

# **PROCEEDINGS**

## **2017**

### **UNIVERSITY OF GEORGIA AND UNIVERSITY OF FLORIDA CORN SILAGE AND FORAGE FIELD DAY**



**College of Agricultural & Environmental Sciences**  
**UNIVERSITY OF GEORGIA**



**Corn Silage and Forage Field Day**  
**June 15, 2017**



**June 15, 2017**

**University of Georgia Tifton Campus Conference Center, Tifton,  
GA**

**Department of Animal and Dairy Science**  
**University of Georgia**  
**Tifton, GA, 31793**

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# **2017 Corn Silage and Forage Field Day**

## **June 15, 2017**

University of Georgia Tifton Campus Conference Center

- 7:30 am      Registration
- 8:00 am      Welcome and Introductions, Ballroom A
- 8:15 am      Tour variety test plots
- 9:40 am      Return to conference center
- 10:00 am     The Art and Science of Pricing and Negotiating Corn Silage,  
Ballroom A, Dr. Curt Lacy, Mississippi State University
- 10:35 am     Break (tour exhibits)
- 10:55 am     Breakout sessions
- A. Fertilizing and Liming for High Yields - Corn Silage vs Corn for Grain  
          Dr. Glen Harris, University of Georgia
- B. Irrigation and Wastewater Applications in Silage and Forage Production  
          Dr. Wesley Porter, University of Georgia
- C. Advancements in Corn Silage Processing  
          Dr. Luiz Ferraretto, University of Florida
- 11:20 am     Repeat Breakout Sessions
- 11:40 am     Visit exhibits
- Noon      Lunch
- 1:00 pm      Drive to the Animal & Dairy Science Farm
- 1:15 pm      Calibrating Irrigation and Waste Handling Systems  
          Dr. Wesley Porter, University of Georgia

Directions to Field Demonstration: Turn left on RDC Road when leaving UGA Tifton Campus Conference Center. Turn right onto Moore Highway and continue to stop sign. Cross Zion Hope Road into Animal Science Farm and continue to the first pivot on the left.

# THE ART AND SCIENCE OF PRICING AND NEGOTIATING CORN SILAGE

*Curt Lacy, Extension Professor and Regional Extension Coordinator*

*Delta Research and Extension Center*

*Mississippi State University*

## INTRODUCTION

Successfully negotiating the price for corn silage involves both art and science. Even though the math may be fairly straight-forward, finding a price that both parties can live with involves more art than science. The aim of these proceedings and the associated presentation is to provide both milk and corn producers with tools that they can use in negotiating a fair price for both parties.

## PRICE IS NOT VALUE

Many people equate value and price but they are not the same. Value is determined by the purchaser and is essentially how much something is “worth.” Price on the other hand, is a number that two or more parties agree to exchange goods or services. Economically rational people base their price on value, but the two are not always the same. In practice, purchasers do well when they pay a lower price than something is worth. On the other hand, they should avoid overpaying or paying a price higher than something is worth.

## DETERMINING VALUE

The value of corn silage to a dairy producer is equal to the net returns per cow not including the cost of silage. Dividing this number by the tons fed per cow gives us the value in dollars per ton for silage.

Even though they are not purchasers, corn farmers also make a value determination when they opt to sell corn silage instead of corn for grain. A more thorough discussion of this concept can be found in the UGA Cooperative Extension Circular 1020, “Production Costs vs. Feeding Value of Forages.”

## NEGOTIATING A PRICE

Several Extension publications cite the method of positional bargaining to negotiating a price for inputs without a clearly defined markets such as corn silage, land rent, etc. These

publications also list some variation of the following steps to negotiating a price. These steps are generally adapted from the best-selling book, "Getting to Yes: Negotiating Agreement without Giving In" by Fisher, Ury, and Patton.

The specific list below was obtained from Oklahoma Cooperative Extension Service publication AGE-198, "Negotiation Strategies" by Doye, Love, and Hyer. They suggest:

1. Separate the people from the problem.
2. Focus on interests, not positions.
3. Invent options for mutual gain.
4. Insist on using objective criteria for judging a proposed solution.

Applying these steps to negotiating a price for corn silage involves understanding current corn and dairy market conditions, costs of production, and other factors that impact profitability for corn and milk producers. It is important that parties agree on a price that is beneficial for everyone involved. As with any negotiation having a **written, signed** agreement is highly recommended to avoid any confusion or misunderstanding.

Sometimes, market conditions for one or both commodities involved don't allow either or both parties to make any money. In those instances, it is important for both parties to be honest with each other and try to find a solution that will work this year keeping in mind that in the long-run it is both parties best interest that they both remain in business.

Farmers may consider having a long-term agreement that considers long-term trends or cycles. Some livestock sectors have "window-contracts" whereby as long as prices stay within a set range or "window" one formula prevails. However, if prices move either above or below the "window" the parties adjust the price based upon another pre-determined formula (e.g. 50/50 or 60/40). This prevents one partner from exploiting the other. It also serves to keep both producers in business over the long-haul. There is no "wrong" method or formula as long as all parties agree to the formula and it is mutually beneficial to everyone.

Finally, regardless of the agreement, it is important that the criteria for determining the price be objective and easily verifiable. Examples include corn prices as published by USDA-AMS or the number of acres in a field according to FSA. Using this type of information will strengthen trust and help insure the business arrangement continues for a long-time.

## SUMMARY

Determining the price for corn silage involves both art and science. Utilizing the principles and methods provided in the presentation and theses proceedings should result in a written pricing agreement that is mutually for all parties for many years.

# REFERENCES AND RESOURCES

*Below is a list of resources and the web addresses at which they were obtained on June 7, 2017.*

Timothy Beck. "Trading Corn Silage Guide." Penn State Extension.

<http://extension.psu.edu/business/farm/management/financial-management/calculators/corn-silage/guide>

Damona Doye, Ross Love, and Tracy Hyer. "Negotiation Strategies." Oklahoma Cooperative Extension Service AGEC-198. <http://pods.dasn.okstate.edu/docushare/dsweb/Get/Document-1676/AGEC-198web13.pdf>

Curt Lacy and Jeremy Kichler. "Production Costs vs. Feeding Value of Forage." UGA Cooperative Extension Circular 1020.

<http://extension.uga.edu/publications/detail.cfm?number=C1020>

Joe Lauer and Ryan Sterry. "Pricing Corn Silage."

<http://corn.agronomy.wisc.edu/AA/pdfs/A104.pdf>

Timothy Nennich and Kern Hendrix. "Determining a Value for Corn Silage."

<https://www.extension.purdue.edu/dairy/articles/ValueCornSilage.pdf>

Don Nitchie. "Skills for Negotiating; Land Rents, Contracts, Purchases and Other Business Agreements." <http://blog-abm-news.extension.umn.edu/2016/09/skills-for-negotiating-land-rents.html>

William Ury, Roger Fisher, and Bruce M. Patton. Getting to Yes: Negotiating Agreement Without Giving In, 2<sup>nd</sup> edition. ISBN-10: 0395631246, ISBN-13: 978-0395631249.

# Production Costs vs. Feeding Value of Forages



John Bernard

*Dr. Curt Lacy, Associate Professor, Department of Agricultural & Applied Economics  
Jeremy Kichler, County Extension Coordinator, Macon County, Georgia*

Determining an equitable price for purchased forages is a necessary but often uncomfortable topic of discussion for feed growers and purchasers. Usually this discussion is in the context of corn silage; however, the same principles can be used in any discussion involving hay, baleage or grains.

## Key Concepts

In order for an input market to be efficient, the price agreed upon by both buyers and sellers should adequately compensate the producer while still allowing the purchaser the opportunity to economically use the input.

<b>Table 1. Major Items Impacting Costs for Producers and Purchasers of Corn Silage</b>	
<b>Producer \$/Ton of Forage</b>	<b>Purchaser \$/Cwt. of Milk</b>
<ul style="list-style-type: none"><li>• Weather</li><li>• Fuel</li><li>• Fertilizer</li><li>• Seeds</li><li>• Machinery</li></ul>	<ul style="list-style-type: none"><li>• Nutrient content and digestibility</li><li>• Production response</li><li>• Price of output (milk)</li><li>• Price of alternative feedstuffs</li></ul>

## Negotiating the Price

An equitable price can only truly be reached if both parties know the forage's value to them. Producers must know their total cost and purchasers must know the value of production from using the input (silage in this case). In some years it is quite possible that because of escalating inputs for the corn grower or cheaper milk for the dairy producer a corn silage price that will satisfy both producers objectives cannot be attained. In that instance, there will likely be some serious negotiating that occurs between the parties.

## Grower Perspective

The value of the silage to the producer depends upon the alternatives for the crop because the price paid for the silage must compensate the grower for any foregone revenue from alternative markets.



The two most common examples would be grain-corn harvested for silage and corn grown strictly for silage. If the corn harvested for silage could be harvested for grain and marketed as such, then the value to the producer is the value of the grain less the harvesting costs. For instance, if the corn would likely yield 150 bushels and be sold for \$4.00 per bushel, then the value of the corn is \$600 per acre. If it would cost \$50 to harvest (including drying), then the value is \$600 minus \$50, or \$550.

