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A developmental approach to the adoption of low-input farming practices

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$14,178 for one year

Background and goals

While it is true that a significant, growing minority of Iowa farmers are successfully adopting low-input systems such as ridge till—and are profiting as a result—the vast majority of Iowa farmers continue to practice conventional, chemically intensive methods. Moreover, there exists a counter-trend in Corn Belt agriculture toward no-till systems. While no-till systems conserve soil resources, they often require more fertilizer and herbicides.

These production-centered issues are the focus of increasing concern among Iowans about the sustainability of Iowa's rural communities. One major concern is that Iowa agriculture may be moving toward a more corporate-style agriculture characterized by larger and fewer farms that are increasingly dependent on non-family labor and management. Although some believe that such farms will continue to take a back seat to modern, efficient farms based on household labor and management, the trend toward larger, more industrialized farming is apparent.

The primary goal of this research was to provide a more comprehensive understanding of the factors and processes that either inhibit or encourage the adoption of low-input production systems on the cash-grain, chemically intensive farms of Iowa and elsewhere in the Corn Belt. These investigators studied in particular the connections between social structures and chemical use in Iowa agriculture.

Approach and methods

This project was structured by using an intensive, qualitative approach. The investigators sought to identify the causal mechanisms governing the adoption of production systems and chemical use practices on individual farms. In practice, this entailed looking very closely at a limited number of operations in a relatively small study area. Generalizations were based on the emergence of similar mechanisms among similarly situated farm operations. This case-study method is well adapted to developing explanations of adoption processes that can then be examined further through extensive survey research.

The basis for comparative analysis was 40 farm history case studies drawn from two populations of farmers in an area consisting of Franklin, Grundy, and Hardin counties in north-central Iowa. The study area is characterized by fertile soils and topography well suited to a high concentration of corn/soybean, cash-grain production. Twenty-five farmers were chosen randomly from county-wide ASCS lists; their farms provided an overview of the range and relative predominance of farming systems in the area. In order to ascertain the character of low-input agriculture in the study area, 15 low-input farmers were selected with the cooperation of Practical Farmers of Iowa and local agency personnel. Ninety-two percent of all farmers contacted agreed to participate.

The farm history interviews consisted of a series of questions structured around key aspects of the operation including (1) the historical evolution of production practices including rotations, livestock, tillage, fertilization, and pest control, (2) profitability and marketing strategies, (3) attitudes toward and participation in USDA programs, and (4) agro-environmental issues including views on low-input agriculture and its relevance to the operation. Follow-up questions that asked why

y *This project was funded and conducted prior to Roberts' term on the Leopold Center Advisory Board.*

participants adopted new practices provided a rich source of collective insight held by Iowa farmers regarding the advantages and disadvantages of both conventional and low-input farming practices.

Findings

The study' s findings can be interpreted through the use of the structural model of decision-making and enterprise development depicted in Fig. 1. In making decisions about the use of chemicals or the selection of alternative production systems, it was determined that farmers must mediate between three sets of structural conditions. *Market and policy imperatives* require that farmers achieve a rate of profit sufficient to be competitive in local land markets and meet household needs. For 37 of the 39 operations, attaining that level of profitability meant compliance with USDA Feed Grain Program regulations as well.

The second set of structural conditions is termed the *production and accumulation system* of the operation (PAS). The PAS embodies a history of capital and knowledge base investments in particular production systems and marketing strategies as well as a set of social relations governing farm management and land tenure. Over time, individual farms evolve toward a distinct set of operational conditions that act as a fundamental material context for subsequent production decisions or innovation. Therefore, a decision to adopt low-input practices must first leap the hurdle of compatibility with the existing PAS.

For example, two of the low-input operations studied were small livestock operations (80 and 250 acres) engaged in organic crop production. In each case, a successful transition to this system was facilitated by the structural compatibility of their PAS with the requirements of organic production: (1) livestock as a basis for a multi-crop rotation and as a fertility source and (2) a relatively high ratio of labor inputs to land base. In contrast, low-input operations in the 500- to 800-acre range had adopted a much less labor-intensive corn/soybean rotation using a ridge till system. While both sets of operators were similar in their commitment to sustainable agriculture, each selected different production systems for reasons tied to their PAS structure.

