Forage & Cattle Planner (FORCAP)

User Manual, 2014

Version 2

By

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****** Please note that all Figures present information as would appear after the user modifies cells as described within. The user may move to the Scenario Manager tab and reset Scenario 2 as a short cut to get the same figures. The manual is intended to also serve as a tutorial. ******

Tables

Forage & Cattle Planner User Manual

I. Introduction

The Forage & Cattle Planner was designed to provide Arkansas Cow-Calf producers with a planning tool that would allow operation-specific analyses of varying production processes as they relate to both cattle and pasture management. As such, the model allows the user to use default values to generate an understanding of what the economics of an average Arkansas operation of the producer's chosen size looks like. It also allows the user to modify those values with information from their own operation and results in an automated side-by-side comparison of a flexible 'Bench Mark' vs. a user-defined, 'Your Farm' operation. The model is divided into several spreadsheet tabs so that information pertaining to a particular aspect of the operation is viewable on-screen and can be printed on one page. These tabs are hyperlinked at the top of each screen (pushing the gray buttons or left-clicking the mouse on the tabs near the bottom of the screen). In these tabs, the model proceeds by allowing the producer to accept default values or modify the following:

- input prices for cattle, fertilizer, feed, marketing charges, fuel, winter annuals, fencing, property tax, insurance, capital cost, operating interest, fuel use, twine, pasture establishment and major veterinary charges;
- land in pasture or hay along with the amount of fertilizer applied, number of applications and forage species by area on the operation;
- pasture management to determine fencing cost as well as expected grazing efficiency, cost of water sources, type and amount of winter annuals, stockpiling and strip grazing preferences;
- cattle production parameters including annual breeding failures, expected cow and calf losses, specification of typical cow replacement age, average mature and young cow weights, weaning age and weights, birth weights and age of first breeding as well as calving season, stocking rate and expected hay waste;
- timing of forage availability to simulate impact of weather conditions on seasonal production. As such, the user chooses when to release stockpiled forage and/or other forages to potentially simulate grazing restrictions to manage periods of excess/shortage of forage availability. The user can also model impacts of drought by curtailing the sum of monthly production to less than 100%. This section of the model has obvious ties to changes in pasture management and cattle production. Harvest of excess forage using haying equipment, if feasible, can also be enabled in this section;
- transport distances and transport type for marketing cattle, supplemental TDN feed needs that may arise as a result of using only pasture and hay as a feed source to maintain cattle, vaccination program and expected frequency of veterinary services; and

- capital requirements associated with breeding stock, equipment, and buildings along with repair and maintenance, property tax and insurance cost estimates.

With these parameters selected, the producer can then analyze an enterprise budget highlighting sales of calves, cull animals and excess hay, if any, for both the 'Bench Mark' and 'Your Farm'. Costs are broken down into cash expenses of fertilizer, feed, veterinary and drug charges, sales commission, yardage, insurance and checkoff, other marketing charges, twine, fuel, herd sire purchases, farm vehicle charges, pasture reseeding/establishment charges as well as repair and maintenance charges. These cash charges are assumed to be financed with an operating loan and hence operating interest charges are estimated. Finally, ownership charges for capital assets of breeding stock, equipment, and buildings are assessed to reflect depreciation, property taxes and insurance as well as investment returns foregone by investing in these assets.

Subtracting cash costs from sales results in net cash returns to owner labor and land to allow the producer to determine whether cattle production is sufficiently profitable to cover cash operating expenses but not ownership charges for long term capital investments. Subtracting both cash and ownership charges from sales leads to returns to operator labor, land and management on a farm, per cow and per acre basis intended for comparison with other potential land use choices. These returns may be used for making longer term changes. Note that no charges are assessed to land in this model. Cash rental rates for pasture and hay land may be subtracted from per acre returns to assess returns to owner labor with this adjustment. Estimates of labor hours invested in the enterprise per year are not offered.

To address changes in longer term profitability, three additional tabs are added to allow for further producer production practices that relate to:

- estimated changes in cattle productivity as a result of modifying cattle genetics by changing herd sire breed with attendant estimated average change in birth and weaning weights of calves that results in changes from state average prices (used when breed effects are not applied) and an anticipated change in calving difficulty with attendant changes in veterinary and death loss parameters;
- evaluation of different state average price histories for steer and heifer calves in one hundred pound weight increments from #400 to #800 per head, for cull cows and bulls. The user can select the most recent price year, 5- or 10-year averages with the option to deflate 5- and 10-year averages. Use of longer term averages removes the effect of cyclically high or low cattle prices. These options are available for cattle, fertilizer and are automated for supplemental feed prices. The user is responsible to change other input prices to reflect longer term averages. Look for cattle and fertilizer price updates when software is updated; and
- selection of a user-specified forage species to allow for specification of seasonal production by month with attendant crude protein and TDN specification for assessment of forage quality.

Finally, all of the above choices also impact estimates of greenhouse gas emissions (GHG) from enteric fermentation, urine and manure, respiration as well as fertilizer, fuel and input use. Farm level emissions are summarized in one sheet to provide guidance about how changes in pasture and cattle management could potentially affect GHG emissions. Estimates include the most common GHG's, namely nitrous oxide (N_2O), methane (CH_4) and carbon dioxide (CO_2). All are expressed in their CO_2 equivalent form to reflect their relative global warming potential.

All of the above information represents estimates that are a result of a set of complex calculations performed in the model. These calculations are described in more detail in the reference manual rather than the user manual. Changes in parameter values and its implications on returns and GHG emissions are estimates and the user should use their own reasonable judgment to reflect whether the direction of change in returns and GHG emissions is appropriate before proceeding to change their cow-calf operation on the basis of the results. As such, this software is provided 'as is' and without warranties as to performance or merchantability. Further, statements may have been made to you about this software. Any such statements do not constitute warranties and shall not be relied on by the user in deciding whether to use the program or act on its results. This program is provided without any expressed or implied warranties whatsoever. Because the diversity of conditions and hardware under which this program may be used, no warranty of merchantability or warranty of fitness for a particular purpose is offered. The user is advised to test the program thoroughly before relying on it. The user assumes the entire risk of using the program. The University of Arkansas will not be liable for any claim or damage brought against the user by any third party, nor will the University of Arkansas be liable for any consequential, indirect or special damages suffered by the user as a result of the software.

II. General Model Information

The Forage & Cattle Planner contains many different working parts on each tab. These working parts include check boxes, macro buttons, drop-down lists, comment boxes, and reference cells. **Cells that the user can change are colored and are also referred to as reference cells or drop down lists or menu options in this manual**. Light blue cells are for entries for 'Your Farm', light green cells are for entries for the 'Bench Mark'. Dark blue cells contain drop-down lists for 'Your Farm', and dark green cells contain drop-down lists for the 'Bench Mark'. <u>The user should keep in mind as they work through each tab that although an option that exactly describes the user's needs may not be given, the option that most closely does describe the user's operation should be chosen to provide a reasonable estimate of economic and GHG performance</u>.

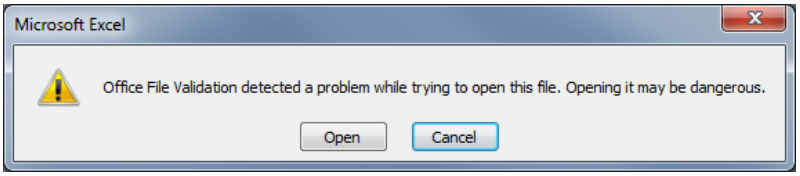
Installation Instructions and File Naming

This software was developed as a spreadsheet in 2003-2007 compatible file format of Excel® using a Windows 7 working environment. Its file extension is therefore .xls and the name of the file is 'FORCAP.xls'. You can download and save this file to any directory or file folder on your computer (please do not use a flash drive for this directory). If you get this file via e-mail, please be sure to save the file on your machine first instead of opening straight from the e-mail as you will be able to find the program later. Depending on the security settings on your computer you may get several warning messages when opening the file after you have saved the file to a directory on your computer (Figure 1). These messages will differ depending on the version of Excel®, operating system and your security settings. You will need to follow screen instructions in Excel 2003/2007 to set appropriate security settings to enable macros.

Figure 1. Handling Initial File Install Messages

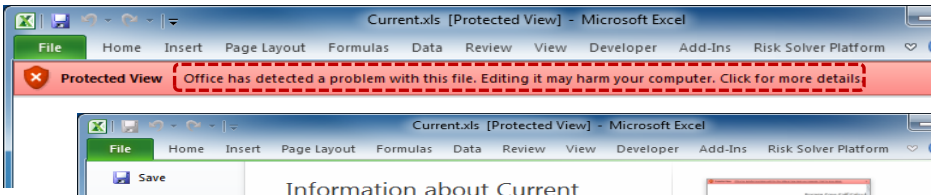
Excel 2003/2007:

Click on 'Open' and proceed.

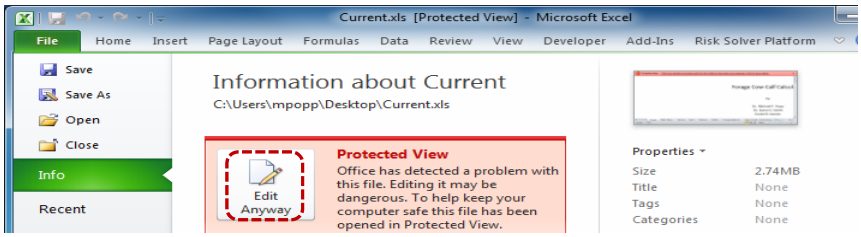


Excel 2010:

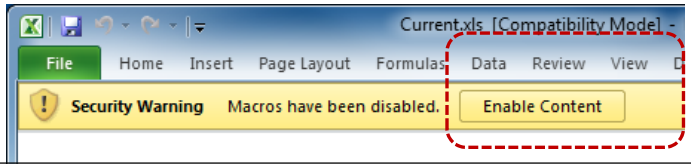
Click for more details.



Click on 'Edit Anyway'



Note the change to [Compatibility Mode]. Now click on 'Enable Content'. This will allow full functionality of the software.



Please be sure to enable macro content when first installing the software and press the enable content button should it ask at the beginning of each session. Also, the spreadsheet will open on your computer in 'Protected View' when installed in Microsoft Office 2010. Please look at the pictures and instructions above to learn how to get to 'Compatibility Mode' in Mircosoft Office 2010.

The ‘Scenario Manager’ tab allows some specialized save and recall functions to allow comparisons of several user defined scenarios. This is discussed later in this manual.

Formula Protection and Copy and Paste Restrictions

Formulas in cells, objects and scenarios are protected so that the functionality of the program is not accidentally compromised. As noted in the *Conditional Formatting* section of this manual, below, please do not copy and paste values from one location or cell in the spreadsheet to another, as conditional formatting and data validation fields have been installed and these cells would be damaged with such activity.

Check Boxes

Check boxes are used by clicking on the box, a check in the box indicates a “yes” response and a blank box indicates a “no” response. The check boxes can also be used to choose default data. In this case a check indicates that the user wants to use default data whereas a blank box indicates that the user does not want to use the default. At times the user also has the option of typing over cells with user-specific information. Where plausible, this user-entered information is highlighted so that the user can easily identify where he or she has made changes from the default. Note that use of default formulas often automatically updates numbers when changes are made in other tabs. These automatic updates may not occur when user-specified information has been entered. Hence cells that do not contain spreadsheet formulas and are highlighted should be reviewed more cautiously as changes to default values are analyzed.

Macro Buttons

Macro buttons are the gray square boxes with the words “OK”, “Save” or “Reset” in them and they reset or save information to default data or default spreadsheet formulas. This allows the user to easily revert to program defaults or compare their user specified information with program defaults. **Note that the ‘Undo’ button, ‘’on the spreadsheet will not revert the spreadsheet to a condition before the Macro button is pressed**. Macro buttons with red ‘OK’ lettering or ‘Reset’ perform changes in multiple sections of a tab, whereas those with black letters only affect one entry. Macro buttons in the ‘Scenario Manager’ tab perform routines that affect several tabs. These buttons are to be used with caution and are described later. Again, you can’t undo macros once you have pressed the buttons. The buttons to move from page to page or tab to tab located at the top of each tab only move you from page to page. They do not change formulas.

Drop-Down Lists

Drop-down lists can be used by clicking on the cell; after clicking on the cell a downward pointing arrow should appear to the right of the cell. Clicking on this arrow will show the

contents of the drop down list. You can scroll up or down in this box using the mouse cursor and then click on the desired entry using the left mouse button. In the 'Farm' tab, a producer can create a custom blend fertilizer and 'Save' it to become part of a drop down choice. A similar option exists in the 'Forage Species' tab, where entry of a new name for a user-specified forage will add that name to the drop down menu as long as that new forage is saved. Drop-down menu choice will be italicized in the remainder of this manual. Note that you may accidentally type a new word in the drop down menu box. An error message will appear saying the cell is restricted. Simply push 'Cancel'.

Comment Boxes

Comment boxes are located throughout each tab of the model and are indicated by small red triangles located in the top right corner of the cell. These comment boxes contain information to better explain contents of a cell or range of cells and may offer additional detail about changes in other locations of the spreadsheet. Comment boxes will appear when the mouse is positioned over the cell containing the red triangle and will disappear when the mouse is moved away from the cell. They do not affect the operation of the spreadsheet.

Reference Cells

The reference cells are any cells that are colored and can be changed. Reference cells contain default values given the user's answers to previous questions, but these default values can be changed by the user to more accurately describe their operation. If the cells are light blue or light green, values may be entered manually. To do this the user simply needs to click on the cell they wish to change and enter the appropriate value. The user should be mindful of how the base values appeared in the cell (dollar amount, percentage, etc.) and enter their own values similarly. Some reference cells have limits imposed on potential entries. These limits are provided to help the producer choose values within a range of values for which the model was designed. Please follow the error prompts to resolve potential problems. Note that the percentage values may need to be entered as fractions (i.e. 5% = 0.05) if the 'Retry' instead of the 'Cancel' button was clicked when an error message has appeared.

Conditional Formatting

Conditional formatting is built into each tab of the model to highlight to the user where they have either made changes from the default assumptions for 'Your Farm' or when the 'Your Farm' values are different from the 'Bench Mark'. The same will happen to 'Bench Mark' cells that the user is able to change. Conditional formatting also at times leads to cells with red tinting. In these situations the user should carefully review their choice to ensure that no errors are present. Note that not all possible user choices are error checked for logical consistency with the rest of the program. Some of the error checking features have come at a cost. **The user**

should not use the copy and paste options for duplicate entries across months or to copy information from one reference cell to another as this will render the software unusable. Each reference cell needs to be updated one at a time. Should the copy and paste feature have been used, please 'Undo' or '  ' those entries. If all else fails, download another copy of the software and retype your work.

Baseline Farm Scenario *(please follow these instructions for following figures to match the manual)*

Through the remainder of this manual, a baseline cow-calf operation is described to help explain the operation of the model. The baseline is thus a point of reference and represents the parameter values the model is downloaded with. The baseline may not correctly describe your operation because the baseline will just be used to help the user become familiar with the model. The baseline farm scenario is established to simulate a starting point for 'Your Farm'. As such, some numbers under the 'Your Farm' column in the various spreadsheet tabs may have conditional formatting that highlights differences compared to the 'Bench Mark' column. Highlights of the baseline are 2013 cattle, fertilizer and supplemental feed prices, 2014 average prices for all other inputs on the 'Prices' tab including default fuel use per day of feeding and farm vehicle charges. On the 'Farm' tab, a *Medium*[1] farm with 60 hay acres and 180 pasture acres (cells C5 to D6) is used with a *Medium* hay fertilization level and a *Lime Only* pasture fertilization level (cells C10 and C11). The *Medium* hay default values are modified by adding 75 lbs of Urea (cell K10) to the 100 lbs of Ammonium Nitrate fertilizer (cell G10) on 'Your Farm'. Nearly all other options on the 'Farm' tab reflect default values by pushing the "OK" macro buttons for each option. One exception is the use of 10% *Orchardgrass* which deviates from the default by first lowering the Fescue percentage from 65% to 55% and then entering 10% in the *Orchardgrass* column (please go ahead and increase the *Orchardgrass* area to 20% by first lowering the Fescue area to 45% and you will be able to tell a difference in net returns and GHG emissions. 'Undo' those changes and revert back to 55% Fescue and 10% *Orchardgrass*). For the 'Pasture' tab, a *Rotational* grazing option (cell I6) was chosen with the defaults accepted for all options except for no winter annuals and no stockpiling. Note that the *Rye* acres in cell L24 are larger than what is available and hence the cell is highlighted in red. Please enter 20 acres of *Wheat* (you will need to modify the drop down list to *Wheat* in cell I24) and 30 acres of stock piling and turn both of these practices on by checking the appropriate check boxes. Strip grazing is unchecked. On the 'Cattle' tab all defaults are accepted but breeding failures (cell E11) are set to 10%, cow herd size is increased to 50 in cell J9 and hay waste is lowered to 15% in cell J22. Also the calving season is *Year round* for the 'Bench Mark' operation whereas 'Your Farm' uses a 'user defined' season defined as having 25%, 50% and 25% of calves born in February, March and April, respectively (cells C30 to E32 and cell E27). The reported defaults are accepted on the 'Forage Balance' tab and haying is allowed but

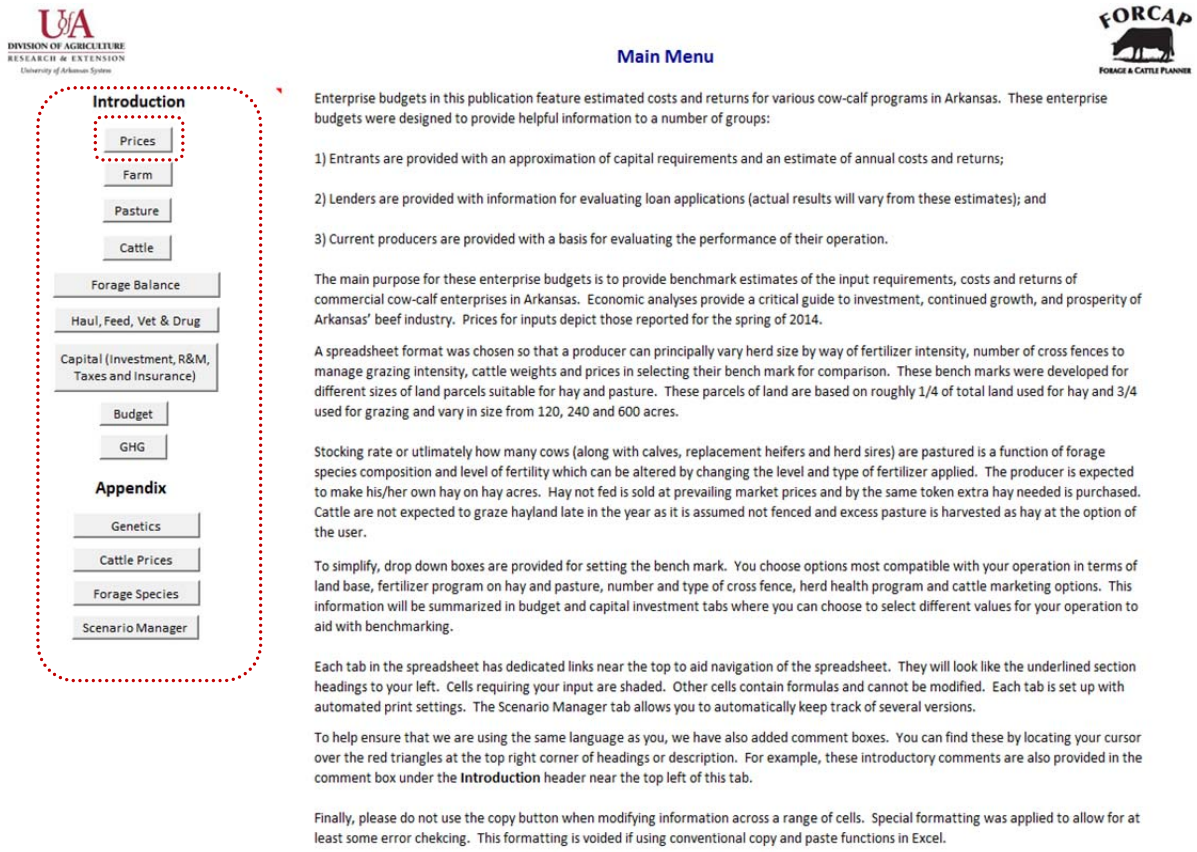
[1] Drop-down menu choices are *italicized* throughout this manual and cell references are provided so the user can enter or modify values as they work on the spreadsheet. These cell references, like C6 refer to column and row indicators in the spreadsheet (they are turned off on the 'Cover' and 'Main Menu' tabs).

results in no hay harvest (cell B30) for the 'Bench Mark' farm as forage available is insufficient to harvest at least ½ a bale per acre (experiment by lowering the min. bales harvested in cell P11 to 0.2 and harvested hay increases to 79 bales for the 'Bench Mark'). Bales are harvested on 'Your Farm' (cell P30) and do not increase with lowering the minimum bale threshold as sufficient forage exists in several months to already harvest 60 bales even with the ½ bale minimum threshold (note that the 'Your Farm' numbers may be different if you did not modify the information in the 'Pasture' tab as noted above). Please reset to 0.5 bales in cell P11 before proceeding. In the 'Haul, Feed, Vet & Drug' tab defaults are again used except that the average distance hauled for cattle using the 'Your Farm's' own trailer was increased to 75 miles. All defaults have also been accepted in the 'Capital' tab. Note that a 'Bench Mark' change in farm size from *Small* to *Medium* or *Large* in the 'Farm' tab (cell C4) is not automatically updated in the 'Capital' tab until the red 'OK' button is pushed in cell H26. Genetic changes are not applied in the 'Genetics' tab and one herd sire was specified for 25 cows with a useful life of four years, with more than half of the operation's calves having no horns when sold. The initial bull purchase price is set to $2,000 and other long-term market values for breeding stock are shown in the 'Capital' tab. The 'Budget' and 'GHG' tabs allow no user entries. Initial genetics of the herd in the 'Genetics' tab, are not applied in cells B14 and C14 and hence do not affect outcomes of the model at this time. 'Cattle Prices' are set to *Yr 2013*. In the 'Forage Species' tab, *Orchardgrass* is selected as the default user-specified forage in the section entitled "Define your Extra Forage" and has already been increased to 10% of pasture acreage in the 'Farm' tab. In the 'Scenario Manager' tab, you may now go and 'Save Current Scenario' and the file will be overwritten with the above changes. Go ahead and press the 'Save as Scenario 2' button, so that you now have the downloaded baseline version with changes to the 'Farm' and 'Pasture' tabs as used in this manual so far and becomes available for resetting as the current scenario as well. The intent for the 'Scenario Manager' tab is to allow for easy file handling of several versions of the program and to have a user-friendly interface for making several comparisons of production practices on one page.

