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MPP-Dairy Financial Stress-test Calculator: A User's Guide

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A financial stress-test calculator has been created to assist dairy farm managers in determining how MPP-Dairy might assist in farm financial risk management. This guide describes the tool and its use.

The volatility of both farm milk and feed prices has increased in recent years. Private risk management tools exist to deal with this in the form of futures and options contracts for milk, corn and soybean meal as well as cash forward contracts. Most dairy cooperatives have programs that facilitate risk management. The use of these futures, options and forward pricing tools can complement MPP-Dairy as part of a portfolio of farm risk management program. Often the use of price or margin risk management tools focus exclusively on the net expected profit margin. While this is useful information, it is important to consider what implications potential milk income over feed cost losses could have for the financial resiliency of the farm business. In order to consider these aspects we must consider the current cash and equity (i.e., solvency) positions of the farm. The primary questions being:

- **What is the farm's financial risk exposure?**
- **How large is the potential loss a farm business can afford?**
- **And how will the farm business deal with the losses if they occur?**

The National Program on Dairy Markets and Policy (DMaP) provides a tool that assists in examining the potential for payments from MPP-Dairy given market outlook or historical prices. New for 2015 is a financial stress-test calculator. The intention of the stress-test calculator is to examine the extent to which MPP-Dairy can assist in managing farm risk related to profit, liquidity and solvency. This user's guide defines farm financial terms, describes the stress-test calculator including farm information, and discusses using the calculator.

Farm Financial Definitions

Farm financial performance has three dimensions: profitability, solvency, and liquidity.

***Profit* is a dollar value defined as revenues minus the cost of production.** Profit is a flow concept, meaning that it measures what is occurring in the business over a period of time, usually a year. For farms, dollars of profit is often measured using net farm income (NFI). NFI is farm profit which is the return to operator(s) labor and management, return to equity capital and the return to unpaid family labor.

***Liquidity* reflects the ability of farms to meet financial obligations as they come due.** Working capital is the difference between current assets (cash and assets that are expected to be converted to cash in the next year) and current liabilities (expenses for the next year including the current portion of long-term debt). **We can divide working capital by milking herd size to get a value that is comparable across herd and over time. In general, more working capital indicates less liquidity risk.** One rule of thumb is to have at least three months of expenses in working capital.

***Solvency* is defined as possessing adequate assets to cover liabilities as reflected by positive equity. Solvency indicates the long-term accumulation of**

equity. The debt-to-asset ratio (D/A) measures the financial position of the business as the creditor's claims against the operation. A smaller D/A value is indicative of greater farm equity and less risk of insolvency. Lenders use D/A to assess insolvency risk and will charge higher interest rates to farms above risk thresholds. One common benchmark value is a D/A value of 0.6 with higher values indicating more risk but, of course, farm operators might set their own target below that benchmark.

The fundamental accounting equation defines assets less liabilities as equaling equity. Thus, farm assets are either owned (equity) or have claims against them (liabilities or debts). Using this information we know that the D/A ratio and the equity-to-asset ratio (E/A) must sum to one (or 100 if we are in percentage terms). Therefore, the solvency benchmark of keeping the D/A ratio below 0.6 is equivalent to keeping the E/A ratio above 0.4 and we can easily move between these complementary notions of farm financial solvency.

Figure 1. MPP-Dairy Stress-Test Tool: Input Screen
http://dairymarkets.org/MPP/Tool

Entering Your Farm Information

Figure 1 illustrates the input/output screen for the stress-test calculator. The stress-test calculator, like any tool, is most useful for decision-making with accurate, timely, farm-specific information plugged in. The inputs are in the left-hand column. **The first section "Production & Prices" is where farm information on expected milk production, expenses, margin basis and other revenue are entered.** The information that is used in the calculator includes: number of milk cows, expected pounds of milk sold per cow in the year analyzed, expenses other than feed ($/cwt), worst-case income over feed cost basis ($/cwt), and other farm revenue ($/cwt).

