Contracting for Canola in the Great Plains States

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Acknowledgments

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Abstract:

Canola has become an important crop in the last decade in the U.S. Production of canola is risky and competes with other crops which have a range of risk reduction mechanisms. Alternative contracting strategies were evaluated by comparing returns to labor and management for growers and gross margins for processors. Alternative contracting strategies included no contract, fixed price with and without act of god provisions, and an oil premium contract. Grower returns and processor gross margins were simulated and resulting distributions were evaluated using stochastic efficiency with respect to a function. We estimated certainty equivalents and ranked contract preferences for both growers and processors by region in North Dakota. Grower and processor risk preferences varied by region. Producers and processors preferences differed for contract alternatives in the Northwest, Northeast and Eastcentral regions and were in agreement in the Northcentral region. This suggests that development of a single contract that would be widely adopted across the state would likely have to be altered by region to be acceptable to growers and processors.

Key Words: Canola, Grower, Processor, Contracting, Risk, Stochastic Efficiency (SERF).

Contracting for Canola in the Great Plains States

Introduction

During the past decade canola has evolved to be an important crop in the Great Plains of the United States. Area planted has increased from virtually nil in the early 1990s to about 1 million acres in more recent years, about 95% of which is grown in North Dakota. Though US canola production has grown rapidly, it remains small in comparison to Canadian canola which is about 15 million acres and has had similar growth. The difference is that in North Dakota there are many more competing crops and canola in Canada provides an alternative to growers from the more regulated wheat and barley marketing system. Nevertheless, growth for both of these crops has been facilitated by more advanced technologies, including genetic modification, Liberty Link, and Clearfield technologies, as well as growth in demand due to it being a healthful oil, and due to the growth in biodiesel demand both in Europe and in the United States.

Canola production however is risky, and there are many competing crops with varying risk reduction mechanisms. Earlier, there was limited use in contracts (pre-plant) with growers, but, in recent years there has been an escalation in use of contracts in North Dakota, as well as in Canada and Australia. In North Dakota this is driven by the growth in demand for canola, the battle for acres, risk in crop production and competing crop contracts along with their risk mitigation provisions. Of particular interest in the case of canola contracts is the lack of provisions for oil premiums. While use of premiums is a common practice in other crops and in other oilseeds in the United States and Canola in Australia, at least traditionally it has not been common in canola in North America. Nevertheless, end-users are seeking ways to influence growers to increase oil content and oil-premiums are one means to provide such incentives. There are alternatives, one of which is the specification of variety requirements in a contract. In concept, a carefully selected set of approved or allowed varieties, which are known to be greater in oil content could accomplish much the same. Indeed, this is the current practice in North Dakota. But, it remains an important empirical question as to the type of contract that would be most effective in improving oil content. This is important to both growers and to processors since for the latter, increased oil has substantial impacts on increasing processing margins.

The purpose of this paper is to analyze contract terms and alternatives for canola. The focus is on contracts between processors and growers in the North Dakota canola producing region. Specifically, we compare risks and returns to growers using different contracting and risk reduction strategies. We develop a crop budget for growers, and a processing budget for processors and analyze risks and returns associated with alternative contracts. We make specific comparisons on the risks and returns to both growers and the processor of using a contract with specified varieties, and one using premiums/discounts for higher oil content. These generate very similar returns, and the results are mostly in the risk implied in the contract. Separate analysis are conducted in each of the four major producing regions in North Dakota.

The paper contributes to the growing recent literature on agricultural contracting (MacDonald *et al*. 2004; Wilson and Dahl 2008 and 2009ab; and Wilson, Gustafson and Dahl 2009) and expands upon some of these ideas by quantifying risks and returns of alternative

provisions to improve crop quality, in this case oil content. In the first section below we discuss factors impacting the growth in contracting. Then, we provide a brief description of the canola industry in North Dakota, as well as a description of alternative contracts. Later sections describe the empirical model and present the results. The final section provides a summary of results and implications for management and the industry.

Growth in Contracting

The most recent broad based survey on contracting in agriculture (to our knowledge) was done by MacDonald et al., (2004) who examined contracting of commodities in the U.S. in 2001 and compared use of contracts to that in various time periods. They indicate that the number of farms using contracts and value of production under contract increased from 1969 to 2001. The number of farms using contracts increased from 6% to 11% from 1969 to 2001 and the value of production increased from 12% in 1969 to 36% in 2001. They illustrate that the share of wheat under contract increased from 6% of value in 1991-1993 to a high of 9% in 1996-1997 and declined to 5% in 2001. Most of the contracting of crops was focused in fruit, vegetables, rice, sugar beets, and peanuts. Contracts in crops were largely marketing contracts, while livestock contained both marketing and production contracts.

MacDonald et al., (2004) conclude that the spot market is having difficulty providing accurate price signals for products geared toward new consumer demands. They indicate that this trend for increased use of vertical coordination, through contracts and ownership will continue.

More recently, it is our observation that contracting has escalated drastically. While it is difficult to document this without a broad-based survey, it is our observation that for some commodities; pre-plant contracting has been adopted for more than 70% of industry demand, and has now become common business practice in the industry. We would attribute this to a response to three important factors. One is the battle for acres. The second is the apparent escalation in risk, as a result of the increase in volatility as described above. Third is the apparent deterioration of, or unavailability of, traditional hedging mechanisms for managing risks.

Competition and the Battle for Acres: Implications for Contracting

In part due to the growth in demands relative to supplies, and shifts in agronomic technology and production practices, a battle for acres exists in many regions of United States agriculture. While in some states there are few cropping opportunities and the battle is not as apparent, in North Dakota, as an example, growers in some regions have up to 12-16 different crops that can be grown. In fact, extension budgets normally contain returns for this many crops (Swenson *et al*). Some elevators now are posting prices for up to 12 crops at one time. Finally, it should be noted, that in this state the crops are apparently as diverse as any other state with the exception of California.

As a result of this, and the growth in GM row crops in non-traditional regions, there has been a shift in production. The response has been for an escalation in contracting. As examples, canola contracts have been offered with act-of-god clauses for prescribed varieties, and some ethanol plants offered contracts for 3 years of corn production. Most of the malting barley is now bought on pre-plant contracts (Wilson, Gustafson and Dahl, 2009). Some of these are offered up to 14 months prior to harvest and there have been relaxed quality requirements. Most of the different types of sunflowers have extensive contracting mechanisms. There has been lesser contracting in durum wheat, but during 2007 contracts were offered in the spring for new crop (pre-plant) delivery and during the 2008 contracting season contracts were offered with a record premium relative to HRS wheat. Many of the minor crops, including peas, edible beans, Sunflower, NuSun, Vestive, etc. are all nearly 100% contracted.

Background on Canola and Contracting

Canola in North Dakota:

Compared to traditional crops in North Dakota, canola would be considered a new cropping alternative. However, it is not dissimilar from the numerous other crops that are emerging. Area planted has increased from near nil in the 1990s to about 1 million acres in recent years (Figure 1). As noted, though area planted in North Dakota is less than that in Canada, North Dakota is by far the dominant producing state within the United States (Figure 2). Further, though Canada is also a very large producer, it has substantially increased crushing capacity and other demands that puts downward pressure on the availability of canola for shipments to the United States.
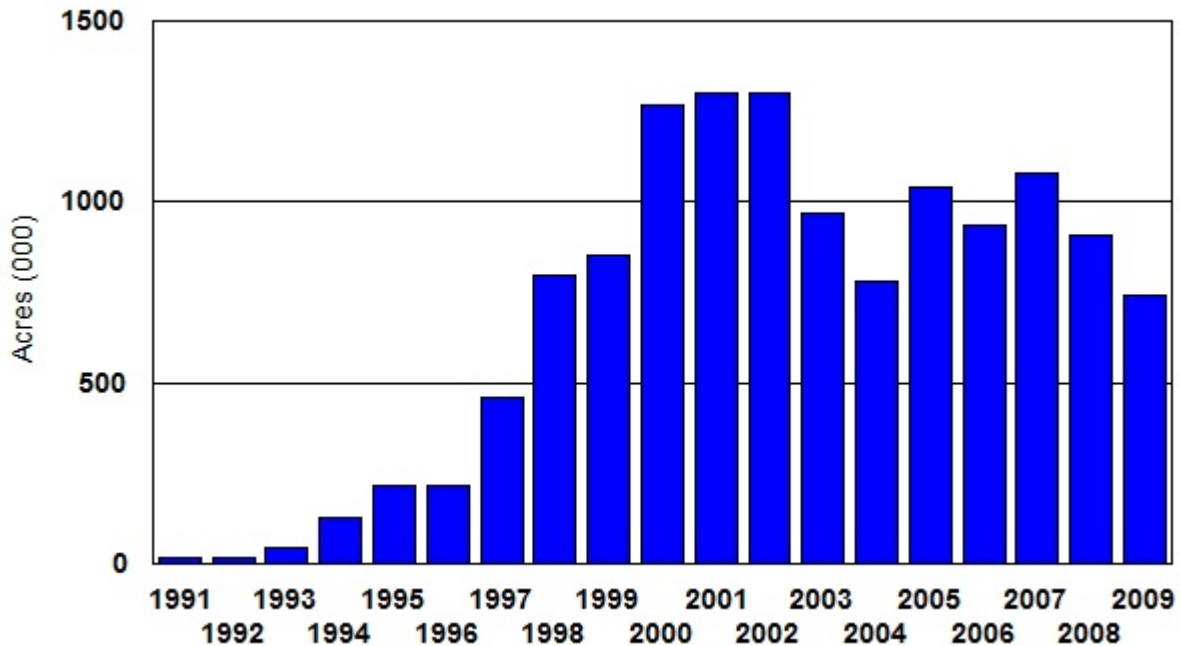
Figure 1. North Dakota Canola Planted Area, 1991-2009.
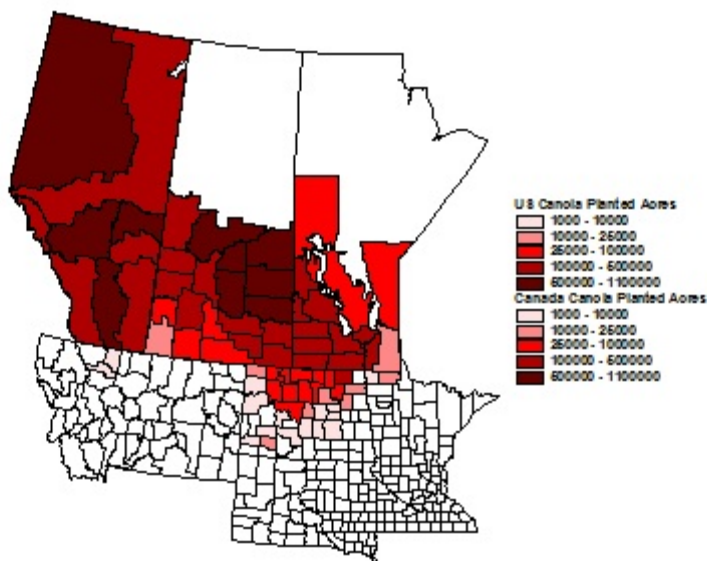
Figure 2. U.S. and Canada Canola Planted Acres in 2007, by County/Agricultural Region.

Though planted on smaller acreages than many other crops in the U.S. and North Dakota, Canola is important for a number of reasons. First, it provides attractive returns to growers in some regions in which canola is suited agronomically. Second, given the higher prices due to the growth in demands in recent years, the returns have been greater than normal. This ultimately has a positive impact on competing crop prices since these crops have to compete for acres. Third, canola is an important rotation crop and provides positive agronomic benefits to traditional small grains. Finally, several processors in North Dakota use Canola and having a local supply is advantageous versus relying exclusively on imported feedstocks.

There are numerous varieties grown in North Dakota. All are private varieties provided by the major seed companies. The composition of varieties changes over time with advances in technology, and improvements in yields, oil content, disease resistance, etc. Agronomic technology plays an important role in several respects. Most important is that the varieties are now virtually all genetically modified with some form of herbicide resistance and development is progressing on traits for nitrogen use efficiency. The main groups of herbicide resistant canola include Roundup Ready, Liberty Link, and Clearfield. Roundup Ready and Liberty Link are genetically modified (GM) canola varieties. Clearfield is a non-GM herbicide tolerant cropping system developed using traditional plant breeding. Herbicide resistant canola provides improved weed control and better yields. According to the Canola Council of Canada (2005), growers reported an average 10% yield increase for their GM canola compared to conventional canola in a 2001 study. GM canola was introduced in Canada in 1995, and accounted for approximately 80% of canola acres in Canada in 2005 (Canola Council of Canada 2005). Initial trials on nitrogen use efficiency suggests 20-30% increase in seed yield for the same level of nitrogen fertilization or similar yields with 1/3 to 1/2 of the nitrogen used (Dansby, 2008). Oil types for

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varieties can be traditional oil type and high oleic type varieties. Finally, there is a transition now from the industry being dominated by open pollinated varieties to a rapid adoption of hybrid and synthetic varieties.

In response to this there has been a general increase in yields. The general trend in average U.S. yields is for an increase of about 13.5 lbs/a/year over the period of 1991/92 to 2009/10, however, there has been a wide range variation in yields from year to year.

The oil and protein content of canola varies across varieties, regions, agronomic practice, as well as through time. Sample data obtained from the Northern Canola Growers Association shows the performance of canola in North Dakota and Minnesota with regard to many of these quality factors. The average quality of these samples is presented in Table 1 for those years for which the data are available. An analysis of the sample data shows that there is a significant tradeoff between oil content and protein content, as demonstrated in Figure 4. The correlation between oil content and protein content in the sample data is -0.77.

The chart includes the fitted line equation $y = 13.519x + 1243.2$ and $R^2 = 0.2515$.
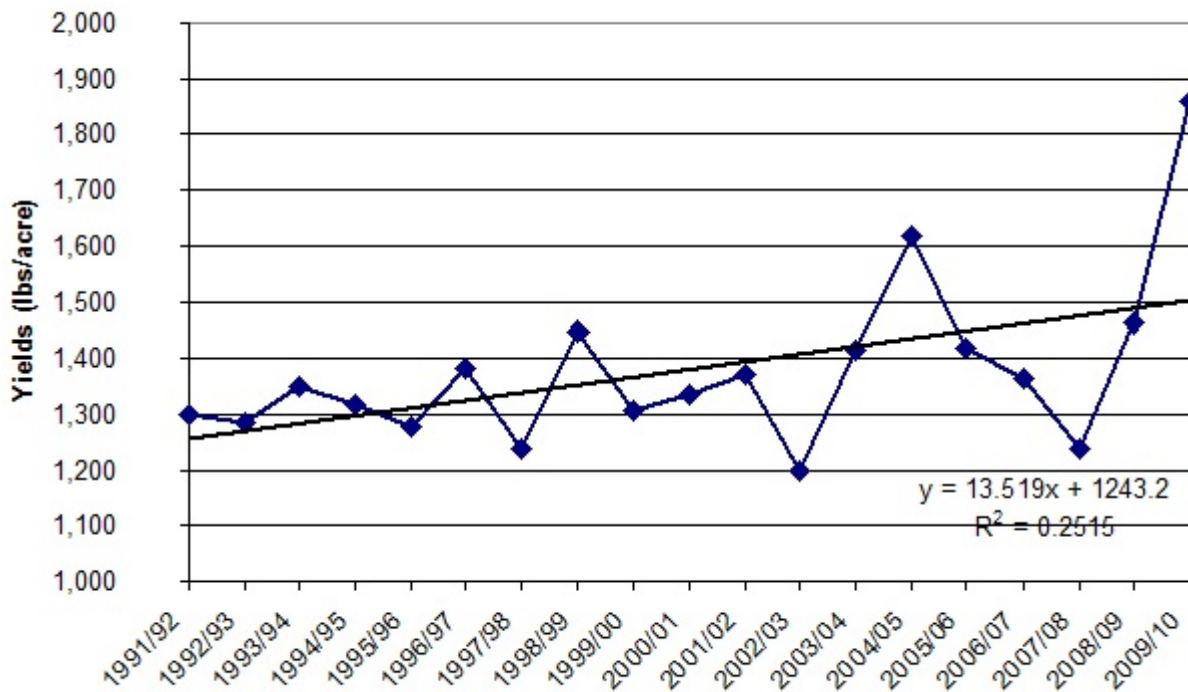
Figure 3. U.S. Canola Yields, 1991/92-2009/10.
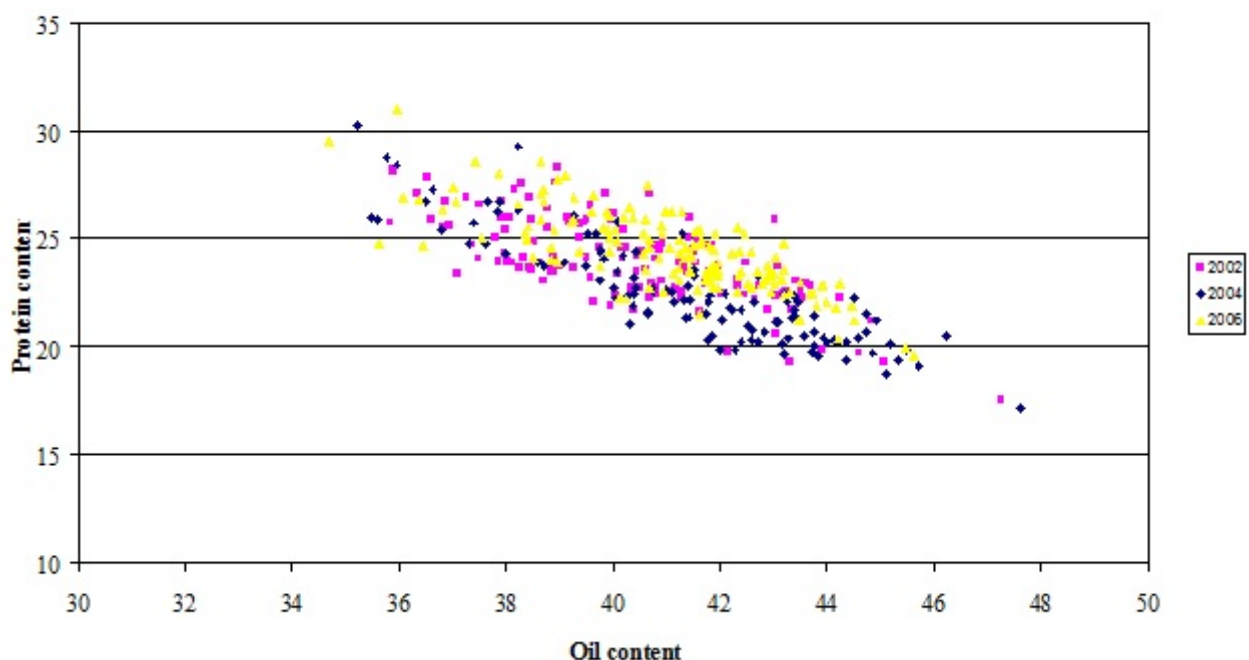
Figure 4. Oil and Protein Content From North Dakota Canola Samples, 2002, 2004 and 2006.

