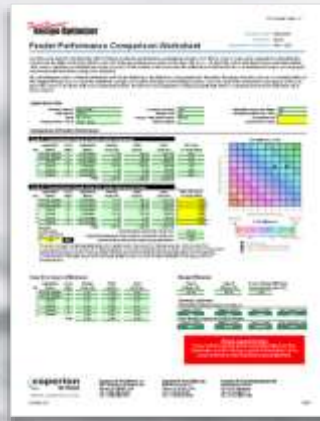


*FeedSmart*TM **Recipe Optimizer**



**Minimize recipe costs without
compromising end product quality**

**Overview
and User Training**

*This presentation provides essential training to
processors using the Coperion K-Tron Recipe Optimizer*

About Security

FeedSmart uses macros to perform several important operations. If you have obtained your copy of FeedSmart through any source other than Coperion K-Tron, you may wish to download a secure copy before use by going to:

**[www.coperion.com/en/knowhow/technology/
feedingtechnology/feedsmart](http://www.coperion.com/en/knowhow/technology/feedingtechnology/feedsmart)**

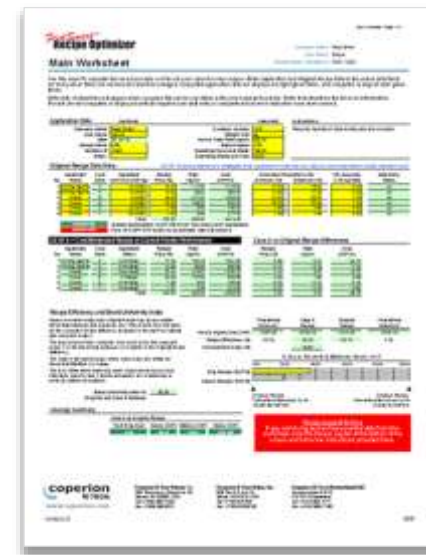
Always make a backup copy and have up-to-date anti-virus software installed and active to screen any software you run.

What is FeedSmart?

FeedSmart is a Microsoft Excel based tool developed by Coperion K-Tron as part of its Total Savings Solution concept.

Total Savings Solution =

**Acquisition Cost Savings
+ Ingredient Cost Savings
+ Support Cost Savings
+ Intangible Cost Savings**

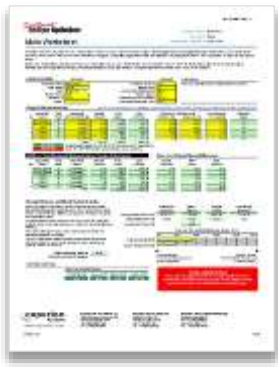


FeedSmart™ Recipe Optimizer

Total Savings Solution Tools

1

FeedSmart™ Recipe Optimizer



Based on the costs, proportions, tolerances and feeding accuracies you enter, FeedSmart minimizes total ingredient cost by strategically replacing expensive ingredients with less costly recipe components, all without violating quality limits.

2

TruCost™ Savings Comparator

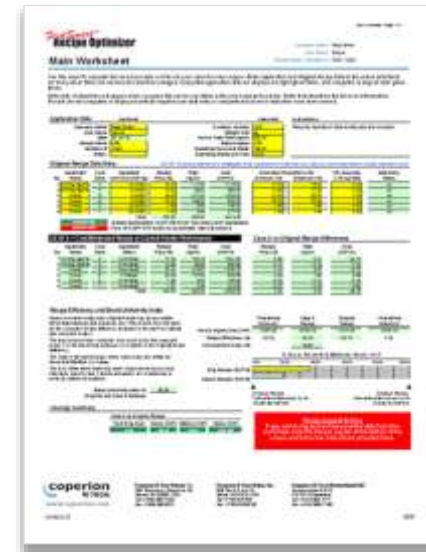
TruCost combines data from as many as twenty FeedSmart Recipes with Acquisition and Support Cost data you enter, and then compares supplier offerings and projects costs and savings over process lifetimes of up to twenty years.



What is FeedSmart?

FeedSmart focuses on minimizing Ingredient Costs, typically the most significant element in the Total Savings Solution.

Total Savings Solution =
Acquisition Cost Savings
+ Ingredient Cost Savings
+ Support Cost Savings
+ Intangible Cost Savings



What is FeedSmart?

FeedSmart is a Microsoft Excel based tool processors can use to...

- **Determine the lowest possible cost for their recipes, formulations, blends or compounds using their current feeding system**
- **Compute the added savings achievable with improved feeder performance**
- **Calculate the effect changing ingredient tolerances has on recipe cost**
- **Evaluate competing feeder suppliers' performance levels**

FeedSmart's Recipe Model

Tolerance over Target

FeedSmart's Recipe Model

Traditional Recipe Model

- Target-based proportions
- Fixed material costs
- Limited feeder-performance-related savings

FeedSmart's Recipe Model

- **Tolerance**-based proportions
- **Variable** material costs
- **Enhanced** feeder-performance-related savings

FeedSmart's Recipe Model

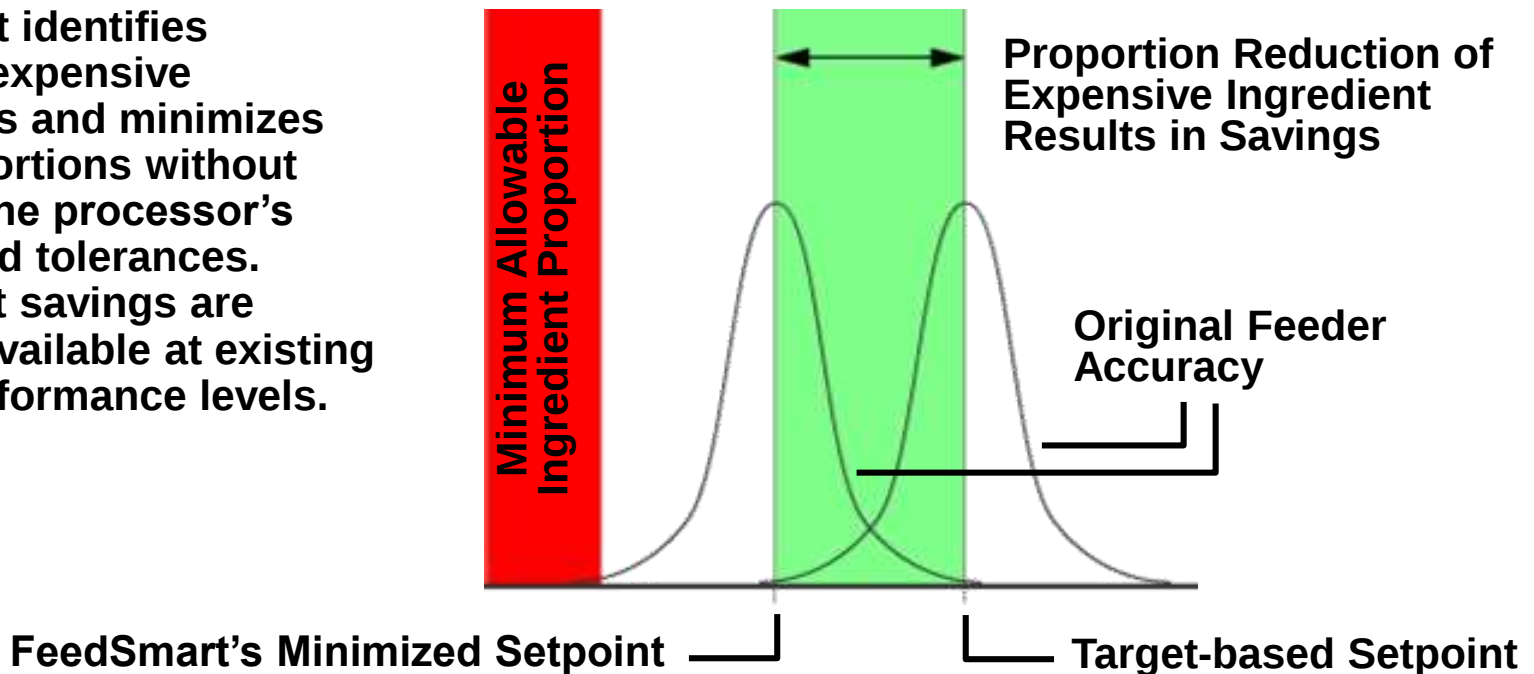
Characteristics of Tolerance-based Model

- Strategic use of processors' established ingredient tolerances to engineer savings
- Relatively expensive ingredients are minimized
- Less costly ingredients are maximized
- Initial computed savings achievable with existing feeder system
- Specific additional savings associated with improved feeder performance
- Sensitivity analyses, payback and ROI calculations possible

FeedSmart's Recipe Tolerance Model

Minimizing Expensive Ingredients with Original Feeding System

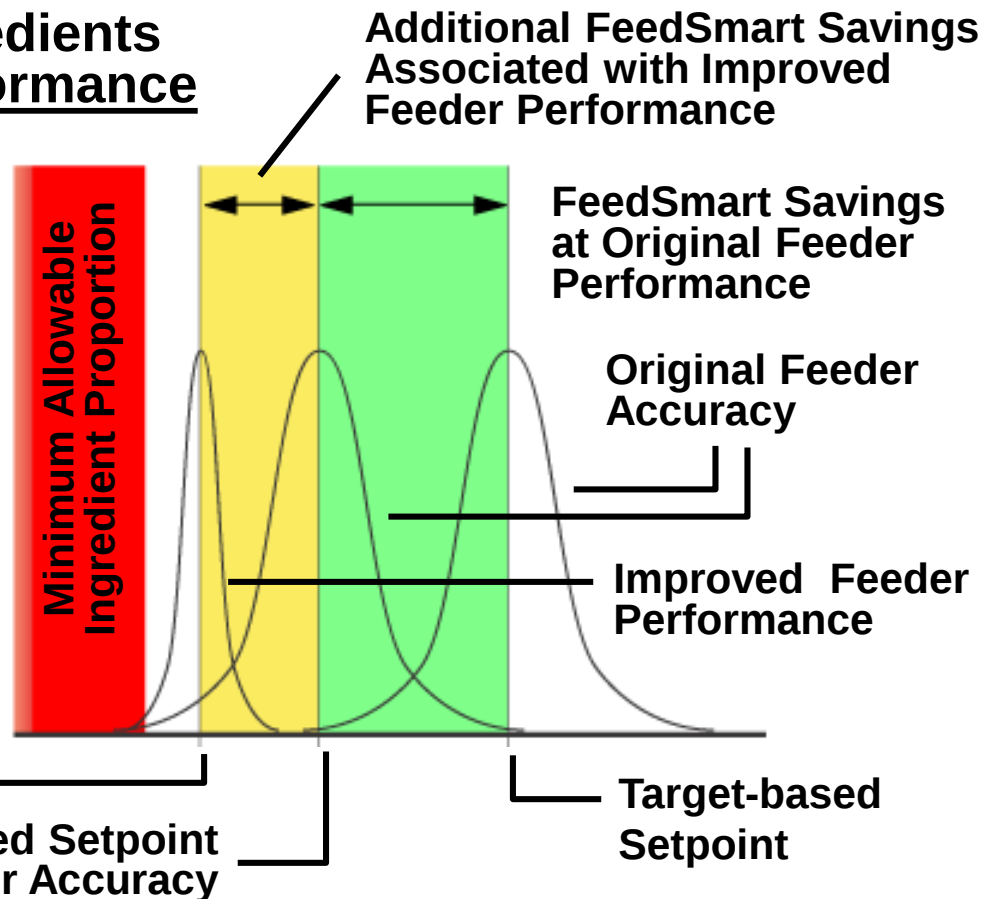
FeedSmart identifies relatively expensive ingredients and minimizes their proportions without violating the processor's established tolerances. Significant savings are typically available at existing feeder performance levels.



FeedSmart's Recipe Tolerance Model

Minimizing Expensive Ingredients with Improved Feeder Performance

Better feeding accuracy permits operation closer to expensive ingredients' minimum proportion limits, enabling additional savings. FeedSmart computes the incremental savings associated with improved feeder performance.

