

Overview of Farm Management

In the early 20th century, families operated most farms using local resources and labor. The farmers recycled organic material, and used rainfall and built in natural pest controls. Farms had both livestock and cropland. Farmers safeguarded production through rotating crops in space and time to reduce risk. Legumes were grown in rotation to provide inputs of nitrogen. These techniques suppressed insects, weeds and diseases by breaking the lifecycles of these pests. Only limited equipment and services were purchased off farm.¹

Today as more and more farmers are integrated into international economies, imperatives to diversity disappear and monocultures are rewarded by economies of scale. In turn, lack of rotations and diversification take away key self-regulating mechanisms, turning monocultures into highly vulnerable agroecosystems dependent on high chemical inputs.²

Farm Characteristics

In 2011, 96 percent of U.S. crop farms were designated as family farms, and they accounted for 87 percent of the value of crop production.”³ In recent decades the percent of farms designated as “family farms” has remained steady (from 97.1 to 98.3 percent of all farms from 1996 to 2011), but the definition of family farm has changed. According to the latest USDA definition, a family farm is “any farm organized as a sole proprietorship, partnership, or family corporation. Family farms exclude farms organized as nonfamily corporations or cooperatives, as well as farms with hired managers.” Even very large farms, farm businesses that own or rent multiple locations, and farms managed by non-resident owners may be classified as family farms.⁴

Both small farms and very large farms have increased in number with a decrease in midsize farms. Since 2000, the number of small farms has increased and USDA indicates this may reflect life style decisions and the ability to farm part time and hold an off-farm job. Small residential farms, where owners are retired or derive some of their income from off-farm work, have increased in number in recent years, as have very large farms. However, “farms with at least \$1 million in sales ... accounted for 24 percent of the value of agricultural production in 1982 and 59 percent in 2007. Meanwhile the share (of sales) held by small commercial farms, with \$10,000 to \$250,000 in sales, fell by two-thirds.”⁵

The growth of farm size reflects a shift in agriculture production from smaller to larger commodity crop farms (field corn, soybeans, wheat, hay) referred to as cropland consolidation. The practice of monoculture (growing a single crop intensively over a large area of land) has increased. Typically corn and soybeans are raised in rotations designed to maintain soil quality and limit pest infestations. The trend is strongest in the more rural areas of the country, most significantly in the Midwestern states. Both owned and rented property may be managed as a

single farm and are so considered in USDA statistics. About 40 percent of U.S. farmland has been rented over the last 25 years.⁶ In the USDA report on farm size, the authors observe three trends in this crop consolidation:

- Four crops (field corn, wheat, hay and soybeans) accounted for over 83% of the crop acres. “Twenty-two percent of crop production occurred on farms that produced only a single crop commodity, while 30 percent occurred on farms with two crops. Only 11 percent occurred on farms with five or more crops.”⁷
- “The three high-value categories—vegetables and melons; fruits, nuts, and berries; and greenhouse/nursery crops—accounted for nearly 37 percent of all cash receipts from crops in 2007 but less than 4 percent of harvested acreage.” The high value categories have high yield per acre and use labor and physical capital intensely.
- A long-term shift in the mix of crops is occurring with cotton, tobacco and oats decreasing and field corn, hay and soybeans increasing as well as “high value categories”.⁸

There are several basic advantages of size that apply to large farms including better financial performance, higher rates of return on equity and decreased labor hours. A farm harvesting 2000 acres uses less than half the labor of a farm harvesting 500 acres. Larger farms have 35 to 50% lower costs per acre for assets and equipment. The same cost savings apply to the fruit and vegetable operations.⁹

"Intensification of agriculture has not, however, been an unmixed blessing. Environmental impacts have increased, including potential degradation of the soil and water resources vital to both farm productivity and human health."¹⁰ For more information on specific environmental concerns see the Agriculture Update papers on soil management, water management, animal management and pesticide management. Specifically, these impacts include:

- Environmental impacts of pesticide use, including potential damage to pollinator populations and toxic residues in waterways
- Nitrogen run-off, resulting in impaired waterways and dead zones
- Soil erosion as a result of loss of wind-breaks, hedge-rows, and swales
- Human health implications of pesticide and herbicide residues
- Increased reliance on irrigation
- Reduction in biodiversity¹¹

The industrialization of agriculture also has depleted the social energy of rural America¹², including the loss of local food sheds and local food security.¹³ Contraction of markets for mid-size farms is another result.¹⁴

Consolidation of Cropland into Larger Farms

“This huge increase in efficiency has been the result of many factors, including use of fertilizer, pesticides, introduction of farm machinery, development of hybrid strains, and increased knowledge about farm management practices...producing higher yields using less labor and less land.”¹⁵ Most of these factors and their issues are discussed under specific short agricultural update papers including soil management, animal management, pesticides, water management, plant breeding and genetic engineering and will not be discussed in detail here.

Current modern practices are the result of basic changes in practices beginning around the end of World War II.

Technological Change

- **Technology:** Larger production runs allow for the use of more capital equipment, increasing efficiency and reducing labor. Mechanical harvesters, sprayers, and planters enhance the ability to seed and harvest large acreage, saving time and labor. Innovations that provide the farmer with more accurate and timely information increase the farmer’s ability to manage land.
- **Chemical Pesticides:** Historically farmers have controlled plant pests through weeding or mechanical tilling, and insects and other pests through crop rotation and tillage. The use of pesticides can significantly reduce the cost of labor to complete these tasks. From 1950 to 1980 the use of pesticides rose, but leveled off after 1980 as better pesticides developed.
- **Plant Breeding and Genetically Engineered Seeds:** Seeds designed to produce crops that better withstand conditions through resisting pests, which exhibit greater stem strength or more rapid growth, provide the farmer with more efficiency.
- **Tillage Practices:** “No till” systems leave crop residue from the previous harvest on the soil. Soil is left undisturbed, not plowed or harrowed from prior harvest to planting, except for the injection of nutrients. This saves on passes of machinery.¹⁶
- **Information Technologies:** Management practices and information technologies (IT) allow the farmers to measure and manage intra-field variations in soil attributes, pest presence, product attributes, and production outcomes.¹⁷ To read about one farmer’s experience with information technologies visit Madison Farms, Precision Farming at <http://www.madisonfarms.com/index.php?page=5>¹⁸

Aging Farmer Population

Deputy Agriculture Secretary Kathleen Merrigan sees an epidemic sweeping across America’s farmland. The country’s farmers and ranchers are getting older, and there are fewer people

standing in line to take their place. “If we do not repopulate our working lands, I don’t know where to begin to talk about the woes,” she said in a recent interview.¹⁹

Change in Farm Organization

During the 20th century, crop production was largely separated from livestock production, and crop farmers focused on producing a few commodities. In 1900, most farms grew corn, usually to feed to their own animals. By 2010, only one in six farms grew corn, and those farms usually specialized in crops, with no livestock.²⁰ Farmers without livestock have more time for crops, but tend to use a limited variety of crops, based on available soil, nutrients and water.²¹ As specialization increased, crop selection followed the location. For example, the corn belt concentrated heavily on livestock feed. Hilly and more urban agriculture decreased as growing areas were smaller, separated by residences and forest.²²

The Influence of Government Policies

Subsidies such as the ethanol corn subsidy of 46 cents per gallon that stopped in 2011 encouraged corn production. When the subsidy stopped, the renewable fuel standard, which mandates that at least 37 percent of the 2011-12 corn crop be converted to ethanol and blended with the gasoline, kept corn prices high.²³ Crop insurance has influenced farm growth because farmers are eligible for payouts not only when their crops fail due to drought or flood, but also when the prices of their crops drop.²⁴ Critics say crop insurance has reduced the risk of farming so much that farmers are now incentivized to farm on marginal lands, such as wetlands or lands with less than optimal soil.²⁵ The national Farm Credit System created by the U.S. Congress in 1916 provides a source of financing for expensive farm equipment. Conservation subsidies encourage environmentally sound practices through cost sharing.²⁶ EPA CAFO rules induced some farmers to constrain farm size to remain under the size at which the rules apply.