Because we are interested in examining the whole-farm financial implications of milk income over feed cost losses, we want to consider the other revenue and expenses as well as the basis between the farm IOFC and the ADPM. Milk is the largest source of revenue and feed is the largest expense on most dairy farms which is why we expect the income over feed cost margin to be correlated with farm profitability. Milk production involves many expenses beyond feed and most dairy farms have other enterprises. Expenses other than feed (non-feed) can be estimated using farm accounting software. Similarly, other farm revenues may be primarily related to the dairy enterprise (i.e., cull cows) or involve unrelated crop and livestock enterprises. The best way to estimate the other revenue value is to utilize farm-specific information. By including the non-feed

expenses and non-milk revenue, we can calculate the IOFC level where the farm will "break-even."

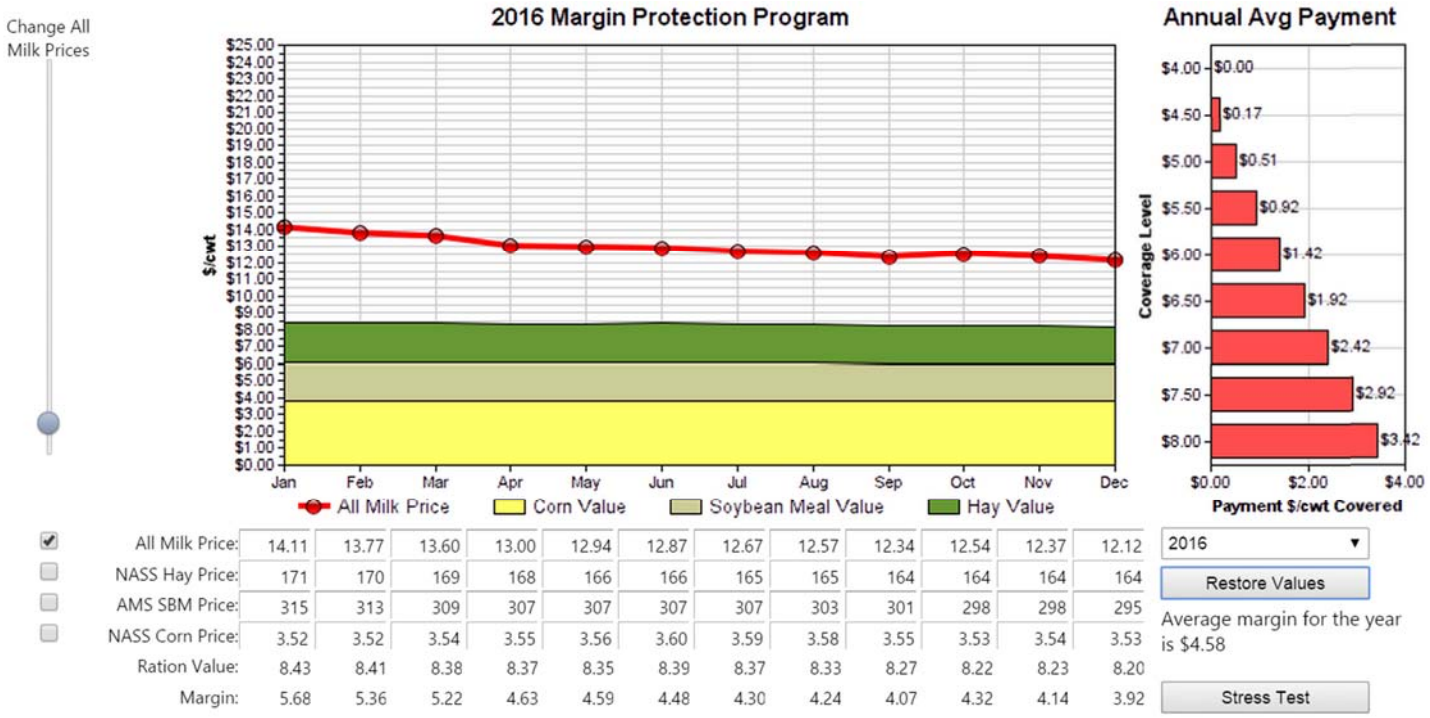
The MPP-Dairy basis for a given operation is the difference between the farm's own mailbox milk price less feed cost and the national MPP-Dairy margin (U.S. All milk price less the feed cost index using U.S. corn, hay and soybean meal prices). Some regions and farms might expect the basis to be positive based on historical patterns and some will expect a negative basis. This relationship may change both over time and across farms. A "worse" basis in this case refers to a basis that is closer to negative, or more negative rather than positive. In that case, the farm is receiving a smaller margin than the MPP-Dairy margin, which means it has less money to pay bills and generate a profit. What then is the worst case MPP-basis? We suggest using farm records to examine the average annual basis for the operation in past years. The "worst case" basis then may be the situation in 2009 or 2012 which were very poor years for U.S. dairy farms in general. Some regions might find more recent months to be particularly poor if, for example, their mailbox milk price has diverged from the US All milk price. Using the "worst case" basis results is a conservative estimate of the farm financial outcomes.

