



Evaluating Baler Ownership With the OwnBaler Spreadsheet

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Introduction

This paper accompanies the *OwnBaler* computer spreadsheet, which was developed as a decision aid to help individuals think through the baler ownership decision. Thus, most of the underlying assumptions and formulas are simply asserted rather than developed here. Because the purpose of this paper is more of a “user’s guide” as opposed to an academic paper, most of the underlying assumptions and formulas used are simply asserted rather than developed here.

For a more comprehensive treatment of machinery costs than provided here, and for development of the mathematical formulas underlying *OwnBaler*, the reader is directed to *Farm Machinery Operation Cost Calculations, MF-2244* and *Leasing vs. Buying Farm Machinery, MF-2953*. Supporting research references are contained therein. Both publications can be found at the website www.AgManager.info. The reader is pointed also to the *OwnTractor*, *OwnBaler*, *OwnCombine*, and *OwnTruck* spreadsheets available at the same website. Finally, a user web-search will reveal other useful machinery cost related articles by faculty from other universities.

Background

The trend towards larger, more sophisticated, more productive, and higher cost machinery makes machinery purchase decisions especially important. Machinery investment decisions are inherently complex because they involve time, and a dollar today is worth more than a dollar tomorrow – because it can earn interest. A few examples of time issues regarding machinery are a) machinery depreciates over time; b) tax depreciation and market depreciation typically occur at different rates; c) repairs tend to increase as a machine ages; and d) as machines age they become less dependable (more prone to breakdowns), leading to owner concerns about timeliness. Although *OwnBaler* accommodates most relevant time-dimensioned issues related to baler ownership, it does not explicitly deal with timeliness issues. For example, quantifying lost profit from reduced crop quality or yield due to excessive breakdowns is not handled by *OwnBaler*. Such potentially important considerations are left to the user to assess.

In an economic analysis, machinery ownership and operating costs often are classified into the following categories: 1) interest; 2) depreciation; 3) repair and maintenance; 4) labor; 5) fuel and lubrication; and 6) property taxes, insurance, and shelter (TIS). Although the timing of tax depreciation does impact overall costs and profitability, the depreciation ultimately of interest here is market depreciation. Market depreciation is the change in machine market value over time, which represents a real loss in asset value. Although based on prevailing lender interest rates, the interest cost considered most important here is opportunity interest, rather than the interest associated with an actual loan arising from an owner’s financing decision. That is, because equity could be invested elsewhere, it is considered to bear interest just as does debt (and at the same rate – see *MF2244*). Because a machine could have been sold at the end of last year, with the proceeds invested elsewhere, this year’s opportunity interest cost is calculated by multiplying last year’s machine market value by the prevailing lender interest rate.

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The focus of *OwnBaler* is ownership and operating costs for balers. The result is a cost per hour that presumably can be compared with baler leasing and rental rates. More importantly, to aid

the purchase decision, *OwnBaler* affords comparisons among balers that are different in terms of class (round vs. square), age (new vs. used), usage rates (high vs. low hours), bale size, and even bale coverings (twine vs. net wrap) in the case of round balers. But, since custom baling rates often are a more important benchmark, *OwnBaler* considers at least minimal information on the tractor pulling the baler, and the associated labor and fuel. The final output is a baler analysis summary that shows baler ownership and operating costs, as well as total baling operation costs, each broke down on the basis of \$/year, \$/bale, \$/ton, \$/hour, and \$/acre.

The goal of machinery investors is assumed to be maximizing after-tax (i.e., income tax) profits. Thus, wherever necessary, *OwnBaler* computes after-tax values. However, because decision makers are used to thinking about observed costs, which are intrinsically pre-tax (e.g., baler lease costs and custom rates for baling), *OwnBaler* converts after-tax to pre-tax values in the final analysis.

Following a discussion around baler valuation, this paper proceeds directly into a description of using the *OwnBaler* spreadsheet. A brief discussion of underlying concepts and assumptions, on an issue-by-issue basis, is provided in that section.

