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Case Study
Interview of Mark Bryan
9/29/2013

Farm Description:
Mark Bryan is a farmer that lives in McComb, near Findlay in the Northwest part of Ohio. His family farm consists of just under 2000 acres. They also do additional specialized work for some local owners, making the acreage covered about 2150 acres. He shares the farm (each owning about one-third of the property) and the work with his father and his uncle, while his mother does the bookkeeping. Mark plants the beans; his dad plants the corn and runs the combine, while his uncle plants the wheat. There are several fields of alfalfa grown for livestock on the farm, too. Decisions about buying are shared since quantity discounts are available for seed and other inputs, but selling decisions are individual, based on the amount of the crop owned by each of them.

Oats are seeded with new a new alfalfa seeding as a cover crop and are harvested before the alfalfa is tall enough to be cut for the first time. Clover is also sometimes seeded with oats for the same reason. Clover is planted when Mark wants it for hay. It is fed to the horses to eat in round bales during the winter since they are kept completely outside.

The crop breakdown in an average year is about 400-450 acres of wheat, 600-650 acres of corn, 700-750 acres of beans and 150 acres of alfalfa for the Hay Mill (Yarnells). Alfalfa is cut three or four times per season by the mill company and is made into alfalfa pellets and cubes for livestock feeds. The alfalfa mill in the area can dry it and make it into pellets so that it can be stored over a longer time. Mark's family also keeps about fifteen acres of alfalfa or grass mix hay for livestock raised on the farm. Any unused hay (five acres or so) is sold as small bales to locals.

Animals on the farm:
Mark and his family have four horses, several pigs and they raise goats for milk and use them as his children's 4H projects. They also have five dogs.

Crop Rotation:
Crops are rotated to maximize the nutrient use. Different crops have different nutrient requirements and the soil can become exhausted of nutrients if one crop is planted year after year. The acreage follows a corn-beans-wheat rotation. Typically alfalfa is planted after wheat (up to 4 years) to encourage deep tap-root structure which will fracture the soil (the soil is especially high in clay content in his area) to increase both natural drainage and pathways for other crops' roots to follow in time of drought. Alfalfa in a field over four years seems to have a beneficial effect on the next crop after two years. For example, during a year of severe drought after an alfalfa field had been replaced by corn for 2 years, the bushels per acre harvested were 99 bushels on that field as compared to about 70 bushels on the rest of the farm during that drought year.

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Questions:

1. What was the percent increase in production per acre from the alfalfa?
2. What are the characteristics of alfalfa that create the benefits of planting in a field? (think root structure and legume vs non legume plants.)

Harvesting:

When crops are harvested, Mark needs to decide to sell or store it. When all farmers in an area are harvesting, the price for the commodity is going to be lower, because of a large supply of the crop. Mark gets text updates 3 times a day on his phone with the local grain prices. In addition, the storage facilities in an area may be limited and deals must be negotiated with truckers and railroads to haul the harvested crop to companies that will process it into food, animal feed and fuel. If a farmer has his/her own storage, that can be an advantage, especially if there is higher moisture content in the harvested crop than is beneficial for storage.

Questions:

3. Why is high moisture content detrimental to a harvested crop?
4. What kinds of organisms can "spoil" a harvested crop?

When Mark is ready to sell, the crop is taken to a grain elevator where the amount he will be paid is determined by weight and the moisture content. Mark receives the market price if the moisture requirement is met and the elevator is open. When the storage is getting full, the elevator may only be open limited hours. When harvesting, Mark has to make decisions about whether to take the crop to the elevator or keep it in his own storage bins. His storage, called silos or grain bins, are equipped with dryers so that the moisture content can be lowered before selling. (He keeps fans on in most of his bins until a certain temperature/dryness has been achieved to maintain product…otherwise your grain will mold in the bin) This can be accomplished with much less expense by the individual than the amount paid to the elevator. If a farmer takes her crop to the grain elevator and it has higher moisture content, the elevator will charge a fee for drying and there will be a fee assessed for shrinkage of the total weight (since water adds weight). See these documents for the fee structure.