III. Main Menu

The 'Main Menu' tab on the Forage & Cattle Planner (Figure 2) provides information about the model and its intended use. The 'Main Menu' tab contains general information and some instructions regarding the model. At the left of the tab are macro buttons to help the user navigate the spreadsheet. The user can use these same macro buttons, as located at the top of each page, by clicking on them. This will move them to the desired tab with similar names displayed near the bottom of the screen except that the tabs on the bottom are highlighted depending on where the user is currently entering information. Moving back and forth on tabs does not modify any of the information in the spreadsheet. Please press the 'Prices' button to move to the 'Prices' tab.

Figure 2. Main Menu Tab

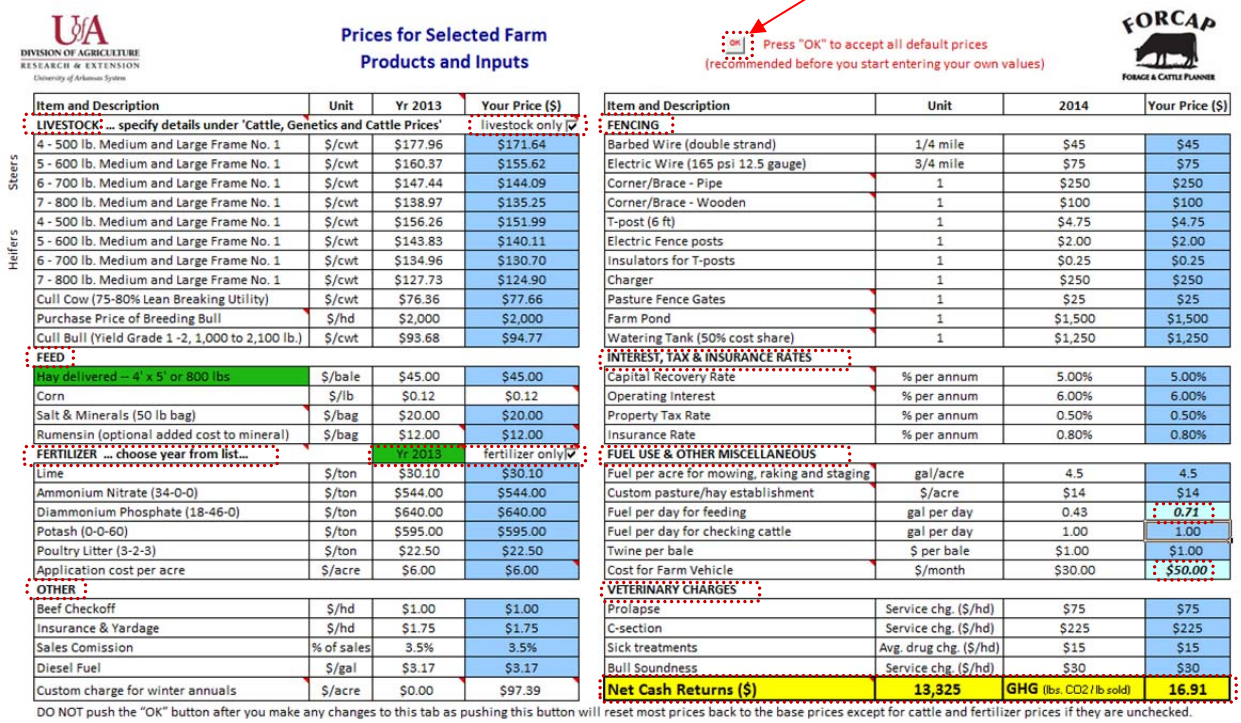


IV. Price Information

The 'Prices' tab on the Forage & Cattle Planner allows the user to provide input prices and other parameters as outlined in the introduction to this manual. While these prices, fuel use, and other parameters are used in several places in the model, they can only be changed on this tab unless specifically noted otherwise. Default values are applied to the 'Bench Mark' operation and are not changeable.

Shaded cells apply to 'Your Farm' and are highlighted if they vary from default numbers. It is recommended that before the user makes any changes to this tab that they push the red 'OK' button at the top of the page. Do not push the red 'OK' button after any changes have been made to this tab as pushing this button will revert all input prices to the defaults. A notable exception is that if 'livestock only' and 'fertilizer only' buttons have been unchecked (Figure 3), the red "OK" button will not reset cattle and fertilizer prices to their defaults. Note that both the feeding fuel use and farm vehicle charges are dependent on cow numbers and are likely to be highlighted, even though they are default values, as the 'Bench Mark' cow numbers will likely be different than 'Your Farm' values once the user has entered their own information.

Figure 3. Prices Tab (GHG and return numbers may differ given instructions on p. 7)



Prices for Selected Farm Products and Inputs

Press "OK" to accept all default prices (recommended before you start entering your own values)

	Item and Description	Unit	Yr 2013	Your Price ($)
	LIVESTOCK: ... specify details under 'Cattle, Genetics and Cattle Prices'			livestock only ☑
Steers	4 - 500 lb. Medium and Large Frame No. 1	$/cwt	$177.96	$171.64
Steers	5 - 600 lb. Medium and Large Frame No. 1	$/cwt	$160.37	$155.62
Steers	6 - 700 lb. Medium and Large Frame No. 1	$/cwt	$147.44	$144.09
Steers	7 - 800 lb. Medium and Large Frame No. 1	$/cwt	$138.97	$135.25
Heifers	4 - 500 lb. Medium and Large Frame No. 1	$/cwt	$156.26	$151.99
Heifers	5 - 600 lb. Medium and Large Frame No. 1	$/cwt	$143.83	$140.11
Heifers	6 - 700 lb. Medium and Large Frame No. 1	$/cwt	$134.96	$130.70
Heifers	7 - 800 lb. Medium and Large Frame No. 1	$/cwt	$127.73	$124.90
	Cull Cow (75-80% Lean Breaking Utility)	$/cwt	$76.36	$77.66
	Purchase Price of Breeding Bull	$/hd	$2,000	$2,000
	Cull Bull (Yield Grade 1 -2, 1,000 to 2,100 lb.)	$/cwt	$93.68	$94.77
	FEED			
	Hay delivered -- 4' x 5' or 800 lbs	$/bale	$45.00	$45.00
	Corn	$/lb	$0.12	$0.12
	Salt & Minerals (50 lb bag)	$/bag	$20.00	$20.00
	Rumensin (optional added cost to mineral)	$/bag	$12.00	$12.00
	FERTILIZER ... choose year from list...		Yr 2013	fertilizer only ☑
	Lime	$/ton	$30.10	$30.10
	Ammonium Nitrate (34-0-0)	$/ton	$544.00	$544.00
	Diammonium Phosphate (18-46-0)	$/ton	$640.00	$640.00
	Potash (0-0-60)	$/ton	$595.00	$595.00
	Poultry Litter (3-2-3)	$/ton	$22.50	$22.50
	Application cost per acre	$/acre	$6.00	$6.00
	OTHER			
	Beef Checkoff	$/hd	$1.00	$1.00
	Insurance & Yardage	$/hd	$1.75	$1.75
	Sales Comission	% of sales	3.5%	3.5%
	Diesel Fuel	$/gal	$3.17	$3.17
	Custom charge for winter annuals	$/acre	$0.00	$97.39

Item and Description	Unit	2014	Your Price ($)
FENCING			
Barbed Wire (double strand)	1/4 mile	$45	$45
Electric Wire (165 psi 12.5 gauge)	3/4 mile	$75	$75
Corner/Brace - Pipe	1	$250	$250
Corner/Brace - Wooden	1	$100	$100
T-post (6 ft)	1	$4.75	$4.75
Electric Fence posts	1	$2.00	$2.00
Insulators for T-posts	1	$0.25	$0.25
Charger	1	$250	$250
Pasture Fence Gates	1	$25	$25
Farm Pond	1	$1,500	$1,500
Watering Tank (50% cost share)	1	$1,250	$1,250
INTEREST, TAX & INSURANCE RATES			
Capital Recovery Rate	% per annum	5.00%	5.00%
Operating Interest	% per annum	6.00%	6.00%
Property Tax Rate	% per annum	0.50%	0.50%
Insurance Rate	% per annum	0.80%	0.80%
FUEL USE & OTHER MISCELLANEOUS			
Fuel per acre for mowing, raking and staging	gal/acre	4.5	4.5
Custom pasture/hay establishment	$/acre	$14	$14
Fuel per day for feeding	gal per day	0.43	*0.71*
Fuel per day for checking cattle	gal per day	1.00	1.00
Twine per bale	$ per bale	$1.00	$1.00
Cost for Farm Vehicle	$/month	$30.00	*$50.00*
VETERINARY CHARGES			
Prolapse	Service chg. ($/hd)	$75	$75
C-section	Service chg. ($/hd)	$225	$225
Sick treatments	Avg. drug chg. ($/hd)	$15	$15
Bull Soundness	Service chg. ($/hd)	$30	$30
Net Cash Returns ($)	**13,325**	**GHG** (lbs. CO2 / lb sold)	**16.91**

DO NOT push the "OK" button after you make any changes to this tab as pushing this button will reset most prices back to the base prices except for cattle and fertilizer prices if they are unchecked.

Livestock

The livestock section in the 'Prices' tab contains a check box (Figure 3). By checking the box at the top of the livestock section, next to the words "livestock only," the user can use prices from the 'Cattle Prices' tab. The user can choose *Yr 2013* prices, *Past 5 yr avg.* or *Past 10 yr avg.* prices in the 'Cattle Prices' tab as part of a drop down menu choice. These prices will change as the user works through the model and picks their calving season and thereby what months calves are normally sold on their operation. With the "livestock only" check mark selected, the model automatically selects the sale month and weight category for livestock sales. Note that this check mark is unchecked when herd sire genetics are changed in a later section of this manual. Should the user want to enter their own price, they should uncheck the "livestock only" check box and specify their own price, which will now be highlighted, and also not change if the red "OK" button is pushed near the top of the screen.

Note that user-specified prices will be overwritten with genetics-adjusted prices if the 'Genetics' tab is used. Also note that user-specified prices do not change when the user changes the calving season. However, calving season adjustments will apply when genetics-adjusted prices are applied. Hence, any time cells are highlighted, the user should pay attention to them when reviewing their production and marketing choices. In the end, prices should reflect what the user estimates their cattle are being sold for. Prices are entered in dollars per hundred pounds sold ($/cwt.) as this is the way cattle are sold at a majority of cattle auctions in Arkansas. However, if the user generally sells cattle by the head instead of by weight

the user can calculate a $/cwt price by taking the price at which the animal was sold for and dividing that price by the animal's weight and then multiplying by 100 ((price per head sold/animal's weight per head in lbs) * 100). Also in the livestock section, there is a row for "Purchase Price of Breeding Bull." The user can enter the price that was paid for the bull that is currently being used on their farm. For this row, prices are entered in dollars per head ($/hd); it is important to note that this is different from the other row entries for the section. If the user is using more than one bull on their operation, an average price for their bulls can be entered. If the user is using a bull that was raised on their operation they can enter the bull's appraised value. In this section, for our baseline scenario, please ensure that the check box next to the words 'livestock only' is highlighted.

Feed

The feed section (Figure 3) pertains to supplemental feed fed to cattle throughout the year. The user should be aware that there is not a common unit for this section. Prices are quoted in $/bag, $/bale and $/lb. So the user should make note of the unit for a given row before entering the price. For the hay row, the user needs to select if they use 4'× 5' or 5'× 5' round bales via the green drop-down box. If the user does not use round bales and instead uses square bales or another form of hay, for both the 4'× 5' and 5'× 5' options a bale weight is given. The user can still enter bale prices, but it will take some manipulation. For example, if the user uses 60 lb square bales that they purchase for $8 a bale we can still enter this as a round bale price. We will select the *4'×5'or 800 lbs* option. We will then divide 800 lbs by 60 lbs which gives us 13.33; this means that it takes 13.33 of the 60 lb square bales to equal 800 lbs of hay. Next, we will multiply the price per bale of $8 by 13.33 giving us a price of $106.64. **For the corn row, the price of supplemental feed is actually determined in the 'Haul, Feed, Vet & Drug' tab.** Users who buy their corn in different units such as by the ton or pound instead of by bushel, the conversion is 56 lbs for every bushel. So if the operator bought a ton of corn he would divide the 2,000 lbs (pounds in one ton) of corn by 56 lbs (pounds in one bushel) this gives the operator 35.7 (number of bushels of corn in one ton); the user should then divide the price he paid for the ton of corn by 35.7 and this will give the operator the price per bushel ($/bushel). The other two rows are in the unit of dollars per bag (50 lbs per bag). There are other ways to buy mineral besides 50 lb bags: i) for operators who buy mineral in blocks, please put the price paid per block in the cell; ii) for operators who buy mineral in tubs divide the weight of the tub by 50 and then take that answer and divide the cost of the tub by it (for example- a 125 lb mineral tub can be purchased for $40. Divide 125 by 50 and get 2.5. Next divide $40 by 2.5 and enter $16); and iii) for operators that buy their mineral in bulk, take the overall weight in lbs and divide by 50 and then take that answer and divide the overall cost by the number of 50 lb units of the amount purchased. These conversions are necessary for appropriate cost calculations in the budget sheet.

The last row in the feed subsection pertains to operations that use Rumensin®. Most operations that use Rumensin® will buy it in a premixed form such as buying mineral that contains Rumensin® in it. So when entering the price for Rumensin® it is important to capture

what the Rumensin® alone is costing you. To do this we need to subtract the Rumensin® premix cost from the cost of similar mineral without Rumensin®. For example, if the user buys Rumensin® premixed in a 40 lb mineral block for $22 and can buy a similar block without Rumensin® for $10 the Rumensin® cost will be $12 ($22-$10) per 40 lbs of mineral or $15 per 50 lbs of mineral. If you do not use Rumensin® on your operation, please enter a price of $0 to turn off the Rumensin® effect. In this software, adding Rumensin® to the cattle diet lowers enteric fermentation and thereby also cattle methane emissions. Since nutrition benefit results of this feed additive are mixed and depend on a host of factors, its addition to the diet will only affect enteric fermentation but not feed conversion efficiency or intake in this software.

For our baseline farm scenario we do not make any changes from the reported prices. Later, as you work through this to establish 'Your Farm', feel free to change these numbers. If they differ from the default values, they will be highlighted.

Fertilizer

At the top of the fertilizer section (Figure 3) is a dark green drop down box that allows the user to pick base prices from *Yr 2013, Yr 2012, Past 5 yr avg.* or *Past 10 yr avg.* The check box next to the drop-down list applies these prices to the reference cells. The user can still change individual fertilizer prices away from the defaults. Should the user choose to do so, they should uncheck the box to avoid inadvertent resetting to default values with the pressing of the red "OK" button near the top of the 'Prices' tab. Fertilizer costs are reported in price per ton and the application cost is reported in cost per acre. Similar to the livestock section, we will check the box next to the words "fertilizer only" for our base farm scenario. **Note that a user option for fertilizer is introduced in the 'Farm' tab so that custom blends of fertilizer, compost or other soil amendments can be user specified.** Note also, that the choice of longer term average of fertilizer price should match the longer term average choice for cattle prices to be consistent.

Other

These are costs that do not easily fall into one of the other sections (Figure 3). Insurance, yardage, and Beef Checkoff are all auction costs and are reported in dollars per head. The Beef Checkoff is a program of the National Cattleman's Beef Association for research and marketing relevant to the cattle industry at both the state and national levels and is applied to every transaction. It is requested that even private sales pay Beef Checkoff funds; however, in this case, it is up to the individual operator to report. Sales commission is also an auction cost. It is reported as a percentage of sales. For operators who sell their calves at a sale barn, these auction costs should appear on your sales receipt. Diesel costs are reported in dollars per gallon, for this cost the operator should enter current diesel prices or an average price for the year. The last charge found in this section captures the amount the user is charged for using a no-till sod seeder. This section automatically updates to a per acre charge on the basis of information provided in the 'Forage Species' tab and 'Pasture' tab where use of winter annuals can be specified. If the

user plants zero acres of winter annuals, the amount defaults to zero. **The program also checks whether at least two pastures are available so that winter annuals can establish without grazing pressure. Zero available acres for winter annuals are shown with only one pasture.**

Fencing

Barbed wire and electric wire costs are provided in price per length of wire on the roll (Figure 3). For barbed wire the unit is price per one-quarter mile ($ per ¼ mile) and for electric wire the cost is price per three-quarter mile ($ per ¾ mile). All other costs are entered as price per unit; so, for example, T-posts are price per T-post ($/T-post) and insulators are price per insulator ($/insulator). The farm pond cost is for digging a farm pond and includes a cost share program. Costs for farm ponds and watering tanks are prorated for 20 years. We will not make any changes to values in this section for our baseline.

Interest, Tax, & Insurance Rates

All four of the rates in this section are annual percentage values (Figure 3). The capital recovery rate is used to capture depreciation and foregone investment returns to capital investment in breeding stock, equipment and buildings. Setting this rate to 0.0001%, the minimum allowed, still calculates depreciation but essentially removes impacts of foregone investment returns. The operating interest rate is the rate of interest charged to the user on farm inputs that are financed and not immediately paid for (Ellinger, 2011). For operators who do not borrow money to operate, it may be set to 0%. The property tax rate is the percentage rate used by the tax assessor's office to calculate property tax amounts each year (you may raise or lower this rate pending actual property taxes paid and/or modify which assets you pay property taxes on in the 'Capital' tab). The insurance rate is the rate used to determine what insurance costs will be. Again further selection options exist in the 'Capital' tab. For our baseline, we will not make any changes to this section.

Fuel Use & Other Miscellaneous

Input costs for this section are in varying units (Figure 3). Costs related to feeding and checking cattle are reported in gallons per day and defaults are linked to cow numbers for the fuel used in feeding. Fuel used in hay production is reported in gallons per acre. Custom pasture/hay establishment includes seed, seedbed preparation and chemicals for weed and pest control needed to maintain productive hay and pasture and is prorate to an annual charge. If the producer does significant weed control using spraying equipment they will likely want to modify this amount and add a sprayer in the 'Capital' equipment tab. Twine or bale wrap costs are reported in dollars per bale. For this calculation, take the cost for the roll of twine or bale wrap and divide it by the number of bales serviced by that roll of twine or bale wrap. Farm vehicle costs (oil change, tires, etc.) are reported in dollars per month. For this calculation, take the total

vehicle costs for the year, decide what portion you wish to charge to your cow-calf operation and divide by 12. The default value charges $1 per cow per month to reflect the likelihood that not all vehicle use will be related to the cow-calf operation. Like the previous section, we will not make any changes to values in this section for our baseline.

Veterinary Charges

Each veterinary charge represents the charge for the service on a per head basis (Figure 3). For example, if the operation had two cows in need of a C-section over the course of a typical year and the vet charged $450 for these visits the user should enter $450/2= $225 as the cost per head for C-sections. Note that other vet charges for mileage, for example, can be entered in the 'Haul, Feed, Vet & Drug' tab. Again, we make no changes here.

Net Cash Returns

Each tab in the model has a bar near the bottom right highlighted in yellow (Figure 3). It updates either net cash returns (sales – cash costs) or net returns (sales – cash costs – ownership charges) for the farm as well as GHG footprint in lbs of CO_2/lb of liveweight of calves and cull animals sold. If the user changes the poultry litter price to $0, for example, please note the increase in net cash returns. If the user changes the property tax rate, net cash returns do not change as property taxes are part of ownership charges. GHG emissions change if the user modifies the fuel use per day for feeding or for checking cattle. If the user changes the fuel use for checking to 1.5 gal per day, for example, both net cash returns and GHG will change. The user should press the 'Undo' button '**'** several times to revert to original cost values if they made changes to numbers as suggested in this paragraph.

V. Farm Size, Fertility and Forage Species Options

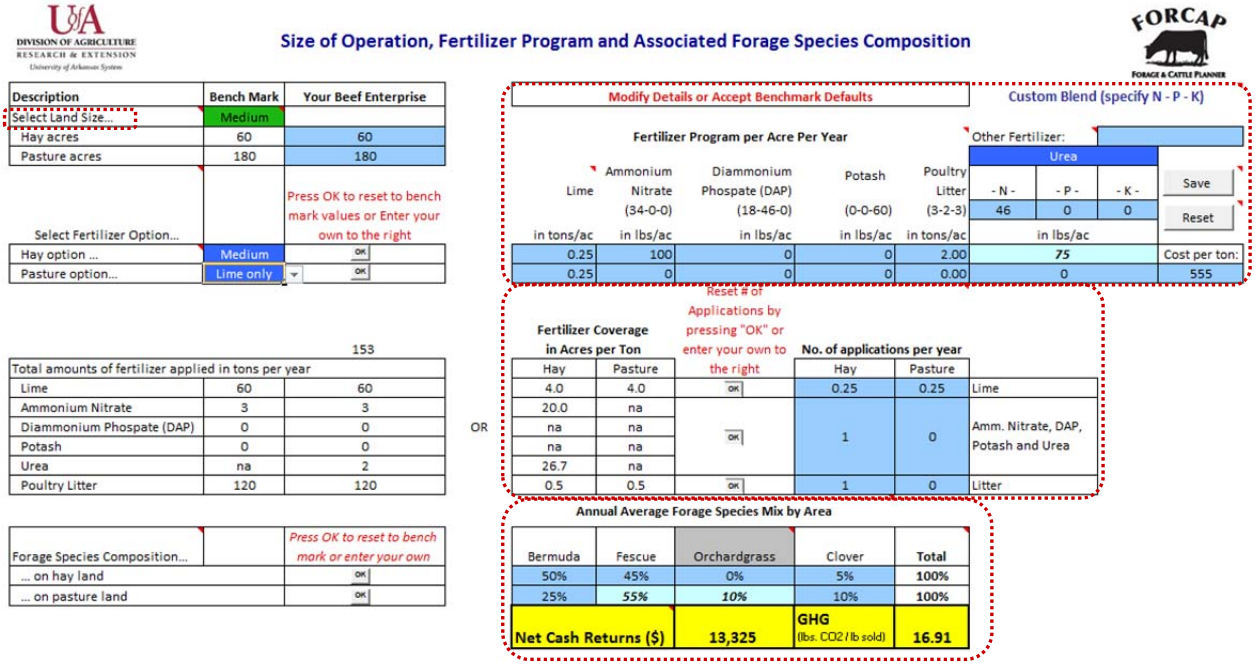
In the 'Farm' tab, the user selects land size, fertilizer and forage species composition options. Figure 4 shows what the 'Farm' tab looks like.

