AgProfit™: a net present value and cash flow based decision aid for agriculture producers

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Abstract

Purpose – The purpose of this paper is to present AgProfit™ as a tool for users to assess economic risks associated with adoption of new technologies or production practices in production agriculture.

Design/methodology/approach – This paper presents the AgProfit™ software program, its approach to capital investment analysis and demonstrates the program use by developing a scenario for analysis and discusses the process and results of the analysis.

Findings – AgProfit™ was developed to assist growers in understanding the risks associated with technology adoption. The example presented in this paper demonstrates the value of the software program as a decision-making tool on the complex question of how many acres are required for an economically beneficial adoption of a new technology. Thus, with this software program, a grower can base investment decisions on the net present value and internal rates of return on an investment rather than a sales pitch or "gut" feeling.

Originality/value – AgProfit™ is a recently developed software program that fills a void in available decision tools, providing users with the ability to assess the profitability and feasibility of production investment decisions.

Keywords Computer software, Agriculture, Technology adoption, Financial analysis, Risk assessment, Specialty crops, Net present value, Decision support systems

Paper type Technical paper

Introduction

Effective farm management requires long-term planning and decision making. These decisions range from crop selection and selecting input suppliers to major investments in new equipment and infrastructure. The goal of all these decisions is to improve the profitability and sustainability of the operation. However, these decisions are only as good as the time and effort invested in understanding the operational and economic impacts of the options available. This paper presents a new tool available to agricultural producers to analyze the impact of investment choices on the profitability and financial feasibility of their farming operation; AgProfit™. AgProfit™ is a windows-based software program that was developed to help specialty crop producers understand the financial implications of their cropping systems, equipment, and technology adoption decisions but is broadly applicable to most any agribusiness financial analysis when the economic impacts can be quantified or estimated. AgProfit™ employs the discounted cash flow approach of net present value (NPV) and internal rate of return (IRR) based

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upon costs, returns, and discount rates entered by the user in each scenario. The output provides users with a means to evaluate the profitability and cash-flow feasibility of an investment in new cropping system, equipment and/or new technology. This paper presents the financial model of the software and an example evaluating a technology adoption scenario evaluating the purchase of an automated orchard platform for use in an apple orchard as a demonstration of the software's capabilities.

Background

AgProfit™ was developed to help perennial specialty crop producers assess profitability and financial feasibility of cropping system, equipment, and technology investments. Unlike annual crop producers, perennial specialty crop producers are required to invest significant capital into cropping system infrastructure such as trees or vines, irrigation systems and trellising that can be in place for several decades. This high initial investment coupled with long payback periods place critical importance on the planning process as errors may not be realized for several years and cost producers tens of thousands of dollars. The concept for the investment analysis tool was to develop a means for producers to quickly assess the profitability and cash-flow feasibility before they approach a lender or investor to secure financing for the investment. Currently, many producers are making these investment decisions based upon extension service reports, industry trade reports, and conversions with respected producers because there has not been agricultural investment decisions tools, such as AgProfit™, available. Very little rigorous analysis of long run financial impacts is preformed because growers often lack training or resources to fully evaluate the investment before making a decision. In most other businesses, managers perform some form of capital budget or investment analysis to determine the value of each opportunity and justify expenditures. These analyses usually rely on an IRR analysis to determine if the investment would have sufficient returns to justify the investment (Gitman, 2006). AgProfit™ allows agricultural producers to perform both NPV and IRR assessments to evaluate the profitability of investment opportunities like their non-farm sector counterparts. The NPV approach uses the formula:

$$NPV = -INV + P_1/(1+i) + P_2/(1+i)^2 + \cdots + P_n/(1+i)^n + S_n/(1+i)^n \qquad (1)$$

where:

NPV	=	present value of net cash inflows.
INV	=	initial investment.
$P_1, P_2 \ldots P_n$	=	cash flows from the investment in years 1,2,. . .n.
i	=	discount rate (opportunity cost, cost of capital, or required rate of return).
n	=	expected life of the asset or planning horizon.
S	=	salvage value of the asset in year n (Barry *et al.*, 1999, p. 278).

To calculate the IRR of the investment, the above formula is used with the exception that NPV is set to 0 and the equation solved for i:

$$0 = -INV + P_1/(1+i) + P_2/(1+i)^2 + \cdots + P_n/(1+i)^n + S_n/(1+i)^n \quad (2)$$

(Barry *et al.*, 1999, p. 281).

