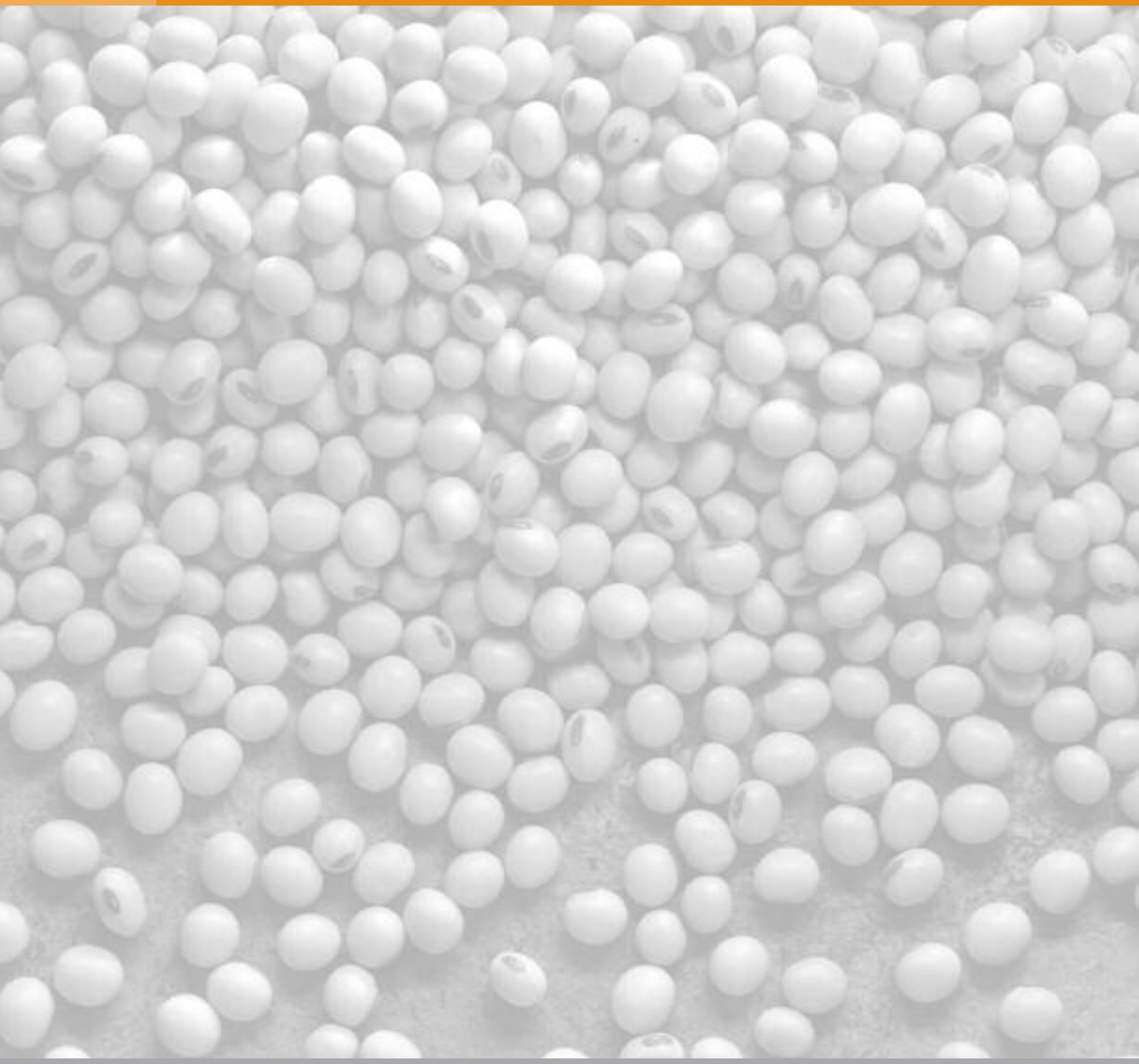
CBOT® Soybean Crush

Reference Guide

Chicago Board of Trade



Chicago Board of Trade

Introduction

In the soybean industry, the term 'crush' refers both to a physical process as well as a value calculation. The physical crush is the process of converting soybeans into the by-products of soybean meal and soybean oil. The crush spread is a dollar value quoted as the difference between the combined sales values of the products and the cost of the raw soybeans. This value is traded in the cash or futures market based on expectations of future price movement of soybeans versus the components. The relationship between prices in the cash market is commonly referred to as the Gross Processing Margin (GPM). The crush value traded in the futures market (often referred to as the Board Crush) is an intercommodity spread transaction in which soybean futures are bought (or sold) and soybean meal and oil futures are sold (or bought). The crush spread is often used by processors to hedge the purchase price of soybeans and the sales prices of the soybean meal and oil. It also offers many opportunities for speculators, as the spread relationship between the raw material and its products varies over time.