Finally, it is important that oil content is generally lower in the U.S. than that produced in Canada, but protein content has been higher. Canola oil content in Canada in 2000- 2006 averaged 43.2% for No. 1 Canola versus about 41.2% for canola in North Dakota and Minnesota (Figure 5) (Canada Grains Commission (1997-2009) and Coleman, 2007). In contrast, for the same period, protein content for Canadian canola averaged 21.8% versus 23.0% for North Dakota and Minnesota (Figure 6).

Table 1. Quality of North Dakota and Minnesota Canola Crops

	2000	2001	2002	2003	2004	2005	2006
Oil content*, %	41.4	41.1	40.4	40.1	41.5	42.6	41.0
Protein content*, %	21.9	22.9	24.0	23.4	22.5	22.0	24.4
Chlorophyll content, mg/kg	10.2	18.1	20.4		18.9		14.0
Total glucosinates*, umol/g	10.4	12.9	13.1		10.8		11.4
Free fatty acids, % in oil	0.61	0.65	NA		NA		NA
Erucic acid, % in oil	0.36	0.11	NA		NA		NA
Linolenic acid, % in oil	8.6	8	NA		NA		7.7
Oleic acid, % in oil	64.4	64.1	NA		NA		63.3
Total saturated fatty acids, % in oil	7.4	8	NA		NA		7.2
Iodine value	109.21	107.63	NA		NA		109.3

*8.5% moisture basis

NA=not available

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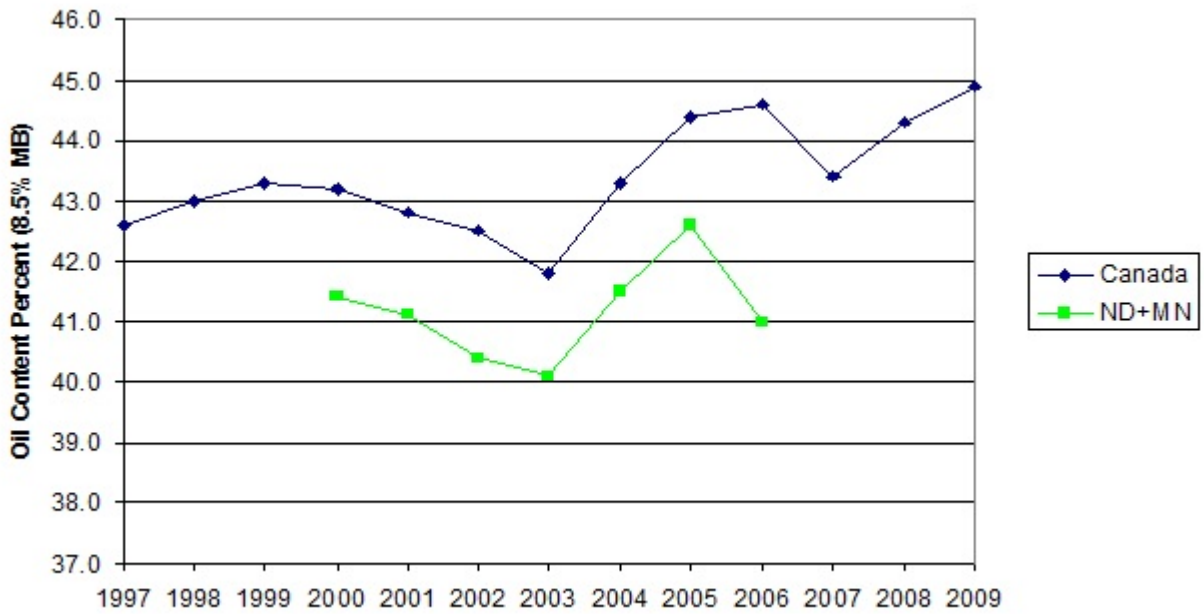
Figure 5. Average Oil Content for Canada No. 1 Canola and North Dakota and Minnesota Canola, 1997-2009.
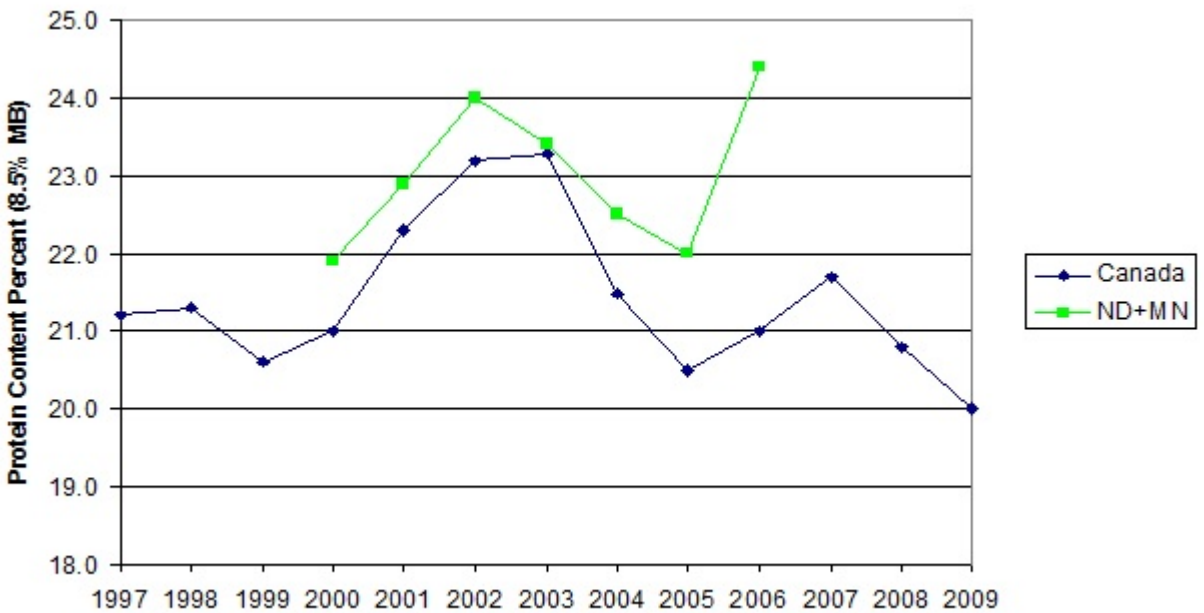
Figure 6. Average Protein Content for Canada No. 1 Canola and North Dakota and Minnesota Canola, 1997-2009.

Producing canola, like other crops, is risky. Canola has traditional risks including price and yield. Price risk can be managed by hedging at Winnipeg, but there remains basis and exchange rate risks. Or, canola could be cross-hedged at Chicago (Flaskerud, Dahl and Wilson). Finally, there are varying forms of contracts (discussed below) that can be used to mitigate price risk. In addition, there are agronomic risks related to shattering, disease to some extent, etc, and there is risk associated with oil content which is random, but, can be impacted by variety selection, and agronomic practices. Taken together, the risks are important and ultimately provide the motivations for developing alternative contracts.

Contracting and Canola:

There are three reasons why contracting has evolved to be important in Canola. One is that it is a risky crop and a contract provides a mechanism of risk sharing. Second, contracts provide a price signal about the future value of the commodity which is much more precise than can be inferred through a futures or basis specification. Finally, a contract can be used to improve the quantity of a desired characteristic, in this case oil content.

Canola evolved as an industry in which contracting was not a dominant feature. In recent years, contracting has become more important and contract provisions have become more strategic and stylized. In North Dakota, one of the prevailing contract types is a contract in which the variety is specified. During the most recent couple of years, the dominant buyer in North Dakota has offered, a pre-plant contract in which the grower would have to plant from a list of approved varieties. These are or have been specified as varieties typically having greater yields and/or oil versus others. In addition, payment prices vary by delivery period with prices lower in the September-December time period and higher for April-July time frames. This provision is designed to spread deliveries throughout the year.[1] There are a number of other specific contract provisions including: 1) provide field description by June 15; 2) provide proof of canola seed purchase of approved variety; 3) provide copy of Farm Service Agency form 578; 4) provide final yield report as soon as available, but before October 30; and 5) if these four provisions not adhered to by specified dates, contract reverts to cash contract without Act-of-God provisions.

Act-of-God (AOG) provisions have evolved to be very important in most crop contracting, as in Canola. Generally, most of the contracts, though not all, contain AOG provisions. Sometimes these clauses are offered without a price differential. Examples are shown in Table 2 below. AOG provisions are common across crops but, they are by no means standardized. There are many different interpretations of AOG clauses. Those most common are: 1) a limit on the proportion of normal production or maximum contracted volume that can be covered under AOG; 2) a price differential for AOG provisions; 3) information requirements in order to verify yield losses which can include description of location of field and/or crop

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[1] The contract has a first-right of refusal on production exceeding that contracted from the field identified in the contract retained at market price (ADM).

insurance adjustment assessments; 4) limitations on specific location to apply for contract (requirement that contract applies only to crop produced on specific field identified in the contract). Specific crops may require specific varieties for contracts, these include amongst others, malting barley and high oleic sunflowers and canola. Contracts with AOG provisions may also contain the first right of refusal on purchase of any volume exceeding the contracted volume.

Table 2. Selected Characteristics of Example AOG Contract Provisions by Crop

Crop	Discount for AOG	Max Contract Allowed	AOG Requirements	Variety Requirements	Source
Durum	Limited obs of $1.00/bu	Unknown			SunPrairie Dakota Growers Pasta
Barley		50 bu/a		Variety Specific	Anheuser Busch
Flax	$0.50/bu	15 bu/a	Crop Insurance Adjustment Information Required to release		SunPrairie
NuSun Sunflowers	$1.00/cwt	1000-1200 lbs/a dependent on county			SunPrairie
High Oleic Sunflowers		2000 lbs/a		Variety Specific	SunPrairie
Canola	$0.50 - $1.00/cwt	1000 lbs/a			SunPrairie
High Oleic Canola	$0.45/cwt	1000 lbs/a		Variety Specific	SunPrairie

An alternative would be some form of a contract with an explicit oil premium in a pre-plant contract. The concept would be that if growers had a greater than specified oil content, they would receive a premium. Growers could seek to achieve greater oil content by choice of variety, agronomic techniques, amoung others. In this type of contract, the grower is largely bearing risks associated with not achieving the above-contract oil level.

Use of oil premium contracts is common in some of the other speciality oil crops. As examples: contracts for High Oleic Sunflowers provide premiums/discounts for oil content over/under 40%. Pates (2009) indicates that for High Oleic sunflowers, for 2009 Technology Crops International Inc. offered contracts with a premium of $3/cwt over NuSun prices or growers would be allowed to price up to 25% of the crop on the Chicago Soybean futures with the remainder at $2/cwt over NuSun prices. Reference is also frequently made to Canola in Australia where it is common to use oil-premium contracts. The Australian Oilseeds Federation, (P. Salisbury and T. Potter, (1999)) indicate premiums/discounts for canola of 1.5% for each 1% oil content over/under 40%.

Canadian use of contracts in canola, particularly, pre-plant contracts is only now starting to evolve with similar pressures to that in North Dakota. It is not a common practice to use oil-premium contracts in Canada. In fact, upon recent clarification with oil traders in Canada, there are not any oil premiums on generic canola. There are production contracts which use a buyers call which assures delivery from the grower to the grain buyer. These production contract premiums can range from $15 -$40 / mt. Otherwise, there are a number of identity preserved (IP) canola contracts. The largest is Nexera™ canola - a variety by Dow that is low in linolenic acid and high in oleic acid that allows the oil to be -0- trans fat. Cargill Intermountain Canola has developed a similar variety. There is a Liberty Link type variety that is grown under IP conditions that is non-transgenic and can be used for non-gmo applications. There are also some smaller programs that are specifically high-oil content Canola that aren't necessarily IP'd but run with small premium programs as well.

Finally, these issues are ultimately important to canola crushers. Contracts with AOG provisions impact processors by introducing uncertainty of supplies and increases risks associated with both the cost and ability to purchase spot supplies to aleviate contract shortages. Contracts without AOG provisions shift these risks onto producers. Variation in the quality of canola delivered to processors (oil and meal content) affects the quantity of outputs (oil and meal) processors can obtain which in turn impacts crushing margins. Contracts with oil premiums/discounts are a method of sharing benefits/costs of quality deviations between growers and crushers.

Specification of Contract Provisions in this Study:

This study models risks and returns associated with different contract provisions in Canola. The focus is on variety contract specification vs, an oil premium specification. This section provides details behind the contracts that were modeled.

Four contract alternatives were modeled for growers and crushers that included 1) no contract; 2) fixed price contract without AOG; 3) fixed price contract with AOG; and 4) an oil premium contract for each of the four marketing regions (Northwest, Northcentral, Northeast and Eastcentral). The no contract alternative assumes that producers would hedge production with futures at planting time and as such, only subject to basis risk. Fixed price contracts assumed contracts would be limited to the first 1000 pounds of production, with production exeeding the contracted volume priced similar to the no contract alternative and for the contracts without AOG, production shortages required to be purchased to fulfil the contract. The oil premium contract introduces a premium/discount paid to growers for oil content over/below 42%. Payoffs for both growers and processors were evaluated for each of the alternatives.

Emperical Models

Payoff functions were defined for growers and processors for the four contracting alternatives. Payoff functions for growers were defined as net returns to labor and management or returns over both fixed and direct costs. Grower payoffs by contract alternative were defined as follows for no contract, fixed price without AOG, fixed price with AOG and oil premium contracts:

$$E(\Pi)_{i_{nocontract}} = \hat{Y}_i * (F + \hat{B} - T_i) - DC_i - FC_i$$

$$E(\Pi)_{i_{FPN\&AOG}} = Min(\hat{Y}_i, 1000) * (FP - T_i) + Max(\hat{Y}_i - 1000,0) * (F + \hat{B} - T_i)$$
$$- Max(1000 - \hat{Y}_i, 0) * (F + \hat{B} - T_i) - DC_i - FC_i$$

$$E(\Pi)_{i_{FPAOG}} = Min(\hat{Y}_i, 1000) * (FP - T_i) + Max(\hat{Y}_i - 1000) * (F + \hat{B} - T_i) - DC_i - FC_i$$

$$E(\Pi)_{i_{ASX}} = \hat{Y}_i * (F + \hat{B} - T_i + F * OP * (\hat{O}_i - 42)) - DC_i - FC_i$$

where $\hat{Y}_i$ is random yield in region i, F is canola futures in \$US dollar units (assumed hedged both in futures for canola and the Canadian/US Dollar exchange rate), $\hat{B}$ is random basis at processor, T_i is transportation cost from production region i to the processing plant, DC_i and FC_i are the direct and fixed costs for producing canola in region i, FP is fixed price offered for the fixed price contracts, OP is the oil premium/discount as % of futures and $\hat{O}_i$ is the random percent oil contained in canola produced in region I.