When using NPV to make decisions it is typical that if the investment has a NPV greater than 0 the investment should be made and if the NPV is less than 0 the investment should be rejected. That is because the equation consists of all the costs and desired rates of return. Therefore, if the NPV is greater than 0, the investment can achieve all the financial objectives stipulated. IRR is more commonly used because the result (solving for the interest rate) provides a clear indication if the investment will exceed the cost of capital (i) or not, however, it is more difficult to determine without being proficient with a financial calculator. Finding the IRR requires solving for a solution set large enough to accurately determine the slope of a line, known as the present value profile, that crosses the *x*-axis when plotted or sufficient iterations to resolve IRR with enough significance to be useful which can be a daunting task. Despite being commonly used, IRR has some inherent weaknesses that make NPV a better capital budgeting tool (Gitman, 2006; Brigham *et al.*, 1999). The first being that the IRR calculation assumes future cash flows are reinvested at the IRR, even if this rate is above the market rate for capital. The assumption that the firm can reinvest capital at above market rates is unrealistic and leads to an overly optimistic projected rate of return. Additional weaknesses are that irregular cash flows can result in multiple IRRs and that when comparing mutually exclusive projects, a smaller project with a higher IRR will rank higher than a larger project with a lower IRR even though the larger project has a greater NPV. For these reasons we will focus on NPV as the principle tool, however, if required by an investor or bank, the AgProfit™ analysis can provide the IRR of the scenario.

Before we work through an example we need to discuss how AgProfit™ arrives at its results. As discussed previously, this approach to investment analysis uses discounted cash flows. Cash flows result from returns minus costs:

$$P = R - C \quad (3)$$

where:

$P =$ net cash flow from the investment.

$R =$ total returns from the investment.

$C =$ total cash costs associated with generating the returns.

So far the model used has addressed the fact a dollar today is worth more than a dollar in the future due to the cost of money (interest) and risk with the "i" component of equations (1) and (2). However, there is another component of the time value of money: inflation. Inflation captures the expected increase in future prices of goods and services; in effect, dollars in the future have less purchasing power than dollars today. Ideally equation (4) is used to determine cash flows P:

$$P_1(1+i_f) = R_1(1+i_f) - C_1(1+i_f) \quad (4)$$

where: i_f = inflation.

However, these analyses typically assume the same inflation index is used to adjust both returns and costs (as shown in the equation (5)) allowing a simplified formula to determine the impact of inflation on the components of cash flows (Rappaport and Taggart, 1982; Barry *et al.*, 1999):

$$P_1(1 + i_f) = (R_1 - C_1)(1 + i_f) \quad (5)$$

This simplification of equation (4) results in the following revision of equation (1) to account for inflationary effects:

$$\begin{aligned} NPV &= -INV + P_1(1+i_f)/(1+i)(1+i_f) + P_2(1+i_f)^2/(1+i)^2(1+i_f)^2 \\ &\quad + \cdots + P_n(1+i_f)^n/(1+i)^n(1+i_f)^n + S_n(1+i_f)^n/(1+i)^n(1+i_f)^n \end{aligned} \quad (6)$$

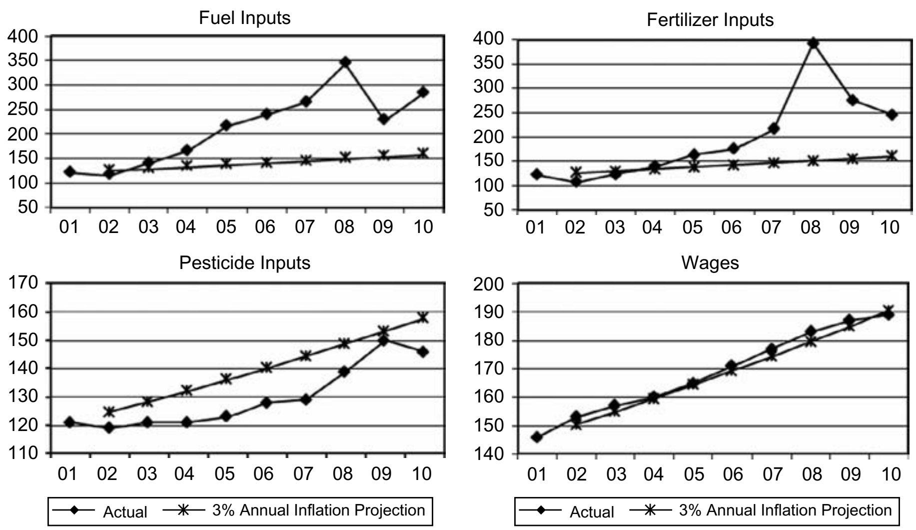
where: i_f = the expected inflation rate for that period.