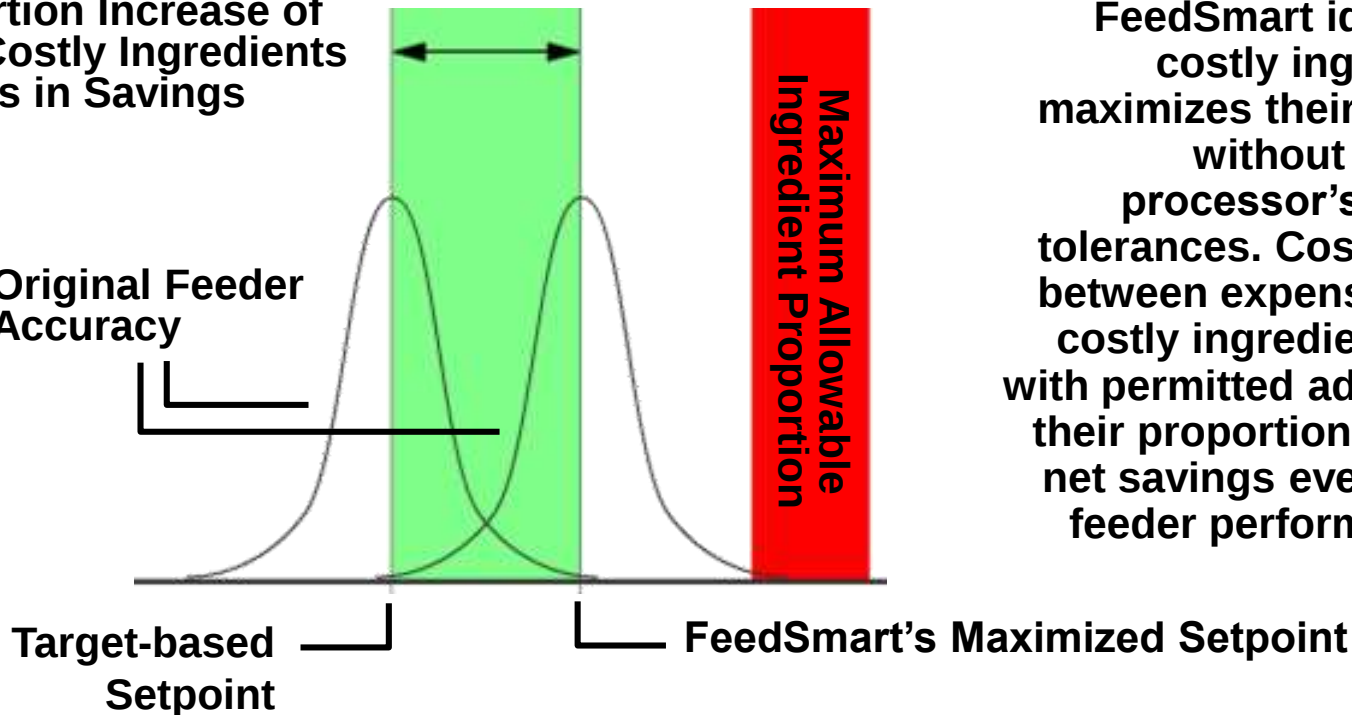


FeedSmart's Recipe Tolerance Model

Maximizing Less Costly Ingredients with Original Feeding System

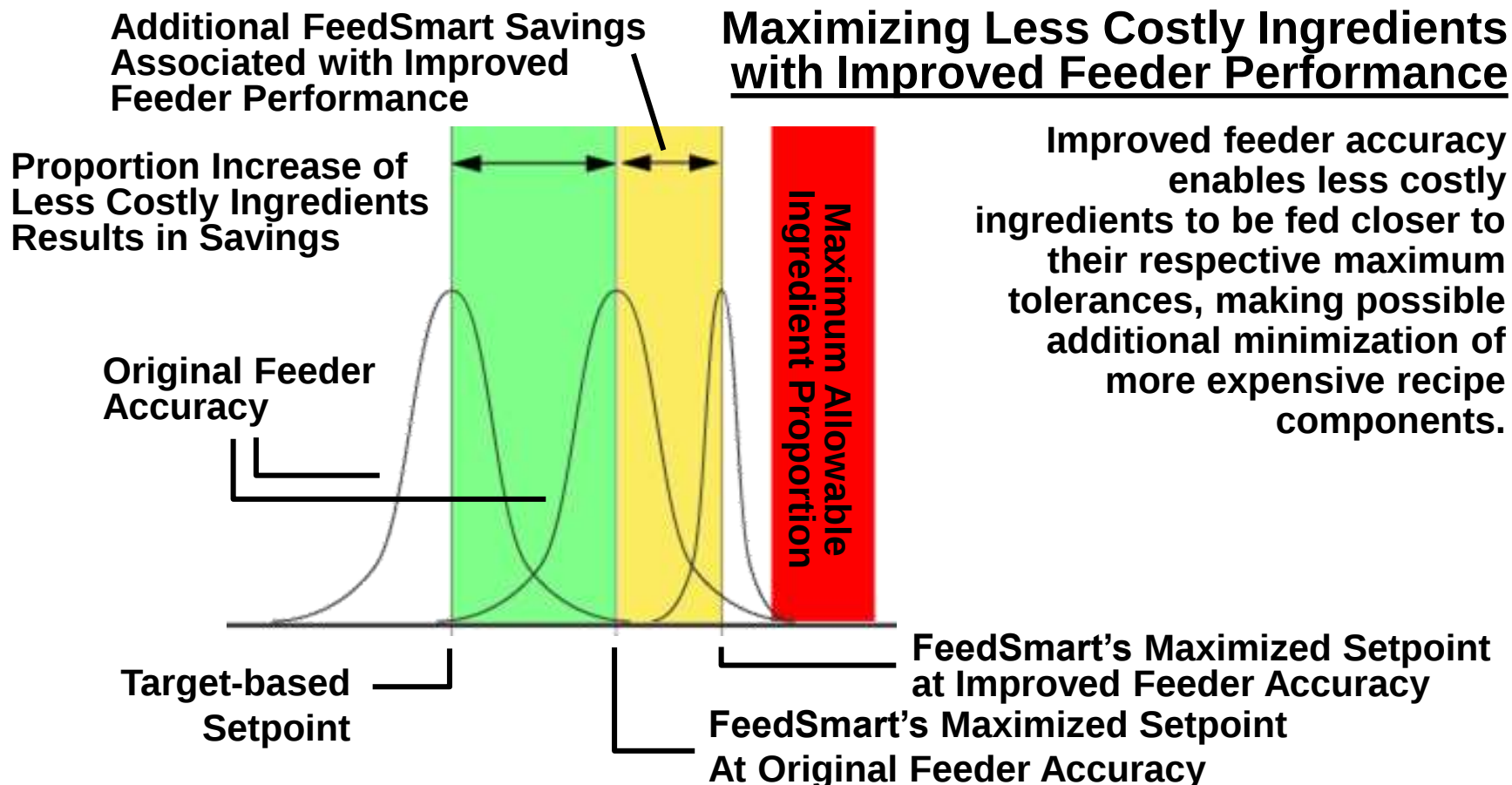
Proportion Increase of
Less Costly Ingredients
Results in Savings

Original Feeder
Accuracy



FeedSmart identifies less costly ingredients and maximizes their proportions without violating the processor's established tolerances. Cost differences between expensive and less costly ingredients combine with permitted adjustments in their proportions to produce net savings even at existing feeder performance levels.

FeedSmart's Recipe Tolerance Model



How FeedSmart Works

FeedSmart uses a 6-Step approach

1. **Ingredients are ranked by unit cost.**
2. **Based on entered data, Minimum and Maximum Permissible Operating Proportions are computed for each ingredient.**
3. **The *Maximum* Permissible Operating Proportion is temporarily assigned to each ingredient, resulting in a Total Recipe Proportion in excess of 100%.**
4. **FeedSmart returns to the most expensive ingredient, replaces the Maximum with the *Minimum* Permissible Operating Proportion, and checks to see if Total Recipe Proportion has fallen below 100%.**

How FeedSmart Works

5. If not, FeedSmart progresses to the next-most-expensive ingredient and repeats the process.
6. When Total Recipe Proportion *does* fall below 100%, FeedSmart simply adds the deficit to the most recently minimized ingredient. The recipe is now optimized to its lowest possible cost within the constraints of the application.

NOTE: When enabled, FeedSmart's System Optimization feature adjusts the proportions of the cost-minimized recipe as required to avoid the possibility of permitted variations in one ingredient causing any other ingredient to violate its proportion limits.

FeedSmart Overview

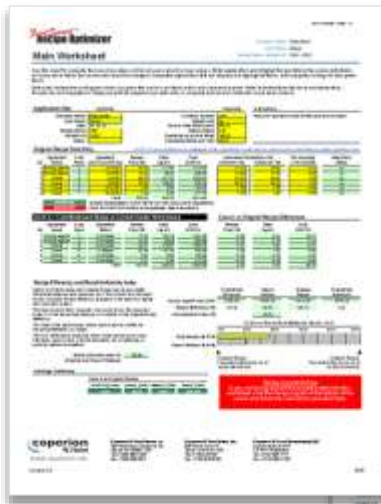
FeedSmart is a Microsoft Excel® Workbook consisting of...

- **Welcome, Introduction, Instructions and Glossary**
- **5 Primary User Worksheets**
- **1 Recipe Log**
- **2 Information Worksheets**

FeedSmart may be freely distributed without permission.

FeedSmart Overview

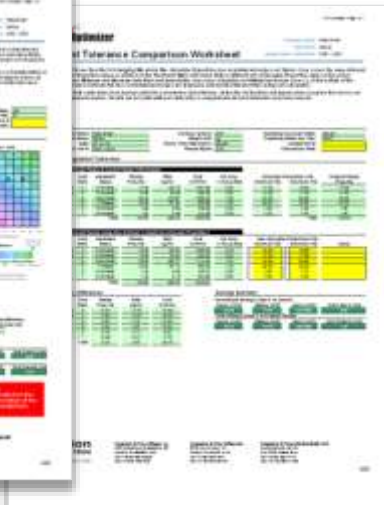
FeedSmart's 5 Primary Worksheets
consist of...



Main
Worksheet



Feeder
Performance
Comparison
Worksheet



Ingredient
Tolerance
Comparison
Worksheet



Savings
Builder
Worksheet



Results Summary
Worksheet
(display only)

The Main Worksheet

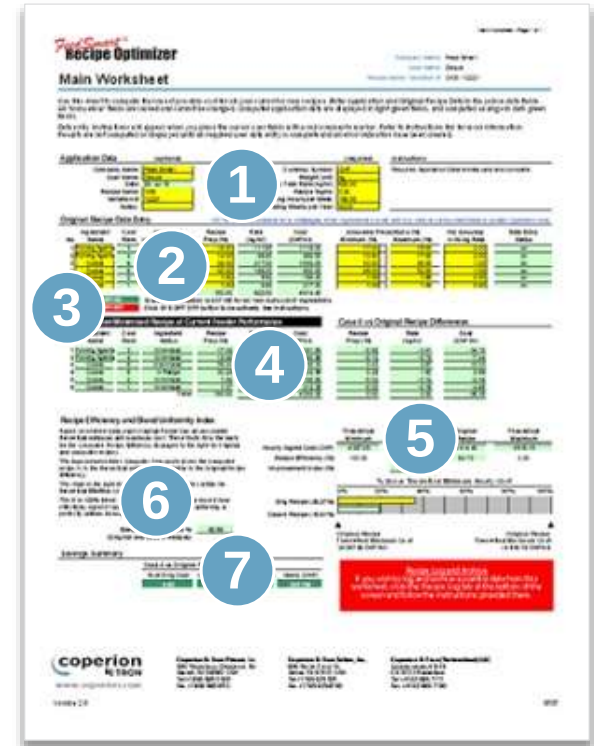
*Function: Primary Application Data Entry
and Initial Recipe Optimization*

Note: For full functionality this worksheet requires that macros be enabled.

The Main Worksheet

Consists of 7 elements...