Farm Size

The user selects the 'Bench Mark' farm size in this tab as the basis for comparison to their operation ('Your Farm'). This is done in the dark green drop-down box in the 'Select Land Size…' in row 4. The user should choose to compare their operation to an option that is similar in acreage to their operation for a comparison between the 'Bench Mark' and 'Your Farm' to be appropriate. Operation sizes that the user can compare their operation to include *small* with 120 total acres (zero hay acres and 120 pasture acres), *medium* with 240 total acres (60 hay acres and 180 pasture acres), and *large* with 600 total acres (150 hay acres and 450 pasture acres). Operations that have a primary focus on hay production, but also maintain a small cow-calf operation, should choose the *large* farm and change the acreage to match the operation. By

choosing the *large* farm, the default capital list on the 'Capital' tab will contain all of the haying equipment. For our baseline we have selected a *medium* farm size with 60 hay and 120 pasture acres.

Figure 4. Farm Tab (GHG and return numbers may differ given instructions on p. 7)



Fertilizer

The user can choose fertilization levels on the 'Farm' tab (Figure 4). For fertilization levels, the 'Bench Mark' uses the default recommendations in calculations. The user can specify their fertilization levels as they may differ from the default options by entering information in cells F10 to N11. Under the fertilizer options section the user is able to pick the fertilization level that best matches their fertilization practices for both their hay acreage and their pasture acreage. Default fertilization levels that the user is able to choose from include *None, Lime only*, *Low*, *Medium*, and *High*. To see how each level differs, the user should watch how the numbers change under the 'Fertilizer Program per Acre per Year' section highlighted above in Figure 4. For our baseline we chose *Medium* fertilizer on hay and *Lime only* on pasture and have added *Urea* as the custom fertilizer on hay acres at 75 lbs per acre. The N-P-K values for custom blends like *Urea* are updated with the drop down menu choice selected in cell K6, but another alternative can be entered and saved by specifying custom N-P-K in cells K8 to M8, a cost per ton in cell N11, and a new name for this custom blend of fertilizer in cell M5.

Note that even if the user reports that they do not have any hay acres they must still choose a fertilization level for hay acres. An appropriate choice for a situation of no hay acres would be the choice of *None* for fertilizer on hay acreage in this case. Regardless, the program

determines GHG footprint and cost on the basis of number of acres the fertilizer is applied to and if this choice is 0, GHG footprint and cost are zero regardless of fertilizer option chosen. Note that haying equipment should also be removed in the 'Capital' tab if no haying is performed.

In Arkansas, it is common practice to apply lime once every four years to correct pH. This means that the 0.25 for lime in the 'Fertilizer Program per Acre per Year' means that one ton of lime was applied for a four year period (1/4=0.25). It can also mean that lime was applied on one quarter of the acreage (30 tons on 30 of the 120 acres). If you wish to apply fertilizer on only a part of your hay or pasture acreage on any of the fertilizers and lime, please multiply the actual fertilizer rate applied times the portion of acres fertilized. For example, you apply 100 lbs of urea on 1/2 the hay acres. Please record 100 lbs x 1/2 = 50 lbs in the hay row under urea. This is required as the fertilizer rate is multiplied by all acres to determine cost. Also, the 0.25 under the hay and pasture columns in the "# of Applications per Year" is derived by one application every four years (1/4= 0.25). The number of applications per year is needed to determine application costs. You could split apply fertilizer in a particular year, for example, and then the number of applications would be 2. This would not affect the fertilizer cost but it would affect fuel use and custom charges for fertilizer application in the budget and for tracking GHG emissions. With lime set at 0.25 ton per acre applied 0.25 times per acre the fertilizer cost is based on 60 tons of lime applied per year as shown in cells (C14 and D14) and application charges are $6.00 per acre on 60 acres.

To the right of the different fertilizer choices is an area that allows the user to add another fertilizer or a custom fertilizer. The dark blue box with the word *Urea* in it is a drop down list that allows the user to choose from four different options. For the four choices in the drop down list, base N-P-K levels and costs are provided. Even though base values are provided, the user can still make changes to these values. If the user wants to save the changes they have made they should click the 'Save' button and the user-specified option is saved as another option in the drop down menu. It is important to specify a name for this new fertilizer option in cell M5 before 'Saving' to avoid confusion with other fertilizers. The 'Reset' button resets N-P-K and cost information for drop down menu options to previously saved values. Also note that user specified fertilizers are not updated to other price years or long-term averages when the user changes those options in the 'Prices' tab.

A final note on fertilizer applications is that the model works under the assumption that the operator does not own any equipment to spread fertilizer or litter and either rents equipment as needed or hires someone to custom spread. If the operator does own equipment to spread fertilizer or litter they will need to enter the equipment in the 'Capital' tab and would then be able to lower the custom fee for fertilizer application in the 'Prices' tab (cell E29) to reflect only fuel charges per acre.

Forage Species Selection

If the user decides to make changes to the pasture forage species composition in Figure 4, the user must make sure that the percentages they enter are equal to 100% of the land base

available. Make sure to enter values separately in each box and do not copy and paste. Automated error messages appear if you should attempt to increase forages to greater than 100% of the area available. When looking at the forage varieties, the user will notice that one of the varieties is located in a gray box. The gray box indicates that the forage in that cell is the user specified forage that can be modified in the 'Forage Species' tab. The name of the forage selected in the *Options* drop-down box (cell B6) in the 'Forage Species' tab will appear in the gray box in the 'Farm' tab under the "Annual Average Forage Species Mix by Area". The user may notice later in the spreadsheet on the 'Pasture' tab that winter annuals can be included as available forage. These annuals are intended to be sod-seeded on acreage that is predominantly warm season and hence dormant during the period when winter annuals would produce forage – that is winter annuals are considered a double-crop. These winter annuals are not included in the "Annual Average Forage Species Mix by Area" section as this activity is linked more to pasture management in the 'Pasture' tab and user-defined options in the 'Forage Species' tab.

Note that the user can push the "OK" button at any time to revert blue boxes for a specific row back to their original base numbers. For the baseline we added 10% of *Orchardgrass* to pasture land by first lowering Fescue to 55%. All other options should be the base numbers with the exception of added *Urea* on hay acres. Note that these changes from default values are highlighted so the user is always reminded when they have chosen values different from their chosen 'Bench Mark' farm. Note that default values in this section of the spreadsheet are also linked to fertilizer options in cells C10 and C11. Raising the fertility level in C11 on pasture, for example, to *Medium*, results in a forage species mix exceeding 100% as the default forage species mix with *Medium* fertilizer has a higher *Bermuda* grass breakdown. Please reset to *Lime Only* in cell C11 before proceeding.

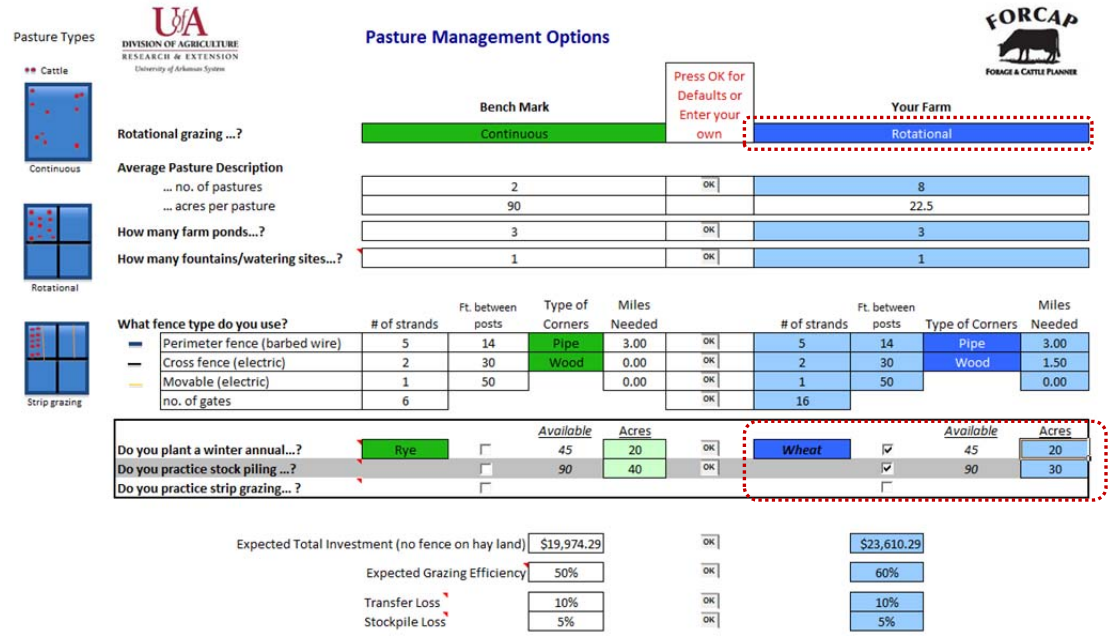
VI. Pasture Management and Water Access

The 'Pasture' tab contains information pertinent to pasture management for the operation (Figure 5). The 'Bench Mark' values for this tab could be changed to generate a comparison that is similar to 'Your Farm'. Benchmark values are located in green cells. Light and dark blue cells contain values that will be used when making calculations about 'Your Farm'. We will leave these values as they are set in Figure 5.

Rotational vs. Continuous Grazing

The first question is what kind of grazing strategy your operation utilizes. If the user does not know what type of grazing strategy they use, pictures are located on the left side of the tab to help the user better understand the different options. In these pictures; cattle are red dots, pasture area is blue, and fences are black and light brown lines. After the user chooses from *Continuous* or *Rotational* strategies, they are asked about the number of pastures making up their

Figure 5. Pasture Tab (GHG and return numbers may differ given instructions on p. 7)



total pasture acreage. Acres per pasture are determined by dividing total pasture acres by the number of pastures. Note that all pastures are assumed to contain the same number of acres. The number of farm ponds and number of watering sites is determined loosely by assuming access to watering sites from as many as four pastures for each water source. When looking at these questions note that numbers in green cells are the default values and they may differ for 'Your Farm' depending on the pasture acreage entered in the 'Farm' tab even when using the defaults. The user can accept the defaults or enter their farm's numerical answers to these questions in the light blue cells. For our baseline, note that 'Your Farm' uses *Rotational* grazing in cell I6 and is planting 20 acres (cell L24) of *Wheat* (cell I24) as a winter annual and stockpiling 30 acres (cell L25) of pasture as discussed above (p. 7). Stockpiled acres are managed for later access in the year than other pasture acres in the 'Forage Balance' tab.

Fence Post Spacing and Cost

The next section covers fencing (Figure 5). Recommendations are given for fencing based on the type of grazing method and number of acres chosen in the benchmark. The user can select if they want the 'Bench Mark' farm to have pipe or wooden corners in the green drop-down lists in the fencing section. The user should enter their farm's numerical answers to fencing specifications in the light blue cells. For our baseline, we are going to select default values for water sites and fencing. The "Expected Total Investment" for fencing and watering equipment is outlined in row 30. The program compiles costs for the user's answers in the 'Pasture' tab based on related costs in the Fencing section of the 'Prices' tab for both the 'Bench Mark' and 'Your Farm'.

Stockpiling, Strip Grazing and Winter Annuals

The 'Pasture' tab (Figure 5) also contains questions that allow the user to select whether they use stockpiling, strip grazing, or if winter annuals (such as *Rye, Wheat* or *Ryegrass*) are planted; some of these questions are only considered in calculations if more than one pasture is available on the operation as some of these practices require keeping cattle out of a pasture to allow delayed grazing or establishment of winter annuals. For more information regarding stockpiling and strip grazing please place the cursor over those cells in the model and comment boxes with information explaining those practices will appear. The user can implement planting winter annuals, stockpiling or strip grazing by checking the checkbox in the rows for the options they want to implement. If the checkbox is not checked then these options will not be applied even if an acreage number exists. That is, the bench mark does not plant 20 acres of *Rye* as the check box in cell E24 is not marked. Note that for each row there are separate checkboxes for the 'Bench Mark' and 'Your Farm' to allow comparison of costs and benefits for these options. For example, if the user does not currently stockpile forage, but they are thinking of implementing it on their operation, they can leave the checkbox unchecked under the 'Your Farm' section and check the corresponding checkbox in the 'Bench Mark' section to see what the differences to their operation might be or they can toggle back and forth the check box on 'Your Farm' and note the changes in net returns and GHG in the yellow box. The 'Scenario Manager' tab allows users to save several scenarios for comparison and is discussed later.

Based on the number of pasture acres the user specifies in the 'Farm' tab, a limit is placed on the number of acres that can be planted in winter annuals and the number of acres that can be used for stockpiling. For example, the user cannot have 65 acres for stockpiling if they have already stated that they only have 50 acres of pasture. Acres available are reported to assist the user to determine whether their selected acreages are appropriate or not. Available acres default to zero if only one pasture paddock exists in row 9. If the user has more acres in winter annuals or stockpiling than what they have listed as the amount of pasture acres, the cells for the amount of acres of winter annuals and stockpiling will turn red to alert the user that information used is likely inappropriate.

Expected Grazing Efficiency, Transfer and Stockpile Losses

Towards the bottom of Figure 5, the expected grazing efficiency value is a ratio that shows how well cattle on the operation are expected to be able to utilize pasture growth defined as forage available 2" above the ground. Grazing efficiency is reported as a percentage. Values between 30% and 70% are common as cattle trample forage, and desirable species are selectively grazed to an extent that less desirable forages mature to a point where they no longer have significant nutritive value and hence are not grazed by cattle. Higher values are better as more forage production is utilized. Default values are linked to *Continuous* and *Rotational* grazing with added utilization reserved for intensive grazing management via strip grazing. Expected Grazing Efficiency starts at 50% when *Continuous* grazing is used and will change to 60% when

Rotational grazing is used. If the user has specified that *Rotational* grazing is used on their operation and further specify that they practice strip grazing the "Expected Grazing Efficiency" in row 32 reaches 75%.

Transfer and stockpile loss values are used to further adjust expected grazing efficiency when the operator chooses to intentionally set aside forage for later consumption (stockpiling) or when forage losses result as a function of having too much forage available for cattle to graze. Transfer losses occur as forage matures to levels beyond their most nutritive state. Such mature forages often shed leaves and/or develop seed. The program applies this transfer loss to forage that is not consumed until the following month. Also, forage is not transferred for more than one month. For example, excess May forage is only available in June net of transfer loss. If not grazed in June it is treated as unused in July. The stockpile loss percentage is used when stockpiling is implemented. The stockpile loss percentage is a percentage of the total amount of set-aside, stockpiled forage growth that has accumulated over the stock piling period beginning in August and ending in November. The user specifies access to stockpiled forage starting in October in the 'Forage Balance' tab. The default value for stockpile losses is lower than for transfer losses as cattle are not allowed access during the stock piling period and also because of the start of cool season forages in the fall when stockpiling is being practiced. Overall, the operator should strive to minimize both transfer and stockpile losses to optimize utilization of forage production. The "OK" buttons return 'Your Farm' numbers to defaults used with the 'Bench Mark' farm. More details on pasture management are provided in the discussion on the 'Forage Balance' tab.

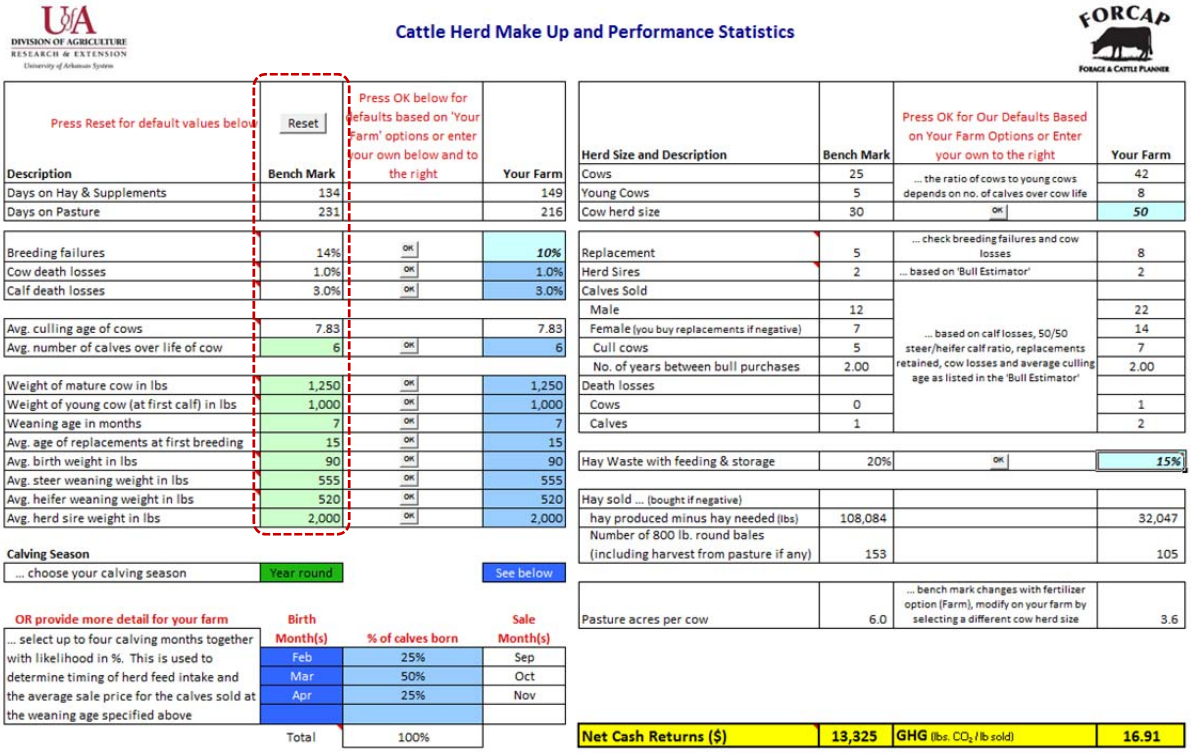
VII. Cattle Herd Composition and Performance

The 'Cattle' tab contains information about the number and weight of cattle as well as cattle management options (Figure 6). While the user can change values in green and blue cells, values in white cells cannot be changed because they are governed by underlying formulas or given a number that meets the minimum requirements that must be fulfilled. Towards the top left of the tab is a 'Reset' button. The 'Reset' button should be clicked before any changes are made on the tab. The 'Reset' button on this tab is unique as it does not affect answers under the 'Your Farm' column. Pushing the 'Reset' button will only reset values for the 'Bench Mark' operation.

Herd Statistics

Herd statistics include everything on the left side of Figure 6 above the "Calving Season" section. "Days on Hay and Supplements" shows how many days the operator will need to feed hay and supplements to their cattle throughout a year based on the user's answers to questions on this tab and previous tabs. "Days on Pasture" shows how many days throughout the year cattle on the operation can get their complete nutrition from pasture without supplementation of hay or

Figure 6. Cattle Tab (GHG and return numbers may differ given instructions on p. 7)



Cattle Herd Make Up and Performance Statistics

Press Reset for default values below	Reset	Press OK below for defaults based on 'Your Farm' options or enter your own below and to the right	
Description	Bench Mark		Your Farm
Days on Hay & Supplements	134		149
Days on Pasture	231		216
Breeding failures	14%	OK	10%
Cow death losses	1.0%	OK	1.0%
Calf death losses	3.0%	OK	3.0%
Avg. culling age of cows	7.83		7.83
Avg. number of calves over life of cow	6	OK	6
Weight of mature cow in lbs	1,250	OK	1,250
Weight of young cow (at first calf) in lbs	1,000	OK	1,000
Weaning age in months	7	OK	7
Avg. age of replacements at first breeding	15	OK	15
Avg. birth weight in lbs	90	OK	90
Avg. steer weaning weight in lbs	555	OK	555
Avg. heifer weaning weight in lbs	520	OK	520
Avg. herd sire weight in lbs	2,000	OK	2,000

Calving Season

... choose your calving season	Year round	See below

OR provide more detail for your farm	Birth Month(s)	% of calves born	Sale Month(s)
... select up to four calving months together with likelihood in %. This is used to determine timing of herd feed intake and the average sale price for the calves sold at the weaning age specified above	Feb	25%	Sep
	Mar	50%	Oct
	Apr	25%	Nov
	Total	100%	

Herd Size and Description	Bench Mark	Press OK for Our Defaults Based on Your Farm Options or Enter your own to the right	Your Farm
Cows	25	... the ratio of cows to young cows depends on no. of calves over cow life	42
Young Cows	5		8
Cow herd size	30	OK	50
Replacement	5	... check breeding failures and cow losses	8
Herd Sires	2	... based on 'Bull Estimator'	2
Calves Sold			
Male	12	... based on calf losses, 50/50 steer/heifer calf ratio, replacements retained, cow losses and average culling age as listed in the 'Bull Estimator'	22
Female (you buy replacements if negative)	7		14
Cull cows	5		7
No. of years between bull purchases	2.00		2.00
Death losses			
Cows	0		1
Calves	1		2
Hay Waste with feeding & storage	20%	OK	15%
Hay sold ... (bought if negative)			
hay produced minus hay needed (lbs)	108,084		32,047
Number of 800 lb. round bales (including harvest from pasture if any)	153		105
Pasture acres per cow	6.0	... bench mark changes with fertilizer option (Farm), modify on your farm by selecting a different cow herd size	3.6
Net Cash Returns ($)	**13,325**	**GHG** (lbs. CO_2 / lb sold)	**16.91**

other feedstuffs. Breeding failures, cow losses, and calf losses are percentages that the user can specify under the 'Your Farm' column. In the 'Bench Mark' column the percentages that appear for breeding failures, cow losses, and calf losses are the base percentages given the user's answers to other questions. The base calf loss percent is 3% and the base cow loss is 1% (Ritchie et al. 1994). The user should note that as they work through this tab these percentages could change. For example, selecting a *Fall* calving season lowers breeding failures compared to *Spring* due to lower levels of toxins from fescue consumed by cows at key times in the production cycle. The user should also note that applying breed effects on the 'Genetics' tab will make changes to these calf and cow death losses. The next two rows ask for mature cow weights and young cow weights. Answers to these rows should be an average per head weight for cattle on the operation. These weights are important as the model estimates feed use and nutrition requirements on the basis of these weights. Calf weaning age in months helps to calculate the anticipated weaning weight for calves on the operation. The average birth weight for calves is important as calving difficulty is shown to increase as birth weight increases (Ritchie et al. 1994). Average weaning weight for steers and average weaning weight for heifers impact calf revenues by telling the model which weight ranges to pull anticipated prices from. Birth weight and weaning weight also affect average daily gain (ADG) calculations from birth to weaning age and thereby anticipated feed use. When applying breed effects on the 'Genetics' tab, birth weight and weaning weights will change based on expected progeny difference (EPD) changes.