Market Valuation (Depreciation)

A key requirement of the machinery investment decision is a reasonable expectation of market valuation (depreciation) over time. That is, how much will a new or used machine purchased for X dollars today be worth Y years from now, after being used for Z hours each year? To be most reliable, machinery market valuation formulas should be based on many years of observed market data. Consequently, the market valuation formulas in *OwnBaler* were developed using information extracted from Iron Solutions, The Official Guide of the Equipment Industry (the Guide). The Guide is essentially the “Blue Book” of the North American Equipment Dealers Association (NAEDA). It shows expected market values for many brands and types of machines, from new to 20+ years old. To gain substantial insight into how the Guide has been used to develop machinery cost calculation formulas, especially for tractors, the reader can read the publication associated with *OwnTractor* available at www.agmanager.info.

Unfortunately, information in the Guide was not as directly useful for developing baler depreciation formulas as it was for tractors or sprayers. First of all, the only indicator of historical usage rate on used balers was the number of bales accumulated. Of course, because bales vary in size from baler to baler, it is difficult to generalize usage-based depreciation relationships from such data. What is needed instead is “number of hours of use” – since engineering depreciation and repair estimation formulas designed to accommodate usage rate are based on hours of use. Secondly, though the Guide provided average accumulated bale counts by age by baler class, it did not provide information on how a baler’s market value is to be adjusted if it has been used less- or more-intensively than the average baler of that age. Consequently, before estimating depreciation relationships from the data, we first had to convert accumulated bale numbers to hours of use numbers. Second, we had to rely on our experience as farm management economists to manipulate the measures of market depreciation until they resulted in a reasonable tradeoff between age- and usage-based depreciation, all the while continuing to predict baler market value fairly accurately.

It should be noted that the machine’s market price series from the Guide used in *OwnBaler* is the series referred to as the Resale Cash Value. As defined in the Guide, it “is a reference point for what the unit will be worth on the lot, after reconditioning, on a cash basis. It does not take into

account the added dealer costs of offering interest-free financing, extended warranty, etc.” Essentially, this price series embodies all repair and rebuilding costs to ensure the machine is in top running condition given its age and hours. We considered using an alternative price series, referred to as the Trade Value Premium series, which is typically about 90% of the Resale Cash Value for 1-year-old machines and diminishes to 60%-70% of the Resale Cash Value series for 20-year-old machines. However, the engineering type formulas we use for repair calculations (described later) assume machines are kept in top condition with all of the necessary repair and rebuilding costs. Thus, if a user is accustomed to thinking of used machine value being that which he can obtain from a dealer given the dealer will do some reconditioning when he gets the unit in, then *OwnBaler* might slightly overstate expected future market value for a used baler. However, given the engineering-type repair calculations, the spreadsheet probably will slightly overstate repairs for such users. Consequently, on the balance, the two overstatements should offset each other, providing a reasonable measure of total baler costs.

In the analysis behind *OwnBaler*, we fundamentally considered depreciation as a separate function of age and of hours of use. That is, aging a baler without putting hours on it will cause it to depreciate at a certain rate and putting more hours on a baler without making it any older will cause it to depreciate at a different rate. We also tested a number of more complex relationships. For example, we examined whether the depreciation due to age might change due to hours and vice versa. We also tested whether balers with different bale capacity depreciate at different rates. Although adding complexity to the depreciation formulas always resulted in predicting market value more accurately for some balers, when we tried to generalize the formulas across different balers, it would cause other balers’ market value to be predicted less accurately. Consequently, *OwnBaler* uses the more simple depreciation relationship, where only age and hours are considered independently.

Considering the tradeoff between predictive accuracy and the generality that fosters usability of *OwnBaler*, we settled on only two classes of balers, with each class having its own age and hours depreciation factors:

- Class 1: Large round balers
- Class 2: Large square balers

Based on the analysis undertaken, we believe that *OwnBaler* will be reasonably reliable for nearly all balers that fit the two classes (but not for small square balers). Because user-determined current market value should reflect such things, we do not consider baler options (e.g., accumulator, bale kicker, electronic display, etc.) to be particularly problematic for the analysis. Though, the user is cautioned to compare balers with similar options.