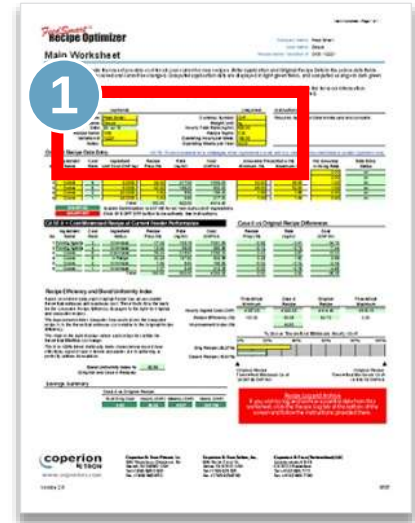
- 1 Application Data
- 2 Original Recipe with Data Entry Monitor and Optional Auto Limit Function
- 3 System Optimization Option
- 4 Case A Solution
- 5 Recipe Efficiency
- 6 Blend Uniformity Index
- 7 Savings Summary



The Main Worksheet

1 Application Data Entry

- Optional entry of Company Name, User Name, Recipe Name, Variation # and Notes
- Required entry of the following:
 - Currency Symbol (up to 2 characters)
 - Weight Unit (up to 2 characters)
 - Hourly Total Rate (in entered weight units)
 - Recipe Sigma (from 2.00 to 6.00)
 - Operating Hours per Week (168 max)
 - Operating Weeks per Year (52 max)



The Main Worksheet

1 Application Data (Recipe Sigma)

Recipe Sigma tells FeedSmart what confidence level is associated with the application's ingredient tolerances.

Since feeder performance is always cited at 2 Sigma, FeedSmart uses Recipe Sigma to appropriately optimize recipe proportions for ingredient tolerance limits that may be based on a confidence level other than 2.

Users should never enter a Recipe Sigma *lower* than the value associated with their established quality standards.

If desired, entering a *higher* value adds an additional margin of safety beyond that provided by established quality standards, but ingredient cost savings will be reduced accordingly.

The Main Worksheet

2 Original Recipe Data Entry

- Ingredient Name
- Unit Cost (in entered currency/weight units)
- Original Recipe Ingredient Proportions (0.00 to 100.00)
- Minimum Allowed Proportions (0.00 to 100.00)
- Maximum Allowed Proportions (0.00 to 100.00)
- Feeder Accuracies (+/- % of set rate @ 2 Sigma)

NOTE: After user entry of required data, FeedSmart displays computed Unit Weight Cost Rank, Hourly Rate and Hourly Cost in this section for each ingredient.

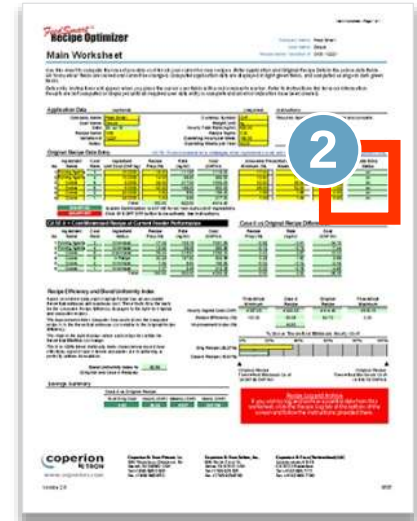
The screenshot shows the 'Main Worksheet' in the FeedSmart Recipe Optimizer. A red box highlights the 'Original Recipe Data Entry' section, which contains a table with columns for Ingredient Name, Unit Cost, Original Recipe Ingredient Proportions, Minimum Allowed Proportions, Maximum Allowed Proportions, and Feeder Accuracies. Below this table, there are sections for 'Recipe Efficiency and Overall Performance' and 'Summary Statistics'. The bottom of the worksheet displays the 'coperion k-TRON' logo and version information.

The Main Worksheet

2 Original Recipe Data Entry (Data Entry Monitor)

FeedSmart automatically scans recipe data to avoid incorrect or unacceptable entries. Any of the following Status Codes may appear for any ingredient:

- **ENTRY INCOMPLETE** - You've overlooked entering some required data.
- **MIN PROP** - Entered Minimum Allowable Proportion is higher than the entered Recipe Proportion.
- **MAX PROP** - Entered Maximum Allowable Proportion is lower than the entered Recipe Proportion.
- **FDR ACC MIN** - The entered Feeder Accuracy will cause the ingredient to violate its Minimum Allowable Proportion.
- **FDR ACC MAX** - The entered Feeder Accuracy will cause the ingredient to violate its Maximum Allowable Proportion.
- **OK - AUTO LIMIT ON** - Ingredient data entry is accepted and FeedSmart's Auto Limit Function is active.
- **OK** - Ingredient data entry is accepted.

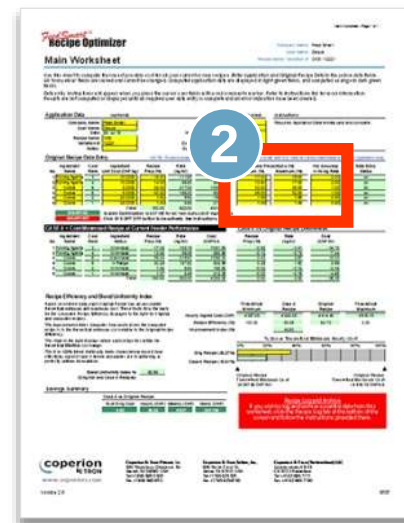


The Main Worksheet

2 Original Recipe Data Entry (Data Entry Monitor)

If '?' appears next to a Minimum or Maximum Allowable Proportion entry, FeedSmart has detected that allowable variations in one or more of the recipe's other ingredients could cause the indicated ingredient to violate the cited limit in the original recipe.

NOTE: This function operates whether or not the System Optimization feature is enabled. However, it is automatically disabled for specific ingredients where FeedSmart's Auto Limit Function (next slide) is in effect.



The Main Worksheet

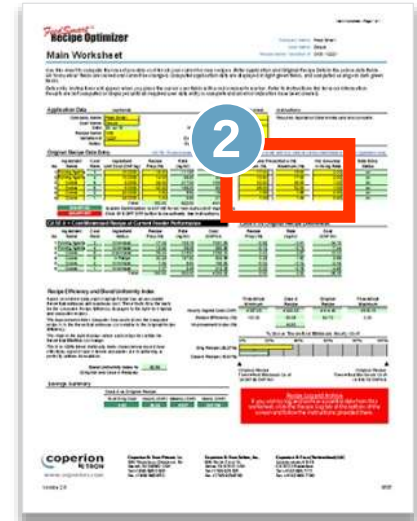
2 Original Recipe Data Entry (Optional Auto Limit Function)

Where Minimum and Maximum Proportion limits are not available or may not have been established for a given ingredient, FeedSmart permits cost minimization without user entry of these limits.

When FeedSmart detects that both Minimum and Maximum Allowable Proportion data fields have been left empty (while all other required data for that ingredient has been entered) the Auto Limit Function activates automatically.

The Auto Limit Function uses the Feeder Accuracy value entered for the subject ingredient to compute allowable limits implied by the entered feeder performance.

A recipe can contain any combination of manually entered and Auto Limit allowable proportions.



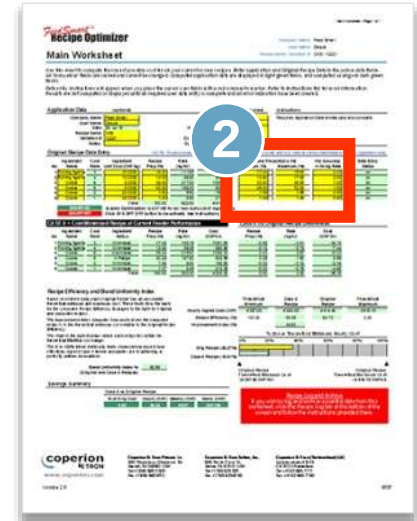
The Main Worksheet

2 Original Recipe Data Entry (Optional Auto Limit Function)

When the Auto Limit Function is active for all ingredients (or even for all but one), no cost minimization is possible at the Feeder Accuracies associated with the original recipe. Total recipe cost will remain at its originally computed value.

However, the savings associated with *improved* feeding accuracy can be quickly determined simply by switching to the Feeder Performance Comparison Worksheet and entering improved (lower) Feeder Accuracy values there.

For reference, when the Auto Limit Function is active for any or all ingredients, the computed value(s) for Auto Limit Minimum and Maximum Allowable Proportions are displayed in the Case A section of the Ingredient Tolerance Comparison Worksheet.



The Main Worksheet

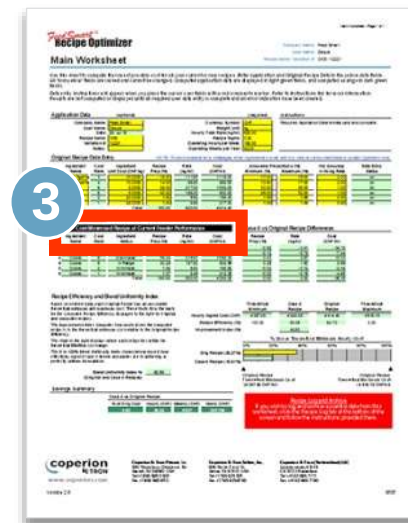
3 System Optimization Option

FeedSmart's System Optimization feature prevents momentary variations in one or more ingredients from causing *other* ingredients to temporarily exceed their allowed limits in the total blend stream.

System Optimization automatically identifies potential violations, and adjusts the recipe solution to prevent them. In doing so, System Optimization adjustments slightly increase recipe cost.

However, depending on the processing operations following formulation, System Optimization may or may not be required.

For applications where little or no 'upstream/downstream' mixing is performed after formulation such as in high-speed plastics compounding, direct packaging of the product, or deposition onto a separate product stream, momentary recipe accuracy is important, and System Optimization should be turned on.



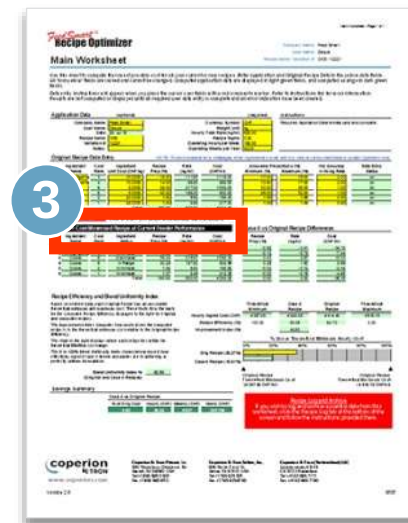
The Main Worksheet

3 System Optimization Option

When the blend is effectively mixed after recipe formulation, these momentary variations tend to average out and System Optimization may not be required.

As a rule of thumb, if the timescale of any post-formulation mixing is less than the timescale associated with the determination of feeder accuracy (sample duration), System Optimization should be turned on. Otherwise it can be turned off.

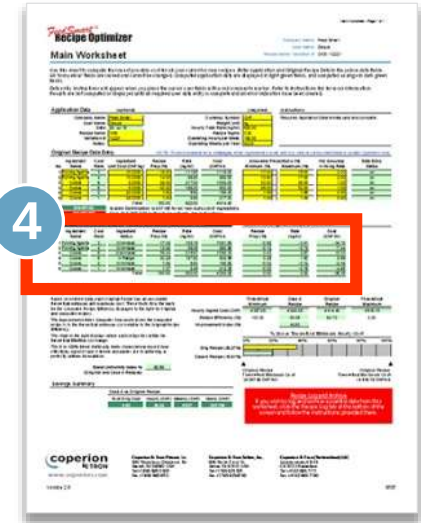
Note that, even when enabled, the System Optimization function will be automatically and selectively disabled for any ingredient where the Auto Limit Function is active, since, by definition, no allowance exists within the computed tolerance band for System Optimization adjustment.



The Main Worksheet

4 Case A Solution

- Ingredient Status (Minimized, Maximized, In Range or Fixed)
- Case A solution proportions
- Hourly rate and cost for each ingredient
- Calculated differences from original recipe values



FeedSmart™ Recipe Optimizer
Main Worksheet

Ingredient Data

Ingredient	Status	Proportion	Hourly Rate	Cost	Difference
Ingredient 1	Minimized	0.10	10.00	1.00	0.00
Ingredient 2	Maximized	0.20	20.00	4.00	0.00
Ingredient 3	In Range	0.30	30.00	9.00	0.00
Ingredient 4	Fixed	0.40	40.00	16.00	0.00

Case A Solution

Hourly Rate and Cost for each ingredient

Calculated differences from original recipe values

4 Case A Solution (Ingredient Status)

- **Ingredient Status (Minimized, Maximized, In Range or Fixed)**
- **Minimized** - The ingredient's calculated recipe proportion has been *minimized* within the constraints imposed by the combined effect of allowed tolerance, feeder accuracy and Recipe Sigma.
- **Maximized** - The ingredient's calculated recipe proportion has been *maximized* within the constraints imposed by the combined effect of allowed tolerance, feeder accuracy and Recipe Sigma.
- **In Range** - The ingredient's calculated recipe proportion is greater than its allowed minimum proportion but less than its allowed maximum.

