ESTIMATING THE VALUE OF BT CORN:

A SURVEY

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Abstract

This document contains a survey used to gather data for use in estimating the value of Bt corn within a particular region. The survey instrument is provided in an appendix. The body of this paper provides background information regarding the survey and contact information for questions.

Keywords: Bt corn, European corn borer, Southwestern corn borer, economic benefits

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Introduction

To estimate the value of Bt corn within a particular region, data on corn borer behavior must be obtained. The survey instrument in the appendix allows the respondent to provide the best available data.

If you are interested in completing this survey, please contact Paul Preckel (see below for contact information) before doing so. While we are interested in a broad, regional analysis, limits on available time and resources may force us to forego analysis of similar regions.

Regional Analysis

Corn borer infestation levels and farming conditions may differ by state, and even by regions within a state. Therefore, the respondent may need to complete two or more surveys to accurately reflect conditions prevalent within his or her state. In considering the number of surveys to complete, keep in mind that the objective is to group corn production areas that are roughly similar, particularly in terms of corn borer infestation. Therefore, a new survey should be completed only if two or more regions are significantly different. For example, areas of southwest Kansas may face pressure from European corn borer (ECB), southwestern corn borer (SWCB), and spider mites, whereas the remainder of the state is typically faced with only ECB pressure. Thus, Kansas must be modeled as two distinct areas, and completion of two separate surveys is needed.

Factors Not Addressed By The Survey

There are instances in which, due to unique circumstances in the region considered, the survey instrument may not address an important factor. For example, the presence of spider mites in southwest Kansas would not be addressed in the survey but must be considered in the economic analysis. Please contact Paul Preckel (contact information below) to discuss any critical factors that you feel are not addressed in the survey. This discussion will help to expedite the data collection process.

Contact Information

The respondent may contact Paul Preckel to discuss the survey instrument.

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Appendix

ECB and SWCB Infestation Dates

This information will define the number of generations that may be experienced in your state in a given year.

1. ECB infestation dates by generation

   For Indiana, we used – ECB peak flight black light data provided by Ron Blackwell in Purdue's Department of Entomology.

   What can be used – Similar data would be ideal.

   Please complete the following table. Space is allowed for up to 5 generations.

ECB Generation	Average Peak Flight Date
1	
2	
3	
4	
5	

Source(s) – If more than one source is used, please note which information was provided by each source:

2. SWCB infestation dates by generation

For Indiana, we used – Not applicable for previous research.

What can be used – Peak flight data similar to that for ECB.

Please complete the following table. Space is allowed for up to 5 generations.

SWCB Generation	Average Peak Flight Date
1	
2	
3	
4	
5	

Source(s) – If more than one source is used, please note which information was provided by each source:

ECB and SWCB Insecticide Efficacy

3. Spraying efficacy by ECB generation
4. For Indiana, we used – 80% against 1st generation ECB, 60% against 2nd, and 50% against 3rd. These are representative of published estimates, such as those included in Ostlie, K.R., W.D. Hutchison and R.L. Hellmich, "Bt Corn and European Corn Borer," NCR Publication 602, University of Minnesota, St. Paul, MN, 1997.

What can be used – Similar published estimates or expert opinion. These efficacy estimates may not apply to your state but may need to be adjusted to include efficacy against more than three generations if more are likely in your state.

Please complete the following table.

ECB Generation	Spraying Efficacy
1	
2	
3	
4	
5	

Source(s) – If more than one source is used, please note which information was provided by each source:

4. Spraying efficacy by SWCB generation

   For Indiana, we used – Not applicable for previous research.

   What can be used – Expert opinion.

   Please complete the following table.

SWCB Generation	Spraying Efficacy
1	
2	
3	
4	
5	

   Source(s) – If more than one source is used, please note which information was provided by each source:

Probability of ECB and SWCB Infestation

The following excerpt from our recently published journal article (*Review of Agricultural Economics*) will help to clarify the type of information needed for this work.

The following assumptions were used (Bledsoe):

1. For corn planted before May 10, if infestation of one or more ECB per plant occurs in any of the three generations, then the conditional probability of it being in first, second or third generation is 0.60, 0.35, and 0.05, respectively.
2. For corn planted between May 10 and May 23, if infestation of one or more ECB per plant occurs, then the conditional probability of it being in first, second, or third generation is 0.45, 0.40, and 0.15, respectively.
3. For corn planted after May 23, the corresponding conditional infestation probabilities are 0.05, 0.60, and 0.35 for first, second and third generations, respectively.

5. Probability of ECB infestation by corn planting period.

This corresponds to the above statements. For each planting date, answer the following set of questions:

- Given this particular planting period, what is the probability of realizing infestation from first generation ECB?
- Given this particular planting period, what is the probability of realizing infestation from second generation ECB?
- Answer this question for each possible generation in your state.

The sum of the probabilities assigned in each answer must sum to one.

For Indiana, we used – Expert opinion from Larry Bledsoe of Purdue's Department of Entomology.

