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ISSUES AND TRENDS IN THE U.S. FIELD CROP SECTOR

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INTRODUCTION

The U.S. and Canadian crop sectors share several common trends. Changes in international trade patterns, the growing importance of privately funded agricultural research, and continuing pressures toward larger farm size are likely to affect both countries in similar ways. In what follows, I will expand on a few areas that Kurt Klein has already touched upon - -specifically, the differentiation of commodities by end-use characteristics and biotechnology - -and introduce another topic, e-commerce, that may have important implications for competitive conditions in the crop sector. I will also discuss three other areas of special interest in grains and oilseeds: consolidation and integration of handlers and processors; progress toward harmonization of regulatory regimes; and the recent evolution of U.S. agricultural policy.

DIFFERENTIATION BY END-USE CHARACTERISTICS

The marketplace for grains and oilseeds has seen a proliferation of 'value-added' varieties. Advances in plant breeding have made it feasible to design commodities with specific end-use characteristics. Some specialty crops, such as waxy corn, predate the biotech revolution by many years, and others, such as high-oil corn and food-grade soybeans, are more recent products of

commercial breeding programs. Genetic engineering can only further this trend by facilitating the incorporation of traits desired by processors, livestock feeders, and food manufacturers (Riley and Hoffman, 1999).

For producers, price premiums offer the main incentive for growing value-enhanced crops. Premiums must be sufficient to compensate producers for any yield differentials relative to standard varieties, and for any extra costs (including segregation) associated with production or on-farm storage. Because value-enhanced crops are identified with niche markets, premiums are highly dependent on supply conditions and, in some cases, can only be secured through contractual arrangements with buyers. These market factors point to a host of issues relating to 'vertical coordination' in the market channel for grains and oilseeds, for example the increased reliance of food manufacturers and processors on contracting, rather than spot-market transactions, for procurement of crops with specific end-use characteristics. As in the livestock and poultry sectors, an increase in contracting will tend to diminish the significance of traditional cash markets while accentuating the informational asymmetries among producers. Contracting may entail standardization of production methods (e.g., chemical applications) to ensure that the crop meets buyers' quality requirements. Some loss of control, either in production methods or marketing, seems inescapable for producers who contract for value-enhanced commodities. It should be noted that, for some crops and production regions, the potential for contracting could be limited by uncertainty over growing conditions and crop quality. For example, domestic millers and some export buyers of hard spring wheat have preferences for particular varieties due to their milling or baking characteristics, yet contracting with growers by wheat variety is quite uncommon[1], likely because of the large, intrinsic quality variation in spring wheat due to year-to-year changes in growing conditions.[2]

The differentiation of crops holds important implications for grain handling and transportation. Much of the U.S. grain handling infrastructure has

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[1] In fact, General Mills is one of the few firms with procurement for particular wheat varieties, and these account for only 15 percent of the firm's total purchases.

[2] William Wilson (personal communication) also suggests that premiums for specific varieties have not emerged because of difficulties in distinguishing wheat varieties in the U.S. system.

been designed to take advantage of low-cost, high-volume shipments and opportunities for bulk storage. This reflects deregulated rail rates and the advent of unit trains (both in the 1980s), in addition to Commodity Credit Corporation (CCC) loan programs and the Farmer Owned Reserve (FOR) under earlier farm bills, which created substantial need for commercial grain storage. Efficient handling and transportation of 'generic' commodities are likely to remain an important feature of the U.S. system. However, the growing importance of specialty crops and niche markets is creating new demands: for more careful segregation and identity-preserved (IP) shipments and other forms of coordinated 'supply chain management.' Vertical linkages between processors and grain handlers, through direct acquisitions, strategic alliances, preferred-supplier relationships or other methods, is often an outgrowth of commercial demand for grains or oilseeds with specific quality attributes.

Crop differentiation also presents a challenge to the public sector; for example, with respect to the price-reporting and commodity-analysis functions of USDA. Prices quoted for standard grades (e.g., No. 2 yellow corn) at traditional market centers, collected and published by the USDA Agricultural Marketing Service (AMS), give little guidance to producers or traders of value-enhanced crops. Similarly, data provided by the National Agricultural Statistics Service (NASS) for crop acreage, and Economic Research Service (ERS) *Situation and Outlook* reports, do not provide the level of detail necessary for analysis of supply-demand conditions for these crops within the broader commodity aggregates.[3] The absence of public price information for value-enhanced crops not only obscures the efficiency of the price discovery process, but also creates problems for crop and revenue insurance.

BIOTECHNOLOGY AND GENETICALLY MODIFIED CROPS

For a large segment of the public, the term 'biotechnology' is now firmly linked with genetic engineering, despite the more expansive interpretation given

[3] However, NASS does report acreage planted to genetically-modified crops as an aggregate.

it by many researchers.[4] Food products derived through genetic modification (GM) have found a level of acceptance in the North American market but are strongly resisted elsewhere, notably in Europe. Consumer resistance to GM crops and official trade barriers in foreign markets could have profound consequences for the U.S. crop sector in years to come.

Most of the commercially successful applications of genetic engineering to U.S. crops have targeted agronomic characteristics, e.g., insect resistance in corn and cotton, or herbicide tolerance in soybeans. Tremendous potential also exists for enhancing the end-use characteristics of grains and oilseeds through genetic engineering techniques. However, much will depend on consumer acceptance and the resolution of outstanding regulatory issues in U.S. and foreign markets. Differences in proposed labeling standards (mandatory versus voluntary, 'positive' versus 'negative' labels) and tolerances are now the subject of intense scrutiny. Growers of GM crops without enhanced consumption characteristics have no incentive to voluntarily label their production as 'containing GM'. On the other hand, voluntary labeling of 'GM-free' crops might be economically justified by price premiums or access to otherwise restricted markets. (See Golan, 2000 for discussion.) Internationally, the United States and Canada appear to be increasingly isolated in their opposition to mandatory labeling of GM crops.[5] Given the importance of offshore markets to both countries, it seems likely that foreign labeling requirements and standards will dictate more careful segregation of GM and non-GM crops within the North American grain handling system, whether or not labeling becomes mandatory.

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[4] Riley and Hoffman (p. 23) define biotechnology as "the use of biological organisms or processes in any technological application. Genetic engineering can be thought of as a subset of biotechnology ¼" According to Caswell, Fuglie and Klotz (p. 2), the term "refers to all parts of an industry that creates develops, and markets a variety of products using monoclonal antibodies, cell culture, biosensors, and genetic engineering techniques." More recently, agricultural biotechnology has referred to the use of recombinant DNA technology (DNA formed by combining segments of DNA from different organisms) to alter or move genetic material in plants (such as corn or soybeans) so that a desired trait is expressed.

[5] Labeling requirements for genetically-modified food are now in force in the EU, and soon will be implemented in Japan, South Korea, Australia, and New Zealand.

Additional costs of segregation and IP shipments must be ultimately borne by buyers or by producers and handlers, depending on the demand characteristics and shares of particular markets. The size and incidence of cost burdens associated with segregation are now attracting research interest. A recent study suggests that segregation of non-GM varieties could add about 22cents/bu to total marketing costs for corn (from country elevator to export terminal), and about 18 cents/bu or 54cents/bu for non-GM soybeans, depending on the segregation process used (Lin, Chambers, and Harwood, 2000). The economics of IP shipments are also important and likely to change in the near future, with larger container vessels reducing the cost of unitized shipments to overseas markets (Prentice, 2000). In combination with modern computer technology, intermodal containers offer the opportunity for direct shipments between producers and buyers in domestic or international markets, and traceability. The question is whether premiums for 'GM-free' crops will be sufficient to justify such shipments on a large scale.

E-COMMERCE

The revolution in information technology associated with computers and the internet has affected the U.S. crop sector in several ways, not least by providing ready access to a wealth of new market information. Farmers are increasingly using the internet to check prices of commodities and farm inputs. Although statistical evidence is limited, at least one study also suggests that 'farmers are quick to make the switch to e-transactions, specifically with regard to purchasing seed, crop chemicals, and machinery' (Mueller, 2000; p. 3). This technology seems certain to intensify the competitive pressures on farm input suppliers. (An example of an electronic market for farm inputs is ***xsag.com***). Whether e-commerce, i.e., transactions conducted over the internet, will play a major part in the future of crops marketing is a bit more difficult to anticipate, as there are several directions possible.

One of the more visible models of e-commerce is that of the electronic exchange, where buyers and sellers meet to transact business. Access to the exchange may require a membership fee or subscription, but firms can then post bids or offers in a neutral environment that is fully transparent to other users. (An example is ***AgEx.com***, which operates electronic markets in rice,

almonds, walnuts and pulses.) To their users, the chief advantages of electronic exchanges may be lower search costs and the ability to quickly review bids or offers of potential trading partners. Whether through organized auctions or simple posting of bids and offers, electronic exchanges can only widen the scope of markets (facilitating transactions with new players) and intensify price competition.

On-line business-to-business (B2B) marketing of grains and oilseeds has received backing from major industry players. An example is Pradium Inc., which promises to launch virtual trading pits for cash grains, oilseeds and products early this year. Major investors include Cargill and ADM; other investors include Cenex Harvest States, Louis Dreyfus Corp. and DuPont (*Milling and Baking News*, Oct. 31, 2000). This follows by some months the launch of ***Rooster.com***, an e-commerce site that links farms, elevators and suppliers of farm inputs, backed by many of the same investors. (*Agweek*, October 23, 2000). On first consideration, the promotion of e-commerce by major commodity trading firms is somewhat surprising because, by making market prices more transparent, electronic exchanges would seem to erode the informational advantages enjoyed by firms like Cargill and ADM. However, there may be considerable cost savings associated with shifting away from a telephone-based trading system to one based on computers and the internet. And the firms now taking the lead in e-commerce for grains and oilseeds are integrated and diversified processors, for whom commodity trading is becoming more ancillary.

The electronic exchange is not the only model of e-commerce relevant to grains and oilseeds. Producers, elevators and processors are likely to develop a greater reliance on electronic sharing of information- -e.g., procurement plans, detailed information on grain inventories, measures of end-use performance for specific shipments, etc. Those activities would be an outgrowth of greater vertical coordination of supply chains, as processors and food manufacturers seek greater control over quality and logistics. Intranet technology will allow partners in a supply chain to share as much (or as little) information as they like. This kind of selective information sharing takes e-commerce in a different direction than that represented by electronic exchanges: toward longer-term alliances and contractual arrangements between firms and less transparency in pricing.

Table 1: Measures of Market Power at Different Points in the U.S. Marketing System, 1995.

	4-Firm Capacity Share	*Herfindahl Index*	*Largest Four Firms in Each Sector*
		Export Handling	
Gulf and PNW	56	1334	Cargill, ADM, Harvest States, Bunge
U.S. Gulf	53	897	Cargill, ADM, Continental (HSPV& Corpus Christi tied)
PNW	69	2089	Cargill, TEMPCO (Harvest States), Peavey, United Grain
		Processing	
Flour Milling	70	1420	Cargill, ADM, ConAgra, CFP
Malting*	60	1178	ConAgra, Cargill, Anheuser Busch, ADM
Brewing	87	2818	Anheuser Busch, Miller, Coors, Stroh
Minor Oilseeds*	78	2085	ADM, CanAmerica,Cargill, Cargill Ltd.

* Shares in North America.

Source: Wilson and Dahl, 1999.

CONSOLIDATION IN GRAIN HANDLING AND PROCESSING

Concentration in the grain handling and processing sectors is a topic of perennial interest to U.S. farmers. Interest has been heightened recently by Cargill's acquisition of Continental's grain division,[6] but concerns about industry concentration and the major firms' market power in grains and oilseeds has a much longer history (Lauck, 2000). One of the interesting facets of this topic is that, while similar concerns were expressed over a quarter century ago (in the wake of the 'Great Grain Robbery'), the list of major firms has since changed drastically. Cooperatives now play a larger role than they did in the 1970s, and several of the private firms that dominated grain exports in the 1970s have exited. The 1990s saw a proliferation of mergers, acquisitions and joint ventures, most designed to combine country origination with export terminal

[6] See Hayenga and Wisner (year) for a summary of economic issues surrounding this merger.

or processing capacity. Joint ventures between various cooperatives (Harvest States, Farmland, AGRI Industries, Growmark) and privately-held companies (Cargill, Continental) or publicly-traded corporations (ADM, ConAgra) now make for a fairly complex picture of firm rivalry in individual market channels.[7]

Table 1 (from Wilson and Dahl, 1999, p. 26), shows two measures of concentration for different segments of U.S. grain handling and processing industries: the 4-firm capacity share and Herfindahl index.[8] In general, export grain handling is somewhat less concentrated than the processing industries. The Herfindahl index for export handling at PNW ports (measured as load-out capacity) suggests a greater potential for exercise of market power than at the U.S. Gulf. However, handling margins at export elevators are also limited by competition between port areas, so concentration measures at the PNW may be somewhat misleading. These results point to an analytical problem, i.e., how to define the market boundaries for investigations of industry concentration or market power. The issue of market boundaries applies equally to processing industries, such as flour milling or malting, where companies have integrated both horizontally and vertically. With the elimination of barriers to trade in North America, the frame of reference for competition (antitrust) policy will increasingly include Canada and Mexico.

Although public concerns about industry concentration tend to focus on market power, consolidation in grain handling and processing has also been driven by efficiency gains. In an empirical analysis of the hard wheat milling industry, Steigert and Carton (1998) found an inverse relationship between industry concentration and average marketing margins. They found little evidence that the industry exercised market power in either upstream or downstream markets, despite a 4-firm capacity ratio reaching 77 percent at the end of their study period.

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[7] For a review of ownership changes and joint ventures in grain handling, see Wilson and Dahl (1999). Between 1991 and 1998, they count 24 new joint ventures in the grain trade, and 91 mergers or acquisitions.

[8] Defined as $H = _ S_i^2$ where S_i is the share (%) of firm i in a given industry or market segment. H=10,000 corresponds to a pure monopoly while H=0 corresponds to perfect competition.

Integration of the North American market for grains and oilseeds presents some interesting questions in this context. To what extent are horizontal mergers a response to reduced trade barriers? Are other factors at play? A recent study of the malting industry addresses the impact of the Canadian-U.S. Trade Agreement (CUSTA) on the economics of transborder mergers (Buschena and Gray, 1999). Prior to trade liberalization, the U.S. and Canadian malting sectors were distinct and separate; as a result of CUSTA, they evolved into a single continental market. The elimination of barriers to continental trade could have been expected to increase price competition between firms, but a wave of mergers and acquisitions, beginning in the late 1980s, left a handful of companies with most plant capacity on both sides of the border. Using a Cournot framework, Buschena and Gray illustrate two motivations for mergers: first, the anti-competitive effect; and second, cost efficiencies associated with coordination of production plans. Interestingly, they show that mergers of U.S. and Canadian malting firms could have produced a positive welfare effect despite a loss of price competition, due to savings associated with regional shifts of production.

There are other aspects of horizontal integration in the malting barley sector. Malt companies (or their parents) and Anheuser-Busch, the largest brewer (with substantial malting capacity of its own), have broadened their geographical access to malting-quality barley through ownership of grain handling facilities on both sides of the U.S.-Canada border. With geographical diversification in procurement, these firms are less vulnerable to quality risks and supply disruptions.

HARMONIZATION OF REGULATORY REGIMES

Although the United States and Canada have made substantial progress toward an integrated market for grains and oilseeds, further integration is limited by differences in marketing institutions and regulatory features. The role of the Canadian Wheat Board (CWB) as single-desk seller of Western Canadian wheat and barley provides the most obvious contrast with U.S. market organization, and seems sure to remain a point of contention. There are also other, subtler differences in the grains sector, including systems of grades and standards and controls over variety release. These do not appear to be signifi-

cant barriers to north-south trade.[9] Barriers to trade in the other direction have also been reduced. Exports of U.S. feed barley to western Canada are a reversal of the historical pattern, and U.S. exports of corn to Manitoba have provoked the kind of response (Canadian allegations of unfair subsidies) that North Dakota farmers might well understand.[10]

Apart from the role of the CWB, there are other regulatory differences that affect market integration in a nontrivial way. Canada's grain transportation system is much more highly regulated than that in the United States. As a result of caps on rail rates, movements of Canadian grain from the Prairies to export position are substantially cheaper than comparable west-bound movements from Northern Plains states. The rate caps apply only for Canadian grains. Their significance can be gauged by the observation that, if U.S. farmers had equal access to Canada's rail system and regulated rates, the drawing area of that system could extend well across the border into prime wheat producing areas of North Dakota and Montana (Wilson and Dahl, 1998). Of course, there is no prospect of equal access at these favorable rates, and the survival of rate caps will depend on Canada's own debate over rail deregulation. The point is that potential changes in Canada's rail system are also of interest to the United States- -at least to the extent that they facilitate transshipment of U.S. grain, thereby altering the competitive environment for U.S. rail carriers.

U.S. grain producers see the need for some harmonization of regulatory regimes. As an example, Canadian producers pay lower prices for many farm chemicals than their U.S. counterparts, partly because of differences in

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[9] In several ways, the Canadian system has adapted to accommodate preferences of U.S. grain buyers. For example, cleaning to 'export standard' is not required when Canadian wheat is shipped to U.S. destinations; this differs from Canada's treatment of offshore shipments. In the barley sector, the normal (multi-year) variety registration process has been expedited in recent years to meet U.S. demand for specific malting varieties. This was something of a challenge for the grading and handling system, because these varieties lack the visually distinguishable features Canada has traditionally used to prevent commingling (Johnson, 1999).

[10] Given past concerns of U.S. producers about wheat and barley imports, there was some irony in the recent dispute about corn exports to Canada. However, OECD comparisons of producer subsidy equivalents (PSEs) make clear that U.S. producers of grains and oilseeds are more heavily subsidized than their Canadian counterparts.

patent protection. Chemicals registered for use on a certain crop may not be registered in another, while no restrictions apply to cross-border movements of the farm output. Other examples concern phytosanitary restrictions, such as those applied by Mexico requiring mandatory fumigation and TCK testing of U.S. wheat. In such cases, the United States has sought bilateral agreement about which U.S. origins warrant special testing, fumigation or quarantine. One suspects that disputes over phytosanitary standards would be easier to resolve if it were clear that costs are incurred by both buyer and seller. That depends, in turn, on whether the buyer has access to alternative sources of supply not subject to the same restrictions.

EVOLUTION OF U.S. FARM POLICY

The 1996 Federal Agricultural Improvement and Reform Act (FAIR) was heralded as a major reform of U.S. agricultural programs, completing the trend toward decoupling of federal payments from planting decisions that had been marked by two previous farm bills. Under FAIR, producers of program commodities were to receive transition payments in decreasing amounts, year by year, in exchange for (nearly) complete flexibility in planting decisions. However, the collapse of commodity prices after 1997 led to financial distress in parts of the farm sector, and Congress responded with substantial programs of emergency assistance, rising from $2.8 billion in FY 1998 to $7.8 billion in 1999, and an estimated $8.9 billion in 2000. Combined with large loan deficiency payments (LDPs), the result has been a sharp increase in direct payments to farmers, to the extent that U.S. commitments under the WTO for reduction of internal supports could be jeopardized. In 2000, direct government payments were estimated to account for over 50 percent of U.S. net farm income.

This experience prompts several observations about U.S. farm policy. First, commodity prices continue to play an important role in determining program payments, partly due to the loan deficiency payment (LDP) mechanism, which provides a kind of price floor for producers of wheat, feed grains, soybeans, rice, and cotton, without constraining market prices.[11] In FY 2000, LDPs

[11] Loan rates under the FAIR were established at a time of much higher market prices. Few envisioned that loan rates would become relevant to producers within a few short years.

were estimated to reach $6.4 billion, up from an average of about $300 million per year during 1993-95. It also reflects an important political reality: that low prices can provide impetus for *ad hoc* federal assistance to farmers. In an era of widening federal surpluses, there is a chance that Congress will enact programs of emergency assistance with some regularity while commodity prices remain low.

Second, as a result of LDP payments and emergency assistance, farmers have been substantially cushioned from the effects of low commodity prices. This effect has negated the kind of supply response that might have been expected if producer returns were entirely linked to output markets.[12] Acreage planted to program crops has been fairly stable in recent years despite lower prices, although the share of soybeans has grown, and that of wheat has declined, in response to loan-rate differentials. Program benefits are still capitalized into land values and are reflected in farmland rental rates. In fact, average land prices have continued to rise over the past five years, even in the Northern Plains and Corn Belt, regions where there have been warnings of acute farm financial stress since 1997. A major obstacle to future elimination of farm subsidies, at least those tied to acreage, is the huge loss of wealth this could entail for landowners. Of course, that was part of the logic of transition payments under the FAIR Act.

Third, because most farm program benefits are tied to acreage or production, they accrue mainly to large commercial farms. This outcome represents a problem for policymakers, because much of the motivation for farm programs has been support of small and moderate-sized 'family farms.' There is a growing recognition of segmentation within the farm sector, although no universal agreement about definitions[13], or about which segments should be targeted for 'safety-net' protection. The largest share of government payments

[12] Some argue that the absence of a U.S. supply reaction has pushed more of the burden of adjustment to low commodity prices on foreign producers (outside of the EU). See Penn, 2001 (pp. 22-30) for discussion of the 'U.S. supply response anomaly.'

[13] USDA-ERS (2000) has developed a typology of family farms: five types of 'small' family farms (sales less than $250 thousand); 'large' family farms (sales between $250 thousand and $500 thousand); and 'very large' family farms (sales of $500 thousand or more). See *ERS Farm Typology for a Diverse Agricultural Sector*, USDA-ERS Agriculture Information Bulletin No. 759, September 2000.

(about 60 percent) accrue to farms with sales in excess of $100 thousand per year. These farms represent less than 15 percent of all farms, but account for nearly 45 percent of total acres. Family farms in the larger sales classes tend to be more efficient as measured by operator expense ratios, and their longer-term economic prospects may be quite different than those of lower sales classes.

Fourth, U.S. farm programs have historically been focused on commodities. This means that farm programs have supported and stabilized farm incomes only indirectly. An alternative approach involves developing a safety net for farm households based on income and earnings criteria (Gundersen, et al., 2000). This would lead to a very different distribution of benefits than current programs.

CONCLUDING REMARKS

Predicting the future course of U.S. farm programs is not easy. Much depends on progress toward multilateral reductions in farm subsidies under the WTO and on changing international market conditions for major crops. Other changes in the U.S. field crop sector seem more certain. The historical trend of increasing farm size seems likely to continue, driven by technological change and economies of scale. The field crop sector is also likely to see further movement toward vertical coordination of producers, handlers, and processors, through contracting, strategic alliances, and other means. These trends are part of what others have called the 'industrialization of agriculture.'[14] While there is no prospect of most U.S. field crops being absorbed into vertical linkages to the same degree as poultry and swine, the growth of demand for specialized, enhanced-value crops, and desire of processors and food manufacturers for greater control over quality and logistics, will make production contracting more common. Contracting and the proliferation of specialized crops will tend to diminish the role of organized markets (including futures exchanges) as centers of price discovery.

[14] See Saxowsky and Duncan (1998) for a useful discussion of the choices facing producers and rural communities. They argue that smaller-scale farms may be able to produce for many niche or specialty markets, but that this likely requires specialized knowledge of production systems and marketing.

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