# Timeline to Diversifying Farming Practices

Why and How Farmers can Transition to More Resilient Practices

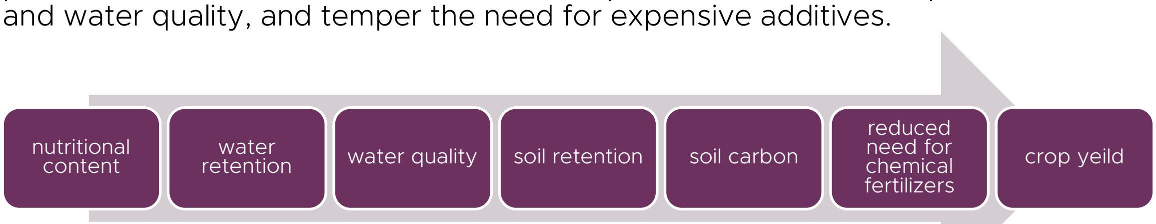
*Farmers and Policymakers can meet the needs of the present without diminishing opportunities for the future.*
*-John Ikerd, Prof of Agricultural Economics, Univ of Missouri*

With the global population expected to reach 9.8 billion in 2050, over a third of the world's arable land lost in just the past four decades, and rising agricultural production expenses, farmers globally may soon face difficulty in growing enough food to meet demand. Current projections estimate that farmers utilizing current, traditional, farming practices will see decreased income. Farming inputs like fertilizers, pesticides, and tilling machinery are annually increasing in cost, and climate instability is increasing the chance of unprofitable harvests. Continuing to operate in the existing agriculture system will result in reduced food supply and reduced profits. Farmers will be unable to make a living and feed the population.

Fortunately, diversifying farming practices away from traditional practices and toward more sustainable practices is one viable solution that can support the livelihood of farmers, sustain our food systems, and have a positive impact on the climate. For example, traditional practices such as mono cropping, excessive tillage, and artificial nutrients management can be substituted with sustainable alternatives like crop rotation, cover crops, no till, and natural nutrient management. Any steps toward diversification of farming practices work to creates a virtuous cycle where food production becomes more sustainable over time, both for farmers and for the earth.

As with any solution, the devil is in the details. Research suggests that after four years of using these sustainable farming techniques, a farm can generate up to 12% more crop yield per hectare, while simultaneously lowering operational costs (see Figure 1 below). After implementation, one farmer in Ohio reported a $38 increase in net income per acre. Thus, farms cannot transition overnight, and farmers and food systems will need additional support during the transition period.

In addition to long term increases in revenue for a farm, productive farming produces more nutritious food, improves underlying ecosystem functions, and is oftentimes societally beneficial. These phenomena are, in part, due to diversified farms' declining need for pesticides, fertilizers, and other accessories that create a cycle where more and more products are needed to maintain the same harvest output. Sustainable farming techniques like low-to-no-till, nutrient management, and cover cropping, can increase the percent of essential minerals, vitamins, and proteins in the food, improve local air, soil, and water quality, and temper the need for expensive additives.




Increased value-adds of diversifying farming practices.

The transition to sustainable farming can be divided into three stages: identification, implementation, and inertia. Herein, we've generalized transition steps to acknowledge a farm's individual features. The purpose of this work is to outline the transition to sustainable, diversified farming and highlight the points where a farmer needs the most support to transition from standard to diversified techniques.

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## Stage 1 — Identification

A farmer looking to transition to sustainable best practices can begin with identifying the practices on the land that are considered unsustainable in the long term. This includes overuse of Nitrogen and Phosphorus fertilizers, excessive tillage, monocropping, and underutilizing animal impact and composting/manure.