This model works for most economic sectors (Gitman, 2006). However, for most sectors of the economy, production is controlled by a relatively few manufacturing operations with significant investments in market research, development, and planning; in addition, the means of production, while not without lags and lead times, are virtually completely controllable. In this environment, aside from price variations and potential substitution of some inputs, costs are highly predictable and for mature markets, total market demand and supply can be quantified with a high degree of certainty. This is the major difference when dealing with agricultural production systems, predicting supply and demand is complicated by weather and other phenomenon beyond the producer's control. In many cases, supply and correspondingly prices are not known until harvest. This uncertainty increases price volatility and exposes agricultural producers to more risk. Along with the inherent price uncertainty, agricultural producers must address the tendency for agricultural markets to have excess supply. Agricultural markets typically consist of many producers independently making production decisions for the next season based upon the current season's market signals (prices). In many cases, the appearance of a profitable crop attracts a significant increase in production capacity the following season as the transition costs are minimal for many producers. This holds true for many perennial crop producers as well as those that produce annual crops as their asset base is agriculture specific and orchard renewal or farm expansion is an ongoing process. In addition to always looking for profitable crops, agriculture producers are also working to improve their production efficiency. Producers that are able to produce crops more efficiently are sustainable at lower prices than less efficient producers, thus the concept of the "agricultural treadmill" (Cochrane, 1958). Agricultural treadmill theory suggests, over time as producers improve production efficiency, profit premiums attract increased adoption of the efficient production practices which increases supply and lowers prices driving out excess profits. The term treadmill refers to the perpetual work to improve efficiency without actually improving long-run sustainability of the operation. If an agriculture producer stops improving efficiency they are soon unprofitable and unsustainable. This phenomenon, while not completely unique to agriculture, is more pronounced in this sector because the producers have no market power and are price takers. The important aspect is that this downward price pressure is contrary to inflationary pressure which causes a general upward trend in the price of goods and services. Therefore, agriculture producers face generally increasing input prices such as labor, energy, chemicals, etc. while returns from their production operation are highly volatile. A review of selected historical production and input data provides a glimpse of the challenge agricultural producers face as they strive to remain profitable and sustainable. For example, petroleum based inputs (fuel and fertilizer) have experienced faster increases than other chemicals such as pesticides or wages (Figure 1). In this case, fuel and fertilizer prices are driven by commodity markets while pesticide prices are driven by patent protection and state and federal regulations and wages by state regulations and availability thus the greater price volatility in fuel and fertilizer prices. The same holds true for grower prices. Figure 2 shows farm-gate prices for California cantaloupe and processed sweet corn from Washington, New York, and Michigan. Note that the inflation based price projections are significantly greater than actual prices until 2008 and 2009. However, Figure 3 shows fresh and processed apple prices from Washington, New York, and Michigan tracking with the inflation based price projections as does fresh and processed broccoli from California (Figure 4). In watermelon, however, the price varies by production region. Prices in Georgia and Texas track with inflation while California prices fall below the inflationary projections (Figure 5). These variations in input and return prices suggest that accurately modeling the production system requires users to understand their market as well as the trends in input prices. The main point being that if agricultural producers were to develop a budget for an investment and built in the assumption that their returns would inflate at the same rate as their costs, they would likely overstate their returns and understate the economic risk of the investment which could have dire consequences for the operation.

AgProfit™ was developed to allow the user to account for this inflation rate phenomenon. Rather than assume that the inflation value (i_f) is equivalent in return and cost components as presented in equation (1), this method makes the assumption that inflation can impact each component of the equation differently as shown below in equation (7):