Alternatively, if the corn crop grown is a silage variety, then a more correct valuation would be the value of the silage at the stage when ownership changes. For example, if a dairy producer will be purchasing a crop standing in the field ready for silage harvest, then a reasonable price to the corn grower is his total cost up to that point, plus some return. For instance, if the corn grower has \$500 invested in a corn crop prior to harvest and desires an annual return of 10 percent on his investment for the four months that his money has been invested, then a more appropriate charge would be the \$500 plus \$16.50 return on investment (10 percent per year for four months =  $3.33\% \times \$500$ ).

Corn silage budgets are available from the UGA Extension Agricultural and Applied Economics website at [www.secattleadvisor.com](http://www.secattleadvisor.com) under “Budgets and Decision-aids.”

## Dairy Producer Perspective

For the dairy producer, the true value of the silage will be determined by the value of the production as well as the feeding alternatives for the silage. For example, silage fed to lactating cows will likely have a higher value of production than silage fed to heifers. It also follows that when milk prices are higher, dairy producers should be able to pay more for silage than when prices are lower.

One method that dairy producers may find useful for determining the value of silage is known as the “residual value” or “returns to silage.” Using this method, dairymen determine their net returns with all costs included except for a ZERO price for silage. If they know how many tons of silage they will feed, they can determine the most they can pay for silage.



Bill Graves

For example, if a producer has total costs of \$15/Cwt. for milk, excluding silage, and will feed his cows 22 tons of silage to achieve a milk yield of 23,000 pounds, the residual value of silage will be \$52.27 per ton at \$20/Cwt. for milk, \$0 at \$15/Cwt. and (\$52.27) at \$10/Cwt. milk price. In the last two situations, the producer will just be trying to minimize his losses so he will have to negotiate especially hard with the corn grower.

Programs such as “**Milk2006cornsilagev**” can be used to generate numbers that will help complete this analysis. A summary table showing how the numbers from this program can be used in developing the residual price is shown below.

**Table 2. Maximum Sale Price for Corn Silage at Various Milk Prices**

Tons of Silage/acre	22.00	22.00	22.00	22.00
Price of Milk (\$/Cwt)	\$10.00	\$15.00	\$20.00	\$25.00
Pounds of Milk Produced	23,000	23,000	23,000	23,000
Gross Value of Milk/acre	\$2,300.00	\$3,450.00	\$4,600.00	\$5,750.00
Cost of Milk Production EXCLUDING Corn Silage	\$15.00	\$15.00	\$15.00	\$15.00
Cost of Milk/Cow	\$3,450.00	\$3,450.00	\$3,450.00	\$3,450.00
Residual Value of Silage	\$(1,150.00)	\$ 0.00	\$1,150.00	\$2,300.00
Max Price for Producers	\$(52.27)	\$ 0.00	\$52.27	\$104.55



In addition to the residual value method, producers can compare other alternatives to feeding silage. In other words, if a ration can be formulated without silage and will yield the same level of milk production, producers can use the cost difference between the two rations to estimate the value of corn silage.

An example of using this method is given below in Table 2. In this table, prices of alfalfa hay (50 percent), corn (28 percent) and soybean hull pellets (22 percent) are used to indicate the equivalent price of corn silage on an as-fed basis.

For instance, if the combined price of corn and soybean hull pellets is \$150 per ton and alfalfa hay is \$200 per ton, then corn silage at \$68.94 or less per ton would be a better value. Conversely, if alfalfa hay is \$100 per ton and corn/soybean hulls are \$175 per ton, then corn silage would need to be less than \$53.91 to be more economical.

**Table 3. Equitable Price of Corn Silage at Various Prices of Alfalfa Hay, Corn and Soybean Hulls\***

		Alfalfa Hay Prices (\$/ton AF)				
		\$100.00	\$150.00	\$200.00	\$250.00	\$300.00
Corn/Soybean Hull Price (\$/ton AF)	\$150.00	\$49.05	\$59.00	\$68.94	\$78.88	\$88.83
	\$175.00	\$53.91	\$63.86	\$73.80	\$83.74	\$93.69
	\$200.00	\$58.78	\$68.72	\$78.66	\$88.60	\$98.55
	\$225.00	\$63.64	\$73.58	\$83.52	\$93.47	\$103.41
	\$250.00	\$68.50	\$78.44	\$88.38	\$98.33	\$108.27
	\$275.00	\$73.36	\$83.30	\$93.24	\$103.19	\$113.13
		*Assumes a diet composition of 50:28:22 of alfalfa hay, corn and soybean hull pellets. The price for corn and soybean hull pellets is a composite price. This table is intended merely as a guide. Significant changes in diet formulations should be made only after consulting a qualified nutritionist.				

## Other Considerations

In recent years, technology has enabled the development of numerous corn varieties designed specifically for silage production. By design, these varieties can produce more milk with less tonnage than a grain variety. As a result, it is important for both corn and dairy producers to think in terms of milk per acre as opposed to tons of silage per acre. Although this may complicate matters for some producers, it will likely help others determine the true value of corn silage.

To determine milk production per acre, producers will need some way to convert silage quality and tonnage into a milk yield response. This can be done by using a ration-formulation program, a ration evaluator or some other decision-aid.

One such decision-aid is “**Milk2006CornSilagev.**” This program, available from University of Wisconsin Extension, is a Microsoft Excel spreadsheet that allows producers to enter information regarding silage quality and yield and then returns an estimated milk yield per acre. Using this information, corn or dairy producers can estimate milk value per acre and then determine the value of corn silage.

## Summary

To arrive at an equitable price for corn silage, it is critical for both corn and dairy producers to understand their production costs as well as the value of corn silage alternatives.

If corn silage is sold standing in the field, corn producers can use their input cost plus some rate of return as well as the value of the silage sold as grain minus harvesting costs. If it is to be sold delivered to the dairyman, the total cost of production plus hauling plus some return on investment should be used.

Dairy producers should evaluate corn silage in terms of its production value as well as the value of alternative feedstuffs.

In some years, market conditions may exist that cause the price of the silage to be too high for dairymen or too low for the crop producer. In those situations, the two parties should acknowledge what is occurring and negotiate a price that inflicts minimal financial damage on everyone involved.

## Additional Resources and Websites

University of Georgia – [www.caes.uga.edu](http://www.caes.uga.edu)

University of Florida – [www.ifas.ufl.edu](http://www.ifas.ufl.edu)

Corn Silage Budgets – [www.secattleadvisor.com](http://www.secattleadvisor.com)

University of Wisconsin - <http://www.uwex.edu/ces/crops/uwforage/Silage.htm>



Jeremy Kichler

**Learning** *for* **Life**



# Negotiation Strategies

**Damona G. Doye**

Regents Professor and Extension Economist

**Ross O. Love**

Extension Economist

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Former Extension Assistant

Negotiation: "To confer with another person so as to arrive at a settlement of some matter; also to arrange for or bring about such conferences" (Merriam-Webster Dictionary).

Like it or not, you are a negotiator. Whether in family or business dealings, people reach many decisions through negotiation. You haggle with the cattle buyer for an acceptable price for your steers. You discuss with farm help the wages you are willing to pay them and the quality of work you expect in return. You dicker with the equipment salesman for a new piece of machinery. And you negotiate the terms of your latest operating note with your lender. Negotiation is a fact of life.

Most people know of only two ways to negotiate, either soft or hard. The soft negotiator wants to keep peace and readily makes concessions to avoid or resolve conflicts. The hard negotiator sees conflict as a battle in which the person who takes the most extreme position and holds out fares better. The soft negotiator may end up feeling used and abused; the hard negotiator may exhaust himself and damage or destroy the personal relationship with the other party. Typical strategies for negotiation often leave people dissatisfied, worn out, or hostile and perhaps all three.

The most common form of negotiating—positional bargaining—depends on successive taking and giving up of positions (imagine two people haggling over the price of an item). Although positional bargaining can be successful, it is not necessarily efficient and may not result in a peaceable solution. Negotiators may lock into positions, becoming more committed to the position than to the underlying concerns or original interests of either party. Eventually they may feel that compromise will result in losing face.

Positional bargaining also creates incentives that stall settlement—individuals may take extreme positions, stubbornly hold to them, drag their feet, threaten to walk out, try to deceive the other party, and so on. Rather than jointly attempting to produce an acceptable solution, positional bargaining becomes a battle. Any agreement reached may reflect splitting of differences, rather than careful and creative development of a mutually beneficial solution.

What is the best way for people to deal with their differences? This fact sheet summarizes one possible step-by-step strategy for coming to mutually acceptable agreements in

Oklahoma Cooperative Extension Fact Sheets  
are also available on our website at:  
<http://osufacts.okstate.edu>

conflicts using principled negotiation. This method of negotiation is described in the best-selling book, *Getting to Yes: Negotiating Agreement Without Giving In* by Roger Fisher and William Ury. In general, recommended steps for successful negotiation are:

1. Separate the people from the problem.
2. Focus on interests, not positions.
3. Invent options for mutual gain, that is work together to create options that will satisfy both parties.
4. Insist on using objective criteria for judging a proposed solution.

Whether you are analyzing a stressful situation, planning a negotiation or discussing options, you will want to consider these four points.

## Separating the People from the Problem

Everyone knows how hard it is to deal with a problem without people misunderstanding each other, getting angry or upset and taking things personally. Negotiating resolutions may be easier if you remember the "other side" is a human being with emotions, deeply held values, a different background and viewpoints and is, like you, somewhat unpredictable.

