Chapter 2. Soybean Production and Marketing in North Carolina

Introduction

While the effort, skill, and resources invested in growing a plentiful crop and managing production risk are substantial, the key to profit lies in successful marketing and managing price risk. Some years may present an easy path to profit, while others may pose a challenge. This chapter aims to underscore the crucial role of marketing and price risk in soybean production, providing foundational knowledge, evaluating current market conditions, and offering specific input cost information for North Carolina.

Marketing and price risk

Crop producers in North Carolina are no stranger to risk. Factors outside the producer's control, such as weather, can influence the amount produced and contribute to production risk. Similarly, a North Carolina producer does not influence national soybean price levels, making them a price-taker and subject to market demand and supply conditions that contribute to price risk. Price risk is the uncertainty surrounding the prices a producer will receive for a commodity after deciding to plant it and harvest it for sale. Expectations about soybean prices in a given year are factored into planting decisions (among many other factors) when deciding how many soybean acres to plant. These expectations about possible harvest time prices can be formulated before planting (soybeans in North Carolina are usually planted beginning in May and as late as July) to make more informed planting decisions. These expectations can be made by taking account of pre-planting future price levels for harvest time futures prices (the November soybean futures contract is considered the harvest futures contract) and adjusting the current harvest time futures by adding the historical basis usually paid at harvest time for a particular location. Expectations about post-harvest prices can also be formed similarly, when storage for later sale may be in play, by looking at current futures prices of later maturing futures contracts (such as January, March, and May) and by adding the historical basis usually paid at the period of interest for the delayed sale. After planting, neither growing conditions determined by the weather nor market demand and supply conditions, which factor into prices, are predictable, meaning uncertainty exists about how much soybeans a producer will have available to sell and at what prevailing price they can sell their soybeans. The quantity produced and the price received affect producer profits, possibly for better or worse.

Profit for a crop is the total revenue received less the total costs of growing the crop, which is shown as:

$$\text{profit} = \text{total revenue} - \text{total costs}.$$

This section on marketing focuses on the total revenue part of the equation. To keep things simple and to focus just on soybeans (most farms produce several crops), the total profit is equal to the revenue that will come from collecting sales of all the soybeans a farm produces minus the total costs to produce the soybeans, which can be expressed as:

$$profit = \left[\left(price_{soy} \times yield_{soy} \times acres_{soy}\right) +\right] - total\ costs_{soy}$$

Considering soybean revenue alone, recognizing that it is a function (a product of two random variables), namely price and yield—meaning revenue is also a random variable. So, we will not know the revenue value until both price and yield are known. We will only know the yield at harvest, and we will only know the price at the time of the actual sale.

$$\underbrace{price_{soy}}_{unknown} \times \underbrace{yield_{soy}}_{unknown} \times acres_{soy}$$

Given that producers must make acreage and crop input decisions before knowing prices and yields, what are the options for dealing with these unknowns and uncertainties?

Addressing yields first, best management practices developed by crop scientists and entomologists, for example, can make soybean yields more predictable and reduce the likelihood of crop failure. In terms of financial tools, crop insurance is also available. Crop insurance can offer yield protection or revenue protection. The main advantages of crop insurance are that it protects against catastrophic losses and can improve producer access to credit by insuring between 50% and 85% of a farm's approved production history (APH) or revenue (the farm APH is multiplied by the Base Price), in 5% increments. The disadvantage is that a premium must be paid[1]. This premium adds to total costs, so selecting the type and level of coverage can be complex. NC State's Department of Agriculture and Resources Economics (ARE) website provides resources on crop insurance.

This section is devoted to marketing and the financial tools to manage price risk. As with yields, we ask similar questions:

- Is there anything we can do to make soybean prices more predictable?
- How can we reduce the financial impact of low soybean prices?

As with crop management practices, determining the "best" practices will depend on various farm characteristics—managing price risk is specific to each farm. When choosing a price-risk management strategy, it is essential to consider the producer's risk tolerance and capacity and the national and local market conditions that impact prices.

While risk tolerance and risk capacity may be related, they are separate considerations. *Risk tolerance* refers to the producer's emotional ability to withstand commodity price volatility or rapidly falling prices. Someone who is risk-averse may lose sleep during times of high soybean price volatility; someone else who is risk-loving may be willing to accept exposure to soybean price fluctuations during the same volatile period. *Risk capacity* is the maximum amount of loss the farm enterprise can tolerate, regardless of the producer's attitude toward risk. A farm enterprise following a good year may be capable of withstanding up to $25,000 of potential losses on soybeans; such a loss would be painful, but the farm could eventually recover. A $25,000 loss may bankrupt the same farm following a bad year.

Therefore, implementing an appropriate marketing strategy requires preparation. Mainly, the producer needs to establish:

A. How much potential loss am I *willing* to accept? [tolerance]

[1] Crop insurance premiums are subsidized by the Federal Crop Insurance Corporation (FCIC), so farmers do not pay the full cost of insurance.

