IDENTITY PRESERVATION IN MARKETING SYSTEMS IN CANADA: DEVELOPMENTS IN WHEAT AND CANOLA SECTORS

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paper presented at the

Symposium

"Product Differentiation and Market Segmentation in Grains and Oilseeds: Implications for Industry in Transition"

Sponsored by
Economic Research Service, USDA
and
The Farm Foundation

Washington, DC

January 27-28, 2003

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Peter Phillips and Stewart Smyth

ABSTRACT

Increasingly variable consumer preferences, rising concerns about food safety, diverging regulatory systems and narrowing operating margins in the global agrifood system are driving forces behind the search for new product differentiation systems in the global grains and oilseeds sector. This paper offers a typology of product differentiation systems, examines the current and planned use of the various types of systems in the grains and oilseeds sectors in Canada and provides some observations on the appropriate role for the public sector in establishing and enforcing new market structures for product differentiation.

Key Words:
Product differentiation; identify preserved production; canola; wheat; Canada; institutions

INTRODUCTION

Increasingly variable consumer preferences, rising concerns about food safety, diverging regulatory systems among trading countries and narrowing operating margins in the global agrifood system are all driving forces behind the search for new product differentiation systems in the global grains and oilseeds sector. Consumers, both through their individual purchases and through their representative governments, are demanding more specific and often new product attributes—sometimes related to food safety and other times related to production and processing methods or non-safety related traits. Meanwhile, although the incorporation of primary agriculture in the World Trade Organization Agreement since 1995 provided new impetus for international specialization and trade in primary commodities, many governments are slowly but surely establishing divergent regulatory hurdles for trade in many of these markets. In a search to sustain or improve operating margins, processors and producers are seeking new ways to differentiate their products to satisfy those diverging demands.

This paper discusses the driving forces behind this movement (section 2), offers a typology of product differentiation systems (section 3), examines the current and planned use of the various types of systems in the grains and oilseeds sectors in Canada (section 4) and provides some observations on the appropriate role for the public sector in establishing and enforcing new market structures for product differentiation (section 5).

DRIVING FORCES OF PRODUCT DIFFERENTIATION

The provision of adequate supply and variety of relatively safe, affordable and nutritious foods to feed a rapidly growing world population and increasingly more affluent consumers was one of

the key accomplishments of the 20th century. But, in response to rising standards of living, consumers have increasingly demanded more specific assurances of the safety, provenance and quality of the foods they consume. While this trend became evident shortly after the Second World War and accelerated during the 1990s in response to a series of food safety failures (e.g. catastrophic contamination of the UK cattle herd with "mad cow" disease, which is linked to vCJD in humans, deliberate or inadvertent contamination of food with dioxins and anti-freeze and endemic outbreaks of listeria, e-Coli and salmonella) and introduction of new technologies, especially transgenically modified foodstuffs (especially corn, soybeans and canola).

This heightened awareness and concern was partly triggered by a more open and integrated global food system following the incorporation of primary agriculture in the World Trade Organization Agreement after 1995. Consumers became more aware of the highly integrated supply chains that delivered foods from multiple regions and regulatory systems to their store shelves and expressed concerns about the increased pressures for international specialization and trade in primary commodities.

Governments responded to these concerns in a variety of ways. While many of the individual government measures may have been implemented for legitimate objectives, the result has been diverging regulatory hurdles for trade in many of these markets. Different countries now require different levels of assurance that the products they are importing did not involve certain production processes, such as hormones in beef or transgenes in grains and oilseeds. These new hurdles are not only higher, but differ between markets, requiring greater specificity in shipments to international markets.

At the same time as regulators have changed the terms for market access, commercial supply chains have also imposed new standards of safety and conformity on their suppliers, partly in order to meet the trading requirements but more often in order to position their proprietary consumer goods into differentiated product markets. In many cases the private standards have diverged from (usually exceeding) public standards.

Table 1: Canadian Grains and Oilseeds Production and Trade in Context

Product	Average Canadian production, MT, 1996-2000	Canada's % share of global production, 1996-2000	% of Canadian production exported, 1996-2000	Canada's export market share, 1996-2000	Canadian exports to # individual export markets, 2000
Canola	7.0	19.1%	48.5%	41.0%	40
Barley	13.6	9.6%	15.5%	9.9%	13
Wheat	26.3	4.4%	66.9%	16.1%	58

Sources: FAOSTAT (2003), Industry Canada Strategis (2003).

Canadian producers and processors of grains and oilseeds have been particularly sensitive to these trends, as they are dominant global suppliers in a few key markets (table 1). Canada produces between 4% (wheat) and 60% (durum, barley) of the world supply of key grains and oilseeds, exports between 15% (barley) and 67% (wheat) of its annual production and accounts

for between 10% (barley) and 40% (canola) of world trade in those commodities. They export these goods to more than 60 different markets annually. As a result, Canadian producers and processors are being pressed to find ways to satisfy the demands of consumers, regulators and commercial supply chains around the world.