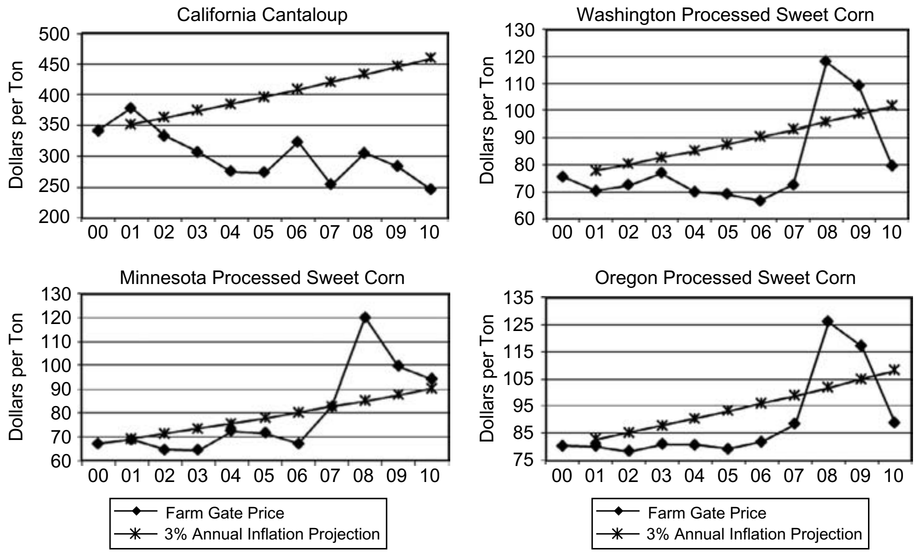
$$Pi_f = R(1 + i_{fr}) - C(1 + i_{fc}) \quad (7)$$

where:



Source: US Department of Agriculture, National Agricultural Statistical Service (2000-2009, 2011)

Figure 1.
Agricultural fuel, fertilizer, pesticide, and wage costs index 2000-2010 (1990 to 1992 = 100) compared with inflationary model of 3 percent annual increase from 2000



Source: US Department of Agriculture, National Agricultural Statistical Service (2000-2011)

Figure 2.
Farm gate prices from 2000 through 2010 for selected crops and price projections at 3 percent annual inflation from 2000

Pi_f = inflation adjusted cash flow.

R = total return from investment;

C = the total costs associated with investment.

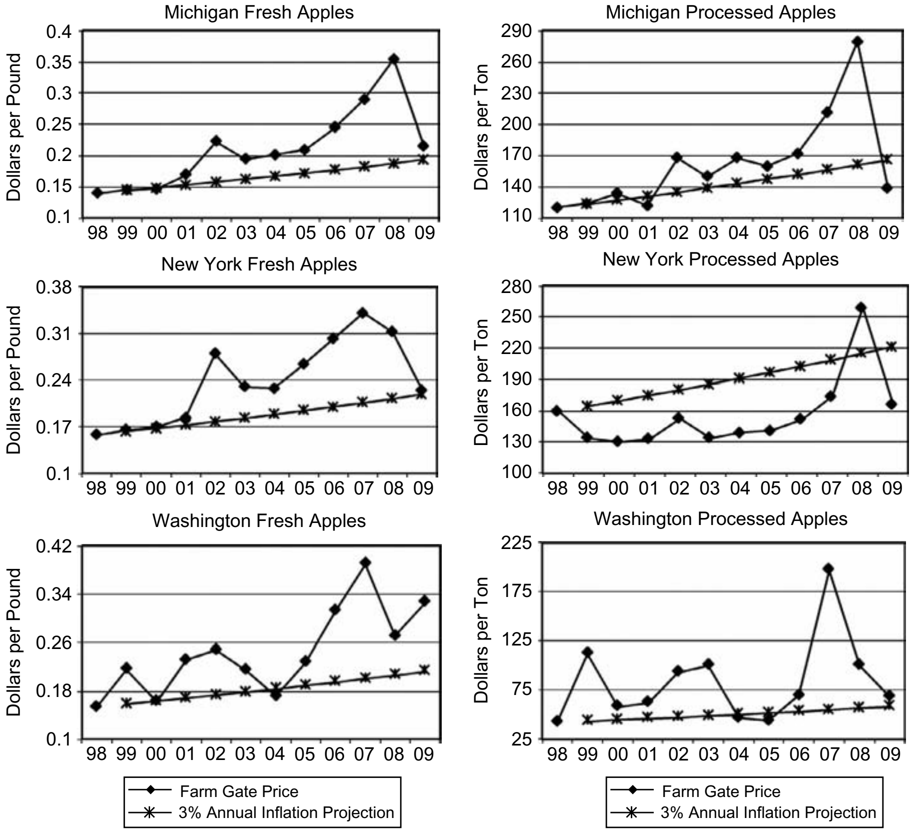
i_{fr} = expected rate of inflation for returns.

i_{fc} = expected rate of inflation for costs.

The uniqueness of this approach is that inflation rates for each cost or return item can be applied as the budget is being developed. Thus, when the budgets are "stacked" in a scenario, inflation is compounded by the number of years from Year 0 for each cost and return entry. This approach has the added benefit of allowing different inflation factors for different inputs and outputs to account for changing market conditions.