The November/December crush (buying/selling November soybeans and selling/buying December soybean meal and oil futures) is used to hedge new-crop gross processing margins because the November/December prices often reflect the market's perception of conditions in the new soybean crop year. Many seasonal, cyclical, and fundamental factors affect the soybean crush spread; for example, soybean prices are typically lowest at harvest and trend higher during the year as storage, interest, and insurance costs accumulate over time. Changes in demand for high protein feed over the course of the year and depletion of South American soybean stocks during the late fall and winter months are additional factors than can affect the crush spread; others include crop size and yields, world demand, carryover stocks, Third World purchases of edible oils, Malaysian palm oil production, European meal demand, government programs, and weather. Fundamental and technical analysis can be used to help forecast the potential for repetitive market behavior, although there are many unpredictable elements (such as weather) that affect the crush spread. The historical data provided in this publication highlight some of the trends and market conditions that have prevailed in the crush spread over the past decade.

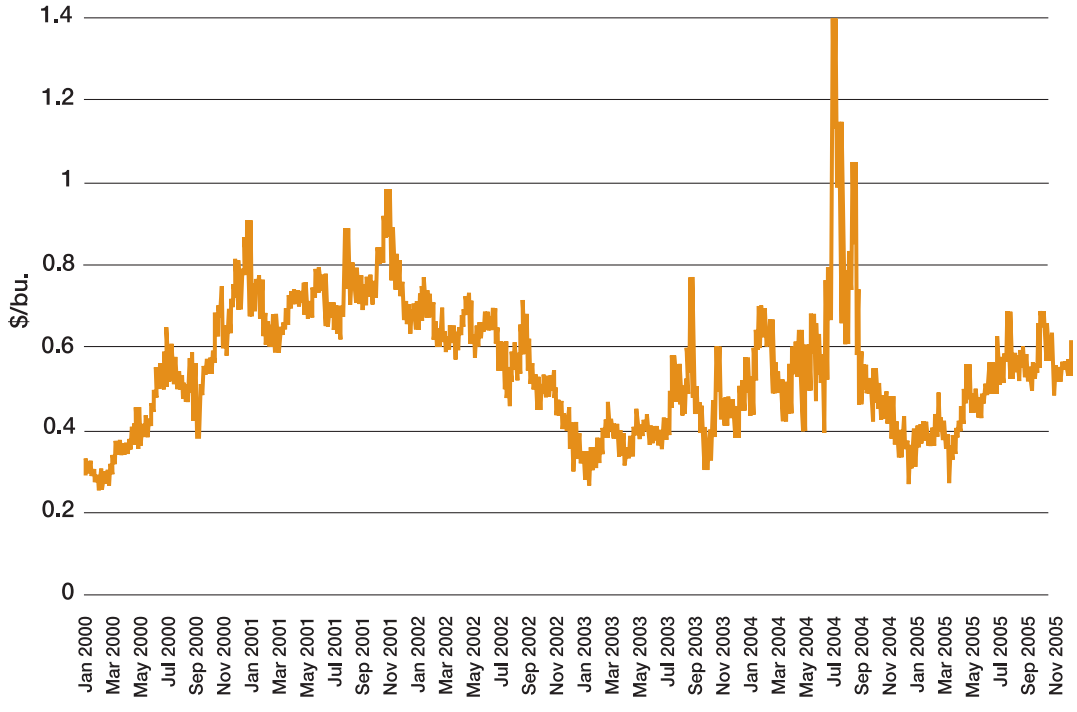
WHY TRADE SPREADS?

