IMPROVING PROTOCOL COMPLIANCE WITH ESTRUS SYNCHRONIZATION PLANNER TOOLS

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Introduction

Lack of time and labor was the most common reason producers cited for not using various reproductive technologies according to the 2007-08 National Animal Health Monitoring Survey. Another survey of artificial insemination (AI) users by the authors found that "time" was the most common answer when asked "what has limited the success of your AI program?" These responses point to the importance of planning well in advance of the breeding season to avoid missteps in an AI program. More time planning can help avoid the last minute special trip to town for a needed item or the realization that the breeding season will arrive before the cows achieve the desired body condition. A successful AI program is the result of good year round management, cows in adequate body condition and a positive energy balance prior to breeding, no disease or nutrition issues suppressing response and all details of the estrus synchronization and AI program being well thought out and executed. Indeed in a survey of AI users, attention to detail was one of the top three themes of producer comments when asked what made their AI program work; 14% of respondents mentioned attention to detail. Nutrition and heat detection received the most mentions by 17% of producers each.

Implementation of protocols that synchronize estrus and allow for fixed-timed AI require more precision than beef producers may be accustomed. Label directions for vaccinations might say 'repeat in two to four weeks and annually thereafter', considerable room to move the actual administration date around a few days to account for expected weather challenges, breakdowns or other issues that might come along. Synchronization protocols have much less flexibility.

In 1998, an Excel-based planning tool was developed by Daryl Strohbehn, extension beef specialist from Iowa State University, now retired, known as the Estrus Synchronization Planner. The planner helps producers successfully implement synchronization programs by guiding users to appropriate protocols and based on user inputs, translates selections into dates and times on a calendar. If used in a timely manner, it can help avoid the all too common issue of 'time getting away from us', limiting protocol selection. How far in advance of breeding this needs to occur will vary considerably with each operation, however, first time AI users should probably start this planning process at weaning for raised replacement heifers and well before calving starts for the mature cow herd.

Based on responses of users to a 2013 survey (Johnson and Dahlke, 2015) the Estrus Synchronization Planner has been successful in helping producers with their AI programs. Producers moderately to strongly agreed that the planner made scheduling easier (93%, 140/150), reduced errors in implementing protocols (88%, 123/140), improved communication with those involved with the breeding project (88%, 123/140), and helped to find the most cost effective protocol for their situation (86%, 121/140).

History and background of the Estrus Synchronization Planner

The planner was developed during an era of rapidly increasing knowledge on control of follicular growth and the incorporation of that knowledge into synchronization systems. The original planner had six basic synchronization systems and was available free upon request via e-mail or CD. Additional systems and program refinements were made when Mark Dikeman and later Garland Dahlke joined the Iowa Beef Center. It was available for free download on the web from about 2001 to 2004.

Around this same time a group of extension reproductive physiologists were working on ways to coordinate their efforts to reduce confusion over the wide number of protocols that were being used and to direct producers to protocols supported by valid research. This group became the Beef Reproduction Task Force and teamed with a broader industry group (Beef Reproduction Leadership Team) to improve communication regarding synchronization systems and success when implemented. These protocols can be found in the catalogs of the major AI studs and at www.BeefRepro.info. Extensive research and field trial data support the use of these protocols as described. The recommendations are updated annually to incorporate the most recent research. For a majority of producers, selecting a protocol from this list should improve the chances of a good response. Other protocols may work, but often involve additional steps and costs with no improvement in response.

Efforts to update the Estrus Synchronization Planner to reflect recommendations from the Beef Reproduction Task Force took place in 2004. This significantly revised version with extensive support material was available for $25 and met goals from the Iowa State system to generate cost recovery funds. Yearly updates were made to the program and cost remained the same until 2011 at which time sufficient industry support had been developed to offer the program for free download on the web. Use of the planner increased significantly with this change. The planner guides users to appropriate protocols and based on user inputs, translates selections into dates and times on a calendar.

Program Basics

To use the Estrus Synchronization Planner you will need a copy of MS Excel or Open Office. The planner can be downloaded at no charge from the Iowa Beef Center at http://www.iowabeefcenter.org/estrus_synch.html . This page also contains additional reference materials related to synchronization of estrus and AI. You will also find tips for downloading and saving your copy of the Estrus Synchronization Planner in two forms; printed document or video. A video on use of the planner is also available. Before you download the spreadsheet it will ask for your contact information. This is very important as we will contact you by e-mail when updates are made to the planner, generally on an annual basis. The current version is Synch 15.7 released in July of 2015. Every attempt is made to have the program free from bugs before release. However 2015 has resulted in some frustrations going back to planned improvements that were eventually shelved because of lack of compatibility of features across versions of Excel. If you get an error message or unexpected value, check your version against what is listed at the website and if the error occurs in the current issue please contact us.

After registering and submitting the registration form, select the download link (Figure 1). A pop-up will then appear which allows you to open or save the file. Select “Open” followed

by the "OK" button. Screens may vary slightly from those shown here based on browser and software versions.

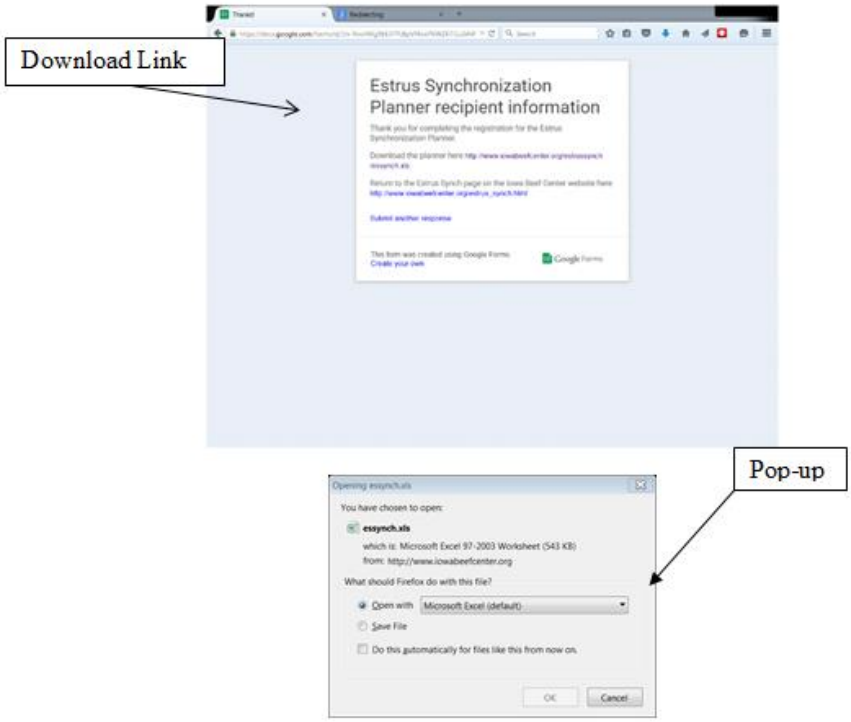


Figure 1. Downloading and opening the Estrus Synchronization Planner

After opening essynch.xls, you will see the Estrus Synchronization Planner program appear on your screen (Figure 2). This program will open in a compatibility mode which will allow it to run in either old or new versions of Excel. In some cases you may need to use the maximize button within the worksheet to see all the navigation tabs at the bottom of the program. The zoom features of Excel in the lower right hand portion of the screen can also be used to modify the size and amount of text shown on the screen.