For the baseline farm, reported defaults were used for each of these rows with the exception of expected breeding failures in cell E11.

Calving Season

The "Calving Season" section in Figure 6 asks the user when calves are being born on their operation. The user can choose from defaults in the drop down boxes located in row 27 or specify their own monthly distribution by selecting *See below* for 'Your Farm'. The user can now specify the monthly distribution of calf births. Note that sale months are staggered based on the weaning age specified above. If the user has one or more blank cells under birth months, make sure that the cells to the right of the blank cells do not have percentages in them (see row 33). If the calving percentage does not equal 100% an error message will appear to the right of the section. The answer to the calving season option (*Year round, Spring* = 100% March calving, *Fall* = 100% October calving and *See below* = user-specified) and the user's answer to sale weight, determines the sale prices used for the 'Bench Mark' and 'Your Farm' values for livestock in the 'Prices' tab. An exception is if the user defined their own sale prices. For our baseline we selected a calving season as shown in Figure 6. The 'Year round' option splits calving across all twelve months according to observations based on sample farms (15% in Jan, 18% in Feb, 14% in Mar, 9% in Apr, 5% in May and Jun, 3% in Jul and Aug, 8% in Sep, Oct and Nov and 4% in Dec).

Herd Description

The top part of this section in Figure 6 asks the size of the user's cow herd. From the user's answer in this row, the model breaks the cow herd into mature cows and young cows. For our baseline we increased the cow herd size from 30 to 50 head. The number of mature cows and young cows is based on the user's answer to the previous question of "Avg. number of calves over life of cow." As the average number of calves over the life of a cow increases the number of young cows decreases and as the average number of calves over the life of a cow decreases, the number of young cows increases. The number of replacements owned/needed is based on the number of breeding failures and cow losses; it is often the same as the number of young cows as cow losses are small and spread across mature and young cows. The number of calves sold is based on a 50/50 male to female calf breakup and the number of calf losses. The user should understand that the model assumes that the user is keeping their own heifer calves as future replacements; therefore, the number of heifer calves sold is the total number of heifer calves minus the number of replacements needed. The number of cull cows is based on the number of replacements less death losses. The software assumes that the operator is interested in maintaining their herd at a constant size. Hence, replacements are added to the herd at the same rate as old cull cows are sold after adjusting for death losses. The number of years between bull purchases is based on the user's answers in the 'Genetics' tab about the intended length of stay

for a bull as well as the number of herd sires on the operation. Death losses are based on cow and calf loss percentages.

Hay Waste and Needs

This section in Figure 6 is based on values in the 'Farm', 'Pasture' and 'Forage Balance' tabs as well as nutrient requirements for cattle described in the 'Cattle' tab. The hay feeding and storage losses are defaults observed on average for Arkansas cattle operations. If the value for round bales is in parentheses it means that the number is negative and that is the number of bales that will need to be purchased having accounted for hay production from hay acres as well as excess hay harvested from pastures if available.

Stocking Rate

The "Pasture acres per cow" row allows the user to see what their stocking rate is; or how many pasture acres they need per cow to maintain that cow. Stocking rate is a function of herd size, amount of land, grazing efficiency, and fertilization. Pushing the "OK" button in cell I9 above, changes the stocking rate to the default value based on the default fertilizer option set in the 'Farm' tab. The user should specify the number of cows expected to calf or their "Cow herd size" in cell J9 to determine their stocking rate. Note that the user can specify any stocking rate they want so long as at least 5 cows are on the operation. Numbers in light green boxes are derived from either state averages or the user's answers to questions on previous tabs. For our baseline farm, the stocking rate is 3.6 acres per cow, as the cow herd size was adjusted up to 50 cows with a 10% breeding failure. Hay waste of 15% and a user-defined calving season are the only other parameters different from the default value.

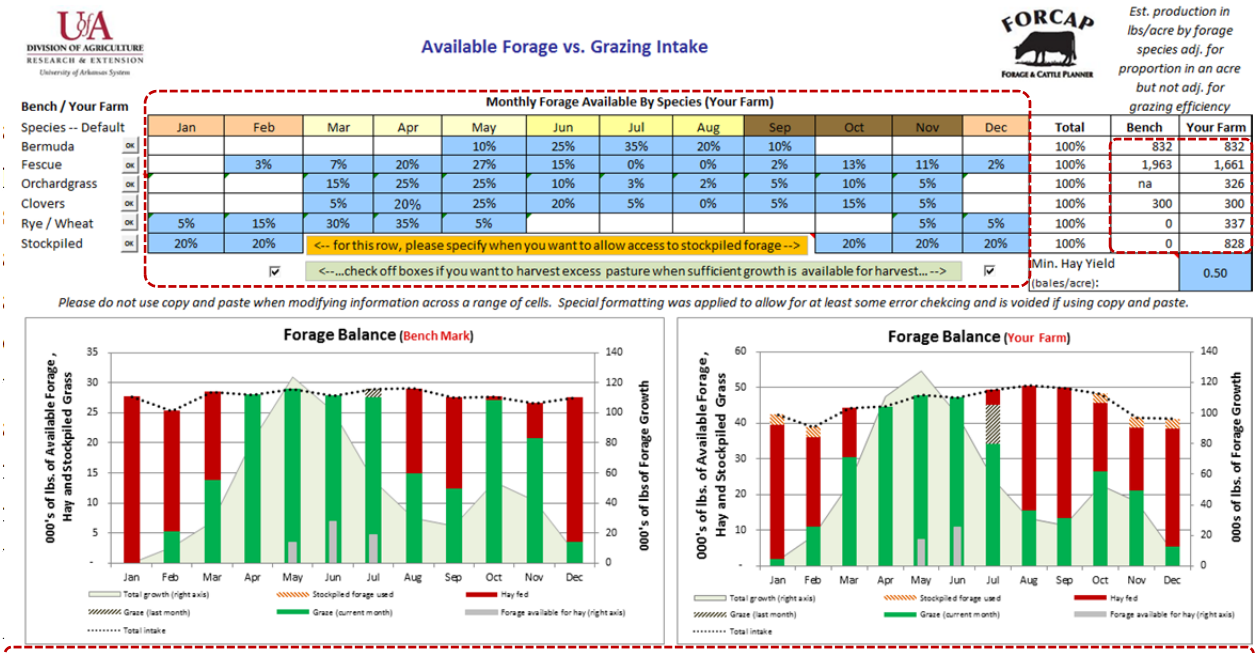
VIII. Balancing Forage Availability with Grazing Needs

The 'Forage Balance' tab contains information and graphs pertaining to forage production and grazing intake (Figure 7). For the baseline, the defaults were used in the 'Forage Balance' tab and we checked the boxes to say that we would harvest hay from excess pasture when available.

Monthly Forage Production

The top section, "Monthly Forage Available by Species" allows the user to break up what percentage of their total forage production takes place in different months. Months are color coded into four seasons; light orange for winter, light yellow for spring, bright yellow for summer, and brown for fall. These roughly coincide with the seasons developed for the 300 day grazing program but forage production in this program is broken down into monthly detail.

Figure 7. Forage Balance Tab (GHG and return numbers may differ given instructions on p. 7)



Available Forage vs. Grazing Intake

Est. production in lbs/acre by forage species adj. for proportion in an acre but not adj. for grazing efficiency

Monthly Forage Available By Species (Your Farm)

Bench / Your Farm	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Bench	Your Farm
Species -- Default															
Bermuda					10%	25%	35%	20%	10%				100%	832	832
Fescue		3%	7%	20%	27%	15%	0%	0%	2%	13%	11%	2%	100%	1,963	1,661
Orchardgrass			15%	25%	25%	10%	3%	2%	5%	10%	5%		100%	na	326
Clovers			5%	20%	25%	20%	5%	0%	5%	15%	5%		100%	300	300
Rye / Wheat	5%	15%	30%	35%	5%						5%	5%	100%	0	337
Stockpiled	20%	20%	<-- for this row, please specify when you want to allow access to stockpiled forage -->							20%	20%	20%	100%	0	828

<--...check off boxes if you want to harvest excess pasture when sufficient growth is available for harvest... -->

Min. Hay Yield (bales/acre): 0.50

Please do not use copy and paste when modifying information across a range of cells. Special formatting was applied to allow for at least some error checking and is voided if using copy and paste.

Hay bales:	0	% of growth grazed	38	Net Cash Returns ($)	13,325	GHG (lbs. CO_2 / lb sold)	16.94	% of growth grazed	51	Hay bales:	60

Forage Requirements and Est. Days on Feed (Bench Mark)

Month	Cows	Bulls	Replace-ments	Heifer calves	Steer calves	Total required	Estimated days on feed
Jan	23,038	2,306	1,585	375	396	27,700	30
Feb	21,264	2,083	1,217	345	358	25,267	24
Mar	24,191	2,306	954	515	538	28,505	16
Apr	23,777	2,232	634	655	689	27,986	-
May	24,594	2,306	601	687	727	28,916	-
Jun	23,483	2,232	642	758	790	27,904	-
Jul	23,963	2,306	729	945	985	28,929	-
Aug	23,211	2,306	775	1,343	1,414	29,049	15
Sep	21,799	2,232	1,035	1,200	1,269	27,535	17
Oct	22,312	2,306	1,294	889	942	27,744	1
Nov	21,806	2,232	1,394	560	591	26,582	7
Dec	22,902	2,306	1,489	393	416	27,507	26
Annual	276,339	27,156	12,350	8,665	9,115	333,625	134

Forage Requirements and Est. Days on Feed (Your Farm)

Month	Cows	Bulls	Replace-ments	Heifer calves	Steer calves	Total required	Estimated days on feed
Jan	36,030	2,306	3,984	-	-	42,320	27
Feb	32,951	2,083	3,880	-	-	38,913	19
Mar	38,510	2,306	3,394	-	-	44,210	9
Apr	41,303	2,232	1,123	-	-	44,658	0
May	45,535	2,306	-	-	-	47,842	0
Jun	44,212	2,232	-	309	327	47,080	0
Jul	44,145	2,306	-	1,394	1,425	49,271	3
Aug	42,041	2,306	-	3,050	3,135	50,532	21
Sep	37,704	2,232	-	4,778	5,039	49,753	22
Oct	35,429	2,306	886	4,705	5,019	48,345	12
Nov	33,159	2,232	2,618	1,686	1,800	41,495	13
Dec	35,128	2,306	3,742	-	-	41,177	24
Annual	466,148	27,156	19,626	15,921	16,745	545,596	149

Graph Information

	Graze (current month)	Stockpiled forage used	Graze (last month)	Hay fed	Total intake	Total growth (right axis)	Forage available for hay (right axis)
Jan	-	-	0	27,700	27,700	-	(0)
Feb	5,300	-	-	19,967	25,267	10,600	-
Mar	13,717	-	-	14,788	28,505	27,434	-
Apr	27,986	-	-	-	27,986	81,468	-
May	28,916	-	-	-	28,916	123,869	13,487
Jun	27,904	-	-	-	27,904	101,219	27,904
Jul	27,542	-	1,387	-	28,929	55,085	19,048
Aug	14,967	-	-	14,082	29,049	29,934	-
Sep	12,367	-	-	15,168	27,535	24,734	-
Oct	27,017	-	-	727	27,744	54,034	-
Nov	20,784	-	-	5,799	26,582	41,567	-
Dec	3,533	-	-	23,973	27,507	7,067	-

	Graze (current month)	Stockpiled forage used	Graze (last month)	Hay fed	Total intake	Total growth (right axis)	Forage available for hay (right axis)
Jan	1,818	2,832	-	37,670	42,320	3,636	-
Feb	10,836	2,832	-	25,246	38,913	19,877	-
Mar	30,366	-	-	13,844	44,210	54,247	-
Apr	44,658	-	-	-	44,658	110,718	-
May	47,842	-	-	-	47,842	127,498	17,305
Jun	47,080	-	-	-	47,080	98,933	25,464
Jul	34,107	-	11,051	4,112	49,271	56,845	-
Aug	15,554	-	-	34,979	50,532	31,108	-
Sep	13,290	-	-	36,463	49,753	26,581	-
Oct	26,418	2,832	-	19,095	48,345	52,835	-
Nov	21,079	2,832	-	17,585	41,495	42,158	-
Dec	5,406	2,832	-	32,939	41,177	9,616	-

Those users familiar with the 300 day grazing program are asked to break down their forage production by month as all production decisions in this program are modeled on a monthly time step. Each species of forage available is located in cells A5 to A10. To the right of the forage type, under the "Monthly Forage Available by Species (Your Farm)" section, default production months are given. Default "OK" buttons allow resetting to default values for

a normal production and rainfall year as used for the ‘Bench Mark’ farm. The user can adjust to either use the default values or modify to adapt to their own operation or to model an abnormal year. The user can choose to enter their own seasonal breakdown of forage availability for each forage and month that is unlocked for modification (the shaded cells). White cells are unavailable for modification except for the user specified forage – *Orchardgrass* in this case, or any other forage the user specifies in the ‘Forage Species’ tab.

If the user chooses to enter their own seasonal availability percentages in the ‘Forage Balance’ tab, it is important that they do not try to copy numbers into adjoining cells by cell dragging or by using copy and paste. The user should manually enter a percentage into each cell separately. At the right of each row is a total percentage column. The total for each forage must be less than or equal to 100%. When the total percentages for the forages are less than 100% it can resemble times of drought or little rain.

To the right of the monthly forage breakdown is the estimated annual yield in lbs. of dry matter (DM) per acre for each species. It represents the amount of production available to cows over the course of a year. Adding the production by forage species across rows 5 to 9 provides an estimate of the total forage grown per acre. Note that the stockpiled forage available is also presented but merely represents the amount of forage set aside for delayed consumption. It should not be added to the production total. These numbers are adjusted by what proportion of area the given species has in an acre. Note that the ‘Your Farm’ operation grows *Orchardgrass* and sod-seeded *Wheat* along with stockpiled forage wheras the benchmark farm does not use orchardgrass and *Rye* since the winter annual check mark had not been checked in the ‘Pasture’ tab for the ‘Bench Mark’ farm. Bermuda and clover yields are the same given the same fertilizer application level for the ‘Bench Mark’ and ‘Your Farm’. Fescue yield seems lower but is a reflection of the acreage diversion to 10% *Orchardgrass*. As an aside, applying 100 lbs of *Urea* in the ‘Farm’ tab on pasture for your farm would raise the ‘Your Farm’ production of Bermuda to 1,206 lbs per acre (please undo this change before continuing to read this manual).

Forage Production Graphs

Below the monthly forage production by species section are graphs that show the forage balance for ‘Your Farm’ and for the ‘Bench Mark’ in Figure 7. The shaded area in the background of the graph represents overall pasture forage growth by month and represents forage availability before removing production for delayed consumption if the user stockpiles. The dotted black line on the graph shows the total dry matter intake (DMI) required for the entire herd which varies with assumptions made in the ‘Cattle’ tab. The colored bars show how the cow-calf operator meets the total dry matter intake requirements of the herd. If the operation’s forage production meets the total DMI needed each month then the cattle can simply graze (green and black cross hatched sections of the bars); however, if farm forage production is less than the total DMI needed for a particular month, the graph shows that the operator must supplement through use of hay (red shaded portions) or stockpiled forage (lighter colored cross hatched sections). The operator can also supplement with feed (corn, range cubes, etc.) to meet

nutrition requirements but these feeds are not expected to impact hay intake and are therefore not shown in the forage balance graph. Any forage not grazed within its current or following month is available for hay harvest but subject to a minimum yield requirement specified in cell P11. Hay harvest can also only occur if there are at least two pastures and hay acres/haying equipment are specified for the operation.

Directly below the forage graphs in Figure 7, the computer calculates the estimated percentage of total annual pasture growth actually grazed or the estimated grazing efficiency defined as the total herd intake less hay fed as a percentage of total annual pasture growth. Also below the graph is the amount of hay harvested as a function of available forage that would go unused if not harvested mechanically (the thinner gray bars). The percentage of annual pasture growth grazed is thus a function of expected grazing efficiency (in turn driven by pasture management – *Continuous*, *Rotational* or *Rotational* plus *Strip Grazing* in the 'Pasture' tab) as well as the matching of forage production via forage species mix with herd dry matter intake needs that are driven by stocking rate, calving season, weaning age and cattle weights. The user is encouraged to change calving season in the 'Cattle' tab for example to determine effects on the forage balance graphs. Please be sure to revert parameter values prior to proceeding by pressing the 'Undo or '' button should you have chosen to change calving season or other parameter values.

Forage Requirements

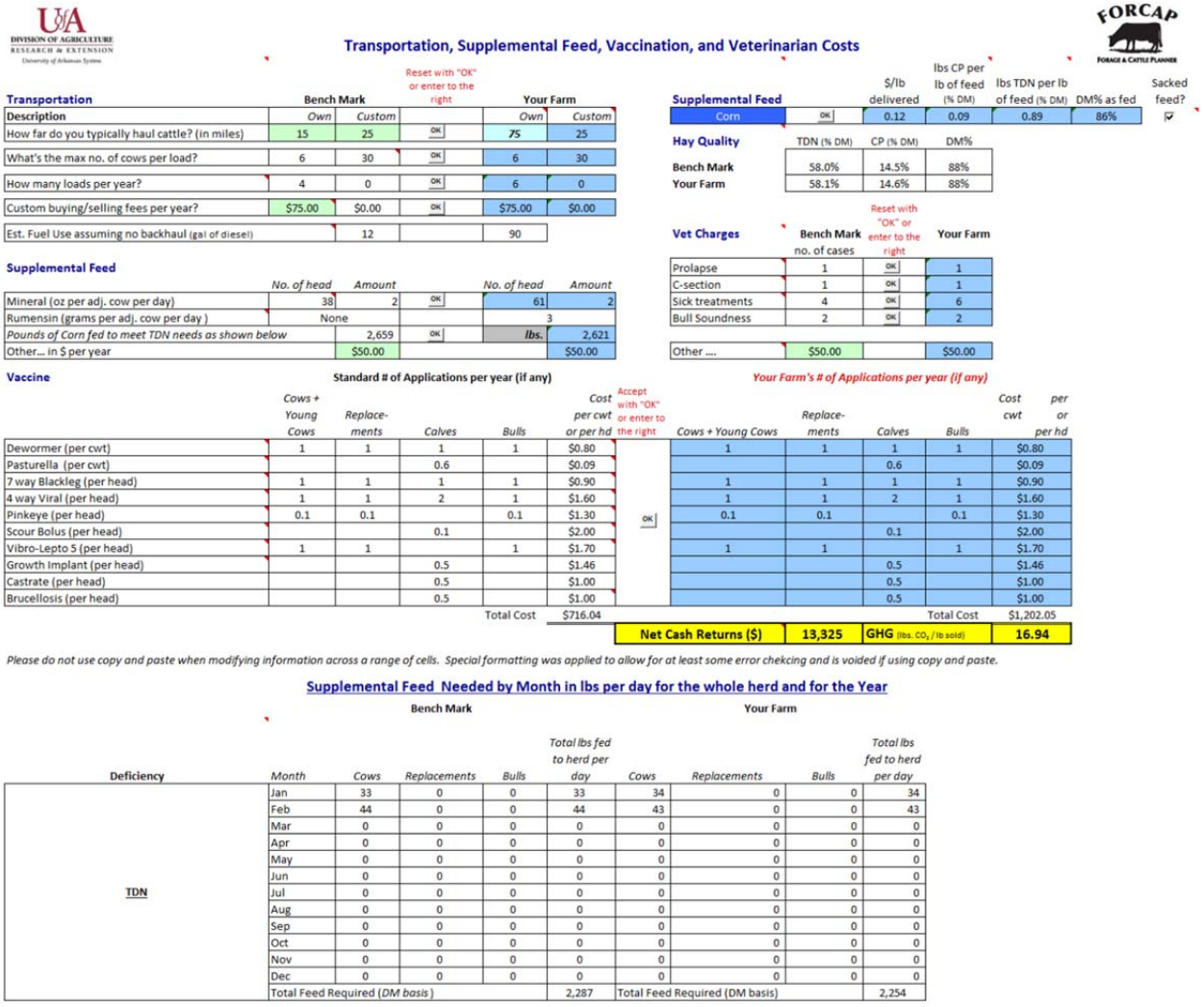
Below the forage balance graphs in Figure 7 are the forage requirements and estimated days on feed information. The user needs to scroll down to see this part. This section shows what the forage requirements are for the 'Bench Mark' and 'Your Farm' per year based on how many cows, bulls, replacements and calves the user stated they have. Note that heifer and steer calves do not consume forage in all months of the 'Your Farm' table when a defined calving season has been selected; whereas the 'Year round'- calving, 'Bench Mark' farm has consumption for calves year round. Given an operation's total forage requirements and total forage production, an estimated days on feed for each month is reported so the user may determine when to have hay resources available over the course of the year. Note that potential hay production from pastures is assumed to occur in the month the forage is available.

The table entitled 'Graph Information' merely reports the information in the graphs in tabular form. Note that total growth and forage available for hay are not adjusted for expected grazing or haying efficiency. Nonetheless, grazing days and hay yield is adjusted for those efficiencies (not all above ground production is harvestable).

IX. Transportation, Supplemental Feed, Vaccination, and Veterinarian Costs

The 'Haul, Feed, Vet & Drug' tab (Figure 8) contains information and values about the transportation and health care of cattle as well as supplemental feed needs. For the baseline operation, we modified only the average distance the user transports their cattle from the default value (cell F6).