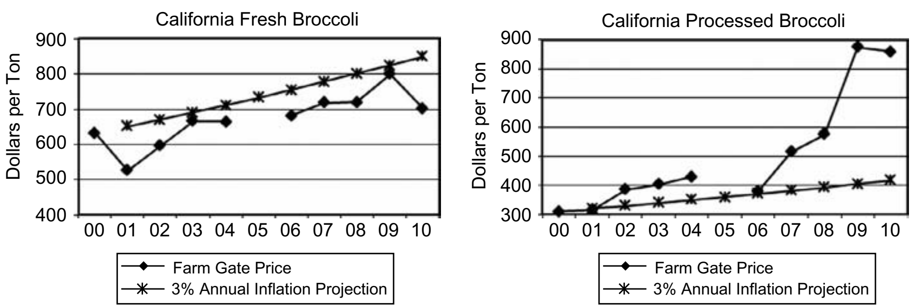
How to use AgProfit™ for the analysis

AgProfit™ uses a series of enterprise budgets developed to depict the scenario of interest for the analysis. The scenario can be projected up to 20 years into the future. The budgets are created using current costs and return values as well as inflation factors to replicate anticipated cost/price increases over time. The user can customize pre-existing budgets or start from a blank budget template and create his or her own. After the user downloads and installs the software they can load budgets into a scenario for analysis. The scenarios can be of full costs and returns or merely partial budgets with only costs and returns associated with the proposed change to the production system. After the scenario is developed the software generates several outputs: annual returns, annual



Source: US Department of Agriculture, National Agricultural Statistical Service (2000-2010)

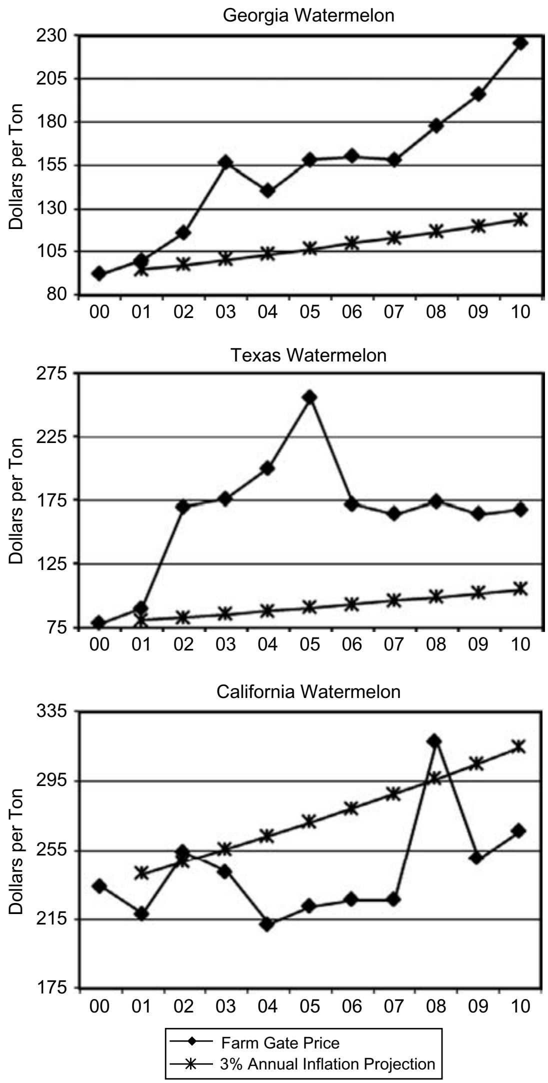
Figure 3.
Farm gate prices from 2000 through 2009 for fresh and processed market apples from Michigan, New York, and Washington and price projections at 3 percent annual inflation from 2000



Source: US Department of Agriculture, National Agricultural Statistical Service (2000-2011)

Figure 4.
Farm gate prices from 2000 through 2010 for fresh and processed market broccoli price projections at 3 percent annual inflation from 2000

costs, net returns, cumulative net returns, NPV, IRR, etc. This information can be exported or saved as a scenario file for later reference and modification. The users can modify the scenarios by changing any element of the budget to assess the sensitivity of the scenario to different stresses and market conditions.