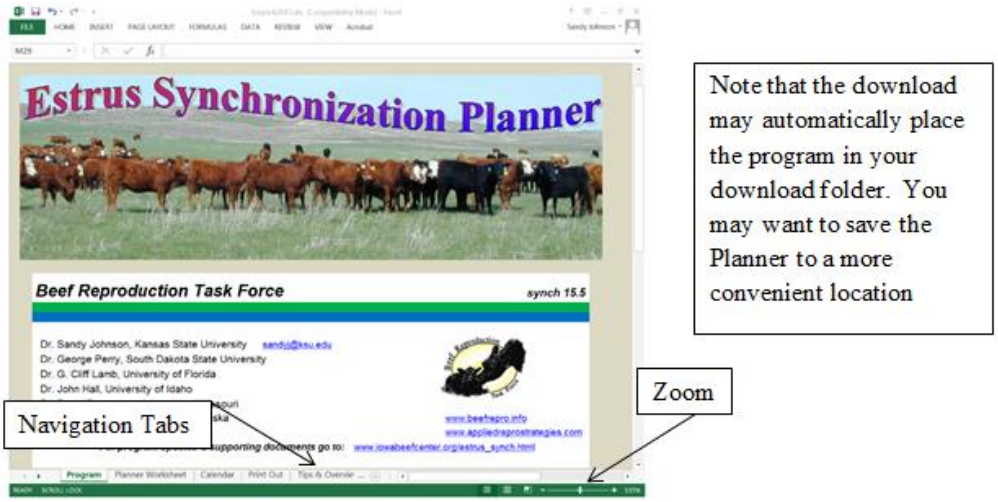


Figure 2. Opening screen and basic navigation

Saving - The Estrus Synchronization Planner is a formatted Excel sheet that should be saved to your computer after downloading and opening the program. Once saved to your computer you will not need to go to the download site to operate. Save the program in the desired folder on your computer (FILE- SAVE AS). You may wish to rename "*Essynch2015*" or rename the sheet after the protocol that you have just set up. For those that provide AI service to others, the program can be further customized by adding your name and contact information on the top right hand side of the *Planner Worksheet*. Saving after this addition will avoid the need to re-enter each time you use the program. To save the program follow the normal save routine as you would for any spreadsheet developed with your version of Excel.

Create a shortcut - To create and save a shortcut for this program on your desktop 'right-click' while the *Essynch2015.xls* file that you have downloaded is highlighted in File Explorer view and a menu will appear (Figure 3). Select 'Create Shortcut' from this menu and you will see a new icon appear that will be labeled as a shortcut. Drag this new icon on to your Desktop or where ever you would like to place the shortcut.

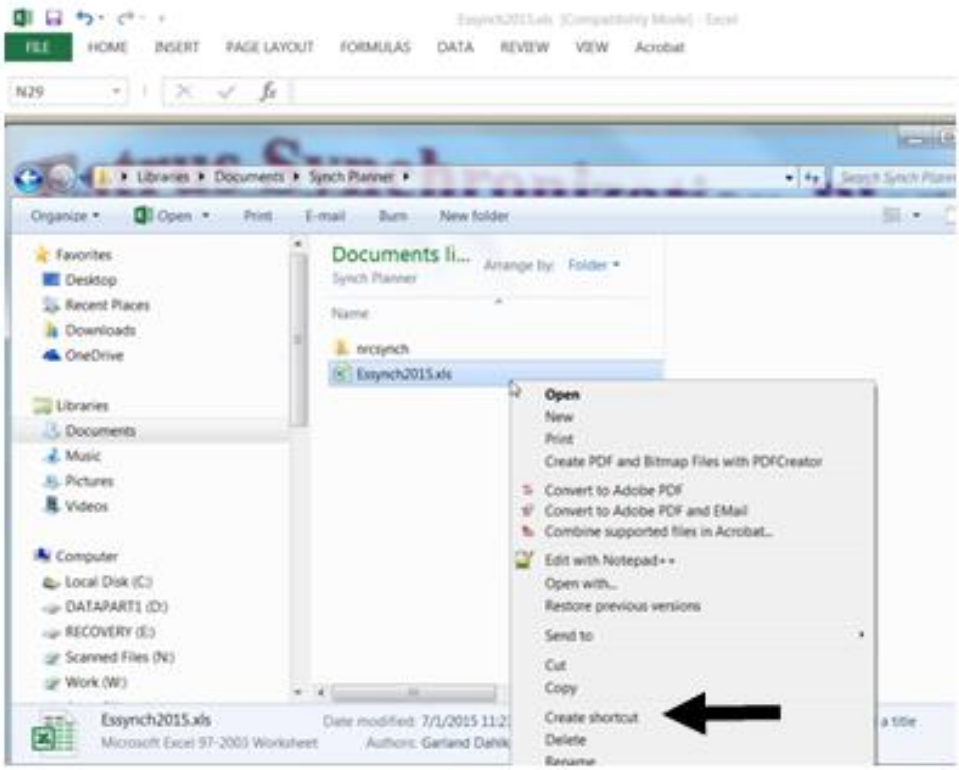


Figure 3. Creating a desktop shortcut

Basic Excel features – The Estrus Synchronization Planner is made up of several worksheets whose names appear on navigation tabs (Figure 2) at the bottom of the screen: *Programs, Planner Worksheet, Calendar, Printout,* and *Tips & Overview*. Click on the appropriate tab to move throughout the program. The *Tips and Overview* section provides some basic definitions and guide to operation. In the *Planner Worksheet* you will see several small red triangles (Figure 4). As you move your mouse over each one, comment boxes will appear

that provide definitions or explanations. To make or change an input (white boxes), click in the white box and begin typing. Default format for dates is MM/DD/YY and for times hh:mm am/pm. After you have clicked in an input box you can use the F2 key to edit the contents. This is particularly helpful for the date and time cells.