The Main Worksheet

4 Case A Results (Ingredient Status)

- Fixed – For Case A (Main Worksheet), ingredient Feeder Accuracy does not allow for proportion optimization. Thus, for that ingredient, its computed proportion and hourly cost will be the same as that of the original recipe.

The screenshot shows the 'Main Worksheet' of the FeedSmart Recipe Optimizer. A red box highlights the 'Fixed' status for Case A, indicating that ingredient feeder accuracy is not allowed for proportion optimization. The table displays various data points including ingredient names, proportions, and costs.

Ingredient	Original	Optimized	Fixed	Hourly Cost
Ingredient 1	10.00	10.00	Fixed	\$1.00
Ingredient 2	20.00	20.00	Fixed	\$2.00
Ingredient 3	30.00	30.00	Fixed	\$3.00
Ingredient 4	40.00	40.00	Fixed	\$4.00
Ingredient 5	50.00	50.00	Fixed	\$5.00

For Case B (FPC Worksheet), the newly entered feeding accuracy is insufficiently different from that used for the Case A solution to result in a change in the ingredient's computed proportion, significant to the 2nd decimal place.

For Case C (ITC Worksheet), newly entered tolerance limit(s) are insufficiently different from that used for the Case A solution to result in a change in the ingredient's computed proportion, significant to the 2nd decimal place.

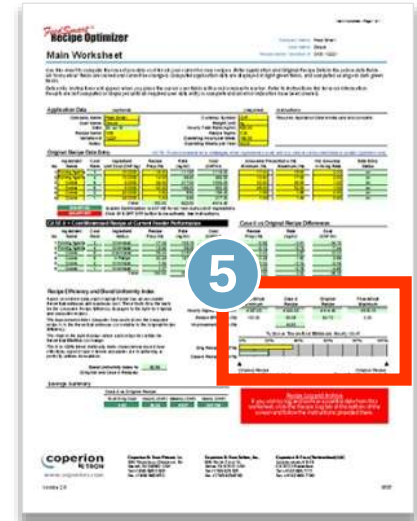
The Main Worksheet

5 Recipe Efficiency

Under the tolerance-based recipe model every recipe has a minimum and maximum cost, attainable only with a hypothetical, 'zero-error' feeding system.

FeedSmart automatically calculates these theoretical cost limits for both original and optimized recipes.

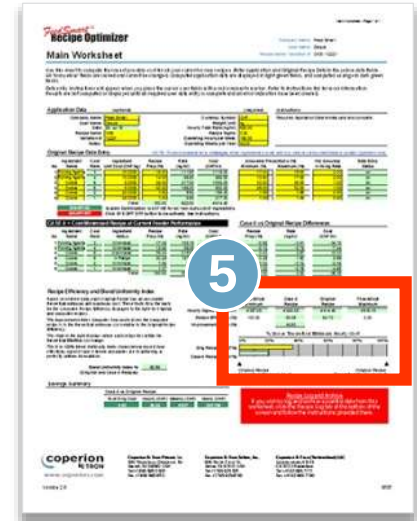
FeedSmart then determines where the original and optimized recipes lay on the spectrum of possible costs, and calculates efficiencies using a 0-100% scale where 0% = maximum theoretical cost and 100% = minimum theoretical cost.



The Main Worksheet

5 Recipe Efficiency

- Hourly Ingredient Costs (Case A solution, original recipe, and theoretical minimum and maximum costs)
- Computed Recipe Efficiencies (Case A solution and original recipe)
- Improvement Index % (indicates how much closer the Case A solution is to the theoretical minimum cost relative to the original recipe's efficiency)
- % Above Theoretical Hourly Minimum Cost chart (provides a graphic comparison of the cost effectiveness of the original and Case A solution recipes)



The Main Worksheet

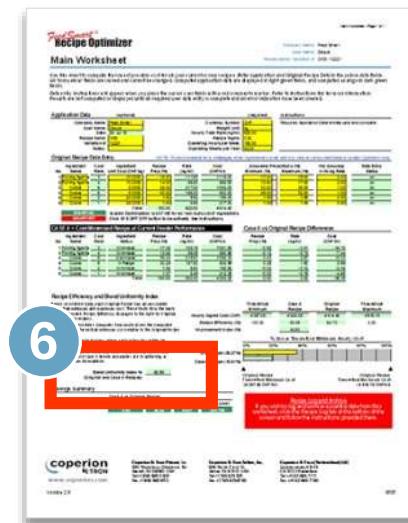
6 Blend Uniformity Index (BUI)

While feeder performance is directly associated with the achievement of ingredient cost efficiencies, it also determines the *uniformity* of the formulated recipe.

FeedSmart's computed BUI is an accurate measure of the ability of the feeding system to produce a consistent and uniform recipe.

The BUI is a recipewide composite of individual measures of *feeder efficiency*, where each computed value of feeder efficiency is weighted according to the associated ingredient's proportion in the original recipe.

BUI ranges from 0 to 100%, with 100% representing a perfectly uniform formulation.



The Main Worksheet

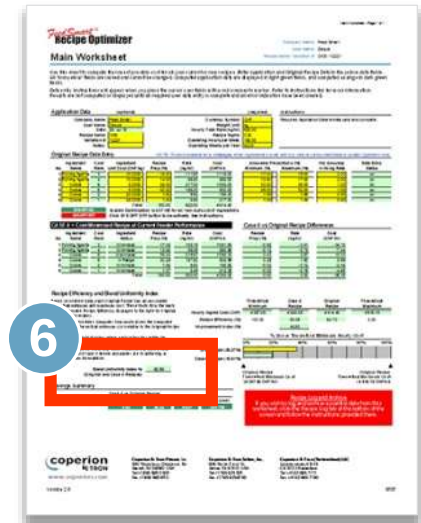
6 Blend Uniformity Index (BUI)

For a given ingredient, 0% feeder efficiency is defined as the *poorest* feeder repeatability performance that would *not* violate either of the original recipe's proportion limits.

For a given ingredient, 100% feeder efficiency is defined as an ideal +/-0.00 feeder repeatability performance.

For a given ingredient, the computed feeder efficiency is where, on the 0-100% scale, actual feeder performance lies.

NOTE: The Blend Uniformity Index is identical for original recipe and Case A solution because both involve the same level of feeder performance.



The Main Worksheet

7 Savings Summary

- Case A Savings as % of original recipe cost
- Hourly Savings
(@ entered total rate and currency)
- Weekly Savings
(@ entered hours/week and currency)
- Yearly Savings
(@ entered weeks/year and currency)

The screenshot displays the 'Main Worksheet' of the FeedSmart Recipe Optimizer. A red circle with the number '7' highlights the 'Savings Summary' section. This section includes a table with columns for 'Original Recipe Cost', 'Optimized Recipe Cost', 'Savings', and 'Savings %'. Below the table, there are input fields for 'Hourly Savings', 'Weekly Savings', and 'Yearly Savings', each with a corresponding unit and currency selection. The 'Hourly Savings' field is highlighted with a red box. The bottom of the worksheet features the 'coperion k-TRON' logo and contact information.

The FPC Worksheet

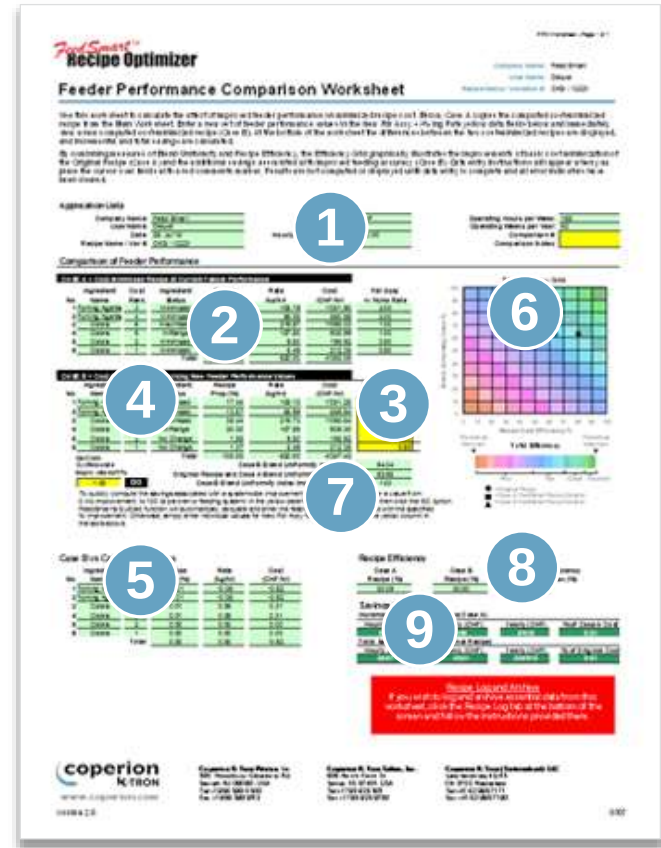
*Function: Determine Added Cost Savings
Associated with an Overall Improvement in
Feeder Performance*

Note: For full functionality this worksheet requires that macros be enabled.

The FPC Worksheet

Consists of 9 elements...

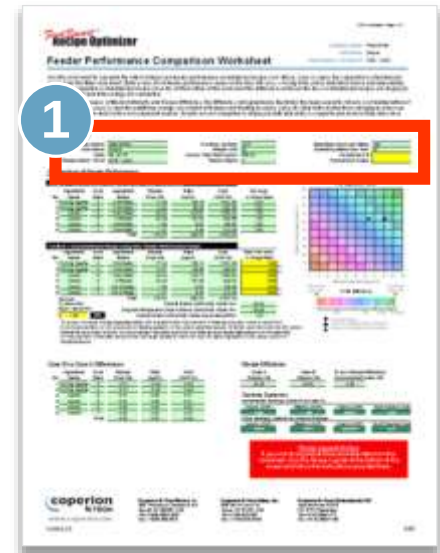
- 1 Application Data
- 2 Case A Solution
- 3 Case B Entry with Monitoring and Optional QuiCalc Entry
- 4 Case B Solution
- 5 Case B vs A Differences
- 6 Efficiency Grid
- 7 Blend Uniformity Indices
- 8 Recipe Efficiencies
- 9 Savings Summary



The FPC Worksheet

1 Application Data

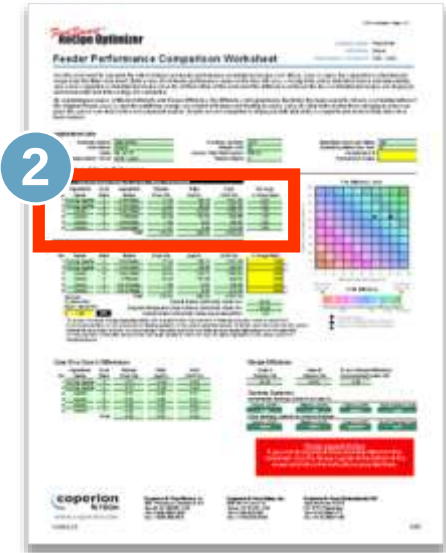
- User entered data copied from the Main Worksheet for ease of reference
- Comparison # and Notes data fields to uniquely identify the comparison



The FPC Worksheet

2 Case A Solution

- Results of initial recipe optimization from Main Worksheet (Case A) are copied to this section for ease of reference



The FPC Worksheet

3 Case B Entry

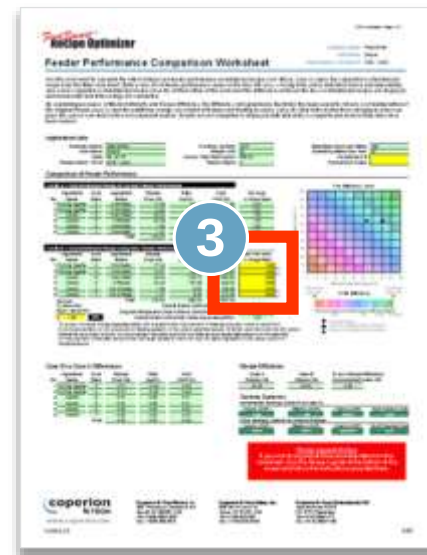
- User entry of new Feeder Accuracy values for each ingredient to form the basis for the Case B solution

The screenshot shows the 'Feeder Performance Comparison Worksheet' in the FeedSmart Recipe Optimizer. It includes a title bar, a header section with a date and user, and a main body with several tables. The 'Ingredient Data' table is the primary focus, with a red box highlighting the 'Feeder Accuracy' column. A blue circle with the number '3' is positioned next to this column. Other tables include 'Feeder Performance Data' and 'Feeder Performance Summary'. A red banner at the bottom right reads 'New Feeder Accuracy Values Entered'.