Contract Farming and Vertical Integration

The ability of the farmer to contract with a buyer for sale of his crop prior to harvest reduces financial risk for the farmer, providing a secure outlet for crops and price support that may ease credit risks. Under production contracts for livestock, the buyer owns the commodity and the farmer contracts to provide service to bring it to market. (For more information on livestock see the Animal Management update paper.) A company having business in areas that are at different points on the same production path is vertically integrated. An example is Perdue, which provides chicks to the farmer and then processes and markets the broilers.

Under more common *marketing contracts* a price, delivery outlet and quantity are set for the commodity, thus reducing risk. Usually there are specifications of acceptable product standards. Large farms are more likely to use contracts and contracts covered over 40% of crop production in 2011.²⁷

There are concerns that contracting produces “a tilt in market power with a possible shift in bargaining power as input suppliers and output processors (and first purchasers otherwise) gain greater economic power, undoubtedly at the expense of producers.”²⁸ Firms not engaged in contract or ownership integration may find themselves unable to market products or purchase products from firms that are vertically integrated.²⁹

Sustainable Agriculture

Legal Definition of Sustainable Agriculture: The term "sustainable agriculture"³⁰ means an integrated system of plant and animal production practices having a site-specific application that will over the long-term:³¹

- Satisfy human food and fiber needs.
- Enhance environmental quality and the natural resource base upon which the agriculture economy depends.
- Make the most efficient use of nonrenewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls.
- Sustain the economic viability of farm operations.
- Enhance the quality of life for farmers and society as a whole.

John Ikerd, retired professor of soil science at the University of Missouri has said,

*We cannot prove through empirical studies that one approach to agriculture is sustainable or that another is not. It would quite literally "take forever" to collect the data for such a study.... I believe there is a growing consensus in support of three fundamental prerequisites: **A sustainable agriculture must be ecologically sound, economically viable, and socially responsible.***³²

Examples of agricultural practices that promote sustainable agriculture vary depending on regional soil conditions and weather conditions. In general they include crop rotation and tillage practices, use of cover crops, soil enrichment through plant and livestock inputs, use of natural pest predators, and bio-intensified integrated pest management³³ as well as use of energy conservation technology and renewable energy sources³⁴.

Results of an eight year farm study conducted in Iowa indicate that more diverse crop rotation systems – comparing 2, 3, and 4 year crop rotations - can use small amounts of synthetic agrichemical inputs as powerful tools with which to tune, rather than drive, agroecosystem performance while meeting or exceeding the performance of less diverse systems and reducing freshwater toxicity.³⁵

The Union of Concerned Scientists sees four major factors in healthy farm planning: a landscape that allows for the maintenance of uncultivated areas; crop diversity and rotation using long crop

rotation and expanding crop selection to include fruits and vegetables to build diversity and improve the soil; integrating livestock to increase diversity through well managed pastures and availability of manure; and using cover crops to avoid bare soil.³⁶ These practices may result in lower gross return per acre; however, the reduced gross income can be balanced by lower input costs for chemicals and fertilizers, machinery, pesticides and fuel so that net returns can be as good or better.³⁷

Organic Agriculture

The USDA defines organic as:

*Organic is a labeling term that indicates that the food or other agricultural product has been produced through approved methods that integrate cultural, biological, and mechanical practices that foster cycling of resources, promote ecological balance, and conserve biodiversity. Synthetic fertilizers, sewage sludge, irradiation, and genetic engineering may not be used.*³⁸

The USDA provides a detailed guidance relating to production, handling, processing, labeling and marketing, certification, allowed and prohibited substances, and policies.³⁹ “In 2010, a mere eight years after USDA’s regulations officially went into effect, organic foods and beverages made \$26.7 billion.”⁴⁰ Organic agriculture follows practices for crop rotation, biodiversity and mixed plantings to protect both the soil and the environment.