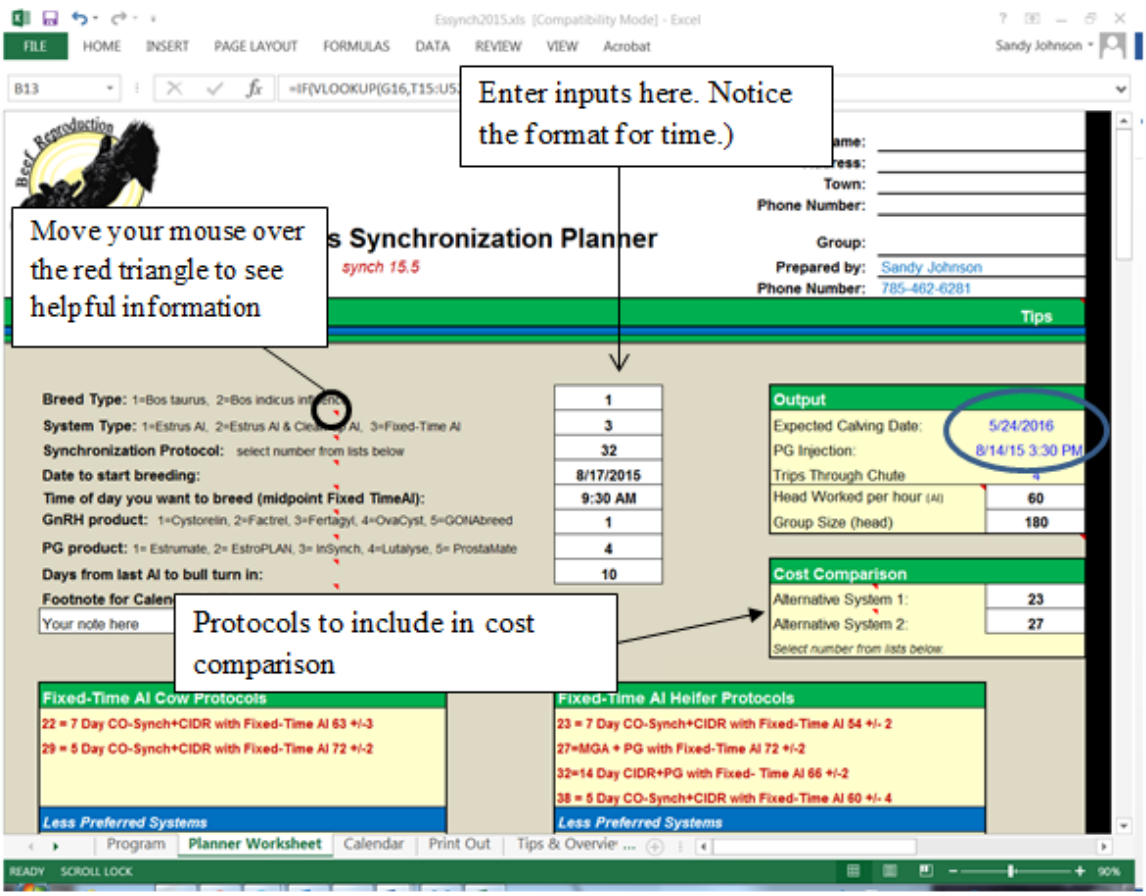


Figure 4. Enter your values in the white input boxes

Use of the Planner

To begin using the planner, click on the *Planner Worksheet* (Figure 4) tab to select desired inputs. In the top right hand corner you can enter information to identify the producer, group of cattle and the individual preparing the plan. This information will transfer to the calendar and print out portions automatically.

Breed Type - In the Input portion of the spreadsheet enter "1" for *Bos taurus* or "2" for *Bos indicus* (1/2 *indicus* breeding or greater).

System Type - Protocols are grouped based on how much if any heat detection is required; 1) AI after observed estrus (most heat detection), 2) AI after observed estrus followed by clean-up fixed-time AI or 3) strict fixed-time AI (no heat detection). Enter 1, 2, or 3 in the input box to make the appropriate selection. When the "detection-insemination type" is changed from 1 to 3, the recommended protocols listed below change based on that selection. Select a synchronization system by entering a number from the listed systems for cows or heifers.

The short list of recommended protocols is different for cows (listed to the left) and heifers (listed to the right). The timing of insemination differs for some protocols between cows and heifers. Other reasons for differences include that use of MGA (melengesterol acetate) is only approved for use in heifers. Additionally, heifers do not seem to respond as consistently to GnRH and some heat detection systems for heifers will not include GnRH whereas it is included for cows. Systems listed as "less preferred" generally require additional handlings and/or costs with no improvement in results, or do not work on non-cycling animals.

Date to start breeding - Entering the date to start breeding provides the expected calving date in the Output cells to the right (Figure 4, circled). This is based on a 281 day gestation length. This will be the day of fixed-timed AI for strict fixed-time insemination or the day you can begin heat detection in systems requiring heat detection.