Processor Payoffs were defined as the gross crushing margin. These payoffs for processors were developed by contract alternative and are defined as follows for no contract, fixed price without AOG, fixed price with AOG and oil premium contracts:

$$E(\Pi)_{i_{NoContract}} = (\hat{Y}_i * \hat{O}_i / 100) * PO + (\hat{Y}_i * (1 - (\hat{O}_i / 100) - .03) * PM$$
$$- \hat{Y}_i * (F + \hat{B})$$

$$E(\Pi)_{i_{FPN\&AOG}} = Max(\hat{Y}_i, 1000) * (\hat{O}_i / 100) * PO + Max(\hat{Y}_i, 1000) *$$
$$(1 - (\hat{O}_i / 100) - .03) * PM - Max(\hat{Y}_i, 1000) * (FP)$$

$$E(\Pi)_{i_{FPAOG}} = \hat{Y}_i * (\hat{O}_i / 100) * PO + \hat{Y}_i * (1 - (\hat{O}_i / 100) - .03) * PM - \hat{Y}_i * (FP)$$

$$E(\Pi)_{i_{ASX}} = \hat{Y}_i * (\hat{O}_i / 100) * PO + \hat{Y}_i * (1 - (\hat{O}_i / 100) - .03) * PM - \hat{Y}_i * (F + \hat{B} +$$
$$F * OP * (\hat{O}_i - 42))$$

where PO is the price of canola oil, PM is the price of canola meal, and the rest are as previously defined.

Data

Direct and fixed costs for four multi-county planning regions (Northwestern, Northcentral, Northeastern and Eastcentral North Dakota) for 2008 were obtained from Swenson and Haugen (2007) for canola.

Relationships for yields and oil content were derived from North Dakota Variety Trial Data for canola by variety from 2003-2007 (Kandel) and was limited to those varieties which had at least 10 total observations (i.e, 2 locations for 5 years, 4 locations for 3 years, etc.). Relationships for yields for contracts included only a subset of varieties above that were specified in the 2008 contract. Relationships were estimated for yields and oil for all varieties and for contract varieties utilizing binary variables for location and year (Table 3). RMSE of regressions was retained to allow incorporation of the error from regression relationships as an element of yield and oil determination by marketing region in the simulation. Distributions for error were assumed normally distributed with mean of zero and standard deviation equal to the RMSE. In the simulation, an average of annual effects was utilized for 2008.

Table 3. Estimated Relationships for Yields and Oil Content for All and Contract Varieties, 2003-2007.

	All Varieties		Contract Varieties	
	Yield	Oil	Yield	Oil
Intercept	1262	36.68	1127	36.98
	(20.62)	(127.41)	(13.35)	(86.26)
L_{EC}	698	3.88	687	2.78
	(12.23)	(14.42)	(6.80)	(6.05)
L_{NE}	1283	7.07	1362	6.56
	(23.02)	(26.91)	(13.78)	(14.61)
L_{NC}	1139	3.64	1340	3.09
	(19.95)	(13.51)	(12.95)	(6.49)
2003	182	2.35	370	2.85
	(2.93)	(7.99)	(3.37)	(5.26)
2004	147	3.95	330	4.88
	(2.34)	(13.37)	(3.26)	(9.68)
2005	-194	2.21	0	3.20
	(-3.04)	(7.34)		(7.87)
2006	-222	2.05	0	2.62
	(-3.40)	(6.65)		6.94)
RMSE	403	1.90	402	1.83
R2	.60	.66	.61	.68

* t values for parameter estimates in ( ).

Contract prices for growers for canola were assumed fixed at $0.2545/lb without the AOG and $0.2485 with the AOG which where those that were prevalent in March of 2008 (ADM). Futures prices were assumed hedged in $US equivalent (assumes hedge applied in both WCE Canola futures and US/Canada Exchange Rate). Futures prices and exchange rates were those applicable for November 2008 WCE contract and November CME Canada/US exchange rate converted to a $US equivalent for March of 2008. Basis values at the processor were estimated as the spread between Velva Cash Canola and WCE nearby canola futures converted to $US. Basis was assumed normally distributed with means ($-0.0138/lb) and standard deviations ($0.0057/lb) derived from daily data from August, 2003 to September, 2008. Transportation costs representing the difference between the processor basis and the marketing region basis were assumed to be NW ($-0.0004/lb), NC ($-0.0002/lb), NE ($-0.0005/lb) and EC ($-0.0004/lb).

Cash prices for canola oil and meal were assumed to be current prices in March 2008 (70.56 cents/lb for canola oil and $276.85/ton (US ton) for canola meal. Correlations between basis levels and prediction errors for non-contract and contracted yields and oils were estimated. The only statistically significant correlations that exist were those for yields (non-contracted with contracted), and oil (non-contracted with contracted) (Table 4). These correlations were applied to random draws from distributions for yieldsand oil content.

Table 4. Correlations for Basis Levels and Error for Yields and Oil

	Non-Contract Yield	Non-Contract Oil	Basis	Contract Yield	Contract Oil
Non-Contract Yield	1	.09	0	.95	0
Non-Contract Oil		1	0	0	.94
Basis			1	0	0
Contract Yield				1	0
Contract Oil					1

Simulation

There are three steps in our analytical methodology. First, we derive the returns to management and labor for growers and gross crushing margin for processors for each marketing region and contracting strategy. Second, we use stochastic simulation to iterate outcomes of grower returns and processor gross margins for each region and contract alternative. Third, stochastic efficiency with respect to a function (SERF) was used to estimate certainty equivalents that decision makers would place on a risky alternative relative to a no risk investment across a range of Arrow-Pratt absolute risk aversion coefficients. SERF was used to determine ranks among grower and processor choices using *Simetar* (Richardson, Schumann, and Feldman, 2005). The range of absolute risk aversion coefficients (ARAC) was from 0 to 0.0363 for growers and 0 to 0.32156 for processors where the upper bound for the ARAC was estimated using McCarl and Bessler's non-negativity certainty equivalent approach. Risk premiums were measured as the difference in certainty equivalents relative to the no contracting strategy for each location. The premium indicates the change that would have to occur in the certainty equivalent of net payoffs/gross margin in order to induce a change in preferences, and can be used to infer ranks.

Results

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A base case for growers and processors by region was developed to be representative of the environment experienced in March of 2008. Returns to management and labor and gross margins for processors were simulated for each of the four alternatives by marketing region.

The resulting distributions for returns to management and labor vary by region and contract alternative for growers (Figures 7-8). Average grower returns to management and labor vary by region and among the contract alternatives within regions (Table 5). For example, the Northwest marketing region has highest returns for the No Contract strategy, while for the Northcentral, it is the Fixed price contract without AOG, and for the Northeast and Eastcentral, the highest returns are for the oil premium contract. Variability for growers measured by the coefficient of variation generally shows similar or increasing variability for the contract alternatives relative to the no contract alternative. The exception to this was the Northcentral Region where the fixed price contract with and without AOG had lower coefficients of variation.

For processors, gross crushing margins generally show a different result. Across regions, the fixed price contract with or without AOG had the highest average gross crushing margin. However, in all regions, the lowest coefficient of variation was for the oil premium contract, followed by the fixed price contract with AOG, fixed price without AOG, and highest coefficient of variation for the No contract alternative.

Table 5. Characteristics of Distribution of Returns to Management and Labor and Gross Crushing Margin by Region.

	Grower Returns to Mgmt & Labor				Processor Gross Crushing Margin			
	No Contract	Contract No AOG	Contract AOG	Oil Premium	No Contract	Contract No AOG	Contract AOG	Oil Premium
Northwest								
Mean	146	113	124	128	152	200	206	181
Std. Dev.	111	138	107	106	24	23	23	12
C.V.	0.76	1.22	0.87	0.83	0.16	0.11	0.11	0.07
Northcentral								
Mean	462	500	494	466	193	216	221	190
Std. Dev.	112	111	111	116	24	22	22	12
C.V.	0.24	0.22	0.23	0.25	0.13	0.10	0.10	0.07
Northeast								
Mean	482	486	480	524	232	255	260	199
Std. Dev.	111	110	110	121	24	22	22	12
C.V.	0.23	0.23	0.23	0.23	0.11	0.09	0.09	0.06
Eastcentral								
Mean	323	302	296	328	196	219	226	191
Std. Dev.	111	111	110	114	24	22	23	12
C.V.	0.34	0.37	0.37	0.35	0.12	0.10	0.10	0.07
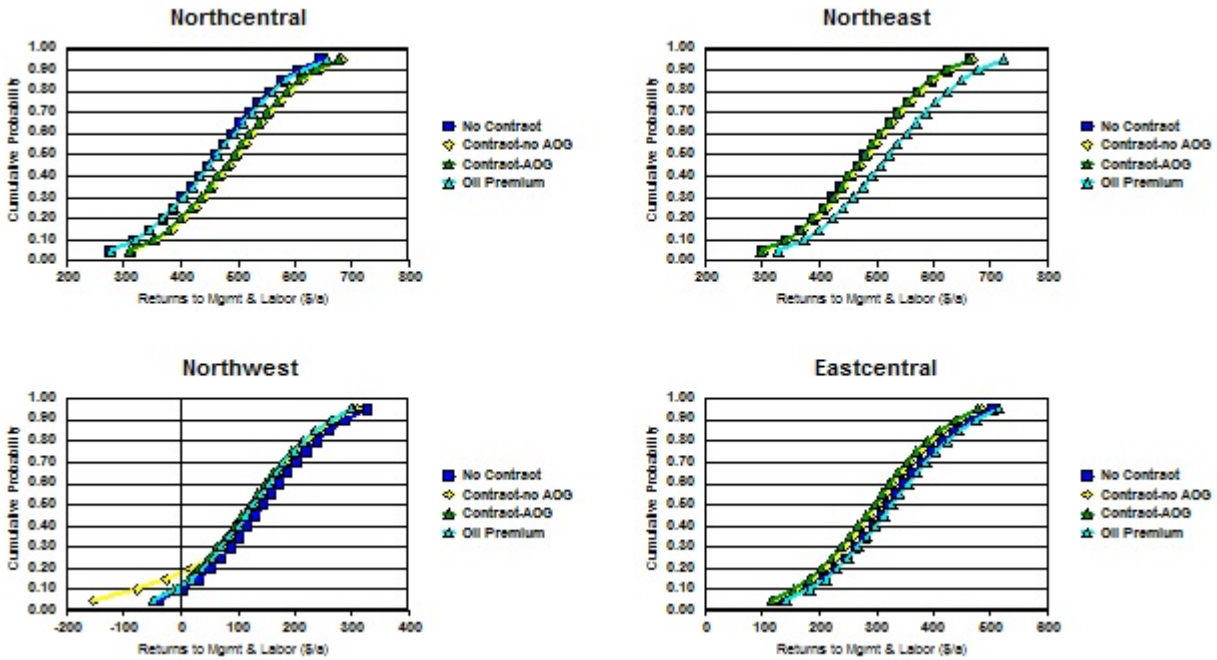
Figure 7. Distributions for Grower Returns to Management and Labor for Contract Alternatives, by Region
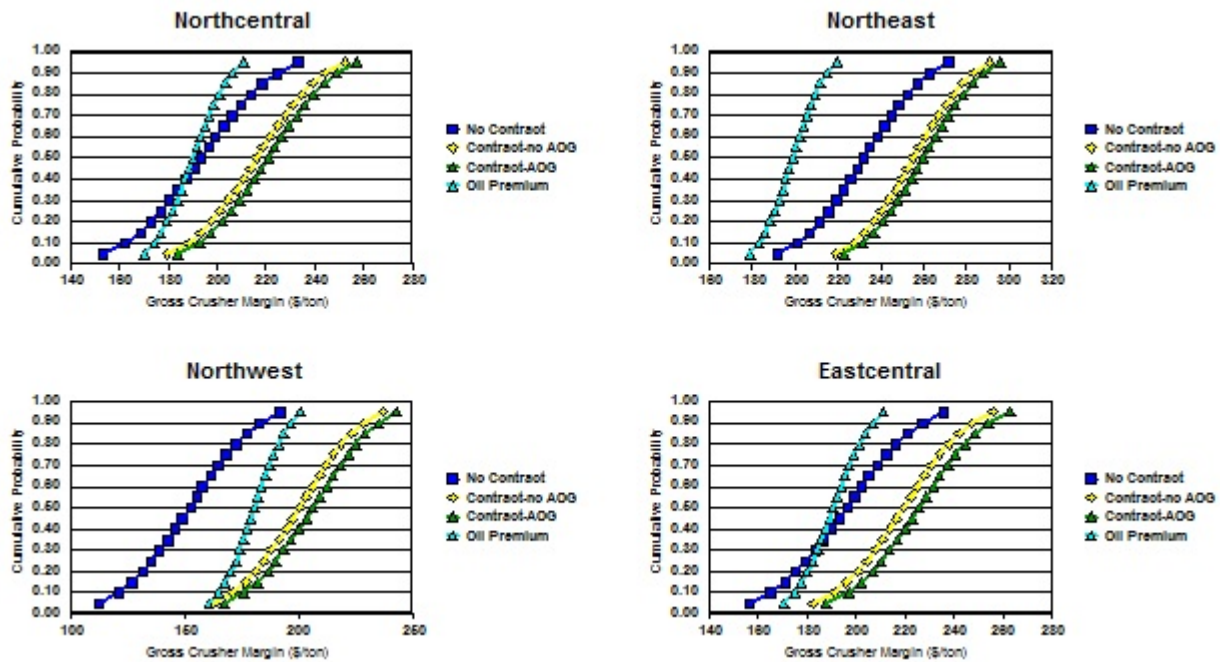
Figure 8. Distribution of Processor Gross Crushing Margin for Contract Alternatives, by Region

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Certainty equivalents (Appendix Table A1) and risk premiums (Figure 9 and Appendix Table B1) were estimated for growers and processors by region and across risk attitudes. These values indicate risk premiums for growers in Northwest North Dakota whose risk attitude ranged from risk neutral to highly risk averse would prefer no contract over the three contract alternatives. For risk neutral growers, they would prefer no contract over the oil premium contract by $18/a, Fixed price with AOG by $22/a and the Fixed price without AOG by $33/a. As growers in the Northwest become more risk averse, the preference of no contract over the oil premium and fixed price with AOG declines so that for the most risk averse growers, they prefer no contract over fixed price with AOG by $0.51/a and the oil premium by $3/a. In contrast, as growers become more risk averse, the preference for no contract over fixed price without AOG becomes larger and increases to $251/a for the most risk averse growers.

For crushers, purchase from Northwest North Dakota under each of the three contract alternatives would be preferred across risk neutral to highly risk averse crushers. Crushers that are risk neutral to slightly risk averse would prefer a fixed price contract with AOG ($54/ton), while slightly risk averse to highly risk averse would prefer a fixed price contract without AOG. Crushers that are risk neutral would view the oil premium contract as the third preferred choice ($29/ton), however, as risk aversion increases, crushers would rank the oil premium contract as second preferred contract for moderately risk aversion. As risk aversion increases, the oil premium contract becomes the preferred alternative with the most risk averse crushers preferring the oil premium contract to no contract by $73/ton.

In the Northcentral region, both growers and crushers prefer the contract alternatives over no contract for some range of risk aversion. For growers, the fixed price contract, with and without AOG, is preferred to the no contract alternative for all risk aversions from risk neutral to highly risk averse. The fixed price without AOG is more preferred over the no contract alternative than the fixed price with AOG, with both fixed price contracts being more preferred by highly risk averse growers ($51-$57/a) than risk neutral growers ($32-38/a). The oil premium contract was preferred to the no contract alternative by $4/acre for risk neutral growers, but quickly becomes the least preferred alternative as growers become more risk averse. For crushers, they prefer the fixed price contract with AOG over the fixed price without AOG and both contracts over the no contract alternative across the range of risk aversions by $23-$40/ton. Crushers preference for the oil premium contract varies from least preferred option for risk neutral crushers ($-3/ton), to most preferred contract for high risk aversion ($42/ton). Thus, for the Northcentral region, both growers and crushers prefer the fixed price with and without AOG over the no contract alternative over a wide range of risk aversions.

In the Northeast region, risk neutral to higher risk averse growers prefer the oil premium contract over all the other contract alternatives and the risk premiums for the oil premium contract decline as growers become more risk averse. Risk neutral growers would prefer the oil premium contract over no contract by $42/a and this declines to $10/a for the most risk averse growers. The most risk averse growers preferred the two fixed price contracts with the fixed price without the AOG provisions being preferred over no contract by $23/a while the fixed price with AOG being preferred by $17/a. The fixed price contract without AOG is preferred over the

no contract alternative by risk neutral to highly risk averse growers. However, the fixed price contract with AOG is less preferred to the no contract alternative risk neutral to moderately risk averse growers in the Northeast region.