B. What is the maximum loss the farm *can* withstand? [capacity]

Reviewing the broad financial picture of the farm by evaluating the cash flows, current liquidity, and profitability will help determine the answers to A and B. Since risk tolerance can exceed risk capacity, whichever one is lower, A or B, is a limit to keep in mind. The next information to establish is:

C. What is the break-even price per bushel? To find this value, we must solve for the soybean price when profit equals zero.

$$soybean\ revenue - soybean\ costs = \$0 \rightarrow \underbrace{\left(price_{soy} \times yield_{soy} \times acres_{soy}\right)}_{soybean\ revenue} = soybean\ costs$$

This can be rearranged as:

$$price_{soy}^{breakeven} = \frac{soybean\ costs}{yield_{soy} \times acres_{soy}}.$$

D. At what price will you meet the loss limit determined in steps A and B? Say the loss limit is $\$X$; What price per bushel is the loss limit then reached? The process is very similar to finding the break-even price.

$$soybean\ revenue - soybean\ costs = -\ \$X$$

$$\rightarrow soybean\ revenue = soybean\ costs - \$X$$

$$\rightarrow \underbrace{\left(price_{soy} \times yield_{soy} \times acres_{soy}\right)}_{soybean\ revenue} = soybean\ costs - \$X$$

Which can also be rearranged as:

$$price_{soy}^{loss\ limit} = \frac{soybean\ costs - \$X}{yield_{soy} \times acres_{soy}}.$$

Steps C and D require budgets because costs are needed to solve for the break-even and loss-limit prices (enterprise budgets are provided at the end of this chapter). The steps also require making an informed assumption about yield. A reasonable assumption would be to project a trend yield based on a farm's historical yields to account for the fact that in an increasing yield over time scenario, the APH yield will lag the expected yield based on a projection using the trend yield. Finally, the number of acres planted must be decided. Deciding on the number of acres to plant before knowing prices and yields is challenging when multiple crops compete for acreage (an example might be corn and soybeans competing for the same acres). Consequently, these limits may need to be revisited and revised during the planning stages.

Soybean Prices in North Carolina

The following subsection provides a common set of tools to manage price risk. To use these tools appropriately, it is important to understand how prices in North Carolina will be related to national soybean prices.

The Chicago futures price, which we consider the national soybean price, is a contract in which a buyer and seller agree to a price for a standard quantity of soybeans that will be exchanged at some future date. Future prices adjust frequently (daily), reflecting national supply and demand changes. National

storage stocks plus national acres planted combined with average national yield make up the total U.S. soybean supply. Midwestern states, such as Illinois, Iowa, Minnesota, and Indiana, are the largest soybean-producing states in the U.S. These states are physically closer to future market delivery locations in Chicago. In addition, these Midwest sources are export-oriented, given their advantageous proximity to the Mississippi River. Therefore, national prices will adjust with national supply, which depends largely on the market conditions in the Midwest.

North Carolina markets are different. North Carolina is not near Chicago; rail is the primary link between North Carolina markets and Chicago or Midwest states. Also, North Carolina is a net importing region due to a large livestock industry in the state. In addition to what is happening nationally, North Carolina's supply and demand conditions can significantly impact the prices North Carolina producers receive. Thus, North Carolina's conditions are important to consider as part of the local price risk.

The primary measure linking local North Carolina prices to futures prices is the "basis."

$$basis = \underbrace{cash\ price}_{price\ received\ in\ NC} - \underbrace{futures\ price}_{national\ price}$$

Rearranged,

$$cash\ price = futures\ price + \underbrace{basis}_{reflects\ relative\ NC\ conditions}.$$

Figure 2.1 compares the North Carolina cash price to the nearby Chicago futures price, showing that the relationship between these two price series adjusts over time. The basis can be positive or negative.

Unfortunately, the basis equation is deceptive in its simplicity. Futures contracts are specific to product quality, delivery location, and delivery time. The hidden feature of basis combines two price relationships: (1) prices today and the futures contract delivery date and (2) prices in North Carolina and futures contract delivery locations. Typically, the basis is reported using the nearby futures contract, which is set to expire next. Futures contracts are very specific, and prices are quoted for listed grades/quality, affecting the price received.

Figure 2.2 shows the average monthly Fayetteville immediate (nearby) soybean basis for each year 2020-2024. Several aspects of soybean nearby basis for Fayetteville, NC, are notable. Firstly, variation is driven by differences in the Fayetteville area's local demand and supply conditions for each of the five years. When supplies are plentiful and or when demand is weaker for a given year, we can expect basis levels to be lower (weaker). When demand is stronger or supplies are short, we can expect the basis to be higher (stronger). Secondly, the basis is seasonal in Fayetteville and is lowest around harvest time, when supplies are plentiful. Basis then increases (strengthens) in the post-harvest months of January through September. A strengthening of basis during this period leads to higher soybean prices, encouraging soybeans to be sold out of storage. Thirdly, variation over the months across years is smallest during the harvest months and up through April. The one exception is the impact of COVID-19 in April 2020, when the basis was extremely negative because nearby futures prices briefly increased significantly relative to the local price in Fayetteville. Beginning in May and when local supplies are being drawn from storage, the variation in basis over the same month but different years gets larger up until September across the various years.