Unlike *OwnTractor*, the *OwnBaler* spreadsheet can analyze several sideline issues that could be of interest. For example, because a given baler can make variously sized bales (different diameter for rounds and different length for squares), the associated cost comparisons can be made. The same goes for bales with different densities (i.e., different weights given size). Also, for a round baler, the choice of using twine or net wrap can be analyzed by *OwnBaler*.

Using the *OwnBaler* Spreadsheet

The *OwnBaler* spreadsheet calculates ownership and operating costs for balers using internal calculations based on inputs provided by the user. Blue numbers in the spreadsheet are user inputs and black numbers are calculated from the blue numbers. Simply put, if you the user want

a black number to change, you must change a blue number. The spreadsheet accounts for both time-dimensioned variables as well as those that are fixed over time. This section of the paper describes each of the spreadsheet inputs, assumptions, and related calculations. The end result is an annually amortized pre-tax cost per unit that can be compared across alternative baler ownership strategies as well as directly with rental rates. Also, sufficient auxiliary information is requested of the user so that expected baling operation costs can be compared directly with custom rates.

In *OwnBaler*, the time a purchase decision is made is considered year 0. The first year a baler actually is used is considered to be year 1, and so on. Although income taxes typically are not paid until early in the year after they are accrued, for simplicity, we assume taxes are paid in the same year as accrued. This should result in little distortion overall, and potentially none for those paying income tax estimates quarterly. Thus, with these assumptions, because the baler is considered purchased in year 0, that is also the first year that tax depreciation is taken. Conceptually, for a baler that is to be used for 3 years, it is probably best to think of purchasing it on December 31 in year 0, using the baler throughout the year-1, year-2, and year-3 seasons, and subsequently selling the machine on December 31 in year 3.

Notice that *OwnBaler* assumes the baler is explicitly sold following the last year of use rather than traded in. Because trading a machine results in a change in tax basis rather than in depreciation recapture, results would be different than those calculated in the spreadsheet. However, as long as treatment of exiting machines is consistent (as it is here, where exiting machines are always considered sold), then using *OwnBaler* to evaluate different balers still is appropriate – whether or not a baler is in fact sold or traded.

User inputs are entered in the user input section. This section also shows related calculations for use elsewhere or otherwise of interest to the user. The time and tax section displays the time-dimensioned variable values over time, ultimately leading to a computation of after-tax net present value of costs. The baler analysis summary section condenses the results of the analysis into a breakdown of pre-tax baler ownership and operating costs (by year, bale, ton, hour, and acre), providing costs that easily can be compared across alternative ownership strategies and directly with rental rates. Also, on this page is the “total” cost analysis, which allows comparing baler ownership and operating costs with custom rates for the same services.

The *OwnBaler* spreadsheet has three main sections: 1) user input and related calculations section, 2) time and tax (TT) section, and 3) analysis summary section.

The following is a step-by-step discussion of the inputs required in the *User Input* section.

Step 1. Select the baler’s class, age, and accumulated number of bales at purchase time

For a round baler you also will need to indicate the expected portion of bales baled with net wrap rather than twine. More description of twine vs. net wrap follows later.

Step 2. Select the baler’s size characteristics

Enter the width of the bale in inches as accurately as you can. This is the horizontal measure, perpendicular to the line of travel. This number is determined by the baler specifications. See the table (in Baler Models tab) in *OwnBaler* for some common dimensions for balers. Also in inches, enter the fixed height if a square baler or the *maximum* height (diameter) if a round baler.

Again, this number is determined by the baler specifications. Finally, for square balers only, enter the *maximum* length of a square bale in inches as determined by the baler specifications. Often this value will be around 96 inches. The length cell will be ignored when examining round balers.

