**Crops and Management**

The game is based on making decisions about tradeoffs between economic, energy production, and environmental benefits. These tradeoffs and their associated severity are summarized in the table below. The number represents the magnitude that the player choice (either crop choice or management options) will have on the corresponding elements of individual fields (yield, soil health, and water quality).

**Player Decision Implications:***[need to update with additional features]*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | *Yield* | *Soil Health* | *Water Quality* |
| *Crop Choices* |  |  |  |  |
|  | Corn | 3 | -2 | -2 |
|  | Cover Crop | 1 | 3 | 2 |
|  | Switchgrass | 2 | 2 | 2 |
| *Management Options* |  |  |  |  |
|  | Increased Fertilizer | 1 | -2 | 0 |
|  | No-Till | 0 | 1 | 0 |

**Corn**

*[insert photo – game card would work]*

Corn is the most commonly planted crop in the United States. The grain is widely used to produce both biofuels, such as ethanol, and food for livestock and people. Scientists have recently discovered new ways to produce biofuels from rest of the corn plant called corn stover. Using corn stover to produce biofuels is an attractive idea because the stover is already being produced in great quantities and, unlike corn grain, is not used directly to feed people.

Because corn has been grown and bred for thousands of years, farmers have developed sophisticated methods for producing high yields of the crop under a wide range of conditions. There are also very good markets for both corn grain and stover, which are important ingredients for food, fuel and other products. For this reason, corn is currently the most profitable bioenergy crop.

However, there are also some drawbacks to planting corn. Corn is an annual crop. This means that farmers need to replant it every year, which can be expensive, takes time and has negative environmental impacts. Replanting, tilling the soil, fertilizing and harvesting every year can have negative impacts on soil health and produces more carbon dioxide ( CO2) emissions from tractors. Also, like most annual crops, corn does not have very deep roots. When the plant is harvested, the remaining roots do not restore very much carbon to the soil as they decompose. Shallow roots do less to prevent water and wind erosion.

In addition, corn needs large additions of fertilizers, pesticides, and water to grow well. This can be both expensive for the farmer and can harm wildlife and groundwater. Corn is a grown as a monoculture (only one crop type in the whole field). These conditions make it a poor habitat for insects, birds and wildlife

**Switchgrass**

*[insert photo – game card would work]*

Switchgrass is native to the United States and has been growing wild in the country’s grasslands for thousands of years. It is a hardy plant that grows well in a range of conditions thriving in upper midwest, central and southeastern U.S. In particular, switchgrass can grow well on soils that are too poor to support a healthy corn crop. It has received a great deal of attention recently as a potential bioenergy crop because it can produce good yields in poor soils with little water and fertilizer inputs.

Unlike corn, switchgrass has been grown and bred by farmers as a crop only recently, primarily as a forage crop for livestock. Farmers and scientists have had less time to figure out the best way to grow and harvest this crop under a range of field conditions, but researchers are working hard to improve techniques for switchgrass cultivation. Switchgrass yields per acre are lower than those of corn, but the costs of production are also lower. Unlike corn, switchgrass does not have the same strong, well-established markets for both food and fuel. Farmers growing switchgrass can expect modest profits in comparison to corn. However, it can be an appealing option to farmers because it can grow well on land not suitable for corn.

Switchgrass is a perennial plant that grows back year after year from its extensive root system. Therefore farmers can spend less time and money on replanting. Less time spent running tractors for tilling and planting also means less CO2 released into the atmosphere. Switchgrass’s very deep root system helps take CO2 out of the atmosphere and store it in the soil. Deep roots also prevent soil erosion, chemical runoff and help the crop tolerate droughts.

Like corn, switchgrass is grown as a monoculture. But because switchgrass is a native perennial, it provides more reliable habitat for birds, insects and other wildlife that have depended on the plant for thousands of years. Scattered weeds often grow in switchgrass fields, which also contributes to supporting biodiversity.

**Fertilizer**:

**Till vs. No -Till**