CME Group

AGRICULTURAL PRODUCTS

Soybean Crush Reference Guide

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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 and futures markets 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 is an inter-commodity spread transaction in which Soybean futures are bought (or sold) and Soybean Meal and Soybean Oil futures are sold (or bought). When using futures prices, the crush spread is referred to as the Board Crush. The Board Crush spread is often used by processors to hedge the margin between the purchase price of soybeans and the combined selling price of the soybean meal and oil. It also offers opportunities for speculators, as the spread relationship between soybeans and the soybean by-products varies over time.

The November-December Board Crush (buying November Soybean futures and selling December Soybean Meal futures and December Soybean Oil futures) is used to hedge new-crop gross processing margins. The November-December Reverse Board Crush uses the opposite positions (selling November Soybean futures and buying the December Soybean Meal and Soybean Oil futures).

The November/December futures 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.

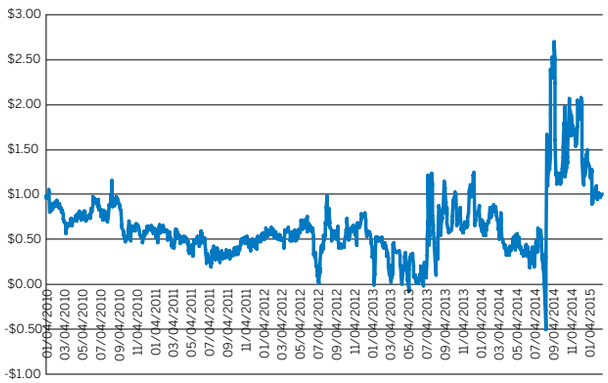
WHY TRADE SPREADS?

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

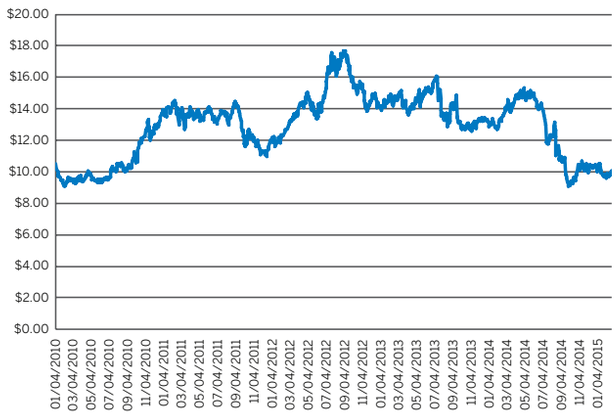
Lower Risk: Spreads usually offer lower risk[1] than outright futures positions, since the prices of related commodities exhibit a strong tendency to move up or down together. This relationship may offer protection against losses that can arise from unexpected or extreme price volatility.

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.

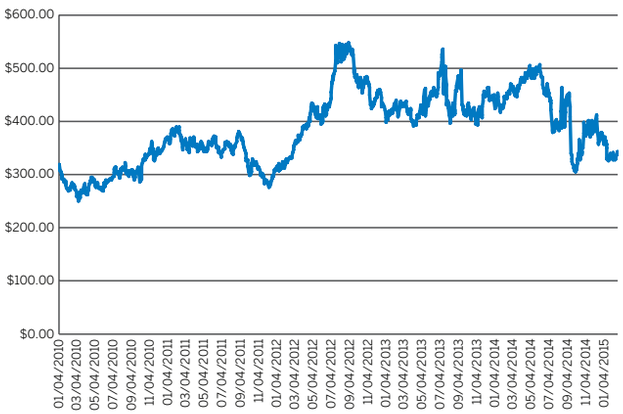
SOYBEAN CRUSH



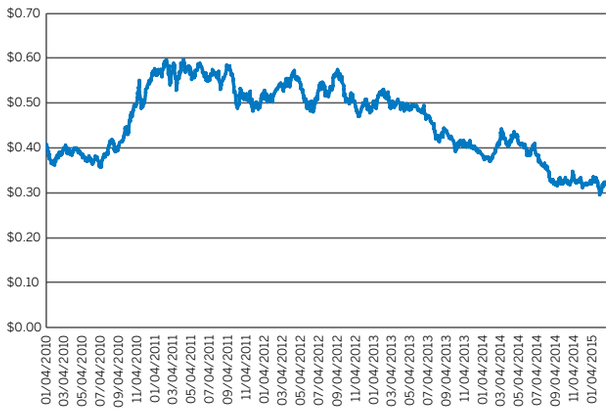
SOYBEAN



SOYBEAN MEAL



SOYBEAN OIL



[1] Similar to other commodity spreads, the Soybean Board Crush is generally less risky than the outright components but there can be periods of time where the crush spread volatility can be relatively high.