The second input section is "Risk Management" where MPP-Dairy choices and other milk and feed price risk choices are entered. MPP-Dairy production history is defined by the program rules but is, in general, the highest of the amount of milk marketed in 2011, 2012, or 2013 adjusted by the growth factor defined by USDA Farm Service Agency. The MPP-Dairy Coverage Percentage is chosen by the farmer as a percent between 25 and 90 percent of their operation's production history. "CME & Other" percent of milk production and feed hedged and the average IOFC (Income over feed costs) hedged reflect the private risk management tools used to protect dairy farm income.

The section entitled "Financials" is where the current liquidity and solvency related information are entered. These values are found on the current balance sheet. We prefer to examine these at market value—as opposed to cost value—as some asset's purchase price is not reflective of current value (e.g., land purchased many years ago). Working capital per cow is the current farm assets less current farm liabilities divided by milking herd size. This is a measure of liquidity which the tool will later assume is the initial cushion to be used first in the event of unprofitable margins. Assets per cow reflects the total farm asset value—again using a market value—divided by herd size. This value gives us an idea of how large the asset base is—the higher the assets per cow, the easier it is for farm managers to absorb losses with long-term debt. Debt-to-Asset ratio (D/A) is a measure of farm solvency which is defined as the ratio of total farm liabilities and total farm assets. The effect of the "crisis" on farm asset value allows the user to adjust asset value should they wish to reflect the effect of low dairy profit on farm assets. For example, dairy cow prices may be depressed in a situation where expected profits are low or negative. **"Diagnostics" allows one to examine the expected milk production for the year (the number of cows multiplied by the milk per cow).** The cash-flow break-even MPP-Dairy margin which is the level of protection that would be necessary to cover cash-flow adjusted for expenses other than feed, the worst-case margin, and revenue other than milk. The D/A ratio after devaluation reflects any change from a negative effect of the crisis on asset value. For example, milk cow values may be depressed in times of poor profitability. All of these values are independent of MPP-Dairy.

Figure 2. MPP-Dairy Stress-Test Tool: Choose Your Own Prices

http://dairymarkets.org/MPP/Tool



Using the Stress-test Tool

The intention of the Stress-test Tool is to help in evaluating the comprehensive effects of MPP-Dairy on farm financial situation. By examining potential MPP-Dairy effects across coverage level and coverage percentages, the tool may assist in dairy farm risk management decisions.

There are many factors which are unknown when projecting the effects of the coming year. The original MPP-Dairy Decision Tool uses daily milk and feed futures and options data to project an expected margin based on most recent market consensus. However, in making your risk management decisions, you should also consider what is *unlikely* to happen, but would be very dangerous for your operation, if it does happen. To facilitate that exercise, the advanced MPP-Dairy decision tool allows you to enter your own forecast for the following year. As you can see in Figure 2, you can create your own stress-test scenario with next year's milk prices much worse than currently expected. Likewise, you can create a scenario with feed prices rising above currently expected levels.

This margin projection is based on the current knowledge and supply and demand factors in both milk and feed markets can, and will, change the margin. In addition, there is uncertainty about the basis between the ADPM and the farm IOFC and perhaps asset values. Thus, it is important to consider several possible scenarios.