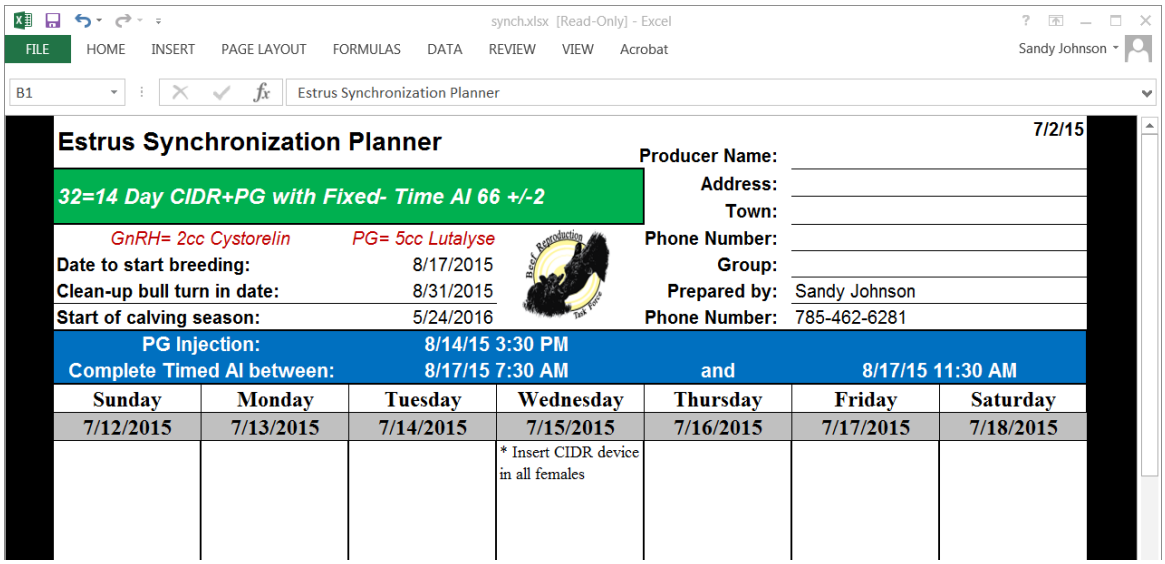
The time of day you want to breed (midpoint Fixed-time AI) becomes important for protocols that use fixed-time AI or clean-up fixed-timed AI. Only synchronize as many females as you can comfortably inseminate in a 3 to 4 hour time period in the given situation. You can enter the number of head you can inseminate per hour and the total number in the group. A "reduce breeding group size" message will appear when you have at least one more animal than what you can breed in 3 hours. This is a conservative number to account for times when things don't happen as quickly as expected. Enter the midpoint of the time of day you want to conduct fixed-timed AI and check the time of day for CIDR removal or PG injection to the right under the Output section. This will help you meet the specified interval prescribed for the protocol. Trial and error may be needed so that PG injection/CIDR removal and AI both occur at workable times. Or review Table 1 to see common times used. To get the best response from the selected protocol it is important to follow the schedule and timing of activities as described. Fixed-timed insemination systems require a precise interval between CIDR removal and timed AI. By asking what day and time you want to begin breeding, the planner calculates the precise day and hour other treatments of the protocol should be administered.

Table 1. Common times for treatment and AI to achieve desired intervals for fixed-time AI

System	Interval	CIDR Removal/PG	Timed AI
Cow - 7 Day CO-Synch+CIDR	63 hrs.	5 pm	8 am
Cow - 5 Day CO-Synch+CIDR	72 hrs.	8 am	8 am
Heifer - 7 Day CO-Synch+CIDR	54 hrs.	1 pm	7 am
Heifer - MGA + PG	72 hrs.	7 am	7 am
Heifer - 14 Day CIDR+PG	66 hrs.	2 pm	8 am
		7 pm	1 pm
Heifer - 5 Day CO-Synch+CIDR	60 hrs.	7am	7 pm

For example let's plan a fixed-timed AI program for 180 head of heifers using the 14 Day CIDR+PG system with fixed-timed AI to occur 66 ± 2 hours after CIDR removal. Based on past experience in the given facilities and associated crew, 60 head can be inseminated in one hour. The heifers can be gathered and in the holding pen by 8 am and 3 hours will be needed for insemination. The midpoint between 8 am and 11 am is 9:30 am. We put 9:30 am as the time we want to breed in the planner, the planner returns a time to give the prostaglandin (PG) injection of 3:30 pm. This would be our mid-point to give PG. If the estimated amount of time required to give PG is 1 hour, we would start giving PG at 3:00 pm. If a group of

heifers consisted of 10 head with adequate facilities and insemination would take less than an hour, then plan to start breeding at 8 am and start giving PG at 2:00 pm with no further adjustments. With 66 hours as the target interval to fixed-time AI, the calendar portion of the planner (Figure 5) shows the range to complete timed AI at 7:30 to 11:30 AM.



Estrus Synchronization Planner 7/2/15

32=14 Day CIDR+PG with Fixed- Time AI 66 +/-2

GnRH= 2cc Cystorelin *PG= 5cc Lutalyse*

Date to start breeding:	8/17/2015
Clean-up bull turn in date:	8/31/2015
Start of calving season:	5/24/2016

Producer Name:	
Address:	
Town:	
Phone Number:	
Group:	
Prepared by:	Sandy Johnson
Phone Number:	785-462-6281

PG Injection: 8/14/15 3:30 PM
Complete Timed AI between: 8/17/15 7:30 AM and 8/17/15 11:30 AM

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
7/12/2015	7/13/2015	7/14/2015	7/15/2015	7/16/2015	7/17/2015	7/18/2015
			* Insert CIDR device in all females			

Figure 5. Top portion of calendar sheet showing range of times to complete timed AI

GnRH product/ PG product - If you would like the name of the specific GnRH (Gonadotropin- releasing hormone) or prostaglandin (PG) product you are using to show up on the calendar or other print outs, select the number of the appropriate product. The recommended dosage to use will also show up on the output sheets. If the specific product is unknown at the time, zero, the default, will return GnRH or prostaglandin on the output.

Days from last AI to bull turn in - The interval from the last AI to bull turn in can be indicated so it will be shown on the calendar. Generally if identifying AI sired calves is not a priority bulls can be turned out the day after AI. However, if correct identification of parentage is critical, consideration should be given to the method of sire identification and timing when planning bull turnout.

Alternative System 1/Alternative System 2 - A cost comparison can be done on up to two alternative systems. Select a number from the lists. Systems do not need to be of the same system type.

The lower portion of the *Planner Worksheet* has input areas to estimate costs (Figure 6). The feed/yardage costs are only figured into MGA programs. The default labor estimate is based on the number of working days in a particular system and the group size. This includes gathering, sorting, synchronization treatments, heat detection and AI service (Loeske, 1989). Users can override this value and enter their own estimate of total number of hours of labor for the cost analysis. User defined charges can be added. To complete the cost analysis, enter your own values for the cost of various inputs. If no cost information is needed, proceed directly to the program outputs. Updated cost information is not needed to continue.

