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Application of Principles of Integrated Agricultural Systems: Results from Farmer Panels

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Abstract: The Integrated Agricultural Systems workgroup is examining agricultural systems of the US to determine fundamental principles that underlie successful production systems. Our hypothesis is that principles are applicable across regions, but key drivers interact to influence producer decisions and create distinct production systems. We interviewed agricultural producers to examine the underlying rationale for producer decisions and discern primary factors influencing production and marketing practices. While drivers are common among regions, interactions between drivers and influences on decision-makers vary substantially to create unique production systems. The internal social driver that values farming lifestyle is the principal factor that leads people to farming. The type of farming is partly a lifestyle choice and is influenced by other factors. Economic drivers and marketing options are primary drivers influencing production systems and management choices, as farmers provide an economic foundation for their families. While all producers employed strategies to manage production and marketing risks, these varied with different marketing channels. Identification of key drivers and principles can be used by producers, scientists and policy makers to direct agricultural production and agricultural research. New management systems can be developed that are flexible enough to respond to changing societal demands, and are environmentally and economically sustainable.

Key words: Agricultural markets, economic drivers, social drivers, risk management, entrepreneurial strategies, integrated agricultural systems.

1. Introduction

Agriculture in the U.S. is undergoing profound changes from increasing urbanization, turbulence in input costs and commodity prices, and shifts in consumer demands and global competition. Future challenges will need to address increasing population with a shrinking land base for agricultural production, food safety and security concerns, and resource preservation and environmental concerns. Knowledge of the fundamental principles of agricultural production systems is critical in order to design agricultural systems and markets that are economically feasible and environmentally sustainable [1].

The Integrated Agriculture Systems Workgroup was formed to delineate principles that underlie successful agricultural systems for physiographic regions throughout the U.S. We hypothesize that these principles are location neutral and applicable to a wide spectrum of agricultural systems [2]. At the first meeting, scientists identified key drivers that provide an impulse or motivation for taking specific actions within agricultural production systems [3]. These drivers, common to all agricultural systems, interact to create the characteristics of the production system. The drivers were grouped into five primary areas: Social, Political, Economic, Environmental and Technological.

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Internal social drivers were defined as those factors, arising from within the farm system, that direct the decision making process of the farmer [4]. External social drivers include consumer attitudes and societal values, and are translated into political drivers as they are incorporated into laws and regulations, such as environmental regulations. Economic drivers operate both internal and external to the farming operation, and include the money flow and marketing operations of the crop [5]. Environmental drivers include climate, pests, invasive species and natural resources that impact the production system [6]. Technological drivers arise in response to limitations in production, processing, and marketing, and are influenced by internal and external social values and economics [7]. Technological advances have arisen from many disciplines, including biological and engineering advances as well as knowledge systems, such as conservation practices and computer modeling.

Integrated agricultural production systems have been defined as agricultural systems with multiple enterprises that interact in space and/or time resulting in a synergistic resource transfer among enterprises [2]. Integrated agricultural systems have become less common in the U.S. as agricultural concentration and production have increased [8]. However, they may provide a vehicle to address some of the growing concerns with conventional agriculture [1, 2].

By examining different agricultural systems in detail, we will determine fundamental principles that underlie agricultural systems. Our goal is to determine if the same principles apply across different regions and production systems. Identification of these principles will allow producers, scientists, and policy makers to develop economically and environmentally sustainable production systems [9]. Understanding how the key drivers of agricultural production interact to influence producer decisions and create different production systems will allow the directed development of optimal, sustainable production practices.

Our hypothesis is that principles are applicable across regions, but key drivers interact to influence producer decisions and create distinct production systems. We test this hypothesis through an examination of case studies of production systems from different geographic regions of the United States.

2. Materials and Methods

We examined production systems in detail by posing a series of questions to invited panels of producers. University, Federal, and Extension scientists from a range of backgrounds interviewed the farmers, and then met to discuss production strategies and develop drivers, characteristics and principles of operation from these case studies.

Panelists were selected who were actively engaged in agriculture from predominant production systems within each geographic region. We are interested in examining farming operations that contribute positively to agricultural production, but remain family owned. To this end, we chose farmers who rely on farming as their primary source of income. The farmers invited to the workshops do not represent “average” farmers in terms of acreage farmed or number of output products, as reported by state statistics [10]. Note, however, that reported state averages include all farms, including recreational and retirement farms whose primary function may not be the production of agricultural products. Most notably, the farmers interviewed are progressive farmers who regularly work closely with scientists and extension. Although larger than average, the farms were all operated by a single, often multi-generational family. None of the farmers considered their operations agri-businesses, though several of the farms were incorporated to take advantage of this business strategy.

The first producer panel meeting held in Auburn, AL in 2005 examined Southeast production systems including: traditional row crop production, hay and grass seed production, and livestock. Row crops included cotton, corn, soybeans, and peanuts.

