Unit D: Applying Basic Economic Principles in Agribusiness

Lesson 4: Utilizing Economic Principles to Determine How Much to Produce

Student Learning Objectives: Instruction in this lesson should result in students achieving the following objectives:

1. Understand the Law of Diminishing Returns

2. Determine the most profitable level of production.

3. Explain factors that affect profit.

Recommended Teaching Time. 3 hours.

Recommended Resources: The following resources may be useful in teaching this lesson:
http://www.investopedia.com/terms/l/lawofdiminishingmarginalreturn.asp

List of Equipment, Tools, Supplies, and Facilities:

Writing surface
PowerPoint Projector
PowerPoint Slides
Copies of WS: 4-1
Copies of WS: 4-2

Terms:

Law of Diminishing Returns
Marginal Cost
Marginal Revenue

Interest Approach: Divide the students into groups. Tell them they are preparing to begin a wheat production enterprise. Ask each group to make a list of the things they will need to get started. Ask them how they will know how much wheat they would produce to be most profitable. Then discuss these answers as a class asking students questions like "How did you know that you would need _____?" or "Why do you think you should produce that much?" Relate to the students that with the study of economics and the law of diminishing returns, we can find these answers.

Summary of Content and Teaching Strategies

To help students master these objectives, discuss the information on the PowerPoint Presentation and have students take notes on WS: 4-1.

Objective 1: Understand the Law of Diminishing Returns.

Anticipated Problem: What is the law of diminishing returns?

PowerPoint Slide #3
I. The Law of Diminishing Returns affects physical output and economic returns.

    A. The ***law of diminishing returns*** states that as a variable resource is added to fixed resources, marginal output declines immediately or after an initial stage of increasing marginal returns. Total output may increase at an increasing rate for a time, but then increases at a decreasing rate until it reaches its maximum.

        1. One example that illustrates this principle particularly well is a vegetable enterprise. With the addition of more water, the vegetable plants will produce more high quality vegetables. However, with even more water added, the plants will begin to die because they have too much water.

PowerPoint Slide #4

    B. Values need to be provided to understand the law of diminishing economic returns.

        1. ***Marginal cost*** is the extra cost of producing one more unit of output.

            a. Marginal cost is calculated by dividing the change in cost by the change in output.

            b. $MC = \triangle C / \triangle O$ Where $\triangle$ is change, C is cost, and O is output.

PowerPoint Slide #5

        2. ***Marginal revenue*** is the extra revenue from producing and selling one more unit of output.

            a. Marginal revenue is calculated by dividing the change in revenue by the change in output.

            b. $MR = \triangle R / \triangle O$ Where $\triangle$ is change, R is revenue, and O is output.

PowerPoint Slide #6

        3. Net returns will be highest when marginal cost is equal to marginal return.

            a. The amount that should be produced is the where marginal cost equals marginal revenue or where marginal cost is just less than marginal revenue.

            b. $MC \le MR$ (Marginal Cost is less than or equal to Marginal Revenue)

Objective 2: Explain factors that affect profit.

Anticipated Problem: What factors affect profit?

PowerPoint Slide #7
II. Some speculation may need to be used when calculating marginal cost and marginal revenue. However, a business owner that has much experience with an enterprise will be better able to predict costs, revenues, and other factors based upon his knowledge and past enterprise records.

    A. Some factors that affect the profit of an agribusiness can be controlled by the business

owner. The business owner should be aware of these factors.

1. Price can be controlled if the agribusiness sells its products directly to consumers. The price should be set high enough to earn a profit, but not so high that consumers will not want to purchase the product.

2. Care for the commodity can be controlled.

   a. Crops should be checked often for pests and steps should be taken to control pests if any are found.

   2

   b. Animals need have proper feed or pasture and water. Animals should also be carefully watched for sickness. If an animal becomes sick, special attention or medication may be needed to bring the animal back to its proper state of health.