What can be used – If data are available on ECB infestation, then they can be used. If these data are unavailable, then your expert opinion is satisfactory.

Please complete the following table. Each row must sum to one.

Planting Period	Probability of 1st gen.	Probability of 2nd gen.	Probability of 3rd gen.	Probability of 4th gen.	Probability of 5th gen.	Total Prob.[a]
Before May 1						1.0
May 1 – 9						1.0
May 10 – 16						1.0
May 17 – 23						1.0
May 24 – 40						1.0
After May 30						1.0

[a] The sum across each row must be 100% or 1.0.

Source(s) – If more than one source is used, please note which information was provided by each source:

6. Probability of SWCB infestation by corn planting period.

For Indiana, we used – Not applicable

What can be used – Data or your expert opinion.

Please complete the following table. Each row must sum to one.

Planting Period	Probability of 1st gen.	Probability of 2nd gen.	Probability of 3rd gen.	Probability of 4th gen.	Probability of 5th gen.	Total Prob.[a]
Before May 1						1.0
May 1 – 9						1.0
May 10 – 16						1.0
May 17 – 23						1.0
May 24 – 40						1.0
After May 30						1.0

[a] The sum across each row must be 100% or 1.0.

Source(s) – If more than one source is used, please note which information was provided by each source:

7. Probability of number of ECB per plant given that infestation has occurred

This corresponds to the statement below from the journal article mentioned earlier.

1. For any generation, if an infestation occurs, the probabilities of one, two or three ECB per plant are 0.60, 0.32, and 0.08, respectively.

For Indiana, we used – Expert opinion from Larry Bledsoe.

What can be used – Again, either data or your expert opinion.

Please complete the following table, filling in only those cells that are relevant. The probabilities are conditional upon there being at least one ECB per plant. Probabilities in each column must sum to one. In our study, this probability was the same across all generations. We have allowed space for this probability to change in each generation in your state. Space is allowed for up to 10 ECB per plant.

Number of ECB per plant	**Probability by generation**[a]				
	1	**2**	**3**	**4**	**5**
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Total Prob.	1.0	1.0	1.0	1.0	1.0

[a] The sum of each column must be 100% or 1.0.

Source(s) – If more than one source is used, please note which information was provided by each source:

8. Probability of number of SWCB per plant given that infestation has occurred

For Indiana, we used – Not applicable

What can be used – Data or your expert opinion

Please complete the following table, filling in only those cells that are relevant. The probabilities are conditional upon there being at least one ECB per plant. Probabilities in each column must sum to one. We have allowed space for this probability to change in each generation in your state.

Number of SWCB per plant	**Probability by generation[a]**				
	1	**2**	**3**	**4**	**5**
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Total Prob.	1.0	1.0	1.0	1.0	1.0

[a] The sum of each column must be 100% or 1.0.

Source(s) – If more than one source is used, please note which information was provided by each source:

9. Statewide average probability of ECB and SWCB infestation in a given year
10.
11. This corresponds to the statement below from the previously mentioned journal article.
12.
13. 5. The total probability of less than one larva per corn plant in a given year is 0.75.

For Indiana, we used – Expert opinion from Larry Bledsoe.

What can be used – Data or your opinion. In Indiana, the statewide average is about 1 in 4 years. However, in some areas it may be as high as 4 in 10 years. Therefore, we have asked for a low, average, and high probability for this to more accurately describe your entire state.

Please complete the following table.

Insect	**State wide Average**	**State wide Low Probability**	**State wide High Probability**
ECB			
SWCB			

Source – If more than one source is used, please note which information was provided by each source:

Yield Losses Due to ECB and SWCB

The following table shows the yield losses used in the Indiana research

		Planting date					
	No. of ECB	**Before May 1**	**May 1-9**	**May 10-16**	**May 17-23**	**May 24-30**	**After May 30**
First Generation	1	5.0	5.5	4.1	3.0	0.5	0.0
	2	7.4	8.2	6.1	4.5	0.8	0.0
	3	9.1	10.0	7.5	5.5	1.0	0.0
Second Generation	1	2.3	4.0	4.5	4.8	6.1	6.3
	2	3.4	6.0	6.8	7.2	9.1	9.4
	3	4.2	7.4	8.3	8.8	11.2	11.5
Third Generation	1	2.0	2.0	2.0	2.0	2.6	4.0
	2	3.0	3.0	3.0	3.0	3.9	6.0
	3	3.7	3.7	3.7	3.7	4.8	7.4

9. Yield losses due to ECB

10.

For Indiana, we used – The estimates in the above table are based on estimates of physiological losses in Indiana by number of ECB per plant and timing of infestation from: Edwards, C.R., R.E. Foster and J.L. Obermeyer, "European Corn Borer in Field Corn, Sweet Corn, Peppers, and Snap Beans," Publication E-17, Purdue University Cooperative Extension Service, West Lafayette, Indiana. (A copy of that table is below.)