Source: US Department of Agriculture, National Agricultural Statistical Service (2000-2011)

Figure 5.
Farm gate prices from 2000 through 2010 for fresh and processed market watermelon price projections at 3 percent annual inflation from 2000

Scenario analysis

This section will present the use of AgProfit™ as a tool to assess the economic impact of technology adoption, a self-propelled orchard platform, in a medium density apple orchard. AgProfit™ can be used at several different points across the technology development and adoption continuum. It can be used to quantify the value to the user by estimating the financial impact of the proposed technology's benefits. It can also be used to assess research and development investment to solve grower problems by quantifying the economic impact of solving the problem on a per acre basis. Quantifying the economic impact to growers is the foundation for assessing the benefits to the industry as a whole and quantifying market potential of a new technology in dollars. This paper presents an assessment of an existing technology from the grower's prospective.

To begin the process, we first specify the benefits of the technology to be adopted by the grower. In this case, it is a self-propelled platform for use in orchards. Self-propelled platforms are currently on the market and in limited use. When assessing new technology it is important to consider applicability to the production system. The development and utilization of the orchard platform had to be proceeded by the development of higher density fruiting wall orchard architecture. In fact, a significant barrier to wide spread adoption of orchard platforms has been the limited adoption of the higher density fruiting wall orchard architecture by growers with significant acreage planted in the three-dimensional low density orchard configurations. These three dimensional plantings cannot effectively utilize platforms because the fruit is not located within a vertical plane allowing workers to work from a relatively fixed position in the row. In addition, the tree branching structure prevents platform access to some rows. Therefore, as more orchards renew and adopt the higher density planting and trellised architecture, more growers will have the opportunity to take advantage of the platform. This paper assumes the grower has already adopted the trellised, two-dimensional, fruiting wall orchard architecture on some acreage and is considering the incorporation of an orchard platform into the operation. The following sections develop the AgProfit™ scenario and present the results of an AgProfit™ analysis. This analysis assessed two aspects of the grower's dilemma: the costs and benefits of orchard platform adoption and the minimum utilization (acreage) for the orchard platform to be financially profitable and economically feasible.

Setting up the scenario

This scenario will be based upon a medium density apple budget (Seavert *et al.*, 2007). In the scenario, the prices received by the grower are held constant and not inflated over time, while all input costs are inflated at 3 percent per year. This scenario also does not include any weather or production related price/quantity variation sensitivity analyses as it is a simplified example to demonstrate some of the features of the software program. Growers developing a scenario would want to review historical production records to modify the scenario to include cyclical production variations. AgProfit™ does not estimate price and quantity variability but relies on user estimates of variability. Once the production environment has been specified, the next step is to define the impact of the orchard platform on the operation in both costs and benefits. This part can be difficult, especially if the technology is new and does not have many users. In this case, the platform has enough presence in the industry for the growers to be able to collect information from the manufacture as well as other growers. Washington State University and the Washington Tree Fruit Research Commission have run field trials and worked with growers improving the functionality of orchard platforms. Their work suggests the platform can reduce pruning and training labor by 40 percent over traditional hand labor with ladders (unpublished data). We will use this as the benefit the grower receives from adopting this technology. The budgets for traditional production systems indicate pruning and training requires 110 hours per acre at a cost of $13 per hour (including all employment related taxes and benefits) or $1,430 per acre per year. The orchard platform reduces that to

66 hours or $858 per acre per year, a difference of $572 per acre. The current model of orchard platform costs about $36,000 (Blueline Manufacturing, Moxee, WA). We will also assume the platform has a ten-year life with a salvage value of $6,790. Ownership costs can be allocated either of two ways: replacement costs or cash costs. The replacement cost approach is useful if the investment life, in this case the life of the platform, exceeds the analysis period or is assumed to be perpetually renewed as in the case of regularly used tractor and plow. This approach assumes an annual equipment ownership cost equivalent to annual depreciation allocated per acre, conceptually an accrual accounting for equipment utilization. The cash cost approach factors in the initial purchase investment followed by operation costs for the life of the investment and the sale of the asset at the end of the investment period. The orchard platform uses 0.25 gallon of fuel per hour and annual repairs vary with utilization based upon acreage. Our analysis will look at three block sizes, 5, 7.5, and 10 acres. The final variable required for the development of the orchard platform in the program is the field efficiency. In this case, the field efficiency is set to 85 percent. This indicates that 85 percent of the time the platform is performing work and 15 percent of the time it is involved in non-productive activities such as refueling, turning at row ends, etc. In this example, the grower is self-financing the purchase, therefore, percent financed is set to zero.