The FPC Worksheet

3 Case B Entry (Monitoring)

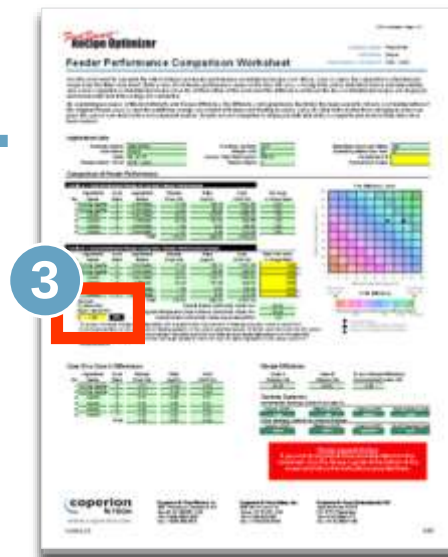
- Although the FPC Worksheet *will* accept feeder accuracy entries *poorer* than those used for Case A, it is designed to compute savings resulting from improved feeder performance.
- To avoid the display of negative savings on this worksheet, feeder accuracies associated with Case B should reflect an overall improvement compared to Case A performance levels. A cautionary message will be displayed if any Case B entry is poorer than its corresponding Case A entry.
- FeedSmart will not display a Case B solution if any entered Case B feeder accuracy violates either of the associated ingredient's entered or Auto Limit tolerance limits.



The FPC Worksheet

3 Case B (Optional QuiCalc Entry)

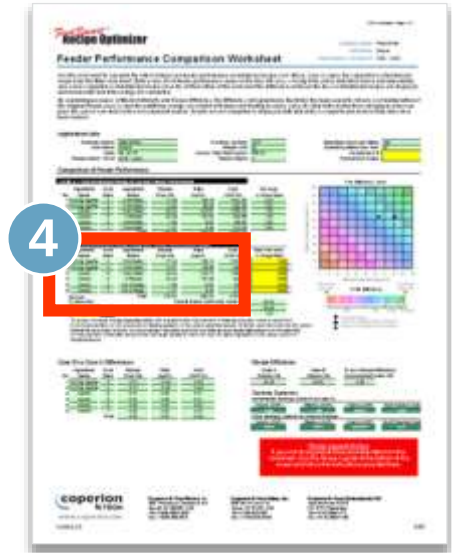
- To quickly compute the savings associated with a uniform, systemwide improvement in feeding accuracy, enter a value from 0 (no improvement) to 100 (a perfect, zero-error feeding system).
- Press 'Enter' then click the 'GO' button.
- FeedSmart's QuiCalc function will automatically calculate and enter the feeder accuracies associated with the specified % improvement.
- Otherwise, simply enter individual feeder accuracies directly in the New Fdr Accy data fields as appropriate.



The FPC Worksheet

4 Case B Solution

- Ingredient Status (Minimized, Maximized, In Range or Fixed)
- Case B solution proportions
- Hourly rate and cost for each ingredient



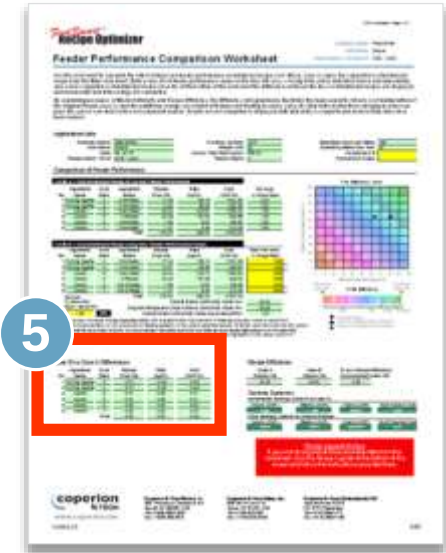
The screenshot shows the 'FeedSmart Recipe Optimizer' interface. The 'Feeder Performance Comparison Worksheet' is displayed. A red box highlights the 'Case B Solution' table, which contains the following data:

Ingredient	Min	Max	In Range	Fixed	Hourly Rate	Cost
Ingredient 1	10.00	20.00	15.00	15.00	1.00	15.00
Ingredient 2	5.00	10.00	7.50	7.50	0.50	3.75
Ingredient 3	2.00	5.00	3.50	3.50	0.20	0.70
Ingredient 4	1.00	2.00	1.50	1.50	0.10	0.15
Ingredient 5	0.50	1.00	0.75	0.75	0.05	0.04
Ingredient 6	0.20	0.50	0.35	0.35	0.02	0.01
Ingredient 7	0.10	0.20	0.15	0.15	0.01	0.00
Ingredient 8	0.05	0.10	0.07	0.07	0.00	0.00
Ingredient 9	0.02	0.05	0.03	0.03	0.00	0.00
Ingredient 10	0.01	0.02	0.01	0.01	0.00	0.00

The FPC Worksheet

5 Case B vs Case A Differences

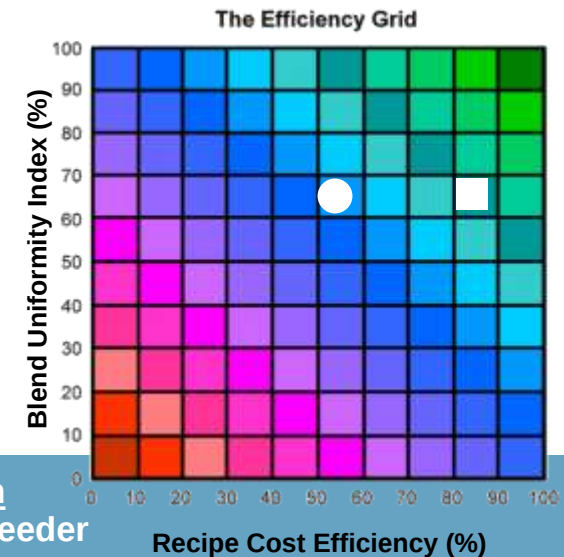
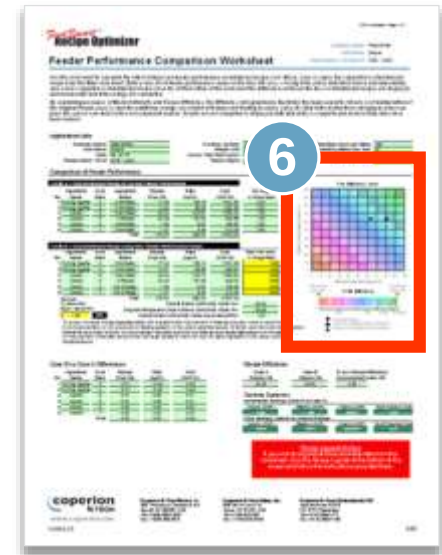
- Ingredient-by-ingredient comparisons of proportions, rates and costs for each ingredient.



The FPC Worksheet

6 Efficiency Grid

- Plots Blend Uniformity Index against Recipe Efficiency for the original recipe and Case A and Case B solutions.
- Provides a graphic visualization of the improvement in cost efficiency provided by recipe optimization, as well as the additional savings and recipe uniformity provided by higher levels of feeder performance.



● Original Recipe
at original feeder
accuracies

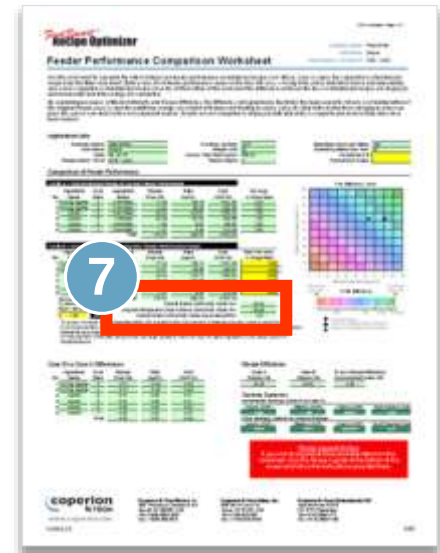
■ Case A Solution
at original feeder
accuracies

▲ Case B Solution
with improved feeder
accuracies

The FPC Worksheet

7 Blend Uniformity Indices

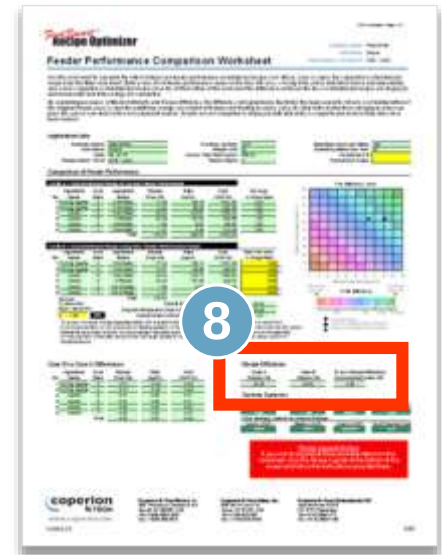
- Computed Blend Uniformity Indices are displayed for Case A and Case B solutions.
- Computed improvement % of Case B over Case A is displayed.



The FPC Worksheet

8 Recipe Efficiencies

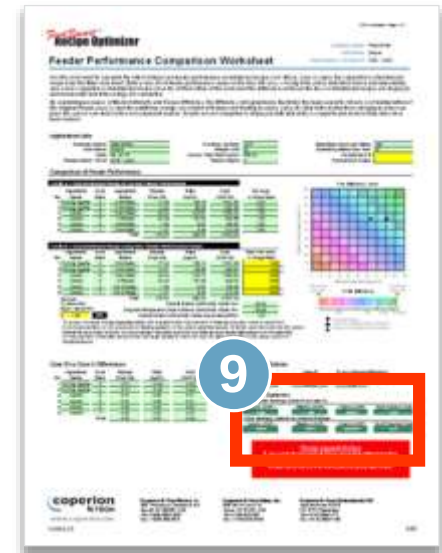
- Case A Recipe Efficiency is copied from Main Worksheet for easy reference
- Case B Recipe Efficiency is displayed
- Case B vs Case A Recipe Efficiency Improvement Index indicates how much closer Case B's cost is to the recipe's theoretical minimum cost relative to Case A.



The FPC Worksheet

9 Savings Summary

- Case B vs Case A - Hourly, weekly, yearly and % incremental savings associated with the improved level of feeder performance
- Case B vs Original Recipe - Hourly, weekly, yearly and % incremental savings associated with the improved level of feeder performance



Recipe Log

*Function: Storage and Retrieval of
FeedSmart Solution Data Sets*

Note: For full functionality this worksheet requires that macros be enabled.



The Recipe Log

Use this sheet to log and archive essential data for up to 50 FeedSmart Solutions.

The **ADD OR REPLACE** buttons copy the currently displayed FeedSmart data set (original recipe and Case A and B solutions) to the Recipe Log.

The **DELETE** buttons clear the desired data set.

The **LOAD** buttons copy the logged solution data set to the Main and FPC Worksheets for review or editing.

Logged data is available for use with other spreadsheet or database programs. Data may be transferred to other programs either by copying and pasting selected data or by importing from the destination program.

The ITC Worksheet

*Function: Determine the Effect of
Relaxed Ingredient Tolerances on
Optimized Recipe Cost*

The ITC Worksheet

Consists of 6 elements...

- 1 Application Data
- 2 Case A Solution
- 3 Case C Data Entry
- 4 Case C Solution
- 5 Case C vs A Differences
- 6 Savings Summary

Information Page 10

FoodSmart[™] Recipe Optimizer

Ingredient Tolerance Comparison Worksheet

Company Name: _____

Plant Name: _____

Report Date: _____

Use this worksheet to see the effect of changing the order of ingredients. Ingredients are listed in standard recipe order. Check, Cook & Bake are the same order and they are listed in the same order in the Recipe & Menu Report. When a different order is suggested, the ingredients are listed in the order suggested. Ingredients are listed in the same order as they are listed in the Recipe & Menu Report. When a different order is suggested, the ingredients are listed in the order suggested. When a different order is suggested, the ingredients are listed in the order suggested.