Figure 2-1. Fayetteville Versus Nearby Chicago Futures Prices

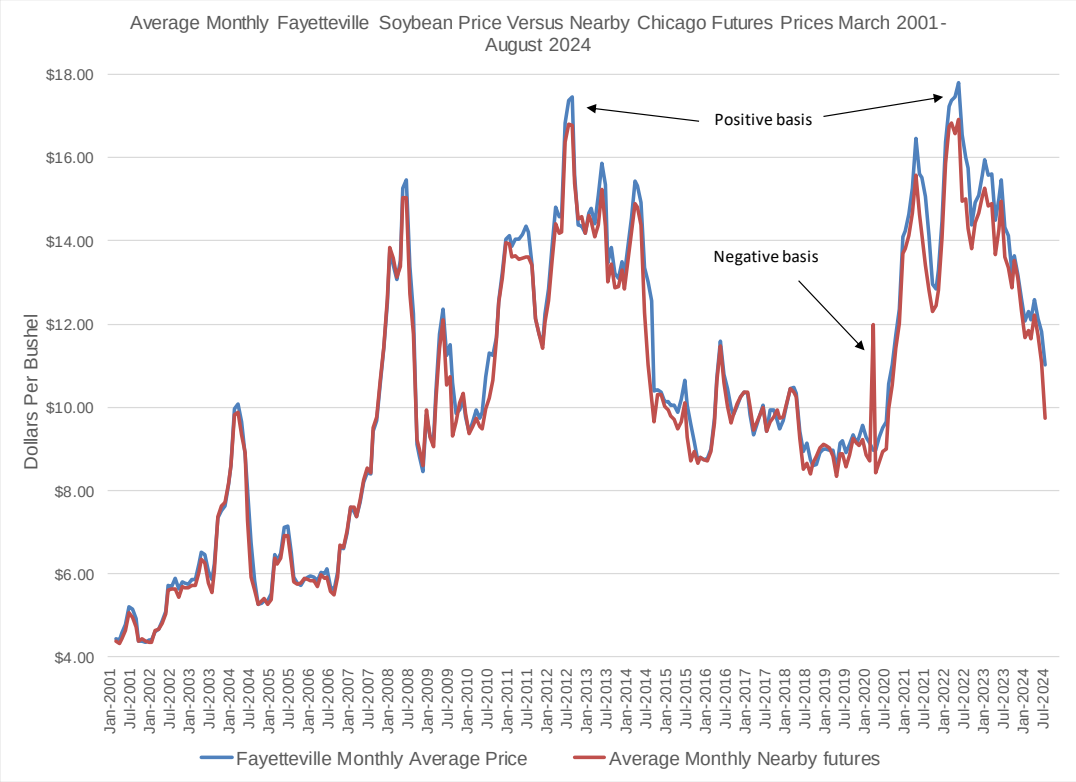


Figure 2-2. Fayetteville Average Monthly Immediate Basis for 2019-2024

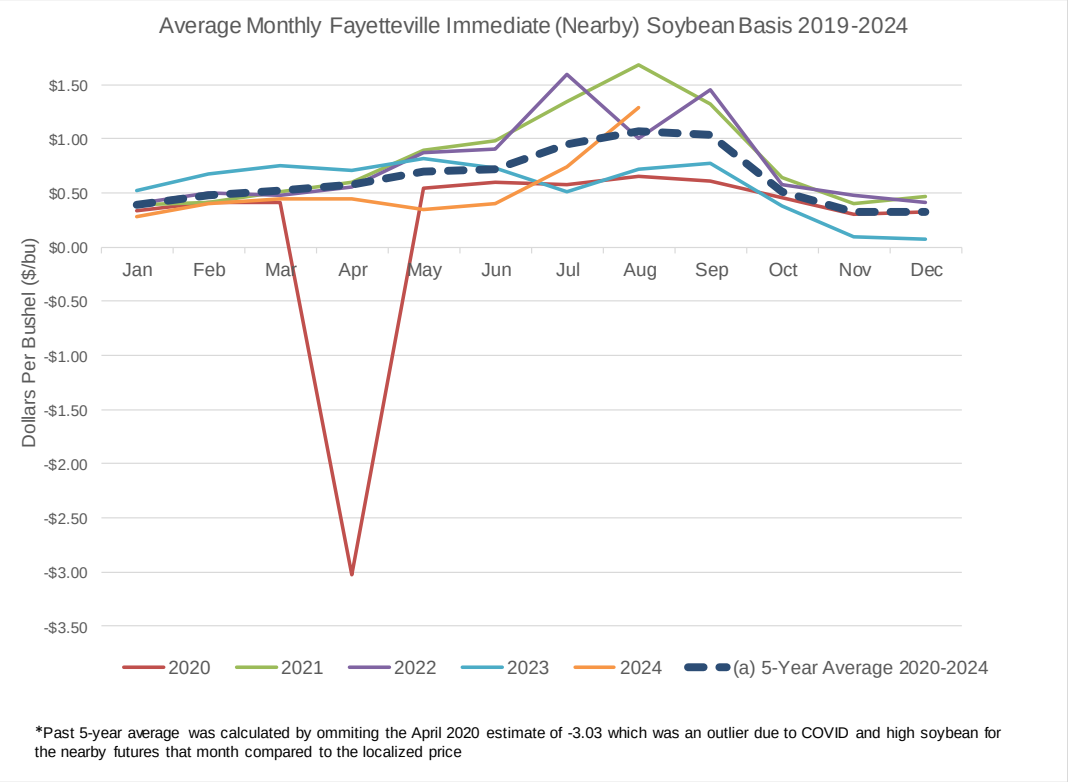
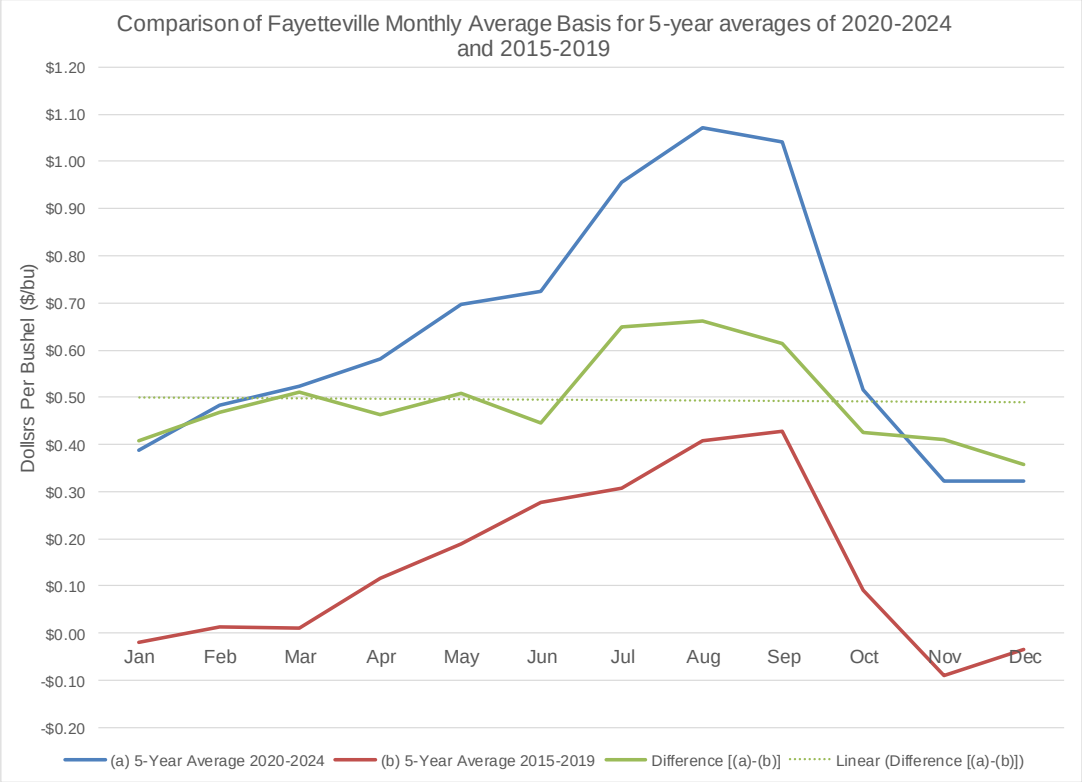