Livestock production systems included confinement chicken production, catfish and cattle production. Ancillary enterprises included timber production, catfish feed and processing plants, manure spreading, custom harvesting and cotton ginning. The second producer panel meeting was held in Orono, ME in 2008. The systems examined from the Northeast included: traditional potato, small grains and corn production, organic vegetable production, and livestock production. The livestock production systems were grass-fed beef and organic dairy. Ancillary enterprises of the Northeast farmers included corn cob fuel, firewood and maple syrup production, snow plowing and custom harvesting.

3. Results and Discussion

3.1 Drivers of Production Systems

One of the strongest drivers was the internal social driver that valued farming as a lifestyle. Irrespective of production system, producers saw farming as more than just a job, but a commitment to family and heritage. The particular type of farming enterprise (conventional vs. organic) was further influenced by the producers' values. Other social drivers that impacted the production choices arose from external values, primarily customer values and marketing options. Social issues and opinions become evident through implementation of policies and regulations. Producers in both regions were politically active, but their issues and concerns varied by location and production system.

Economics was one of the two most prominent drivers on which producers base their decisions. For producers, economics covers making a living, reducing risk, and marketing the product. Producers in both regions and across all production systems stressed the need to implement production practices with the goal of earning enough to have a decent living. The choice of crop and livestock mix that the producer used were somewhat dictated by environment but also greatly influenced by the internal social values of the individual.

The environment was an external factor that resulted in significant differences between production systems and practices in the Southeast and Northeast. The cold temperatures and short growing season in Maine created more challenges to production. Alternative technologies, such as hoop houses and barns, were required to extend the season. These added expense to the production system and restricted the ability of younger producers with limited capital to expand. Maine soils are generally rocky and hilly, and some are highly eroded. Both traditional and organic producers emphasized the importance of rebuilding soils as the key component for improving their production systems. However, the colder climate, especially in the northern portions of Maine, limited the use of soil-building practices such as cover crops. Farmers in Alabama also saw soil as a primary factor determining their production success. However, the high cost of rented land and competition from other farmers for improved land restricted their use of soil-improving practices to land that they owned [11].

In keeping with the entrepreneurial spirit and aggressive approach to learning, the producers chosen for the panels were willing to try new technologies, even if unproven, provided the technology fit with their production philosophy. While all producers interviewed were progressive, those in Maine were more aggressive in implementing new technology due to available marketing channels and internal and external social values. The producers, especially the larger, more traditional producers, saw implementation of new technology as a means of reducing input costs, for example allowing them to move to once-over field preparation or harvest operations. All of the producers used computers, especially for marketing decisions and knowledge acquisition. Producers used the internet for following price trends and markets, as well as establishing marketing outlets, and to expand their knowledge base on potential crops and crop production practices beyond that which was available locally.

3.2 Characteristics of Production Systems

In commodity markets, the identity of the producer is not important to the buyer. Commodities are commonly produced in large scale operations and sold on the global market. Any single producer has little ability to affect the quantity and price of goods sold. Producers of specialty crops have moved towards contracts with processors or consumers to manage risk. In specialty markets, the identity of the producer becomes much more important as producers establish individual sales markets. Specialty crops and niche markets allow the producers to distinguish themselves based on quality, production techniques, location differences, and so on.

In the panel discussions, there were significant differences between commodity crop and specialty crop producers, based primarily on their willingness to try alternative marketing strategies. In Alabama, the majority of production is devoted to commodity crops, including rice, cotton, peanuts, and corn [12]. Alabama producers interviewed who grew commodity crops mentioned that they felt they were "farming the programs", a process with which they were dissatisfied. The availability of income supports, while providing some risk management, constrained the decision-makers with respect to specific enterprises and the components of their production systems.

In contrast, the absence of potential support payments led Maine producers to develop their own markets. Maine agriculture consists primarily of dairy, potato and vegetable production. Commodity crops (most commonly corn) are used as a rotation crop or for on-farm animal feed production. A significant number of Maine's dairies have converted to organic production because they believe it gives them a competitive advantage and increased income. To reduce marketing risks, some Maine producers have formed cooperatives that bargain with processors. Community support was also important in providing marketing avenues for Maine growers, especially for organic vegetables and dairy, and grass fed beef. While the initial absence of marketing options was risky for the growers, development of individual marketing contracts left them with substantial freedom in their farming operations. By having a stronger voice in the market, Maine producers manage the marketing risk while maintaining control of their production.

3.3 Comparison of Regional Production Systems

Conventional production systems in the U.S. have transitioned towards agribusiness systems, with increases in land area and capital investment used to offset increasing input costs. This transition has been driven by the industrialization of processing, marketing and food consumption. In the absence of commodity payments in these systems, producers have moved towards contract sales to manage marketing risks. Traditionally, a benefit of contracts is that they transfer risk to the processor and lessen risk to the producer. Comparison of two predominant production systems in the Northeast and Southeast reveal some interesting differences that greatly impact the success of the operations.