Figure 8. Haul, Feed, Vet & Drug Tab (GHG and return numbers may differ given instructions on p. 7)



Transportation, Supplemental Feed, Vaccination, and Veterinarian Costs

Transportation	Bench Mark Own	Bench Mark Custom	Reset with "OK" or enter to the right	Your Farm Own	Your Farm Custom
How far do you typically haul cattle? (in miles)	15	25	OK	75	25
What's the max no. of cows per load?	6	30	OK	6	30
How many loads per year?	4	0	OK	6	0
Custom buying/selling fees per year?	$75.00	$0.00	OK	$75.00	$0.00
Est. Fuel Use assuming no backhaul (gal of diesel)		12		90	

Supplemental Feed		$/lb delivered	lbs CP per lb of feed (% DM)	lbs TDN per lb of feed (% DM)	DM% as fed	Sacked feed?
Corn	OK	0.12	0.09	0.89	86%	☑

Hay Quality	TDN (% DM)	CP (% DM)	DM%
Bench Mark	58.0%	14.5%	88%
Your Farm	58.1%	14.6%	88%

Supplemental Feed	No. of head	Amount		No. of head	Amount
Mineral (oz per adj. cow per day)	38	2	OK	61	2
Rumensin (grams per adj. cow per day)	None			3	
Pounds of Corn fed to meet TDN needs as shown below		2,659	OK	*lbs.*	2,621
Other... in $ per year		$50.00			$50.00

Vet Charges	Bench Mark no. of cases	Reset with "OK" or enter to the right	Your Farm
Prolapse	1	OK	1
C-section	1	OK	1
Sick treatments	4	OK	6
Bull Soundness	2	OK	2
Other	$50.00		$50.00

Vaccine	Standard # of Applications per year (if any) Cows + Young Cows	Replace-ments	Calves	Bulls	Cost per cwt or per hd	Accept with "OK" or enter to the right	Your Farm's # of Applications per year (if any) Cows + Young Cows	Replace-ments	Calves	Bulls	Cost per cwt or per hd
Dewormer (per cwt)	1	1	1	1	$0.80		1	1	1	1	$0.80
Pasturella (per cwt)			0.6		$0.09				0.6		$0.09
7 way Blackleg (per head)	1	1	1	1	$0.90		1	1	1	1	$0.90
4 way Viral (per head)	1	1	2	1	$1.60		1	1	2	1	$1.60
Pinkeye (per head)	0.1	0.1		0.1	$1.30	OK	0.1	0.1		0.1	$1.30
Scour Bolus (per head)			0.1		$2.00				0.1		$2.00
Vibro-Lepto 5 (per head)	1	1		1	$1.70		1	1		1	$1.70
Growth Implant (per head)			0.5		$1.46				0.5		$1.46
Castrate (per head)			0.5		$1.00				0.5		$1.00
Brucellosis (per head)			0.5		$1.00				0.5		$1.00
				Total Cost	$716.04					Total Cost	$1,202.05
							Net Cash Returns ($)	13,325	GHG (lbs. CO_2 / lb sold)		16.94

Please do not use copy and paste when modifying information across a range of cells. Special formatting was applied to allow for at least some error chekcing and is voided if using copy and paste.

Supplemental Feed Needed by Month in lbs per day for the whole herd and for the Year

Deficiency	Month	Bench Mark Cows	Bench Mark Replacements	Bench Mark Bulls	Bench Mark Total lbs fed to herd per day	Your Farm Cows	Your Farm Replacements	Your Farm Bulls	Your Farm Total lbs fed to herd per day
TDN	Jan	33	0	0	33	34	0	0	34
	Feb	44	0	0	44	43	0	0	43
	Mar	0	0	0	0	0	0	0	0
	Apr	0	0	0	0	0	0	0	0
	May	0	0	0	0	0	0	0	0
	Jun	0	0	0	0	0	0	0	0
	Jul	0	0	0	0	0	0	0	0
	Aug	0	0	0	0	0	0	0	0
	Sep	0	0	0	0	0	0	0	0
	Oct	0	0	0	0	0	0	0	0
	Nov	0	0	0	0	0	0	0	0
	Dec	0	0	0	0	0	0	0	0
	Total Feed Required (*DM basis*)				2,287	Total Feed Required (DM basis)			2,254

Transport to Market

Questions in the transportation section are asking about the transportation of cattle to and from sale barns and other points of sale. Using the default parameters, the model allows for custom hauling of pot loads or semi-truck trailer loads of cattle or the use of a custom hauler with a larger trailer than what most small operations would have. Using default values, the

program also assigns trips for purchasing herd sires and hauling cull cattle to market. The intent is to capture fuel cost of transport. Default values for fuel use are 7.5 mpg for semi-trucks and 10 mpg for owner operated vehicles.

Supplemental Feed

Items in the supplemental feed section (middle left, top right and bottom sections of Figure 8) pertain to how the farm meets total digestible nutrient (TDN) deficiencies as well as what types of other supplements are fed. It is important to note that values initially found in these boxes are derived from the user's answers and values in previous sections of this software. Supplemental feed is automatically fed to ensure cows maintain weight year round by meeting their TDN requirements. Calves are assumed to have sufficient TDN via milk from the cow that in turn is fed sufficient TDN. The program reports TDN deficiencies in the table at the bottom of the tab (the numbers differ with pounds fed in the 'Supplemental Feed' section near the middle, as feeds contain moisture) and TDN deficiencies change based on the type of feed selected in the drop down box selected in cell I5 near the top right of the tab. The user can overwrite the pounds fed number on their operation in cell G20, keeping in mind that their calf weaning weights and breeding failures may be inflated if those weights are not already adjusted for this effect in the 'Cattle' tab. The chart at the bottom of the tab shows how much supplemental feed will need to be fed and when it will need to be fed during the year for cows, replacements, and bulls. This information is given for both the 'Bench Mark' farm and 'Your Farm.' Note that supplemental feed is sufficiently small in this software that dietary intake by cows, herd sires and replacement cattle is not expected to affect the amount of forage or hay consumption driven by the animals' weights. The user should notice that cost for the supplement is reported in dollar per delivered pound. The easiest way for the user to calculate this is by taking the total cost for supplemental feed and dividing it by the quantity. For example, the user buys a ton of bulk whole corn for $300 delivered to the operation. The user would divide $300 by 2,000 lbs and get a cost per pound of $0.15. Also, the user should note the check box in cell O5 near the top right of the tab. This checkbox asks if the user purchased supplemental feed in 50 lb bags or in bulk. The model assumes that there is a penny per pound increase for sacked feed over bulk feed. Eleven supplemental feed choices are available with default prices for *Yr 2013* or *Past 5 yr avg.* pending the cattle price selection chosen. Default information on crude protein (CP), TDN and moisture content are also provided and can be replaced with user-specified information if desired. Changes to supplemental feed prices, CP, TDN and moisture content affect both the 'Bench Mark' and 'Your Farm' operations. The software also reports on estimated hay quality based on forages grown on the operation as weighted by hay and pasture acreage. This latter information is driven mainly by values reported in the 'Forage Species' tab, but is also a function of hay vs. pasture acreage, forage species composition, cattle and pasture management.

Vet Charges

This section involves charges that can be incurred by a cow-calf operation when assistance from a veterinarian is needed (Figure 8). The program uses a prolapse rate of 2% of total pregnancies. The base number for caesarian sections (C-sections) is based on an article from McDermott et al. and is derived by multiplying the number of cows bred by the number anticipated to have difficulty and subsequently by the percent of difficulties anticipated to need a C-section. This same process is used for replacement heifers and added to the number of C-sections expected for mature cows (McDermott et al. 1991). As calving difficulty in the 'Genetics' tab increases, the number of C-sections will change. As calving difficulty increases, C-sections will increase. Sick treatments are estimated to occur at a rate of 5% of total number of cattle and calves. One bull soundness test per bull per year is assessed. Also, veterinary charges not directly covered in the section can be lumped together and put in as a dollar value in the green and blue boxes next to the word "Other" in row 21.

Vaccines

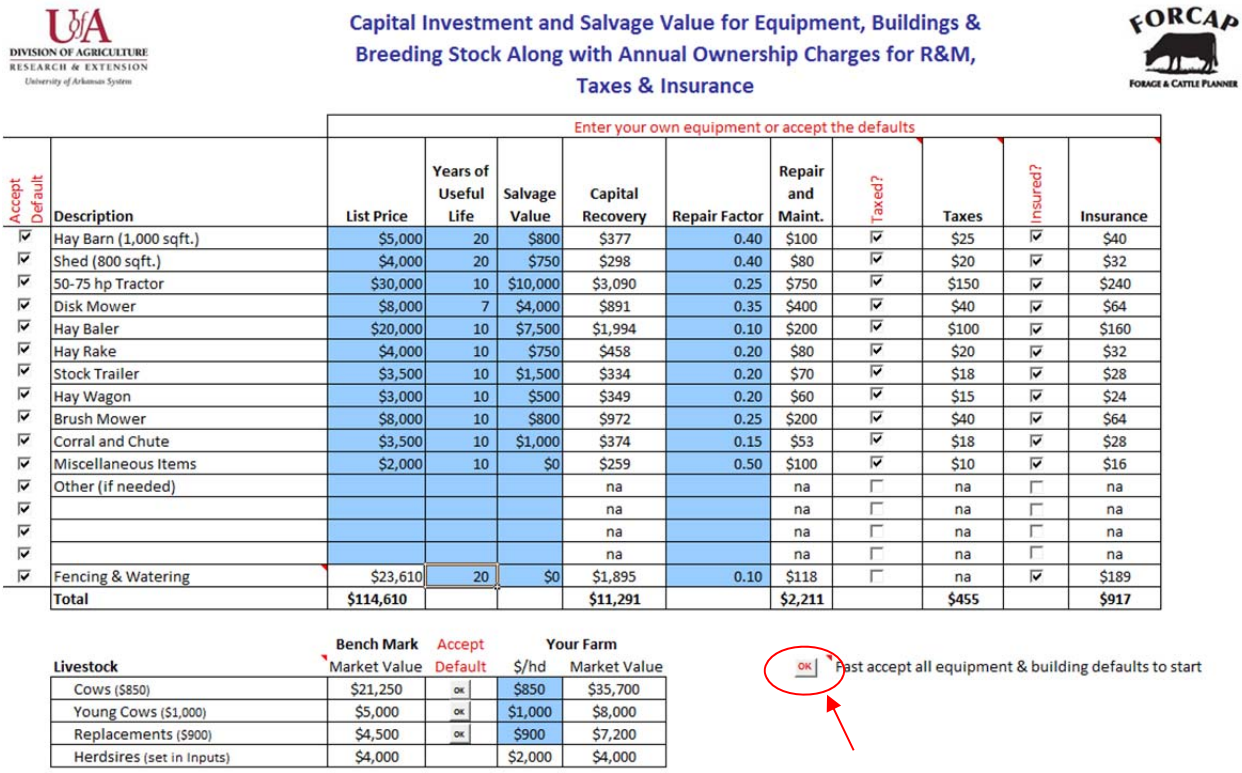
The default vaccine program for the 'Bench Mark' and 'Your Farm' sections are based on what is recommended for cattle and calves in Arkansas by the University of Arkansas, Department of Animal Science. Values in the vaccines section show the number of times a described animal is given a particular vaccine or treatment. For example, under Brucellosis there is a 0.5 in the calves' column. This means that half the calves (heifers) are given the vaccine once a year. If a vaccine or treatment is given to a group more than once a year, like a 4 way viral vaccine given to calves, a "2" is entered in the pertinent column.

X. Capital Recovery, Repair and Maintenance, Taxes and Insurance

The 'Capital' tab contains information and values concerning major farm assets and investments, such as buildings and equipment needed for the operation (Figure 9). Before the user begins to enter or change any numbers in the chart or add more items to the chart, the user should first click the "OK" button at the bottom right of the tab so that investment needs are based on the 'Bench Mark' farm size selected in the 'Farm' tab. *Small* cow-calf operations, for example, are not expected to have haying equipment. Further, *Large* cow-calf operations may have larger equipment than *Medium* sized cow-calf operations. The quick list compiled in the table after the user clicks the "OK" button at the bottom right of the tab is compiled by what an average Arkansas Cow-Calf farm of similar size as the users', would have on their operation.

The user can change all blue boxes in a given row. If taxes are paid on the described item for the row please check the taxes box in that row. If insurance has been purchased on the described item for the row please check the insurance box in that row. *(Note: Insurance and tax rates are entered in the 'Prices' Tab.)* To completely get rid of items in the list please uncheck

Figure 9. Capital Investment, Repair & Maintenance (R&M), Taxes and Insurance Tab



Capital Investment and Salvage Value for Equipment, Buildings & Breeding Stock Along with Annual Ownership Charges for R&M, Taxes & Insurance

Enter your own equipment or accept the defaults

Accept Default	Description	List Price	Years of Useful Life	Salvage Value	Capital Recovery	Repair Factor	Repair and Maint.	Taxed?	Taxes	Insured?	Insurance
☑	Hay Barn (1,000 sqft.)	$5,000	20	$800	$377	0.40	$100	☑	$25	☑	$40
☑	Shed (800 sqft.)	$4,000	20	$750	$298	0.40	$80	☑	$20	☑	$32
☑	50-75 hp Tractor	$30,000	10	$10,000	$3,090	0.25	$750	☑	$150	☑	$240
☑	Disk Mower	$8,000	7	$4,000	$891	0.35	$400	☑	$40	☑	$64
☑	Hay Baler	$20,000	10	$7,500	$1,994	0.10	$200	☑	$100	☑	$160
☑	Hay Rake	$4,000	10	$750	$458	0.20	$80	☑	$20	☑	$32
☑	Stock Trailer	$3,500	10	$1,500	$334	0.20	$70	☑	$18	☑	$28
☑	Hay Wagon	$3,000	10	$500	$349	0.20	$60	☑	$15	☑	$24
☑	Brush Mower	$8,000	10	$800	$972	0.25	$200	☑	$40	☑	$64
☑	Corral and Chute	$3,500	10	$1,000	$374	0.15	$53	☑	$18	☑	$28
☑	Miscellaneous Items	$2,000	10	$0	$259	0.50	$100	☑	$10	☑	$16
☑	Other (if needed)				na		na	☐	na	☐	na
☑					na		na	☐	na	☐	na
☑					na		na	☐	na	☐	na
☑					na		na	☐	na	☐	na
☑	Fencing & Watering	$23,610	20	$0	$1,895	0.10	$118	☐	na	☑	$189
	Total	**$114,610**			**$11,291**		**$2,211**		**$455**		**$917**

Livestock	Bench Mark Market Value	Accept Default	Your Farm $/hd	Your Farm Market Value
Cows ($850)	$21,250	ok	$850	$35,700
Young Cows ($1,000)	$5,000	ok	$1,000	$8,000
Replacements ($900)	$4,500	ok	$900	$7,200
Herdsires (set in Inputs)	$4,000		$2,000	$4,000

ok Fast accept all equipment & building defaults to start

the box at the far right of the row and the row will not be used in calculations. However, please refrain from copying and then pasting from one cell to another to fill in information. The user can enter more investments or farm assets to the list in the empty rows created when a particular piece of equipment is not used or underneath the auto compiled list. The user should enter a description of the item in the description column and appropriate numbers in the blue boxes. Taxes and insurance for items the user entered are handled the same way as the items in the auto compiled list. The capital list given on the 'Capital' tab is for the user to specify for the 'Your Farm' section. A 'Bench Mark' capital list is also generated although it is not seen on the 'Capital' tab. The 'Bench Mark' capital list is the default list for the chosen farm size (*Small, Medium, or Large* in the 'Farm' tab). Any changes the user makes to their capital list will not be applied to the capital list for the 'Bench Mark.' The user will notice at the bottom of the capital list is a row for "Fencing and Watering". This row is cross-linked to the 'Pasture' tab. The amount entered in the list price column for "Fencing and Watering" is the "Expected Total Investment" for 'Your Farm' on the 'Pasture' tab. For the 'Bench Mark' capital list the "Fencing and Watering" list price comes from the "Expected Total Investment" for the 'Bench Mark' on the 'Pasture' tab but again is not reported in the 'Capital' tab.

Repair & Maintenance Cost Estimates

The repair and maintenance (R&M) cost column provides estimates for annual R&M costs for the item in the corresponding row. These values are expected to hold true on average over the life of the item. It may well be that a larger repair happens later in the useful life of the item. In sum, and across all items, the values in the R&M column are expected to hold for a typical year for an operation as many different types of equipment at different stages in their life (some new, some old) need maintenance and repair. These estimated costs are based on the item's list price, useful life, and repair factor. To calculate repair and maintenance costs the item's list price is multiplied by the repair factor. This answer is then divided by the item's useful life. For example, on the *Medium* size operation's capital list the first item described is a 1,000 sq. ft. hay barn. The list price for the hay barn is $5,000. We multiply this list price by the repair factor. The repair factor for the hay barn is 0.4. When we multiply $5,000 by 0.4 we get $2,000. Next we will divide this answer by the useful life of the hay barn which is 20 years. Dividing $2,000 by 20 years we get a yearly repair and maintenance cost for the hay barn of $100. The interested reader is referred to Kay, Edwards and Duffy (2008) for a more in-depth discussion on capital costs.

Breeding Stock Capital Investment

Below the table addressing equipment and building ownership charges is a table that summarizes average long term investment needs related to breeding stock. The user can accept the default values or enter anticipated long term market values for their own breeding stock in the blue shaded cells (E27 to E29). Herd sire value modifications would be performed in the 'Genetics' tab. The user should not click the "OK" button at the bottom right of the tab after changes have been made to the table unless they want to cancel all changes and revert back to the original auto compiled list. For our baseline we merely accepted all the defaults by pressing the red "OK" button.

XI. Budget Sheet

The 'Budget' tab contains financial information and values regarding the cow-calf operation. The concept of the 'Budget' tab is to pull together information from all other tabs and summarize that information for the user. The user can print the 'Budget' tab on one page to allow a summary of operations for conveying pertinent financial information to bankers, creditors, or other financial advisors. Note that print settings for one-page printouts are set for all other tabs as well. The screen is 'frozen' in this tab. This means that the user can scroll through parts of the tab while the top part of the tab remains stationary. None of the values shown on the 'Budget' tab can be changed while at the 'Budget' tab. All values are based on values entered in other screens or tabs.

Figure 10. Budget Summary and Cattle Price Sensitivity (GHG and return numbers may differ given instructions on p. 7)

DIVISION OF AGRICULTURE RESEARCH & EXTENSION University of Arkansas System

Comparison of Production Cost and Returns to Land, Labor and Management

FORCAP FORAGE & CATTLE PLANNER

	Bench Mark						Your Farm			
	Weight (in lb if app.)	Unit	Quantity	Price or Cost/Unit	Total	VS.	Total	Weight (in lb if app.)	Quantity	Price or Cost/Unit
GROSS RECEIPTS					Total		Total			
Steer Calves	555	lb	12	$1.59	$10,621.95		*$18,903.22*	555	*22*	*$1.55*
Heifer Calves	520	lb	7	$1.48	$5,371.10		*$10,459.29*	520	*14*	*$1.44*
Cull Cows	1,117	lb	5	$0.76	$4,264.77		*$6,072.04*	1,117	*7*	*$0.78*
Cull Bulls	2,000	lb	0.50	$0.94	$936.76		*$947.70*	2,000	0.50	*$0.95*
Excess Hay (if any)	800	bale	153	$40.00	$6,120.00		*$4,200.00*	800	*105*	$40.00
TOTAL RECEIPTS					**$27,314.59**		*$40,582.25*			
DIRECT COSTS										
FERTILIZER										
Fertilizer Costs		$/farm	1	$7,218	$7,218.00		*$8,466.75*		1	*$8,467*
FEEDING AND OPERATING										
Purchased Hay	800	bale	0	$45.00	$0.00		$0.00	800	0	$45.00
Corn		lbs	2,659	$0.12	$320.98		*$316.36*		*2,621*	$0.12
Salt and Minerals	50	$/bag	35	$20.00	$700.00		*$1,792.00*	50	*56*	*$32.00*
Other Feed		$/farm	1	$50	$50.00		$50.00		1	$50
Veterinary & Drug Charges		$/farm	1	$1,186	$1,186.04		*$1,702.05*		1	*$1,702*
MARKETING										
Sales commission		$/sales	1	3.5%	$741.81		*$1,273.38*		1	3.5%
Yardage, Insurance, and Checkoff		$/farm	1	$67	$67.38		*$119.63*		1	*$120*
Cattle Purchasing Costs		$/farm	1	$75	$75.00		$75.00		1	$75.00
Custom Hauling		$/farm	1	$0	$0.00		$0.00		1	$0
MISCELLANEOUS										
Twine		$/bale	362	$1.00	$361.83		*$468.05*		*468*	$1.00
Fuel		$/gal	1072	$3.17	$3,397.76		*$2,892.07*		*912*	$3.17
Herd Sire(s)		$/hd	0.50	$2,000	$1,000.00		$1,000.00		0.50	$2,000
Farm Vehicle		$/month	12	$30	$360.00		*$600.00*		12	*$50*
Other (pasture reseeding + winterannuals if any)		$/farm	1	$3,550	$3,550.20		*$5,497.90*		1	*$5,498*
Repair and Maintenance		$/farm	1	$2,192.37	$2,192.37		*$2,210.55*		1	*$2,211*
TOTAL DIRECT COSTS (TDC)					**$21,221.37**		*$26,463.74*			
OPERATING INTEREST (on 1/2 of TDC)		rate	1	6%	$636.64		*$793.91*		1	6%
RETURNS ABOVE DIRECT COSTS				farm total	**$5,456.58**		*$13,324.60*			
				$/calving cow	**$181.89**		*$266.49*			
				$/acre	**$22.74**		*$55.52*			
OWNERSHIP CHARGES										
Capital Recovery		$/farm	1	$11,000	$10,999.64		*$11,291.40*		1	*$11,291*
Opportunity Cost on Breeding Stock		rate	1	5%	$1,737.50		*$2,745.00*		1	5%
Property Taxes		$/farm	1	$629	$628.75		*$729.50*		1	*$730*
Insurance		$/farm	1	$888	$887.79		*$916.88*		1	*$917*
TOTAL OWNERSHIP CHARGES					**$14,253.68**		*$15,682.78*			
RETURNS TO LAND, OWNER'S EQUITY, AND LABOR				farm total	**-$8,797.11**		*-$2,358.19*			
				$/calving cow	**-$293.24**		*-$47.16*			
				$/acre	**-$36.65**		*-$9.83*			

Cattle Price Sensitivity Analysis

	- 20%	- 10%	- 5%	Curent Prices	+ 5%	+ 10%	+ 20%
RETURNS ABOVE DIRECT COSTS	$6,303	$9,814	$11,569	$13,325	$15,080	$16,835	$20,346
RETURNS TO LAND, OWNER'S EQUITY, AND LABOR	-$8,831	-$5,595	-$3,976	-$2,358	-$740	$878	$4,115

At the bottom of the 'Budget' tab, total profit or loss is calculated and provided as a total for the operation, a dollar per calving cow amount, and a dollar per acre amount (hay plus pasture acres). Some cells on the 'Your Farm' side are highlighted to mark differences

compared to the 'Bench Mark' operation. Unfortunately, the user cannot click on the cells that show this highlighting and be taken back directly to the spot in the spreadsheet where the deviation was made. This is because some values will deviate as a result of several changes away from default values in the spreadsheet. Note that prices per unit sold and bought and quantity information is provided for both the 'Bench Mark' and 'Your Farm'. Critical in the cattle sales section is that prices per pound of steer and heifer calves sold are prorated across weight categories. A 555 lb steer calf for example uses the #5-600 steer calf price and the #6-700 steer calf price from the 'Prices' tab to calculate a 'linearly interpolated' price that is $5/100^{th}$ of the way between the #5-600 and the #6-700 price. This is done to avoid reporting price changes in 100 lb increments when calves weigh 598 or 602 lbs, for example, and would differ substantially without a price slide. By linearly interpolating between the two weight categories the price for 598 lb steers will be only slightly higher than the price for 602 lb steers.