Those who trade spreads, which are defined as the buying of one or more futures contract(s) and selling of a different but related futures contract(s), typically do so for two important reasons – lower risk and attractive margin rates.

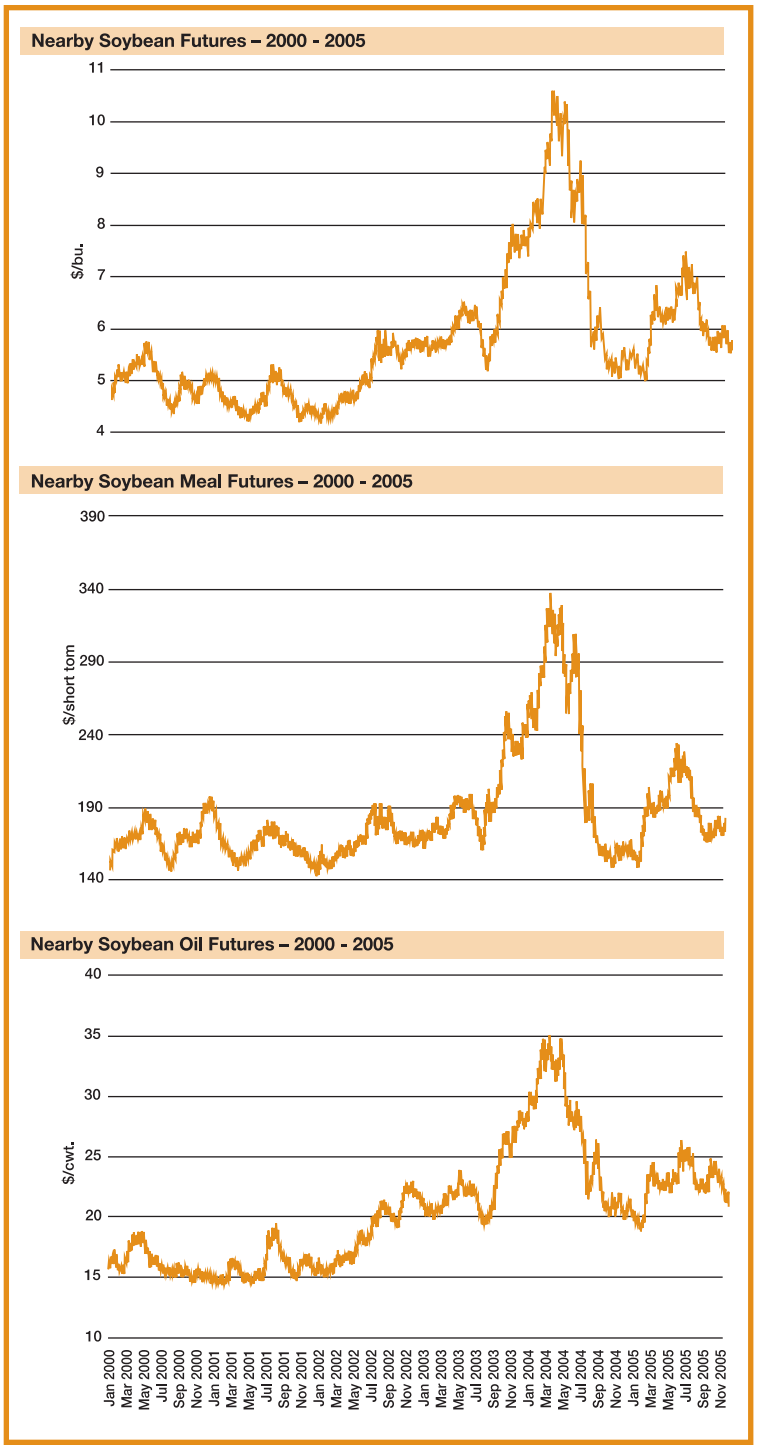
- Lower Risk – Spreads usually offer lower risk[1] than outright futures positions, since the prices of related commodities exhibit a strong tendency to move up or down together. This relationship may offer protection against losses that can arise from unexpected or extreme price volatility.