THE CRUSH SPREAD

The crush is quoted as the difference between the combined sales value of soybean meal and oil and the price of soybeans. The Board Crush spread includes Soybean futures, which are traded in cents per bushel, Soybean Meal futures priced in dollars per short ton, and Soybean Oil futures traded in cents per pound. To determine the relationship of the three commodities and potential trading opportunities, it is necessary to convert soybean meal and soybean oil prices to cents per bushel because of their different pricing units.

When a bushel of soybeans weighing 60 pounds is crushed, the typical result is 11 pounds of soybean oil, 44 pounds of 48 percent protein soybean meal, 4 pounds of hulls and 1 pound of waste. Although soybean meal can be delivered with different levels of protein, the CBOT Soybean Meal futures contract specifications are for 48 percent protein.

To Convert Prices into Cents per Bushel

Soybeans:	No conversion required Soybean futures are quoted in cents per bushel
Soybean Meal:	0.022 x price of soybean meal 44 lbs/2000 lbs = 0.022
Soybean Oil:	11 x price of soybean oil 11 pounds of oil per 60 lb. bushel

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 profitability of processing. When the processing margin exceeds processing costs, crushers will most likely process more soybeans; when the margin falls below processing costs, processors may scale back their operations.

To manage the risks of changing crush margins or GPM, processors will often use the Board Crush as a hedge. The Board Crush uses the same calculations but with futures prices instead of the cash market prices used in calculating the GPM.

An Example of Calculating the Board Crush

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

November Soybean futures:	$9.44 per bushel (5,000 bushels)
December Soybean Meal futures:	$304 per short ton (100 short tons)
December Soybean Oil futures:	$0.3358 per pound (60,000 pounds)

Step 1 – Convert prices into dollars per bushel:

Soybean Meal:	$304.00 x .022 = $6.69 per bushel
Soybean Oil:	$0.3358 x 11 = $3.69 per bushel

Step 2 – Subtract the cost of soybeans from the combined sales value of the products:

Soybean Meal + Oil ($6.33 + $3.66):	$10.38
– Soybeans	– $9.44
Board Crush	**$0.94**

CRUSH SPREAD TERMINOLOGY

The difference between the price of soybeans and the combined 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 Board Crush spread occurs when the price of Soybean futures rises relative to the combined sales price of Soybean Oil and Meal futures. When this occurs, the spread declines. A trader expecting a narrowing crush spread sells the Board Crush spread (put on the Board Crush) – buying Soybean futures and selling Soybean Meal and Soybean Oil futures.
- Note that the position you take in the soybean products (soybean meal and soybean oil) is the same position you are taking with the crush.
- A widening Board Crush spread occurs when the combined sales price of Soybean Oil and Meal futures rise relative to the price of Soybean futures. When this occurs, the spread increases. A trader expecting a widening crush spread buys the Board Crush (put on the reverse Board Crush) – selling Soybean futures and buying Soybean Meal and Oil futures.

The difference between the price of soybeans and the combined sales value of soybean meal and oil can vary over time.

An Example of Trading a Narrowing Board Crush Spread

Sell the Board Crush
October 30

Buy
July Soybean futures
1 contract at $10.48 per bushel

Sell
July Soybean Meal futures
1 contract at $338.70 per short ton

July Soybean Oil futures
1 contract at $0.3520 per pound

Lift the Board Crush
November 25

Sell
July Soybean Futures
1 contract at $10.65 per bushel

Buy
July Soybean Meal futures
1 contract at $348.40 per short ton

July Soybean Oil futures
1 contract at $0.3409 per pound

Results			
Soybeans:	$0.11 Gain ($10.65 – $10.48)	x5,000 (bu)	= ($850.00)
Soybean Meal:	$2.20 Loss ($338.70 – $348.40)	x100 (s. ton)	= (970.00)
Soybean Oil:	$0.0111 Gain ($0.3520 – $0.3409)	x60,000 (lbs)	= $666.00

