start …" when the second yield penalty kicks in. In this example, the first penalty kicks in 7 days from the start and has a yield penalty of 0.5 percent. The new penalty kicks in after 7 additional days with a yield penalty of 1 percent. The numeric example below shows that the two penalties are calculated independently.
- **Total Number of Workdays Limit**: Total targeted workday limit for the machinery operation. Not used in the current analyses.
- **Output Name**: The timeliness penalty Output name (i.e. corn). These Output properties are only used in Operation or Component Timeliness Penalty Analyzers. Operating and Capital Budgets use the Outputs in the Budgets
- **Output Unit**: The timeliness penalty Output unit.
- **Output Price**: The timeliness penalty Output price.
- **Output Yield**: The timeliness penalty Output quantity.
- **Composition Unit**: The timeliness penalty composition unit (i.e. acre). The composition properties are standard Output properties and serve as a multiplier (i.e. head of livestock).

- **Composition Amount**: The timeliness penalty composition unit (i.e. 1).
- **Output Times**: A general multiplier used with all Outputs.

The Operation.Amount in this example is 500 acres. Running the calculator generates the following penalty properties:



These penalty properties are further defined in the *Capital Input Analysis 1* reference:

- **Operation or Component Amount and Unit**: 500 acres set in the base Operation.
- **Field Capacity**: 4.85 acres per hour = 1 / 0.2063 Power Input hours per acre
- **Area Covered per Day**: 48.5 acres = 4.85 acres per hour * 10 hours Available Labor per Day
- **Field Days Needed**: 10.3 = 500 Operation acres / 48.5 Area Covered per Day
- **Probable Field Days Needed**: 15.9 = 10. 3 Field Days Needed / 0.65 Workday Completion Probability
- **Probable Finish Date**: May 6, 2003 = April 21, 2003 Inputs Applied Date + 15.9 Probable Field Days Needed
- **Total Revenue**: 542,500 = 500 Operation Amount Acres * $7 Output Price * 155 Output Yield * 1 Composition Amount * 1 Output Times
- **First Penalty Days**: 8.87 = (0 ((Planned Start Date - Actual Start Date) * -1) + 15.9 Probable Field Days Needed) – 7 Timeliness Penalty Start Days.
- **Second Penalty Days**: 1.89 = (0 ((Planned Start Date - Actual Start Date) * -1) + 15.9 Probable Field Days Needed) – (7 Timeliness Penalty Start Days + 7 Additional Penalty Start Days)
- **First Timeliness Penalty Cost**: 24,058 = 542,500 Total Revenue * (0.5 First Timeliness Percent Rate / 100) * 8.87 First Penalty Days
- **Second Timeliness Penalty Cost**: 10,140 = 542,500 Total Revenue * (1.0 Second Timeliness Percent Rate / 100) * 1.89 Second Penalty Days
- **Total Penalty Cost**: 34,198 = 24,058 First Penalty + 10,140 Second Penalty
- **Timeliness Penalty Cost per Hour:** 331.5 = 34,198 / ((1 / 4.85 Field Capacity) * 500 Operation Amount Acres)

This Planting Operation generated a penalty because it has a 500 acre Operation.Amount. In most instances, Operations and Components are given 1 unit (acre) amounts so that they can be reused in multiple budgets and because 1 acre costs are easier to understand. The actual acreage of this crop can be set using the TimePeriod.Amount property of Operating and Capital Budgets.

These two amounts are mvultiplicative: Total Acreage = Operation/Component.Amount * TimePeriod.Amount.

H. Analyzers

The data generated by these calculators can be aggregated and further analyzed using the analyzers explained in the *Capital Input Analysis 1* sibling reference.

I. Sustainable Capital Input Management

Version 2.1.4 added this section because agriculture, including agricultural machinery, makes significant contributions to total GHG emissions (EPA, 2016 reports 9%; GCIAR, 2012 reports 19% to 29%). While this tutorial's original intent –to support standard machinery calculations in budgets –remains valid, the Performance and Social Performance Analysis (SPA) tutorials verify that "socially sound" business management now means that capital input management must take full account of all impacts on global warming.

Car and truck manufacturers recognize that customers are concerned about global warming and routinely provide global warming-related metrics so that consumers can make informed comparisons. Significant parts of the agricultural sector also recognize that consumers and supply chain participants are concerned about the sustainability of their food. Fewer agriculturalists recognize that IT will eventually allow consumers to make shopping comparisons based on food sustainability.

Future upgrades of this tutorial will focus on sustainable capital input management. In the interim, several of the machinery calculations, such as fuel and oil consumed per hectare, can be converted into sustainable accounting metrics, such as Total Machinery GHG per hectare. These metrics can be further analyzed using the Indicator metadata-TEXT dataset-custom algorithm-mathematical library patterns explained in SPA.