The chart below identifies the most common practices that are typically employed by farmers and the alternative, more productive, practice that a farmer may want to consider.

| Practice/Issue | Current Effect on Environment | Proposed Alternative |
|---|---|---|
| Overuse of fertilizers | • High erosion rates<br>• Soil that appears red is evidence of degraded topsoil<br>• Harmful algal blooms in nearby bodies of water | • Soil amendments regenerate soil health, fertilizers add missing nutrients explicitly for the crop.<br>• Use a soil amendment that restores soil quality, like compost |
| Overuse of pesticides | • Decrease in beneficial microbes, organisms like earthworms, and fungi | • Use buffer zones<br>• Pest management techniques with native beneficial insects |
| Monocropping | • Reduction in nutrients and organic matter in soil (red soil)<br>• High erosion rates<br>• Decrease in plant growth and beneficial microbes over time | • Rotational cropping<br>• Cover crops |
| Excessive Tillage | • Highly compacted soil<br>• Decreased water-holding capacity of soil<br>• Loss of vital microorganisms<br>• Deterioration in surface water quality | • Reduce tillage intensity<br>• Use less agitating tools like chisel plow shanks<br>• Cover crops |
| Animal Impact | • Reduction in soil organic matter<br>• Reduction in water holding capacity of soil | • Studies suggest that multi-species pasture rotation dramatically improves soil health |

## Stage 2 – Implementation

After a farmer has identified practices to implement, support is critical as the farm changes from one technique to another.

This makes Stage 2 the most vulnerable period for the farmer. Support needed can range from monitory support to make up for loss of income to loans to purchase new equipment. Exact methods of changing land management practices will vary based on resources available and extent of underlying conditions identified within Stage 1. Some studies suggest that after four years of initial implementation of sustainable techniques, a farm can expect to break even, and subsequent years are increasingly profitable.

Bain & Co (a consultancy) did a study on profit and loss incurred by the transition from traditional to more diversified agriculture techniques. Figure one depicts the conclusions. In this figure, Year 1 depicts the revenue from traditional farming practices, and is indicated as the "breakeven point." The lefthand columns for Years 2-6 are the additional costs associated with each diversified technique (including money saved from reduced tillage, shown in gray) and the righthand columns are the additional revenue from the techniques. In Year 2 (the first year of the switch), there are \$191-\$40 = \$151 in additional costs, and only \$33 in additional revenue. In Year 4 there are \$144-\$42 = \$102 in additional costs, and \$119 in additional revenue. In Year 4 – a \$17 profit per hectare is realized. In Year 5 there are \$132-\$43 = \$89 in additional costs, and \$154 in additional revenue, a \$65 profit.