Net gain: **$546.00**

An Example of Trading a Widening Board Crush Spread

Buy the Board Crush
June 27

Sell
November Soybean futures
1 contract at $12.00 per bushel

Buy
December Soybean Meal futures
1 contract at $374.9 per short ton

December Soybean Oil futures
1 contract at $0.4053 per pound

Lift the Reverse Crush
July 22

Buy
December Soybean futures
1 contract at $10.69 per bushel

Sell
December Soybean Meal futures
1 contract at $341.4 per short ton

December Soybean Oil futures
1 contract at $0.3684

Results			
Soybeans:	$1.31 Gain ($12.00 – $10.69)	x5,000 (bu)	= $6,550
Soybean Meal:	$33.50 Loss ($341.4 – $374.9)	x100 (s. ton)	= ($3,350)
Soybean Oil:	$0.0369 Loss ($0.3684 – $0.4053)	x60,000 (lbs)	= ($2,214)

Net gain: **$986.00**

TRADING THE BOARD CRUSH SPREAD

Although the previous examples have used a one-to-one-to-one ratio of futures contracts (one Soybean futures contract, one Soybean Meal futures contract and one Soybean Oil futures contract), the Board Crush (and reverse Board Crush) can also be traded as a spread 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 spread 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 the Board Crush or the reverse Board Crush spreads, 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 futures contracts, 11 Soybean Meal futures contracts and 9 Soybean Oil futures contracts. This is the smallest ratio of contracts that accurately represents the equivalent yields of the three commodities.

The Board Crush

Soybeans:	50,000 bushels = 10 Soybean futures contracts (at 5,000 bushels/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 = 1,110 short tons of meal = 11 Soybean Meal futures contracts (at 100 short tons/contract)
Soybean Oil:	50,000 bushels of soybeans x 11 lbs of oil = 550,000 lbs of oil 550,000 lbs/60,000 lbs/futures contract = 9 Soybean Oil futures contracts (approximate)[2]

CME Group supports execution of Soybean Board Crush spread transactions on CME Globex. Execution of crush spreads can be completed via legging into the crush (trading each of the individual components) or by trading the Exchange defined Soybean Board Crush spread, which is the relationship between the three components (CME Globex Commodity Code: SOM). Traders within this spread may be matched with others trading the other side of the Soybean Board Crush spread or matched with traders trading the outright markets for Soybean, Soybean Meal, and Soybean Oil futures. This is possible due to implied functionality. Outright orders in the Soybean, Soybean Meal and Soybean Oil futures are used to create implied Soybean Crush orders along with the actual Soybean Board Crush spread orders entered into CME Globex. Trades will be matched only in the specified fixed ratio of contracts. Implied crush bids are rounded down to the nearest tick and implied crush offers are rounded up to the nearest tick. Explicit Soybean Board Crush spread orders entered into CME Globex are calculated as implied orders into the Soybean, Soybean Meal and Soybean Oil futures markets. Although theses bids and offers are eligible for trade execution, these quotes will not be publicly displayed or disseminated.

[2] Trading the crush in a single 50,000 bushel unit results in under-hedging the soybean oil component of the crush by 10,000 lbs.

[3] Not all ISVs provide an auto-spreader.

OPTIONS ON THE SOYBEAN BOARD CRUSH SPREAD

Options on the Soybean Board 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 per bushel or $62.50 per contract.
- Daily price limit: There is no price limit on any day.
- Contract months: Eight standard delivery months with the following soybean crush spread combinations (note: October and December 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 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 Crush Spread call option has the right to buy the crush – 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 Crush Spread put option has the right to sell the crush – 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 buyers of 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 and cents 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 and cents 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.

Only buyers of calls and buyers of puts have the right to exercise their option contract into a futures position on any day during the life of the option.