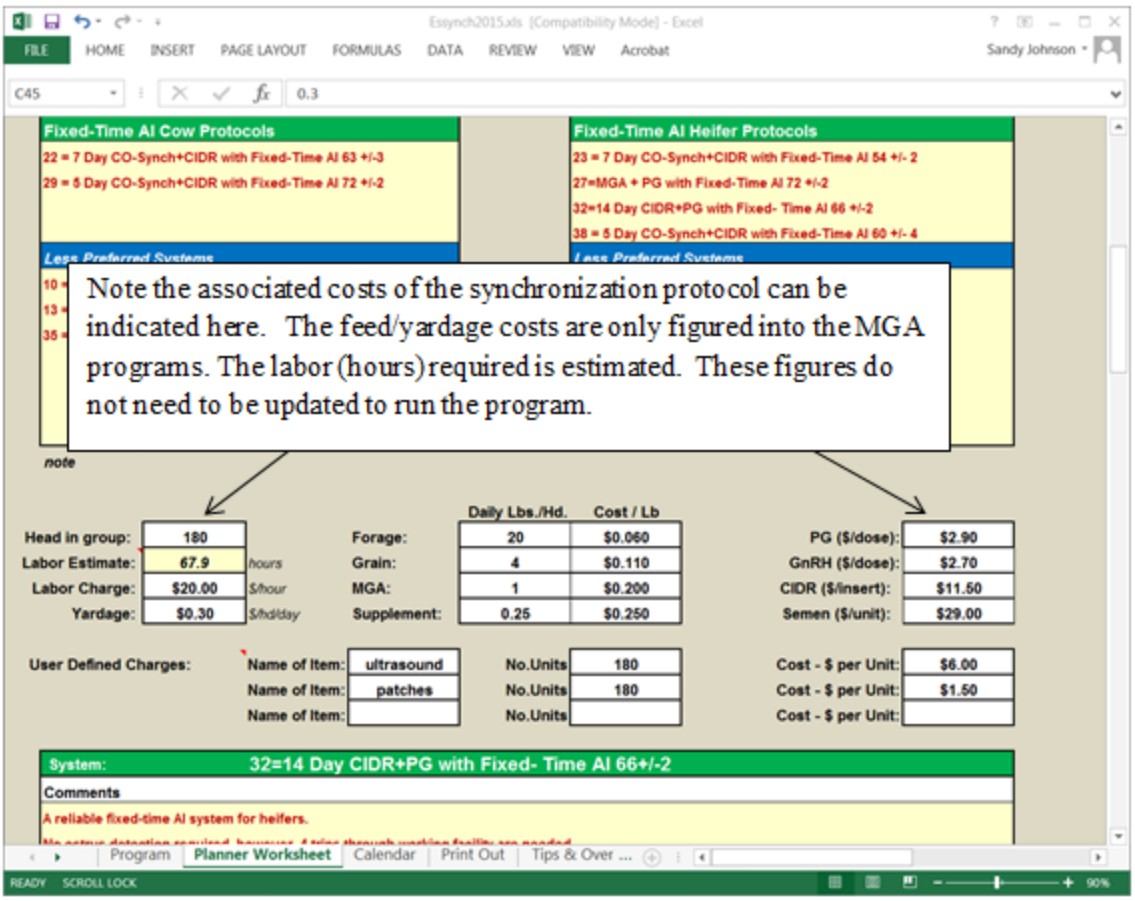


Figure 6. Cost input section of *Planner Worksheet*

Program Output

Depending on the priority of the users, the next step would be to go to either the *Calendar* tab or the *Print Out* tab. The *Print Out* tab gives comments on using the selected synchronization system and then a written summary of what needs to occur each day (Figure 7). The next section of this worksheet (Figure 8) gives a summary of the immediate costs of using the system along with the costs of the alternative systems selected on the *Planner Worksheet*. Costs are broken down into synchronization cost, AI cost, total cost per synchronized female, feed and yardage cost (MGA systems only) and total cost. The bottom section (Figure 8) gives a cost per pregnancy based on the estrous response rate and conception rate.

To see how the selected synchronization system falls on the calendar (missing Grandma's birthday party or when help will be home from school) go to the *Calendar* tab to see the agenda in a calendar format (Figure 9). If the system or the dates don't work then go back to the *Planner Worksheet* to make the needed changes and re-evaluate. Select PRINT from your Excel menu to print the *Calendar* or *Print Out* output. To create a pdf version of the output to share electronically, use the print command in Excel (FILE – PRINT - PRINTER) and change the printer to Adobe PDF or other pdf printer. It will ask you to name the file and where to save it. The PDF document can be printed to paper or attached and sent anywhere by attaching to an e-mail message.

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7/6/15

Estrus Synchronization Planner

Date to start breeding:	8/17/2015
Clean-up bull turn in date:	9/2/2015
Start of calving season:	5/24/2016

Producer Name:	Robert Rancher
Address:	
Town:	Rural America
Phone Number:	
Group:	Heifers
Prepared by:	Sandy Johnson
Phone Number:	785-462-6281

6 = MGA + Prostaglandin

Estimated average number of times per head through the working facility: **2**

Comments

This system is highly recommended for heifers and works effectively in postpartum cows.
Estrus detection should begin at the time of PG administration.
Majority will exhibit estrus between 48 and 96 hours after PG.
Daily intake during MGA feeding is critical, may require drylot feeding.
Deliver MGA in either a well mixed ration or a supplement with not less than 3-5 lbs fed per head per day.
For either MGA feeding methodology provide adequate bunk space(12 in. for TMR, 18 in. for MGA + grain only).
Immediate addition of clean-up bulls could lead to questions about parentage.

Date of Activity	Day of the Week	Description of Activity
☐ 07/16/15	Thursday	Start feeding Melengestrol Acetate (MGA) at .5 mg/hd/day. Continue feeding until 7/29/2015.
☐ 07/29/15	Wednesday	Last day to feed MGA at .5 mg/hd/day.
☐ 07/31/15	Friday	Large numbers of females will show heat the next 4 days - DO NOT BREED!
☐ 08/17/15	Monday	Inject 5cc Lutalyse (PG) to all females. Start heat detection. Breed females AI 10-14 hours after standing heat.
☐ 08/18/15	Tuesday	Continue heat detection. Breed females AI 10-14 hours after standing heat.
☐ 08/19/15	Wednesday	Peak heat at 60 - 72 hours after PG. Continue heat detection. Breed females AI 10-14 hours after standing heat.
☐ 08/23/15	Sunday	Last day of heat detection. Breed females AI 10-14 hours later if showing standing heat.
☐ 09/02/15	Wednesday	Turn clean up bulls in with females. Immediate addition of clean-up bulls could lead to questions about parentage.