Comparison and Cook & Bake orders are listed in the same order as they are listed in the Recipe & Menu Report. When a different order is suggested, the ingredients are listed in the order suggested. When a different order is suggested, the ingredients are listed in the order suggested.

Application Data

Company Name:	Plant Name:	Unit:	Comparison Name:	Comparison Date:
Recipe Name:	Recipe Date:	Recipe Type:	Comparison Date:	Comparison Date:
Recipe Name:	Recipe Date:	Recipe Type:	Comparison Date:	Comparison Date:

Comparison of Ingredient Tolerances

Ingredient	Order	Ingredient	Recipe	Rate	Unit	Comparison	Comparison	Comparison	Comparison
1. Cooking Oil	1	1. Cooking Oil	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2. Cooking Oil	2	2. Cooking Oil	1.00	1.00	1.00	1.00	1.00	1.00	1.00
3. Cooking Oil	3	3. Cooking Oil	1.00	1.00	1.00	1.00	1.00	1.00	1.00
4. Cooking Oil	4	4. Cooking Oil	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5. Cooking Oil	5	5. Cooking Oil	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Cook & Bake Comparison Data Using New Ingredient & Menu and Alternative Ingredients

Ingredient	Order	Ingredient	Recipe	Rate	Unit	Comparison	Comparison	Comparison	Comparison
1. Cooking Oil	1	1. Cooking Oil	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2. Cooking Oil	2	2. Cooking Oil	1.00	1.00	1.00	1.00	1.00	1.00	1.00
3. Cooking Oil	3	3. Cooking Oil	1.00	1.00	1.00	1.00	1.00	1.00	1.00
4. Cooking Oil	4	4. Cooking Oil	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5. Cooking Oil	5	5. Cooking Oil	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Cook & Bake

Ingredient	Order	Ingredient	Recipe	Rate	Unit	Comparison	Comparison	Comparison	Comparison
1. Cooking Oil	1	1. Cooking Oil	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2. Cooking Oil	2	2. Cooking Oil	1.00	1.00	1.00	1.00	1.00	1.00	1.00
3. Cooking Oil	3	3. Cooking Oil	1.00	1.00	1.00	1.00	1.00	1.00	1.00
4. Cooking Oil	4	4. Cooking Oil	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5. Cooking Oil	5	5. Cooking Oil	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Cook & Bake

Ingredient	Order	Ingredient	Recipe	Rate	Unit	Comparison	Comparison	Comparison	Comparison
1. Cooking Oil	1	1. Cooking Oil	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2. Cooking Oil	2	2. Cooking Oil	1.00	1.00	1.00	1.00	1.00	1.00	1.00
3. Cooking Oil	3	3. Cooking Oil	1.00	1.00	1.00	1.00	1.00	1.00	1.00
4. Cooking Oil	4	4. Cooking Oil	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5. Cooking Oil	5	5. Cooking Oil	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Engineering, Sales & Service for
 all types of extrusion
 systems & extrusion
 lines & extrusion
 lines & extrusion
 lines & extrusion

Engineering, Sales & Service for
 all types of extrusion
 systems & extrusion
 lines & extrusion
 lines & extrusion
 lines & extrusion

Engineering, Sales & Service for
 all types of extrusion
 systems & extrusion
 lines & extrusion
 lines & extrusion
 lines & extrusion

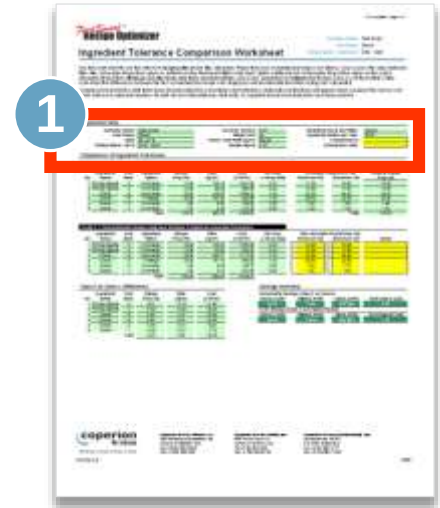
10/10/10

10/10/10

The ITC Worksheet

1 Application Data

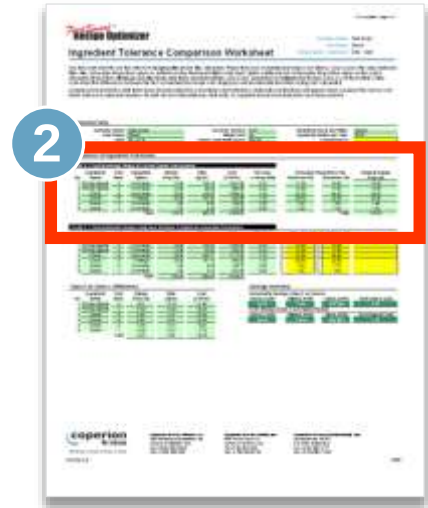
- User entered data is copied from the Main Worksheet for ease of reference
- Comparison # and Notes data fields to uniquely identify the comparison



The ITC Worksheet

2 Case A Solution

- Case A data and solution are copied from Main Worksheet for ease of reference
- If Auto Limit Function is active for any Case A ingredients, computed tolerances are reported in this section.

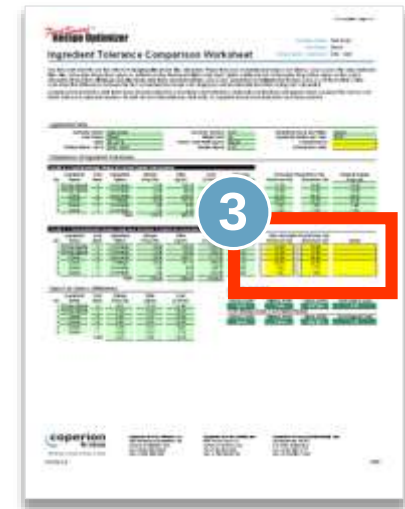


The screenshot displays the 'Ingredient Tolerance Comparison Worksheet' within the FeedSmart Recipe Optimizer interface. A red rectangular box highlights a specific section of the worksheet, which is identified by a blue circle containing the number '2'. This section appears to be the 'Case A' solution, showing a table of ingredient tolerances. The table has multiple columns, including 'Ingredient', 'Tolerance', and 'Status'. The 'Status' column contains values like 'OK', 'WARN', and 'FAIL'. The 'Tolerance' column shows numerical values. The 'Ingredient' column lists various feed components. The worksheet also includes a header section with 'FeedSmart Recipe Optimizer' and 'Ingredient Tolerance Comparison Worksheet'.

The ITC Worksheet

3 Case C Data Entry

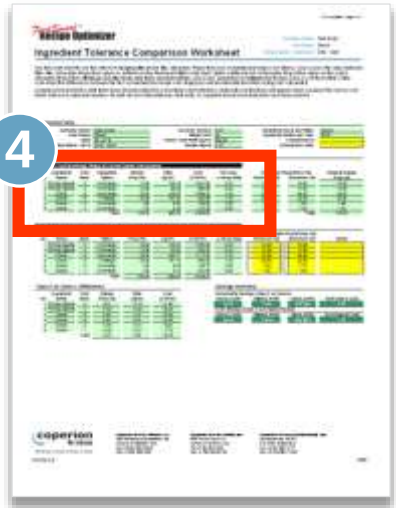
- User entry of new Minimum and Maximum Proportion Limits for each ingredient to form the basis for the Case C solution
- Note that the ITC Worksheet is designed to compute savings associated with *relaxed* ingredient tolerances. To avoid the display of negative savings on this sheet, tolerances entered for Case C should reflect an *overall* relaxation of limits compared to Case A.
- Unacceptable tolerance entries will cause an error message to be displayed.



The ITC Worksheet

4 Case C Solution

- Proportions, rates and costs are computed and displayed for Case C solution at the entered tolerances.

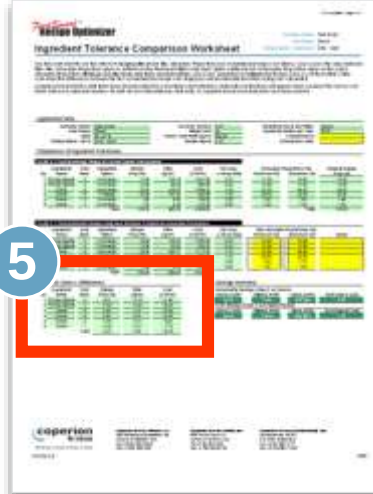


The screenshot displays the 'Ingredient Tolerance Comparison Worksheet' from the FeedSmart Recipe Optimizer. A red box highlights a section of the table, and a blue circle with the number '4' is positioned next to it. The table contains multiple columns for ingredients, including 'Ingredient', 'Current Rate', 'Current Cost', 'Tolerance', 'Case C Rate', 'Case C Cost', 'Case C Proportion', 'Case C Rate', 'Case C Cost', and 'Case C Proportion'. The data is organized into several rows, with the highlighted section showing specific values for Case C solution at entered tolerances.

The ITC Worksheet

5 Case C vs A Differences

- Ingredient-by-ingredient comparisons of proportions, rates and costs for each optimized recipe are displayed.

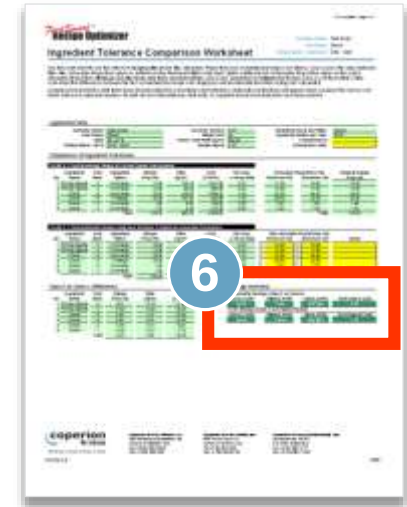


The screenshot displays the 'Ingredient Tolerance Comparison Worksheet' (ITC Worksheet) from the FeedSmart Recipe Optimizer. A blue circle with the number '5' is positioned to the left of a red rectangular box that highlights a specific section of the worksheet. This section contains a table with multiple columns, likely representing different ingredients and their respective proportions, rates, and costs for comparison between Case C and Case A. The table is organized into several rows, with the highlighted area focusing on a specific set of data.

The ITC Worksheet

6 Savings Summary

- Case C vs Case A - Hourly, weekly, yearly and % incremental savings associated with the new ingredient tolerance values.
- Case C vs Original Recipe - Hourly, weekly, yearly and % incremental savings associated with the new ingredient tolerance values.



The screenshot shows the 'Ingredient Tolerance Comparison Worksheet' from the FeedSmart Recipe Optimizer. It contains several tables with columns for ingredients, tolerances, and savings. A blue circle with the number 6 is overlaid on the table, and a red rectangle highlights a section of the table.

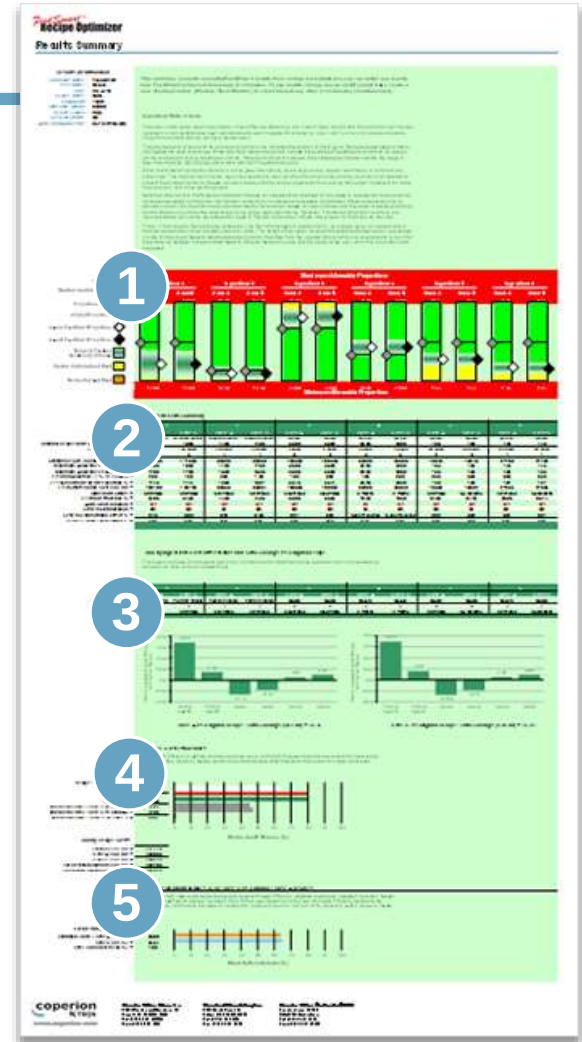
Results Summary

*Function: Consolidated Display of
Current FeedSmart Results*

Results Summary

Consists of 5 elements...