In negotiation, the "people problem" often causes the relationship to become entangled in discussion of the problem. Personality differences may cause conflicts unrelated to a business problem. Dealing with a problem and maintaining a good working relationship need not be conflicting goals. But, the negotiating parties must be committed and psychologically prepared to treat the relationship and problem separately. You can be prepared by anticipating potential "people problems" of three kinds: perception, emotion, and communication. And, remember you have to deal with your own as well as their people problems.

## Perception

Don't confuse your perceptions with reality and don't deduce the other side's intentions from your fears. The farmer who gets a notice from a lender requesting additional financial statements may jump to the conclusion that an adverse decision is imminent. In fact, bank examiners may be requiring the lender to increase loan documentation. The request for additional financial information may have been sent to all bank customers with outstanding loans.

Put yourself in the other party's shoes. Each side in a negotiation may see only the merits of its case and only the faults of the other side. The ability to see the situation as the other side sees it, as difficult as it may be, is one of the most important skills a negotiator can possess. Withhold judgement while you "try on" their views. They probably believe that their views are right as strongly as you believe yours are. Discuss each other's perceptions. For example, in negotiating a new lease agreement for cropland, you might say, "I felt that our previous arrangement for expense and crop sharing was fair. Do you feel the same way?"

Although blame is an easy trap to fall into, don't blame them for your problem, no matter how tempting. Even if blaming is justified, it is usually counterproductive. The other side becomes defensive and will stop listening or begin a counter attack. Give them a stake in the outcome of the negotiation by making sure they participate in the process.

Make your proposals consistent with the other side's values. Often in negotiation, people hold out not because a proposal is unacceptable, but simply because they want to avoid the appearance of backing down. If a proposal can be presented so that it seems a fair outcome, they may accept it.

## Emotion

Feelings may be more important than talk, particularly in a bitter dispute. Recognize and understand emotions, both theirs and yours. Make emotions explicit—talk about them—and acknowledge them as legitimate. Allow the other side to let off steam, if need be. It may make it easier to talk rationally later. Listen quietly without responding to attacks and encourage the speaker to continue until he or she has said everything he/she wants to say. Don't react to emotional outbursts, as it may lead to arguments which hinder negotiations.

## Communication

Without communication, there is no negotiation. Listen actively and acknowledge what is being said. Listening enables you to understand their perception, feel their emotions, and hear what they are trying to say. Ask the other party to spell out exactly what they mean or repeat ideas if they are unclear to you. For instance, if you have wheat pasture and are thinking about leasing it to a stocker operator, the cattleman may ask if you have a receiving program available. You might need to ask him to define a receiving program or list the options (holding, feeding, vaccinating, etc.) he or she considers essential. Active listening improves not only what you hear but what they say.

Talk to the other side—a negotiation is not a debate! Speak about yourself, not about them. Describe a problem in terms of its impact on you rather than in terms of what they did. For example, say "I feel let down" instead of "You broke your word". Speak with purpose and make every word count.

## Focus on Interests, Not Positions

For a wise and fair solution, reconcile interests not positions. Behind opposed positions lie shared and compatible interests as well as conflicting ones. A farmer trying to buy a drill needs it to get in the wheat crop and generate income. The machinery dealer has an investment in the drill and needs

to recover the cost of the equipment, interest on borrowed money, store overhead costs, salaries of salesperson, etc. The farmer and machinery dealer have compatible interests — the farmer would like to have the drill and the machinery dealer would like to sell it. Conflicts may arise when terms of an exchange are discussed.

Each side has multiple interests. The most powerful interests are basic human needs: security, economic well-being, a sense of belonging, recognition, and control over one's life. Identify the interests of all the parties involved in the negotiation. Ask why, and then ask why not? Make a list to sort various interests on each side. It helps to write them down as they occur to you. Make your interests come alive—be specific. Concrete details not only make your interests credible, they also add impact. Do not however imply that the other side's interests are unimportant or illegitimate.

Acknowledge their interests as part of the problem. If you want the other side to appreciate your interests, begin by demonstrating that you appreciate theirs. Do unto others as you would have them do unto you. If you want someone to listen to and understand your reasoning, give your interests and reasoning first and your conclusions or proposals later. Be concrete but flexible. Begin your negotiation with well thought out interests and options, but keep an open mind.

Be hard on the problem, soft on the people. Spend your aggressive energy focusing on the problem, looking forward, not back. Two negotiators, each pushing hard for their interests, often stimulate each other's creativity in developing mutually advantageous solutions.

## Invent Options for Mutual Gain

Skill at inventing options is one of the most useful assets a negotiator can have, but it does not come naturally. Practical negotiation appears to call for practical thinking, not wild ideas. Four obstacles often inhibit consideration of multiple options: premature judgement, searching for a single answer, the assumption of a "fixed pie", and thinking that "solving their problem is their problem". By focusing on a single best answer too early or taking sides, you are likely to short circuit a wiser decision-making process in which you select from a large number of possible answers. How do you get around these obstacles to develop creative options? You need to:

1. Separate the act of inventing options from the act of judging them.
2. Broaden the options on the table rather than look for a single answer.
3. Invent ways of making their decision easy.

## Separate Inventing from Deciding

Separate the creative act from the critical one; in other words, separate the process of thinking up possible decisions from the process of selecting among them. Invent first, decide later. A brainstorming session is the next required step. A brainstorming session with a few friends and colleagues should produce as many ideas as possible to solve the problem at hand.

Although more difficult than brainstorming with your own side, brainstorming with people from the other side can prove extremely valuable. Perhaps the farm landlord and tenant could discuss what they've heard about allocating responsibilities differently, so that both end up better off. To protect

yourself when brainstorming with the other side, distinguish the brainstorming session explicitly from a negotiating session where people state official views and speak on the record.

## Broaden Your Options

Even with the best of intentions, participants in a brainstorming session are likely to operate on the assumption that they are really looking for the one best answer. At this stage however it is good to come up with several options thus providing room within which to negotiate.

Another way to generate multiple options is to examine your problem from the perspective of different professions and disciplines that can offer unique insight into the situation. For example in the farm family/creditor discussions, it may be helpful to seek the advice of trained specialists to act as a third party to provide options for the two parties to consider.

## Look For Mutual Gain

Shared interests may not be immediately obvious, but look for them. Ask yourself: Do we have a shared interest in preserving the relationship? What opportunities lie ahead for cooperation and mutual benefit? What costs would we bear if negotiations broke off? Shared interests should be looked at as opportunities. Stressing your shared interests should make the negotiation smoother and more peaceable. One way to come to a mutually acceptable agreement is to invent several options all equally acceptable to you and ask the other side which one they prefer. You want to know which is preferable, not necessarily what is acceptable. You can then take that option, work with it some more and present additional variations. Thus, you can improve a plan until you can find no more joint gains.

Since success for you in negotiation depends upon the other side's making a decision you want, you should do what you can to make that decision an easy one. Avoid being too impressed with your own case, especially if you neglect the interests of the other side in the process. To overcome the short sightedness that results from looking too narrowly at one's immediate self-interest, put yourself in their shoes. Look for precedents in other negotiations that might shed light on or support your case.

## Using Objective Criteria

Negotiate on the basis of objective criteria. An objective criteria is independent of the will of either side. Suppose for example your lender informs you that your operating note will not be renewed this year. You explain, calmly, as many reasons as you can think of "off the top of your head" why you believe he/she should renew your operating note. What may develop is a contest of wills. Using objective criteria moves the contest away from individual wills and focuses on specific, objective decision-criteria that are mutually agreeable. It helps produce amicable and efficient negotiations.

The first step in developing objective decision criteria is to discuss with the other party possible "fair" standards and procedures. Decide on exactly what objective criteria are mutually acceptable and establish checks to ensure that criteria to satisfy the agreed upon objective is met. Let's say that in the borrower/lender dispute, the mutually agreed upon criteria is a realistic cash flow plan indicating the ability to pay all debt

and expenses when due. The values for expected receipts and expenses should be agreeable to both sides. The more standards of fairness, efficiency or scientific merit you bring to bear on your particular problem the more likely you are to produce a final package that is wise and fair.

Other examples of objective criteria include basing decisions on standards such as market value, precedent, what a court would decide, equal treatment, efficiency, etc. For example, when negotiating the price of a piece of farm land an appraisal often serves as an objective criteria from which the real estate agent and client (potential purchaser) can negotiate an acceptable price.

Objective criteria should apply at least in theory to both sides. You can use the test of reciprocal application to tell whether a proposed criterion is fair and independent of either party's will. For example, if the real estate agent selling you the farm land offers you a standard form contract, you would be wise to ask if that is the same standard they would use if they were buying farm land or property.

Remember, no matter how good you feel about the objective criteria you have come up with you must come to the table with an open mind. Frame each issue as a joint search for objective criteria. To encourage a team approach, ask the other person for their theory or rationale. Reason and be open to reason.

## Summary and Conclusions

The four positions of principled negotiation-separate the people from the problem, focus on interests rather than positions, generate a variety of options before deciding what to do, and base the result on some objective standard-are relevant from the time you begin to think about negotiating until an agreement is reached or you decide to abandon the effort. A negotiation is successful if it is efficient, produces a wise agreement when agreement is possible, and improves or at least does not harm the relationship between the negotiating parties. In contrast to positional bargaining, principled negotiation permits you to work with another person as a team in a search for a solution. And, separating the people from the problem allows you to deal directly and compassionately with other negotiators as human beings.