Often times, it is a difficult set of logistics to determine whether and how to sell the harvested crops. Mark farms for other land owners in an arrangement called "custom work." This is when the landowner pays for the work (planting and harvesting and hauling) at a flat rate. Harvesting does not wait so when crops are being cut, there is a complicated set of decisions to make about when to cut not only his crops, but the crops of other land owners he works for and to get the harvest to the grain elevator.

Sometimes Mark needs to consider making a decision to either 1) harvest immediately and then take to the elevator to dry, and sell it them for a lower price or 2) harvest with the capacity of his dryer (so not as fast as taking to the elevator) and risk losing some of the crop to either pests or weather. He usually dries his own crop and takes landowner crops to the elevator.

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Questions:

5. If Mark takes a truckload of corn (25 tons of corn) to the elevator and it is 22% moisture, what will be the amount he would make if the bushel price is $8.00/bushel?
6. How much would he make if the corn had 15% moisture?

Capital Investments:
The capital investments made on the farm are related to newer updated equipment. This year they purchased a new tractor that is operated with continuously variable transmission or CVT. This is a technology that uses a pulley system that allows an infinite variability between highest and lowest gears with no discrete steps or shifts, unlike the traditional transmission that utilizes gears. The operator dials in the speed, then the transmission determines the RPM's or speed for the terrain and operation. This technology uses only about half the fuel as tractors with traditional transmissions. In addition, the exhaust is treated by a "scrubber"-type apparatus using diesel exhaust fluid (DEF) as a selective catalytic reduction (SCR) in order to lower nitrous oxide (NO_x) concentration of the diesel exhaust emissions from diesel engines. The exhaust is advertised as air that is cleaner than it was when it entered the engine.

One of Mark's neighbors has three tractors with payments that equal $25,000/year/tractor. However, the tractors are so fuel efficient, that the fuel savings is equal to the payments on one of the tractors for the year! Diesel prices are about $3.25/gallon right now, but they have fluctuated greatly in the past 2-3 years, making it an expensive input that is necessary for operating planting and harvesting equipment.

Another area for capital is business software that is compatible with precision farming equipment. Much of the software is PC compatible, so Apple users are at a disadvantage in this market.

Fuel:
Where does Mark get his fuel? He has diesel delivered to his farm by a local fuel hauler. The hauler runs his own small business that provides fuel to the local Hearthside Solutions factory and if he has left over fuel, instead of taking it back to his business, he will drop it at local farmers' whose storage needs a fill-up. (Contracts are available for diesel fuel to guarantee a specific price, but the minimum amount that most companies require to be contracted is 5000 gallons. Storage of 5000 gallons on a farm requires special permits from the EPA as well as regulations so that storage would then be subject to regular inspections.)

Soil Maintenance/Preparation:
Two of the most important decisions a farmer makes, after deciding what crops he will plant, include the type of tillage he will use and the fertilizer he will apply.

There are two general tillage systems farmers use: no-till or conventional tillage. Tillage refers to how the ground is prepared for planting. Some farmers use all one approach while others use no-till for some crops and conventional tillage for others.

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Mark uses no-till for beans. When planting beans, the planter drills a ¼" wide column and the beans are planted in the column. After harvesting the beans, he plants wheat with a drill that puts the wheat seed into the ground. After wheat is harvested, he will till the soil with a disk that tears up the wheat stubble and buries an herbicide-resistant weed called mare's tail. The disking helps to break up the soil. When it is time to plant corn in the spring, the field will be turned with a "light" disk to level the soil and warm it before planting. After corn is harvested, he will leave the stubble on the field until it is time to plant beans again in the spring.

Equipment:
The main difference in tillage equipment is whether a vertical system or a horizontal system is used. Most farmers use a combination, depending on the season and the purpose. See Case IH for more information about the differences between the equipment and photos of each type (Chisel Plow, Disk Rippers and In-Line Rippers).