Program | Planner Worksheet | Calendar | **Print Out** | Tips & Overview

Figure 7. Estrus Synchronization Planner spreadsheet, page 1 of *Print Out* worksheet
Information based on selections made in *Planner Worksheet*

Cost Comparison of Three Selected Systems			6 = MGA + Prostaglandin		32=14 Day CIDR+PG with Fixed- Time AI 66+/-2		33=PG - 6 Day CIDR with E-AI and Cleanup AI
Item	Dose or Units	Cost/Unit	Total Cost	vs.	Total Cost	vs.	Total Cost
5cc Lutalyse Cos	20	$2.80	$56.00		$56.00		$95.20
2cc Cystorelin Cc	0	$2.90	$0.00		$58.00		$52.20
MGA Supplement	280	$0.20	$56.00		$0.00		$0.00
CIDR Cost	0	$11.00	$0.00		$220.00		$154.00
Synchronization Cost Subtotal			**$112.00**		**$334.00**		**$301.40**
Detect/Mgt.Labor	27.7	$13.50	$374.15		$305.49		$432.03
Semen	20.0	$25.00	$500.00		$500.00		$500.00
ultrasound	25.0	$5.00	$125.00		$125.00		$125.00
patches	40.0	$2.00	$80.00		$80.00		$80.00
			$0.00		$0.00		$0.00
			$0.00		$0.00		$0.00
AI Cost Subtotal			$1,079.15		$1,010.49		$1,137.03
Total Cost (not including feed & yardage)			**$1,191.15**		**$1,344.49**		**$1,438.43**
Cost / Female Synchronized			**$59.56**		**$67.22**		**$71.92**
Days in Drylot			*39*		*0*		*0*
Forage (lbs)	15,600	$0.060	$936.00		$0.00		$0.00
Grain (lbs)	3,120	$0.110	$343.20		$0.00		$0.00
Yardage (hd-day)	780	$0.300	$234.00		$0.00		$0.00
Supplement (lbs)	195	$0.250	$48.75		$0.00		$0.00
Feed & Yardage Cost Subtotal			**$1,561.95**		**$0.00**		**$0.00**
Total Cost			**$2,753.10**		**$1,344.49**		**$1,438.43**

This feed & yardage cost does not credit in the cost of maintaining the female on pasture.

$/Synch AI = cost per successful AI pregnancy for the selected system under the given success rate.

Cost - Response Analysis: 6 = MGA + Prostaglandin

Estrous Response Rate		Conception Rate of those Responding to Synchronization 35%	45%	55%	65%	75%
75%	% AI Pregnant	26.3%	33.8%	41.3%	48.8%	56.3%
	$/Synch AI preg.	$203.08	$157.95	$129.23	$109.35	$94.77
80%	% AI Pregnant	28.0%	36.0%	44.0%	52.0%	60.0%
	$/Synch AI preg.	$194.85	$151.55	$123.99	$104.92	$90.93
85%	% AI Pregnant	29.8%	38.3%	46.8%	55.3%	63.8%
	$/Synch AI preg.	$187.59	$145.90	$119.37	$101.01	$87.54
90%	% AI Pregnant	31.5%	40.5%	49.5%	58.5%	67.5%
	$/Synch AI preg.	$181.13	$140.88	$115.27	$97.53	$84.53
95%	% AI Pregnant	33.3%	42.8%	52.3%	61.8%	71.3%
	$/Synch AI preg.	$175.36	$136.39	$111.59	$94.43	$81.84

Figure 8. Estrus Synchronization Planner spreadsheet, page 2 of *Print Out* worksheet
Information based on selections made in *Planner Worksheet*
Compares cost of the selected system to chosen alternatives
Cost response analysis shows costs based on varying conception and estrous response rates

Estrus Synchronization Planner 7/6/15

6 = MGA + Prostaglandin

GnRH= 2cc Cystorelin *PG= 5cc Lutalyse*

Date to start breeding:	8/17/2015
Clean-up bull turn in date:	9/2/2015
Start of calving season:	5/24/2016

Producer Name:	Robert Rancher
Address:	
Town:	Rural America
Phone Number:	
Group:	Heifers
Prepared by:	Sandy Johnson
Phone Number:	785-462-6281

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
7/12/2015	7/13/2015	7/14/2015	7/15/2015	7/16/2015	7/17/2015	7/18/2015
				* MGA @ 0.5 mg/hd/day	* MGA @ 0.5 mg/hd/day	* MGA @ 0.5 mg/hd/day
7/19/2015	7/20/2015	7/21/2015	7/22/2015	7/23/2015	7/24/2015	7/25/2015
* MGA @ 0.5 mg/hd/day	* MGA @ 0.5 mg/hd/day	* MGA @ 0.5 mg/hd/day	* MGA @ 0.5 mg/hd/day	* MGA @ 0.5 mg/hd/day	* MGA @ 0.5 mg/hd/day	* MGA @ 0.5 mg/hd/day
7/26/2015	7/27/2015	7/28/2015	7/29/2015	7/30/2015	7/31/2015	8/1/2015
* MGA @ 0.5 mg/hd/day	* MGA @ 0.5 mg/hd/day	* MGA @ 0.5 mg/hd/day	* MGA @ 0.5 mg/hd/day		* Many females in heat next 4 days. DO NOT BREED!	
8/9/2015	8/10/2015	8/11/2015	8/12/2015	8/13/2015	8/14/2015	8/15/2015
8/16/2015	8/17/2015	8/18/2015	8/19/2015	8/20/2015	8/21/2015	8/22/2015
	* Detect Estrus & Breed * inject 5cc Lutalyse-all females	* Detect Estrus & Breed	* Detect Estrus & Breed * Peak Estrus	* Detect Estrus & Breed	* Detect Estrus & Breed	* Detect Estrus & Breed
8/23/2015	8/24/2015	8/25/2015	8/26/2015	8/27/2015	8/28/2015	8/29/2015
* Detect Estrus & Breed						

Figure 9. Estrus Synchronization Planner spreadsheet, *Calendar* worksheet

Once the output from the planner has been generated, a number of additional steps should be taken to help ensure a successful synchronization program. Share the output with everyone involved in the project (and your spouse even if they aren't directly involved) and double check for conflicts on their calendars. Post a copy of the calendar in the barn and/or in the area where AI supplies are stored. Mark the synchronization products with date they will be used. Mistakenly administering GnRH rather than prostaglandin (or vice versa) is a common problem.

Make sure necessary supplies are on hand including appropriately sized needles, syringes, gloves, AI sheaths, lube, paper towels and heat detection aids. Test temperature of automatic thaw units. Clean and check condition of insemination gun(s), tweezers and straw cutter.

Review record keeping plans and methods. For timed-AI systems you may want to record how much time it took to inseminate, number of cows and number of people helping (perhaps names as that relates to level of experience/ability). This can be used to plan in subsequent years. Check facilities for any needed repairs.

Mobile version

The Estrus Synchronization Planner is now available for use on your mobile device (EstruSynch). Direct your browser to www.estrussynch.com for this web-based application that requires a wireless signal or other internet connection to operate. Wireless coverage may limit use in some pasture settings. The program has the most critical but not all of the features of the full version. Protocol updates in the mobile version may lag behind the spreadsheet version.