Step 3. Select the baler's expected purchase price

This is the dollar amount expected to be paid for a baler in question (without a trade-in). If you are including a trade-in, be sure to estimate the outright cost and not to enter only the boot paid.

Step 4. Select the baler's market price

The baler's market value determines a number of costs in the spreadsheet. First, it determines a new equivalent price (*NEP*), which is used to determine accumulated repair costs over time and thus annual repair costs. Additionally, it is used to initialize the market value series that ultimately determines annual market depreciation, opportunity interest costs, and TIS (property taxes, insurance, and shelter) annual costs. Intuitively, these annual costs should not vary based on whether a baler buyer happened to get an especially good or especially bad deal on the baler purchase. Consequently, the spreadsheet needs to isolate the purchase price from the market price of the baler in question.

In practice, the baler's purchase price and market price typically should be the same. At least you should start that way. Then, you can examine the impact of "talking the dealer down" simply by inserting a lower purchase price in that cell. On the other hand, a buyer might believe that "paying over the market" is appropriate for a baler in especially good condition. Inserting a market price that is lower than the purchase price means that the resultant dollars of annual depreciation will be lower than it would have been had it been keyed off of the purchase price (since, given a baler usage rate, depreciation is a constant *percent* of market value) – precisely what is desired for someone purchasing a mint condition baler, for example.

Step 5. Select a cash downpayment

As already discussed, there is an opportunity interest cost associated with an investment whether or not money is actually borrowed – because equity funds could just as well be invested elsewhere to earn a return. Thus, for a baler investment, the choice of financing does not impact profitability or cost. However, to aid understanding, *OwnBaler* allows for a user-selected downpayment. Then, *OwnBaler* shows (in the TT section) the cash flows associated with an interest-only loan, followed by a balloon principal payment at the end of the last year of use for the baler. Other loan structures, such as an annually amortized loan, are not considered in *OwnBaler*. Of course, such alternative structures would not impact profitability or cost. You might select different downpayment amounts to see that baler costs do not change.

Step 6. Select the number of seasons (years) the baler will be used before it is sold

By varying the value in this cell, an important what-if exercise will be provided that helps determine the optimal baler trading strategy.

Step 7. Enter information about the size of bales you expect to make

Earlier, information was inserted to get at baler capacity. Now, you are asked about the size of the bales that will be made. For example, 4-foot diameter bales can be made with a round baler capable of making 6-foot ones. Similarly, 6-foot long bales can be made with a square baler capable of making 8-foot ones. This section begins by providing a common density (lb per cu.

ft.) value, which is based on either a 1,700 lb 5x6 round bale or a 1,325 lb 3x4x8 Hesston square bale. Then, you are asked to insert your own estimate of density. For example, if you expect to set the bale tension on a 5x6 round baler to result in 1,400-lb bales, then you merely need to multiply the stated density by 1400/1700, and type in that value as the density. Bale density can vary dramatically based on crop, moisture, travel speed, and baler settings, to list a few of the factors. Use the computed weight per bale reported a little lower in the spreadsheet, along with your experience, as an important reality check.

Step 8. Enter information about the scale of your baling operation

The spreadsheet asks you to consider your haying problem as one involving average travel speed (mph) when baling, an average swath width in feet, and an average crop yield in tons per acre of hay at baling moisture. The swath width is the width of hay you are baling. Thus, if two 14-foot windrows are raked together for baling, the swath width is 28 feet. The tons/acre measure is for an average cutting or baling. For example, in a 4-cuttings-per-year alfalfa scenario, it might be the annual tons/acre production divided by 4. An average bales per acre per cutting value is computed as a check against reality, as are values for bales, acres, and tons per hour.

Here, you are asked for an expected number of bales you will be making annually. This is a critical input on your part, and often the most well-known number for a custom operator. Then, given your other inputs, a total acres baled per year number is calculated, as is a baler hours per year number.