Figure 10 also shows a cattle price sensitivity below the actual budget. This section is included to determine the impact of cattle price premiums on net cash returns or net returns. This was done as a breakeven price on calves sold, for example, would be difficult to calculate as calves are not the only output sold in the cow-calf operation. An operation also sells cull cattle and potentially excess hay. It would be difficult to allocate costs to calves only. Nonetheless, the user will get a sense of the impact of cattle price changes on the bottom line by looking at the cattle price sensitivity summary. In the example provided, a ± 20% change in prices offers positive returns above direct cost whereas nearly a 10% increase in prices is needed to cover long term or ownership charges.

XII. Greenhouse Gas Emissions (GHG)

The 'GHG' tab shows the total emissions for both the 'Bench Mark' and 'Your Farm' (Figure 11). Emissions are broken down into three categories: i) the total for the operation; ii) pounds of GHG per acre (lbs /acre); and iii) in pounds of GHG per pound of live weight leaving the farm.

It also shows emissions for cattle, forage, and agricultural inputs. Cattle emissions are measured by respiration (CO_2), enteric fermentation (CH_4), and nitrous oxide (N_2O). Forage emissions are negative (as indicated by the parentheses) as they measure the amount of CO_2 taken from the atmosphere during photosynthesis. Agricultural input emissions capture details regarding use of fertilizer (CO_2 and N_2O), fuel (CO_2), and other emissions (CO_2). All emissions are converted to CO_2 equivalent to account for differences in global warming potential across the different gases listed above. For our baseline farm scenario, the model reports that emissions are 17.15 lbs of CO_2 equivalent per pound of live weight leaving the 'Bench Mark' farm. The 'Your Farm' scenario has a lower emissions level at 16.94 lbs of CO_2 equivalent per pound of live weight sold. Included are direct and indirect emissions. Direct emissions result from using fuel on the operation, for example, which results in 7 lbs of CO_2 equivalent emissions per gallon of diesel fuel used. Indirect emissions result from emissions generated in the manufacture of

Figure 11. Estimates of Greenhouse Gas Emissions by Farm, per Pound of Meat Sold and per Acre (GHG and return numbers may differ given instructions on p. 7)

Comparison of Total, Per Acre and Per lb of Beef GHG Emissions (Carbon Dioxide, Methane, and Nitrous Oxide)

		Bench Mark		Your Farm		Bench Mark		Your Farm		Bench Mark		Your Farm	
			Total				lbs/acre				per lb of live weight leaving farm		
		lbs	lbs CO2 eq	lbs	lbs CO2 eq	lbs	lbs CO2 eq	lbs	lbs CO2 eq	lbs	lbs CO2 eq	lbs	lbs CO2 eq
Cattle													
Respiration	CO2		231,425		383,087		964		1,596		12.48		12.67
Enteric Fermentation	CH4	960	24,009	1,333	33,314	4.0	100	5.6	139	0.05	1.29	0.04	1.10
Nitrous Oxide	N20	99	29,431	164	49,020	0.4	123	0.7	204	0.01	1.59	0.01	1.62
Total			**284,864**		**465,421**		**1,187**		**1,939**		**15.36**		**15.39**
Forage													
Grazed	CO2		(51,059)		(61,746)		(213)		(257)		(2.75)		(2.04)
Hay	CO2		(46,700)		(52,666)		(195)		(219)		(2.52)		(1.74)
Total			**(97,760)**		**(114,412)**		**(407)**		**(477)**		**(5.27)**		**(3.78)**
Ag Inputs													
Fertilizer	CO2		78,146		92,897		326		387		4.21		3.07
Fertilizer	N2O	144.2	42,965	192.4	57,333	0.6	179	0.8	239	0.01	2.32	0.01	1.90
Fuel	CO2		7,861		8,306		33		35		0.42		0.27
Other	CO2		2,023		2,617		8		11		0.11		0.09
Total			**130,994**		**161,152**		**546**		**671**		**7.06**		**5.33**
Net Carbon	CO2 eq		**318,099**		**512,161**		**1,325**		**2,134**		**17.15**		**16.94**

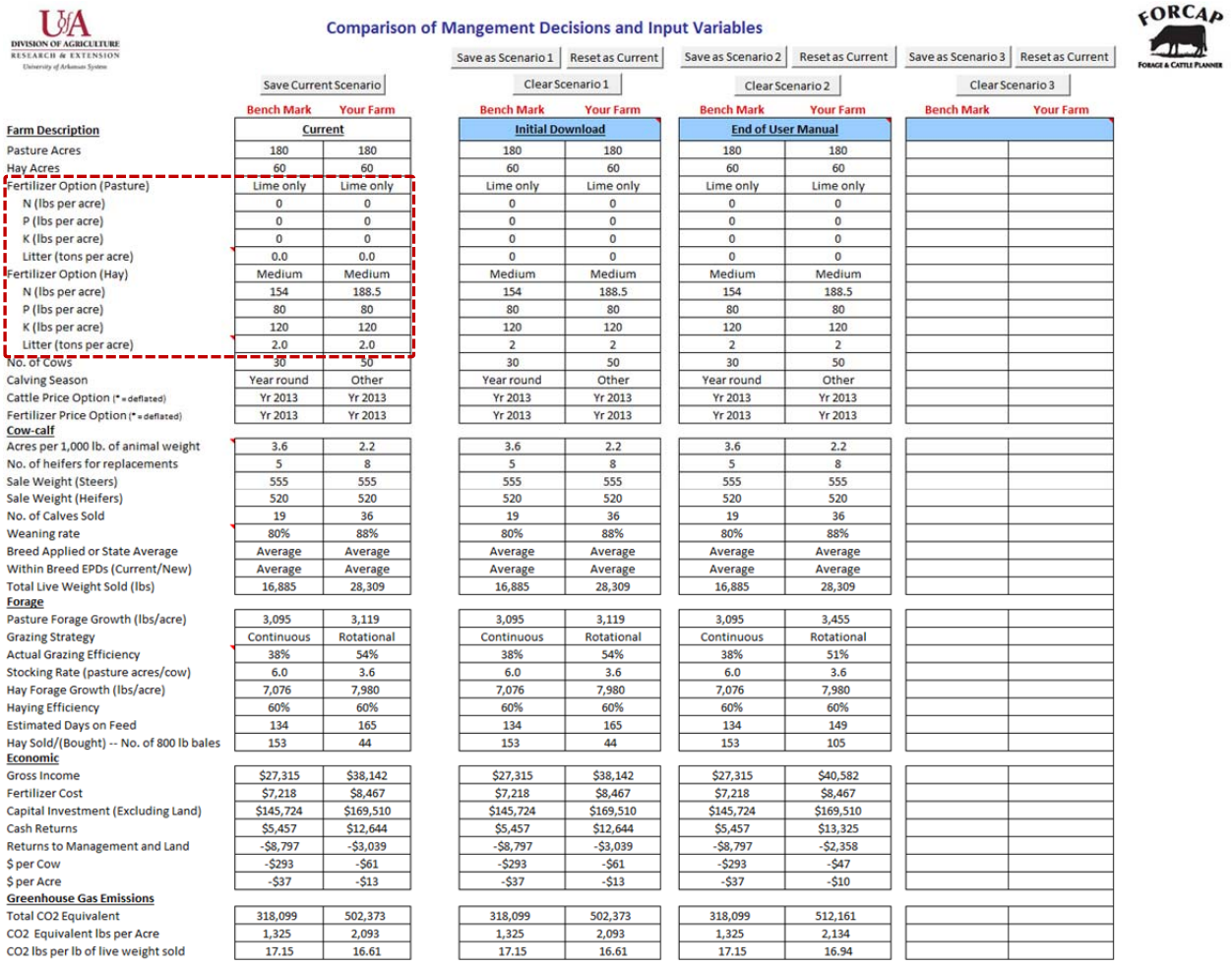
Note that carbon trapped in hay and pasture produced on farm is only counted at 1/8th of its actual amount as forages would decompose and eventually releases GHG whether eaten or not. A 1/8th credit is applied as material in contact with soil via equipment or hoof traffic is assumed to become part of soil carbon.

inputs. As an example, nitrogen fertilizers require use of natural gas in production in many instances and such production is assumed to emit 1.3 lbs of CO_2 equivalent emissions per lb of actual N applied. Further, N fertilizer applied volatilizes an additional 1.27 lbs of N_2O when applied but this value depends on weather and soil conditions at time of application. As such, regarding the difference in CO_2 equivalent emissions per pound of live weight sold between the 'Bench Mark' and 'Your Farm', this change in emissions level results from higher fertilizer use and longer transport distances for the user-specified operation resulting in higher emissions, but also emissions savings with greater grazing efficiency and fewer breeding failures. Note that these values are estimates and based on normal weather, GHG emission levels for agricultural inputs reported for the region and a number of other assumptions. Thus, these estimates do not represent actual values as too many factors not modeled (like weather, soil type, past land use and drainage, etc.) will affect true GHG emissions on a cattle operation. Nonetheless, the information is provided for the operator to arrive at a sense of the direction and magnitude of change in GHG emissions an operation might achieve by modifying production practices. Clearly, this tool should thus not be used to certify GHG emissions levels for a cow-calf operation.

XIII. File Management and Scenario Comparisons

The 'Scenario Manager' tab allows the user to compare different scenarios they have completed and saved (Figure 12). This tab shows up to four different scenarios at a time side-by-

Figure 12. Scenario Manager Tab for Summary of Multiple Comparisons (GHG and return numbers may differ given instructions on p. 7)



Comparison of Mangement Decisions and Input Variables

	Save Current Scenario		Save as Scenario 1 / Reset as Current / Clear Scenario 1		Save as Scenario 2 / Reset as Current / Clear Scenario 2		Save as Scenario 3 / Reset as Current / Clear Scenario 3	
	Bench Mark	Your Farm	Bench Mark	Your Farm	Bench Mark	Your Farm	Bench Mark	Your Farm
Farm Description	Current		Initial Download		End of User Manual			
Pasture Acres	180	180	180	180	180	180		
Hay Acres	60	60	60	60	60	60		
Fertilizer Option (Pasture)	Lime only	Lime only	Lime only	Lime only	Lime only	Lime only		
N (lbs per acre)	0	0	0	0	0	0		
P (lbs per acre)	0	0	0	0	0	0		
K (lbs per acre)	0	0	0	0	0	0		
Litter (tons per acre)	0.0	0.0	0	0	0	0		
Fertilizer Option (Hay)	Medium	Medium	Medium	Medium	Medium	Medium		
N (lbs per acre)	154	188.5	154	188.5	154	188.5		
P (lbs per acre)	80	80	80	80	80	80		
K (lbs per acre)	120	120	120	120	120	120		
Litter (tons per acre)	2.0	2.0	2	2	2	2		
No. of Cows	30	50	30	50	30	50		
Calving Season	Year round	Other	Year round	Other	Year round	Other		
Cattle Price Option (* = deflated)	Yr 2013	Yr 2013	Yr 2013	Yr 2013	Yr 2013	Yr 2013		
Fertilizer Price Option (* = deflated)	Yr 2013	Yr 2013	Yr 2013	Yr 2013	Yr 2013	Yr 2013		
Cow-calf								
Acres per 1,000 lb. of animal weight	3.6	2.2	3.6	2.2	3.6	2.2		
No. of heifers for replacements	5	8	5	8	5	8		
Sale Weight (Steers)	555	555	555	555	555	555		
Sale Weight (Heifers)	520	520	520	520	520	520		
No. of Calves Sold	19	36	19	36	19	36		
Weaning rate	80%	88%	80%	88%	80%	88%		
Breed Applied or State Average	Average	Average	Average	Average	Average	Average		
Within Breed EPDs (Current/New)	Average	Average	Average	Average	Average	Average		
Total Live Weight Sold (lbs)	16,885	28,309	16,885	28,309	16,885	28,309		
Forage								
Pasture Forage Growth (lbs/acre)	3,095	3,119	3,095	3,119	3,095	3,455		
Grazing Strategy	Continuous	Rotational	Continuous	Rotational	Continuous	Rotational		
Actual Grazing Efficiency	38%	54%	38%	54%	38%	51%		
Stocking Rate (pasture acres/cow)	6.0	3.6	6.0	3.6	6.0	3.6		
Hay Forage Growth (lbs/acre)	7,076	7,980	7,076	7,980	7,076	7,980		
Haying Efficiency	60%	60%	60%	60%	60%	60%		
Estimated Days on Feed	134	165	134	165	134	149		
Hay Sold/(Bought) -- No. of 800 lb bales	153	44	153	44	153	105		
Economic								
Gross Income	$27,315	$38,142	$27,315	$38,142	$27,315	$40,582		
Fertilizer Cost	$7,218	$8,467	$7,218	$8,467	$7,218	$8,467		
Capital Investment (Excluding Land)	$145,724	$169,510	$145,724	$169,510	$145,724	$169,510		
Cash Returns	$5,457	$12,644	$5,457	$12,644	$5,457	$13,325		
Returns to Management and Land	-$8,797	-$3,039	-$8,797	-$3,039	-$8,797	-$2,358		
$ per Cow	-$293	-$61	-$293	-$61	-$293	-$47		
$ per Acre	-$37	-$13	-$37	-$13	-$37	-$10		
Greenhouse Gas Emissions								
Total CO2 Equivalent	318,099	502,373	318,099	502,373	318,099	512,161		
CO2 Equivalent lbs per Acre	1,325	2,093	1,325	2,093	1,325	2,134		
CO2 lbs per lb of live weight sold	17.15	16.61	17.15	16.61	17.15	16.94		

side and shows production parameters and outcome estimates for both the 'Bench Mark' and 'Your Farm' for each scenario. Numbers shown in this tab are sourced from other sheets and the screen is again 'frozen' to allow the user to scroll down without losing the information in the header of the spreadsheet. This sheet is designed to allow the user of the model to see how different scenarios lead to different performance estimates. Importantly, this tab summarizes fertilizer use in pounds of actual N-P-K applied. These numbers include contributions from poultry litter with the litter application level also reported. This information is helpful for potential calculations in the 'Forage Species' tab as actual N-P-K application levels are not recorded elsewhere. Note that N represents nitrogen or N, P represents phosphate or P_2O_5 and K represents potash or K_2O.

The user has the option to save up to three different scenarios that they can compare to the original 'Current Scenario'. These scenarios are all saved in the file with your designated file name that may be different from 'FORCAP.xls'. The left most column represents the current description of the model and the Scenario 1 to Scenario 3 columns represent previously defined

model runs. A user can save the current model as one of the scenarios at any time and can label these scenarios in the shaded cells provided for this purpose. Figure 12 shows the 'Initial Download' as the scenario of the model downloaded from our website and the 'End of User Manual' as the option that will prevail after making some changes to default values as described in this manual. The third scenario option is left blank. With the 'Save as Scenario 1/2/3' and 'Reset as Current' macro buttons the user has the flexibility to save the current model or restore a previous version. User prompts are provided to avoid mishaps and inform the user about current file location and other pertinent information. **Note that the 'Save as Scenario 1/2/3' command will save custom options for fertilizer and forage species and will reset those when the 'Reset as Current' macro button is pushed. If the user does not want those updates, they can close the program without saving and the current model settings for custom fertilizer and forage species will not be affected. It is therefore recommended to use the 'Save as Current' macro button before using the 'Reset as Current' macro buttons.** The spreadsheet is thus designed to save information that pertains to the Current Scenario as well as three other scenarios all in one .xls file.

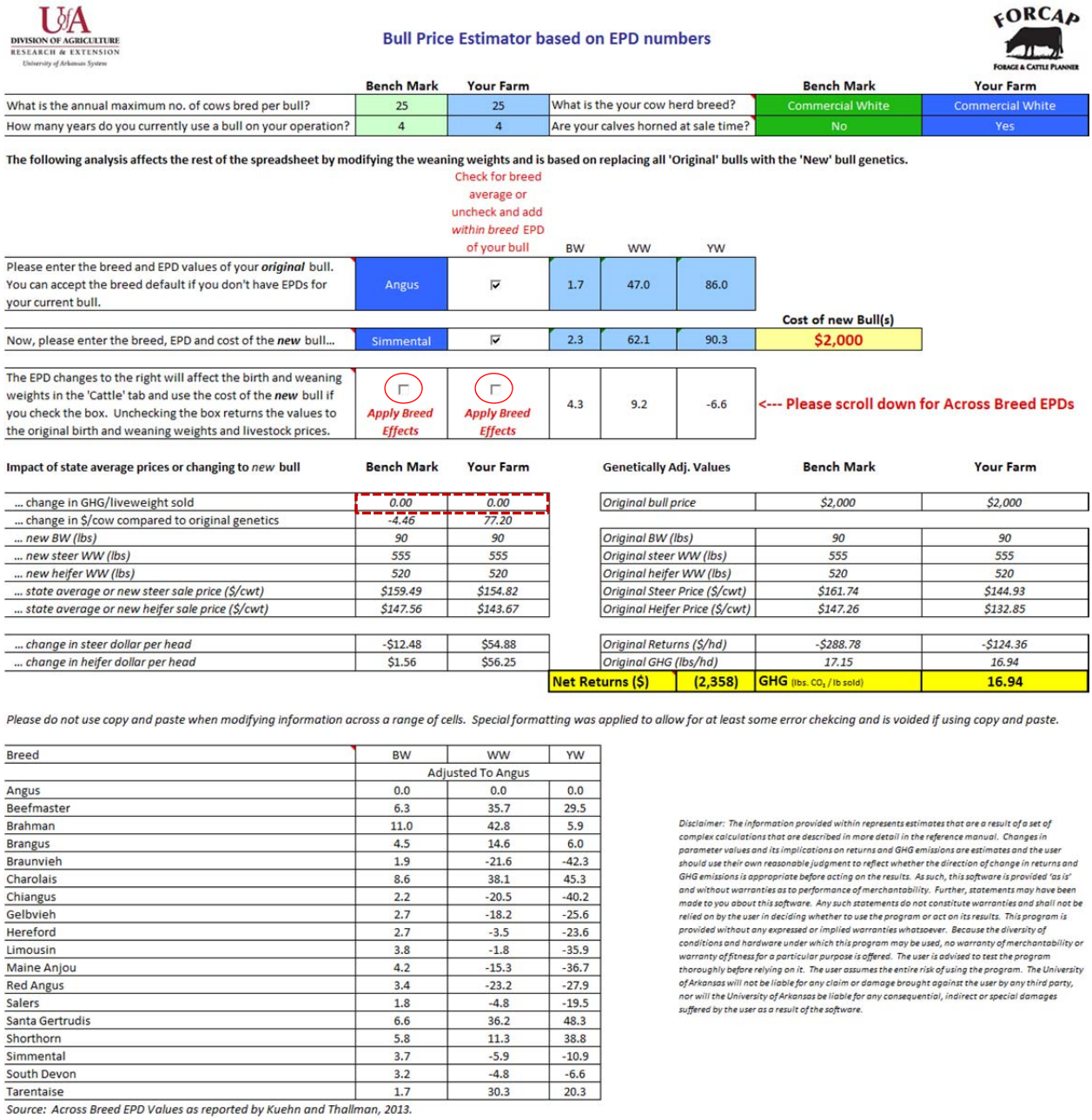
XIV. Modeling Cattle Breed Impacts

The 'Genetics' tab allows the user to see what kind of changes could occur on the operation by changing cow or bull genetics (Figure 13). To this point, average genetics and Arkansas state average prices have been used. The model assumes that the user would change genetics by changing bulls rather than selling existing cows and replacing with a different breed although this option can be modeled in this software by accounting for price and birthing difficulty effects. Further, please note that the model operates under the assumption that all bulls would change from the current breed to a new breed. You may need to press the apply breed effects buttons circled in red ***three*** times before you get the same numbers as shown in Fig. 13.

Genetics Specifications

Like most of the other tabs, the 'Genetics' tab starts with a variety of questions to better understand the user's operation and to outline current production parameters. At the top left of the page the user is asked how many cows they allow each bull to breed and how many years, on average, that they keep a bull (cells B5 to C6). On the right side of the tab (cells G5 to H6), the user is asked what the primary composite of their farm's cow-herd is, what composite herd they would like to use as the benchmark to compare to, if more than half of their calves have horns when sold, and if more than half of the benchmark's calves would have horns when sold. When choosing cow herd make-up, the user is allowed to choose from 18 bull breeds along with six commercial options based on majority of hide color. Answers to these questions drive pricing factors that are applied to state average prices based on breed, hide color, and presence of horns using information provided by Troxel et al. that pertain to Arkansas cattle prices (Table 1). Note

Figure 13. Genetics Tab for Changing Cow and Bull Genetics from State Average Values (GHG and return numbers may differ given instructions on p. 7)



DIVISION OF AGRICULTURE RESEARCH & EXTENSION University of Arkansas System

Bull Price Estimator based on EPD numbers

FORCAP FORAGE & CATTLE PLANNER

	Bench Mark	Your Farm		Bench Mark	Your Farm
What is the annual maximum no. of cows bred per bull?	25	25	What is the your cow herd breed?	Commercial White	Commercial White
How many years do you currently use a bull on your operation?	4	4	Are your calves horned at sale time?	No	Yes

The following analysis affects the rest of the spreadsheet by modifying the weaning weights and is based on replacing all 'Original' bulls with the 'New' bull genetics.