For processors purchasing from the Northeast, they prefer the fixed price contracts both with and without AOG provisions over the no contract alternative by $23-$41/ton. The oilpremium contract, which is preferred by growers, is only preferred for moderately risk averse to highly risk averse processors ($11/ton). Risk neutral processors prefer the no contract alternative over the oil premium contract by $33/ton.

In the Eastcentral region, growers largely prefer the no contract alternative over the other contracting alternatives. Only the oil premium contract is preferred over the no contract alternative for risk neutral to moderately risk averse growers. For processors in the Eastcentral, both fixed price contracts and the oil premium contract are preferred to the no contract alternative. The preference among these three shifts from AOG, no AOG, oil premium for risk neutral to moderately risk averse crushers, to AOG, oil premium and no AOG for highly risk averse crushers. The oil premium contract being preferred to the no contract for all risk aversions except for the risk neutral processors.

Results across regions indicate that there are differences in preferences for contract alternatives between growers and processors for the Northwest, Northeast and Eastcentral regions and agreement in the Northcentral region. This suggests that development of a single contract that would be widely adopted across the state would likely have to be altered by region to be acceptable to growers and processors.
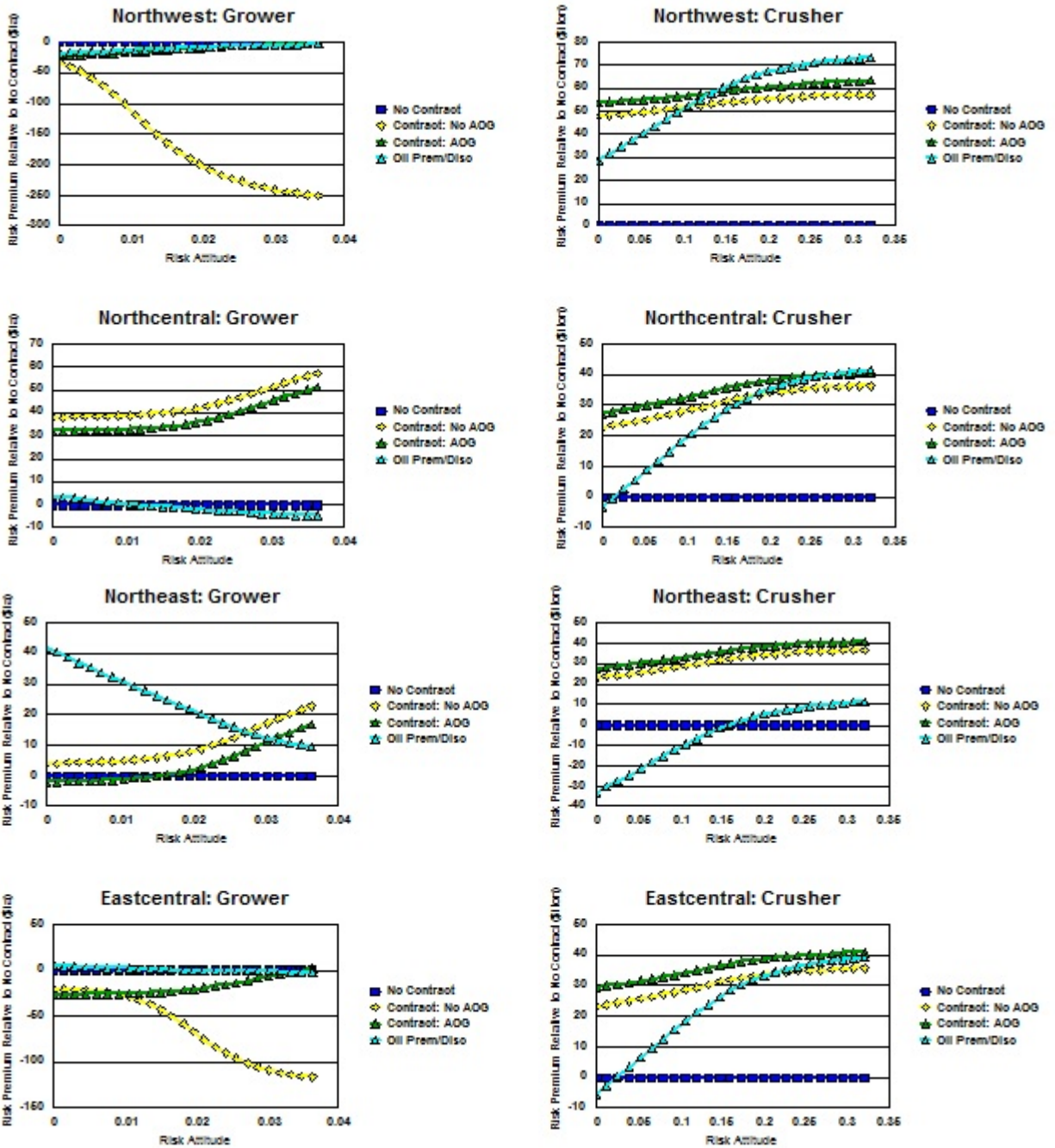
Figure 9. Risk Premiums for Growers and Processors Relative to No Contract Alternative, for Contract Alternatives by Region.

Sensitivities

Several parameters were examined to determine the sensitivity of grower and processor preferences to adjustments in these values. This included, 1) the value of the oil premium/discount for the oil premium contract, 2) the discount in the fixed price contract for the AOG provisions, 3) the premium/discount for the fixed price contracts over the current futures price, and 4) the volume contracted.

Oil Premium/Discounts

The base case oil premium contract assumed that growers would receive a premium/discount for percent of oil content above/below 42% equivalent to 1.5% of the futures value. The sensitivity of preferences for the oil premium/discount contract was examined for oil premium/discounts ranging from 1% to 3% of futures value by 0.25% increments for each percent of oil content above/below 42%. Certainty equivalents for the alternative oil premium/discounts are contained in Appendix Tables A2a-b for growers and processors.

Increasing the oil premium/discount level from 1% to 3% reduced risk premiums for Northwest growers relative to the no contract case (Figure 10 and Appendix Tables B2a-b). For example, risk premiums for risk neutral growers for 1% discount were $-12/a, while increasing the discount to 3% resulted in risk premiums of $-35/a. Increasing risk aversion, lowered the risk premium relative to the no contract alternative so that growers would have risk premiums of $-2/a for 1% and $-6/a for 3% oil premium/discount. For processors in the Northwest, the opposite trend was observed with processors preferring higher oil premium/discount levels over lower and processors that were more risk averse having higher risk premiums relative to no contract alternative than for lower or risk neutral processors. Risk premiums for the oil premium contract by level of premium/discount for processors in the Northwest ranged from $19/ton to $93/ton.

For growers and processors in the Northeast region, results were similar but opposite in effect. Growers in the Northeast preferred higher premium/discounts to lower and had higher risk premiums relative to no contract alternative for risk neutral growers and lower risk premiums for risk averse growers. Processors in the Northeast preferred lower premium/discounts to higher and had more negative risk premiums relative to no contract for risk neutral processors and slightly positive risk premiums lower premiums/discounts for risk averse processors.

Northcentral and Eastcentral growers and processors had similar trends in responses to changes in oil premium/discount levels. For risk neutral growers, in either region, they would prefer higher premiums/discounts to lower, while as risk aversion increases, preferences shift so that lower premiums/discounts are preferred to higher. In both regions, the range of risk premiums from low to high premiums/discounts increases from risk neutral to highly risk averse, with the larger range for risk averse growers in the Eastcentral region.

For processors in the Northcentral and Eastcentral regions, the highest oil premium/discounts are the least preferred oil premium contract for risk neutral processors and the lowest oil premium/discounts are the most preferred oil premium contract. However, as risk aversion increases, the order of preference changes and for higher risk aversion levels, premiums/discounts of 1.75% to 2% become the most preferred oil contracts with most preferred option shifting from 1.75% to 2% as risk aversion increases.
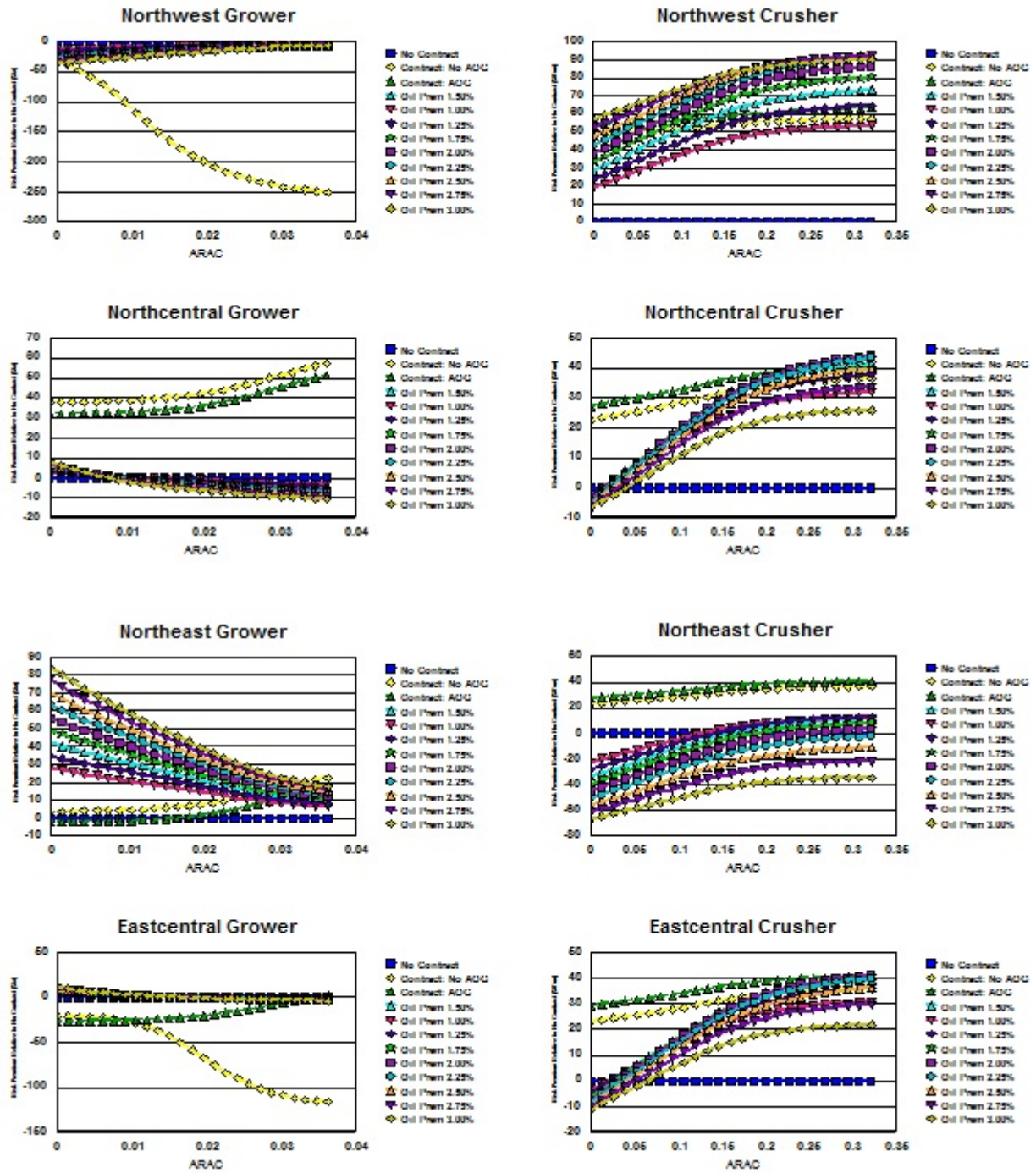
Figure 10. Sensitivity of Risk Premiums for Oil Premium/Discount Contract for Levels of Oil Premium/Discounts for Growers and Processors, by Region.

Discount for AOG Provisions in Fixed Price Contract

The base case assumes a discount for AOG provisions of 0.6 cents/lb. The sensitivity of preferences and risk premiums relative to the no contract alternative were compared for AOG discounts ranging from 0 cents/lb to 1.2 cents/lb in 0.2 cent increments. Certainty equivalents for alternative discounts for AOG provisions for growers and processors are contained in Appendix Table A3a-b.

Increasing discounts by 0.2 cents/lb for growers generally reduced risk premiums by $1-2/a for growers of all risk attitudes in all regions (Figure 11 and Appendix Table B3a-b). In the Northcentral and Northeast regions, increasing the discount for AOG provisions by 0.2 cents/lb reduced risk premiums by $2/bu. and has similar affects across risk attitudes. In the Northwest and Eastcentral regions, growers that were risk neutral reduced risk premiums by $2/a for an increase of 0.2 cents/lb, but as risk attitudes become more risk averse, the change in risk premium for an increase in AOG discounts reduced so that the most risk averse growers in the Northwest region only reduced risk premiums by about $1.3 to 0.40/a.

Increases in discounts for AOG provisions by 0.2 cents/lb for processors generally had similar affects as growers, but opposite in direction. Increases in discounts for AOG provisions increased risk premiums for processors by generally $1-3/ton, for processors of all risk attitudes.
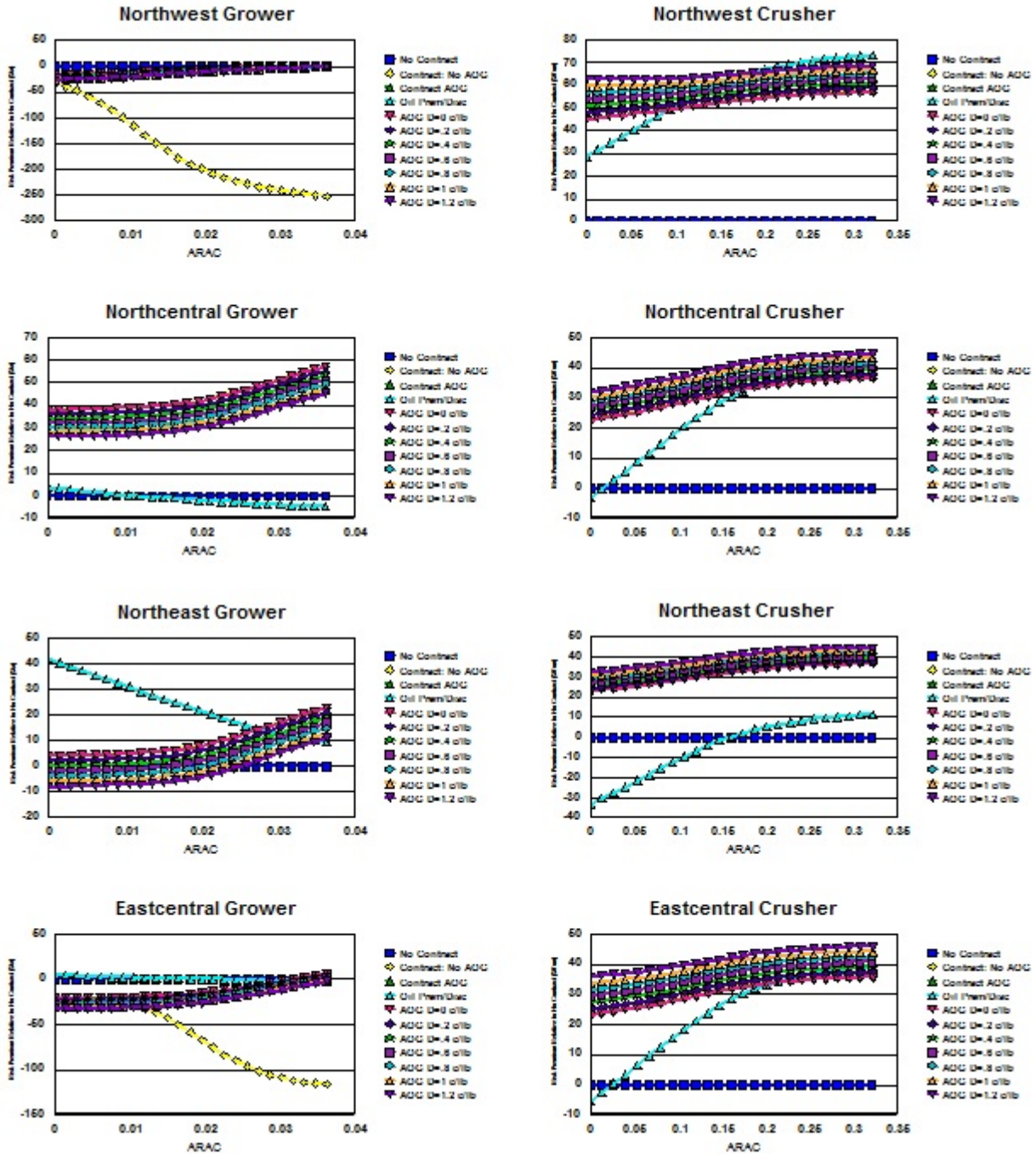
Figure 11. Sensitivity of Risk Premiums to Level of Discount for AOG in Fixed Price Contract, by Region for Growers and Processors.