With this section, your most important task is to check for consistency. If something does not “seem right,” for example, too many bales, too few acres, etc., then you have to change an input to be sure that the calculated numbers are as close to what you know as possible. Focus on the numbers you “most know.” For example, you might know swath width and total acres and total tons, but are less knowledgeable regarding average travel speed – especially considering that the travel speed is supposed to be the “covering new ground” travel speed. Hence, if you run down the windrow at 8 mph but spend 25% of your time turning around (with the pto still engaged), then your average travel speed should be reported as 6.4 (since $8/1.25 = 6.4$). Moreover, when thinking about mph, operators likely tend to remember the fields where they made good time. If you have a baler hour-meter that tallies hours only when the pto is engaged, then the baler hours per year number will also be a “hard” number that can be targeted effectively. On the other hand, baler operators without such an hour-meter likely have little idea about what it should be and so probably will think it should be higher than it is. Finally, if you are a round baler operator, the values input in the twine and net wrap section (described later) also come into play when checking for consistency.

Step 9. Enter miscellaneous information

The annual inflation percent is the expected annual growth rate on machinery values and repair costs. This adjustment is needed because market depreciation and repair cost formulas generally are established using real (not inflation-adjusted) values. That is, values and costs for differently aged and used machines are collected at a single point in time to generate the formulas.

Historically, this number has ranged between 1.0% and 2.0%, hence a value of 1.5% should be reasonable.

The market ding cell is designed to capture one of two things. First, it might capture the additional first year market depreciation of a new machine that is difficult to capture in a model generalizing across many years. Second, it might be used to reflect the added costs associated

with trading machines, for example, the cost of tracking down a decent (market value) buy on a used baler, or the cost of modifying in-cab equipment associated with the newly-purchased baler, etc. Generally, if you believe you are an exceptionally good trader, leave this value set at 0. Otherwise you might consider entering a small value ranging from say 3% to 7%. The way the ding works is as follows. The year you get rid of the baler you will be getting rid (selling) of it at this percent below the market. Mathematically, it can be viewed as a deterrent to annual trading of machinery.

To allow for repairs that increase as balers age with use, *OwnBaler* calculates repairs following procedures developed by the American Society of Agricultural and Biological Engineers. Based on the publication [ASABE D497.7 MAR2011 Agricultural Machinery Management Data](#), obtained from ASABE's website, which describes the standards as of March, 2011, accumulated repairs are described by the formula:

$$\text{Accumulated repairs} = NEP * RFI * (\text{Accumulated hours}/1000)^{RF2} ,$$

where *NEP* is the new equivalent price of the machine, and *RF1* and *RF2* are repair factors. Then, annual repairs are calculated by subtracting last year's accumulated repairs from this year's accumulated repairs. According to the ASABE publication, the *RF1* factor should be 0.10 for large square balers and 0.43 for large round balers. *RF2* should be 1.8 for both classes. We use the suggested *RF2* value of 1.8 as suggested. However, it is likely that historical data underlying ASABE formulas overstated baler hours relative to the baler hour-meter (only when the pto is engaged) type of hours we wish to consider here. Hence, based on our own assessment of the situation, we use an *RF1* value of 0.25 for large square balers and 0.55 for large round balers. The large square baler value was designed to target some known repair costs for a large square baler operator. And, the large round baler value was designed to result in higher repairs per ton for round balers than for square balers, as has been suggested in a number of publications, for example "Farm Machinery Economic Cost Estimates for Late 2005" by Lazarus and Selley at the University of Minnesota and University of Nebraska, respectively. Actually, in that publication, if we increased the swath width and travel speed of the round baler to get to the same acres or tons per hour as assumed for the large square baler, the per unit (acres or tons) repairs for round balers would still be around double that of large square balers. But, we are unsure of the age of the machines assumed in that publication. Moreover, based on information from a custom round baling operation, we have selected the *RF1* factor to result in only slightly higher repairs per ton for round balers as compared to square balers.

If you consider the expected future annual repairs calculated by the spreadsheet to be inconsistent with other information you might have, then the RAF factor can be set to some value other than 1.0. The RAF factor does a simple proportionate scaling. That is $RAF = 0.90$ and $RAF = 1.10$ imply annual repairs that are 10% lower or 10% higher, respectively, than what would be predicted using the ASABE-type formula.