A TYPOLOGY OF PRODUCT DIFFERENTIATION

The definition of product differentiation can have several nuances, depending on the justification for the differentiation. Frequently the terms “identity preserved production and marketing” (IPPM), ”segregation” and “traceability” are used interchangeably in the supply chain literature. This is creating misconceptions about the distinct role that each of these product differentiation systems has in the supply of food products. The purpose of this section is to identify definitions that exist in the literature to date and to suggest definitions where the literature is absent. Each product differentiation system has features that are unique, while also possessing features that are in common with one, if not both, of the other systems. Table 2 compares numerous features of the three different product differentiation systems.

The first system involves identify preserved production and marketing, which is initiated by private firms in the grain and oilseed industry to extract premiums from a marketplace that has expressed a willingness to pay for an identifiable and marketable product trait or feature. An IPPM system is a ‘closed loop’ channel that facilitates the production and delivery of an assured quality by allowing identification of a commodity from the germplasm or breeding stock to the processed product on a retail shelf (Buckwell, *et al*., 1999; Lin, 2002). The objective of an IPPM system is revenue management. Premiums need to be available to attract participants and the efforts of participants will be directed towards receiving a share of the premium. Participation in these systems is voluntary. The lead stakeholders in IPPM systems are private firms seeking to capture the increased value of special traits. The role of the regulatory body is to ensure that industry standards are handled in such a way as to prevent consumer fraud. The information may be asymmetric, as only the product seller can know with certainty what level, if any, of cheating has occurred in the delivery of the product. Moral hazard may be present due to the presence of premiums.

Effective IPPM systems that span entire supply chains must have accurate two-way information flows. This means that information about purity and quality of the product flows downstream and that information coming from consumer demand flows upstream. While the information flow in IPPM systems is two-way, the focus of the system is downstream. Each participant in the system wants to ensure they extract a portion of the value of the special trait, whether from production, processing or retailing the product. This means that each participant will focus on the needs of the next participant in the supply chain. Market failure can result in fraud charges for improper labeling and also create awareness with consumers that certain brand names can not be trusted. Second parties acting on behalf of the brand owner or developer of the special trait will do testing and auditing.

Table 2: Comparing identity preservation, segregation and traceability			
	IPPM	Segregation	Traceability
1. Overall management			
Objective	Revenue management	Product safety	Liability management
Status	Voluntary	Mandatory	Voluntary or mandatory
Lead stakeholder	Private company	Regulator	Commodity group, standards organization or regulator
Information flow	One or two way	One-way	Two-way
Supply chain focus	Downstream	Downstream	Upstream
Testing/auditing	2nd party/brand owner	1st party/regulator	3rd party/standards orgn
2. Production stage features			
Production arrangements	Formal production contracts	Regulation and contracts	Membership in quality standard
Production controls	In-season agronomic rules vary with product	Formal buffer zones; post production land use controls	Process standards adopted and record keeping
3. Processing stage features			
Enforcement	Private	Public	Collective
Quality criteria based on	Product standards	Regs or HACCP	Processes (e.g. ISO)
Tolerance levels	Variable	Set in law	Performance based
Testing/auditing	2nd party	1st party	3rd party
4. Retail stage features			
Provides access to	Branded product market	Markets	Product categories
Information provided to	Consumer	Regulator	Regulator, retailer or processor
Penalties for failure in product market	Consumer fraud charges; lost brand value	Criminal prosecution; mandated product recalls	Consumer fraud charges; exclusion from product category
Price premium	Yes	None	None
Labeling	Private brands	None	Quality standard
Source: Adapted from Smyth and Phillips (2002).			

Numerous IPPM systems are operating in Canada and around the world. Some involve only the breeders and the wholesale market or processor, while others extend to the retailer. Their structure depends on the attribute they are trying to preserve. Some novel oils, such as low linolenic oils that are more stable in fryers, only have value at the processing level while others, such as high oleic oils, have health attributes that can be marketed to consumers. Identity preserved production and marketing systems are important for providing information to consumers about the provenance of a product, as those attributes are not visible or detectable in the product itself. A number of IPPM systems operate in Canada. While organic products are perhaps the most noticeable IPPM products, Cargill has an IPPM system in place to export canola to Japan (the variety gives off virtually no odour when used to fry food), General Mills operates an IPPM system for a select variety of white wheat that possesses a special trait for 'flake curling' when processed into breakfast cereal and DowAgro Sciences uses an IPPM system to export the Nexera canola variety to Japan where it is sold into the specialty gift oil market.

The second product differentiation system is segregation. Lin (2002, 263) defines segregation as the requirement "that crops be kept separate to avoid commingling during planting, harvesting, loading and unloading, storage and transport". Segregation systems are used when potential food safety concerns exist over the co-mingling of the segregated product and all other like products. In short, IPPM are used to capture premiums and segregation is used to ensure food safety. Participation is not optional -- any producer or firm involved with segregated products will have to comply with standards that have been approved by the regulatory agency. The private firm will have the responsibility of developing the actual system, but the regulatory agency will be the final arbiter on approving the system for field use. The focus of product delivery within a segregation supply chain will be downstream. Segregated commodities commonly have industrial value, so these products will be supplied to meet the criteria of the processor. Product failure would most definitely see a complete recall of any products suspected of being affected and could result in criminal prosecution in the most severe instances. Testing and auditing will be vital features of segregation systems and will be conducted by agents of, or acting on behalf of, the regulator. This process will also reinforce the level of trust with foreign export markets.

There are very few segregation systems presently operating in Canada. The best-known segregation system in Canada is for high erucic acid rapeseed, which has industrial value due to the high acid content. There are currently 11 HEAR varieties under cultivation in Canada. Two varieties of transgenic, novel oil canola (Calgene Laurical^{TM} varieties) were contract registered and produced between 1996 and 1999 and there is a small amount of *Brassica juncea* being segregated for the first time in 2002.

The third product differentiation system is traceability. International Organization for Standardization (ISO) has defined traceability as the "ability to trace the history, application or location of an entity by means of recorded identifications" (p.1) and the *Codex Alimentarius* Commission has adopted this as their working definition for all Codex standards (Codex, 2001). Traceability systems are designed to ensuring that products available for consumption are as safe as possible. Participation in a traceability system can be voluntary, depending on where in the supply chain the participant is located. The closer the participant is to the start of the supply chain, the more likely it will be that participation is voluntary. The lead stakeholder may be a commodity group demanding greater clarity in or selection of food products, a standards council that is comprised of industry representatives from all sectors of the supply chain or the regulator seeking to ensure consumer protection. Traceability systems have information flowing two-ways as these systems are designed to react quickly to food safety concerns. If a product is discovered to exceed any defined tolerance level at any point in the supply chain, traceability will be used to identify the source of the problem and to locate any and all retail products that may be affected. Information on food safety flows upstream while information on specific products flows downstream. This results in the focus of traceability systems being upstream. Market failures can also result in consumer fraud charges in addition to permanent exclusion from selling into that supply chain. Testing and auditing will be conducted according to the standards developed by third party organizations.

PRODUCT DIFFERENTIATION SYSTEMS FOR GRAINS AND OILSEEDS IN CANADA

Canada organizes its grains and oilseeds markets in various ways. At root, each system must satisfy the requirements in the *Seeds Act* that specifies allowable tolerances in different commercially cultivated species. Essentially, the seeds in the market must meet or exceed the performance of a "check" or reference variety before entering the market. If the new variety has a trait that is not normally found in that species (such as a transgene from another species or a novel oil not normally present), then more detailed evaluations are required. Once a variety is registered under the *Seeds Act*, it may be sold to farmers. At that point a blended public-private quality control system takes over. The *Seeds Act* identifies the Canadian Seed Growers Association (CSGA) as the official seed pedigree agency in Canada responsible for certifying all new varieties and ensuring they meet the standards set in the *Seeds Act*. They establish the rules for producing foundation, registered and certified seeds and then undertake the audits and conformity measures of growers that are necessary to ensure the standards are achieved. Once the seed is sold to farmers, the quality chain become much more complex. Apart from any regulatory requirements (e.g. contract registration rules for segregation of some output trait varieties) and any private contractual obligations (e.g. crop rotation rules, agronomic advice and records keeping), farmers are for the most part allowed to use their own judgement to manage the quality of their crops. There are currently no on-farm quality assurance programs for food crops.[1] Once the grain is called forward into the grain handling system, the quality system again becomes more formal. All grain entering the handling system is graded. The grading system in Canada is the responsibility of the Canadian Grain Commission (CGC), which is recognized by the *Canada Grain Act* as the official organization to set and enforce the grain grading system. The CGC sets the standards for the grading of grain for domestic and export markets, licensing of grain elevators and shippers and the responsibility of the overall efficiency of the grain handling system. Even so, the grain merchants, railways, export terminal operators and shippers coordinate the logistics for the Canadian Wheat Board (for wheat and barley) or for the private merchants (for canola) that move the grain or oilseeds to the export customer. Hence, their procedures and practices have a vital role to play in assuring the integrity of crop quality. Ultimately, private processing companies take over responsibility for quality when they take the grains and oilseeds and process them into food products. Apart from minimum regulatory standards for food safety and laws requiring honest disclosure of contents and weight on labels, the processing companies are left to establish and maintain their own quality standards. Often those standards are set and audited by retail chains.

Against that backdrop, the Canadian grains and oilseeds industries have begun to pursue various product differentiation strategies.

Canola

During the 1990s, the canola industry had to manage the introduction, production and marketing of more than 275 new varieties, combined with the wholesale adoption of transgenically modified herbicide tolerant varieties (table 3). Since 1970, 33 new varieties with output traits

[1] The Canada Grains Council is leading a two-year on-farm pilot project for food safety. For the 2002 crop year, 30 farms planting grants, oilseeds, fruits and vegetables participated in the project.

(but not involving transgenes) were introduced and beginning in 1995, genetically modified (GM) canola crop varieties entered the Canadian market. Since then, the Canadian regulatory system has approved seven herbicide tolerant transgenic modifications, three transgenic hybrid modifications and two modified industrial oils. These modifications were subsequently bred into 77 commercial varieties, which together accounted for approximately 83% of the Western Canadian canola acreage in 2002 (Button 2002).

Table 3: Distribution of canola varieties based on traits and marketing structures, 1970-2001

Category	No.	Key traits	Period
Spot market traded varieties	+165	Basic agronomic performance	1970-2001
IPPM input trait varieties for specific varieties with potential agronomic benefits	na	Any of the spot market traded varieties	Na
IPPM input trait varieties (transgenic input traits not requiring contract registration)	6	Herbicide tolerance	1995-2001
IPPM output trait varieties (not requiring contract registration)	22	Specialty fatty acids and high oil content	1993-2001
IPPM for organic market	na	All varieties except transgenic varieties eligible	1990-1999
Segregated output trait varieties (requiring contract registration)	13	High erucic acid; low linolenic/ high oleic acids; high laurate acid content	1975-2001
Traceability systems	0	Being developed by Canda Grains Council, 2003	

Sources: Author's estimates based on Canadian Food Inspection Agency, 2002; Canola Council of Canada, 2002; and Canola Guide, 1999.

Four identifiable types of supply chains are now operating in the canola industry in Canada (Table 4): for input traits (spot markets and voluntary IPPM systems for both non-GM and GM varieties) and for output traits (voluntary IPPM systems and mandated segregation systems for industrial output traits). At this point there are no effective traceability systems operating in the Canadian oilseed market, but their efforts coordinated through the Canada Grains Council, an industry-led policy-making and service providing organization, to develop a traceability system for the entire grains and oilseeds sector.

The undifferentiated product market is based on spot markets throughout the supply chain. At root, this is a non-proprietary system, which for the most part involves public or non-proprietary varieties (e.g. AC-Excel), uses spot markets to effect the transfer of inputs and product and conforms with the public grading system established through the *Seeds Act* and the Canadian Grain Commission. Canola in the grading system has one class with three grades, which are determined by the CGC based on 22 factors.

Table 4: Illustrative examples of types of product differentiation in the Canadian canola industry, 1990-2002					
	Undifferentiated traits		GM input trait	Output traits	Novel output trait
Regulatory base	Variety standards in Seeds Act				Variety standards and contract registration rules in Seeds Act
Type/source	1	2	3	4	5
Illustrative variety(s)	AC-Excel	Settler	Innovator; Independence; 3850 and 3880	Nexera	11 different high erucic acid rapeseed (HEAR)
Special trait	None	None	LibertyLink® gene	Character oil	Industrial oil
Dates	1991-2001	1994-2001	1995-1996	2000-present	1982-present
Marketing mechanism	Spot market	Spot market, input packages commodity futures	Management contract with Pools; grower contracts; CCC activity	Contracts with Louis Dreyfus and JRI	Contracts with Saskatchewan Wheat Pool
Seed developer	AAFC	Svalof Weibull & Pioneer Hi-Bred	AAFC and PGS for AgrEvo	Dow AgroSciences	University of Manitoba (under contract)
Grain merchant	Various	Value Added Seeds	Pools	Louis Drefus and JRI	CanAmera
Acres	~500,000	<200,000	215,000	300,000	100,000 to 150,000
Growers	~5,000	<2,000	<2,700	<2,500	<2,000
Grower premium	None	Financing	Est. C$2/acre savings on inputs	C$1/bu above spot price	C$1/bu + payment for trucking + C$25/t compensation for dockage
Transport	Growers truck to crusher or elevator; grain co. manages rail	Growers truck to crusher or elevator; grain co. manages rail	Commercial trucking to crusher arranged by Pools	Commercial trucking to crusher arranged by Pioneer, Canbra and growers	Commercial trucking to CanAmera crushing plant arranged by Sask. Wheat Pool
Crushers	4 companies, 7 locations in Western Canada	4 companies, 7 locations in Western Canada	Canbra at Lethbridge, Alberta; CanAmera at Altona, Manitoba and Harrowby, Alberta	Canbra Foods at Lethbridge, Alberta	CanAmera at Nipawin, Sask.
Marketing arrangement	Seed, oil, meal shipped to any of 35 markets by various agents	Value Added Seeds arranged sale of seed either domestically or offshore	XCAN directed oil and meal to North American market	Pioneer Grain (JRI) arranged sale of seed to Japan	CanAmera sells industrial oil to plastics industry
Note: t = metric tonne; CCC = Canola Council of Canada; AAFC = Agriculture and Agri-Food Canada; PGS = Plant Genetics Systems; JRI = James Richardson International; and Pools = the combined actions of the Alberta Pool Elevators, the Saskatchewan Wheat Pool and the Manitoba Pool Elevator. Sources: 1: Author's estimates; 2: Allen, 1999; 3: Kennedy, B., 1999; 4: DeKock, 2003; 5: Slusar, 2002					

There are four types of IPPM systems that have evolved in recent years. In the first instance, a number of companies have found that they can extract a small premium from crushers (for higher oil quality or content) by more closely managing varietal purity and agronomic practices. In these cases, a grain merchant (e.g. Value Added Seeds) acquires access to a new variety (e.g. Settler) that has the potential to gain market share and meet processors needs and makes that variety available to growers only under a production input and delivery contract. In short, the grower buys a package of inputs (seed, fertilizer and herbicide) from the grain merchant, which finances the transaction until the grower delivers the resulting harvest to the merchant. The objective of this type of arrangement is to lock-in input sales and output volumes, and improve the productivity of the production process. In the late 1990s, these types of contracts were worth as much as C$50/acre (Beard, 2001). These contracts tended to be open-ended pricing arrangements, with provisions for growers to lock in delivery prices based on futures prices. Unlike many of the other contracts in the industry, the grower obligations are usually limited to the specific product contracted and do not restrict in any way the production of other varieties of canola on the growers' farm. In effect, these contracts exist only where there are both corporate benefits and farmer returns.

IPPM systems were also adopted to facilitate the introduction herbicide tolerant (HT) transgenic varieties of canola. Under Canadian law new GM varieties that meet Canadian health, safety, environmental, feed and seed regulations are approved for unconfined commercial release regardless of any potential market difficulties. In 1995 Canadian approval came before the key export markets had approved the seed for importation. An earlier paper (Smyth and Phillips, 2002a) documented the IPPM systems that evolved to handle the market risks of these new varieties. Between 1995 and 1999, Monsanto and AgrEvo (now Bayer AgroSciences) were involved in five systems that have identity preserved ten GM varieties on approximately 385,000 acres (Smyth and Phillips, 2002a). Each of the supply chains began with a specific variety which included a proprietary herbicide tolerant gene which was backcrossed or inserted into a plant by either a contract breeder or by a partner company (e.g. Agriculture and Agri-Food Canada, Plant Genetics System, University of Alberta, Alberta Pool Elevators, Limagrain, Pioneer Hi-Bred or Zeneca/Advanta). Once this variety was registered, Monsanto or AgrEvo contracted with one of the grain merchants (one of the Pools, United Grain Growers or Cargill)[2] to manage the development and operation of an IPPM system. That company then multiplied the seed, undertook production contracts with specific farmers, arranged delivery from farms to a processor with contract truckers, and arranged for a custom crush, identity preservation and diversion of the resulting oil and meal into the North American market. As the objective of the IPPM system was to identity preserve the HT canola from traditional canola marketing channels, none of the GM canola could touch any part of the export handling system, including elevators, rail cars or port terminals. The identity preserved GM production was delivered to Canadian oilseed crushing plants that had markets for the oil and meal in Canada and the US, where regulatory approval had been granted (Saskatchewan Wheat Pool, 1997). In each case, the grain merchant acted as the operating agent for the system, managing the supply chain from seed multiplication to processing. Although the resulting IPPM systems cost an estimated C$33-41/tonne (Manitoba Pool Elevator, 1996 and Saskatchewan Wheat Pool, 1997) and the varieties

[2] In 1995, the Pools represented the joint actions of the Manitoba Pool Elevators, Saskatchewan Wheat Pool and the Alberta Pool Elevators. In 1998 the Manitoba and Alberta Pools merged to form Agricore. In 2001 Agricore merged with United Grain Growers to form United Agricore.

did not yield any premium in the market, the participants in these IPPM systems all agreed that the herbicide resistant technology brought real value to the sector and to producers and all agreed to participate in the IPPM system in order to quickly bring the technology into the marketplace. Farmers were estimated to have earned a small increment over traditional varieties (due to agronomic improvements), after paying for small inefficiencies due to on-farm segregation. The grain companies and crushers estimate they were out of pocket about a few dollars per tonne, but they accepted those losses to lock in access to the new germplasm. AgrEvo and Monsanto spent C$20/tonne on the IPPM systems but gained an estimated net present value of C$100 million through accelerated adoption (Smyth and Phillips, 2002a).

There have also been some attempts to develop IPPM systems to deliver organic canola (which reached about 20,000 tonnes annually in the late 1990s before succumbing to market concerns about cross pollination with GM crops), non-GM produce and socially responsible varieties (which could be non-GM or GM). There is no reliable evidence of how these systems operate or their cost structures. The only evidence we have is in a statement of claim in a class-action lawsuit by the 908 organic producers organized by the Saskatchewan Organic Directorate against Monsanto and Bayer. They assert that they have lost markets that offered 100% premiums on volumes of 20,000 (check) tonnes.

A few IPPM systems for proprietary non-novel trait varieties have operated (i.e. not mandated by law). These have involved varieties with improved oil content (e.g. higher than the average of 40% by volume of seed) or with different profiles of oils (e.g. specialty fatty acids normally found in the composite oil in canola). These products have adopted systems similar to the final system (discussed below) with the only major difference being that if the variety co-mingles with other canola, there is no food safety concern, and hence no liability for the supply chain. In this instance, the chain has asymmetric risk, as the purity of its product could be harmed by co-mingling with undifferentiated canola. Hence, these systems operate only in the presence of significant premiums that can help to enforce compliance. This system offers producer contracts which specify the inputs to be used, impose compulsory delivery, provide a C$40/tonne producer premium and a C$2.50/tonne producer storage subsidy for late season deliveries (paid by the Japanese importer) and place restrictions on other canola crops on the land. There are few substantive differences between how these voluntary IPPM systems are organized and the mandated segregation systems.

Finally, there are a variety of canola varieties with output traits that are required by law to be segregated because of the potential health and safety risks the novel traits pose. These supply chains are designed to handle both commercial interests and public health and safety concerns about the novel attributes in the varieties, in order to allow the production of both food grade canola and industrial rapeseed at the same time. Some products, such as high erucic acid varieties would contaminate the food chain if co-mingled and are therefore mandated by law (via Contract Registration under the *Seeds Act)* to be produced under segregation rules. CanAmera, for instance, contracted with the University of Manitoba to develop through traditional breeding processes a number of varieties of rapeseed with high levels of erucic acid designed to meet demands from the plastics industry. These varieties have been under production since the conversion of the industry to canola. CanAmera has taken the lead and has contracted with Saskatchewan Wheat Pool, a part owner of the crusher, to manage the production and delivery of

the seed. Producers sign contracts that provide them with a produce premium (C$1/tonne), free delivery to the CanAmera plant in Nipawin, Saskatchewan, and a C$25/tonne subsidy to compensate for higher dockage. These contracts are mandated and audited by the CFIA and require strict segregation in the field, on farm and in the handling system, including provisions limiting future canola production on the contracted fields, and appropriate disposal of the meal. Ultimately, the system depends on the price premium that the plastics industry is willing to pay for the crushed oil.

As noted, so far there are no functioning traceability systems operating in the Canadian canola market, although there are efforts to develop such a system being led by the Canada Grains Council.

Wheat

During the 1990s, the wheat industry has for the most part remained a publicly managed industry, with most of the new varieties coming from public breeding programs and the Canadian Wheat Board managing the purchase, pooling and sale of all Western Canadian exports of wheat and barley. As of 2002, the Western Canadian industry had more than 180 conventional varieties registered, of which about 50 are actively marketed each year (table 5). During the 1990s the industry saw some effort to differentiate the wheat trade further as new varieties with extra strong traits, herbicide tolerance and high protein were introduced.

Table 5: Distribution of Canadian wheat and durum varieties by product differentiation system, 1995-2002

Category	No.	Key traits
Spot market traded varieties	183	All wheat varieties sold in one of 20 classes or 5 durum classes by Canadian Wheat Board
IPPM input trait varieties	0	
IPPM for organic market	Na	All varieties eligible; after 2004 farmers must use organic seed where available; there are four major companies managing organic trade in Western Canada
IPPM output trait varieties (not requiring contract registration)	11	• 4 selected varieties for Warburtons specialty breads • 3 CPS White varieties for noodle market managed by Canadian Wheat Board • 1 hard white wheat managed by Canadian Wheat Board • 2 CPS Red wheat varieties managed by Canadian Wheat Board • Navigator extra strong durum, marketed by Saskatchewan Wheat Pool
Segregated output trait varieties (requiring contract registration)	0	None
Traceability systems	0	Being developed by Canada Grains Council, 2003
Sources: Author's estimates based on Seeds B		

In contrast to the canola market, where private research and private marketing dominate, the wheat market remains predominantly managed by public institutions. The grain grading system, the CGC specifies standards for Canadian wheat in the *Official Grain Grading Guide* and the *Canada Grain Regulations*. There are over 30 grade factors used to grade western Canadian common wheat into 6 classes, which grade into 14 different differentiated products (and six residual feed grade markets). Durum, in contrast, has only one class with 5 grades in western

Canada.[3] So far the Canadian Wheat Board has maintained its monopoly as a single desk seller, and requires that any product differentiation be booked through the Board pool accounts (even if the Board only has a nominal role in the transaction) and conforms with all Board class and grading rules. As one might expect, this has acted to limit the potential for profit from this activity.

There are a number of IPPM systems that have evolved for wheat in recent years (table 6). First, there are a number of direct sales between domestic millers and specific farmers, where the miller contracts with an individual producer to deliver a specific variety or quality. While the sale needs to be booked through the Canadian Wheat Board, the specifications of the contract are between the miller and the producer; the Board charges a C$1.50/tonne administration fee for cash sales and C$2/tonne for credit sales. The quality can be privately determined or the Canadian Grains Commission offers a quality assurance program where, for a fee, they will certify a grain to set tolerances. Otherwise, the arrangements are purely private. The Board (Rocher 2003) does not believe this activity accounts for a significant share of the domestic trade. The one area where direct sales have grown is for organic wheat, where there have been a number of low-volume IPPM systems to deliver organic wheat to domestic and export markets (the Board estimates they reached about 115,000 tonnes annually in 2002). Essentially all of the direct sale rules apply equally to organic produce.

A number of IPPM systems have also been introduced to exploit differentiable output traits that would otherwise be blended into the various grades and classes of wheat and durum marketed by the Board. These systems so far have not been driven by science, but by unexploited market opportunities. These systems are totally voluntary, as the related traits do not involve any health or safety risks to consumers or the market system. As with the fourth category of market differentiation for output trait canolas, the chains have asymmetric risk, as the purity of the differentiated product could be harmed by co-mingling with undifferentiated wheat but cannot damage the undifferentiated market. Hence, these systems operate only in the presence of significant premiums that can help to enforce compliance.

Table 6: Illustrative examples of product differentiation in the Canadian wheat industry, 1995-2002

	Basic traits	Organic	Output trait (private)	Output trait (CWB)
Regulatory base	Variety standards in Seeds Act	Variety standards in Seeds Act and Organic Standard	Variety standards and private tolerances	Variety standards and private tolerances
Type/source	1	2	3	3
Illustrative variety(s)	AC Barrie	Any conventional variety	Teal, CWRS	AC Vista
Special trait	None	Production process	Baking qualities	Noodle making qualities
Integrator	None	Sask. Wheat Pool	Warburtons	Canadian Wheat Board
Dates	Ongoing	Ongoing	1996-date	2000-date

[3] Malting barley (one of three classes of barley based on end use (malting, hulless and general) has two classes and three grades, leading to six different products. There has been somewhat more product differentiation in this market as the large brewers (such as Anhaueser Busch) have for a number of years has specific preferences as to the variety of barley they use in the production of beer.

Marketing mechanism	Canadian Wheat Board	SWP acts as principle, managing grower contracts and IP shipments	Agricore United (formally MPE) act as agent for Warburtons and manage grower contracts and IP shipments	Canadian Wheat Board testing process; board pays grain merchant C$1.80/t special handling fee
Seed developer	AAFC; mostly bin-run	Any conventional variety; can be purchased or bin-run	AAFC; all seed bought yearly from United Agricore	AAFC; all seed bought yearly from any one of seed dealers
Grain merchant	One of grain handlers working as agent for Canadian Wheat Board	Sask. Wheat Pool	United Agricore and Saskatchewan Wheat Pool	Any grain merchant
Area/ Production	> 2 million acres	115,000 acres	235,000 acres (200,000 tonnes) in 2002	17,500 acres (15,000 tonnes)
Growers	> 100,000 farmers	<1000 farmers	700-2000 farmers annually	100 farmers annually
Grower premium	None	None	C$30/t initially; dropped to C$20/t by 1999	C$5/t plus storage premium up to C$7.50/t and guaranteed delivery
Transport	Growers truck to elevator; CWB and grain co. manage rail	Growers truck to elevator	Farmer or commercial trucking to designated elevator arranged by Pools	Farmer or commercial trucking to designated elevator arranged by CWB
Marketing arrangement	Seed shipped to port for export to any of 100+ markets by various agents	Seed shipped in IPPM system to market	MPE arranged for IPPM shipment to UK	CWB arranges for IPPM shipment to Asian markets
Note: t = metric tonne; AAFC = Agriculture and Agri-Food Canada; and Pools = the combined actions of the Alberta Pool Elevators, the Saskatchewan Wheat Pool and the Manitoba Pool Elevator. Sources: 1: Author's estimates; 2: Rocher, 2003 ; 3: Kennett et al 1999; 4: Rocher, 2003.				

There is one well-documented example of an IPPM system created in response to a clear commercial demand. Warburtons, one of England's premier bakeries, in 1995 entered into an identity-preserved production program with the Canadian Wheat Board to purchase specific varieties of wheat, including Teal, Columbus, Pasqua and Cora, which the company judges produce the desired characteristics in their premium priced bread. The bakery worked through the Board and Manitoba Pool Elevators (MPE) to contract in 1996 with 700 Manitoba producers, chosen because those varieties grow best in those regions. By 2002 their program had expanded to include Agricore United (combined of MPE, Alberta Pool and United Grain) and the Saskatchewan Wheat Pool, which managed more than 230,000 acres (200,000 tonnes) and more than 2000 producers. Warburtons contracted with those companies to contract with producers, assemble the grain in an IPPM system, provide samples for testing by a Warburtons lab in Manitoba and handle the grain to export position. Warburtons then arranged the rest of the supply chain. Producers, the grain companies and the Canadian Wheat Board pool accounts all got modest premiums, while Warburtons found it was able to expand its production and market share in the UK with the more consistent grain supply.

For instance, the Canadian Wheat Board in recent years created special contract programs for Glenlea wheat, a Canada Western Extra Strong wheat class, and a number of varieties of Canada

Prairie Spring White, in order to identify varietal differences that might be valued by customers. It is important to note that none of these systems are defined by the end customer, rather they are supply chain attempts to anticipate and capitalize on customer preferences. In these cases (as with AC Vista) the Board acts as integrator, contracting with producers to plant certified seed and enforce identity preservation on farm. At harvest, the Board requests a sample that they test for purity. If the delivered grain meets the 95% purity standard, it is guaranteed to be called forward within the crop year, with a producer premium of anywhere from C$2.50/tonne and C$7.50/tonne (which in many years is about the cost of purchasing certified seed). Producers are also paid for on-farm storage after October 1, up to a maximum payment of C$7.50/tonne. Grain handlers receive a C$1.80/tonne special handling fee and the Board spends approximately C$310 to test each loaded vessel (at 5000 tonnes, this translates into C$0.06/tonne cost). Rocher (2003) estimates that each of these IPPM systems costs approximately C$18-20/tonne. There are a few privately directed efforts where companies with proprietary varieties, such as Agricore United (5700PR) or Saskatchewan Wheat Pool (Navigator), seek to control the entire supply chain, with the exception of having to book sales through the Board pool accounts.

As noted in table 5, there are no varieties of wheat that require mandatory contract registration and no functioning traceability systems operating in the Canadian wheat market, although there are efforts to develop such a system being led by the Canadian Grains Council.

CONCLUSIONS AND IMPLICATIONS FOR MARKET STRUCTURE

Production differentiation in the grains and oilseeds sectors presents a clear challenge to the traditional marketing system. Transactions for differentiated products require a more extensive set of institutions than for traditional commodity varieties. Companies, assisted by governments and industry associations, have developed IPPM systems that handle both the risks and assist with capturing the returns from the introduction of new products with commercially valuable traits or the exploitation of market niches. Spot markets are increasingly competing with proprietary vertically integrated supply chains. While canola has progressed more quickly, the wheat sector is beginning to catch up in Canada.

Identity preserved production and marketing systems would appear to have become a significant, permanent feature in the canola and wheat industries. If they are to remain relevant, however, they will need to become more efficient. Identity preserved production and marketing systems appear to be technically feasible for smaller units of production but it is unclear that they are economically viable either in the long-term or for larger scale operations. Some stakeholders believe that if an IPPM system were spread over a much larger production base, efficiencies would be possible while others believe that there are too many supply constraints (e.g. trucking and storage) for it to work. If IPPM systems continue to cost C$30-40/tonne, investment in input traits could wane and the effort devoted to seeking output traits could shift to only higher value attributes.

So far all of the IPPM systems developed have been custom built to meet the specifications of the technology owner and the market. The limited horizontal co-ordination between the systems has come through the seed companies (e.g. Monsanto and AgrEvo) working with their agents

(the grain companies) and through the Canola Council of Canada and Canadian Wheat Board efforts in export markets. For the most part the grain companies have viewed the IPPM systems as valuable proprietary services. Ultimately, however, these systems are designed to earn trust. But trust is a cumulative process, where past successful actions can contribute to achieving a higher level of trust. Conversely, failures in one part of the market can spill over to other market segments. If IPPM is here to stay, then it may not be enough to rely on independent systems.

There is a real concern in parts of Western Canada that vertically managed production systems will create winners and losers within the primary farm community. Those producers with the human and financial resources and expertise in managing more complex production systems—who tend to be younger, larger, better capitalized, more highly educated and experienced (such as through registered seed production)—are more likely to be winners, while producers lacking some of those factors may be excluded from the differentiated markets and forced to face lower and more volatile operating margins.

Finally, product differentiation fundamentally challenges the Canadian Wheat Board structure of broad pooling to mitigate individual risk. Private vertically managed production systems, either for market or safety reasons, have the potential to conflict with the Board policy. It is unclear how this debate might be resolved in Canada.

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