Figure 2.3 compares Fayetteville's monthly average nearby basis for the 5-year averages of 2020-2024 and 2015-2019. Several aspects of this comparison are also notable. Firstly, the seasonality of the basis is evident, with the lowest levels occurring at the harvest and then strengthening (becoming more positive) post-harvest up until August when the basis then weakens (declines) significantly from September until the harvest time low in November. Secondly, the difference between these two periods across each month is very similar in value or almost constant, with 2020-2024 being around $0.50 higher compared to 2015-2019. This difference of $0.50 reveals that soybean farmers have more recently, in the past five years, averaged a higher basis than the previous five-year period. The reasons for this higher basis are complex, with many factors contributing. These factors for this increase include things like higher rail rates for soybeans that are imported, an increase in demand for more locally-grown soybeans around the Fayetteville location, a higher basis on offer for soybeans to try and bid for planted acres for soybeans, and also some inflationary pressure of higher input costs and soybean prices. This increase is the combined result of these factors (and others).

Figure 2-3. Fayetteville Average Monthly Immediate Basis for 2019-2024

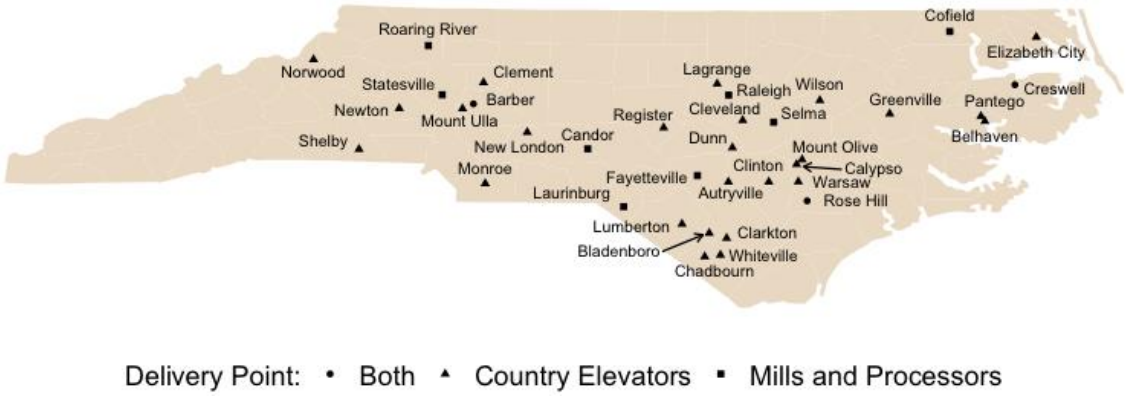


When thinking about North Carolina's soybean basis in general, there are a few assumptions to work from, which are usually, but not always, true.

- The soybean basis is more predictable than the total cash price.
- End users, such as crushing facilities, have a higher soybean basis than intermediary handlers.
- Soybean basis varies throughout the year and is lowest at harvest.

This NC State Extension web page provides regular (monthly) updates on historical price and basis data for many North Carolina locations. The locations for soybean markets are shown in Figure 2.4. The CME Group website provides futures prices. These data can be used to compare current offers to historical prices and basis levels.