- 1 Ingredient Slider Charts
- 2 Ingredient Data Summary
- 3 Ingredient Cost Differentials
- 4 Recipe Cost Efficiencies
- 5 Blend Uniformity Indices



Results Summary

1 Ingredient Slider Charts

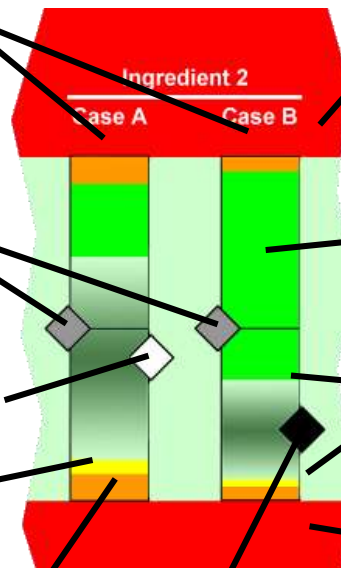
Each ingredient's Case A and B solutions are charted side by side

Original Recipe Proportion

Case A Proportion

System Optimization Offset

Recipe Sigma Offset



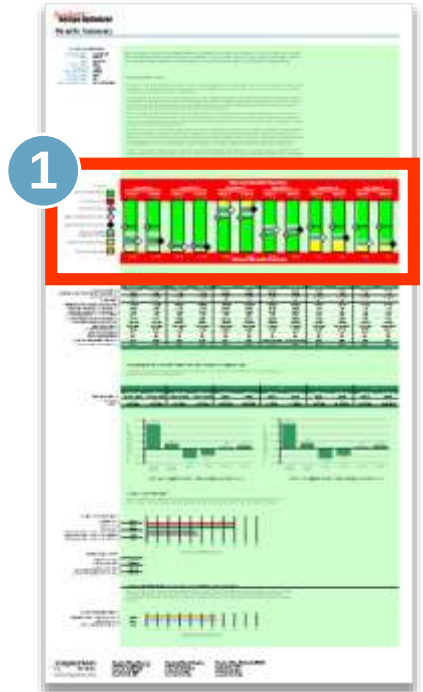
Maximum Proportion Limit

Residual Operating Range

Gradient Shows Range of Feeder Variability

Minimum Proportion Limit

Case B Proportion

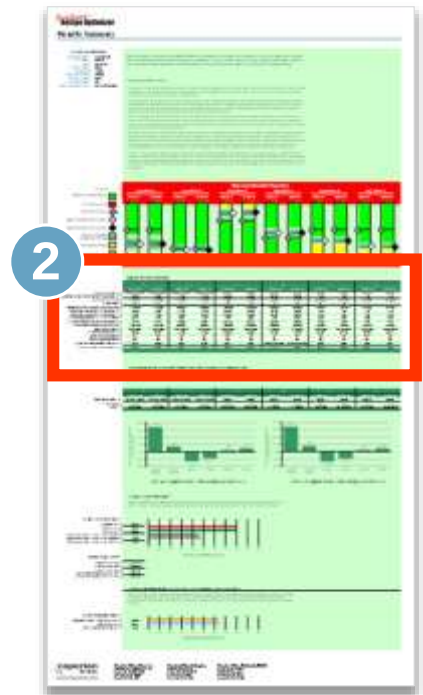


Results Summary

2 Ingredient Data Summary

Detailed original recipe and Case A and B solution data are presented in consolidated tabular form.

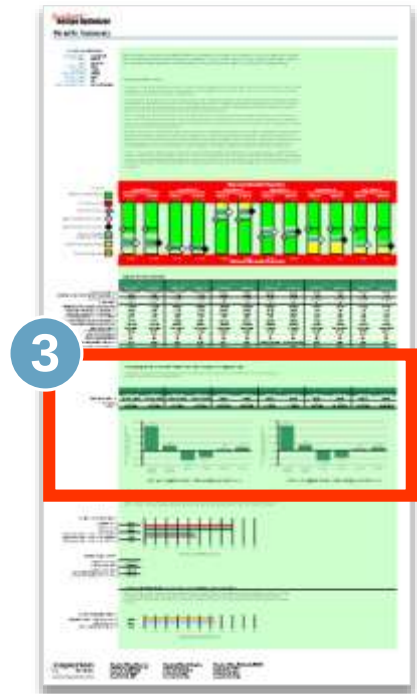
Ingredient Data Summary												
	Case A		Case B		Case A		Case B		Case A		Case B	
Ingredient Name	Maiz 1	Maiz 2	Maiz 1	Maiz 2	Ingredient	Ingredient	Ingredient	Ingredient	Ingredient	Ingredient	Ingredient	Ingredient
Original Recipe Ingredient Proportion %	30.30	30.30	30.30	30.30	10.30	10.30	10.30	10.30	10.30	10.30	10.30	10.30
Unit Cost (\$/lb)	2.5000	2.5000	1.5000	1.5000	1.5000	1.5000	1.5000	1.5000	1.5000	1.5000	1.5000	1.5000
Cost Ratio	4	4	1	1	1	1	1	1	1	1	1	1
Original Recipe Moisture Cost (\$/lb)	20.00	20.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Blended Moisture Proportion %	30.30	30.30	11.30	11.30	11.30	11.30	11.30	11.30	11.30	11.30	11.30	11.30
Blended Moisture Proportion %	30.30	30.30	11.30	11.30	11.30	11.30	11.30	11.30	11.30	11.30	11.30	11.30
Feeding Accuracy +/- % @ 2 Sigma	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
FeedSmart Ingredient Proportion %	30.30	30.30	29.80	29.80	10.30	10.30	10.30	10.30	10.30	10.30	10.30	10.30
FeedSmart Moisture Cost (\$/lb)	20.30	20.30	11.30	11.30	11.30	11.30	11.30	11.30	11.30	11.30	11.30	11.30
Ingredient Status	Feed	Feed	Moisture	Moisture	Moisture	Moisture	Moisture	Moisture	Moisture	Moisture	Moisture	Moisture
Feeding Efficiency %	100	100	100	100	100	100	100	100	100	100	100	100
Auto Limit Function	On	On	On	On	On	On	On	On	On	On	On	On
System Optimization	On	On	On	On	On	On	On	On	On	On	On	On
System Optimization Offset %	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Recipe Sigma Limit Offset %	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00



Results Summary

3 Ingredient Cost Differentials

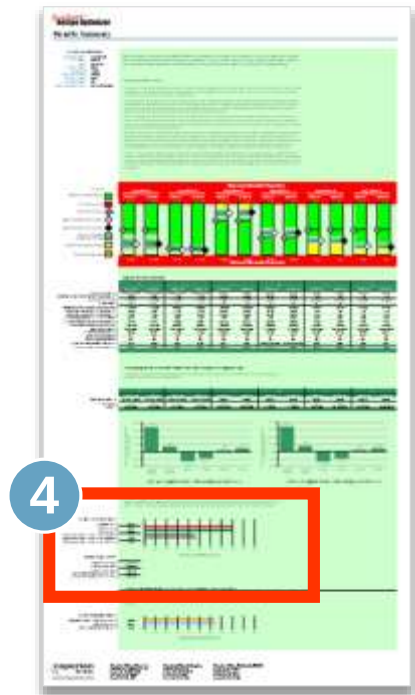
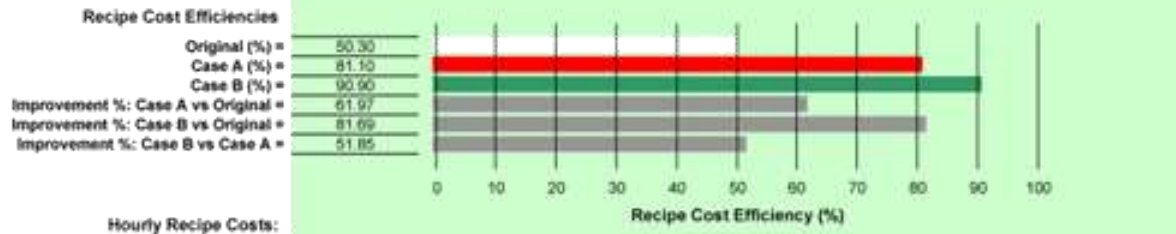
Hourly ingredient cost differentials vs the original recipe are plotted for Case A and B solutions



Results Summary

4 Recipe Cost Efficiencies

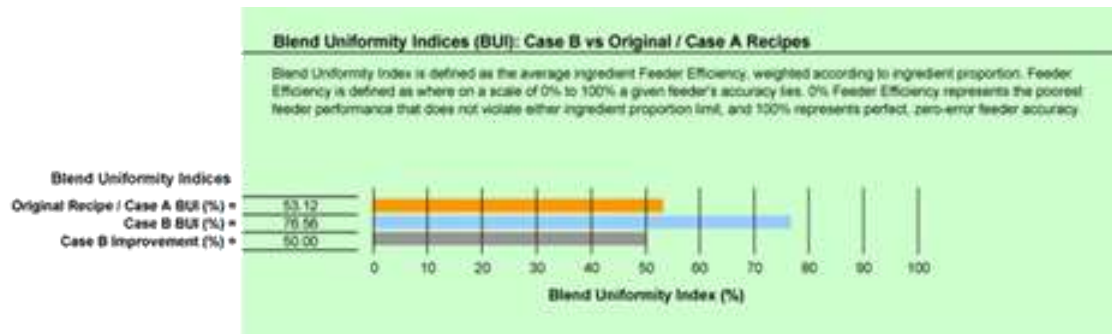
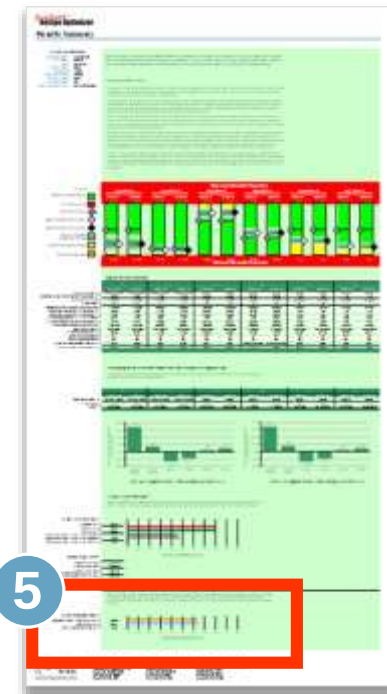
Original recipe, Case A and B cost efficiencies are plotted along with their associated Improvement Indices



Results Summary

5 Blend Uniformity Indices

Blend Uniformity Indices for Case A and B are plotted along with Case B vs A Improvement Index



Savings Builder Worksheet

*Function: Combine Multiple FeedSmart Recipe
Solutions to Determine Total Process
Annual Ingredient Savings*

Note: For full functionality this worksheet requires that macros be enabled.

Savings Builder Worksheet

Concept

With FeedSmart's ability to compute precise material savings associated with specific levels of feeder performance, it is now possible to incorporate these savings into the feeder purchase decision.

The Savings Builder Worksheet takes the first crucial step by enabling the user to construct a customized recipe profile to simulate the actual process operation. FeedSmart then computes total annual ingredient cost savings compared to original recipe costs.

The screenshot displays the 'Savings Builder' interface within the FeedSmart Recipe Optimizer. It features a header with the product name and a 'Save Recipe' button. Below this, there are several sections: 'Introduction', 'Recipe Profile', and 'Savings Builder'. The 'Recipe Profile' section includes a table for defining recipe parameters. The 'Savings Builder' section contains a large table for inputting recipe data, including ingredient names, quantities, and costs. A sidebar on the left lists various ingredients. The bottom of the page includes the Coperion Nelson logo and contact information for regional offices.