Input your choices on the first page (Step 1, Figure 10). Breed type, age, date to start breeding, time of day and insemination method are selected from drop down choices. You must enter a value into the "head in group" box and "days from last AI to bull turn in" to continue. The up and down arrow keys can be used to adjust up or down the number of "head in a group" or other numeric values or prices. When entries are complete, use the "next" button to continue.

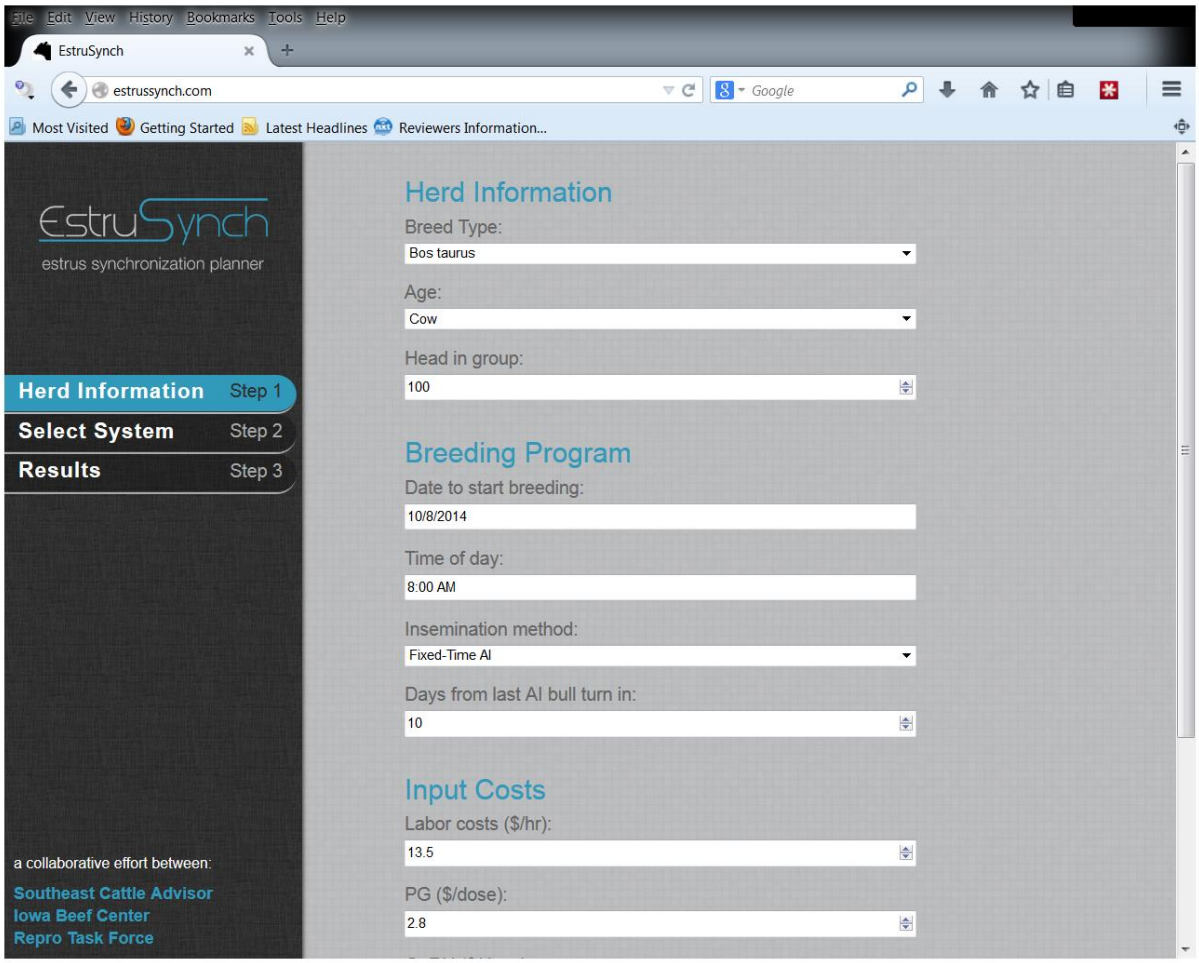

Figure 10. Input screen, Step 1, of the Estrus Synchronization Planner App

In Step 2 (Figure 11), select one of recommended protocols by clicking on the desired system. Comments related to the system selected appear in the lower portion of the screen. If the desired system is not shown, use the "back" button to change the "insemination method". Return to Step 2 and look for desired system; hit "next" to move on.