The analysis

Now we are ready to develop and analyze this scenario. In summary, the user selected apple production budgets and modified them to reflect the adoption of an orchard platform. Budgets were developed with platform ownership costs allocated on an annual replacement or cash flow basis over a ten-year period for the three block sizes discussed. Table I shows the annual hours of use, annual repair costs, and budgeted costs for each usage level. Note that as utilization (acres) increases, hours per year of use increase as does annual repair costs and consequently, in the cash flow model, post purchase years costs, but the per acre ownership cost deceases. Next, ten years of budgets are loaded into the software program and the discount rate is selected. The software has a default discount rate of 8 percent. We will use the default rate for this analysis, although the user could easily select any rate or even analyze the impact of different rates.

Results

A scenario was developed comparing the adoption of an orchard platform by a grower in a medium density apple orchard. The analysis consisted of developing a ten-year production budget scenario to model each production system and each utilization level.

Utilization (acres)	Annual use (hours)	Annual repair	Budgeted costs: Accrual years 1-10	Cash flow[a]: Year 1	Cash flow[a]: Years 2-9	Cash flow[a]: Year 10
5.0	34	$204	$629	$7,232	$46	($1,312)
7.5	51	$322	$436	$4,839	$48	($857)
10.0	68	$437	$340	$3,642	$49	($630)

Notes: [a]Year 1 includes purchase and operation costs; years 2-9 are only operational costs; year 10 includes the sale of the platform at its salvage value

Table I. Orchard platform annual use, repair costs, and budgeted costs on an accrual and cash flow basis, per acre, for different utilization levels

Table II presents a summary of budget costs and returns for the traditional medium density apple production system and production utilizing an orchard platform in 10 acres. Note total revenue in Year 10 of the cash flow model reflects the sale of the orchard platform for its salvage value at the end of the investment period. Also note that packaging and processing, and harvest costs remain constant while non-harvest costs and capital costs vary between the traditional system and the orchard platform production system. Non-harvest and capital costs also vary across utilization models (not shown). In addition, ownership costs vary between the two ownership models as one system represents a stream of payments equal to the value of the orchard platform while the other consists of a lump sum payment in Year 0 followed by operating costs and no platform ownership costs for the remaining years.

Output from the AgProfit™ program is presented in Table III as the difference between production with and without the orchard platform and ownership costs allocated on an accrual basis. The data indicate that platform adoption by a grower with 5 acres or less would be unprofitable as the cost of the platform exceeds its benefits. Total net returns are −$522 per acre with a NPV of −$371 per acre over the ten-year investment period. Growers with orchard blocks of 7.5 or more acres would be better off adopting an orchard platform due to positive total net returns and NPV associated with the increase utilization. Table IV presents the cash flow ownership model. On a cash flow basis, growers with

Table II.
Production cost summary for traditional medium density apple production and apple production with an orchard platform in a 10 acres block, per acre, in dollars

		Orchard platform			
			Cash flow[a]		
	Traditional	Accural years 1-10	Year 1	Years 2 to 9	Year 10
Total revenue	16,854	16,854	16,854	16,854	17,533
Packing processing and value-added costs	8,117	8,117	8,117	8,117	8,117
Harvest costs	1,693	1,693	1,693	1,693	1,693
Non-harvest costs	5,165	4,631	4,631	4,631	4,631
Capital investment	187	478	3,780	187	187
Total annual costs	15,163	14,920	18,221	14,628	14,628
Net returns	1,691	1,935	−1,367	2,226	2,905

Notes: [a]Year 1 includes orchard platform purchase and operation costs; years 2 to 9 only include platform operation costs; year 10 includes the sale of the platform at its salvage value; the orchard platform costs are presented on both an accrual and cash flow accounting basis

Table III.
Net impact of orchard platform in apple production system (platform system returns minus traditional production system returns), on an accrual accounting basis, per acre, over ten years at 8 percent discount rate

Acres	Total net returns	NPV	NPV annual equivalent
5.0	($522)	($371)	($59)
7.5	$1,682	$1,196	$191
10.0	$2,786	$1,982	$317

5 acres have total net returns of $334 per acre, however, when considering the time value of money, 8 percent over ten years, the NPV is −$2,124 per acre and therefore unprofitable as well. This assessment also indicates that adopting an orchard platform on a 5 acres block would require additional cash resources of $4,957 per acre or $24,785 to be feasible (Table V). This assessment also analyzed 7.5 and 10 acres block utilization, both of which were shown to be profitable, with the stated assumptions, for the accrual and cash flow ownerships models. However, in order to be financially feasible the grower would need access to cash resources of $2,564 or $1,367 per acre in the first year for adoption at the 7.5 and 10 acres utilization levels, respectively (Table V). Therefore, even though adoption of an orchard platform would increase grower profits, without access to the addition cash, either from their own resources or borrowing capacity, it would not be a sustainable adoption attempt. Table V also shows all of the utilization rates will generate a positive cash flow at some time during the investment period and the 7.5 and 10.0 acres utilization rates achieve payback in eight and six years, respectively.