Figure 2-4. Locations with Historical Soybean Price and Basis Data

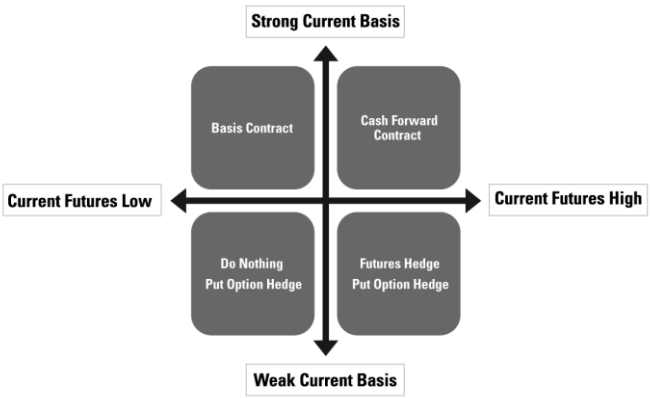


This section emphasizes that North Carolina's prices are composed of two components that should potentially be included in a price risk management strategy. A complete strategy will consider whether and how to manage basis, futures price, or both.

Hedging

The marketing cross framework, shown in Figure 2.5, can help map out a price-risk management strategy. It suggests marketing and hedging strategies based on national and North Carolina market conditions.[2]

Figure 2-5. The Marketing Cross



More information about each strategy follows, but it is important to stress that hedging *is not free*. Some apparent costs, such as fees, are associated with a particular strategy. Non-obvious costs can include time spent monitoring markets and managing one's position. Some methods can limit the producer's ability to gain from price increases. In general, hedging aims to reduce or eliminate the impact of falling soybean prices—the goal is not necessarily to maximize the soybean price.

[2] Piggott, N.E. G.A. Shumaker, and C.E. Curtis. 2005. "A Guide to Price Risk Management in Grain Marketing for North Carolina, South Carolina, and Georgia" (PDF, 2.4 MB). See page 30.

In addition, the prescribed strategies do not specify *how much* to hedge and *when* to hedge. Typically, somewhere between zero to 60% of expected production is hedged. A natural time to place a hedge is at or after planting once a reasonable production expectation can be formed. But hedges can be placed at any time. Someone may place a hedge at a particular time to secure advantageous soybean prices or because the farm's financial circumstances have changed. Having the farm-specific guard rails and price objectives in mind will guide these decisions as situations evolve.

Using futures and options

Futures and options are used to manage national price risk.

Hedging with futures: To initiate a futures hedge, one sells soybean futures (in other words, goes "short") for the contract expiring just after harvest time. Then, at harvest, when delivering to a local buyer for the cash price, the futures market is exited by buying soybean futures (in other words, it goes "long").

Per bushel outcome on hedged production

$$\underbrace{cash\ price}_{received\ from\ local\ buyer} + \underbrace{(futures\ sell\ price - futures\ buy\ price)}_{futures\ market\ profit\ or\ loss}$$

Important to note

Because a futures contract is an agreement to buy or sell in the future, a margin deposit representing a fraction of the total contract value is required. The deposit is required for both buyers and sellers at the time of the trade. From then on, all gains and losses from day-to-day price changes are reflected in the margin account. If a margin account balance falls below a certain level, the producer will receive a margin call, which is a notice from the broker to deposit additional cash into the account immediately. This process is part of the safeguards to ensure the financial integrity of futures contracts. Someone hedged with futures should always have cash on hand while the futures position is open, which may only be feasible for some.

Another obstacle for producers is that a soybean futures contract for 5,000 bushels may be too large (or too lumpy) of a quantity to hedge, depending on the farm's expected soybean production. Smaller-sized futures contracts of 1,000 bushels, called "minis," are available. However, minis tend to have lower trading activity levels than standard-sized contracts, adversely impacting liquidity and the ability to exit and enter the market.

Hedging with options: To initiate a hedge using options, the producer should buy "put" options on the soybean futures contract that expire just after harvest time. A put option gives the holder the right to sell a futures contract at a specific price called the strike price. The fee for this right is called the option premium.

Per bushel outcome on hedged production

In this case, the outcome depends on how the futures price and strike price compare at harvest time. If the $futures\ price > strike\ price$ then the put option expires, amounting to:

$$\text{cash price} - put\ premium$$

However, if $futures\ price < strike\ price$, then buying a futures contract at the current market price and exercising the put option to sell at the strike price amounting to:

$$cash\ price - \ put\ premium + (\underbrace{futures\ sell\ price}_{put\ option\ strike\ price} - futures\ buy\ price)$$

Important note:

Options are not available for mini-sized futures contracts. But, unlike futures, buying an option does not require maintaining a margin account.

Contracting with a local buyer

The only way to manage basis risk is to contract with a local buyer. However, local buyers often offer contracts with means of managing national price risk. There are endless ways to design these contracts, including incorporating futures markets, and they can quickly become complex. Two of the more straightforward and commonly used contract types are discussed below.

Hedging with a cash forward contract: Make an agreement with a local buyer for the total price they will pay per bushel upon delivery during harvest. Since the total price per bushel is agreed upon, fluctuations in future prices and basis are no longer relevant to the quantity hedged.

Per bushel outcome on hedged production

$$forward\ contract\ price$$

Important note:

In this case, both national price and basis risk are transferred from the producer to the local buyer. Because of this, local contracts can have service fees or built-in risk premiums. And because a local custom contract is not traded on an exchange, futures market structures to easily enforce the contract and provide flexibility to exit the contract early are unavailable.