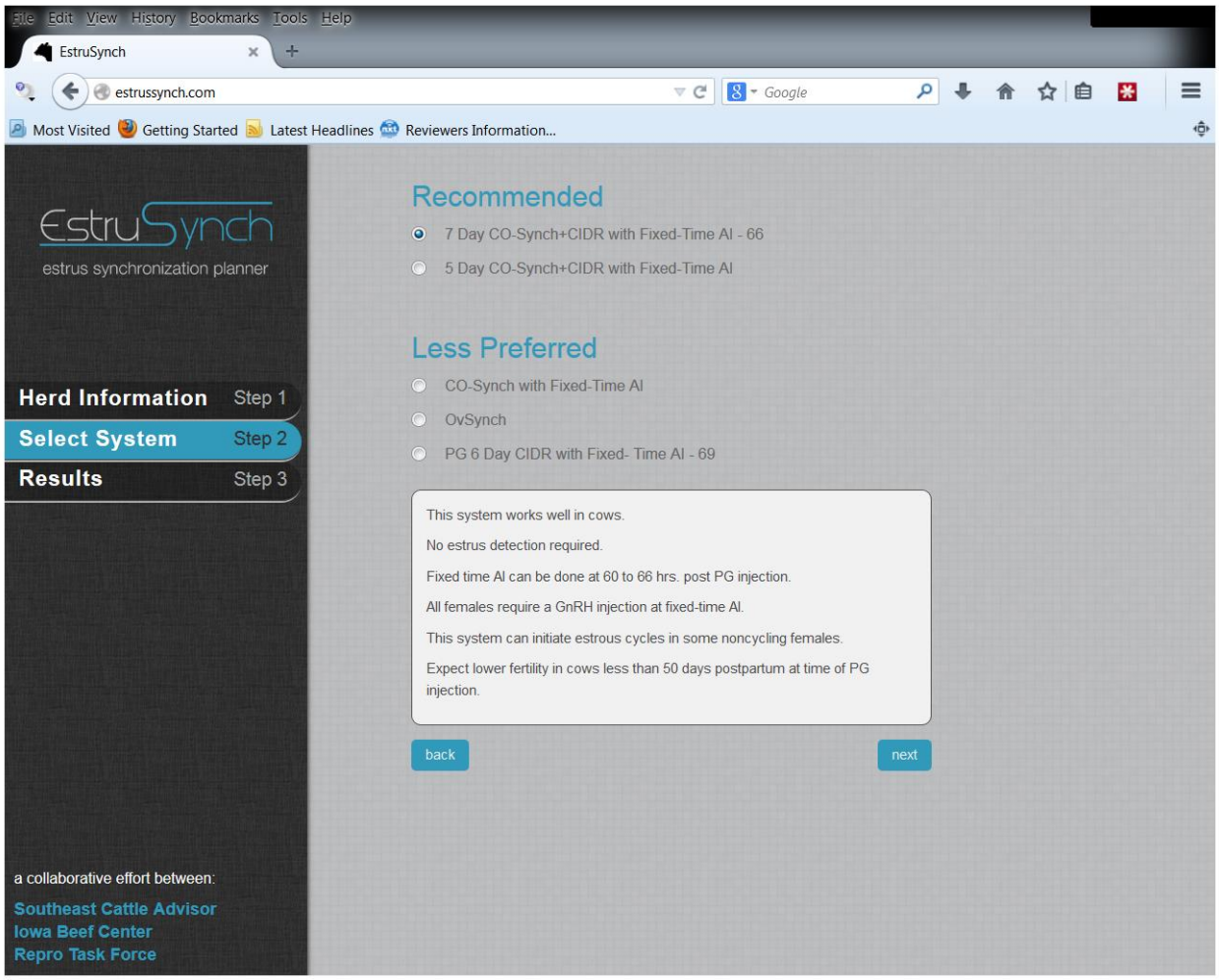

Figure 11. System selection input screen of Estrus Synchronization Planner App

The results from the selections are shown in Step 3 (Figure 12). The labor hours estimated are calculated the same way as in the full version of the planner. Total cost reflects the number of animals entered in Step 1. The breeding schedule created can be shared via e-mail.

Summary

The Estrus Synchronization Planner Spreadsheet and the associated version for hand held devices should help users select appropriate breeding systems and to deliver necessary treatments in a timely fashion. Follow these steps to use the planner successfully. 1) Download planner or check to see you have the latest version (15.7, but check for periodic updates). 2) Move to the *Planner Worksheet* and determine insemination type (AI after observed estrus, AI after observed estrus and cleanup timed AI, or fixed-time AI). 3) Enter

breed type, date to start breeding and time of day to breed (for fixed-time AI systems). 4) Select protocol from list. 5) Review *Calendar* and *Print Out* output and adjust as needed. Use output to communicate with your team members. With these details covered, producers can focus on other aspects of animal nutrition and management, semen handling and insemination technique to further improve AI pregnancy rates.

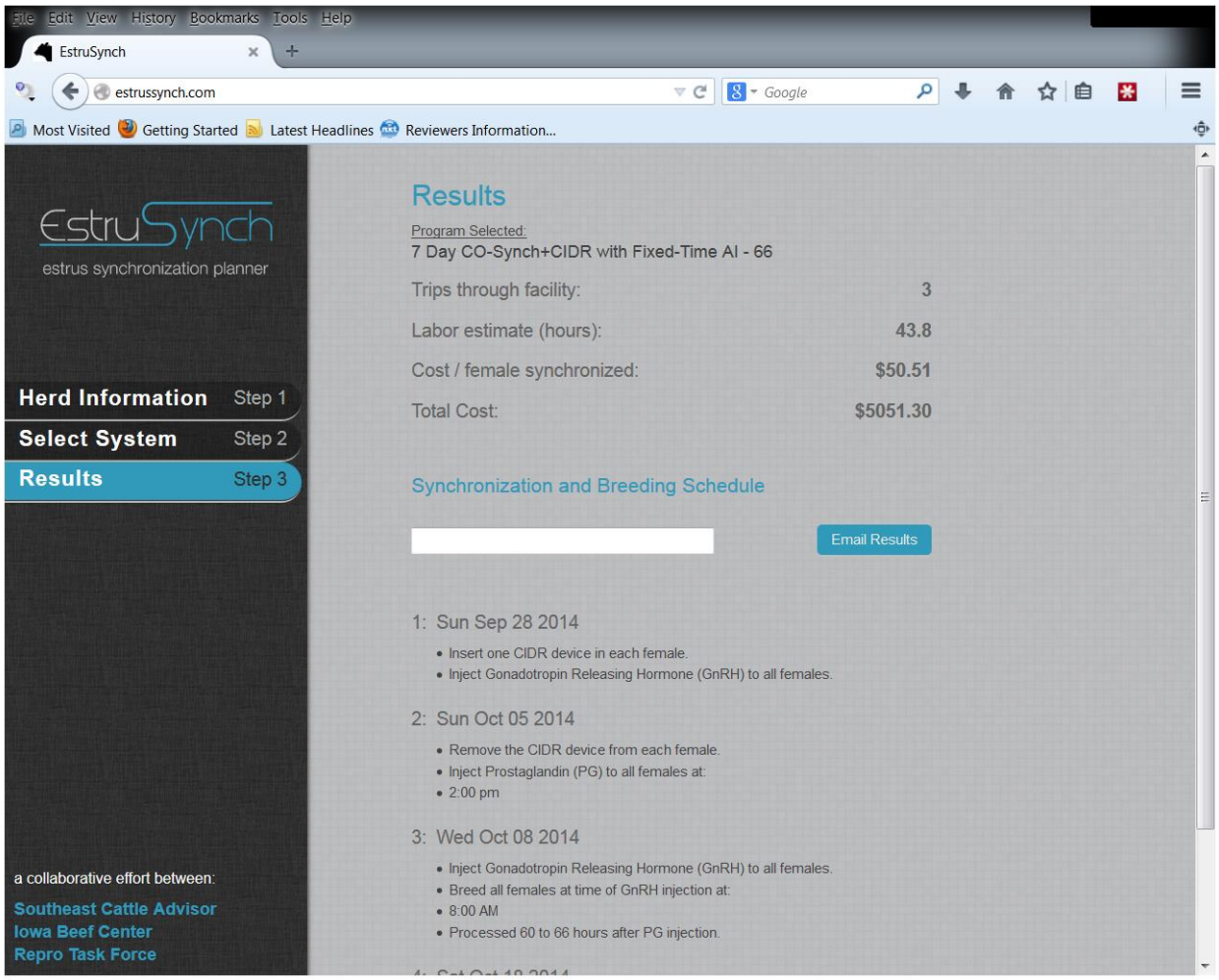

Figure 12. Results screen of Estrus Synchronization Planner App**.**

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