Given the related discussion in the Market Valuation section, you are cautioned against setting the RAF to something below 1.0 merely because you believe the projected repairs are too high. Rather, you should look also at the expected future market value, which might also be too high by your assessment, and thus the two values would more-or-less offset each other. Additionally, it is easy for a farmer who does his own repairs to forget the cost of his labor and the cost of

keeping up his shop. It is also easy to forget to prorate large and infrequent overhaul charges across years. In either case, the user's intuition about repair costs might be on the low side.

The cost associated with property taxes, insurance, and shelter (TIS) is considered to be a fixed percent of baler market value. Assuming no property taxes, *MF2244* suggests a value of 1.5%.

Step 10. Enter tractor, labor and fuel information

Tractor, labor, and fuel information is needed so that *OwnBaler* can compute values designed to be comparable with custom rates (since custom charges include such costs). To focus attention on the baler and keep things simple, tractor ownership is treated as a rental unit. That is, following a request for the horsepower of the tractor expected to be used, a per-horsepower-per-hour rental rate is requested. Typically, tractors rent for \$0.19 to \$0.25 per horsepower hour. Thus, for example, and using a rate of \$0.20, a 150 hp tractor is expected to rent for \$30.00 per hour. Expected fuel consumption, fuel price, and the oil and lubrication percentage round out the tractor costs.

It is important to note that considering the tractor in a rental framework abstracts away from economies of size associated with spreading the fixed costs of a tractor over more units of activity (here bales, which impacts tractor hour-meter hours). If you wish to explicitly consider the expected lowering of tractor costs associated with an analysis of the baling business's expansion, then you might consider examining the tractor in a separate analysis by using *OwnTractor*. Alternatively, you might just lower the tractor rental rate here a little if you substantially increase the number of bales expected in your analysis.

OwnBaler requests an input for the expected ratio of tractor hour-meter hours to baler hours. This is an important input and it is easy to incorrectly understate this number. This is the number of tractor hour-meter hours assigned to the baling operation that is tallied for each baler hour. Road time, idling time, and faster baling speeds (less percent of total time spent baling) will increase it. Based on preliminary work, we believe a reasonable estimate is 1.6-1.9 for square baling and round baling with net wrap, and 1.5-1.8 for round baling with twine. Undoubtedly, the accuracy of the suggested value for this number will improve over time with input from hay baling operators, especially as they consider the relative portions of time their tractors are used in raking, baling, bale moving, and perhaps swathing (if a pull-type swather is operated by the same tractor used in baling).

Given your inputs, *OwnBaler* computes a number of tractor hour-meter hours assumed to be charged to the baling operation. This value is the number of tractor hours tallied that are associated with moving between fields and baling, but not with moving or loading bales. If this value seems inappropriate, adjust the ratio just discussed, or one of the other inputs such as average travel speed when baling, etc. Your experience should be consistent with this number.

Labor hours per tractor hour-meter hours is another important input that is easy to understate. In this cell you should enter an estimate for the labor efficiency associated with operating the tractor that pulls the baler down the road and around the field. A value of 1.0 would indicate that the only labor associated with the baling operation is when the tractor engine is running. A value of 1.5 would indicate that, for every hour the tractor engine is running, an additional half hour of labor is required (for tasks such as servicing the baler and tractor, etc.). Until we learn better, a suggested range is 1.7 to 2.3. Keep in mind that, as in all businesses, all labor and management

time must be assigned to some revenue-generating enterprise. That means time spent driving to and from the field, checking on hay conditions, servicing equipment, etc. must be accounted for along with actual tractor operation time. It may be easiest to check this number against reality by examining the total labor bill on the Analysis page.

Be sure your hourly labor charge includes all labor and associated management cost, whether it is hired labor or labor of the operator. Don't forget to include payroll taxes and fringe benefits. If you are an owner operator, this is the wage rate you will be "paid" for your time spent in the baling operation.