3. The time that crops or animal products are harvested can be controlled.

   a. Crops should be harvested at the proper maturity. If crops are left in the field beyond maturity, pests may invade and decrease the amount of commodity to be harvested.

   b. Animal products should be collected or harvested at the proper time. Eggs should be collected shortly after they are laid to avoid them being broken. Goats and cows should be milk on a regular basis one to three times per day.

B. Some factors that affect the profit of an agribusiness cannot be controlled.

1. Price cannot be controlled if the agribusiness sells its products to a broker. The broker offers a price to producers based upon supply and demand. The broker will also base the price he offers upon the costs of his business because he, too, needs to earn a profit.

2. Weather and environmental conditions that are favorable will help the business owner have a bountiful harvest, while unfavorable weather conditions can ruin a crop.

Objective 3: Determine the most profitable level of production.

Anticipated Problem: How is the most profitable level of production determined?

III. When determining the how much to produce, steps should be taken to arrive at an accurate conclusion. In order to understand these steps more clearly, let's use a wheat enterprise as an example. Wheat price is $0.60 per kilogram. Fertilizer price is $0.45 per kilogram.

Kg Fertilizer	Kg Wheat Yield
30	679
33	684
36	687
39	689
42	690

PowerPoint Slide #12

    A. What is the input?

        1. Fertilizer

           a. Several enterprises utilize more than one input. To calculate the most profitable level of production, use the input that is the most expensive.

    B. What is the output?

        1. Wheat

    C. Question

        1. How much

    D. Principle

        1. MC = MR

PowerPoint Slide #13

    E. Equations

        1. $MC = \triangle C / \triangle O$

           a. To begin calculating marginal cost, the change, or difference, in cost must be found for each level of production. To do this, the cost at each level of input must be found. The difference is the input cost minus the input cost one level less.

Example: 30 x $.45 = $13.50

            33 x $.45 = $14.85   Change in Cost $14.85 - $13.50 = $1.35

            36 x $.45 = $16.20   Change in Cost $16.20 - $14.85 = $1.35

            39 x $.45 = $17.55   Change in Cost $17.55 - $16.20 = $1.35

            42 x $.45 = $18.90   Change in Cost $18.90 - $17.55 = $1.35

PowerPoint Slide #14

           b. To continue calculating marginal cost, the change, or difference, in output must be found for each level of production. To do this, subtract the next lowest level of output from the output.

Example: 679

            684   Change in Output 684 – 679 = 5

            687   Change in Output 687 – 684 = 3

            689   Change in Output 689 – 687 = 2

            690   Change in Output 690 – 689 = 1

PowerPoint Slide #15

           c. To finish calculating marginal cost, the change in cost must be divided by the change in output.

Example: MC = $1.35 / 5 = $.27

            MC = $1.35 / 3 = $.45

            MC = $1.35 / 2 = $.67

            MC = $1.35 / 1 = $1.35

PowerPoint Slide #16

        2. $MR = \triangle R / \triangle O$

           a. To begin calculating marginal revenue, the change, or difference, in revenue must be found for each level of production. To do this, the revenue at each level of output must be found. The difference is the production revenue minus the production revenue one level less.

Example: 679 x $.60 = $407.40
        684 x $.60 = $410.40   Change in Revenue $410.40 - $407.40 = 3
        687 x $.60 = $412.20   Change in Revenue $412.20 - $410.40 = 1.80
        689 x $.60 = $413.40   Change in Revenue $413.40 - $412.20 = 1.20
        690 x $.60 = $414.00   Change in Revenue $414.00 - $413.40 = .60

PowerPoint Slide #17

    b. To continue calculating marginal revenue, use the change in output calculations

       from marginal cost.

Example: 679
       684   Change in Output 684 – 679 = 5
       687   Change in Output 687 – 684 = 3
       689   Change in Output 689 – 687 = 2
       690   Change in Output 690 – 689 = 1

PowerPoint Slide #18

    c. To finish calculating marginal revenue, the change in revenue must be divided by

       the change in output.