Part of the advantage of no-till methods is the crop residue that is left on the field. That residue, i.e. corn stalks, wheat stubble or cover crops that are planted on the field to over-winter, reduce soil erosion (by holding soil in place) and break down slowly over time to return nutrients and organic material to the soil. Organic material in soil will allow air to circulate through it for better root development and water percolation when it rains encouraging more rain to drain to the subsoil, rather than run off the field.

Fertilizer:
Synthetic fertilizer is a blend of nitrogen, phosphorus and potassium. Labels for fertilizers show the percent of each in that order. Fertilizer use is a complicated decision making process by growers. In the fall, growers generally apply potassium. Potassium encourages early growth, increased protein production, efficient water use and helps plants to resist disease and insects. The amount of potassium needed varies with the crop that will be grown in the field the next year.

In the spring, nitrogen and phosphorus are applied. The nitrogen aids growth and green leaves to help with photosynthesis, while phosphorus helps plants develop the seed and yield.

One exciting idea that has some potential is to use waste products from chicken operations where egg products are being used. The eggshells are mixed with fertilizer or manure. The calcium in the eggshells is basic, so it would help to raise the pH of the soil; many farmers apply lime to accomplish this.

Questions:

7. What are the three nutrients in fertilizer?
8. How might a farmer know whether he needs to apply fertilizer and in what amounts?
9. What might be a side effect to the soil of running equipment over the field?

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Answer Key:

1. Percent increase: 70->99 bushels/acre

(99-70)/70 = .41 * 100 = 41% increase over other fields

2. Alfalfa characteristics:

it is a legume, which has symbiotic nitrogen-fixing bacteria in root nodules. The bacteria can add nitrogen back into the soil,
Root structure-alfalfa has a deep root-system, potentially as long as 15m, making it drought-resistant

3. Why is high moisture content detrimental to a harvested crop?

High moisture rate will cause the grain to rot, sprout, or even cause a grain bin fire. Spoiled grain will get a very low price (or will not be accepted) and will have to be mixed in with higher quality grain for wholesale to manufacturers. (Interesting fact, one reason I only feed my grain to my animals is because many local people have complained about deaths/poor growth rate of gain with their livestock around here and it has been connected to moldy feed coming from the elevator).

4. What kinds of organisms can "spoil" a harvested crop?

Insects, bacteria, fungi, protists (also consider abiotic components/too much rain during wheat harvest will cause it to sprout/or knock it off)

5. If Mark takes a truckload of corn (10 tons of corn) to the elevator and it is 22% moisture, what will be the amount he would make if the bushel price is $8.00/bushel?

The shrink is 9.8% The drying charge is .28 The conversion factor is 90.80.
Each bushel weighs about 60 lbs.

$$10 \text{ tons} * \frac{2000 \text{ lbs}}{1 \text{ ton}} = 20000 \text{ lbs} - (20000 * .098) = 18040 \text{ lbs } \textbf{shrink}$$

6. How much would he make if the corn had 15% moisture?

$$10 \text{ tons} * \frac{2000 \text{ lbs}}{1 \text{ ton}} = 20000 \text{ lbs} * \frac{1 \text{ bu}}{60 \text{lbs}} = 333.33 \text{ bu}$$

$$333.33 \text{ bu} * \frac{\$8.00}{1 \text{bu}} = \$2666.64$$

7. What are the three nutrients in fertilizer?

Nitrogen, Phosphorus and Potassium

8. How might a farmer know whether he needs to apply fertilizer and in what amounts?

Many farmers have their soils tested for the presence and amounts of nutrients and pH, so they know what nutrients are deficient and can make informed decisions. The soil nutrients can vary widely even within one field.

9. What might be a side effect to the soil of running equipment over the field?

The soil can become compacted, causing a lack of oxygen and that may inhibit growth of plants.