		Check for breed average or uncheck and add *within breed* EPD of your bull	BW	WW	YW	
Please enter the breed and EPD values of your ***original*** bull. You can accept the breed default if you don't have EPDs for your current bull.	Angus	☑	1.7	47.0	86.0	
Now, please enter the breed, EPD and cost of the ***new*** bull...	Simmental	☑	2.3	62.1	90.3	Cost of new Bull(s) $2,000
The EPD changes to the right will affect the birth and weaning weights in the 'Cattle' tab and use the cost of the ***new*** bull if you check the box. Unchecking the box returns the values to the original birth and weaning weights and livestock prices.	☐ *Apply Breed Effects*	☐ *Apply Breed Effects*	4.3	9.2	-6.6	<--- Please scroll down for Across Breed EPDs

Impact of state average prices or changing to *new* bull	Bench Mark	Your Farm
... change in GHG/liveweight sold	0.00	0.00
... change in $/cow compared to original genetics	-4.46	77.20
... new BW (lbs)	90	90
... new steer WW (lbs)	555	555
... new heifer WW (lbs)	520	520
... state average or new steer sale price ($/cwt)	$159.49	$154.82
... state average or new heifer sale price ($/cwt)	$147.56	$143.67
... change in steer dollar per head	-$12.48	$54.88
... change in heifer dollar per head	$1.56	$56.25

Genetically Adj. Values	Bench Mark	Your Farm
Original bull price	$2,000	$2,000
Original BW (lbs)	90	90
Original steer WW (lbs)	555	555
Original heifer WW (lbs)	520	520
Original Steer Price ($/cwt)	$161.74	$144.93
Original Heifer Price ($/cwt)	$147.26	$132.85
Original Returns ($/hd)	-$288.78	-$124.36
Original GHG (lbs/hd)	17.15	16.94
Net Returns ($)	**(2,358)**	**GHG (lbs. CO_2 / lb sold)**	**16.94**

Please do not use copy and paste when modifying information across a range of cells. Special formatting was applied to allow for at least some error chekcing and is voided if using copy and paste.

Breed	BW	WW	YW
	Adjusted To Angus		
Angus	0.0	0.0	0.0
Beefmaster	6.3	35.7	29.5
Brahman	11.0	42.8	5.9
Brangus	4.5	14.6	6.0
Braunvieh	1.9	-21.6	-42.3
Charolais	8.6	38.1	45.3
Chiangus	2.2	-20.5	-40.2
Gelbvieh	2.7	-18.2	-25.6
Hereford	2.7	-3.5	-23.6
Limousin	3.8	-1.8	-35.9
Maine Anjou	4.2	-15.3	-36.7
Red Angus	3.4	-23.2	-27.9
Salers	1.8	-4.8	-19.5
Santa Gertrudis	6.6	36.2	48.3
Shorthorn	5.8	11.3	38.8
Simmental	3.7	-5.9	-10.9
South Devon	3.2	-4.8	-6.6
Tarentaise	1.7	30.3	20.3

Source: Across Breed EPD Values as reported by Kuehn and Thallman, 2013.

Disclaimer: The information provided within represents estimates that are a result of a set of complex calculations that are described in more detail in the reference manual. Changes in parameter values and its implications on returns and GHG emissions are estimates and the user should use their own reasonable judgment to reflect whether the direction of change in returns and GHG emissions is appropriate before acting on the results. As such, this software is provided 'as is' and without warranties as to performance of merchantability. Further, statements may have been made to you about this software. Any such statements do not constitute warranties and shall not be relied on by the user in deciding whether to use the program or act on its results. This program is provided without any expressed or implied warranties whatsoever. Because the diversity of conditions and hardware under which this program may be used, no warranty of merchantability or warranty of fitness for a particular purpose is offered. The user is advised to test the program thoroughly before relying on it. The user assumes the entire risk of using the program. The University of Arkansas will not be liable for any claim or damage brought against the user by any third party, nor will the University of Arkansas be liable for any consequential, indirect or special damages suffered by the user as a result of the software.

that pricing does not change automatically when new bull genetics are selected or the cow herd breed is changed. These breed effects are applied by checking and unchecking the "Apply Breed Effects" buttons in cells B14 and C14. These questions allow the user to see what kind of changes would occur on the operation by keeping their bull breed constant and changing their cow genetics or any other combination of genetics changes the user desires. Further explanation is provided below.

Expected Progeny Differences

The 'Genetics' tab is driven by expected progeny differences (EPD) obtained from the latest version of an "Across-Breed EPD Chart" (Kuehn and Thallman 2013a) and 2013 Breed Averages for EPD Traits (Kuehn and Thallman 2013b). The Across-Breed EPD table, as presented in the bottom of Figure 13 and Table 2, is a tool that can be used to compare bulls from different breeds by equalizing their EPD values to one base breed. Further, bull comparisons within a certain breed are typically performed using a particular bull's EPDs for a number of production factors as outlined in the right hand columns in Table 2. Within breed averages report changes in breed performance over time and hence it is important to use the most recent EPD within breed and across breed information available. Accuracy values are also important when looking at EPDs. Bulls with low accuracy values may have progeny that deviate quite a bit from the reported EPD value. This manual describes the use of data published in 2013.

When comparisons across breeds are desired, it is common practice to compare breed performance relative to one breed (in this case *Angus*). Further note that these comparisons are estimates that hold over a large number of offspring from a particular bull but not necessarily a particular calf's performance. Also note that, since *Angus* is the base breed that all other breeds are compared to in the Across Breed EPD table, its across breed values are 0 implying that there is no breed change from one Angus to another Angus. This is where the within breed EPD values come in. If the current bull is an Angus with an EPD for birth weight (BW) of 5 that is replaced with an Angus with a BW EPD of -5, the average birth weight difference between the old and new bull would result for the average calf to be born at 10 lbs less per head. The model allows the user to specify EPD values of their current and new bull breeds in rows 10 and 12.You can use the most recent within breed averages or specify your bulls EPD values by typing over information in cells D10 to F12. Breed averages can be reset using the check marks in cells C10 and C12. The model combines the effects of across breed EPD and within breed EPD for bulls.

EPD Walkthrough Example

First, the user should pick out the breed of the bull they are currently using in the dark blue cell (B10) using the dropdown list in Figure 13. Second, if the EPD numbers for the bull are known, leave the checkbox in cell C10 unchecked. If the EPD numbers are not known, please check the box so the program fills in the 2013 Breed Average for the breed selected. Next, the user can move on to the bull they wish to compare to existing genetics in row 12 following the same steps as for the original bull. *(IMPORTANT: for the estimator to work as intended it is most appropriate for the user to compare bulls at either their most recent breed average or at their individual EPD numbers. Comparisons can also be made when EPD values are known for only one bull; however, when comparing a bull with known EPD's to one with unknown EPD's there is a greater chance for discrepancies in the comparison as the bull with*

Table 1. Price Indexes of Breed and Hide Color Effects Relative to State Average Prices for Feeder Cattle in 2000, 2005, and 2010.

	Breed to State Average Price Ratio			Breeds & Cross Breeds Price Ratio was Applied to
Breed by Year	**2010**	**2005**	**2000**	
Angus	1.026	1.028	0.996	A**
Brahman	0.869	0.917	0.864	B
Charolais	1.001	1.000	1.022	C
Hereford	1.011	0.908	0.890	H
Limousin	0.995	0.990	1.016	L
Simmental	0.920	0.948	0.957	S
1/2 Brahman Cross	0.970	0.987	0.986	B × AO, Br × Br
1/4 Brahman Cross	0.969	0.950	0.979	Br × AO
Angus × 1/4 Brahman	0.987	0.983	0.993	A × Br
Angus × Brahman	1.030	0.983	1.021	A × B
Angus × Charolais	1.006	1.021	0.991	A × C
Angus × Hereford	1.029	1.031	1.013	A X H
Angus × Hereford × 1/4 Brahman	1.015	0.973	1.024*	A × Be
Angus × Hereford × Brahman	1.003	1.016	1.024	B × Be
Charolais × 1/4 Brahman	0.973	0.998	1.003	
Charolais × Limousin	0.999	1.027	1.046	C × L
Hereford × 1/4 Brahman	0.959	0.973	1.112	H × Be
Hereford × Charolais	1.017	1.039	1.029	H × C
Hereford × Limousin	0.992	0.998	1.020	H × L
Black	1.015	1.010	1.006	A × AO, Br × AO, Ch × AO
Black White Faced	1.029	1.016	1.016	A × H or S, Br × H or S, Ch × H or S
Gray	0.984	0.996	0.980	A × CW, Br × C or CW, Ch × C or CW
Gray White Faced	0.958	0.989	0.979	
Red	0.956	0.965	0.990	Be, Bv, G, L, M, R, Sa, Sg, Sh, Sd, T, CR
Red White Faced	0.962	0.970	0.980	H × AR, S × AR
Spotted/Striped	0.757	0.909	0.895	Sp × AO
White	0.963	0.982	1.013	C × CY or CW
Yellow	1.014	1.019	1.030	C × AR
Yellow White Faced	1.011	1.020	1.021	C × H or S
Horned Cattle	0.927	0.969	0.984	

* The exact price was not reported for the given year so the closest substitute of Angus × Herford × Brahman was used.

** A = Angus, B = Brahman, C = Charolais, H = Hereford, L = Limousin, S = Simmental, Br = Brangus, Be = Beefmaster, Ch = Chiangus, CW = Commercial White, Bv = Braunvieh, G = Gelbvieh, M = Maine Anjou, R = Red Angus, Sa = Salers, Sg = Santa Gertrudis, Sh = Shorthorn, Sd = South Devon, T = Tarentaise, CR = Commercial Red, AR = All in red hide group, Sp = Spotted/Striped, Commercial Yellow, AO = All Other

Sources: Troxel and Barham 2012, Barham and Troxel 2007, Troxel et al. 2002.

Table 2. Across Breed EPD and Within Breed Average EPD Information for 2013.

EPD Factor	BW	WW	YW	MILK	MARBLING	REA	BW	WW	YW
Breed	Across Breed EPD Adjusted To Angus						Within Breed Average EPD		
Angus	0.0	0.0	0.0	0.0	0.00	0.00	1.7	47	86
Beefmaster	6.3	35.7	29.5	9.9	--	--	0.2	10	14
Brahman	11.0	42.8	5.9	23.2	--	--	1.8	15	24
Brangus	4.5	14.6	6.0	5.8	--	--	0.8	24	43
Braunvieh	1.9	-21.6	-42.3	0.1	-0.67	0.22	2.4	41	65
Charolais	8.6	38.1	45.3	6.9	-0.44	1.02	0.6	24	43
Chiangus	2.2	-20.5	-40.2	4.7	-0.45	0.45	3.1	37	68
Gelbvieh	2.7	-18.2	-25.6	3.6	-0.41	0.78	1.4	64	94
Hereford	2.7	-3.5	-23.6	-17.1	-0.32	-0.09	3.5	45	74
Limousin	3.8	-1.8	-35.9	-8.7	-0.71	1.09	1.5	47	84
Maine Anjou	4.2	-15.3	-36.7	-6.8	-0.84	0.95	2.0	39	78
Red Angus	3.4	-23.2	-27.9	-3.9	-0.30	-0.08	-0.9	55	82
Salers	1.8	-4.8	-19.5	2.2	-0.10	0.79	1.7	41	80
Santa Gertrudis	6.6	36.2	48.3	12.4	-0.66	-0.05	0.5	4	6
Shorthorn	5.8	11.3	38.8	20.2	-0.16	0.21	2.4	15	25
Simmental	3.7	-5.9	-10.9	-0.8	-0.42	0.53	2.3	62	90
South Devon	3.2	-4.8	-6.6	-0.3	0.08	0.16	2.6	41	77
Tarentaise	1.7	30.3	20.3	24.1	--	--	1.9	16	29

* BW = birth weight in lbs per head, WW = weaning weight in lbs per head, YW = yearling weight in lbs per head, MILK = milk production in lbs per day per head, MARBLING = marbling score, REA = Ribeye area in square inches.

Sources: Kuehn and Thallman 2013 a and b.

unknown EPD could be significantly below or above their breed average. Also, accuracy values greatly impact the reliability of EPD's. Comparing bulls with large variances in accuracy values may lead to incorrect results.)

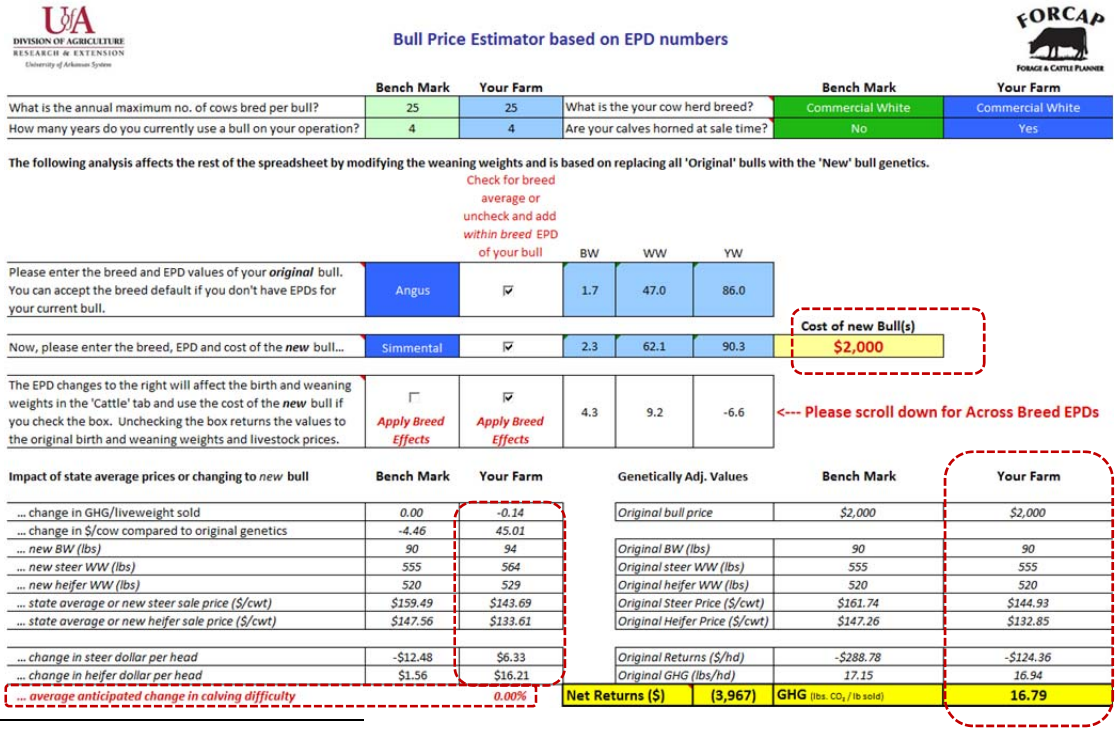
The next section, row 14, shows the expected changes in birth weight (BW), weaning weight (WW) and yearling weight (YW) in offspring sired by the new vs. original bull. The statistics are averages and report changes in expected calf weights in lbs per head. In our example, shown in Figure 13, the original *Angus* bull with average breed EPD values will wean 555 lb steer and 520 lb heifer calves on average as specified in the 'Cattle' tab. Switching to a *Simmental* bull would on average lead to 9.2 lb heavier weaned animals using the following EPD calculations:

Simmental WW EPD = (+62.1 breed average WW) + (-5.9 Across Breed WW Factor) = 56.2
Angus WW EPD = (+47.0 breed average WW) + (0.0 Across Breed WW Factor) = 47.0
Est. change in avg. WW = Simmental WW EPD (56.2) – Angus WW EPD (47.0) = 9.2

Similar calculations can be performed for any of the breeds in the software. Note that only BW and WW changes are used in the model.

Breed effects can now be turned on and off for both the 'Bench Mark' and 'Your Farm'. *(NOTE: Please toggle the breed effects button **three** times to ensure proper resetting of the program to initial absence of breed effects as changes in cow and bull genetics effects are not automatically updated each time you change genetics information in the 'Genetics' tab or make modifications in other parts of the program. A crosscheck for accuracy is that the change in GHG/liveweight sold information in cells B18 and C18 need to be at zero when breed effects are not applied in the 'Bench Mark' and 'Your Farm', respectively).* Using the within breed average (or user-defined) EPD values, the model now summarizes performance information in rows 16 to 28 by providing original statistics in columns F to H and modified statistics in columns A to C when breed effects are applied. Figure 14 highlights differences when breed effects are applied to 'Your Farm' with a switch from *Angus* to *Simmental* bulls with a cow herd composite breed of *Commercial White* (predominantly white hide color *Charolais* crossbred cows). Before applying the breed effects (Figure 13), note that offspring of *Angus* × *Commercial White* calves are selling at a discount relative to state average prices (compare genetically adj. prices for the original bull in cells H23 and H24 to state average prices reported in cells C23 and C24 for 'Your Farm'[2]). With breed effects applied (Figure 14), we note that the *Angus* × *Commercial White* prices in the

Figure 14. Genetics Tab with Sample Herd Sire Genetics Change Applied (GHG and return numbers may differ given instructions on p. 7)



Bull Price Estimator based on EPD numbers

	Bench Mark	Your Farm		Bench Mark	Your Farm
What is the annual maximum no. of cows bred per bull?	25	25	What is the your cow herd breed?	Commercial White	Commercial White
How many years do you currently use a bull on your operation?	4	4	Are your calves horned at sale time?	No	Yes

The following analysis affects the rest of the spreadsheet by modifying the weaning weights and is based on replacing all 'Original' bulls with the 'New' bull genetics.

		Check for breed average or uncheck and add *within breed* EPD of your bull	BW	WW	YW	
Please enter the breed and EPD values of your ***original*** bull. You can accept the breed default if you don't have EPDs for your current bull.	Angus	☑	1.7	47.0	86.0	
Now, please enter the breed, EPD and cost of the ***new*** bull...	Simmental	☑	2.3	62.1	90.3	Cost of new Bull(s) $2,000
The EPD changes to the right will affect the birth and weaning weights in the 'Cattle' tab and use the cost of the ***new*** bull if you check the box. Unchecking the box returns the values to the original birth and weaning weights and livestock prices.	☐ *Apply Breed Effects*	☑ *Apply Breed Effects*	4.3	9.2	-6.6	<--- Please scroll down for Across Breed EPDs

Impact of state average prices or changing to *new* bull	Bench Mark	Your Farm	Genetically Adj. Values	Bench Mark	Your Farm
... change in GHG/liveweight sold	0.00	-0.14			
... change in $/cow compared to original genetics	-4.46	45.01			
... new BW (lbs)	90	94	Original BW (lbs)	90	90
... new steer WW (lbs)	555	564	Original steer WW (lbs)	555	555
... new heifer WW (lbs)	520	529	Original heifer WW (lbs)	520	520
... state average or new steer sale price ($/cwt)	$159.49	$143.69	Original Steer Price ($/cwt)	$161.74	$144.93
... state average or new heifer sale price ($/cwt)	$147.56	$133.61	Original Heifer Price ($/cwt)	$147.26	$132.85
... change in steer dollar per head	-$12.48	$6.33	Original Returns ($/hd)	-$288.78	-$124.36
... change in heifer dollar per head	$1.56	$16.21	Original GHG (lbs/hd)	17.15	16.94
... average anticipated change in calving difficulty		0.00%	Net Returns ($) (3,967)	GHG (lbs. CO_2 / lb sold)	16.79

[2] The same price discount (in %) applies to the 'Bench Mark' farm except that calves are sold during different marketing months given different calving seasons selected for the 'Bench Mark' (Year round) vs. 'Your Farm' (Feb/Mar/Apr).

original genetically adj. values cells H23 and H24 are the same as in Figure 14, but that the switch to *Simmental* × *Commercial White* calves leads to lower prices in C23 and C24 given pricing factors reported by Troxel et al. for the marketing year 2010 in the state of Arkansas. Whether this price differential (from breed and weight effects) will hold up in 2014 or 2020 is anybody's guess. Note also changes in cell C18 (GHG/liveweight sold) decreases and per cow profits increase in C19. New birth and weaning weights are adjusted using the EPD values and herd feed intake is automatically recalculated. Also updated is an anticipated change in calving difficulty. Given the large frame size of *Commercial White* cows a change to a heavier BW bull does not adversely affect the operation's performance in this instance. A multitude of comparisons can now be performed using the procedures highlighted in this section. Note that in this case, applying the breed effects lowered overall net returns because the state average prices are better than those achieved by using either an *Angus* or *Simmental* bull on *Commercial White* cows.

Note also that application of breed effects changes the livestock prices in the 'Prices' tab and cattle performance statistics in the 'Cattle' tab and also the veterinary charges in the 'Haul, Feed, Vet & Drug' tab should changes in cattle genetics lead to anticipated changes in calving difficulty. An increase in difficulty of two percent per pound of increased birth weight was used (Ritchie et al. 1991). However, to increase calving difficulty, the new bull breed must have had a higher birth weight than the old bull and a bull of the dam's breed.

A producer can also modify the cost of the new bull(s) in cell G12 prior to applying breed effects. In the above scenario, changing the cost of the *Simmental* bulls to $3,000 (uncheck apply breed effects in cell C14, enter the cost of the new bull(s) as $3,000 in cell G12 and then check apply breed effects to 'Your Farm' in C14) lowers the profitability increase from *Angus* to *Simmental* from $45.01/cow without a bull cost change to $32.51/cow with $3,000 bulls. Note that the model can only be used to compare average bull(s) on the operation to another average bull(s). This is a limitation of the model.