Example: 3 / 5 = .60
       1.80 / 3 = .60
       1.20 / 2 = .60
       .60 / 1 = .60

PowerPoint Slide #19

    d. If the price is equal at each level of production, that will be the marginal revenue.

       However, if the price changes with more or less production, than the marginal

       revenue must be calculated.

       i. For this example problem, we could have realized that $.60 would be the

          marginal revenue, but we calculated it just to show the process.

PowerPoint Slide #20

F. Conclusion
   Marginal Revenue = $.60

Yield	Fertilizer	Fertilizer Cost	Cost	Output	Marginal Cost
679	30	$13.50	△none	△none	none
684	33	$14.85	$1.35	5	$.27
687	36	$16.20	$1.35	3	$.45
689	39	$17.55	$1.35	2	$.67
690	42	$18.90	$1.35	1	$1.35

PowerPoint Slide #21

   687 kg of wheat should be grown by applying 36 kg of fertilizer per hectare because
Marginal Cost is $.45 and is less than Marginal Revenue which is $.60. If the business
owner were to raise 689 kg wheat by adding 3 more kg of fertilizer per hectare, the marginal
cost increases greater than marginal revenue; therefore, the business owner would lose
profit.

Review/Summary: To review this lesson, guide students in completing WS 4-2. Be sure
to discuss the correct answers with the class. If students need more practice, create more
problems for them to complete

Evaluation: A sample written test is attached.

Answers to Test:

Part One: Completion

    1 = marginal cost

    2 = law of diminishing returns

    3 = marginal revenue

    4 = harvested

    5 = high, high

Part Two: Short Answer

1. Use Objective 2 to score this question.
2. Wheat price is $0.54 per kilogram. Fertilizer price is $0.40 per kilogram.

Kg Fertilizer	Kg Wheat Yield
30	679
32	681.5
34	685
36	687.3
38	689
40	690

What is the input? **Fertilizer**
What is the output? **Wheat**
Question? **How Much**
Principle? **MC=MR**
Equations: **MC=△C / △O**
Change in Cost: 30 x $.40 = $12.00

32 x $.40 = $12.80	**Change in Cost $12.80 - $12.00 = $.80**
34 x $.40 = $13.60	**Change in Cost $13.60 - $12.80 = $.80**
36 x $.40 = $14.40	**Change in Cost $14.40 - $13.60 = $.80**
38 x $.40 = $15.20	**Change in Cost $15.20 - $14.40 = $.80**
40 x $.40 = $16.00	**Change in Cost $16.00 - $15.20 = $.80**

Change in Output:

679	
681.5	**Change in Output 681.5 – 679 = 2.5**
685	**Change in Output 685 – 681.5 = 3.5**
687.3	**Change in Output 687.3 – 685 = 2.3**
689	**Change in Output 689 – 687.3 = 1.7**
690	**Change in Output 690 – 689 = 1**

MC= △ R /△O
Marginal Revenue = $.54

Conclusion: **Marginal Revenue = $.54**

Yield	Fertilizer	Fertilizer Cost	△Cost	△Output	Marginal Cost
679	30	$12.00	none	none	none
681.5	32	$12.80	$.80	2.5	$.32
685	34	$13.60	$.80	3.5	$.22
687.3	36	$14.40	$.80	2.3	$.34
689	38	$15.20	$.80	1.7	$.47
690	40	$16.00	$.80	1	$.80

689 kg of wheat should be produced because it is has the closest
Marginal Cost without going over Marginal Revenue.

Utilizing Economic Principles to Determine How Much to Produce

Instructions. Use the PowerPoint Presentation shown by your instructor to take notes on the following information.

Understand the Law of Diminishing Returns
Law of Diminishing Returns:

Marginal Cost:

Marginal Revenue:

Factors that Affect Profit
    Controllable:

    Non-Controllable:

Determine the Most Profitable Level of Production:
    Wheat price is $0.60 per kilogram. Fertilizer price is $0.45 per kilogram.