J. Summary and Conclusions

Capital Inputs are critical resources employed in many industries. They permit factory workers to build widgets faster, farmers to reduce their unit costs, doctors to diagnose illness better, and power plants to produce cleaner energy. This reference demonstrates how to calculate machinery, irrigation power, general capital, and timeliness penalty, costs. These costs may help people to manage Capital Inputs in ways that allow them to improve their lives and livelihoods and the prospects for their descendants.

Footnotes

1. This reference was updated using Version 2.0.0 because DevTreks has matured a lot since the last update in 2014. The Version 2.1.0 upgrade was tested by comparing Version 2.0.8 and 2.1.0 binaries with the same datasets –the associated Capital Input analyzers needed additional refactoring before the results matched. Version 2.1.0 found that base element multipliers, such as Input.Times, did not change some machinery calculations, such as the irrigation calculations. The reasons is documented in the Capital Input Analysis reference. Version 2.1.6 fixed bugs with the Timeliness Calculators and Analyzers found during this tutorial upgrade in August, 2018. Version 2.1.6 also upgraded to secure links on localhost –https://localhost:5000 .
2. Capital Inputs can be calculated using a variety of techniques. The Ag Production tutorial points out that the role of social networks is to provide recommendations to their information technologists about new calculators they need and to produce the technical documentation. That idea was seldom raised in any professional meeting the author attended in years past, but it may be that the underlying institutions recognize modern technology doesn't facilitate "business as usual" anymore (i.e. aka "doing it wrong"). Refer to the Social Budgeting and Source Code tutorials for further information about the needed institutional reforms.
3. In this context, the term "Budget" refers to the combination of Inputs and Outputs found in Operations, Components, Outcomes, Operating Budgets, or Capital Budgets.

4. Prices, not quantities, are usually defined using standalone Inputs and Outputs. Technology can be defined by setting the quantity of Inputs and Outputs found in Budgets.
5. When DevTreks ran these calculations online using Version 2.0.0, not all results matched the documented results. Several tutorials mention that the targeted science and technology clubs are assumed to have the technical expertise to find out why. For example, the first calculation used an effective life of 12,000 hours, rather than the 6,000 hours documented. Again, it's the role of social networks to provide technical documentation and assure high quality data standards –not necessarily a software development firm.

References

American Society of Agricultural and Biological Engineers, ASAE D497.7 MAR2011Agricultural Machinery Management Data

American Society of Agricultural and Biological Engineers, ASAE EP496.3 FEB2006 (R2011) Agricultural Machinery Management

Caterpillar Inc. Irrigation Engine Ratings Guide. Peoria, Illinois, 2009

CGIAR. Research Program on Climate Change, Agriculture and Food Security (CCAFS). Big Facts. Food Emissions. Last accessed August, 2018:

http://ccafs.cgiar.org/BIGFACTS/

Edwards. Iowa State University Farm Machinery Selection, File A3-28, www.extension.iastate.edu/agdm (last accessed February, 2012)

Guerrero, Amosson, Marek, and Johnson. Economic Evaluation of Wind Energy as an Alternative to Natural Gas Powered Irrigation. Journal of Agriculture and Applied Economics, 42,2(May, 2010)

Hallam, Eidman, Morehart and Klonsky (editors) .Commodity Cost and Returns Estimation Handbook, Staff General Research Papers, Iowa State University, Department of Economics, 1999

Martin, Dorn, Melvin, Corr and Kranz. Evaluating Energy Use for Pumping Irrigation Water. (authors are University of Nebraska) Proceedings of the 23rd Annual Central Plains Irrigation Conference. Burlington, CO. 2011

Rogers and Alam. Comparing Irrigation Energy Costs. Kansas State University, Manhattan, KS, USA, 2006

Sanden, Klonsky, Putnam, Schwankl, and Bali. Comparing Costs and Efficiencies of Different Alfalfa Irrigation Systems. UC Davis, Davis, California, USA, 2011

Siemens, University of Illinois User Guide Farm Machinery and Selection Program, Version S10, 1988. Last accessed May, 2015: https://www.devtreks.org/commontreks/preview/commons/resourcepack/DevTreks%20Machinery%20Costs/437/none

U.S. Environmental Protection Agency. Inventory of U.S. Greenhouse Gas Emissions and Sinks. 2016. Last accessed August, 2018:

https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks

References Note

We try to use references that are open access or that do not charge fees.

Improvements, Errors, and New Calculators

DevTreks –social budgeting that improves lives and livelihoods

Please notify DevTreks (devtrekkers@gmail.com) if you find errors in calculations. Also please let us know about suggested improvements and new calculators.

Video tutorials explaining this reference can be found at:

https://www.devtreks.org/commontreks/preview/commons/resourcepack/Machinery Costs 1/437/none