Unfortunately, operating at a small loss for short periods of time is often unavoidable in modern production agriculture. In the event of unprofitable margins, the farm is assumed to first use liquidity and then to take on more debt to cover the losses. Thus, the process is first to use net income, then liquidity reserves, and finally additional debt. Users should consider that they likely do not want their working capital to go to zero and additional debt is very expensive—perhaps prohibitively so—if D/A is approaching 100 percent. There are a couple of rules of thumb for liquidity including having enough working capital to cover three months of expenses.

Farm equity is wealth that represents the farm operator's lifetime accumulation that will often be the basis for retirement and inheritance for the

next generation. As such, farmers want to accumulate equity and are loath to see the value decline. For farms in danger of being insolvent (D/A > 60%), lenders will charge higher interest rates on all of their debt and at some point may withhold credit.

To the extent possible farm operators should strive to use risk management tools available to avoid excessive D/A values, maintain working capital and preserve profit. The stress-test tool calculates the premiums that are netted out in the tool. However, the costs of CME futures and options or other risk management tools are not included (but they can be netted out of the margins covered in the private risk management section).

An Illustrative Case Study

Consider a brief example. Pleasant Acres Dairy has 320 milk cows which average 23,400 pounds of milk sold per cow. They have $8/cwt expenses other than feed. From experience and records they believe the worst case basis is -$1.50/cwt and they have $2/cwt in other revenue.

Their milk production history is 6.9 million pounds. They are examining a 90% coverage level—this can be changed later. Currently there is no milk or feed covered by CME or other contracts. They possess $600/cow in working capital and $11,500/cow in assets. The D/A ratio is a healthy 34%. Past experience indicates that asset values might decline 5% in a crisis. Given this information, the cash-flow break-even MPP-Dairy margin is $7.50/cwt. As the stress-test scenario, 2016 margin is chosen to be $4.58/cwt, a magnitude similar to 2009 and 2012 values.

The expected profit with "No MPP" is -$2.92/cwt with working capital declining to -$83/cow and D/A climbing to 38.2%. While Pleasant Acres is not in immediate danger of solvency issues, the working capital value may end up substantially below where they would want to be. To examine the potential effects of MPP-Dairy examine the following rows. While Pleasant Acres cannot entirely avoid losses at this margin, the $8/cwt coverage level results in a relatively small expected loss of -$0.74/cwt in profit while maintaining working capital at $426/cow and keeping D/A at 36.4%. The $8/cwt coverage level costs $0.66/cwt in premiums which is netted out of the profit, liquidity and solvency values.

Figure 3. MPP-Dairy Stress-Test Tool: Evaluating Impacts of MPP-Dairy
http://dairymarkets.org/MPP/Tool

Production & Prices	
Cows	320
Milk Per Cow (lbs/yr)	23,400
Expenses, Other than Feed ($/cwt)	$8.00
Worst-Case IOFC Basis over MPP ($/cwt)	-$1.50
Other Revenue (beef, crops, etc.) ($/cwt)	$2.00
Risk Management	
MPP-Dairy: Production History	6,900,000
MPP-Dairy: Coverage Percentage	90%
CME & Other: % of 2016 Milk and Feed Hedged	0%
CME & Other: Average Hedged IOFC	$0.00
Financials	
Working Capital Per Cow	$600
Assets Per Cow	$11,500
Debt-to-Asset Ratio (At Market Value)	34%
Effect of Crisis on Assets Value	-5%
Scenario: Average MPP-Dairy Margin in 2016	$4.58
Diagnostics	
Expected 2016 Milk Production	7,488,000
Cash-Flow Breakeven MPP-Dairy Margin	$7.50

	MPP-Dairy		Profitability	Liquidity	Solvency
	Premium Costs		Net Income	Working Capital/Cow	Debt/Asset Ratio
	Total $	$/cwt	$/cwt	$/cow	%
No MPP			-$2.92	-$83	38.2%
$4.00	$100	$0.00	-$2.92	-$83	38.2%
$4.50	$942	$0.01	-$2.79	-$53	38.1%
$5.00	$1,984	$0.03	-$2.53	$8	37.8%
$5.50	$3,910	$0.05	-$2.20	$84	37.6%
$6.00	$5,726	$0.08	-$1.82	$174	37.2%
$6.50	$10,109	$0.14	-$1.47	$257	37.0%
$7.00	$27,123	$0.36	-$1.27	$302	36.8%
$7.50	$35,526	$0.47	-$0.97	$373	36.5%
$8.00	$49,156	$0.66	-$0.74	$426	36.4%

As a middle ground, $6.50/cwt coverage would cost Pleasant Acres $0.14/cwt in premiums, and could reduce their losses in case of a catastrophic scenario from -$2.92/cwt to -$1.82/cwt, preserving their working capital above $250/cow and likely avoiding the need for taking on new debt.