Hedging with a basis contract: Make an agreement with a local buyer for the basis they will pay per bushel upon delivery during harvest. This locks in basis but leaves someone exposed to fluctuations in the futures price.

Per bushel outcome on hedged production

$$futures\ price + contract\ basis$$

Important note:

In this case, only basis risk is transferred from the producer to the local buyer. These contracts may also include service fees or built-in risk premiums.

Table 2-1. Summary of Marketing Cross Strategies

Marketing Strategy	Exposed to Futures Price Risk?	Exposed to Basis Risk?	Important to Note
Do Nothing (for example, cash sale at harvest)	Yes	Yes	
Cash Forward Contract	No	No	• May have service fees or built-in risk premiums • Counter-party risk
Basis Contract	Yes	No	• May have service fees or built-in risk premiums • Counter-party risk
Futures Hedge	No	Yes	• Can hedge only in futures contract-size increments • Potential for margin calls
Put Options Hedge	Yes, but limited	Yes	• No margin calls • Can only hedge in futures contract-size increments • Must pay a fee called the "premium"

Outlook for 2024 and beyond

This section discusses supply and demand conditions in North Carolina and nationally. It highlights the relationship between supply and demand trends and prices, providing context for developing a marketing and risk-management strategy. Outlook factors discussed here are time-sensitive and can become outdated quickly. Market outlooks can take either a short-run or longer-run perspective.

The USDA's World Agricultural Supply and Demand Estimates (WASDE) are prepared and released by the World Agricultural Outlook Board (WAOB) monthly, and annual forecasts are provided for the supply and use of U.S. and world soybeans.[3] Some months can see significant changes in these estimates, particularly at different times of the marketing year, and some months, changes to the estimates are minimal. The following discussion highlights some essential concepts about expectations and essential relationships in play moving into a new crop year.

North Carolina Soybean Production

Over the most recent five years (2019 to 2023), the North Carolina soybean crop has averaged around $746 million, and in a good year, the crop is worth as much as $931 million to farmers (2022). North Carolina farmers have planted an average of 1.573 million acres of soybeans over the past five years (2019 to 2023) (Table 2-2). Soybeans have the most significant footprint in row crop acres in North Carolina, and most soybean acres in North Carolina are in the eastern part of the state in the coastal plain. The most recent five-year (2019 to 2023) average production is 61.029 million bushels, with an average yield of 38 bushels per acre over the same period (Table 2-2). In a good crop year, yields have been as high as 40 bushels per acre in 2021. The five-year (2019 to 2023) marketing year average price is $12.08 per bushel (Table 2-2). A final important point is that North Carolina soybean production accounts for a small share of national production, explaining why it has minimal influence on prices

[3] https://www.usda.gov/oce/commodity/wasde

nationally. For example, in 2023, North Carolina's share of national production was 1.5% (62.7/4,165—North Carolina bushels over total bushels produced nationally).

Since 2015, soybean acres planted in North Carolina have been on a downward trend. However, in 2020, North Carolina farmers planted 1.600 million acres of soybeans, which represented a turnaround in declining acreage, which had been on the decline over the previous four years from the most recent high of 1.820 million acres in 2015 (see Table 2-2 and graph in Figure 2-4[a]). Acreage slightly increased in the next two years (2021 acres were at 1.65 million and 2022 were at 1.70 million) and achieved the trend level planted acres in 2022 (see Figure 2-4[a]). Since then, soybean acreage in North Carolina has slightly declined to below-trend levels, with 1.640 million acres planted in 2023 and 1.630 million in 2024. The recent years of 2021 (with a record yield of 40 bushels per acre) and 2022 (with a record price of $14.40 per bushel) saw cash receipts increase significantly to above trend levels to $860 million in 2021 and $930 million and 2022 (a record). In 2023, cash receipts pulled back to trend levels of around $809 million due to slightly fewer acres planted (a reduction of 600,000), a reasonable growing season achieving a trend yield (38.5 bushels per acre), and a lower soybean price of $12.90 per bushel. At the time of writing (September 2024), the 2024 expected production is estimated to be 58.320 million bushels, a decline of around 7.1 percent less than the 2023 levels. This reduction in production is attributable mainly to lower estimated yields in 2024 of 36 bushels per acre and slightly fewer acres. With current new crop soybean futures (November 2024) trading around $10.13 at the time of writing and using a historical basis estimate for nearby basis at harvest time in Fayetteville of around $0.32 per bushel, the current best "guestimate" of harvest time prices is around $10.45 per bushel in Fayetteville. With 2024 new crop local prices in the mid $10 per range per bushel currently and with an expected lower production of 58.320 million bushels, cash receipts for soybeans for 2024 are tracking to be in the low $600 million range. This is a significant decline from the record $931 million in 2022.