- Attractive Margin Rates – Since spreads are usually less risky than outright positions, spread margin rates are generally lower than those of the combined outright positions. Spread margin rates apply even if a trader "legs into" (trade entry for the spread components, or "legs," are not simultaneous) the spread over time.

The Soybean Crush – 2000 - 2005



[1] An intercommodity spread may not always be less risky than an outright position. For example, if a trader is long November soybeans and short December meal and oil, and the meal and oil prices increase while soybean prices decrease over the life of the position, the trader might lose money on all sides (legs) of the spread.



THE CRUSH SPREAD

The crush spread is quoted as the difference between the combined sales value of soybean meal and oil and the price of soybeans. Soybeans are traded in cents per bushel, soybean meal in dollars per short ton, and soybean oil in cents per pound – because of these differences in units, conversion of meal and oil prices to cents per bushel is necessary to determine the relationship of the three commodities and potential trading opportunities.

When a bushel of soybeans weighing 60 pounds is crushed, the typical result is 11 pounds of soybean oil, 44 pounds of 48% protein soybean meal, 4 pounds of hulls, and 1 pound of waste. If the hulls are retained, the result is 48 pounds of 44% protein soybean meal. In October 1992, the Chicago Board of Trade revised the soybean meal futures contract specifications from a 44% protein standard to 48% protein soybean meal.

To Convert Prices into Cents Per Bushel

Soybeans:	No conversion required
Soybean Meal:	44 lbs (48% protein meal per bushel) / 2,000 lbs (per ton) = 0.022 x price of meal
Soybean Oil:	11 lbs (oil per bushel) x price of oil

Once these commodities have been converted to a price per bushel, individual crushing facilities can compare these numbers to data on their own production efficiency to determine the profitability of processing – this calculation is referred to as the Gross Processing Margin (GPM) or "Crush."

To Calculate the Crush or GPM

[(Price of Soybean Meal ($/short ton) x .022) + Price of Soybean Oil (¢/lb) x 11] – Price of Soybeans ($/bu.)

Typically, crushing activity is expanded or reduced to maintain sufficient profitability; the GPM is used to gauge the relative costs of production. When the margin exceeds processing costs, crushers will most likely process more soybeans; when the margin falls below processing costs, processors may scale back their operations.

An Example of Calculating the Crush

To illustrate the calculation of the crush, assume the following prices and values for November/December futures contracts:

	November soybean futures:	$7.12 per bushel (5,000 bushels)
	December soybean meal futures:	$221.30 per short ton (100 short tons)
	December soybean oil futures:	$0.2536 per pound (60,000 pounds)
Step 1 –	Convert Prices into dollars per bushel:	
	Soybean meal:	$221.30 x .022 = $4.87 per bushel
	Soybean oil:	$0.2536 x 11 = $2.79 per bushel
Step 2 –	Subtract the cost of soybeans from the combined sales value of the products:	
	Soybean meal + oil ($4.87 + $2.79):	$7.66
	– Soybeans	– $7.12
	Crush	**$0.54**

CRUSH SPREAD TERMINOLOGY

The difference between the price of soybeans and the sales value of soybean meal and oil can vary over time. Expectations about the behavior of the spread offer different trading strategies, depending upon whether one expects the difference to "widen" or "narrow."