Building a relationship of trust, understanding, respect and friendship can make later negotiations smoother. Base the relationship on accurate perceptions, clear communication, appropriate emotions, and a forward looking outlook.

Trying to focus on the basic interests of each side, rather than on "winning" or "losing" will likely produce more efficient results. Keeping an open mind yet being well prepared provides an opportunity to invent options which could serve the interests of both sides and speed up the negotiation.

Italicized sections of this OSU Facts were taken from the book "Getting to Yes" by Roger Fisher and William Ury.

### Other Fact Sheets in the Series:

AGEC-194	Taking Charge
AGEC-196	Finding a New Career
AGEC-197	Coping with the Partial Reduction or Loss of the Family Farm
AGEC-208	Evaluating Options for Change
AGEC-213	Farm Family Decision-Making



# **The Oklahoma Cooperative Extension Service**

## **Bringing the University to You!**

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Extension carries out programs in the broad categories of agriculture, natural resources and environment; family and consumer sciences; 4-H and other youth; and community resource development. Extension staff members live and work among the people they serve to help stimulate and educate Americans to plan ahead and cope with their problems.

Some characteristics of the Cooperative Extension system are:

- The federal, state, and local governments cooperatively share in its financial support and program direction.
- It is administered by the land-grant university as designated by the state legislature through an Extension director.
- Extension programs are nonpolitical, objective, and research-based information.
- It provides practical, problem-oriented education for people of all ages. It is designated to take the knowledge of the university to those persons who do not or cannot participate in the formal classroom instruction of the university.
- It utilizes research from university, government, and other sources to help people make their own decisions.
- More than a million volunteers help multiply the impact of the Extension professional staff.
- It dispenses no funds to the public.
- It is not a regulatory agency, but it does inform people of regulations and of their options in meeting them.
- Local programs are developed and carried out in full recognition of national problems and goals.
- The Extension staff educates people through personal contacts, meetings, demonstrations, and the mass media.
- Extension has the built-in flexibility to adjust its programs and subject matter to meet new needs. Activities shift from year to year as citizen groups and Extension workers close to the problems advise changes.

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# Agronomy Advice

<http://corn.agronomy.wisc.edu>

August 2013

Field Crops 28.5 - 104

## Pricing Corn Silage

Joe Lauer and Ryan Sterry, *Corn Agronomist and St. Croix County Agent*

Pricing corn silage is a difficult decision because it often comes at a time when emotions between sellers and buyers are high. The seller has the opportunity to sell a corn field for either silage or grain and incorporate the fertilizer value of the stover back into the field. The buyer has the opportunity to buy a corn field for silage or buy grain from the market and purchase low quality straw (wheat or corn stover aftermath) to formulate rations.

Arriving at a fair price and being able to take into account the markets (grain, straw, milk and silage), fertilizer, harvesting and quality costs is a difficult decision. Somewhere in the middle of the seller and buyer perspectives negotiations should be able to arrive at a fair price. The Sterry et al. spreadsheet (see <http://corn.agronomy.wisc.edu/Season/DSS.aspx>) accounts for both the seller and buyer perspectives to arrive at a fair price for corn silage. This article performs a sensitivity analysis of this spreadsheet.

The assumptions and initial values typical for the market conditions heading into the 2013 harvest are shown on page 2. To produce the sensitivity analysis in Table 1, one input value at a time was changed on the spreadsheet for grain price, milk price, grain yield, starch content, straw price and NDFD. This can lead to somewhat ambiguous conclusions. For example, often the seller receives a lower price than what the buyer must pay for grain, however, in this example the seller and buyer grain prices are held the same. Also, when one quality measure moves in a certain direction (i.e. starch content) other measures (i.e. grain yield or NDFD) are affected as well. In 2013 many corn fields were late late-planted and affected by drought which affects yield, starch content and NDFD.

Grain prices between \$4 and \$7 per bushel affect corn silage price from \$28 to \$51 per Ton wet. Milk price affects the buyer decision much more than the seller. Low grain yields reduce the price of standing corn silage as does lower starch content. Straw price does not affect the seller perspective, but does affect the buyer perspective of a standing corn silage field

**Table 1. Sensitivity analysis of seller and buyer perspectives using the Sterry et al. spreadsheet for calculating the value of standing corn silage (\$/T) with quality adjustments.**

	Wet Basis (65%)		Dry Matter Basis	
	Seller	Buyer	Seller	Buyer
<b>Grain price (\$/bu)</b>				
\$7.00	50	51	143	145
\$6.00	43	45	122	128
* \$5.00	35	39	101	111
\$4.00	28	33	80	94
<b>Milk price (\$/cwt)</b>				
\$24	36	39	103	113
* \$18	35	39	101	111
\$12	35	38	99	108
<b>Grain yield (bu/A)</b>				
175	35	39	99	110
* 150	35	39	101	111
125	35	38	99	108
100	33	36	93	103
75	29	32	83	93
50	23	27	65	76
25	12	17	35	48
<b>Straw price (\$/T)</b>				
\$100	35	42	101	120
* \$75	35	39	101	111
\$50	35	35	101	101
<b>Starch content (%)</b>				
34%	40	43	113	123
* 29%	35	39	101	111
24%	31	34	88	98
<b>NDFD (%)</b>				
68%	36	39	102	112
* 58%	35	39	101	111
48%	35	38	100	109

\* The normal 2013 assumptions used in the spreadsheet example shown on page 2.

because he has the option to buy wheat straw. NDFD had little effect on corn silage price in this spreadsheet. Users of this spreadsheet need to input their own data for the values used in the calculations.



## 2013 Corn Silage Pricing Decision Aid

by Ryan Sterry, Lee Milligan and Joe Lauer (2007, Revised 2013)



Please enter your input values into the shaded cells. Red letters refer to explanations or guidelines at bottom. Use actual costs when possible, or refer to guidelines.

### Yield Information

Grain Yield Bushels/Acre

150

Silage % DM

35%

Corn Silage/Tons Acre (Wet Basis)

Estimated	Actual	*To use estimated yield
19.97		19.97

### Price Perspective

Local Market Price for No.2 Corn at 15.5% moisture as Buyer or Seller

Seller	Buyer
\$5.00	\$5.00 /bushel

Local Market Price per ton for poor quality/low protein forage to Buyer (a)

\$75 /Ton

Average grain loss for harvest before black layer (Bushels/Acre) (b)

14 bu/A

Gross Value of Corn Crop/Acre

\$750

\$918

Gross Value of Corn Crop/Wet Ton

\$46

Gross Value of Corn Crop/Dry Ton

\$131

### Grain Harvest Costs (c)

Combining Cost/Acre

\$50.00

Trucking Cost/Acre = Grain yield (bu/A) x \$/bushel

150 bu/A x \$0.15 \$/bu

\$22.50

Drying Cost/Acre = Grain yield (bu/A) x \$/bushel

150 bu/A x \$0.20 \$/bu

\$30.00

Storage Cost/Acre = Grain yield (bu/A x \$/bu/month x Time (months)

150 bu/A x \$0.02 \$/bu/mo 9 months

\$27.00

Harvest and Storage Loss (d) = Estimated % loss

150 bu/A x 2.50%

\$18.75

Total Harvest Costs/Acre

\$148.25

Value/Acre of Corn Silage to Seller Adjusted for Grain Harvest Costs (Gross Value of Crop - Grain Harvest Expenses)

\$601.75

Value/Wet Ton of Corn Silage to Seller Adjusted for Grain Harvest Costs

\$30.14

### Silage Harvest Costs (e)

Chopping \$/Acre

\$55.00

Hauling \$/Acre

\$15.00

Harvest and Storage Loss (f)

Estimated Concrete tower

13%

Actual (if known) =

13%

\$119.39

Silage Harvest Costs/Acre

\$189.39

### Fertilizer Value of Harvested Stover

Phosphorus Value = Pounds P205/Ton Dry Matter (from pub A2809)

4.6

Tons Stover DM/acre (See estimate to right)

3.55

Price per lb P205

\$0.50

\$8.16

Estimated stov

3.55

Potassium Value = Pounds K20/Ton Dry Matter (from pub A2809)

32

Tons Stover DM/acre (See estimate to right)

3.55

Price per lb K20

\$0.45

\$51.11

Total Stover Value/Acre

\$59.27

Value/Acre of Corn Silage to Seller Adjusted for Grain Harvest Cost and Fertilizer Value of Harvested Stover (Minimum Value to Acc

\$661.02

Value/Acre Corn Silage to Buyer Minus Silage Harvest Costs

\$728.98

Value of Standing Corn/Ton of Silage W/O Quality Adjustment (Wet Basis)

\$33.10

\$36.51

Value of Standing Corn/Ton of Silage W/O Quality Adjustment (DryMatter Basis)

\$94.58

\$104.31

### Quality Adjustments for Silage (g)

Starch Adjustment/ton DM Silage

\$0.00

\$0.00

% Starch (DM basis)

29

29

Local Corn Price/Bushel

\$5.00

\$5.00

NDF Digestibility Adjustment/ton DM Silage

\$6.26

\$6.26

Silage NDFD (48 Hour invitro)

58%

58%

Milk Price/Cwt

\$18.00

\$18.00

Quality Adjustment (per ton DM)

\$6.26

\$6.26

Silage Base Price Estimate (per ton DM)

\$94.58

\$104.31

Value of Standing Corn/Ton of Silage With Quality Adjustment (Wet Basis)

\$35.30

\$38.70

Value of Standing Corn/Ton of Silage With Quality Adjustment (DryMatter Basis)

\$100.85

\$110.57

### Value of Corn Silage Based on Harvest and Storage (Cost Responsibility Between Seller and Buyer).

Please indicate below which costs are the responsibility of the buyer. Silage harvest costs can be changed in lines 35-38.