Premium/Discount for Fixed Price Relative to Futures

   In the base case, the spread between the futures price (29.2 cents/lb) and the fixed price contract (25.45 cents/lb without AOG and 24.85 cents/lb with AOG) was -3.75 cents/lb. The spread between the fixed price contract value and futures was examined in 2 cent/lb increments from 4.25 cents over futures to -7.75 cents under futures to determine the sensitivity of preferences and risk premiums relative to no contract alternative. Certainty equivalents for the fixed price with and without AOG provisions for alternative fixed prices are contained in Appendix Tables A4a-d.

   Decreasing the spread from 4.25 cents/lb over to -7.75 cents/lb under the futures (reducing the amount the fixed price trades over futures or increasing the discount the fixed price trades under futures) for the fixed price contract with and without AOG provisions reduced risk premiums for growers relative to the no contract alternative (Figures 12-13 and Appendix Tables B5a-d). Effects of increasing the spread varied by region, with growers in both the Northcentral and Northeast regions risk premiums declining by about $20/acre for each 2 cent/lb increase in the spread between the fixed price contract and futures. Further, this effect was consistent for the fixed price contract with and without AOG provisions and across risk attitudes for growers in these two regions. However, for growers in the Northwest and Eastcentral region, the change in risk premiums for growers for a 2 cent/lb increase in spreads declined as growers become more risk averse with the decline larger for the fixed price contract without the AOG provisions and for growers in the Northwest region. The change in risk premiums for a 2 cent/lb increase in spread for growers in the Eastcentral region declined from $20/a for risk neutral growers to about $9/a for the most risk averse growers with NoAOG provisions and $20/a to about $12-14/acre for the most risk averse growers with the AOG provisions. The change in risk premiums for an increase in spread for growers in the Northwest declined from $19/acre for risk neutral growers to $0.5 to 0.8/acre for the most risk averse growers without the AOG provisions and to $2.36 to 5.24/acre for the most risk averse growers with the AOG provisions.

   Decreasing the spread for the fixed price contract had different effects on risk premiums for processors. In the Northcentral and Northeast Regions, increasing the spread for risk neutral growers increased risk premiums for processors with risk neutral processors increasing about $15.6-15.74/ton for each 2 cents/lb increase in spread in both regions for fixed price with and without AOG provisions. As processors become more risk averse, the change in risk premiums increased and also were higher for increases in spread when the change was from spreads which traded over futures (positive spreads) than when the change was from spreads that traded at a discount to futures (negative spreads). Thus, the change in risk premium from a change in spread also varied based on the initial level of spread. Similar results occurred for processors buying from the Northwest and Eastcentral, however two changes are prevalent. First, for changes in spread from levels trading over futures, risk premiums increased as risk preferences become more risk averse, however, as initial levels of spread trade at higher levels under futures, then the change in risk premiums decline as risk aversion increases. This shift from increasing to decreasing as the initial level of spread shifts from over futures to under was most prevalent for processors in the Northwest for the fixed price contract with AOG.
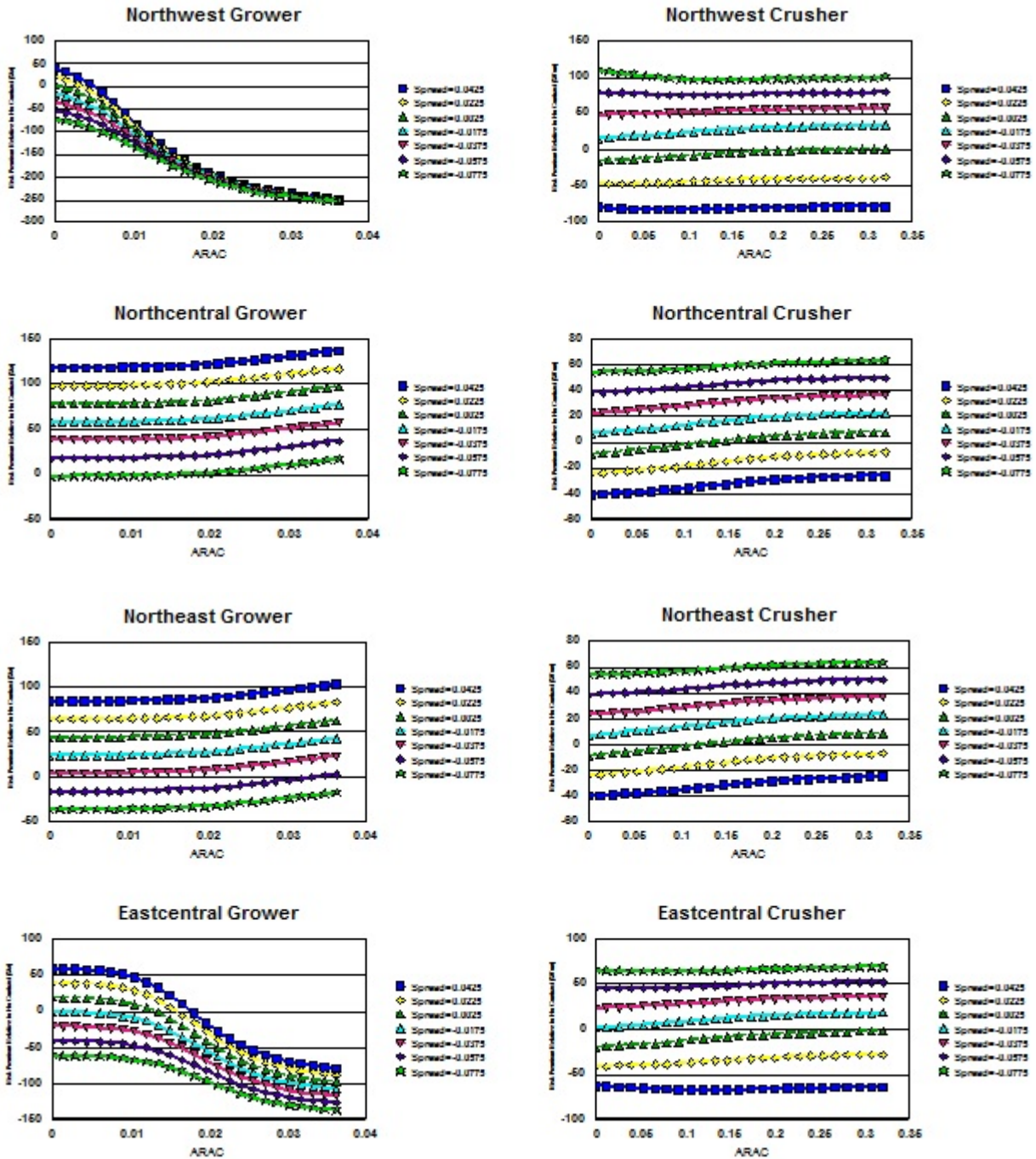
Figure 12. Sensitivity of Risk Premium Relative to No Contract for Fixed Price Contract Without AOG Provisions to Changes in Fixed Price Spread Relative to Futures for Growers and Processors, by Region and Risk Attitude.
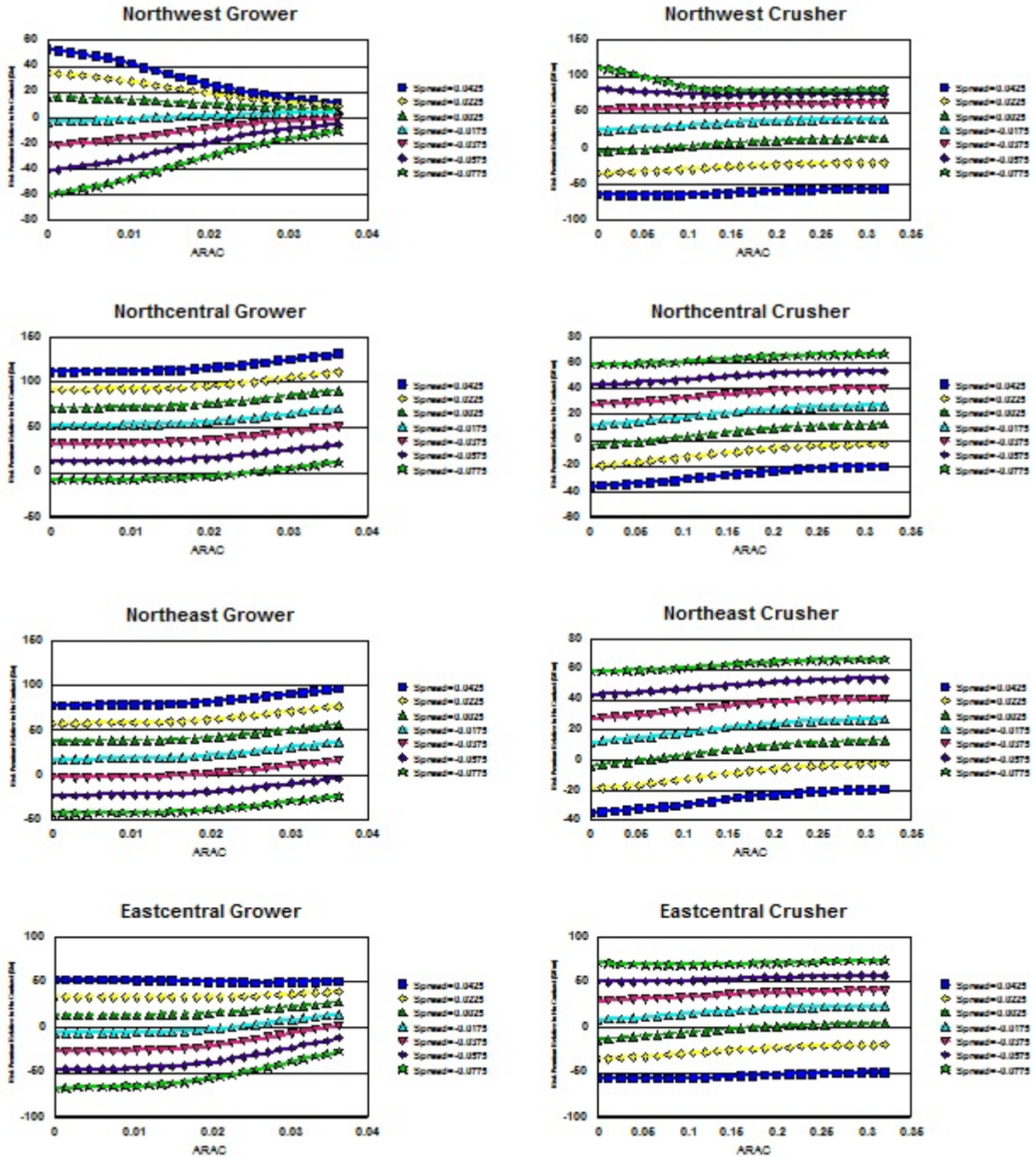
Figure 13. Sensitivity of Risk Premium Relative to No Contract for Fixed Price Contract With AOG Provisions to Changes in Fixed Price Spread Relative to Futures for Growers and Processors, by Region and Risk Attitude.

Contracted Volume

In the base case, it was assumed that growers were limited to contracting 1000 lbs/acre of potential production with the remaining production assumed hedged like the no contract alternative. Sensitivities were conducted in 500 lb/a increments from 500 lbs/a to 2500 lbs/a to determine preferences for growers and processors on the volume contracted and risk premiums. Certainty equivalents for the fixed price contracts with and without AOG provisions for different contracted volumes are shown in Appendix Tables A5a-b for growers and processors.

Results for growers with the fixed price contract without AOG provisions prefer the 500 lbs/a contract volume to higher volumes across all regions (Figure 14 and Appendix Tables B5a-b). Changes in the risk premiums for the different levels of canola contracted, as risk aversion increased vary with region and level of canola contracted. In the Northwest, for all contract levels, risk premiums decline as risk aversion increases. For the Northcentral and Northeast regions, 500-1000 bu contracted risk premiums increase as risk aversion increases, yet, for 1500-2500 bu, risk premiums decline as risk aversion increases. In the Eastcentral region, only the 500 bu contracted risk premiums increase as risk aversion increases. For 1000 bu or higher, risk premiums declined as risk aversion increased. In contrast, processors for the fixed price contract without AOG provisions would prefer the 2500 lbs/a volume over the others for all regions. For processors, risk premiums generally increased as risk aversion increased.

For the fixed price contract with AOG provisions, growers again prefer the 500 lbs/a contract over larger volumes contracted. Risk premiums increased and differences between volumes contracted became less as risk aversion increased for growers in all regions.

For processors with the fixed price contract with AOG provisions, preferences for contracted volumes shifted by risk attitude and region. Processors purchasing from the Northcentral and Northeast regions preferred contracting 2500 lbs/a for risk neutral to highly risk averse attitudes. For processors purchasing from the Eastcentral region, processors across risk attitudes would prefer 2000 lbs/a contract level. For processors purchasing from the Northwest, risk neutral to slightly risk averse processors would prefer 1500 lbs/a and as risk aversion increases would shift to preferring contracting for 1000 lbs/a.
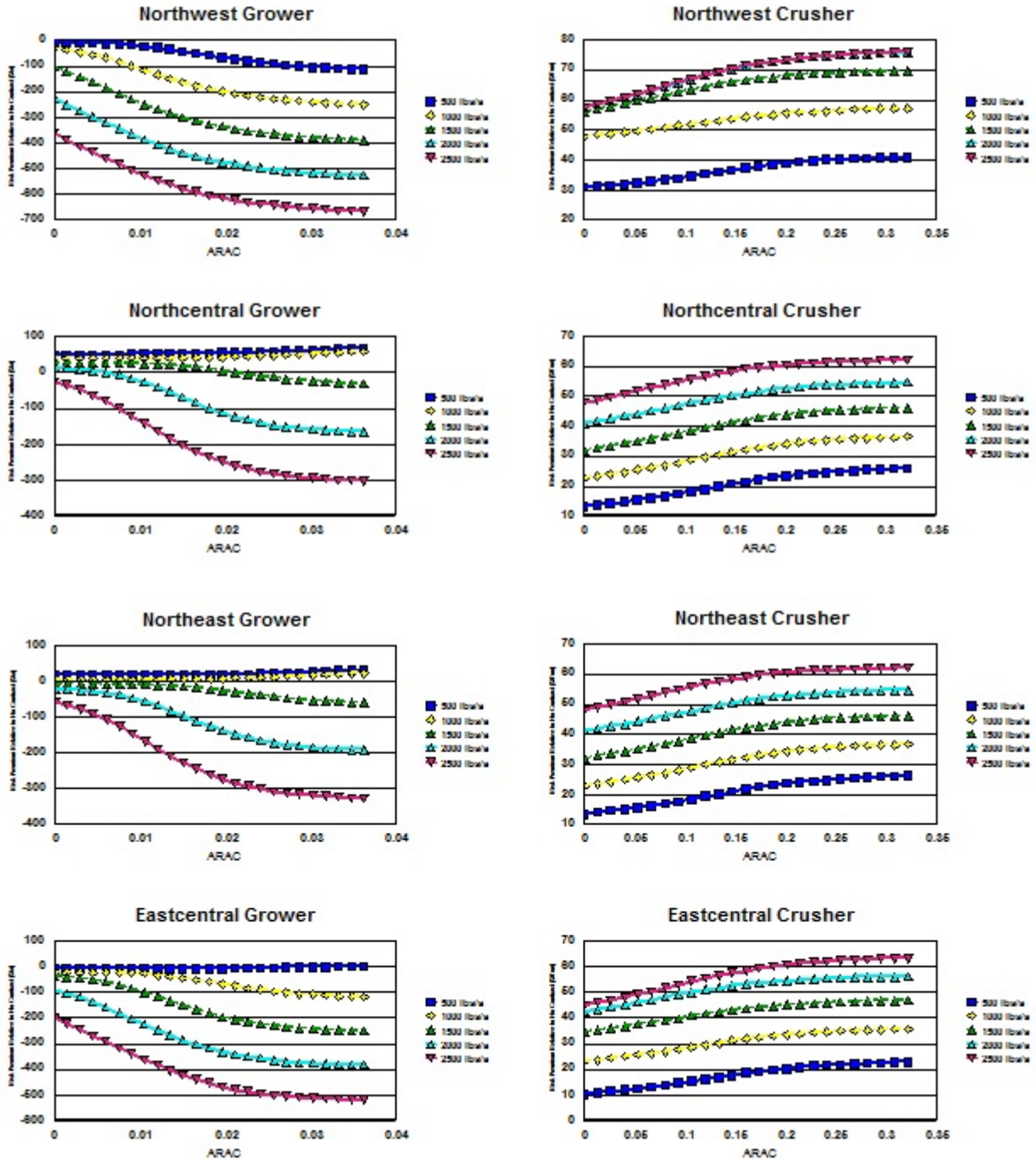
Figure 14. Sensitivity of Risk Premiums for Fixed Price Contract Without AOG Provisions to Volume of Canola Contracted, for Growers and Processors, by Region and Risk Attitude.