- A Narrowing Crush Spread occurs when the price of soybeans rises relative to the sales price of soybean oil and meal. When this occurs, the spread declines. A trader expecting a narrowing crush spread "puts on a crush spread" – buying soybean futures and selling soybean meal and oil futures.

An Example of Trading a Narrowing Crush Spread

Put on Crush Spread	*Lift Crush Spread*
September 28	October 10
Buy	*Sell*
November Soybean Futures	November Soybean Futures
1 contract at $7.12 per bushel	1 contract at $7.01 per bushel
Sell	*Buy*
December Soybean Meal	December Soybean Meal
1 contract at $221.30 per short ton	1 contract at $219.10 per short ton
December Soybean Oil	December Soybean Oil
1 contract at $0.2536 per pound	1 contract at $0.2140 per pound

Results

Soybeans:	$0.11 Loss ($7.12 – $7.01)	x 5,000 (bu)	=	($550.00)
Soybean meal:	$2.20 Gain ($221.30 – $219.10)	x 100 (s. ton)	=	$220.00
Soybean oil:	$0.0396 Gain ($0.2536 – $0.2140)	x 60,000 (lbs)	=	$2,376.00
Net gain:				**$2,046.00**

- A Widening Crush Spread occurs when the sales price of soybean oil and meal rise relative to the price of soybeans. When this occurs, the spread increases. A trader expecting a widening crush spread "puts on a reverse crush spread" – selling soybean futures and buying soybean meal and oil futures.

An Example of Trading a Widening or "Reverse" Crush Spread

Put on Reverse Crush Spread
July 10

Sell
November Soybean Futures
1 contract at $5.30 per bushel

Buy
December Soybean Meal
1 contract at $161.20 per short ton

December Soybean Oil
1 contract at $0.1697 per pound

Lift Reverse Crush Spread
October 1

Buy
November Soybean Futures
1 contract at $5.44 per bushel

Sell
December Soybean Meal
1 contract at $174.70 per short ton

December Soybean Oil
1 contract at $0.1718 per pound

Results

Soybeans:	$0.14 Loss ($5.30 – $5.44)	x 5,000 (bu)	=	($700.00)
Soybean meal:	$13.50 Gain ($174.70 – $161.20)	x 100 (s. ton)	=	$1,350.00
Soybean oil:	$0.0021 Gain ($0.1718 – $0.1697)	x 60,000 (lbs)	=	$126.00
Net gain:				**$776.00**

TRADING THE CRUSH SPREAD OR "CRUSH PACKAGE"

Although the previous examples have used a one-to-one ratio of futures contracts (one soybean futures contract to every soybean meal and soybean oil contract), the crush (and reverse crush) can also be traded as a "package," in which a bid or offer is made for a particular crush value rather than making individual trades in each of the spread legs. The crush "package" is based on a ratio of contracts that more accurately approximates the equivalent yields of soybean meal and oil generated from one bushel of soybeans. When trading a crush package, the trader buys or sells the equivalent of 50,000 bushels of each commodity (after using the unit conversion factors previously discussed), or 10 soybean contracts, 11 soybean meal contracts, and 9 soybean oil contracts. This is the smallest ratio of contracts that accurately represents the equivalent yields of the three commodities.

The Crush "Package"

Soybeans

50,000 bushels
= **10 soybean contracts** (at 5,000 bushels per contract)

Soybean Meal

50,000 bushels of soybeans x 44 lbs / 48% Meal = 2,200,000 lbs of meal
2,200,000 lbs / 2,000 lbs/short ton = 1,100 short tons of meal
= **11 soybean meal contracts** (at 100 short tons per contract)

Soybean Oil

50,000 bushels of soybeans x 11 lbs of oil = 550,000 lbs of oil
550,000 lbs / 60,000 lbs per futures contract
= **9 soybean oil contracts (approximate)**[2]

[2] Note that trading the Board Crush in a 50,000 bushel package results in under-hedging the oil component of the crush by 10,000 lbs.