Pesticides are used in organic farming but must be natural, processed lightly, and not synthetic. There are around 20 chemicals approved for use in the USDA program. Large organic farms may be using liberal amounts, but usage is not tracked. There are some concerns about their safety.^{41,42} Pesticides used in conventional agriculture are often synthetic and are regulated by the EPA. (See the Agriculture Update Paper on Pesticide Management.)

Organic farming is a growing industry that may add significantly to the development of sustainable agriculture practices. Supporters of organic farming have argued that this approach should be used exclusively, while others have insisted organic farming cannot feed the world. A 2012, comprehensive analysis published in *Nature* concluded:

*Our analysis of available data shows that, overall, organic yields are typically lower than conventional yields. But these yield differences are highly contextual, depending on system and site characteristics, and range from 5% lower organic yields ..., 13% lower yields ..., to 34% lower yields (when the conventional and organic systems are most comparable). Under certain conditions—that is, with good management practices, particular crop types and growing conditions—organic systems can thus nearly match conventional yields, whereas under others it at present cannot. To establish organic agriculture as an important tool in sustainable food production, the factors limiting organic yields need to be more fully understood, alongside assessments of the many social, environmental and economic benefits of organic farming systems.*⁴³

Organic farms are not limited to small niche farms and may become part of the large farm universe as farmers recognize the value of the products. Universities are working with farmers to improve organic methods. The nutritional and taste issues of alternate farm systems are discussed in the Agriculture Update paper on USDA's Role in American Nutrition.

Small Farms/Urban farms/Local Food Systems

Recent trends supporting the resurgence of small farms include “a significant increase in both the number and variety of local direct marketing opportunities which can both increase the farmer’s share of food dollars and decrease transportation and storage costs; the growing demand for organic products and the price premiums often associated with them; the increasing popularity of high value specialty crops and value added products; the adoption of techniques such as season extension using passive solar hoop-houses [unheated greenhouses].” These trends can allow farmers to generate greater revenue on smaller acreages.⁴⁴

As the small farm sector has expanded, increasing resources are becoming available.⁴⁵ Tools such as the solar hoop-houses, community granaries and mobile poultry processing units offer options to small farmers to reduce costs and increase efficiency. Organizations like the New England Small Farms Institute are training small farmers, sharing information and organizing special projects to encourage and decrease cost for small farms.

Urban agriculture can include backyard, rooftop, vacant lot, park, roadside and the grazing of livestock in open spaces. The University of Missouri Extension has assembled a report entitled “Urban Agriculture – Best Practices and Possibilities” that gives a comprehensive breakdown of this increasingly popular agriculture approach. It stresses the need to work with both the public and local government, and the need to update local zoning and other ordinances to allow for these practices.⁴⁶

Agriculture in the Middle

“Farms of any size may be part of the market that falls between the vertically integrated, commodity markets and the direct markets. But the midsized farms are the most vulnerable in today’s polarized markets, since they are too small to compete in the highly consolidated commodity markets and too large and commoditized to sell in the direct markets.”⁴⁷ Consumers have generated a market demand for foods that are produced in accordance with sustainable agriculture standards and food products that have unique attributes. Maintaining the productive capability of our agricultural resource base over the long term is today’s challenge.

The future of agriculture, including yield, diversity, and impacts on human health and the environment, will be determined by the management approaches selected by farmers. Many factors, including private family and businesses interests, supply and demand for food and fiber, and the government policies discussed throughout this document will play a role in shaping the decisions that farmers make.

Recommended Reading

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