Integrating MPP-Dairy and CME Futures Contracts

Let us now introduce Legends Dairy. It has the same costs of production as Pleasant Acres Dairy, but it does not own much cropland, and their assets per cow are only $7,000. Furthermore, due to their aggressive growth strategy, their D/A ratio is 50%. If they only use MPP-Dairy, and want to keep their premiums under $0.15/cwt, Legends Dairy would have to choose a coverage level not higher than $6.00/cwt. That choice, however, still leaves them open to scenario where working capital could decline below $200/cow and D/A ratio could increase to almost 60%. In order to keep their liquidity above $400/cow, Legends Dairy decides to combine MPP-Dairy at $5.50/cwt coverage level, and uses other risk management instruments to lock in $0.50/cwt profit on 25% of their production.

Figure 4. MPP-Dairy Stress-Test Tool: Integrating MPP-Dairy and CME Futures Contracts
http://dairymarkets.org/MPP/Tool

Production & Prices	
Cows	3,000
Milk Per Cow (lbs/yr)	23,400
Expenses, Other than Feed ($/cwt)	$8.00
Worst-Case IOFC Basis over MPP ($/cwt)	-$1.50
Other Revenue (beef, crops, etc.) ($/cwt)	$2.00
Risk Management	
MPP-Dairy: Production History	65,000,000
MPP-Dairy: Coverage Percentage	90%
CME & Other: % of 2016 Milk and Feed Hedged	25%
CME & Other: Average Hedged IOFC	$8.00
Financials	
Working Capital Per Cow	$600
Assets Per Cow	$7,000
Debt-to-Asset Ratio (At Market Value)	50%
Effect of Crisis on Assets Value	-10%
Scenario: Average MPP-Dairy Margin in 2016	$4.58
Diagnostics	
Expected 2016 Milk Production	70,200,000
Cash-Flow Breakeven MPP-Dairy Margin	$7.50

	MPP-Dairy		Profitability	Liquidity	Solvency
	Premium Costs		Net Income	Working Capital/Cow	Debt/Asset Ratio
	Total $	$/cwt	$/cwt	$/cow	%
No MPP			-$1.69	$205	59.3%
$4.00	$100	$0.00	-$1.67	$210	59.2%
$4.50	$11,400	$0.02	-$1.54	$240	58.9%
$5.00	$22,900	$0.03	-$1.26	$304	58.3%
$5.50	$56,200	$0.08	-$0.97	$374	57.6%
$6.00	$86,775	$0.12	-$0.59	$461	56.8%
$6.50	$161,750	$0.23	-$0.29	$533	56.2%
$7.00	$461,130	$0.66	-$0.30	$530	56.2%
$7.50	$589,800	$0.84	-$0.06	$586	55.7%
$8.00	$760,300	$1.08	$0.11	$627	55.3%

The DMaP Team includes Marin Bozic, University of Minnesota, Brian Gould, University of Wisconsin, Charles Nicholson, The Pennsylvania State University, Andrew Novakovic, Cornell University, Mark Stephenson, University of Wisconsin, Cameron Thraen, The Ohio State University, and Christopher Wolf, Michigan State University. With respect to any opinions, findings, conclusions, or recommendations, neither the United States Government, the University of Illinois, nor the National Program on Dairy Markets and Policy makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Users bear the sole responsibility for decisions affecting program participation and may want to consult other resources. The National Program on Dairy Markets and Policy is working with the University of Illinois led consortium National Coalition for Producer Education, which is supported by the U.S. Department of Agriculture, Farm Service Agency, under Agreement No. 58-0210-4-002 N.