Conclusion

AgProfit™ was developed as a tool to assist growers in making better long term equipment and technology adoption decisions. Following several iterations of the software program, the current version has evolved as a powerful risk management tool. This paper presented some of the improvements recently added to the new version as well as an example of how the program was intended to be used. In this case, the assessment is of a relatively new technology, self-propelled orchard platforms. The output from the analysis indicates that orchard platform adoption may be profitable for growers with 7.5 or more acres of platform accessible orchard. However, for adoption to be sustainable in this example, growers must have access to addition cash resources as discussed above, which are dependent upon the means of ownership available to the grower. While this analysis assumed a lump sum payment for the full cost of the platform, the software is versatile enough to handle any financing or leasing option the users would like to test. In addition, while this assessment only looked at the costs and benefits of the orchard platform as conditions of the adoption decision, it is also possible to develop crop return scenarios to test the profitability and feasibility under a wide range of market conditions. The aim

Table IV. Net impact of orchard platform in apple production system (platform system returns minus traditional production system returns), on a cash flow basis, per acre over ten years at 8 percent discount rate

Acres	Total net returns	NPV	NPV annual equivalent
5.0	$334	($2,124)	($340)
7.5	$2,252	$28	$4
10.0	$3,214	$1,105	$177

Table V. Orchard platform first year cash deficit, number of years to positive cash flow, and payback of initial investment of a ten-year investment

Acres	Year 1 deficit per acre	Years to positive cash flow	Years to payback
5.0	($4,957)	4	–
7.5	($2,564)	2	8
10.0	($1,367)	1	6

of this paper was to present AgProfit™ as a tool to assist growers in understanding the level of risk associated with adopting new technologies or practices into their operation. A web site has been developed for the distribution of the AgProfit™ software program: www.agtools.org. The software is free to US users.

References

Barry, P.J., Ellinger, P.N., Hopkin, J. and Baker, C.B. (1999), *Financial Management in Agriculture*, 6th ed., Interstate, Danville, IL.

Brigham, E.F., Gapenski, L.C. and Daves, P.R. (1999), *Intermediate Financial Management*, 6th ed., Dryden Press, Fort Worth, TX.

Cochrane, W. (1958), *Farm Prices, Myths and Reality*, University of Minnesota Press, Minneapolis, MN.

Gitman, L.J. (2006), *Principles of Managerial Finance*, 11th ed., Addison-Wesley, New York, NY.

Rappaport, A. Jr and Taggart, R.A. (1982), "Evaluation of capital expenditure proposals under inflation", *Financial Management*, Spring, pp. 5-13.

Seavert, C.F., Freeborn, J. and Castagnoli, S. (2007), "Orchard economics: establishing and producing medium-density apples in hood river county", EM 8829-E, revised September, Oregon State University Extension Service, available at: http:arec.oregonstate.edu/oaeb/files/pdf/EM8829-E.pdf (accessed 26 August 2009).

US Department of Agriculture, National Agricultural Statistical Service (2000-2009), "Agricultural price summary", Pr 1-3 available at: http:usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1003 (accessed 2 March 2011).

US Department of Agriculture, National Agricultural Statistical Service (2000-2010), "Noncitrus fruit and nut summary", FrNt 1-3, available at: http:usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1113 (accessed 2 March 2011).

US Department of Agriculture, National Agricultural Statistical Service (2000-2011), "Vegetable summary", VG1-2, available at: http:usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1183 (accessed 2 March 2011).

US Department of Agriculture, National Agricultural Statistical Service (2011), "Agricultural prices", January, available at: www.usda.gov/nass/PUBS/TODAYRPT/agpr0111.pdf (accessed 2 March 2011).

Further reading

Cooley, P.L., Roenfeldt, R.L. and Chew, I. (1975), "Capital budgeting procedures under inflation", *Financial Management*, Winter, pp. 12-17.

Seavert, C.F., Hinman, H. and Klonsky, K. (2006), "Profitability analysis for long-term crop investments", *Agricultural Finance Review*, Vol. 66 No. 1, pp. 125-35.

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