Kg Fertilizer	Kg Wheat Yield
30	679
33	684
36	687
39	689
42	691

What is the input?
What is the output?
Question?
Principle?
Equations:

Conclusion: Marginal Revenue =

Yield	Fertilizer	Fertilizer Cost	△Cost	△Output	Marginal Cost

Utilizing Economic Principles to Determine How Much to Produce

Instructions. Use your notes to find the most profitable level of production in the problem below.

Wheat price is $0.50 per kilogram. Fertilizer price is $0.40 per kilogram.

Kg Fertilizer	Kg Wheat Yield
30	679
33	684
36	687
39	689
42	691

What is the input?

What is the output?

Question?

Principle?

Equations:

Conclusion: Marginal Revenue =

Yield	Fertilizer	Fertilizer Cost	△Cost	△Output	Marginal Cost

Utilizing Economic Principles to Determine How Much to Produce

Instructions. Use your notes to find the most profitable level of production in the problem below.

Wheat price is $0.50 per kilogram. Fertilizer price is $0.40 per kilogram.

Kg Fertilizer	Kg Wheat Yield
30	679
33	684
36	687
39	689
42	691

What is the input? ***Fertilizer***
What is the output? ***Wheat***
Question? ***How Much***
Principle? ***MC=MR***
Equations: ***MC= △ C / △O***
  Change in Cost: 30 x $.40 = $12.00

33 x $.40 = $13.20	***Change in Cost $13.20 - $12.00 = $1.20***
36 x $.40 = $14.40	***Change in Cost $14.40 - $13.20 = $1.20***
39 x $.40 = $15.60	***Change in Cost $15.60 - $14.40 = $1.20***
42 x $.40 = $16.80	***Change in Cost $16.80 - $15.60 = $1.20***

Change in Output: ***679***

684	***Change in Output 684 – 679 = 5***
687	***Change in Output 687 – 684 = 3***
689	***Change in Output 689 – 687 = 2***
690	***Change in Output 690 – 689 = 1***

MC= △ R /△O
  Marginal Revenue = $.50

Conclusion: ***Marginal Revenue = $.50***

Yield	Fertilizer	Fertilizer Cost	△Cost	△Output	Marginal Cost
679	30	$12.00	none	none	none
684	33	$13.20	$1.20	5	$.24
687	36	$14.40	$1.20	3	$.40
689	39	$15.60	$1.20	2	$.60
690	42	$16.80	$1.20	1	$1.20

687 kg of wheat should be produced because it is has the closest Marginal Cost without going over Marginal Revenue.

Test   Name_____

Test
Utilizing Economic Principles to
Determine How Much to Produce

Part One: Completion

Instructions. Provide the word or words to complete the following statements.

1. The extra cost of producing one more unit of output is called _____ _____.
2. The _____ states that as a variable resource is added to fixed resources, marginal output declines immediately or after an initial stage of increasing marginal returns.
3. _____ _____ is calculated by dividing the change in revenue by the change in output.
4. Crops should be _____ at the proper maturity.
5. When selling products or commodities directly to consumers, the price should be - _____ enough to earn a profit, but not so _____ that consumers will not want to purchase the product.

Part Two: Short Answer

Instructions. Use complete sentences and correct spelling to provide the information below.

1. Name 3 factors that affect profit that can be controlled and 2 factors that cannot be controlled.

2. Find the most profitable level of production. Use the back of this sheet, if needed.
    Wheat price is $0.54 per kilogram. Fertilizer price is $0.40 per kilogram.

Kg Fertilizer	Kg Wheat Yield
30	679
32	681.5
34	685
36	687.3
38	689
40	690

What is the input?
What is the output?
Question?
Principle?
Equations:

Conclusion: Marginal Revenue =

Yield	Fertilizer	Fertilizer Cost	△Cost	△Output	Marginal Cost