Step 11. Enter the necessary financial information

The selected bank interest rate should be the typical borrowing rate expected from lenders. The combined state and federal income tax rate should be the rate expected on the next taxable dollar earned. Typically, federal income tax rates for sole proprietors are either 15% or 28%, with state rates around 4% to 5%. For many users, a dollar of expense saves both income tax and self-employment tax. Thus, *OwnBaler* allows for including self-employment tax (currently 15.3%). Further, because tax depreciation saves income and self-employment tax, yet depreciation recapture when a used baler is sold garners only income tax, *OwnBaler* distinguishes income tax from self-employment tax rates.

OwnBaler allows for the Section 179 expensing deduction for depreciable assets. The Section 179 deduction reduces taxable income by that amount in the year of purchase. This deduction is taken before any IRS formula-based tax depreciation schedule is applied. Under the Small Business Jobs Act, passed in 2010, the maximum allowed was \$500,000 in 2010 (up from the previous value of \$250,000) and is also \$500,000 in 2011, but is scheduled to decline to \$25,000 in 2012. The Section 179 deduction also diminishes on a dollar-for-dollar basis after eligible annual purchases exceed \$2,000,000 (up from \$800,000 in the past). For example, a farm with \$2,100,000 purchases in 2008 could not expense more than \$400,000 using Section 179; at \$2,500,000, the expensing deduction would be \$0.

After accounting for the Section 179 and 50% bonus depreciation deductions, *OwnBaler* uses the MACRS tax depreciation percentages for 7-year property to play out tax depreciation across the years that a baler is considered owned. As the spreadsheet is currently structured, faster depreciation (if applicable) can be accommodated by changing the cell values appropriately, with some cells perhaps set to 0. When changing, care should be taken that the values sum to 100%.

Step 12. Enter the necessary information in the twine and net wrap part of user inputs

The first inputs here include twine and net wrap prices, which should be straightforward. Similarly, each of the other inputs in this section are adequately described in the cell comments in *OwnBaler*. Obviously, if you are considering a square baler, information input or calculated for round balers will not be relevant and vice versa.

Cash flows and economic variable calculations over time (understanding the TT section)

The time and tax (TT) section of the *OwnBaler* spreadsheet calculates the expected values for those variables that change over time. Some columns are not strictly needed, but are included to aid understanding (e.g., loan interest and loan principal, as discussed in the cash downpayment step earlier in this paper, or the annual breakdown of per hour repairs). Most columns are self-explanatory, while others can be understood by examining the formulas they contain.

Essentially, this section tracks all cash flows over time, with future cash flows appropriately discounted to year 0 (the present). Tax savings due to business expenses and tax depreciation is considered a cash flow because it would reduce taxes paid.

After discounting for time, all cash flows in this section are summed to provide the after-tax net present value of costs (NPVc). Since the only time-dimensioned variables considered in *OwnBaler* are interest, depreciation, repairs, and TIS, the NPVc value must be prorated among these four cost categories. Because opportunity interest and market depreciation are ultimately the relevant interest and depreciation cost categories, prorating NPVc is not immediately straightforward. *OwnBaler* handles this as follows. First, though they do not impact cash flows, market depreciation and opportunity interest columns are included in the TT section. Then, the after-tax discounted NPV for each of these two columns, along with that of the repairs and TIS columns, is calculated. Finally, the relative share that each of the four values is of the total of all four, determines the NPVc proration portions.

Baler analysis and summary section

First, this section repeats a few of the underlying user inputs and calculated values to facilitate printing a report. Second, based on after-tax amortization of values from the TT section, followed by conversions to pre-tax values, this section reports the ownership and operating costs associated with the baler analyzed. To facilitate cost and rental rate comparisons, categorical costs are reported as annual costs, followed by \$/bale, \$/ton, \$/hour, and \$/acre. Finally, twine, tractor, labor, and fuel costs are also included – to assist in making comparisons with custom rates charged for baling.