Buyer Pays For (unchecked means seller assumes cost):

☐ Chopping ☐ Hauling ☐ Storage

Chopping \$/Acre

\$ 55.00

Hauling \$/Acre

\$ 15.00

Harvest and Storage Loss

\$119.39

Silage Harvest Costs/Acre

\$189.39

\$0.00

Harvesting & Storage Costs of Buyer & Seller/Ton of Silage (Dry Matter)

\$27.10

\$0.00

Value of Corn Silage /Ton with All Adjustments (Wet Basis)

\$44.78

\$48.19

Value of Corn Silage/Ton with All Adjustments (Dry Matter)

\$127.95

\$137.67

## VRI and Soil Moisture Sensor Update

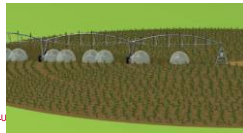
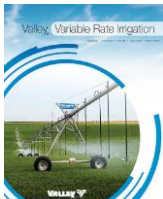
Wesley M. Porter  
Ext. Precision Ag and Irrigation Specialist  
University of Georgia

Corn and Silage Forage Field Day  
June 15, 2017



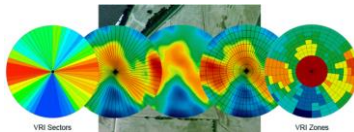
### VRI: Variable Rate Irrigation

- All major pivot manufactures provide VRI:
  - Valley (Valmont), Zimmatic (Lindsay), Reinke
  - Trimble/Valmont, Advanced Ag Systems



### VRI: Zone Development/Site Selection

- <https://ezzone.pythonanywhere.com/>
- Implement widths
- Soil EC
- Soil Type
- Elevation
- Field Size
- Irrigation Tower Length
- Crops produced in field (single or multiple crops)
- Other typical precision agriculture zone development tools



## Variable Rate Irrigation: Wet Areas



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## Variable Rate Irrigation: Overlap



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## Variable Rate Irrigation: Non-Crop Areas



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## Variable Rate Irrigation: Variability




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## Is VRI Relevant to My Operation?

- Your farm's irrigation system could benefit from VRI if your field has:
  - Environmentally sensitive areas under the system coverage area (end gun or nozzles)
  - Different nutrient management zones
  - Non-cropped areas under pivot coverage
  - Varying soil types




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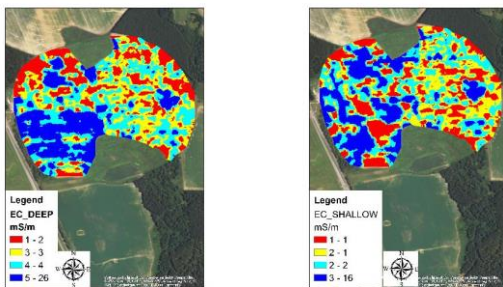
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## Zone Development/Sensor Placement



1-800-ASK

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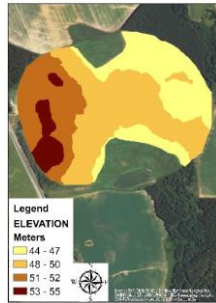
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## Zone Development/Sensor Placement



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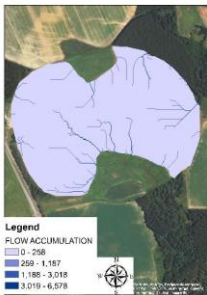
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## Zone Development/Sensor Placement



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## Zone Development/Sensor Placement




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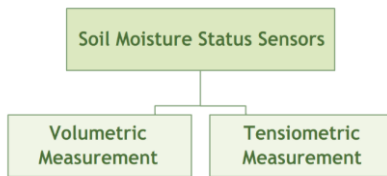
## Soil Moisture Sensor Placement

- The more layers of data that are available the better.
- Local knowledge of the field helps.
- Higher numbers of sensors and more VRI zones will require higher the level of management.
- Higher resolution on a VRI system and more sensors in the field cost more money.



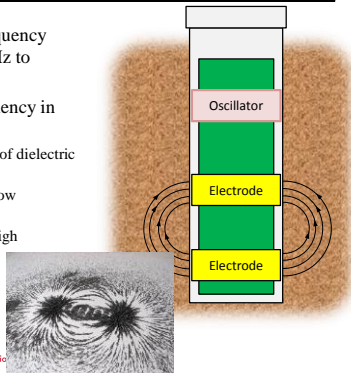
## RSMM

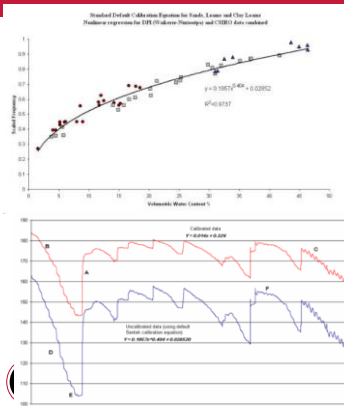
- Remote Soil Moisture Monitoring



## Capacitance Sensors

- Oscillator applies frequency between 50 – 150 MHz to electrodes
- Causes resonant frequency in surrounding soil
  - Frequency is function of dielectric constant
  - High soil moisture = low frequency
  - Low soil moisture = high frequency
- Calibration equation





## Calibration

Proper  
calibration  
required

<http://www.sentek.com.au>

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## Capacitance Sensors

- Adcon
- Dynamax
- AquaCheck
- Sentek
- Aqua Spy
- Etc.
- Decagon



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## Capacitance Sensors

### Advantages

- Accurate after calibration
- Respond quickly
- Wide range (wet to very dry)
- Can be used in high salinity environments
- Many choices on the market

### Disadvantages

- Soil-specific calibration
- Small sensing distance (0.5 to 0.8 inches)
- Cost compared to tensiometric sensors
- Energy requirements



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## Tensiometer

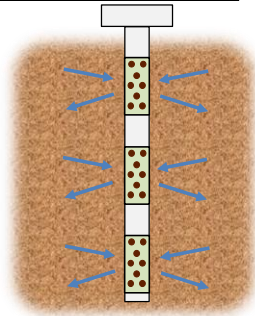
- Plastic tube filled with water.
- Ceramic cup at bottom allows tension in water column to equilibrate with soil water tension
- Water column tension read by gage or pressure sensor
- Requires regular maintenance



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## Granular Matrix Sensors

- Electrodes embedded in granular matrix
- Soil water in soil equilibrates with granular matrix
- Embedded electrodes measure resistance change
  - Wet = low resistance
  - Dry = high resistance



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## Tensiometric Sensors

### Irrrometer

- Watermark
- Tensiometers



### Decagon

- MPS-2 Dielectric Water Potential
- Tensiometers



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## Tensiometric (Granular Matrix) Sensors

### Advantages

- Simple and inexpensive
- Up to 4 inch sensing distance
- Minimal energy requirements

### Disadvantages

- Slower response time
  - Not a factor in irrigation scheduling for agronomic crops
- Less accurate in very wet or very dry soils
- May require temperature compensation



## Data Collection – Telemetry

- Manual
- Bluetooth
- Radio link
- Cell modem
- Satellite uplink



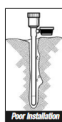
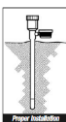
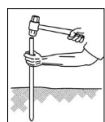
## Problems with RSMM

- Interpretation of sensor data
  - Setting the correct thresholds for each crop
  - Properly weighting sensor depths correctly
- Acquisition of data
  - Manual (infrequent)
  - Telemetry (usually high cost)
- Overall System Cost
- Intensive management required
- Support of systems
  - Installations/Uninstallations
  - Data



## Preparation and Installation

- Tensiometers and Watermarks should be soaked in clean water for approximately 24 hours prior to installation.
- Installation can be completed by a few options:
  - Soil probe or a ½" piece of metal pipe driven into the ground to the proper depth.
  - ½" or greater diameter auger

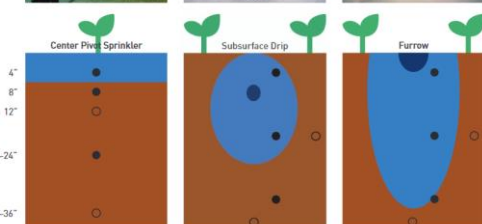


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## Preparation and Installation



## What to Do With the Data



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## What to Do With the Data

- There are a few options of how to proceed with soil moisture data (SWT data):
  - Monitor responses to irrigation and rainfall
  - Determine irrigation trigger levels
  - Variable Rate Irrigation
- How do you determine irrigation trigger levels
  - Soil type
  - Weighted Averages
  - IrrigatorPro



Questions?

## Fertilizing and Liming for High Yields – Corn Silage vs. Corn for Grain

Glen Harris – Extension Agronomist  
University of Georgia (Tifton)

### Corn for Grain

In recent years, Georgia growers producing corn for grain have been striving for higher and higher yields and now commonly aim for a 300 bu/a yield goal. The “default” yield goal for irrigated corn for grain, according to the University of Georgia “Soil Test Handbook for Georgia” is 150 bu/a. **[Note: UGA fertilizer recommendations for all crops can be found in this handbook located on the UGA “Agricultural and Environmental Services Laboratories” website at [aesl.ces.uga.edu](http://aesl.ces.uga.edu)].** The amount of N required is based on 1.2 lb N/bu yield goal and phosphorous(P) and potassium(K) recommendations vary depending on soil test levels. For example, if soil test results are medium for P&K according to UGA (using Mehlich 1 extractant) then the total N-P-K recommended would be 180-90-90 (lb N-P<sub>2</sub>O<sub>5</sub>-K<sub>2</sub>O/a).