Savings Builder Worksheet

Concept...

Savings Builder accommodates up to 20 FeedSmart Case A and B solution data sets from any combination of previously logged or currently created solutions.

As recipe solutions are added to the recipe profile the user enters the % of process time allotted to each recipe.

Once the recipe profile is complete, FeedSmart displays the total annual ingredient costs, savings and identifies the overall favored Case (A or B) on the basis of highest total ingredient cost savings.

The screenshot displays the 'Savings Builder' interface within the FeedSmart Recipe Optimizer. It features a header section with the product name and a 'Save Recipe' button. Below this, there is a note about the accuracy of the data. The main body is divided into several sections: 'Section 1: Solution Data', 'Section 2: Recipe Profile', and 'Section 3: Savings Summary'. Section 1 includes a table for entering solution data. Section 2 includes a table for entering recipe profile data. Section 3 includes a table for the savings summary, which shows the total annual ingredient costs, savings, and the overall favored case. The interface is color-coded with green for input fields and yellow for calculated results. The Coperion K-Tron logo is visible in the bottom left corner.

Savings Builder Worksheet

Consists of 2 elements...

- 1 Application Data
- 2 Process Recipe Profile

FeedSmart™ Recipe Optimizer
Savings Builder

NOTE: To a complete distribution of contents, see the User Manual at a time of release 1.0.

Section 1: Application Data

The Application Data section is used to enter the material and cost data for the process. This section is divided into two parts: 'Material Data' and 'Cost Data'. The 'Material Data' table lists the materials used in the process, and the 'Cost Data' table lists the costs associated with each material.

Section 2: Process Recipe Profile

The Process Recipe Profile section is used to enter the process recipe data. This section is divided into two parts: 'Recipe Data' and 'Process Data'. The 'Recipe Data' table lists the recipes used in the process, and the 'Process Data' table lists the process parameters for each recipe.

Summary

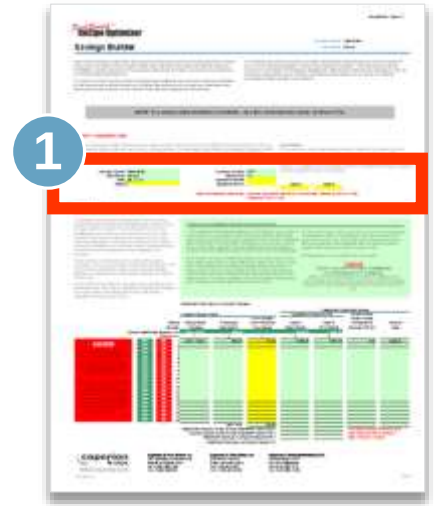
The Summary table provides a summary of the data entered in the previous sections. It includes columns for 'Recipe', 'Material', 'Unit', 'Cost', and 'Savings'.

Savings Builder Worksheet

1 Application Data

- Original Application Data copied from Main Worksheet for ease of reference
- Notes data field to identify the recipe profile
- Operating Hours/Week and Weeks/Year user entry is required. (Entries may differ from similar entries made on Main Worksheet.)
- Case Names (optional) to identify Case A and B solutions, e.g., Supplier 'X' and 'Y', or 'Current' and 'Improved.'

NOTE: If Case Names are not entered, 'Case A' and 'Case B' are used by default.

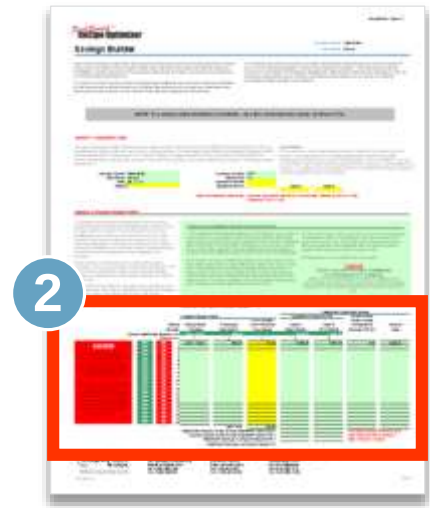


Savings Builder Worksheet

2 Process Recipe Profile

- Automated solution transfer (ADD button) from current Main & FPC Worksheet solutions for up to 20 recipes.
- Solutions may be transferred as they are created, or loaded to the Main and FPC Worksheets from the Recipe Log, and then transferred.
- % of Process Time Producing This Recipe data entry apportions savings associated with specific recipes.
- Upon completion, annual costs, savings vs original recipe, and Case A vs Case B comparisons are displayed.

CAUTION: Do not manually enter data into green fields. Formatting will become corrupted.



Tips and Techniques

Tips and Techniques

Don't overlook FeedSmart's *Tips and Techniques* section. It presents practical information on how to get the most out of this powerful tool...

- **How Can I Handle Multiple Recipes in FeedSmart?**
- **What Do I Do When Recipe Total Throughput Varies?**
- **What If My Recipes Involve More Than Six Ingredients?**
- **How Can I Add a Safety Margin to a FeedSmart Recipe?**
- **How Do I Account for Changeovers, Maintenance and Downtime?**
- **How Can I Identify a Cost-Critical Feeder?**
- **What Do I Do When Feeder Performance Data Isn't Available?**
- **What If Ingredient Costs Change?**
- **How Can I Evaluate Changes to Ingredient Tolerances?**
- **Can I Use FeedSmart to Optimize My Batching Recipes?**
- **How Can I Save My Results?**

Tech Talk

Tech Talk

Be sure to read FeedSmart's *Tech Talk* section. It details some of FeedSmart's more technical aspects...

- Definition of Feeder Accuracy
- Feeder Performance and the Process Timescale
- Recipe Efficiency
- Feeding Efficiency and the Blend Uniformity Index
- Ingredient Tolerances and the Auto Limit Function
- Recipe Sigma
- System Optimization

Use FeedSmart in Every Phase of Process Operation

- **PLANNING PHASE** - Use FeedSmart to estimate recipe costs based on different levels of feeder performance, help determine required feeder accuracies for each recipe component, and compute the expected contribution of each feeder to the anticipated savings stream.
- **APPLICATION DEVELOPMENT PHASE** - Use FeedSmart in combination with supplier testing to translate measured feeder performance into savings estimates.
- **SUPPLIER EVALUATION PHASE** - Use FeedSmart to compare cost savings associated with the feeding performance offered by any number of suppliers, and then integrate that information into your decision process.

Use FeedSmart in Every Phase of Process Operation

- **POST-INSTALLATION PHASE** - Use FeedSmart to compute recipes using verified feeder performance measurements made under actual operating conditions. To accommodate any source of variation in your process, you can create different optimized recipe solutions for different process set-ups or conditions.
- **OPERATIONAL PHASE** – Regularly monitor feeder performance and use FeedSmart to adjust your recipes as needed to assure ongoing recipe optimization.

Notes on Performance Testing

FeedSmart is completely supplier-independent. The processor's application data alone determine the potential cost savings, and feeder performance alone determines the degree to which potential savings can be achieved.

Thus, FeedSmart's ability to quantify cost savings based on feeder performance places increased importance on pre-purchase performance testing.

While it is primarily the processor's responsibility to assure that testing requirements, standards and procedures are consistently applied among candidate feeder system suppliers, Coperion K-Tron has developed policies, guidelines and other resources aimed at supporting the processor's responsibilities in this key area.

Notes on Performance Testing

As a basic element in the testing process, the specification of sample duration is becoming an especially crucial consideration in many of today's more critical processes.

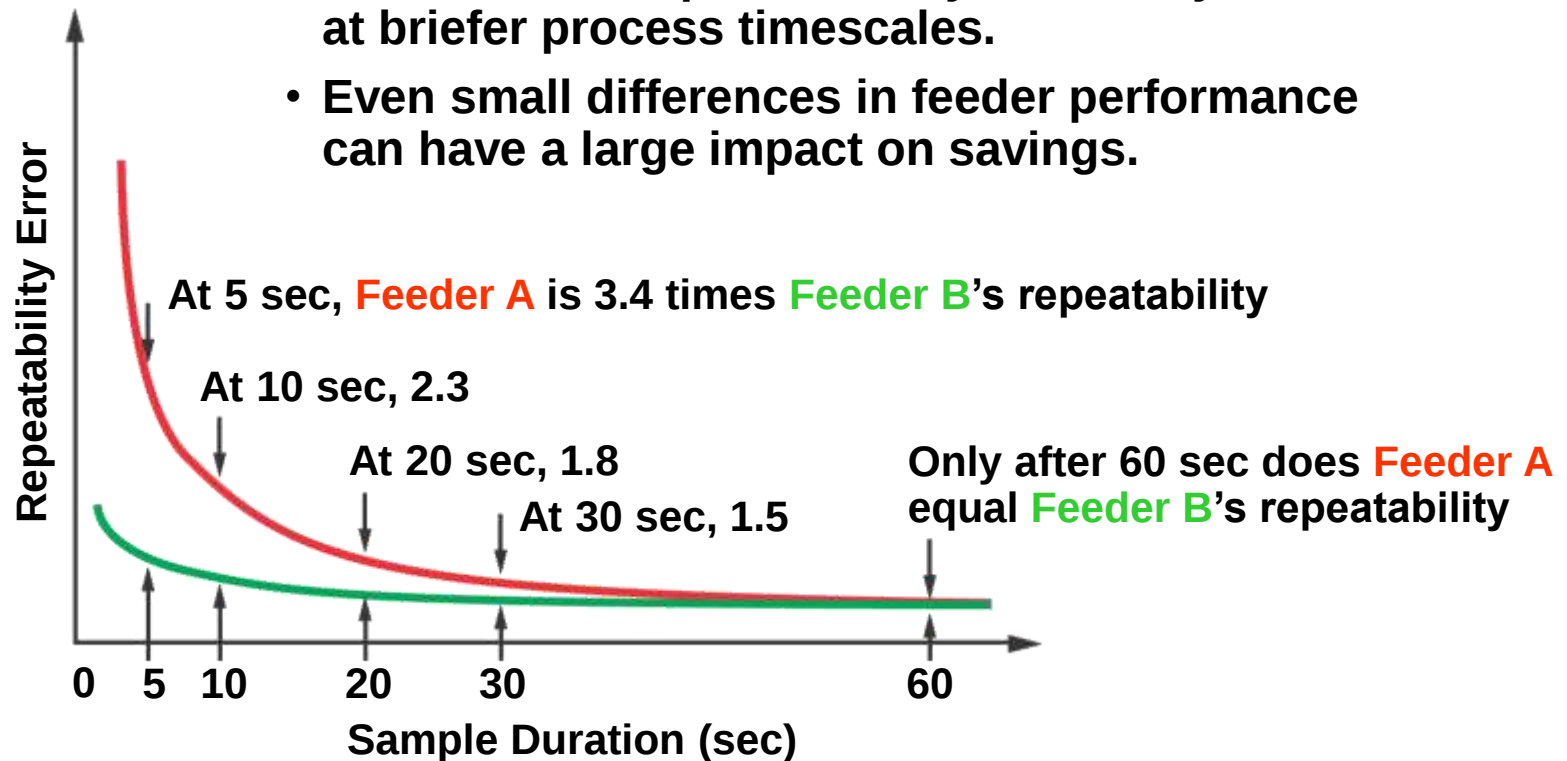
In order to measure expected on-line feeder performance, sample duration must accurately reflect the timescale of the process relevant to the feeding operation.

Coperion K-Tron believes that its advanced feeding technologies, applications expertise, and extensive experience give it a competitive advantage in applications requiring a high level of feeder performance at brief process timescales.

As your use of FeedSmart will confirm, even small differences in overall feeding performance can result in large savings, potentially 'tipping the scale' in favor of the supplier with a performance edge.

Notes on Performance Testing

- Different feeders with *identical* 60-second accuracies can perform very differently at briefer process timescales.
- Even small differences in feeder performance can have a large impact on savings.



*FeedSmart*TM **Recipe Optimizer**

Now, Take the Next Step...

FeedSmart is only the first tool in Coperion K-Tron's Total Savings Solution. Once you've seen for yourself the savings potential of FeedSmart Recipes, we invite you to contact your local Coperion K-Tron Representative for the second tool:

*TruCost*TM **Savings Comparator**

TruCost combines FeedSmart's recipe solutions with other crucial costs to improve your purchase decision process by identifying, analyzing and comparing lifecycle costs of candidate feeding systems.