A NEW TRADING OPPORTUNITY: OPTIONS ON THE CRUSH SPREAD

In consultation with a cross-section of industry participants, the CBOT has developed a new product to enhance trading opportunities related to the soybean crush. Options on the soybean crush spread allow market participants to efficiently establish a crush spread position using a single contract. In addition, buyers of crush spread options do not face the margin requirements necessary in trading an outright futures spread.

Contract Features

- Contract size: 50,000 bushels
- Price basis: Dollars and cents per bushel
- Strike price increment: 2 cents per bushel (e.g. 44, 46, 48, 50, 52)
- Tick size: One-eighth (1/8) of one cent per bushel, $0.00125/bushel or $62.50 per contract.
- Daily price limit: $0.50 per bushel or $25,000 per contract
- Contract Months: Eight standard delivery months with the following Soybean Board Crush Spread combinations (note: October and December Board Crush options are based on November Soybeans since no soybean futures contracts are listed for those months):

Soybeans	Jan.	Mar.	May	July	Aug.	Sept.	Nov.	Nov.
Meal/Oil	Jan.	Mar.	May	July	Aug.	Sept.	Oct.	Dec.
Crush Options	**Jan.**	**Mar.**	**May**	**July**	**Aug.**	**Sept.**	**Oct.**	**Dec.**

Soybean Board Crush Spread Option contracts offer the buyer of the option the right, but not the obligation, to "buy" or "sell" the crush at a specific strike price. The strike price for a crush option contract can be thought of as the value of the crush, or the GPM.

- **A buyer of a Soybean Board Crush Spread Call Option**, or a "buyer" of the crush, has the right to go long eleven (11) soybean meal futures contracts, long nine (9) soybean oil futures contracts, and short ten (10) soybean futures contracts.

- **A buyer of a Soybean Board Crush Spread Put Option**, or a "seller" of the crush, has the right to go short eleven (11) soybean meal contracts, short nine (9) soybean oil contracts, and long ten (10) soybean futures contracts.

Contract Expiration

Only buyers of calls and puts have the right to exercise their option contract into a futures position on any day during the life of the option. Upon exercise, the entry price at which these positions are recorded is determined by the crush spread calculation and the strike price of the option purchased. The strike price, or crush value, is subtracted from the sum of the prices of soybean meal and oil (converted into dollars per bushel); this calculation yields a "synthetic" price at which the buyer of the option will be exercised into soybean futures contracts. Since the prices of soybean meal and oil must be converted into dollars to perform the crush value calculation, these prices are rounded so that, in conjunction with the crush option strike price, they always yield a synthetic soybean futures contract priced in dollars, cents, and quarters-of-a-cent per bushel.

Contract Advantages

The efficiencies afforded by the crush spread option contract allow added flexibility in trading the soybean crush. Specifically, crush spread options can be used to:

- Set a "floor" or minimum price for the soybean crush, which allows crushers to lock in a predetermined Gross Processing Margin in advance of cash market purchases and sales. To establish a floor price, a crusher would purchase a Soybean Board Crush put option.

- Set a "ceiling" or maximum price for the soybean crush for those with increasing-price risk exposure or traders seeking to profit from a favorable reverse crush opportunity. To establish a ceiling price, a crush call option is purchased.

- Establish a price range for the crush, but allow for variation within that range, by buying a put and simultaneously selling a call. This allows traders and processors to estimate crushing margins within a known range, but also participate in favorable price moves.

- Enhance trading revenue by writing (selling) either call or put options.