If a grower wants to shoot for higher grain yields than 150 bu/a, UGA has always had the system in place to simply increase N-P-K by 12-6-10 (lbs/a) for every 10 bu above 150 bu/a. For example, for a soil test with P&K in the medium ranges, then you would apply 240-120-140 for 200 bu/a yield goal. This obviously does not guarantee you will make 200 bu/a just because you fertilized for 200 bu/a. There are a number of other “limiting factors” (plant population, spacing, weed control, disease etc.) that could reduce yield below your yield goal even though you have enough fertilizer to make your yield goal. Also, how well the fertilizer applied performs also has to do with timing, source and placement in addition to rate, otherwise known as the “4 R’s of Fertilization”.

A summary of the UGA fertilizer recommendations for corn for grain by yield goal are summarized for three P&K combinations in the table below (note that not all combinations are in the table, for example for Low P/ Medium K, but these could be deduced from the table.

### **How Much Fertilizer Do I Need for 300 Bushel Corn ?**

Soil Test Handbook of Georgia ([aesl.ces.uga.edu](http://aesl.ces.uga.edu))

Base (Irrigated) Yield Goal = 150 bu/a

For every 10 bushel increase → add 12-6-10

Soil Test P/K	Yield Goal (bu/a)			
	150	200	250	300
Low/Low	180-110-130	240-140-180	300-170-230	360-200-280
Med/Med	180-90-90	240-120-140	300-150-190	360-180-240
High/High	180-70-70	240-100-120	300-130-170	360-160-220

4Rs = Rate, Timing, Source and Placement

## Corn for Silage

So what about a Georgia grower that want to produce high yielding corn silage? The “default” yield goal for irrigated corn silage appears to be 29 tons/a (dryland would be 22 to/a). Yield goals are actually not listed in the “Soil Test Handbook for Georgia”. The base yield goal found in the soil test handbook of Georgia is for 20 ton/a and assumes dryland production. The base N-P-K recommendation for 20 ton/a silage for a medium P&K testing soil is 150-60-120 (lbs/a N-P2O5-K2O). According to the handbook, “if irrigated, increase the fertilizer rates by 30 %”. This would make the recommendation around 195-80-155. And in fact, to help verify this, if you use the computer program called “UGFertex” that can also be found on the [aesl.ces.uga.edu](http://aesl.ces.uga.edu) website, the default value for yield goals for agronomic crops automatically pops up as 29 ton/a. The recommendation for irrigated corn silage with a 29 ton/a yield goal is 195-80-150. Interestingly, this is about the same recommendation for N & P for 150 bu/a corn for grain, but the K recommendation is more similar to 200 bu/a corn for grain.

## Using Animal Waste (Dairy Lagoon) as Fertilizer

Many producers of corn silage also have animal waste available to “supplement” their fertilizer recommendation. The only way to economically and environmentally safely utilize this animal waste as a resource is to soil test and have the manure analyzed. The default values used in UGFertex for dairy lagoon waste are 20-15-25. If you use the example again for a soil testing medium for P&K and with a corn silage yield goal of 29 ton/a (assumes irrigation) the recommendation would be for 10,000 gal/a to meet the fertilizer needs. Note that this is what we called a “N-Based” system and will oversupply P&K by 67 and 95 lb p2O5 and K2O, respectively. A better way to utilize the manure would be what we call a “P-Based” system where you use the manure to provide the recommended P and then supplement with commercial fertilizer for additional N and K if needed. To illustrate how differences in manure N-P-K content can change the fertilizer recommendation, instead of using the default values in UGFertex, if we use the “textbook” values for “Dairy Lagoon” effluent as found in the UGA Extension publications titled “Developing a Nutrient Management Plan for the Dairy farm” (April 1996) of 45-26-55 (lbs N-P2O5-K2O per 1000 gallons)...these values can be entered into UGFertex and then you get a recommendation of around 6000 gal/a. Again this is a “N-based” recommendation, but now since the nutrient content of the manure was different, now there is a surplus of 40 and 164 lbs/a of p2O5 and K2O respectively.



Soil Test Rating	Potassium			
	Low K	Medium K	High K	Very High K
	Coast: 0-60 lbs/A Pied: 0-100 lbs/A	Coast: 61-150 lbs/A Pied: 101-200 lbs/A	Coast: 151-250 lbs/A Pied: 201-350 lbs/A	Coast: 250+ lbs/A Pied: 350+ lbs/A
Phosphorus	Recommended Pounds $N-P_2O_5-K_2O$ per Acre			
<b>Low P</b> Coast: 0-30 lbs/A Pied: 0-20 lbs/A	150-80-160	150-80-120	150-80-90	150-80-80
<b>Medium P</b> Coast: 31-60 lbs/A Pied: 21-40 lbs/A	150-60-160	150-60-120	150-60-90	150-60-80
<b>High P</b> Coast: 61-100 lbs/A Pied: 41-75 lbs/A	150-40-160	150-40-120	150-40-90	150-40-80
<b>Very High P</b> Coast: 100+ lbs/A Pied: 75+ lbs/A	150-0-160	150-0-120	150-0-90	150-0-80

Coast = Coastal Plain Pied = Piedmont, Mountain, and Limestone Valley

### Recommendations:

Recommended pH:	6.0. If the pH is less than 6.0, see Lime Table C.		
Nitrogen:	150 pounds nitrogen (N) per acre		
Magnesium:	If soil test Mg level is low and lime is recommended, use dolomitic limestone; if soil test Mg is low and lime is not recommended, apply 25 pounds of Mg/Acre.		
	Coastal Plain	Low: 0 - 30 lbs/acre	Medium: 31 - 60 lbs/acre
	Piedmont	Low: 0 - 60 lbs/acre	Medium: 61 - 120 lbs/acre
			High: >60 lbs/acre
			High: >120 lbs/acre
Zinc:	If the Zn soil test level is low, apply 3 pounds of zinc per acre.		
Other:	See sulfur (S) recommendations below.		

### Fact Sheet:

If irrigated, increase the fertilizer rates by 30%. Split the nitrogen (N) applications, applying one-fourth to one-third prior to or at planting and the remainder when the crop is 18 to 24 inches high.

Reduce the nitrogen rate by 20 to 40 pounds per acre following peanuts and soybeans, and by 80 to 100 pounds per acre following alfalfa or a legume winter cover crop that is allowed to bloom.

The applied fertilizer should contain sufficient sulfur (S) to supply 10 pounds sulfur per acre. Since sulfur is highly leachable, especially on deep sands, application of sulfur with post plant nitrogen applications may improve efficiency.





UGFertex can be found at  
aesl.ces.uga.edu

## UGFertex-Based Nutrient Application Guidelines

Client: <b>High Yield Joe</b>	Field ID: <b>Back 40</b>
County: <b>Tift</b>	Date: <b>6/12/2017</b>
Soil Group: <b>Coastal Plain</b>	Plow Depth: <b>8 inches</b>
Crop: <b>Corn and Sorghum Silage</b>	Previous Crop: <b>Unknown</b>
Yield Goal: <b>29 tons</b>	Irrigated: <b>Yes</b>

### Results

Very High					<div><div></div><div></div><div></div><div></div><div></div></div> High				
High					<div><div></div><div></div><div></div><div></div><div></div></div> Sufficient				
Medium					<div><div></div><div></div><div></div><div></div><div></div></div> Low				
Low					<div><div></div><div></div><div></div><div></div><div></div></div>				
	Phosphorus	Potassium	Calcium	Magnesium	Zinc	Manganese	Soil pH	Lime Buffer Capacity	
Soil Test Index	50 lbs/Acre	150 lbs/Acre	800 lbs/Acre	50 lbs/Acre	5 lbs/Acre	15 lbs/Acre	6.5	250	Soil Test Index
Buildup:	Soil P: 0	P <sub>2</sub> O <sub>5</sub> Required: 0 lbs/a/year		Years Required			Starter:	N: 0	
	Soil K: 0	K <sub>2</sub> O Required: 0 lbs/a/year		For Buildup: 1				P <sub>2</sub> O <sub>5</sub> : 0	

### Lime and Nutrient Guidelines

Limestone	Nitrogen (N)	Phosphate (P <sub>2</sub> O <sub>5</sub> )	Potash (K <sub>2</sub> O)	Calcium (Ca)	Magnesium (Mg)	Sulfur (S)	Boron (B)	Manganese (Mn)	Zinc (Zn)
<b>0</b> tons/Acre	<b>195</b> lbs/Acre	<b>80</b> lbs/Acre	<b>150</b> lbs/Acre	<b>0</b> lbs/Acre	<b>0</b> lbs/Acre	<b>10</b> lbs/Acre	<b>0</b> lbs/Acre	<b>0</b> lbs/Acre	<b>0</b> lbs/Acre

### Comments

Split the nitrogen (N) applications, applying 1/4 to 1/3 prior to or at planting and the remainder when the crop is 18 to 24 inches tall.