In addition to PAS compatibility, prospective production practices must overcome rather than compound the inherent risks to production imposed by the *agro-ecological environment.* Production risk in farming often centers on the struggle to complete successive stages of the production process in the face of inclement weather. Although a low-input system may offer a higher rate of profit due to more efficient utilization of inputs, its use cannot be sustained if it results in an unacceptable level of production risk.

This is apparent in comparing the predominant low-input corn-soybean system, ridge till (used on 9 of the 15 low-input farms), with the predominant conventional system, minimum tillage. Although the per-acre production costs of ridge till are lower because of reduced tillage and chemical inputs, it does necessitate greater timeliness and precision in field operations as the tradeoff for greater input efficiency (ridge tillers used 85 percent of the nitrogen and about half the herbicide of comparable conventional operations). Specifically, the system sets into place a new production sequence with shorter time frames or production "windows." Sidedressing nitrogen, banding herbicides, and mechanical cultivation must all be completed in relatively narrow production windows during the rainy post-planting period of late May and June. This reflects a fundamental characteristic of low-input systems: increased technological integration with crop and pest growth cycles.

Ridge till participants have learned to manage these risks at scales of production approaching 800 acres for one full-time operator, partly through experience and partly by purchasing new-generation guided cultivators that increase speed, improve accuracy, reduce fatigue, and extend operation into the night. These production risks appear to be offset by reductions in other forms of production risk with ridge till. These include reduced planting risk in wet

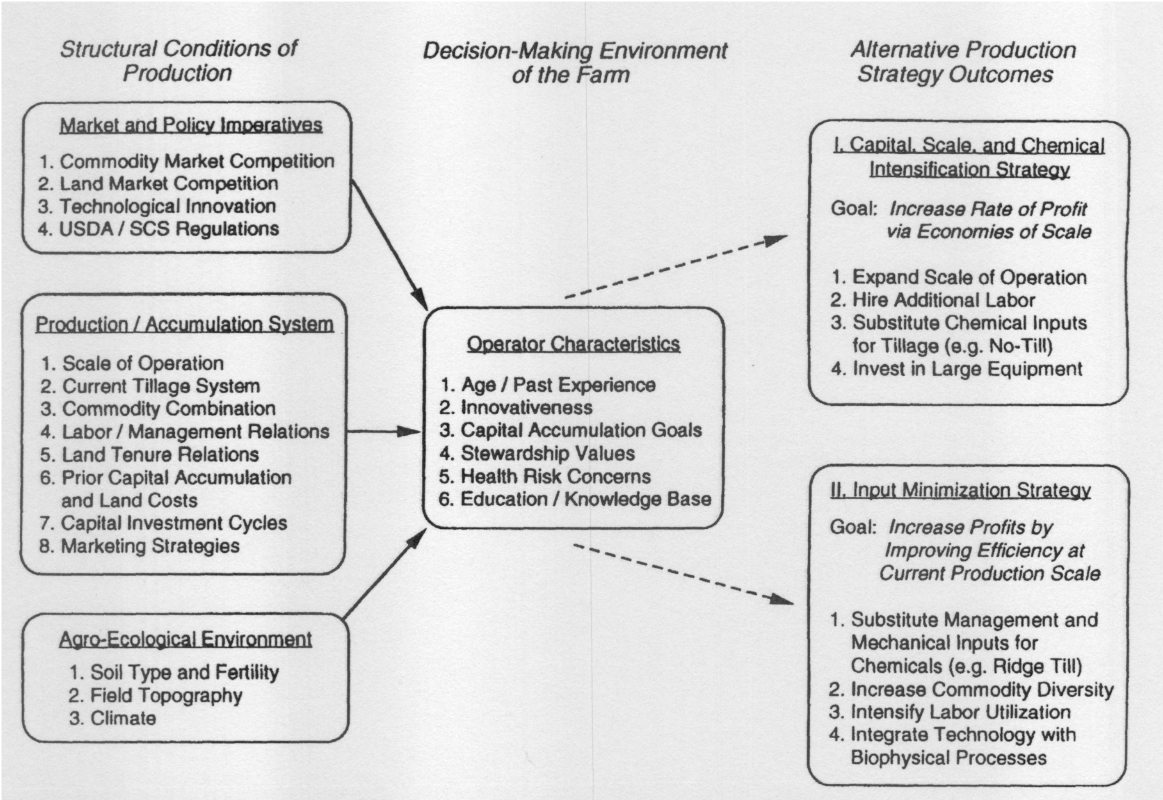

Fig. 1. A structural model of evolution in production strategies and practices.

weather due to faster drying times for ridges and increased rainfall infiltration resulting in lower losses under drought conditions. In summary, ridge till is a more efficient system that necessitates greater temporal and mechanical precision in field operations. This tradeoff has clearly been a net gain for farms operating within the scale limitation of the household labor force. In Franklin County, where the system has been most actively promoted and received, there is evidence that the adoption of the system is following a pattern consistent with diffusion theory. In addition, 7 of the 18 conventional family farm participants said they or their partners were considering adoption.

In contrast, there was no comparable interest in ridge till on the part of the five large-scale (1,240 to 2,100 acres) more corporate-style operations that rely on supplemental hired labor and large-scale field equipment. These operations can be viewed as part of the trend toward development based on capital, scale, and chemical intensification—a trend that is not conducive to agroecological diversity in production (Fig. 1). In 1990, most such operations used minimum tillage systems whose fertilization and pest control practices allowed for scale expansion while minimizing production risk. No-till or minimum tillage systems based on preplant anhydrous ammonia and broadcast herbicides eliminate the need for fertilizer application or weed cultivation in the rainy month of June, thus insuring a greater margin—for human error, equipment failure, and rain delays—that is necessitated by the logistical constraints of dispersed field operations.

Large-scale operations seek to compensate for higher chemical input costs through scale economies in machinery investments and increased production volumes. As a result, these larger, corporate-style operations in the 2500- to 5000-acre range place considerable pressure on local cash-rent land markets. The effect is to constrain the entry of beginning family farmers. Young farmers are particularly receptive to a low-input production strategy given their relatively high land costs, minimal capital, and knowledge base investments in conventional systems.

In spite of the importance of structural conditions in shaping production, differences among operators were often critical aspects in the evolution in production practices (Fig. 1). Older farmers were clearly resistant to innovation with low-input practices, tending to perceive them as too risky, unfeasible on their farm, or outdated. In some cases these farmers had witnessed production breakdowns arising from one practice or another. More fundamentally, these farmers have survived and prospered by mastering conventional production techniques, often in close consultation with local chemical dealers. Also, as farmers approach retirement it is unlikely that they will take up the challenge and risks of learning and applying a new production system, particularly if it requires a new cycle of machinery investment.

The generational bias against low-input agriculture has a greater reach because of the prevalence of joint operations. Forty-six percent of the operations entailed shared labor, management, or machinery; most of these were father-son relationships. In 28 percent of these informal partnerships, a desire on the part of the junior member to innovate with low-input practices had been resisted by the older member.

The individual goals and capacities of the operator play a key role in shaping the PAS as well. In several cases, participants expressed a clear desire to farm on a large scale, and this goal tended to override concerns about environmental or social sustainability. In contrast, a number of the family farm participants (both low-input and conventional) expressed goals related to stewardship, quality of family life and health, and generational continuity in the operation. Conventional operators expressed stewardship simply in terms of soil conservation, whereas low-input operators included managing agricultural chemical hazards in their definition.

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Conventional farmers held two distinct sets of understandings and attitudes towards low-input agriculture: 46 percent perceived low-input agriculture as a holistic, organic approach that was both inconsistent with and threatening to their production system. In contrast, 54 percent expressed a nonideological definition similar to that of the low-input participants, that is, movement along a production continuum toward fewer purchased inputs. Such a definition makes it easier for the conventional farmer to consider and try low-input techniques and begin movement along the low-input continuum. This will be particularly true as farmers continue to confront rising costs.

Implications

Reduced government subsidies, sagging exports, and thinning profit margins have heightened farmers' receptiveness to low-input practices that cut costs without increasing risk or yield losses. Ridge till clearly offers the greatest potential of combining market competitiveness and environmental protection in a corn-soybean production system, yet it has not received the promotional attention given to no-till systems. For that matter, very little of the low-input farmers' knowledge base came from the public research and extension system. This suggests the need for an acceleration in research that tailors low-input systems to different PAS categories and for extension efforts that transfer knowledge from low-input operations to their conventional counterparts. Most fundamentally, these findings illustrate the structural capacity of small and medium sized operations to successfully implement environmentally sustainable systems. This is a strong rationale for public policies that are biased toward, rather than against, family farms.

Results of this and selected other projects were disseminated through a slide set released by the Leopold Center in late 1992.