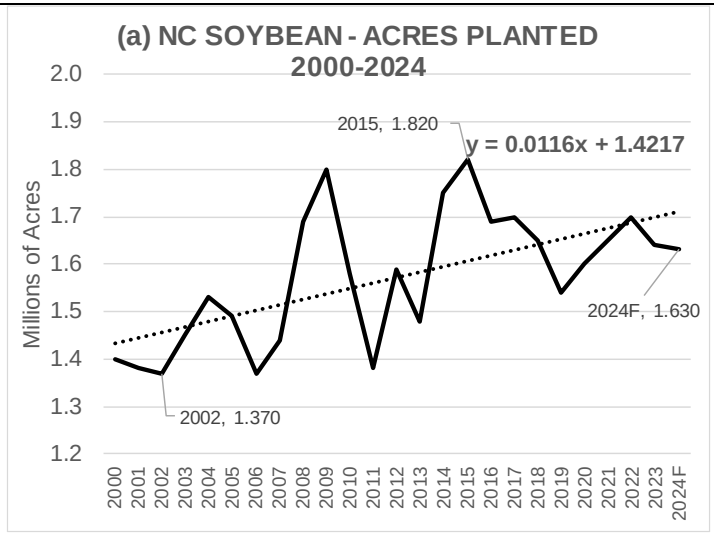
The four graphs in Figure 2-4—acres, yields, production, and price—reveal upward trends over 2000 to 2024F for all four factors of production. The year 2015 was record-setting for a planted average of 1.820 million acres. For the next four years, soybean planted acres plummeted with a decline of 280,000 or a 15.4 percent decline in 2019 to 1.540 million acres. Since then, acreage has been trending up and returned to the average trend levels in 2022 at 1.7 million acres. Since then, for 2023 and 2024, soybean acres have again declined and are below average trend, with planted acres of 1.640 million in 2023 and 1.630 million acres. The lower acreage in 2024, combined with a reduced expected total yield of 36 bushels per acre for the North Carolina state average due to unfavorable growing conditions in 2024 (significant drought during the summer months followed by significant rainfall in many areas of the state) has the 2024 crop production pegged at 58.320 million bushels. This represents a 2.709-million-bushel decline (or 4.4 percent reduction) from the previous five-year average (2019-2023) of 61.029 million bushels. This reduction in local production or inward shift in supply provides some positives for local basis in North Carolina and prices—however, more favorable growing conditions in the major growing regions of the U.S. in 2024 lead to an expected *record* average national yield of 53.2 bushel per acre—is dragging down the futures component of the local prices in North Carolina, meaning that expected local soybean prices will be lower in 2024 with a best "guestimate" for Fayetteville prices to be around $10.45 per bushel at harvest time in Fayetteville for 2024.

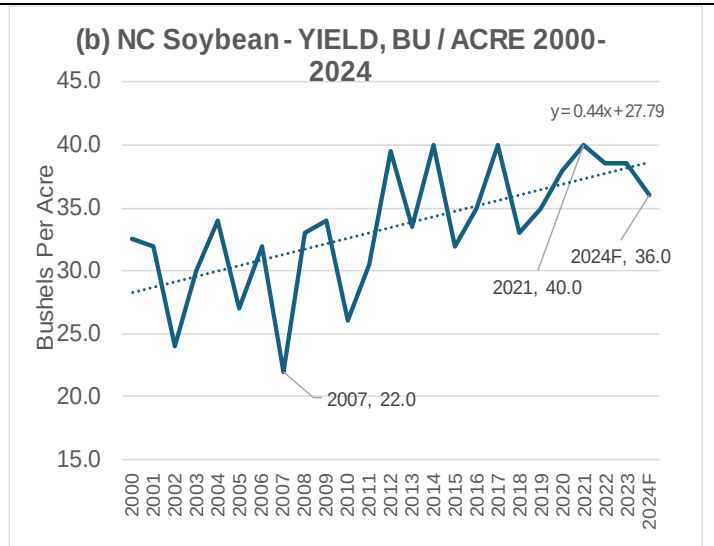
Table 2-2. North Carolina Soybean Acres, Yields, and Production 2000 to 2024

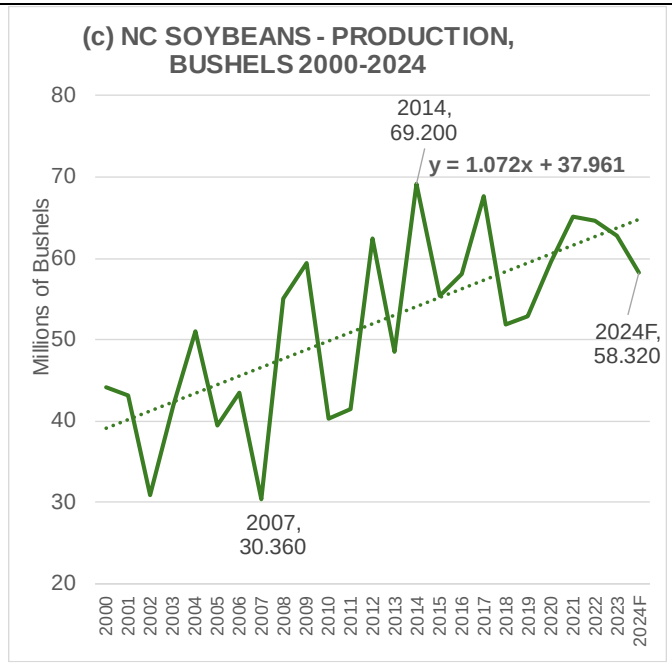
North Carolina Soybean Acres, Yields, Production and Prices 2000-2024						
Year	Acres Planted (Mill)	Acres Harvested (Mill)	Yield (bu)	Production (mill Bu)	Price-Marketing Year ($/bu)	Production (Mill $)
2000	1.400	1.360	32.5	44.200	$4.51	$199.342
2001	1.380	1.350	32.0	43.200	$4.29	$185.328
2002	1.370	1.290	24.0	30.960	$5.63	$174.305
2003	1.450	1.400	30.0	42.000	$7.29	$306.180
2004	1.530	1.500	34.0	51.000	$5.56	$283.560
2005	1.490	1.460	27.0	39.420	$5.64	$222.329
2006	1.370	1.360	32.0	43.520	$6.35	$276.352
2007	1.440	1.380	22.0	30.360	$10.10	$306.636
2008	1.690	1.670	33.0	55.110	$9.33	$514.176
2009	1.800	1.750	34.0	59.500	$9.59	$570.605
2010	1.580	1.550	26.0	40.300	$12.00	$483.600
2011	1.380	1.360	30.5	41.480	$12.10	$501.908
2012	1.590	1.580	39.5	62.410	$14.00	$873.740
2013	1.480	1.450	33.5	48.575	$13.10	$636.333
2014	1.750	1.730	40.0	69.200	$10.20	$705.840
2015	1.820	1.730	32.0	55.360	$8.68	$480.525
2016	1.690	1.660	35.0	58.100	$9.80	$569.380
2017	1.700	1.690	40.0	67.600	$9.50	$642.200
2018	1.650	1.570	33.0	51.810	$8.66	$448.675
2019	1.540	1.510	35.0	52.850	$8.71	$460.324
2020	1.600	1.570	38.0	59.660	$11.20	$668.192
2021	1.650	1.630	40.0	65.200	$13.20	$860.640
2022	1.700	1.680	38.5	64.680	$14.40	$931.392
2023	1.640	1.630	38.5	62.755	$12.90	$809.540
2024F	1.630	1.620	36.0	58.320		
Average	1.573	1.539	33.4	51.903	$9.45	504.629
Min	1.370	1.290	22.0	30.360	$4.29	174.305
Max	1.820	1.750	40.0	69.200	$14.40	931.392
Previous 5-years (2019-2023)	1.626	1.604	38.000	61.029	$12.08	746.018
Source USDA/NASS Quck Stats (https://quickstats.nass.usda.gov/) Accessed Sept 17, 2024						