When sulfur (S) is recommended, apply it with the sidedress nitrogen application.

### Learning for Life

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Using manure content of  
20-15-25  
(default values in UGFertex)

## UGFertex-Based Nutrient Application Guidelines

Client: High Yield Joe	Field ID: Back 40
County: Tift	Date: 6/12/2017
Soil Group: Coastal Plain	Plow Depth: 8 inches
Crop: Corn and Sorghum Silage	Previous Crop: Unknown
Yield Goal: 29 tons	Irrigated: Yes

### Results

Very High								
High								
Medium								
Low								
	Phosphorus	Potassium	Calcium	Magnesium	Zinc	Manganese	Soil pH	Lime Buffer Capacity
Soil Test Index	50 lbs/Acre	150 lbs/Acre	800 lbs/Acre	50 lbs/Acre	5 lbs/Acre	15 lbs/Acre	6.5	250
Buildup:	Soil P: 0	P <sub>2</sub> O <sub>5</sub> Required: 0 lbs/a/year	Years Required		Starter:		N: 0	
	Soil K: 0	K <sub>2</sub> O Required: 0 lbs/a/year	For Buildup: 1				P <sub>2</sub> O <sub>5</sub> : 0	

### Lime and Nutrient Needs and Guidelines

Limestone	Nitrogen (N)	Phosphate (P <sub>2</sub> O <sub>5</sub> )	Potash (K <sub>2</sub> O)	Calcium (Ca)	Magnesium (Mg)	Sulfur (S)	Boron (B)	Manganese (Mn)	Zinc (Zn)
0	195	80	150	0	0	10	0	0	0
tons/Acre	lbs/Acre	lbs/Acre	lbs/Acre	lbs/Acre	lbs/Acre	lbs/Acre	lbs/Acre	lbs/Acre	lbs/Acre

### Manure Guidelines

Residual Credits lbs N/Acre	Manure Rate thousand gal/Acre	Nutrients Supplied			Nutrient surplus(+) or deficit(-) from manure.		
		N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	Deficit can be met with commercial fertilizer.		
0	9.8	196	147	245	N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
Method of Application: Broadcast - immediate incorporation.					+1	+67	+95
Dairy - Slurry Ammonium Factor: 95%					lbs/Acre	lbs/Acre	lbs/Acre

### Comments

If the recommended amount of N is not supplied by the manure, use a commercial source of N and apply the remainder as a sidedress application when the plants are 18-24 inches tall.

When S is recommended, apply it with the sidedress nitrogen application.

Avoid spreading manure near streams, wells, ponds, or environmentally sensitive areas.

Use conservation practices which minimize runoff and erosion. Calibrate application equipment

### Learning for Life

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Using manure content of  
45-26-55  
(From "Developing A Nutrient Management  
Application Guidelines Plan for the Dairy Farm")

## UGFertex-Based Nutrient Application Guidelines

## Results



## Manure Guidelines

## Comments

If the recommended amount of N is not supplied by the manure, use a commercial source of N and apply the remainder as a sidedress application when the plants are 18-24 inches tall.

When S is recommended, apply it with the sidedress nitrogen application.

Avoid spreading manure near streams, wells, ponds, or environmentally sensitive areas.

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## **Advancements in corn silage processing**

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### **Introduction**

Whole-plant corn silage (**WPCS**) is the predominant forage used in dairy cattle diets worldwide. On average, 116 million tons of fresh corn forage per year were harvested in the United States over the last decade. High quality WPCS contributes greatly to supplying the energy, starch and forage NDF needs of high-producing dairy cows, reducing purchased feed costs from expensive grain and byproduct supplements, and generating milk revenues for dairy producers throughout the world. The purpose of this paper is to review selected recent developments and strategies that may influence the nutritive value of WPCS; particularly through the enhancement of kernel breakage.

### **Kernel processing and theoretical length of cut**

The energy value of WPCS contributed by starch is approximately 50% (calculated from NRC, 2001). An increase in starch digestion may lead to better nutrient utilization and decreased feed costs. However, starch digestibility of WPCS may be affected by several factors. First, corn is a seed and has a hard coat, the pericarp, which surrounds and protects the embryo and the starch endosperm from external threats. If intact, the pericarp is highly resistant to microbial attachment (McAllister et al., 1994); therefore, the breakdown of the pericarp and correspondent exposure of the starch endosperm must be the primary objective at harvest to maximize energy availability.

It is well established that the use of kernel processors enhances kernel breakdown at harvest. Ferraretto and Shaver (2012b), from a meta-analysis of WPCS trials with lactating dairy cows, reported greater total tract starch digestibility (**TTSD**) when WPCS was processed using 1 to 3 mm (0.04 to 0.12 inches) roll gap settings compared with 4 to 8 mm (0.16 to 0.31 inches) processed and unprocessed WPCS. This is related to increased surface area for bacterial and enzymatic digestion of finer particles (Huntington, 1997).

Degree of kernel processing in WPCS, however, may be inhibited by other factors. Length of cut settings is one of these factors. Processing increased diet TTSD when theoretical length of cut (**TLOC**) was set at 0.93 - 2.86 cm (0.37 to 1.13 inches) but not when length of cut was shorter or longer (Ferraretto and Shaver, 2012b). This is likely related to greater kernel breakage by cutting knives when using short TLOC settings (Johnson et al., 1999) or inhibition of kernel breakage during passage through the rollers by the stover portion at the longer TLOC. No overall effect of TLOC on TTSD was observed (Ferraretto and Shaver, 2012b) suggesting that the combined effects of TLOC and kernel processing is more important than TLOC alone with regard to TTSD.

Delayed WPCS harvest may increase concentration of starch while reducing concentrations of CP, NDF and ash. Thus, it was suggested as tool to enhance starch and DM yield per acre. However, maturity at harvest may also influence the breakdown of kernels. Kernel vitreous endosperm proportion increases with increased DM content of WPCS (Phillipeau and Michalet-Doureau, 1997) and thereby kernel hardness which in turn causes kernels in very dry WPCS to be less susceptible to breakage during kernel processing at harvest. This explains why processing increased TTSD for diets containing WPCS with 32% to 40% DM at feed-out, but not when WPCS was above 40% DM in the review by Ferraretto and Shaver (2012b; Figure 1).

Other factors, such as proper processor maintenance from wear, frequent quality-control monitoring of kernel breakage during harvest, and adequate TLOC and roll-gap settings for the chopper and processor used are also crucial for obtaining optimal kernel processing.

Kernel processing also affects physical characteristics of the stover portion of WPCS. Processed WPCS contains less whole cob and coarse fiber fractions as a percentage of total mass (Shinners et al., 2000), and perhaps corn stover tissue is sufficiently damaged by processing to increase ruminal fiber degradation (Johnson et al., 1999; Bal et al., 2000). However, kernel processing WPCS did not affect dietary NDF digestibility in the meta-analysis by Ferraretto and Shaver (2012b). These authors discussed that perhaps improvements in NDF digestibility may have been attenuated by the negative impact of greater ruminal starch digestion on fiber degradation (Russell and Wilson, 1996). Alternatively, processed WPCS may have decreased particle size and thereby insufficient ruminal retention time to allow for increased NDF digestibility (Allen, 1997). Particle size of WPCS may be reduced by up to 40% with the use of a

kernel processor at equal TLOC settings (Shinners et al., 2000). At equal TLOC settings, processing reduced the percentage of particles retained above the 19 mm sieve of the Penn State Particle Separator by 20%, on average, across multiple studies. Similarly, digestibility of NDF was not altered by TLOC (Ferraretto and Shaver, 2012b). Greater ruminal pH and retention time is often reported for long particles (Allen, 1997) which could enhance NDF digestibility. In contrast, increased surface area for bacterial attachment when WPCS is comprised of short particles may also increase NDF digestibility (Johnson et al., 1999). Perhaps these factors may have compensated for possible effects when WPCS was harvested with varied TLOC settings.

### **Maturity at harvest**

Although the breakdown of kernels with a corresponding exposure of starch endosperm for digestion is the primary limiting factor on starch digestibility in WPCS, even the exposed endosperm is not fully digested due to existence of a starch-protein matrix formed by the chemical bonds of zein proteins with starch granules (Kotarski et al., 1992). Reduced TTSD observed in diets containing WPCS above 40% DM in the meta-analysis review by Ferraretto and Shaver (2012b) may be related to an increase in the proportion of vitreous endosperm in the kernel associated with greater maturity (Correa et al., 2002; Ngonyamo-Majee et al., 2009). Alternatively, a reduction in the extent of fermentation for drier WPCS (Der Bedrosian et al., 2012) may attenuate proteolysis of zein proteins during fermentation (Hoffman et al., 2011).

Likewise, digestibility of NDF in WPCS is limited primarily by the cross-linking of lignin to other fibrous components (Jung et al., 2012). As maturity progresses, lignin content in WPCS increases (Cone and Engels, 1993). Therefore, increased maturity at harvest may limit not only starch, but also NDF, digestibility of WPCS. Interestingly, however, Ferraretto and Shaver (2012b) reported greater NDF digestibility when WPCS was harvested above 40% DM in a meta-analysis. This was thought to be related to negative effects of greater starch digestibility in the rumen on NDF digestibility (Russell and Wilson, 1996). However, this is in contrast to the commonly reported ruminal in situ NDF digestibility reduction with very dry corn silage (Bal et al., 2000).