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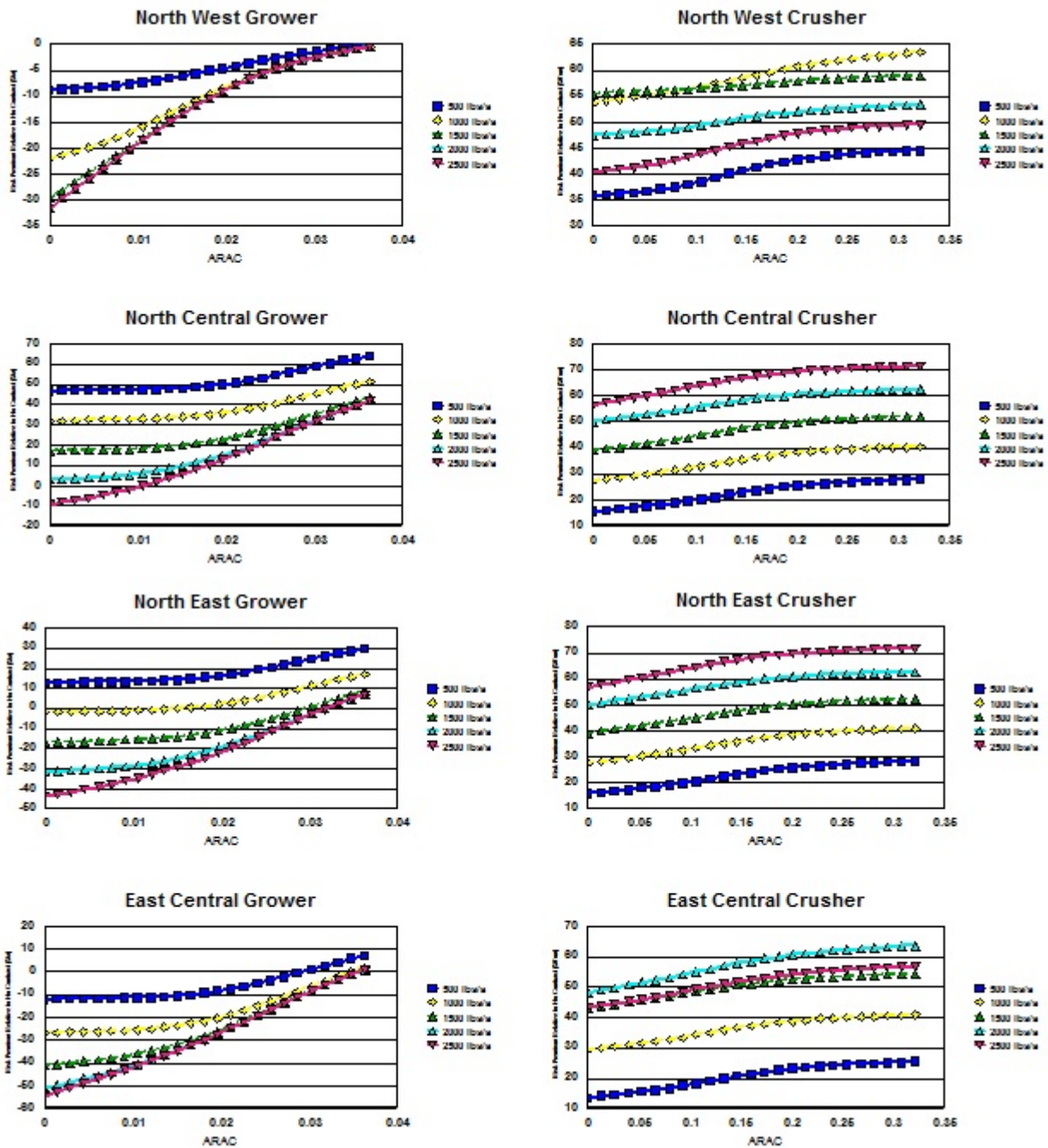
Figure 15. Sensitivity of Risk Premiums for Fixed Price Contract With AOG Provisions to Volume of Canola Contracted, For Growers and Processors, by Region and Risk Attitude.

Summary and Implications

Canola has evolved to be an important crop in the Great Plains of the United States during the past decade. Canola production however is risky, and there are many competing crops with varying risk reduction mechanisms. Four alternative contracting strategies(no contract, fixed price without AOG provisions, fixed price with AOG provisions, and an oil premium contract) for growers and processors were evaluated to compare and contrast risks and risk preferences for each of the contracting alternatives and to evaluate how risks and preferences change across regions of North Dakota and between growers and processors.

Average returns to labor and management for growers and variability of returns varied by region with highest returns as: Northwest No-contract, Northcentral Fixed Price without AOG, Northeast and Eastcentral Oil premium contract. The alternative with the lowest variability (CV) were No- contract for Northwest, Northeast and Eastcentral and the Fixed Price with and without AOG for the Northcentral region. For processors, the Fixed Price with and without AOG contract had the highest returns and the lowest variability was for the oil premium contract and these results were consistant across regions.

Results for grower and processor risk preferences across regions indicate that there is a difference in preferences for contract alternatives between growers and processors for the Northwest, Northeast and Eastcentral regions and agreement in the Northcentral region. This suggests that development of a single contract that would be widely adopted across the state would likely have to be altered by region to be acceptable to growers and processors.

Sensitivities indicate that preferences are sensitive to oil premiums/discounts, discounts for AOG provisions, spread between fixed price and futures, and the volume contracted.

- Increasing oil premiums/discounts generally had opposite effects for growers and processors. Increasing oil premiums/discounts reduced grower premiums in the Northwest and increased grower premiums in the Northeast while reverse occurred for processors. In the Northcentral and Eastcentral regions, increasing oil premiums/discounts effects varied by risk attitude with risk neutral growers preferring higher premiums/discounts and extremely risk averse growers preferring the lower premiums/discounts. Processors effects were reversed from those of growers.

- Increasing discounts for AOG provisions by 0.2 cents/lb generally reduced grower risk premiums by about $1-2/acre and increased processor risk premiums by $1-3/ton.

- Increasing the spread between the fixed price and futures by 2 cents/lb in the Northcentral and Northeast regions decreased grower risk premiums by $20/acre and increased processor risk premiums by $15-16/ton. For growers in Northwest and Eastcentral the change in risk premiums from increasing the spread decline as growers

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become more risk averse. For processors buying from the Northwest and Eastcentral, the effects were reversed.

- Processors generally preferred more contracted volume than less with higher volumes prefered in the Northcentral and Northeast regions (2500 lbs/acre) with lesser volumes in Eastcentral (2000 lbs/acre) and Northwest (1000-1500 lbs/acre). Growers generally preferred lesser contracted volumes than processors.

Results are limited in that improvements in yield levels and stability of yields for seed and/or oil will affect preferences for both growers and processors. Further, different assumptions on pricing of contract overages would impact preferences.

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Appendix Tables

Appendix Table A1. Certainty Equivalents for Growers ($/A) and Processors ($/Ton) for Contract Alternatives by Region and Risk Attitude, Base Case Results.

ARAC	No Contract	Fixed Price No AOG	Fixed Price AOG	Oil Premium/ Discount	ARAC	No Contract	Fixed Price No AOG	Fixed Price AOG	Oil Premium/ Discount
Northcentral Growers					Northcentral Processors				
0	462	500	494	466	0	193	216	221	190
0.0061	424	462	456	426	0.0536	177	203	207	186
0.0136	376	416	410	376	0.1206	157	187	191	181
0.0212	328	370	364	325	0.1876	141	175	179	175
0.0287	279	329	323	275	0.2546	131	167	171	171
0.0363	235	293	287	230	0.3216	125	161	165	166
Northeast Growers					Northeast Processors				
0	482	486	480	524	0	232	255	260	199
0.0061	445	449	443	480	0.0536	216	242	247	195
0.0136	398	404	398	426	0.1206	196	226	231	190
0.0212	350	359	353	371	0.1876	180	214	218	184
0.0287	302	318	312	316	0.2546	170	206	210	179
0.0363	260	283	277	269	0.3216	164	201	205	175
Northwest Growers					Northwest Processors				
0	146	113	124	128	0	152	200	206	181
0.0061	109	40	90	95	0.0536	136	186	191	177
0.0136	64	-85	51	54	0.1206	116	169	173	171
0.0212	24	-184	16	17	0.1876	100	155	160	166
0.0287	-11	-248	-14	-15	0.2546	90	147	152	161
0.0363	-38	-289	-39	-41	0.3216	84	141	147	157
Eastcentral Growers					Eastcentral Processors				
0	323	302	296	328	0	196	219	226	191
0.0061	286	263	260	289	0.0536	180	206	212	187
0.0136	239	202	215	241	0.1206	160	190	195	181
0.0212	191	116	173	191	0.1876	144	177	183	176
0.0287	143	38	135	142	0.2546	134	169	174	171
0.0363	101	-16	103	99	0.3216	128	163	168	167

Appendix Table A2a. Certainty Equivalents for Growers ($/A) for Different Levels of Premium/Discount for Oil Premiums.

		Oil Premium/Discount Level								
ARAC	No Contract	1.0%	1.25%	1.5%	1.75%	2.0%	2.25%	2.5%	2.75%	3.0%
Northcentral Growers										
0	462	464	465	466	466	467	468	468	469	470
0.0061	424	425	425	426	426	426	426	426	426	426
0.0136	376	376	376	376	376	375	375	374	374	373
0.0212	328	326	326	325	325	324	323	323	322	321
0.0287	279	276	276	275	274	273	273	272	271	270
0.0363	235	232	231	230	230	229	228	227	226	225
Northeast Growers										
0	482	510	517	524	531	538	545	552	559	566
0.0061	445	469	474	480	486	492	497	503	508	514
0.0136	398	417	422	426	430	434	439	442	446	450
0.0212	350	364	367	371	374	376	379	382	385	387
0.0287	302	312	314	316	318	320	322	324	325	327
0.0363	260	266	268	269	271	272	273	275	276	278
Northwest Growers										
0	146	134	131	128	125	122	119	116	114	111
0.0061	109	99	97	95	92	90	87	85	82	79
0.0136	64	58	56	54	52	50	48	46	45	43
0.0212	24	19	18	17	15	14	13	12	10	9
0.0287	-11	-14	-14	-15	-16	-17	-18	-18	-19	-20
0.0363	-38	-40	-40	-41	-41	-42	-42	-43	-44	-44
Eastcentral Growers										
0	323	327	327	328	329	330	331	332	333	334
0.0061	286	288	289	289	290	290	291	291	291	292
0.0136	239	240	241	241	241	241	241	241	241	240
0.0212	191	191	191	191	191	191	191	191	190	190
0.0287	143	143	142	142	142	142	142	141	141	141
0.0363	101	100	99	99	99	98	98	98	97	97

Appendix Table A2b. Certainty Equivalents for Processors ($/Ton) for Different Levels of Premium/Discount for Oil Premiums.

					Oil Premium/Discount Level					
ARAC	No Contract	1.0%	1.25%	1.5%	1.75%	2.0%	2.25%	2.5%	2.75%	3.0%
Northcentral Processors										
0	193	191	191	190	190	189	188	188	187	187
0.0536	177	185	186	186	186	186	185	183	182	180
0.1206	157	177	179	181	181	181	180	178	175	171
0.1876	141	169	173	175	177	177	176	173	169	163
0.2546	131	162	167	171	172	173	172	169	163	156
0.3216	125	157	163	166	168	169	168	165	159	151
Northeast Processors										
0	232	210	205	199	193	188	182	177	171	166
0.0536	216	204	199	195	190	184	178	172	166	158
0.1206	196	196	193	190	185	180	174	167	159	150
0.1876	180	188	187	184	181	176	169	162	153	142
0.2546	170	181	181	179	176	171	165	157	147	135
0.3216	164	176	177	175	172	168	162	153	142	130
Northwest Processors										
0	152	171	176	181	185	190	195	200	205	209
0.0536	136	165	171	177	182	187	191	195	199	202
0.1206	116	157	164	171	177	182	187	190	192	194
0.1876	100	149	158	166	173	178	182	185	186	186
0.2546	90	142	153	161	168	174	178	180	180	179
0.3216	84	137	148	157	164	170	175	177	176	174
Eastcentral Processors										
0	196	193	192	191	190	189	188	187	186	185
0.0536	180	186	187	187	186	185	184	183	181	178
0.1206	160	178	180	181	182	181	180	177	174	170
0.1876	144	170	174	176	177	177	175	172	168	162
0.2546	134	164	168	171	172	173	171	168	162	155
0.3216	128	158	164	167	168	169	168	164	157	150

Appendix Table A3a. Certainty Equivalents for Growers ($/A) for Different Levels of Discounts for Fixed Price With AOG Provisions.

				Discount in Fixed Price for AOG Provisions				
ARAC	No Contract	D=0 c/lb	D=0.2 c/lb	D=0.4 c/lb	D=0.6 c/lb	D=0.8 c/lb	D=1.0 c/lb	D=1.2 c/lb
Northcentral Growers								
0	462	500	498	496	494	492	490	488
0.0061	424	462	460	458	456	454	452	450
0.0136	376	416	414	412	410	408	406	404
0.0212	328	370	368	366	364	362	360	358
0.0287	279	329	327	325	323	321	319	317
0.0363	235	293	291	289	287	285	283	281
Northeast Growers								
0	482	486	484	482	480	478	476	474
0.0061	445	449	447	445	443	441	439	437
0.0136	398	404	402	400	398	396	394	392
0.0212	350	359	357	355	353	351	349	347
0.0287	302	318	316	314	312	310	308	306
0.0363	260	283	281	279	277	275	273	271
Northwest Growers								
0	146	130	128	126	124	122	120	118
0.0061	109	95	94	92	90	88	87	85
0.0136	64	55	54	52	51	50	48	47
0.0212	24	19	18	17	16	15	14	13
0.0287	-11	-12	-13	-13	-14	-15	-15	-16
0.0363	-38	-38	-38	-38	-39	-39	-40	-40
Eastcentral Growers								
0	323	302	300	298	296	294	292	290
0.0061	286	266	264	262	260	256	256	254
0.0136	239	221	219	217	215	213	211	209
0.0212	191	178	176	174	173	171	169	167
0.0287	143	139	138	136	135	133	132	130
0.0363	101	107	105	104	103	101	100	98

Appendix Table A3b. Certainty Equivalents for Processors ($/Ton) for Different Levels of Discount for Fixed Price With AOG Provisions.

		Discount in Fixed Price for AOG Provisions						
ARAC	No Contract	D=0 c/lb	D=0.2 c/lb	D=0.4 c/lb	D=0.6 c/lb	D=0.8 c/lb	D=1.0 c/lb	D=1.2 c/lb
Northcentral Processors								
0	193	216	218	219	221	222	224	225
0.0536	177	203	204	206	207	209	210	212
0.1206	157	187	188	190	191	193	194	196
0.1876	141	175	176	178	179	181	182	183
0.2546	131	167	168	170	171	172	174	175
0.3216	125	161	163	164	165	167	168	169
Northeast Processors								
0	232	255	257	258	260	262	263	265
0.0536	216	242	244	245	247	248	250	251
0.1206	196	226	228	229	231	232	233	235
0.1876	180	214	216	217	218	220	221	223
0.2546	170	206	208	209	210	212	213	214
0.3216	164	201	202	203	205	206	207	209
Northwest Processors								
0	152	197	200	203	206	209	212	215
0.0536	136	183	186	189	191	194	196	199
0.1206	116	167	169	171	173	175	177	179
0.1876	100	154	156	158	160	162	164	166
0.2546	90	146	148	150	152	154	156	158
0.3216	84	141	143	145	147	149	151	153
Eastcentral Processors								
0	196	219	221	223	226	228	230	232
0.0536	180	206	208	210	212	214	216	218
0.1206	160	190	191	193	195	197	199	200
0.1876	144	177	179	181	183	184	186	188
0.2546	134	169	171	172	174	176	178	179
0.3216	128	163	165	167	168	170	172	174

Appendix Table A4a. Certainty Equivalents for Growers ($/A) for Different Levels of Fixed Price Spreads Over Futures, Fixed Price Without AOG.