Poultry production in the U.S. is concentrated in the Southeast [13]. The industry is highly vertically integrated [14], with most aspects of production dictated by processor contracts [11]. The processing company owns the chickens and the feed, and specifies the beginning batch of chicks, the feed, construction, maintenance, and upgrading of houses, and all environmental conditions in the houses. Farmers are required to deliver a minimum weight at harvest, and are paid for the weight of the birds less cost of feed. No premium is paid for higher quality or quantity. The loss of control of the production system by the poultry producers was a major negative factor influencing the success of the system. The debt incurred to establish the chicken houses, together with the aggressive company contracts and demands, limited the flexibility of the farmers.

In contrast, the production contracts made between potato farmers and potato processors in the Northeast allowed farmers substantial influence in establishing production decisions, with the exception of cultivar type. By maintaining control of production, farmers had more leeway to respond to changes in markets, and were able to optimize production for their particular situation. Since these contracts were negotiated annually and included a bonus for premium quality, the producers had the incentive to achieve high performance.

Specialty production arises in response to consumer demand or to bring a new or value-added product to market. Development of markets is essential to success of specialty production systems. In the Southeast, catfish production was begun around 40 years ago to provide an alternative product for heavy clay soils [15]. Establishment of farmer cooperatives allowed development of standardized feed, processing, and testing of catfish for off-flavors. Development of markets was also facilitated through cooperatives and processing plants, many of which were farmer-owned. The large-scale production targeted by the catfish industry led to successful sales of catfish in national and international markets. The consistent high quality and flavor of farm-raised catfish led to establishment of a successful industry in the U.S. In the past 3 years, the sudden increase in soybean prices and global competition has negatively impacted the U.S. catfish industry [16]. Soybean is a component of catfish feed, and also an alternative crop to catfish ponds. The sudden doubling of catfish feed costs, together with the higher return for soybean crops, led to a decrease in catfish pond acres. Moreover, the importation of cheaper fish out-competed U.S. catfish in the marketplace. Because catfish markets were established in national and international markets, producers had little customer loyalty or support.

In contrast, the organic and grass-fed beef specialty markets in Maine focused on local markets. This is in part due to their smaller scale of production. However, they are also responding to increasing consumer demand for locally grown and/or organic products. The marketing strategy of one producer demonstrated the importance of and support for local production: “Grown in Maine, by Mainers, for Mainers”. By working closely with their customers, the Maine specialty producers have developed strong support for their products and a growing market. It remains to be seen if the price premium for organic and local production is able to withstand economic downturns.

3.4 Principles

Although there are significant differences between the two regions, such as climate, soils, and types of production systems, certain drivers and principles guided the producers’ decision making and were common to both regions. The single largest factor impacting the farmers’ decision was the desire to farm. The farmers saw farming as a lifestyle choice, and the particular type of production (e.g. conventional vs. organic) was also driven by an internal philosophical commitment. This internal social driver was tempered by the need to provide an economic foundation to support the family. The producers were also active in their rural and farming communities, being active in both civic organizations to support the local community and in growers’ groups to support farming initiatives. This also ties in with the importance of cooperation between farmers and customers to develop sustainable communities [17]. These can be summarized as:

To be successful, production must provide a decent lifestyle for their families, and support for their communities.

Production should allow the transfer to the next generation.

Regional cooperation between farmers and other relevant stakeholders is necessary for sustainable landscape development.

Economics was the second major factor in successful farming operations. All production systems

had methods of managing production and marketing risks, and were focused on providing an economic foundation for their families. Moreover, the restrictive production contracts employed by chicken processors were a strong negative influence on the success of that production system. These economic principles of successful systems can be summarized as:

Methods to manage production and marketing risks should allow flexibility;

Production systems must provide an economic foundation for the family;

Corporate production contracts can reduce producers' management flexibility.

All producers, whether conventional or organic, were concerned about preserving and improving the natural resource base. They were all intimately aware that the health of the soils and the availability of water resources were critical for successful production. Moreover, critical to the continued success of environmentally friendly production systems was the development of markets that valued these attributes. The key environmental principle can be summarized as:

Production practices must keep or improve the natural resource base;

Markets must be developed that value environmental attributes to speed the adoption of "sustainable or green technologies".

Technological principles arise is response to other principles and drivers. The choice of a specific technology, such as conservation technologies, genetically altered crops, and so on, is used to support other choices.

4. Conclusions

Although the agricultural systems we reviewed differed in physical resources, climate, and production systems, producers followed the same principles to further their goals. They all placed high values on continuity, preserving their natural resources, and contributing to their families and communities. If one principle was preeminent, it was to ensure future generations the ability to maintain the same life style. Second was the commitment to contribute to their communities. These internal social values are important in developing sustainable production systems and vibrant rural communities. The key principles we identified are consistent across the geographic regions, and support our hypothesis, though the individual drivers varied within each region.

Reconnecting the consumption and production cycles of agriculture is critical to transition agroecosystems towards sustainability. By identifying the responsiveness of current production systems to forces that are shaping agriculture, we have identified successful strategies that will be useful for addressing future challenges to agriculture. New management systems can also be developed that are flexible enough to respond to changing societal demands, and are environmentally and economically sustainable.

Disclaimer

Mention of trade names is given to provide specific information and does not constitute recommendation or endorsement by the USDA-ARS.

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