### **Corn Shredlage**

Corn shredlage is harvested with a commercially available self-propelled forage harvester (SPFH) fitted with after-market cross-grooved crop-processing rolls set for 2- to 3-mm roll gap and greater roll speed differential than has typically been used (32% versus 21%). Also, the

developer of this processor recommends that the SPFH be set for a longer theoretical length of cut (**TLOC**; 26 to 30 mm / 1.02 to 1.18 inches) than has typically been used in the past (19 mm / 0.75 inches TLOC). Most SPFH manufacturers recommend against removing knives when harvesting WPCS, because of added stress and wear on SPFH components like the cutter-head, processor and blower. Therefore, in practice a 26 mm TLOC (1.02 inches) setting is most common for corn shredlage so that knife removal is not required.

Compared to conventional-processed WPCS the most obvious visual difference for SHRD is the greater proportion of long stover particles in SHRD (Table 1). In addition, this new method allowed WPCS to be harvested at a longer TLOC while still maintaining or improving the degree of kernel processing (Table 1).

Two published studies (Ferraretto and Shaver, 2012a; Vanderwerff et al., 2015 from University of Wisconsin evaluated this new processing method. In summary, greater lactation performance was observed for corn shredlage compared with conventional-processed corn silage either when using a conventional or a BMR corn hybrid. Furthermore, feeding corn shredlage increased total tract starch digestibility in both trials and may be a potential tool for dairy producers and their nutritionists desiring to feed higher corn silage diets without compromising kernel breakage and energy availability for WPCS chopped at a greater length of cut. However, despite a longer length of cut setting on the SPFH and increased particle size for corn shredlage relative to conventional-processed corn silage, milk fat content and rumination activity were not increased. Further research is warranted to evaluate ruminal fermentation patterns and in vivo digestion kinetics to better understand the impact of adding corn shredlage in diets for high-producing dairy cows. In addition, more data is needed regarding NDF digestibility for corn shredlage and the relative peNDF for corn shredlage compared to hay-crop silage, whole cottonseed, and chopped hay or straw, to allow for better decisions on how best to utilize corn shredlage in dairy cattle diets. Assessment of particle size of corn shredlage as an indicator of peNDF and CSPA as an indicator of starch digestibility is essential to determine the best ration formulation strategies.

It is always important to remember, however, that optimal kernel processing can be achieved regardless of the type of chopper or processor used. But it requires constant monitoring of silage physical characteristics throughout harvesting. Thus, benefits of using shredlage processors may not be as pronounced in the field compared with the reviewed feeding trials.



## **Economic impact**

Although benefits of greater kernel processing on milk production is well known, it is very difficult to reliably estimate its economic impact. The exercise presented and discussed in this article is an attempt to provide some numbers to dairy producers and their nutritionists as a starting point. In order to do that, however, a hypothetical scenario had to be created and three values of corn silage processing score (CSPS; % of starch passing through a 4.75-mm sieve), the most used laboratory procedure to estimate kernel breakage, arbitrarily chosen. Table 2 has CSPS values chosen, and predicted fecal starch and total tract starch digestibility (TTSD) values.

The second step (Table 3) was to estimate for each CSPS the amount of corn that would need to be supplemented in order to obtain the same amount of digestible starch as if TTSD was 100%. The following assumptions were made: dietary starch was 25% of DM and consumption of DM was 55 lbs/d. Consequently, it was assumed that cows were eating 13.75 lbs of starch per day. Based on TTSD, values of starch loss in the manure was calculated and ranged from approximately 0.15 to 1.5 lbs. If we assume that corn grain has 70% starch and 70% ruminal in vitro starch digestibility, for each lb of corn supplemented only 0.49 lbs of digestible starch is provided. Thus, by dividing starch loss by 0.49 we reached the amount of corn necessary to fulfill for undigested starch. Last, US\$132.10/ton (approximately US\$0.066/lb) was used to calculate corn grain costs.

Although numbers used in this exercise may not be representative of the entire American dairy industry, it is a good indication of potential economic loss related to poor kernel processing. Thus, it is recommended that dairy farmers and their nutritionists perform similar calculations based on their own scenarios and goals.

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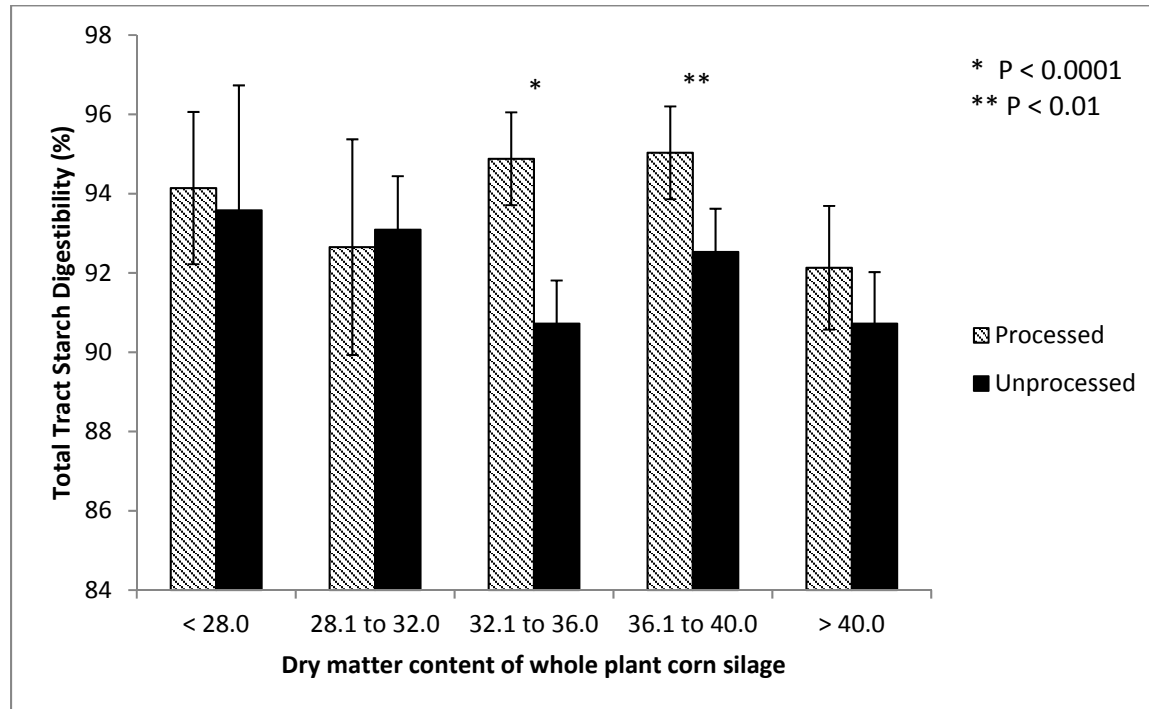


Figure 1. Effect of kernel processing and dry matter content of whole plant corn silage on total tract digestibility of diet starch. Source: Ferraretto and Shaver (2012b).

Table 1. Effects of shredlage processor on whole-plant corn silage particle size and corn silage processing score

Item	<u>Ferraretto and Shaver, 2012b</u>		<u>Vanderwerff et al., 2015</u>	
	Conventional	Shredlage	Conventional	Shredlage
<u>Corn Silage Processing Score</u>				
Starch passing 4750µm sieve, %	60.3 ± 1.9	75.0 ± 1.9	67.6 ± 6.5	72.4 ± 3.6
<u>Particle Size, % of as fed retained</u>				
19.0 mm	5.6 ± 2.0	31.5 ± 5.7	7.1 ± 2.8	18.3 ± 6.4
8.0 mm	75.6 ± 2.6	41.5 ± 3.9	68.1 ± 3.5	54.5 ± 4.4
1.18 mm	18.4 ± 1.6	26.2 ± 2.0	22.3 ± 3.5	24.8 ± 3.2

Table 2. Effect of corn silage processing score (CSPS) on fecal starch and total tract starch digestibility (TTSD)

<u>CSPS, % of starch passing through 4.75-mm sieve</u>	30	55	80
Fecal starch <sup>1</sup> , %	8.40	4.65	0.90
TTSD <sup>2</sup> , % of starch	89.5	94.2	98.9

<sup>1</sup>Predicted from equation of Braman and Kurtz (2015); fecal starch = 12.9 – (0.15 x CSPS).

<sup>2</sup>Predicted from equation of Fredin et al. (2014); TTSD = 100 – (1.25 x fecal starch).

Table 3. Economic estimates of corn supplemented to fulfill undigested starch.

<u>CSPS, % of starch passing through 4.75-mm sieve</u>	30	55	80
Starch intake <sup>1</sup> , lbs/cow/d	13.75	13.75	13.75
Starch loss <sup>2</sup> , lbs/cow/d	1.45	0.80	0.15
Corn grain supplementation <sup>3</sup> , lbs/cow/d	2.96	1.63	0.31
Corn grain cost <sup>4</sup> , US\$/cow/d	0.20	0.11	0.02

<sup>1</sup>Starch intake = (55 lbs DMI x 25% starch) / 100

<sup>2</sup>Starch loss = starch intake – ((starch intake x TTSD) / 100)

<sup>3</sup>Corn grain supplementation = starch loss / 0.49

<sup>4</sup>Corn grain cost = corn grain supplementation x 0.066. Corn grain cost obtained from values reported by FeedVal 2012 on May, 2017.