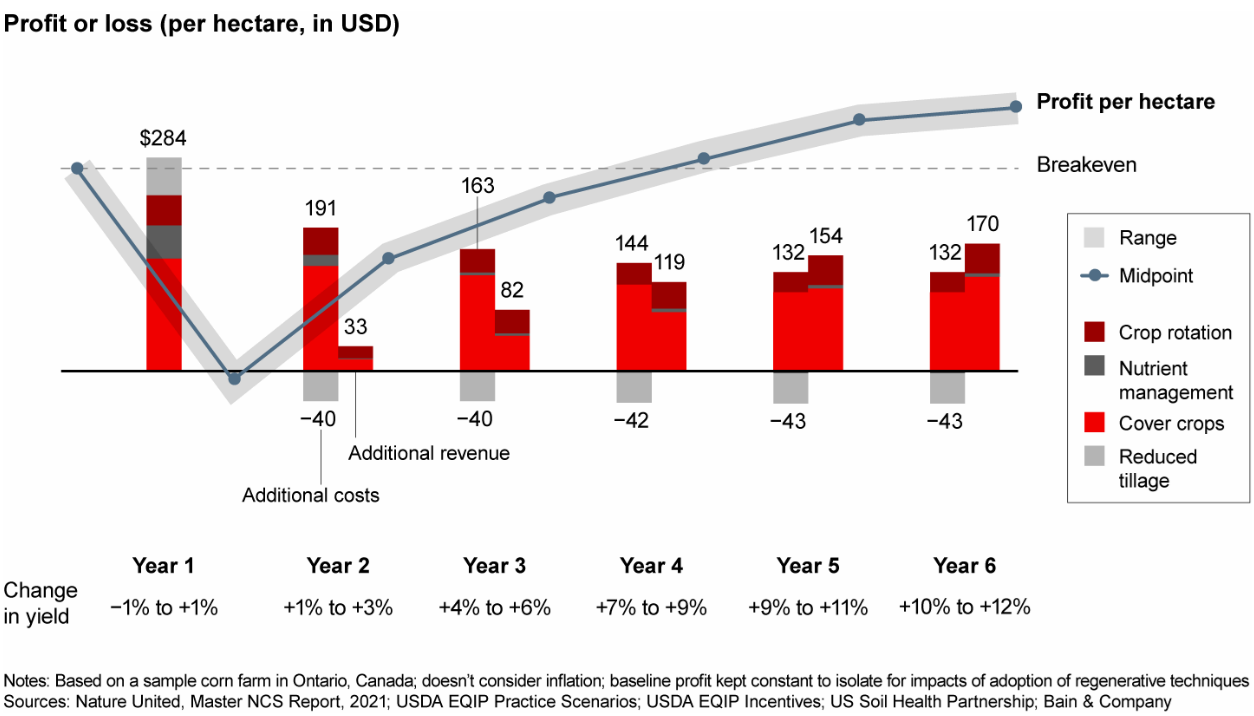


**Figure 1. Graph of Additional Costs and Revenue. From - https://www.bain.com/insights/helping-farmers-shift-to-regenerative-agriculture/**

Many diversified farming techniques aim at restoring soil carbon, which is essential to bolster soil's growing capacity. This means that while farmers make the transitions to productive practices, cultivated soils will increase in their carbon content. Farmers can report these changes in the Georgia Carbon Sequestration Registry, which may yield additional income as a landowner can sell carbon credits to entities that are seeking to offset Greenhouse Gas (GHG) emissions.

## Stage 3 — Inertia

Research suggests that after this transitionary period, a farm acclimates to sustainable, diversified farming techniques such that some degree of self-sufficiency is built, and outside support can be generally reduced. Implementation of these farming techniques fosters resiliency and enables farms to more easily bounce-back from negative events, such as severe storms or droughts. This implies that though Stage 2 requires the most support, it will c be the last time large-dollar-amount support is needed.

Continual use of diversified farming techniques will lead to increased profitability, crop yield, and a cascade of positive effects for the farmer's surrounding ecosystem.

## Policy Recommendations

To do nothing is not a viable solution. Crop yields will fall, and expenses will increase. Policies are needed to aid farmers in their transition to diversified, sustainable, practices. The National Sustainable Agriculture Coalition outlines many ways that farmers could be supported, including grants, microloans, whole farm revenue protection and information services. For instance, Georgia Organics, a nonprofit that dedicates itself to small and mid-sized farms, began an informational program that involves farmers attending workshops, building an action plan, and ultimately creates a resilient farm.

Since Stage 2 is the most vulnerable time for a transition farm, policy may instead choose to focus on assuring the livelihoods of farmers during this stage. Instead of an piece-meal approach, as suggested above, whole farm revenue protection could work as insurance for all crops on a farm. Grants that encourage implementing diverse practices would function similarly.

In 2021, HB355 expanded the Georgia Carbon Sequestration Registry to include farmland. Updating the registry to transparently report sequestered carbon and its linkage to farming techniques use allows for even comparisons between farming practices.

To encourage participation in the Registry the associated registration fee could be waived for the five-year transition period to productive farming. Additionally, it is important that farmers be given information on how to enter the carbon registry and monetize their actions. The Registry has the potential to facilitate collaboration between Georgian farmers, the public, and key stakeholders in the carbon market.

## Glossary of Terms

Tillage — The act of prepping soil for growing. This involves loosening and aerating soil that can be beneficial for factors like inhibition of weed growth when managed correctly, but over-tilling can accelerate nutrient, fertilizers and pesticide runoff by decreasing function of soil

Cover Cropping — Crops grown for the sole purpose of "covering" soil to prevent erosion, increase soil organic matter and more. In Georgia, cover crops include cereal rye, and oats for the winter and sorghums and sun hemp in the summer

Monocropping — Growing the same crop on the same plot of land, year after year. It's main advantage is a farmer can specialize in a certain crop, but this technique depletes the soil of essential nutrients, which causes a reliance of fertilizers

Soil Amendment — Also known as a soil conditioner, these include a wide range of methods, like composting and chicken manure, that seek to restore critical properties of soil

Buffer Zones — Vegetated strips adjacent an agricultural field that aid sediment, nutrient run-off, and water quality

Rotational Cropping — Opposite on monocropping and can include 3 to many different crops. This technique improves soil health and impedes disease and pest cycles

Animal Impact — Especially for farmland that has raises livestock, integrated crop-livestock systems can positively impact agroecosystem processes

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