Contract Advantages

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

- Set a "floor" or minimum price for the Soybean Board Crush, which allows traders to lock in a predetermined GPM in advance of cash market purchases and sales. To establish a floor price, a trader would purchase a Soybean Board Crush spread put option.
- Set a "ceiling" or maximum price for the Soybean Board 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 Soybean Board Crush spread 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 Crush Spread Option Exercise Process

To illustrate the positions a buyer of a December $0.84 crush spread call option contract would receive upon exercise, assume the following prices and values for November/December futures contracts:

November Soybean futures: $9.52 per bushel (5,000 bushels)
December Soybean Meal futures: $306.30 per ton (100 tons)
December Soybean Oil futures: $0.3327 per pound (60,000 pounds)

Step 1 – Round prices

Soybean Meal:	Round to nearest $2.50 per ton $306.30 per ton = $307.50
Soybean Oil:	Round to nearest $0.0025 per pound $0.3327 per pound = $0.3325

Step 2 – Convert Prices into dollars per bushel

Soybean Meal:	$307.50 x .022 = $6.765 per bushel
Soybean Oil:	$0.3325 x 11 = $3.6575 per bushel

Step 3 – Calculate assigned soybean futures price

Soybean Meal rounded price	=	$6.765/bu.
+ Soybean Oil rounded price	=	+$3.6575/bu.
– Crush option strike price	=	– $0.97/bu.
Assigned Soybean futures price		**$9.4525/bu.**

Therefore, the buyer of the call option is assigned:

Long 11 Soybean Meal futures contracts at $307.50 per short ton
Long 9 Soybean Oil futures contracts at $3325 per pound
Short 10 Soybean futures contracts at $9.4525 per bushel

An Example of Buying a Soybean Crush Spread Put Option

Assume that on September 3, a crusher decides to lock in upcoming purchases of soybeans and the combined sales of soybean meal and oil by buying a $0.84 December Soybean Crush put option for $0.0250.

The Crusher's account is debited for the purchase of the December 84 Soybean Crush put option in the amount of $0.0250 per bushel or $1,250.00 per contract ($0.0250 x 50,000 bushels).

Scenario #1: Offset on October 12, Prior to Expiration
The crusher decides to lift the hedge to coincide with the cash market purchases and sales. With the Board Crush currently trading at $0.80, the December 84 Soybean Crush spread put option is in-the-money. The crusher sells the put for $0.0425 per bushel or ($0.0425 x 50,000) $2,125.

The net return for this hedge would be the $2,125 return minus the cost to purchase the option, $1,250.00, or $875 ($0.0175/bu. x 50,000 bushels).

Scenario #2: Exercise at Expiration, Hold Resulting Futures and Offset on October 21
Trading expires in the December Soybean Crush Spread option with the December 84 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:	$272.90 per short ton
December Soybean Oil:	$0.3420 per pound
November Soybeans:	$8.92 per bushel

The crusher is assigned positions with rounded values for Soybean Meal futures (to the nearest $2.50 per short ton) and Soybean Oil futures (to the nearest $0.0025 per pound):

Short 11 December Soybean Meal contracts at $272.50 per short ton Short 9 December Soybean Oil contracts at $0.3425 per pound

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:

($272.50/short ton x .022) + ($0.3425/lb. x 11) – $0.84/bu. = $8.9225

Therefore, the position assigned is: Long 10 November Soybean contracts at $8.9225

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:	$272.80 per short ton
December Soybean Oil:	$0.3415 per pound
November Soybeans:	$8.955 per bushel

Offsetting positions at these prices, the hedger earned:

Soybean Meal:	Short at $272.50/short ton, offset (buy back) at $272.80/short ton = $0.3/short ton loss or $30/contract ($0.20 x 100 short tons)
Soybean Oil:	Short at $0.3425/lb, offset (buy back) at $0.3415/lb. = $0.0010/lb. profit or $60/contract ($0.001 x 60,000 lbs.)
Soybeans:	Long at $8.9225/bu., offset (sell back) at $8.955/bu. = $0.0325/bu. profit or $162.50/contract ($0.0325 x 5,000 bu.)

The total profits from these positions are calculated as follows:

Soybean Meal rounded price	=	$6.765/bu.	
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			**$1,445.00**

The net return for this hedge would be $195 or $0.0039 per bushel (the $1,445.00 return minus $1,250, the cost to purchase the option).

SUMMARY

CME Group options and futures contracts on the Soybean Board Crush Spread provide market participants with several efficient vehicles for both commercial hedging and position trading. CME Group Soybean Crush Spread contracts also have significantly lower margin requirements, as the spread is generally less volatile than the prices themselves.

For more information on Soybean Crush spreads, visit cmegroup.com/soybeancrush.

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