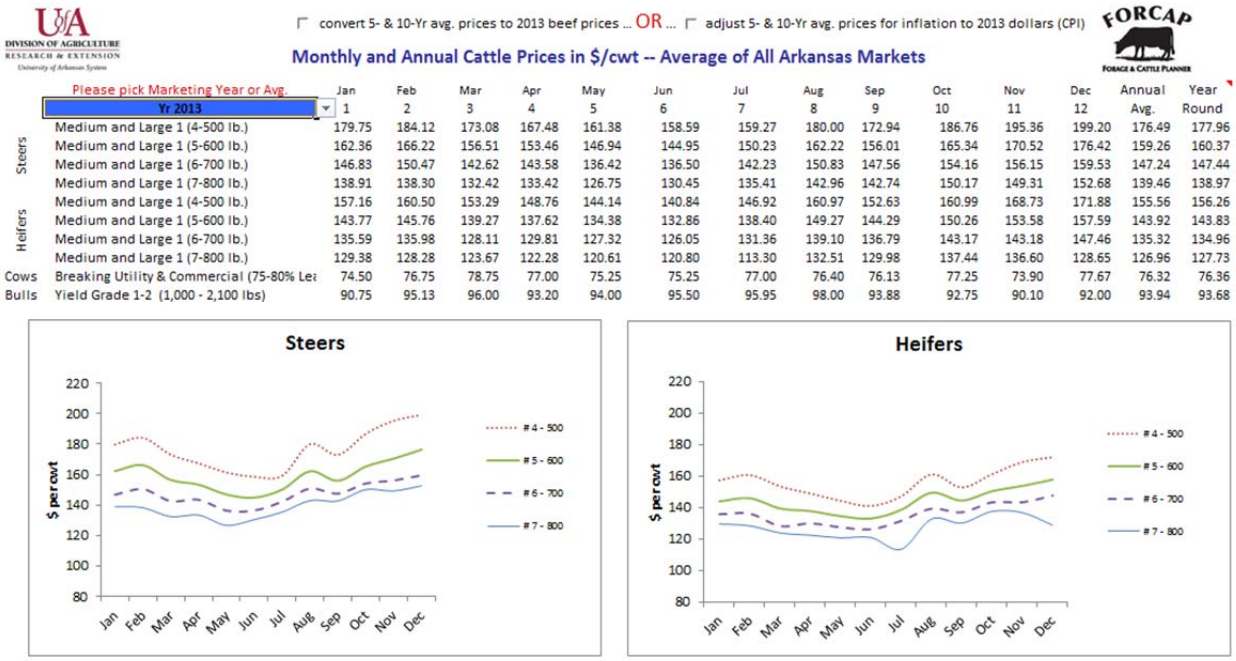
The user can also use the model to estimate a breakeven price that can be paid for the new bull. To utilize this feature the user should look at the "…change in $/cow compared to original genetics" row of the "Impacts of state average or changing to *New* bull" section. If the $/change per cow number for your farm is negative then the user will need to enter a value that is less than the original $2,000 per bull charge used in the software in cell G12. If the $/change per cow number for your farm is positive the user can enter a value that is greater -- repeating this process until the change in $/cow is zero or at breakeven. In the case portrayed in Figures 13 and 14, the breakeven price for *Simmental* bulls would be $5,601/bull. Note that this value is very much farm and cattle price specific, but may assist with developing a notion for how much to pay for changing bull genetics for 'Your Farm'. Other tools and factors not included in this model should also be considered before making a herd sire genetics change. Please uncheck the "Apply Breed Effects" buttons in cells B14 and C14 before continuing.

XV. Cattle Prices

The 'Cattle Prices' tab contains USDA reported sale prices for the state of Arkansas (Figure 15). On this tab the user picks the group of prices they want to use for their operation's budget in cell B6. Using a past five year average, compared to 2013 prices, for example, allows the user to determine the economic impact of changing cattle prices, holding all costs other than supplemental feed and fertilizer as well output prices for hay values constant. Note that the user should 'unapply' and 'reapply' breed effects in the 'Genetics' tab after changing cattle price levels if genetics adjusted price effects are desired as genetics adjusted price changes with breed effects as reported by Troxel et al. were available for 2010, 2005 and 2000. Hence, a change in cattle price years analyzed requires recalculation of breed price effects as those market signals are not the same over time. If breed effects are not applied, changing cattle prices to 5 or 10-year average should also be accompanied with longer term average cost estimates in the 'Prices', 'Haul, Feed, Vet & Drug', 'Farm', and 'Capital' tabs. This is done at the option of the user for fertilizer prices by modifying the drop down menu in the 'Prices' tab and automatically for feed stuffs in the 'Haul, Feed, Vet & Drug' tab for supplemental feeds. Custom fertilizers and other user specified prices are not automatically modified as those prices tend to be relatively farm specific or represent a small portion of budgeted costs.

Near the top of the 'Cattle Price' tab the user also has the chance to adjust cattle prices using a cattle price deflator or a CPI deflator. The former adjusts all longer term average prices to 2013 equivalent cattle prices prior to averaging whereas the latter adjusts cattle prices by the consumer price index commonly used to track inflation. If either of those deflators are used for

Figure 15. Seasonal Cattle Price Data for Arkansas for 2013, 2009 - '13 and 2004 - '13 by Cattle Type



the cattle prices, the fertilizer and feed prices are also adjusted for inflation using NASS published fertilizer prices paid and feed prices paid indexes. Prices for inputs and outputs other than cattle, fertilizer and feed are not automatically updated and are therefore also not deflated. The 'Budget' and 'Scenario Manager' tabs will indicate whether deflated or non-deflated prices are used in the header to the budget or the cattle and fertilizer price options chosen in the 'Scenario Manager' tab as long as one of the two deflation methods are used. Deflation of 2013 prices imposes seasonality observed for all cattle prices in the U.S. on Arkansas cattle prices used in the model. These changes are subtle and also hold for deflation with the CPI index on 2013 prices. Deflating longer term averages with either the beef price index or the CPI index has the effect of accounting for changes in price levels over time by accounting for value changes in the beef sector and general consumer purchasing power, respectively.

Recall, that if the user does not feel that any of the three groups of prices provided accurately represent what their cattle are being sold for they can uncheck the box next to the words "livestock only" under the livestock section on the 'Prices' tab and enter their own prices on the 'Prices' tab in the appropriate rows under the livestock section. Entering your own cattle price data, however, disables automatic updates when calving season, weaning weight and cattle genetics are modified.

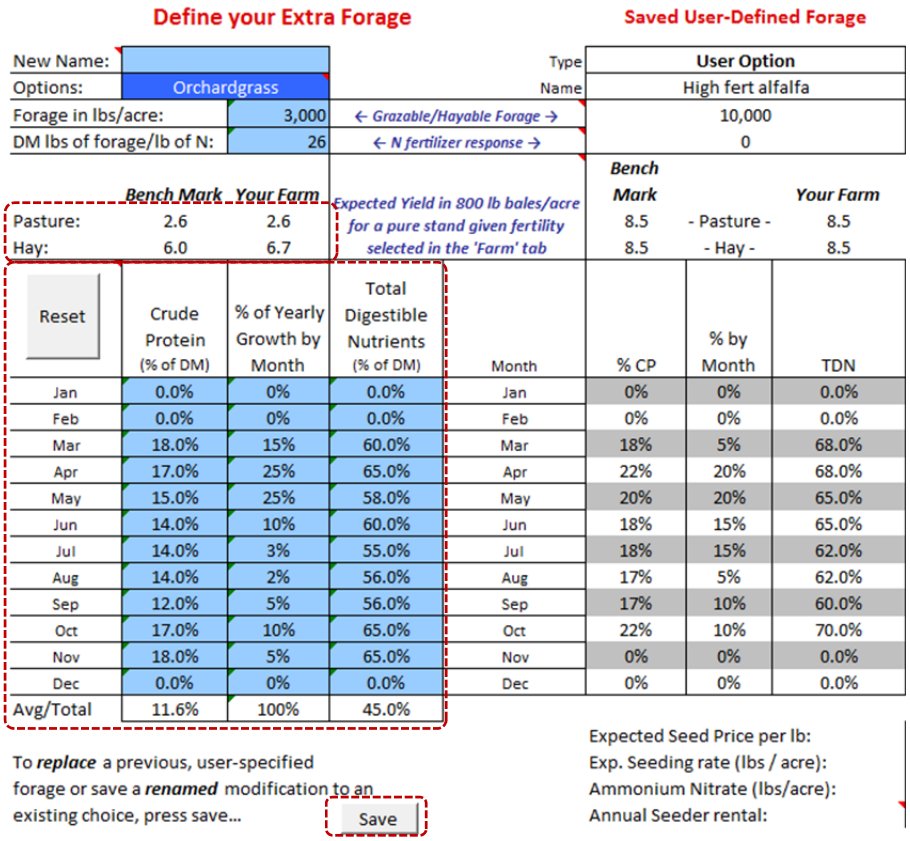
XVI. **Custom Forage Species**

The 'Forage Species' tab allows the advanced user to make changes to the forage composition on their operation. This tab is quite large and contains a significant amount of information. To begin, the user can employ a user-specified forage for the operation that would potentially be used on both hay and pasture acres in the 'Farm' tab, by either selecting from a range of default forages of *Mixed Grass, Orchardgrass, Bahiagrass, Alfalfa,* or *Lespedeza*. As an example, this manual used *Orchardgrass* as the user-defined extra forage that is added to the default forages of *Bermuda grass, Tall Fescue,* and *Clover* as shown in Figure 16 and used on 10% of the hay acreage as specified in the 'Farm' tab.

The user is able to develop a new forage under the "Define Your Extra Forage" section. Assume that the user has very productive land and wants to enhance the grazable level of forage production to 3,500 lbs and the N fertilizer response to 50 lbs of forage/lb of N applied. To achieve this modification from the default value for *Orchardgrass,* the user would first enter the new name in cell B5 (Mod. Orchardgrass), and enter 3,500 and 50 in cells C7 and C8. This would raise the expected level of hay and pasture yield from 2.6 and 6.7 bales on 'Your Farm' to the levels shown in Figure 17. The user could also modify when the forage grows as well as forage quality information related to CP and TDN in cells B13 to D24. Once the user is satisfied with the modifications to the default *Orchardgrass* option, the user now presses the 'Save' button in cell D29 which leads to two changes in the model. One, the user now has another default forage in addition to *Mixed Grass, Orchardgrass, Bahiagrass, Alfalfa,* and *Lespedeza,* called *Mod. Orchardgrass* available in the drop down menu in cell B6 with

performance information highlighted in cells F5 to H24. Two, the model now uses the information contained in A6 to D25 if this user-defined option is part of pasture or hay acreage in the 'Farm' tab in cells H22 and H23.

Figure 16. User-specified Forage Species (Seasonal Growth, Yield, N Response and Forage Quality)



Define your Extra Forage

New Name:			
Options:	Orchardgrass		
Forage in lbs/acre:	3,000	← Grazable/Hayable Forage →	
DM lbs of forage/lb of N:	26	← N fertilizer response →	

	Bench Mark	Your Farm
Pasture:	2.6	2.6
Hay:	6.0	6.7

Expected Yield in 800 lb bales/acre for a pure stand given fertility selected in the 'Farm' tab

Reset	Crude Protein (% of DM)	% of Yearly Growth by Month	Total Digestible Nutrients (% of DM)	Month
Jan	0.0%	0%	0.0%	Jan
Feb	0.0%	0%	0.0%	Feb
Mar	18.0%	15%	60.0%	Mar
Apr	17.0%	25%	65.0%	Apr
May	15.0%	25%	58.0%	May
Jun	14.0%	10%	60.0%	Jun
Jul	14.0%	3%	55.0%	Jul
Aug	14.0%	2%	56.0%	Aug
Sep	12.0%	5%	56.0%	Sep
Oct	17.0%	10%	65.0%	Oct
Nov	18.0%	5%	65.0%	Nov
Dec	0.0%	0%	0.0%	Dec
Avg/Total	11.6%	100%	45.0%	

To ***replace*** a previous, user-specified forage or save a ***renamed*** modification to an existing choice, press save...

Save

Saved User-Defined Forage

Type	User Option
Name	High fert alfalfa
	10,000
	0

Bench Mark		Your Farm
8.5	- Pasture -	8.5
8.5	- Hay -	8.5

% CP	% by Month	TDN
0%	0%	0.0%
0%	0%	0.0%
18%	5%	68.0%
22%	20%	68.0%
20%	20%	65.0%
18%	15%	65.0%
18%	15%	62.0%
17%	5%	62.0%
17%	10%	60.0%
22%	10%	70.0%
0%	0%	0.0%
0%	0%	0.0%

Expected Seed Price per lb:
Exp. Seeding rate (lbs / acre):
Ammonium Nitrate (lbs/acre):
Annual Seeder rental:

Should a user prefer not to overwrite an existing, user-specified forage such as the *High fert alfalfa* shown in Figure 16, the user can also simply write over information in the light blue shaded cells in columns B to D. Note that these changes will apply to the model but are not saved. Default values for any of the options in the drop down menu located in cell B6 can always be reset to their original values by pressing the "Reset" button in cell A12.

Figure 17. Screenshot with Changes to Orchardgrass Added

Define your Extra Forage | **Saved User-Defined Forage**

New Name:	Mod. Orchardgrass			Type	User Option		
Options:	Orchardgrass			Name	Mod. Orchardgrass		
Forage in lbs/acre:	3,500	← Grazable/Hayable Forage →			3,500		
DM lbs of forage/lb of N:	50	← N fertilizer response →			50		
	Bench Mark	Your Farm	Expected Yield in 800 lb bales/acre for a pure stand given fertility selected in the 'Farm' tab		Bench Mark		Your Farm
Pasture:	3.0	3.0			3.0	- Pasture -	3.0
Hay:	9.5	11.0			9.5	- Hay -	11.0
Reset	Crude Protein (% of DM)	% of Yearly Growth by Month	Total Digestible Nutrients (% of DM)	Month	% CP	% by Month	TDN
Jan	0.0%	0%	0.0%	Jan	0%	0%	0.0%
Feb	0.0%	0%	0.0%	Feb	0%	0%	0.0%
Mar	18.0%	15%	60.0%	Mar	18%	15%	60.0%
Apr	17.0%	20%	65.0%	Apr	17%	20%	65.0%
May	15.0%	25%	58.0%	May	15%	25%	58.0%
Jun	14.0%	15%	60.0%	Jun	14%	15%	60.0%
Jul	14.0%	3%	55.0%	Jul	14%	3%	55.0%
Aug	14.0%	2%	56.0%	Aug	14%	2%	56.0%
Sep	12.0%	5%	56.0%	Sep	12%	5%	56.0%
Oct	17.0%	10%	65.0%	Oct	17%	10%	65.0%
Nov	18.0%	5%	65.0%	Nov	18%	5%	65.0%
Dec	0.0%	0%	0.0%	Dec	0%	0%	0.0%
Avg/Total	11.6%	100%	45.0%				

Figure 17 shows a screen shot with *Mod. Orchardgrass* saved over the *High fert alfalfa* option and added unchanged modifications to the seasonal growth distribution. Recall that once the 'Save' or 'Reset' buttons are pushed, the 'Undo' or '↶' no longer work. With the higher 'Grazable/Hayable Forage' available without fertilizer and with N fertilizer applied, note that the user can get a sense of forage yield associated with the forage production (3,500 lb/acre) and N response of 50 lbs of forage/lb of N applied by comparing the hay yield highlighted above between Figures 16 and 17. Base yield with 30 lbs of N applied on pasture (see 'Scenario Manager' tab cell C10) rises from 2.6 to 3 of 800 lb bales and a yield of 11 bales is expected with 188.5 lbs of N applied to hay acres on your farm (cell C15 in the 'Scenario Manager' tab). Note that these changes are only applied to 'Your Farm'. The 'Bench Mark' operation relies on production figures located in cells D48 to N68 in the 'Forage Species' tab as highlighted in Figure 18.

Yield information in rows immediately following the name of the forage in Figure 18 change as N fertility or bale size is modified in the 'Farm' and 'Prices' tabs, respectively. The yield shown, thus only pertain to the parameters set with changes to model parameters as reflected in this manual.

Figure 18. Default Forage Yield, N Response, Seasonal Growth and Quality Information

Existing Default Forage Information Used in the Program

Type	Warm			Cool			Legume		
Name	Bermudagrass			Tall Fescue			Clover		
Grazable/Hayable Forage →	3,000			2,800			3,000		
N fertilizer response →	33			22			0		
Expected Yield in 800 lb bales/acre for a 100% stand given fertility --> selected in the 'Farm' tab	*Bench Mark*		*Your Farm*	*Bench Mark*		*Your Farm*	*Bench Mark*		*Your Farm*
	2.6	- Pasture -	2.6	2.4	- Pasture -	2.4	2.6	- Pasture -	2.6
	6.8	- Hay -	7.8	5.3	- Hay -	5.9	2.6	- Hay -	2.6
Month	CP	% by Month	TDN	CP	% by Month	TDN	CP	% by Month	TDN
Jan	10.5%	0%	55%	14.6%	0%	61%	14.3%	0%	57%
Feb	13.8%	0%	57%	13.9%	3%	59%	14.3%	0%	57%
Mar	9.3%	0%	53%	17.2%	7%	65%	17.0%	5%	65%
Apr	13.3%	0%	57%	22.0%	20%	72%	20.0%	20%	65%
May	17.3%	10%	62%	19.3%	27%	67%	21.0%	25%	65%
Jun	17.4%	25%	61%	18.7%	15%	66%	18.0%	20%	60%
Jul	13.8%	35%	60%	15.5%	0%	62%	14.0%	5%	60%
Aug	14.8%	20%	59%	14.4%	0%	59%	10.0%	0%	58%
Sep	12.8%	10%	58%	15.7%	2%	61%	12.0%	5%	58%
Oct	13.9%	0%	60%	19.0%	13%	67%	16.0%	15%	65%
Nov	12.4%	0%	58%	19.5%	11%	68%	16.0%	5%	65%
Dec	11.8%	0%	57%	17.1%	2%	66%	14.3%	0%	57%

Winter Annuals

The use of winter annuals as a sod-seeded crop on pasture acres provides the potential for greater cool season pasture use in early spring months and also in late fall. The user can specify seed price, expected seeding rate, fertilizer application level (Ammonimum nitrate is 34-0-0) and the cost for rental of a sod seeder. Similar to the user-specified forage options, the user can see the assumptions driving yield and forage quality but the user is only allowed to modify yield by adjusting N fertility as well as seasonal growth distribution but needs to modify the seasonal growth distribution in the 'Forage Balance' tab. The 'Prices' tab reflects cost of seeder rental and fertilizer application in $/acre when pasture acres are sod-seeded with winter annuals but the user needs to add seed cost, seeding rate, fertilizer application at time of seeding and annual seeder rental charges in the cells highlighted in Figure 19.

Figure 19. Specification of Winter Annuals Information

Saved User-Defined Forage

Winter Annuals Information -- Select in Pasture Mgmt. Tab and provide cost information below this table.

User Option			Winter Annuals -- Sod seeded over pasture in warm season grass								
High fert alfalfa			Wheat			Rye			Ryegrass		
10,000			1,500			2,000			2,500		
0			**30**			**30**			**34**		
Bench Mark		***Your Farm***	***Bench Mark***		***Your Farm***	***Bench Mark***		***Your Farm***	***Bench Mark***		***Your Farm***
8.5	- Pasture -	8.5	2.6	- Pasture -	2.6	3.0	- Pasture -	3.0	3.6	- Pasture -	3.6
8.5	- Hay -	8.5	na	- Hay -	na	na	- Hay -	na	na	- Hay -	na
% CP	% by Month	TDN	CP	% by Month	TDN	CP	% by Month	TDN	CP	% by Month	TDN
0%	0%	0.0%	18.0%	5%	75.0%	18.0%	5%	65.0%	15.0%	0%	65.0%
0%	0%	0.0%	21.0%	15%	72.0%	20.0%	15%	65.0%	18.0%	5%	63.0%
18%	5%	68.0%	20.0%	30%	72.0%	23.0%	35%	75.0%	22.0%	15%	76.0%
22%	20%	68.0%	14.0%	35%	62.0%	10.0%	20%	55.0%	17.0%	45%	75.0%
20%	20%	65.0%	8.0%	5%	55.0%	7.0%	5%	50.0%	12.0%	25%	60.0%
18%	15%	65.0%	0.0%	0%	0.0%	0.0%	0%	0.0%	11.6%	5%	52.0%
18%	15%	62.0%	0.0%	0%	0.0%	0.0%	0%	0.0%	0.0%	0%	0.0%
17%	5%	62.0%	0.0%	0%	0.0%	0.0%	0%	0.0%	0.0%	0%	0.0%
17%	10%	60.0%	0.0%	0%	0.0%	0.0%	0%	0.0%	0.0%	0%	0.0%
22%	10%	70.0%	0.0%	0%	0.0%	0.0%	0%	0.0%	0.0%	0%	0.0%
0%	0%	0.0%	20.0%	5%	75.0%	20.0%	10%	75.0%	18.0%	2%	70.0%
0%	0%	0.0%	20.0%	5%	72.0%	20.0%	10%	70.0%	18.0%	3%	70.0%

Expected Seed Price per lb:	$0.34	$0.35	$0.50
Exp. Seeding rate (lbs / acre):	100	100	22.5
Ammonium Nitrate (lbs/acre):	150	150	150
Annual Seeder rental:	300	300	300

XVII. Conclusion

The Forage & Cattle Planner can be a useful tool for Arkansas Cow-Calf producers by allowing analysis of economic and GHG repercussions of changing a large number of production parameters. The user can compare their operation's values to a 'Bench Mark' operation. Changes can also be made to each sector of the farm to more accurately represent the operation's true production practices. The 'Budget', 'GHG' as well as the 'Scenario Manager' tabs provide summaries of information that should prove useful for making informed investment decisions. There is a significant amount of interaction across tabs in the spreadsheet and it remains the user's responsibility to cross check information across tabs as they enter modifications to their spreadsheet. All numbers presented are estimates. As such, the user should not expect to achieve the modeled outcome when potentially making changes to their operation. If modified correctly, the tool should aid with providing information about relative change in profitability and GHG emissions. The information is organized in sequence with the 'Genetics', 'Cattle

Price' and 'Forage Species' tabs relegated for fine tuning estimates likely under the supervision of experts in the respective fields. The tool is not intended to verify economic performance or GHG emissions but rather as a planning and forecasting tool for purposes of what if and sensitivity analyses.

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