An Example of the Soybean Board Crush Spread Option Exercise Process

To illustrate the positions a buyer of a December $0.74 Board Crush Spread Call Option contract would receive upon exercise, assume the following prices and values for November/December futures contracts:

November soybean futures:	$7.12 per bushel (5,000 bushels)
December soybean meal futures:	$221.30 per ton (100 tons)
December soybean oil futures:	$0.2536 per pound (60,000 pounds)

Step 1 – Round prices:

Soybean meal:	round to nearest $2.50 per ton
	$221.30 per ton = $222.50
Soybean oil:	round to nearest $0.0025 per pound
	$0.2536 per pound = $0.2525

Step 2 – Convert Prices into dollars per bushel:

Soybean meal:	$222.50 x .022 = $4.895 per bushel
Soybean oil:	$0.2525 x 11 = $2.7775 per bushel

Step 3 – Calculate assigned soybean futures price:

Soybean meal rounded price	= $4.895/bu.
+ Soybean oil rounded price	= +$2.7775/bu.
– Board Crush Option strike price	= –$0.74/bu.
Assigned soybean futures price	**$6.9325/bu.**

Therefore, the buyer of the call option is assigned:

Long 11 soybean meal futures contracts at $222.50/ton

Long 9 soybean oil futures contracts at $0.2525 per pound

Short 10 soybean futures contracts at $6.9325 per bushel

An Example of Buying a Soybean Board Crush Spread Put Option

Assume that on September 3, a crusher decides to lock in upcoming purchases of soybeans and sales of soybean meal and oil by buying a $0.54 December soybean crush put option for $0.0250 (premium paid at 50% volatility).

On September 3:

Account debited for the purchase of the December Board Crush 54 put option in amount of $0.0250/bu. or ($0.0250 x 50,000=) $1,250.00

Scenario #1 – Offset Prior to Expiration

On October 12:

The crusher decides to lift the hedge to coincide with cash market purchases and sales. With the crush currently trading at $0.52, the December 54 put option is in-the-money. The crusher sells the put for $0.0375/bu. or ($0.0375 x 50,000=) $1,875.00

The net return for this hedge would be the $1,875.00 return minus the cost to purchase the option, $1,250.00, or $625 ($0.0125/bu.)

Scenario #2 – Exercise at Expiration, Hold Resulting Futures, Offset

On October 21:

Trading expires in the December Board Crush option with the December 54 put option in-the-money. The put option is automatically exercised into soybean, soybean meal, and soybean oil futures positions.

Settlement values for the underlying futures contracts are:

December soybean meal:	$169.90/ton
December soybean oil:	$0.2119/lb.
November soybeans:	$5.57/bu.

The crusher is assigned positions with rounded values for soybean meal and oil futures:

Short 11 December soybean meal contracts at $170.00/ton

Short 9 December soybean oil contracts at $0.2125/lb.

The crusher also receives a soybean futures position; the assigned price for this leg is determined by using the rounded prices for soybean meal and oil and the crush option strike price:

($170.00/ton x .022) + ($0.2125/lb. x 11) - $0.54/bu. = $5.5375

Therefore, the position assigned is: Long 10 November soybean contracts at $5.5375

Scenario #2 - Continued on page 12

Scenario #2 – Continued

On October 24:

The crusher decides to liquidate the assigned positions in Soybean, Soybean Meal and Soybean Oil futures the next week at the following prices:

December soybean meal:	$169.80/ton
December soybean oil:	$0.2115/lb.
November soybeans:	$5.56/bu.

Offsetting positions at these prices, the hedger earned:

Soybean meal: Short at $170.00/short ton, offset at $169.80/short ton = $0.20/short ton profit or $20/contract profit ($0.20 x 100 short tons)

Soybean oil: Short at $0.2125/lb, offset at $0.2115/lb. = $0.0010/lb. profit or $60/contract profit ($0.001 x 60,000 lbs.)

Soybeans: Long at $5.5375/bu., offset at $5.56/bu. = $0.0225/bu. profit or $112.50/contract profit ($0.0225 x 5,000 bu.)

The total profits from these positions are calculated as follows:

Meal:	$20/contract x 11 contracts	= $220
+ Oil:	$60/contract x 9 contracts	= $540
+ Soybeans:	$112.50/contract x 10 contracts	= $1,125
Total Profit		**$1,885.00**

The net return for this hedge would be the $1,885.00 return minus the cost to purchase the option, $1,250.00, or $635 ($0.0127/bu.)

NOTES

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