		Spread for Fixed Price Without AOG						
ARAC	No Contract	Spread= 0.0425 c/lb	Spread= 0.0225 c/lb	Spread= 0.0025 c/lb	Spread= -0.0175 c/lb	Spread= -0.0375 c/lb	Spread= -0.0575 c/lb	Spread= -0.0775 c/lb
Northcentral Growers								
0	462	580	560	540	520	500	480	460
0.0061	424	542	522	502	482	462	442	422
0.0136	376	496	476	456	436	416	396	376
0.0212	328	450	430	410	390	370	350	330
0.0287	279	409	389	369	349	329	309	289
0.0363	235	373	353	333	313	293	273	253
Northeast Growers								
0	482	566	546	526	506	486	466	446
0.0061	445	529	509	489	469	449	429	409
0.0136	398	484	464	444	424	404	384	364
0.0212	350	439	419	399	379	359	339	319
0.0287	302	398	378	358	338	318	298	278
0.0363	260	363	343	323	303	283	263	243
Northwest Growers								
0	146	188	169	150	132	113	94	75
0.0061	109	97	83	69	54	40	25	10
0.0136	64	-63	-68	-73	-79	-85	-92	-99
0.0212	24	-176	-178	-180	-182	-184	-187	-190
0.0287	-11	-244	-244	-245	-246	-248	-249	-250
0.0363	-38	-287	-287	-288	-288	-289	-290	-291
Eastcentral Growers								
0	323	382	362	342	322	302	282	262
0.0061	286	342	323	303	283	263	244	224
0.0136	239	272	255	237	220	202	185	167
0.0212	191	164	152	141	128	116	103	89
0.0287	143	78	68	58	48	38	28	17
0.0363	101	22	13	3	-6	-16	-25	-35

Appendix Table A4b. Certainty Equivalents for Processors ($/Ton) for Different Levels of Fixed Price Spreads Over Futures, Fixed Price Without AOG.

		Spread for Fixed Price Without AOG						
ARAC	No Contract	Spread= 0.0425 c/lb	Spread= 0.0225 c/lb	Spread= 0.0025 c/lb	Spread= -0.0175 c/lb	Spread= -0.0375 c/lb	Spread= -0.0575 c/lb	Spread= -0.0775 c/lb
Northcentral Processors								
0	193	153	169	185	200	216	232	248
0.0536	177	139	156	172	187	203	218	233
0.1206	157	123	141	157	172	187	201	215
0.1876	141	112	129	146	161	175	189	202
0.2546	131	104	122	138	153	167	180	194
0.3216	125	99	117	133	148	161	175	188
Northeast Processors								
0	232	193	209	224	240	255	271	287
0.0536	216	179	195	211	227	242	257	272
0.1206	196	163	180	196	212	226	240	254
0.1876	180	152	169	185	200	214	228	241
0.2546	170	144	162	178	192	206	220	233
0.3216	164	139	157	173	187	201	214	227
Northwest Processors								
0	152	73	105	137	168	200	232	263
0.0536	136	54	90	124	156	186	213	238
0.1206	116	35	73	110	142	169	192	213
0.1876	100	20	60	98	131	155	177	198
0.2546	90	11	51	90	123	147	169	189
0.3216	84	5	45	85	118	141	163	184
Eastcentral Processors								
0	196	134	155	176	198	219	241	262
0.0536	180	115	141	164	185	206	225	244
0.1206	160	93	124	149	171	190	208	225
0.1876	144	78	112	138	159	177	194	211
0.2546	134	70	105	131	151	169	186	202
0.3216	128	64	100	126	146	163	180	197

Appendix Table A4c. Certainty Equivalents for Growers ($/A) for Different Levels of Fixed Price Spreads Over Futures, Fixed Price With AOG.

ARAC	No Contract	Spread= 0.0425 c/lb	Spread= 0.0225 c/lb	Spread= 0.0025 c/lb	Spread= -0.0175 c/lb	Spread= -0.0375 c/lb	Spread= -0.0575 c/lb	Spread= -0.0775 c/lb
Spread for Fixed Price With AOG								
Northcentral Growers								
0	462	574	554	534	514	494	474	454
0.0061	424	536	516	496	476	456	436	416
0.0136	376	490	470	450	430	410	390	370
0.0212	328	444	424	404	384	364	344	324
0.0287	279	403	383	363	343	323	303	283
0.0363	235	367	347	327	307	287	267	247
Northeast Growers								
0	482	560	540	520	500	480	460	440
0.0061	445	523	503	483	463	443	423	403
0.0136	398	478	458	438	418	398	378	358
0.0212	350	433	413	393	373	353	333	313
0.0287	302	392	372	352	332	312	292	272
0.0363	260	357	337	317	297	277	257	237
Northwest Growers								
0	146	199	180	162	143	124	105	86
0.0061	109	157	141	124	107	90	73	56
0.0136	64	101	89	77	64	51	37	23
0.0212	24	48	41	34	25	16	6	-5
0.0287	-11	6	2	-3	-8	-14	-21	-28
0.0363	-38	-27	-29	-32	-35	-39	-43	-48
Eastcentral Growers								
0	323	376	256	336	316	296	276	257
0.0061	286	339	319	300	280	260	240	220
0.0136	239	292	273	253	234	215	196	176
0.0212	191	242	225	208	190	173	155	136
0.0287	143	193	179	165	150	135	119	102
0.0363	101	152	141	128	116	103	89	74

Appendix Table A4d. Certainty Equivalents for Processors ($/Ton) for Different Levels of Fixed Price Spreads Over Futures, Fixed Price With AOG.

		Spread for Fixed Price With AOG						
ARAC	No Contract	Spread= 0.0425 c/lb	Spread= 0.0225 c/lb	Spread= 0.0025 c/lb	Spread= -0.0175 c/lb	Spread= -0.0375 c/lb	Spread= -0.0575 c/lb	Spread= -0.0775 c/lb
Northcentral Processors								
0	193	158	174	189	205	221	237	252
0.0536	177	144	161	176	192	207	222	237
0.1206	157	129	146	161	177	191	205	219
0.1876	141	117	134	150	165	179	193	206
0.2546	131	110	127	143	157	171	184	198
0.3216	125	105	122	138	152	165	179	192
Northeast Processors								
0	232	198	213	229	244	260	276	291
0.0536	216	184	200	216	231	247	261	276
0.1206	196	168	185	201	216	231	245	258
0.1876	180	157	174	190	204	218	232	245
0.2546	170	150	167	182	197	210	224	237
0.3216	164	145	162	177	191	205	218	231
Northwest Processors								
0	152	89	118	147	177	206	235	264
0.0536	136	72	104	135	164	191	215	236
0.1206	116	54	89	121	150	173	190	199
0.1876	100	41	77	110	138	160	175	180
0.2546	90	33	70	103	130	152	166	171
0.3216	84	28	65	98	125	147	160	164
Eastcentral Processors								
0	196	140	162	183	204	226	247	268
0.0536	180	124	148	171	192	212	231	250
0.1206	160	105	133	156	176	195	213	229
0.1876	144	92	121	145	165	183	199	216
0.2546	134	84	114	137	157	174	191	207
0.3216	128	78	108	132	151	168	185	202

Appendix Table A5a. Certainty Equivalents for Growers ($/A) for Different Levels of Production Contracted per Acre (lbs/a).

ARAC	No Contract	Fixed Price Without AOG					Fixed Price With AOG				
		500 lbs/a	1000 lbs/a	1500 lbs/a	2000 lbs/a	2500 lbs/a	500 lbs/a	1000 lbs/a	1500 lbs/a	2000 lbs/a	2500 lbs/a
Northcentral Growers											
0	462	512	500	488	473	436	509	494	479	465	453
0.0061	424	474	462	450	424	344	471	456	442	428	419
0.0136	376	427	416	397	322	193	424	410	396	385	380
0.0212	328	328	370	327	205	69	379	364	352	345	343
0.0287	279	339	329	256	123	-12	336	323	312	309	308
0.0363	235	303	293	203	69	-65	300	287	279	277	277
Northeast Growers											
0	482	498	486	474	460	424	495	480	465	450	438
0.0061	445	461	449	437	412	337	458	443	428	415	406
0.0136	398	415	404	386	317	190	412	398	383	372	367
0.0212	350	370	359	321	202	68	367	353	340	333	331
0.0287	302	329	318	252	121	-13	326	312	301	297	297
0.0363	260	292	283	200	68	-65	289	277	268	266	266
Northwest Growers											
0	146	139	113	40	-80	-216	137	124	116	114	114
0.0061	109	97	40	-77	-212	-349	101	90	86	85	85
0.0136	64	29	-85	-221	-359	-496	58	51	49	49	49
0.0212	24	-50	-184	-322	-460	-579	19	16	16	16	16
0.0287	-11	-110	-248	-385	-523	-662	-13	-14	-14	-14	-14
0.0363	-38	-151	-289	-427	-565	-704	-38	-39	-39	-39	-39
Eastcentral Growers											
0	323	314	302	284	232	126	311	296	282	272	269
0.0061	286	277	263	226	128	-5	274	260	247	240	239
0.0136	239	231	202	106	-27	-164	229	215	206	203	202
0.0212	191	186	116	-14	-150	-285	184	173	167	166	166
0.0287	143	142	38	-96	-230	-364	143	135	132	132	132
0.0363	101	104	-16	-149	-283	-416	108	103	102	102	102

Appendix Table A5b. Certainty Equivalents for Processors ($/ton) for Different Levels of Production Contracted per Acre (lbs/a).

ARAC	No Contract	Fixed Price Without AOG					Fixed Price With AOG				
		500 lbs/a	1000 lbs/a	1500 lbs/a	2000 lbs/a	2500 lbs/a	500 lbs/a	1000 lbs/a	1500 lbs/a	2000 lbs/a	2500 lbs/a
Northcentral Growers											
0	193	207	216	225	234	241	209	221	232	243	250
0.0536	177	193	203	212	222	229	195	207	219	230	238
0.1206	157	176	187	197	206	214	179	191	203	214	223
0.1876	141	164	175	185	194	202	167	179	191	202	210
0.2546	131	156	167	177	185	193	158	171	183	193	202
0.3216	125	151	161	171	180	187	153	165	177	187	196
Northeast Growers											
0	232	246	255	265	274	281	248	260	272	283	289
0.0536	216	232	242	252	261	268	234	247	258	269	277
0.1206	196	216	226	236	245	253	218	231	242	253	262
0.1876	180	204	214	224	233	241	206	218	230	241	250
0.2546	170	196	206	216	224	232	198	210	222	232	241
0.3216	164	190	201	210	219	226	192	205	216	226	235
Northwest Growers											
0	152	183	200	208	210	210	188	206	208	200	192
0.0536	136	169	186	196	198	198	173	191	192	184	178
0.1206	116	152	169	181	184	185	156	173	173	166	161
0.1876	100	139	155	168	173	173	143	160	158	152	148
0.2546	90	130	147	159	165	165	134	152	149	143	139
0.3216	84	125	141	153	160	160	128	147	143	137	133
Eastcentral Growers											
0	196	207	219	231	239	241	210	226	239	244	240
0.0536	180	193	206	218	226	229	196	212	226	232	226
0.1206	160	176	190	202	221	216	179	195	209	216	210
0.1876	144	164	177	189	198	204	167	183	196	204	198
0.2546	134	156	169	180	190	196	159	174	188	196	190
0.3216	128	151	163	175	184	191	153	168	182	191	184

Appendix Table B1. Risk Premiums for Growers ($/A) and Processors ($/Ton) for Contract Alternatives by Region and Risk Attitude, Base Case Results Relative to No Contract Alternative.

ARAC	No Contract	Fixed Price No AOG	Fixed Price AOG	Oil Premium/ Discount	ARAC	No Contract	Fixed Price No AOG	Fixed Price AOG	Oil Premium/ Discount
Northcentral Growers					Northcentral Processors				
0	0	38	32	4	0	0	23	27	-3
0.0061	0	38	32	2	0.0536	0	25	30	9
0.0136	0	39	33	0	0.1206	0	30	34	23
0.0212	0	43	37	-2	0.1876	0	34	38	34
0.0287	0	50	44	-4	0.2546	0	36	40	39
0.0363	0	57	51	-5	0.3216	0	36	41	42
Northeast Growers					Northeast Processors				
0	0	4	-2	42	0	0	23	28	-33
0.0061	0	4	-2	36	0.0536	0	26	30	-21
0.0136	0	5	-1	28	0.1206	0	30	34	-7
0.0212	0	9	3	20	0.1876	0	34	38	4
0.0287	0	16	10	14	0.2546	0	36	40	9
0.0363	0	23	17	10	0.3216	0	37	41	11
Northwest Growers					Northwest Processors				
0	0	-33	-22	-18	0	0	48	54	29
0.0061	0	-69	-19	-15	0.0536	0	50	55	40
0.0136	0	-149	-13	-10	0.1206	0	53	57	55
0.0212	0	-208	-7	-7	0.1876	0	55	60	66
0.0287	0	-237	-3	-4	0.2546	0	57	62	71
0.0363	0	-251	-1	-3	0.3216	0	57	63	73
Eastcentral Growers					Eastcentral Processors				
0	0	-21	-27	5	0	0	23	29	-5
0.0061	0	-23	-26	3	0.0536	0	26	32	6
0.0136	0	-37	-24	1	0.1206	0	30	35	21
0.0212	0	-76	-19	0	0.1876	0	33	38	32
0.0287	0	-105	-9	-1	0.2546	0	35	40	37
0.0363	0	-116	2	-2	0.3216	0	36	41	39

Appendix Table B2a. Risk Premiums for Growers ($/A) for Different Levels of Premium/Discount for Oil Premiums Relative to No Contract Alternative.

ARAC	No Contract	1.0%	1.25%	1.5%	1.75%	2.0%	2.25%	2.5%	2.75%	3.0%
Northcentral Growers										
0	0	2	3	4	5	5	6	7	7	8
0.0061	0	1	1	2	2	2	2	2	2	2
0.0136	0	0	0	0	-1	-1	-2	-2	-3	-4
0.0212	0	-1	-2	-2	-3	-3	-4	-5	-6	-7
0.0287	0	-2	-3	-4	-5	-5	-6	-7	-8	-9
0.0363	0	-3	-4	-5	-6	-7	-8	-9	-9	-10
Northeast Growers										
0	0	28	35	42	49	56	63	70	77	85
0.0061	0	24	30	36	41	47	52	58	63	69
0.0136	0	19	23	28	32	36	40	44	48	52
0.0212	0	14	17	20	23	26	29	32	34	37
0.0287	0	9	11	14	16	17	19	21	23	25
0.0363	0	7	8	10	11	12	14	15	17	18
Northwest Growers										
0	0	-12	-15	-18	-21	-24	-27	-29	-32	-35
0.0061	0	-10	-12	-15	-20	-20	-22	-25	-27	-30
0.0136	0	-7	-9	-10	-12	-14	-16	-18	-20	-22
0.0212	0	-4	-6	-7	-8	-9	-11	-12	-13	-15
0.0287	0	-3	-4	-4	-5	-6	-7	-8	-8	-9
0.0363	0	-2	-2	-2	-3	-4	-4	-5	-5	-6
Eastcentral Growers										
0	0	3	4	5	6	7	8	9	10	11
0.0061	0	2	3	3	4	4	5	5	5	6
0.0136	0	1	1	1	2	2	2	1	1	1
0.0212	0	0	0	0	0	0	0	-1	-1	-1
0.0287	0	-1	-1	-1	-1	-1	-2	-2	-2	-3
0.0363	0	-1	-1	-2	-2	-2	-2	-3	-3	-3

Appendix Table B2b. Risk Premiums for Processors ($/Ton) for Different Levels of Premium/Discount for Oil Premiums Relative to No Contract Alternative.

		Oil Premium/Discount Level								
ARAC	No Contract	1.0%	1.25%	1.5%	1.75%	2.0%	2.25%	2.5%	2.75%	3.0%
Northcentral Processors										
0	0	-2	-3	-3	-4	-4	-5	-6	-6	-7
0.0536	0	7	8	9	9	8	7	6	4	2
0.1206	0	19	22	23	24	24	23	21	18	14
0.1876	0	27	31	34	35	35	34	31	27	22
0.2546	0	31	36	39	41	41	40	37	32	25
0.3216	0	32	38	42	43	44	43	40	34	26
Northeast Processors										
0	0	-22	-28	-33	-39	-45	-50	-56	-61	-67
0.0536	0	-13	-17	-21	-27	-32	-38	-44	-51	-58
0.1206	0	-1	-3	-7	-11	-16	-23	-30	-38	-46
0.1876	0	7	6	4	0	-5	-11	-19	-28	-38
0.2546	0	11	11	9	6	1	-5	-13	-23	-35
0.3216	0	12	13	11	8	4	-2	-10	-22	-34
Northwest Processors										
0	0	19	24	29	33	38	43	48	52	57
0.0536	0	29	35	40	46	51	55	59	63	66
0.1206	0	41	48	55	61	66	70	74	76	78
0.1876	0	49	58	66	72	78	82	85	86	86
0.2546	0	52	63	71	78	84	88	90	90	89
0.3216	0	53	65	73	80	87	91	93	92	90
Eastcentral Processors										
0	0	-4	-5	-5	-6	-7	-8	-9	-10	-11
0.0536	0	6	6	6	6	5	4	3	1	-2
0.1206	0	18	20	21	22	21	19	17	14	10
0.1876	0	26	30	32	33	33	31	28	23	18
0.2546	0	30	34	37	38	38	37	34	28	21
0.3216	0	31	36	39	41	41	40	36	30	22

Appendix Table B3a. Risk Premiums for Growers ($/A) for Different Levels of Discounts for Fixed Price With AOG Provisions Relative to No Contract Alternative.