	% Yield Loss - # of ECB per plant		
Plant Stage	1	2	3
Early Whorl	5.5	8.2	10.0
Late Whorl	4.4	6.6	8.1
Pre-Tassel	6.6	9.9	12.1
Pollen Shedding	4.4	6.6	8.1
Blister	3.0	4.5	5.5
Dough	2.0	3.0	3.7

What can be used – You or your department may have publications with such information for your particular state.

Please complete the following table, filling in percentage yield losses for only those cells that are relevant. The growth stages in parentheses are meant to serve as rough guidelines for the plant stage definitions.

	% Yield Loss - # of ECB per plant									
Plant Stage	1	2	3	4	5	6	7	8	9	10
Early Whorl (V6)										
Late Whorl (V9)										
Pre-Tassel (V15)										
Pollen Shedding (R1)										
Blister (R2)										
Dough (R4)										

Source(s) – If more than one source is used, please note which information was provided by each source:

11. Yield losses due to SWCB

For Indiana, we used – Not applicable for previous research.

What can be used – A publication similar to that used above for ECB damage.

Please complete the following table, filling in percentage yield losses for only those cells that are relevant. The growth stages in parentheses are meant to serve as rough guidelines for the plant stage definitions.

	% Yield Loss - # of SWCB per plant									
Plant Stage	1	2	3	4	5	6	7	8	9	10
Early Whorl (V6)										
Late Whorl (V9)										
Pre-Tassel (V15)										
Pollen Shedding (R1)										
Blister (R2)										
Dough (R4)										

Source(s) – If more than one source is used, please note which information was provided by each source:

Costs of Scouting and Spraying for ECB and SWCB

12. Cost of insecticide

For Indiana, we used – A cost of $10.00 per acre, an estimate commonly published in trade articles.

What can be used – Either the per acre cost of a specific commonly used ECB (or SWCB) insecticide in your state or an average per acre cost of several popular insecticides. Please indicate which of the corn borers is affected by each insecticide (ECB, SWCB, or both).

Please complete the following table. Room is available for up to 5 insecticides. An average of all insecticides included in the table will be used for the insecticide cost. If only one insecticide is included, its cost will be used. Costs should be available from a local co-op. We have allowed the information to differ for ECB and SWCB. If they are the same, simply complete the ECB sections and indicate this below.

Insecticide	Effective Against (ECB and/or SWCB)		Application Rate (include units)		Cost per unit	Cost per acre	
	ECB	SWCB	ECB	SWCB		ECB	SWCB

Source(s) – If more than one source is used, please note which information was provided by each source:

13. Insecticide application cost for corn borer control

For Indiana, we used – A cost of $4.00 per acre for application costs (Indiana average custom rate in 1996).

What can be used – Custom rates should be readily available from a local co-op or your state statistician may publish custom rates.

Please complete the following table.

Type of Application	Custom cost per acre

Source(s) – If more than one source is used, please note which information was provided by each source:

14. Scouting cost

For Indiana, we used – Norm Larson, a scout with Midwest Consulting Services, provided us with a cost of $3.00 per acre to scout for ECB.

What can be used – A crop consultant in your state can provide the necessary information. There are two questions to ask the scout:

- What is the cost of a "full package" scouting program (i.e., one that includes scouting for all relevant corn pests in your state)?
- What is the cost of this same package except with ECB and SWCB (if applicable) scouting removed?

The difference in these costs is the relevant figure to be used in the analysis.

Please fill in the following table.

Question	Cost
What is the cost of a "full package" scouting program?	
What is the cost of this package without ECB and/or SWCB scouting?	

Source(s) – If more than one source is used, please note which information was provided by each source:

Planting Periods and Yield Penalties

The following table describes the data used for the Indiana research.

Planting period	Planting dates	Yield penalty
1	Before May 1	0%
2	May 1-9	0%
3	May 10-16	5%
4	May 17-23	15%
5	May 24-30	25%
6	After May 30	39%

15. Planting periods and yield penalties

For Indiana, we used – Doster, D. H., C.L. Dobbins, P.V. Preckel, Y. Han, G.F. Patrick, and D.J. Pershing, "Purdue PC-LP Farm Plan B-95 Crop Input Form," Purdue University Department of Agricultural Economics, West Lafayette, Indiana, July 1995.

This publication provides data on Indiana planting dates and the yield penalty associated with planting in a particular period.

What can be used – A similar publication, possibly from your University's Department of Agricultural Economics or Agronomy. If a similar publication is unavailable, a corn expert in your Department of Agronomy may be able to provide the relevant periods and yield penalties for your state.

Your state may have more or fewer planting periods than Indiana does. We have divided them such that each has a different yield penalty for late planting, with the exception of periods 1 and 2. These were separated because each will have different yield losses associated with the timing of ECB infestation.

In the following table, please fill in the yield losses associated with planting during the given date.

Planting Period	Yield Penalty
Before May 1	
May 1 – 9	
May 10 – 16	
May 17 – 23	
May 24 – 40	
After May 30	

Source(s) – If more than one source is used, please note which information was provided by each source: