Dec 2nd, 12:00 AM

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TARGETING THE PREMIUM MARKET: ORGANIC CROPS FOR IOWA

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According to the USDA Economic Research Service, statistics on organic production in the U.S. lag far behind those compiled for conventional agriculture. In the last USDA census in 1995, there were 4,050 organic farmers reporting 1.5 million acres of production (Greene 1999). The Organic Farming Research Foundation estimates that there were 10,000 U.S. organic farmers in 1998. In Iowa, 120,000 acres of organic production were reported to the Iowa Department of Agriculture and Land Stewardship (IDALS 1999). This figure reflects only acreage reported by those farmers who returned their survey; thus, more acres are believed to go unreported. This increase in organic acreage represents a doubling from the previous year, and a four-fold increase since 1993. The organic industry has been experiencing a 20% annual growth rate, with U.S. sales listed at $4.5 billion in 1998 (OTA 1998). The organic industry is a consumer-driven market based on consumers’ belief that organic products are safer for human consumption and beneficial to the environment (Bourne 1999). Many consumers affirm the superior health benefits and taste of organic products (Sylvander 1993), although scientific studies are limited, except in the area of pesticide content (C.U. 1999). Researchers found 52% more of the conventional produce on U.S. supermarket shelves contained pesticide residues compared with the organic produce.

Certified organic producers are required to undergo third-party certification prior to reaping the premium price of organic products. Certification will verify that synthetic chemicals, including GMO seeds (genetically modified organisms), have not been used for a minimum of 36 months prior to harvest. The National Organic Program of the USDA Agricultural Marketing Service has been assigned the duty of developing national organic standards (Fernandez-Cornejo et al. 1998). Proposed rules, released in 1998, suggested including several components, currently disallowed by the private certification agencies and 15 state certification agencies. The USDA received more than 280,000 complaints against these elements, and is currently in the process of re-writing national rules. In the interim, producers must follow their state laws governing organic production.
Certified Organic Production

With the increasing consolidation of farms, and monopolization of farming inputs (e.g., seed and pesticide packages), farmers will succeed if they assume more control of inputs and prices (Harl 1999). Organic producers are engaged in both strategies. As required by law (the national Organic Farming Production Act of 1990 and Iowa Code Chapter 190C), all certified organic farmers avoid the use of synthetic chemicals in their farming systems. The goal of a sustainable, organic farm is complete reduction of external inputs, using instead on-farm sources of compost for fertilization and non-toxic (biological, mechanical and cultural) methods of pest management. Most organic farmers rely on crop rotations, compost or manure applications, and/or cover crops to maintain soil fertility (Kelly 1990). Because of new regulations related to manure applications, nutrient management for organic farms is one area requiring further research (Grubinger 1992).

More knowledge-based skills are required for organic crop monitoring (Putnam 1990). A study of organic and conventional growers showed that both groups perceive the same insects, weeds and diseases as pests (Langer 1995). Weeds were considered the most serious problem on organic farms in several studies (Peacock and Norton 1990; OFRF 1999). Some weed control practices include cover crops, mulches (Wallace and Bellinder 1992), crop rotations, biological control, smother crops (Markey 1990), intercropping and intensive planting.

Iowa Organic Farmers Research Needs

Iowa State University made a commitment to addressing the research and extension needs of organic farmers through the establishment of the Organic Specialist position in 1997, a joint faculty appointment between the departments of Agronomy and Horticulture. Following this appointment, the Leopold Center for Sustainable Agriculture (LCSA) supported a series of Organic Agriculture Focus Groups in early 1998 in order to help determine which research and extension issues were most important to Iowa farmers. Jerry DeWitt and Kathleen Delate traveled nearly 2,000 miles to six sites asking about the future of organics and critical needs for the industry. Sixty participants, selected from previous organic agriculture conferences or workshops and LCSA lists, included organic farmers, farmers interested in transitioning to organics, Cooperative Extension personnel from surrounding counties, and ag. professionals, such as consultants, bankers, and cooperative managers. The majority of participating farmers felt that there had been inadequate organic research, and voted for increased efforts in all segments of Iowa agriculture: agronomic crops, horticulture and livestock. Research needs of organic producers included the following: ideal crop rotations for best agronomic and economic performance, including land coming out of the Conservation Reserve Program (CRP); compost composition and application rates; improved methods for weed control, particularly under wet conditions; selection and breeding of crops for area conditions; and effective parasiticides for organic livestock production. Results from these meetings included the need for research and demonstration sites on dedicated lands across the state where research on organic practices can be conducted over the long term. Farmers recognized that changes in the agroecology (soils, plant performance, insects, weeds, diseases, and nematodes) and economics of farming systems can be successfully detected only after many years of monitoring. Based on positive input from the local participants in the Greenfield area, the ISU Neely-Kinyon Research and Demonstration Farm was selected as the first Long-Term Agroecological Research (LTAR) site. The Southeast Research and Demonstration Farm in Crawfordsville and the Muscatine Island
Research and Demonstration Farm have also developed into other LTAR sites for organic research.

**Market Research**

Despite the fact that marketing aspects were specifically not included in the Organic Specialist job description, approximately one-half of the requests for information to the office pertain to organic marketing information. Much of this information can be supplied through fact sheets and referrals, but a great deal requires extensive research for which resources are not available. Questions regarding location and longevity of markets top the list. The majority of organic crops are grown for human consumption because of the price premium associated with foods versus animal feed (Fritz 1989). Premiums are offered with organic livestock products, however, particularly for the organic dairy market. Organic price premiums average 57% over conventional prices (Bourne 1999), but premiums can range from 20 to 400%, depending on season and availability.

Many organic farmers have entered into alternative marketing streams, through exclusively organic co-operatives. Examples of these co-operatives include Heartland Organic Marketing Co-op of Greenfield, Iowa, and the Coulee Region Organic Produce Pool (CROPP) of La Farge, Wisconsin DBA Organic Valley. These sophisticated marketing operations often deal directly with European and Japanese buyers, setting prices through cooperative agreements with their producer members. There are currently 35 CSAs (Community Supported Agriculture) farms in Iowa. These farms offer local consumers the opportunity to support the family farm through shares, which guarantee the consumer a certain amount of produce during the growing season (Lockeretz 1995). Despite substantial progress in market development in the last five years, several infrastructural and market development needs of organic producers deserve further attention:

1. **Maintenance of organic integrity.** Organic production derives a premium based on the assurance that the product was grown according to applicable organic standards. Despite the growth of direct markets, such as CSAs and Farmers' Markets, the majority of organic products are sold indirectly through wholesale operations or shippers. Since the producer is rarely the marketer, systems have been established to assure that the product received in the marketplace has not been mixed with any non-certified product along the route. This problem is exacerbated when the products are shipped as commodities, such as soybeans. As commodities, soybeans can be easily mixed with non-organic products at trans-shipment points. Research needs to be conducted on the economic and logistical feasibility of the establishment of dedicated organic facilities along the route.

2. **Shipper rejection resolution.** Currently, organic producers whose product is rejected based on GMO (genetically modified organisms) contamination have little recourse to verify the rejection. The current tests available for GMOs include an expensive, but reportedly accurate, PCR test for an average of $350 per test vs. a $6 strip-test, which alleges to detect one enzyme unique to one type of GMO. GMO allowances range from 0% contamination to 0.5% (the most common) to 5% to allow for what is termed background or incidental contamination (arguably, a violation of pure organic). Inexpensive, broadly available and consistent testing operations are needed. Because responsible parties can include the seed company, the grower, the custom combine operator, the shipper, or the marketer, organic...
farmers need legal advice in how to handle alternative dispute resolution to avoid costly court trials.

3. Ill-suited transportation systems. Due to the limited size of current shipments of organic products, organic producers are forced to utilize costly container shipping facilities designed for large, conventional commodity agriculture. Research is needed into the economic and logistical feasibility of the establishment of cooperative trucking operations for organic producers.

4. Identification of differentiated markets. Many Iowa-grown organic products end up in conventional market streams and do not reap the benefit of an organic premium price. Marketing of organic products is still in its infancy in Iowa, and additional support from the business college and department of economics would be very useful to integrate into the Organic Agriculture Program.

Several local marketing initiatives involving organic producers have been initiated since the Focus Groups and involve staff at Iowa State University:
- Wallace House Foundation Local Food Circle (exploring options for local producers and consumers)
- Field to Family Project (connecting local farmers with families and institutions, such as restaurants, conference centers, and other food-buyers)
- University of Northern Iowa Local Food Circle (connecting local farmers with families and institutions, including UNI and Allen Hospital)
- Johnson County Soil and Water Conservation District/Johnson Co. Extension Local Food Systems Project (working with farmers and chefs).
- State of Iowa Food Policy Council and IDALS Local Food Systems Council

Research Results

Neely-Kinyon LTAR Site

In the first year trials (1998) at the Neely-Kinyon Long-Term Agroecological Research (LTAR) Site, we examined the agronomic and economic performance of conventional and organic systems, using required practices for certified organic production. Before the crop rotations were established for the Organic Agriculture experiments, treatment recommendations were discussed at Focus Group sessions. It has long been known that adding a legume (alfalfa, red clover, or others)/small grain into a conventional rotation of corn and soybeans has provided additional nutritional benefits, but Iowa farmers tend to plant the most lucrative crops—corn and soybeans—as opposed to legumes and small grains, where markets are limited, or returns are not as high. The main purpose of the LTAR experiment is to determine which organic rotations provide the most benefit in terms of yield and biological protection/environmental services (soil and water quality, and conservation of beneficial organisms) compared with a conventional corn-soybean rotation.

While a corn-soybean conventional rotation does not define the extent of conventional rotations, this rotation represents the most common rotation in Iowa. The other three organic rotations are also commonly practiced in Iowa. The third organic rotation, soybean-winter rye-soybean, has been included to discourage farmers who wish to plant the most lucrative organic crop (soybeans) as often as possible. We anticipate greater problems with weeds, diseases and nematodes in this system. Red clover is the legume in the Crawfordsville study, but alfalfa was
selected at the other sites due to its greater economic value. We are conducting an economic analysis on every rotation used in these experiments, and will be able to compare our results with a conventional corn-soybean-legume/small grain rotation, based on results of previously published material.

The Neely-Kinyon Farm Association dedicated a 17-acre block for this long-term study. One-third of the block had previously been in alfalfa (3 years) and the remaining two-thirds in a corn-soybean rotation (1997 crop-soybean). Treatments were assigned in a completely randomized statistical design to the forty, quarter-acre plots constituting the experiment. Treatments were as follows: Conventional Corn-Soybean rotation; organic Corn-Soybean-Oats (with alfalfa); organic Corn-Soybean-Oats (with alfalfa)-Alfalfa; and organic Soybean-winter Rye (winter rye plowdown in the spring prior to soybean planting each year). All crops in all rotations will be planted each year. The planting scheme adopted for this experiment was as follows: 'Pioneer 3489' com planted on May 18; 'IA 3006' soybeans were replanted on June 2 (due to excessive rains and poor stands after the first planting on May 18). Oats ('Don' and 'Jerry') were underseeded with alfalfa ('Nitro,' and Pioneer 54H69). Following harvest in the organic corn and in the soybean-rye plots, winter rye was no-till drilled at a rate of 1 bu/acre, as per local practices on organic farms. A hay crop (alfalfa, fescue and oats) was seeded in the 30-ft border strips around each plot and around the perimeter of the experiment, in order to maintain the required buffer between conventional and organic production, per certification standards. The fertilization goal in this study was to apply equal rates of nutrients in each treatment. Fertilization rates were adjusted in each plot, based on nitrogen additions from the previous crop (i.e., alfalfa). Organic plots were fertilized to provide 150 lb/acre N on May 14, using a manure spreader to apply hoop-house compost from the ISU Armstrong Research and Demonstration Farm. The analysis of this compost averaged 1.54, 0.65 and 3.06% N, P, and K, respectively. This compost consisted of deep-bedded swine manure mixed with corn stalks and straw, which was turned, and stored for one year prior to application, in keeping with certified organic standards. Due to equipment problems, conventional corn plots (in the C-SB rotation) were fertilized with anhydrous ammonia at a rate of 180 lb/acre N on June 5, as opposed to the recommended 150 lb/acre N. Force 1.5 G® was applied for corn rootworm control at a rate of 9 lb/A at planting in the conventional corn plots. Herbicides included Harness® applied on May 19 in the conventional corn plots at a rate of 2 pt/A, and Prowl® applied in the conventional soybean plots at a rate of 3 pt/A on May 19. Because of the success of the mechanical tillage operations in the organic plots, conventional plots were also tilled (as described next). Organic corn plots were rotary-hoed on May 21 and 27, and field cultivated on July 19 and 24. Organic corn plots were hand-hoed on July 13-15, in preparation for the field day (normal practices of machine-cultivating only will be followed in 1999). Soybean plots were only field cultivated once on July 17 because of the re-planting. Normal procedures call for two cultivations. Because soybeans were clear-hilum varieties for the tofu market, plots were walked on July 20 and August 27, to remove any remaining weeds from plots. Quality in tofu beans is equated with clean seed, free of weed seeds. All labor for weeding was recorded in the cost of production studies.

First-year results from the N-K LTAR site were very encouraging. There were no statistically significant differences in yields between the organic and conventional corn and soybeans (P=.05). Conventional corn averaged 169.5 ± 3.31 bushels/acre. Organic corn averaged 140.4 ± 9.24 bu/acre, but there was great variability depending on previous crop (alfalfa vs. soybean). The greatest organic corn yield (177 bushels/acre) was produced on ground previously in alfalfa. Conventional corn yields ranged from 162 to 178 bushels/acre and organic yields ranged from
116 to 177 bushels/acre. Because of the variability among organic plots, significant differences were not obtained. Despite adjusting fertilization rates based on previous crop to provide similar nutrients to each system, plots previously in alfalfa produced greater yields overall. Organic corn averaged 174 and 127 bushels/acre on ground previously in alfalfa and soybean, respectively. Conventional corn averaged 173 and 166 bushels/acre on ground previously in alfalfa and soybean, respectively. Average conventional soybean yields were 48.4 ± 1.46 bu/acre compared with 49.8 ± 0.91 bu/acre for organic soybeans. Because of the late planting, organic oat yields averaged 41 bushels/acre, and 43 square bales of straw/acre. The test weight of the oats was less than required for food-grade milling (36 lb/bushel) at 32 lb/bushel before screening (organic farmers usually screen oats to remove unfilled oats and increase test-weight), which reflected averages in the Greenfield area. The protein content of the oats was 14.5%, an excellent level for food-grade oat products (Iowa Oat Mills, Chelsea, IA). Soybean plant tissue showed no significant differences between treatments in N, P, or K at 51 DAP. Other macro- and micronutrients reflected significantly greater levels of copper, iron, manganese, sulfur and zinc in the conventional corn tissue.

Stalk nitrate content reflected an excess of nitrogen in the conventional system, which may be associated with the extra 30 lb/acre N in the system. The lower stalk nitrate content in the organic corn reflected the need for additional nitrogen inputs, although many fields demonstrated adequate N (750 to 2,000 ppm). Adjustments were made in 1999 to more accurately reflect the nutrient needs of the organic corn crop, although all organic corn crops will follow oat plots underseeded with alfalfa, which should provide additional N to the system.

Soil quality is an important component of any sustainable farming system (Doran 1994). Research at the USDA-ARS National Soil Tilth Lab (C. Cambardella) confirmed that soil quality was greater in the plots previously in alfalfa compared with plots on ground previously in soybeans. Soil analysis of land previously in alfalfa determined greater values for electrical conductivity, NO₃-N, NH₄-N, POTMIN-N (potentially mineralizable-N), POM (particulate organic matter)-Carbon, and percent macroaggregate stability compared with soybean ground. Differences in the top depth for POM-C and POTMIN-N were the most significant, as these parameters are the most sensitive to differences in landuse/management. After one growing season under organic management, Microbial Biomass Carbon (Mb-C) was 128% greater in the organic system; Magroaggregate Stability (AggS) 15% greater; Organic Carbon (Org-C) 6% greater; Particulate Organic Matter Carbon (Pom-C) 8% greater; and N mineralization potential (PminN) 7% greater in the organic system. Nitrate N (NO₃-N) was 44% greater in the conventional system, as reflected in the excess corn stalk nitrate.

Both tillage and herbicides appeared to provide excellent weed control in most plots. When quantified, however, weed populations were greater in the organic corn system, although these populations did not significantly impact yields. No statistically significant differences were detected because of the patchy nature of the weed populations. Organic and conventional soybean plots exhibited similar levels of weed populations, with an average of two hr/plot on hand-weeding needed prior to harvest. This corresponded with area organic farmers' average time for hand-weeding clear-hilum soybeans. Damage levels from corn borer larvae did not reach the
economic threshold (5%) required to justify spraying with *Bacillus thuringiensis*. Soybean cyst nematode egg populations were also patchy in nature, and were generally low except in some of the SB-R plots. Because uniform rotational effects were not present in Year 1, we will continue to monitor SCN in all plots to determine changes over time. Other insect data currently undergoing analysis includes predator/parasite abundance, and potato leafhopper populations. Corn grain analyses for protein, oil and starch exhibited significant differences only for protein content, with the conventional corn having a higher content. Greater concentrations could have been due to the relative deficiency of nitrogen in the organic plots, although grain protein averages for the organic corn were similar to 1997 Iowa averages. Soybean grain analysis demonstrated no significant differences between conventional and organic systems, with average protein approximately 39%, comparable to 1997 averages.

Total costs for organic soybean production for 1998 were $102.70/acre (excluding costs of land) with returns for 1998 organic prices at $850.00/acre, yielding a net profit/acre of $747.30. This profit was 368% greater than that returned on the conventional soybeans. Organic corn costs of production averaged $187.90/acre which included hand-weeding, not normally practiced in commercial production. If the hand-weeding costs were removed, costs would be reduced to approximately $100.00/acre, with returns equaling $372.10/acre, compared with $165.45/acre in the conventional corn. This represents a 227% greater profit in the organic system. Selling price for organic crops represented 1998 prices (F.O.B. or pick-up on the farm), as is the practice for many organic marketers. Prices also reflect the price obtainable for “certified organic” crops, or crops grown on land without synthetic chemicals for three years prior to harvest. Some of the crops grown at the LTAR site would have qualified for certified organic (on land previously in unsprayed alfalfa), while others would be considered “in transition.” Selling price for transitional soybeans in 1998 averaged $10/bushel. Results from the first year at the N-K LTAR site were very promising for organic crops. We expect to see greater differences in the systems, in terms of insect, weed and nematode populations, as rotational effects occur over time. It is also anticipated that soil quality will improve over time in the organic systems through longer crop rotations, and additions of organic matter from compost and cover crops.

*Muscatine Island Research and Demonstration Farm LTAR*

An experiment designed to compare organic and conventional horticultural operations was established at the ISU Muscatine Island Research and Demonstration Farm (MIRF) in Fruitland, Iowa. Plots previously planted to rye at the MIRF were roto-tilled on April 6, and disked on May 19, 1998. 'Hungarian wax' pepper plants were seeded in trays on April 16 and transplanted into rows on May 19. Four replications of seven treatments were planted within the field. Treatments included the following: Treatment 1 = Organic Control (no fertilization); Treatment 2 = Organic Bio-Cal® (900 lb/A with a 50 lb N/A side-dress of compost-Ultra-Gro®); Treatment 3 = Organic Compost (100 lb N/A at planting); Treatment 4 = Organic Bio-Cal® (900 lb/A) plus compost (100 lb N/A at planting); Treatment 5 = Conventional Control (no fertilization); Treatment 6 = Conventional Fertilizer (conventional rates); and Treatment 7 = Conventional Fertilizer (conventional rates) and Lime (hydrated lime at 500 lb/A). Bio-Cal® is a locally produced bi-product of the kiln industry, consisting of 35% of various forms of calcium and the remainder in sulfur, boron and phosphorous. Forty plants were planted in each replicated plot for a total of 1,120 plants in the experiment. The goal of the fertilization program was to obtain similar rates of nutrients in the organic and conventional system (≈100 lb N/A and equivalent
calcium rates). Treflan® was applied at 1 pt/A on May 19, in the conventional plots. No insecticide was applied in any treatments because of low insect pressure. At maximum growing point (July 7), leaf height was not significantly different in plants fertilized with organic compost compared with conventional fertilizers. At the first harvest on July 7, pepper fresh weights from the organic treatments were greater than the conventional treatments, with the greatest number of peppers and greatest average weight harvested from the compost plus Bio-Cal® plots. Total pepper fresh weight over the five harvest periods was not significantly different among treatments, suggesting organic amendments as viable alternatives to synthetic nitrogen. Although not statistically different, greater numbers of peppers were culled due to insect or disease in the conventional plots compared with the organic peppers. This experiment will be repeated at the Muscatine Island Research Farm in 1999 and 2000, with the addition of a conservation tillage treatment. A hairy vetch (Vicia sp.) and rye cover crop were planted on September 21, 1998, in selected plots. Strips of cover crop were tilled in May 19, 1999, and peppers transplanted into the strips, with the remainder of the plot mowed, and left as a mulch for weed prevention and erosion control. The 1999 data is currently undergoing statistical analysis.

**Conclusions**

Current production and market indicators suggest that organic agriculture will continue to increase (Tourte and Klonsky 1998). In our first year comparisons of organic and conventional horticultural and agronomic crops in Iowa, no significant yield differences were observed. These results correspond with those obtained in several states across the U.S. (Greene 1999). When organic price premiums are computed in the economic analyses, organic production outperforms conventional systems. In addition, environmental benefits, in the form of reduced chemical contamination to soil, water and food for consumption, and increased worker safety, suggest that organic agriculture provides long-term benefits beyond the farmgate (Altieri 1995).

**Literature Cited**


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