		Discount in Fixed Price for AOG Provisions						
ARAC	No Contract	D=0 c/lb	D=0.2 c/lb	D=0.4 c/lb	D=0.6 c/lb	D=0.8 c/lb	D=1.0 c/lb	D=1.2 c/lb
Northcentral Growers								
0	0	38	36	34	32	30	28	26
0.0061	0	38	36	34	32	30	28	26
0.0136	0	39	37	35	33	31	29	27
0.0212	0	43	41	39	37	35	33	31
0.0287	0	50	48	46	44	42	40	38
0.0363	0	57	55	53	51	49	47	45
Northeast Growers								
0	0	4	2	0	-2	-4	-6	-8
0.0061	0	4	2	0	-2	-4	-6	-8
0.0136	0	5	3	1	-1	-3	-5	-7
0.0212	0	9	7	5	3	1	-1	-3
0.0287	0	16	14	12	10	8	6	4
0.0363	0	23	21	19	17	15	13	11
Northwest Growers								
0	0	-16	-18	-20	-22	-24	-26	-28
0.0061	0	-14	-16	-17	-19	-21	-22	-24
0.0136	0	-9	-11	-12	-13	-15	-16	-17
0.0212	0	-5	-5	-6	-7	-8	-9	-10
0.0287	0	-1	-2	-2	-3	-4	-4	-5
0.0363	0	-1	0	0	-1	-1	-1	-2
Eastcentral Growers								
0	0	-21	-23	-25	-27	-29	-31	-33
0.0061	0	-20	-22	-24	-26	-28	-30	-32
0.0136	0	-19	-20	-22	-24	-26	-28	-30
0.0212	0	-13	-15	-17	-19	-20	-22	-24
0.0287	0	-4	-5	-7	-9	-10	-12	-13
0.0363	0	6	5	3	2	1	-1	-2

Appendix Table B3b. Risk Premiums for Processors ($/Ton) for Different Levels of Discount for Fixed Price with AOG Provisions Relative to No Contract Alternative.

ARAC	No Contract	D=0 c/lb	D=0.2 c/lb	D=0.4 c/lb	D=0.6 c/lb	D=0.8 c/lb	D=1.0 c/lb	D=1.2 c/lb
Northcentral Processors								
0	0	23	24	26	27	29	30	32
0.0536	0	25	27	28	30	31	33	34
0.1206	0	30	31	32	34	35	37	38
0.1876	0	34	35	36	38	39	40	42
0.2546	0	36	37	38	40	41	42	44
0.3216	0	36	38	39	41	42	43	45
Northeast Processors								
0	0	23	24	26	28	29	31	32
0.0536	0	26	27	29	30	32	33	35
0.1206	0	30	31	33	34	36	37	38
0.1876	0	34	35	37	38	39	41	42
0.2546	0	36	37	39	40	41	43	44
0.3216	0	37	38	39	41	42	43	45
Northwest Processors								
0	0	45	48	51	54	57	60	63
0.0536	0	47	50	53	55	58	60	63
0.1206	0	51	53	55	57	59	61	63
0.1876	0	54	56	58	60	62	64	66
0.2546	0	56	58	60	62	64	66	68
0.3216	0	57	59	61	63	65	67	69
Eastcentral Processors								
0	0	23	24	26	28	29	31	32
0.0536	0	26	27	29	30	32	33	35
0.1206	0	30	31	33	34	36	37	38
0.1876	0	34	35	37	38	39	41	42
0.2546	0	36	37	39	40	41	43	44
0.3216	0	37	38	39	41	42	43	45

Appendix Table B4a. Risk Premiums for Growers ($/A) for Different Levels of Fixed Price Spreads over Futures, Fixed Price Without AOG Relative to No Contract Alternative.

		Spread for Fixed Price Without AOG						
ARAC	No Contract	Spread= 0.0425 c/lb	Spread= 0.0225 c/lb	Spread= 0.0025 c/lb	Spread= -0.0175 c/lb	Spread= -0.0375 c/lb	Spread= -0.0575 c/lb	Spread= -0.0775 c/lb
Northcentral Growers								
0	0	118	98	78	58	38	18	-2
0.0061	0	118	98	78	58	38	18	-2
0.0136	0	119	99	79	59	39	19	-1
0.0212	0	123	103	83	63	43	23	3
0.0287	0	130	110	90	70	50	30	10
0.0363	0	137	117	97	77	57	37	17
Northeast Growers								
0	0	84	64	44	24	4	-16	-36
0.0061	0	84	64	44	24	4	-16	-36
0.0136	0	85	65	45	25	5	-15	-35
0.0212	0	89	69	49	29	9	-11	-31
0.0287	0	96	76	56	36	16	-4	-24
0.0363	0	103	83	63	43	23	3	-17
Northwest Growers								
0	0	42	23	5	-14	-33	-52	-71
0.0061	0	-12	-26	-40	-55	-69	-84	-99
0.0136	0	-127	-132	-138	-143	-149	-156	-163
0.0212	0	-199	-201	-203	-206	-208	-210	-213
0.0287	0	-233	-234	-235	-236	-237	-238	-239
0.0363	0	-249	-249	-250	-250	-251	-252	-252
Eastcentral Growers								
0	0	59	39	19	-1	-21	-41	-61
0.0061	0	56	37	17	-3	-23	-42	-62
0.0136	0	32	15	-2	-19	-37	-55	-73
0.0212	0	-27	-39	-51	-63	-76	-88	-102
0.0287	0	-65	-75	-85	-95	-105	-116	-126
0.0363	0	-79	-88	-97	-107	-116	-126	-136

Appendix Table B4b. Risk Premiums for Processors ($/Ton) for Different Levels of Fixed Price Spreads over Futures, Fixed Price Without AOG Relative to No Contract Alternative.

		Spread for Fixed Price Without AOG						
ARAC	No Contract	Spread= 0.0425 c/lb	Spread= 0.0225 c/lb	Spread= 0.0025 c/lb	Spread= -0.0175 c/lb	Spread= -0.0375 c/lb	Spread= -0.0575 c/lb	Spread= -0.0775 c/lb
Northcentral Processors								
0	0	-40	-25	-9	7	23	38	54
0.0536	0	-38	-22	-6	10	25	40	55
0.1206	0	-34	-17	-1	15	30	44	58
0.1876	0	-30	-12	4	19	34	47	61
0.2546	0	-27	-9	7	22	36	49	62
0.3216	0	-26	-8	8	23	36	50	63
Northeast Processors								
0	0	-39	-24	-8	7	23	39	54
0.0536	0	-37	-21	-5	10	26	41	55
0.1206	0	-33	-16	0	15	30	44	58
0.1876	0	-29	-11	5	20	34	48	61
0.2546	0	-26	-9	7	22	36	49	63
0.3216	0	-25	-7	9	23	37	50	63
Northwest Processors								
0	0	-79	-47	-16	16	48	80	111
0.0536	0	-82	-46	-12	20	50	77	102
0.1206	0	-82	-43	-6	26	53	76	97
0.1876	0	-80	-40	-2	31	55	77	98
0.2546	0	-79	-39	0	33	57	79	99
0.3216	0	-78	-38	1	34	57	80	100
Eastcentral Processors								
0	0	-63	-41	-20	2	23	45	66
0.0536	0	-65	-39	-16	5	26	45	64
0.1206	0	-67	-36	-11	10	30	47	64
0.1876	0	-66	-32	-6	15	33	50	67
0.2546	0	-64	-29	-3	17	35	52	68
0.3216	0	-64	-28	-2	18	36	53	69

Appendix Table B4c. Risk Premiums for Growers ($/A) for Different Levels of Fixed Price Spreads over Futures, Fixed Price With AOG Relative to No Contract Alternative.

		Spread for Fixed Price With AOG						
ARAC	No Contract	Spread= 0.0425 c/lb	Spread= 0.0225 c/lb	Spread= 0.0025 c/lb	Spread= -0.0175 c/lb	Spread= -0.0375 c/lb	Spread= -0.0575 c/lb	Spread= -0.0775 c/lb
Northcentral Growers								
0	0	112	92	72	52	32	12	-8
0.0061	0	112	92	72	52	32	12	-8
0.0136	0	113	93	73	53	33	13	-7
0.0212	0	117	97	77	57	37	17	-3
0.0287	0	124	104	84	64	44	24	4
0.0363	0	131	111	91	71	51	31	11
Northeast Growers								
0	0	78	58	38	18	-2	-22	-42
0.0061	0	78	58	38	18	-2	-22	-42
0.0136	0	79	59	39	19	-1	-21	-41
0.0212	0	83	63	43	23	3	-17	-37
0.0287	0	90	70	50	30	10	-10	-30
0.0363	0	97	77	57	37	17	-3	-23
Northwest Growers								
0	0	53	34	16	-3	-22	-41	-59
0.0061	0	48	32	15	-2	-19	-36	-53
0.0136	0	37	25	13	0	-13	-27	-41
0.0212	0	25	18	10	2	-7	-17	-28
0.0287	0	16	13	8	3	-3	-10	-17
0.0363	0	12	9	6	3	-1	-5	-10
Eastcentral Growers								
0	0	53	33	13	-7	-27	-47	-67
0.0061	0	53	33	14	-6	-26	-46	-66
0.0136	0	52	33	14	-5	-24	-44	-63
0.0212	0	50	34	16	-1	-19	-37	-55
0.0287	0	50	36	22	7	-9	-24	-41
0.0363	0	52	40	28	15	2	-12	-26

Appendix Table B4d. Risk Premiums for Processors ($/Ton) for Different Levels of Fixed Price Spreads over Futures, Fixed Price With AOG Relative to No Contract Alternative.

		Spread for Fixed Price With AOG						
ARAC	No Contract	Spread= 0.0425 c/lb	Spread= 0.0225 c/lb	Spread= 0.0025 c/lb	Spread= -0.0175 c/lb	Spread= -0.0375 c/lb	Spread= -0.0575 c/lb	Spread= -0.0775 c/lb
Northcentral Processors								
0	0	-36	-20	-4	12	27	43	59
0.0536	0	-33	-17	-1	15	30	45	60
0.1206	0	-29	-12	4	19	34	48	62
0.1876	0	-24	-7	9	24	38	51	65
0.2546	0	-21	-4	11	26	40	53	66
0.3216	0	-20	-3	13	27	41	54	67
Northeast Processors								
0	0	-35	-19	-4	12	28	43	59
0.0536	0	-32	-16	0	15	30	45	60
0.1206	0	-28	-11	5	20	34	48	62
0.1876	0	-23	-6	9	24	38	52	65
0.2546	0	-21	-4	12	26	40	53	66
0.3216	0	-19	-2	13	27	41	54	67
Northwest Processors								
0	0	-63	-34	-5	24	54	83	112
0.0536	0	-64	-32	-1	28	55	79	100
0.1206	0	-62	-27	5	34	57	74	83
0.1876	0	-59	-23	10	38	60	75	80
0.2546	0	-57	-20	13	40	62	76	80
0.3216	0	-55	-19	15	41	63	77	81
Eastcentral Processors								
0	0	-56	-35	-13	8	29	51	72
0.0536	0	-56	-32	-10	11	32	51	69
0.1206	0	-55	-27	-4	16	35	53	69
0.1876	0	-53	-23	1	21	38	55	71
0.2546	0	-51	-20	3	23	40	57	73
0.3216	0	-49	-19	5	24	41	58	74

Appendix Table B5a. Risk Premiums for Growers ($/A) for Different Levels of Production Contracted per Acre (lbs/a) Relative to No Contract Alternative.

ARAC	No Contract	Fixed Price Without AOG					Fixed Price With AOG				
		500 lbs/a	1000 lbs/a	1500 lbs/a	2000 lbs/a	2500 lbs/a	500 lbs/a	1000 lbs/a	1500 lbs/a	2000 lbs/a	2500 lbs/a
Northcentral Growers											
0	0	50	38	26	11	-26	47	32	17	3	-9
0.0061	0	50	38	26	0	-80	47	32	18	4	-5
0.0136	0	51	39	20	-54	-184	48	33	19	8	4
0.0212	0	54	43	0	-123	-259	51	37	25	17	15
0.0287	0	60	50	-23	-156	-291	57	44	33	30	30
0.0363	0	67	57	-32	-166	-301	64	51	43	42	42
Northeast Growers											
0	0	16	4	-8	-22	-57	13	-2	-17	-31	-43
0.0061	0	16	4	-8	-32	-108	13	-2	-16	-30	-39
0.0136	0	17	5	-12	-82	-208	14	-1	-15	-26	-31
0.0212	0	20	9	-30	-148	-282	17	3	-10	-18	-20
0.0287	0	26	16	-50	-181	-315	23	10	-1	-5	-6
0.0363	0	33	23	-60	-192	-325	30	17	9	7	7
Northwest Growers											
0	0	-7	-33	-105	-226	-362	-9	-22	-30	-31	-32
0.0061	0	-12	-69	-186	-321	-459	-8	-19	-23	-24	-24
0.0136	0	-35	-149	-286	-423	-560	-7	-13	-15	-15	-15
0.0212	0	-73	-208	-345	-483	-621	-4	-7	-8	-8	-8
0.0287	0	-99	-237	-374	-512	-651	-2	-3	-3	-3	-3
0.0363	0	-113	-251	-389	-527	-665	0	-1	-1	-1	-1
Eastcentral Growers											
0	0	-9	-21	-39	-91	-197	-12	-27	-41	-51	-55
0.0061	0	-9	-23	-60	-158	-291	-12	-26	-39	-45	-47
0.0136	0	-8	-37	-133	-266	-403	-11	-24	-33	-36	-37
0.0212	0	-6	-76	-206	-341	-477	-7	-19	-24	-25	-25
0.0287	0	-1	-105	-239	-373	-508	0	-9	-11	-11	-11
0.0363	0	4	-116	-250	-383	-517	7	2	1	1	1

Appendix Table B5b. Risk Premiums for Processors ($/ton) for Different Levels of Production Contracted per Acre (lbs/a) Relative to No Contract Alternative.

		Fixed Price Without AOG					Fixed Price With AOG				
ARAC	No Contract	500 lbs/a	1000 lbs/a	1500 lbs/a	2000 lbs/a	2500 lbs/a	500 lbs/a	1000 lbs/a	1500 lbs/a	2000 lbs/a	2500 lbs/a
Northcentral Growers											
0	0	13	23	32	41	48	16	27	39	50	56
0.0536	0	15	25	35	44	52	18	30	42	53	60
0.1206	0	19	30	39	49	57	21	34	46	57	65
0.1876	0	23	34	43	52	60	25	38	49	60	69
0.2546	0	25	36	45	54	61	27	40	51	62	71
0.3216	0	26	36	46	55	62	28	41	52	62	71
Northeast Growers											
0	0	14	23	32	41	48	16	28	39	50	57
0.0536	0	16	26	35	44	52	18	30	42	63	61
0.1206	0	19	30	40	49	57	22	34	46	57	66
0.1876	0	23	34	44	52	60	25	38	50	60	69
0.2546	0	25	36	46	54	62	27	40	51	62	71
0.3216	0	26	37	46	55	62	28	41	52	63	72
Northwest Growers											
0	0	31	48	56	58	58	36	54	55	48	40
0.0536	0	33	50	60	62	62	37	55	56	48	42
0.1206	0	35	53	65	68	68	39	57	57	50	45
0.1876	0	39	55	68	73	73	42	60	58	52	47
0.2546	0	40	57	69	75	75	44	62	59	53	49
0.3216	0	41	57	70	76	76	45	63	59	53	50
Eastcentral Growers											
0	0	10	23	35	42	45	14	29	43	48	43
0.0536	0	13	26	38	46	49	16	32	46	52	46
0.1206	0	16	30	42	51	55	19	35	49	56	50
0.1876	0	20	33	45	54	60	23	38	52	60	54
0.2546	0	22	35	46	56	62	25	40	54	62	56
0.3216	0	23	36	47	56	63	25	41	54	64	57