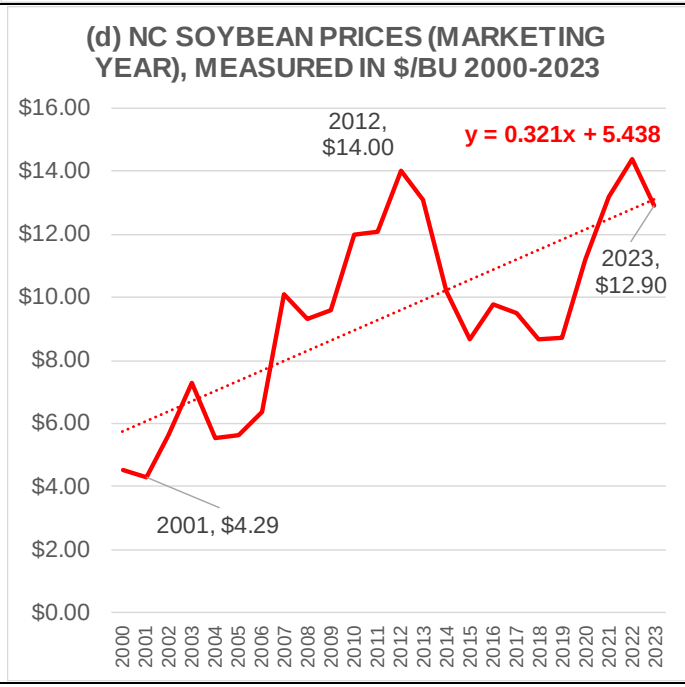
Source: USDA/NASS Quick Stats (Accessed January 2022)

Figure 2-2. North Carolina Soybean Acres, Yields, Production, and Price









U.S. Soybean Situation and Outlook 2024

Table 2-3 shows several highlights concerning the current demand and supply of U.S. soybeans and the outlook for U.S. soybean markets moving into 2024/25. The national soybean crop in 2024 is expected to be 10.2% higher than the previous year's crop, with a total production of 4.589 billion bushels. The higher production level resulted from an increase in acreage to 87.1 million acres (an increase of 4.2% from 2023) and a gain in yields to 53.2 bushels per acre (an increase of 5.1% from 2023). The expected 53.2-bushel yield in 2024 is slightly above the trend yield and will be the highest yield on record. The planted acreage of 87.1 million acres, combined with the record yield, will produce a record 4,586-million-bushel crop. Combining this year's production with beginning stocks of 53.2 million bushels amounts to a total supply of 4,941 million bushels (the second-highest level in history). Expected crushed in 2024/25 is projected at record levels of 2,425 million bushels, representing a 5.7 percent increase from 2023. Expected export levels are projected to be 8.8 percent higher than the previous year at 1,850 million bushels. However, these higher exports are well below the records set in 2020 when they were 2,265 million bushels or 415 million bushels higher. Combining the expected record crush with the improved exports amounts to a total demand of 4,389 million bushels. Despite the record crush and the significant improvement in exports, it will mean adding some bushels to ending stocks with projected ending stocks of 550 million bushels, a 61.8 percent increase from 2023 levels. This significant increase in stocks provides a significant boost to buffer stocks and an increase in ending stocks as a percentage of use to 12.5%, a 51.4% increase over 2023. The higher ending stocks dampen price prospects moving forward, with the U.S. season average prices currently estimated to be $10.80 for 2004/25, $1.70 less than previous years in 2023, or a 13.6 percent decline. These significantly lower prices offset the revenue impacts of the record yields in 2024 for farmers with record yields and contribute to profitability challenges for some growers, especially accentuating farmers experiencing less than record yields.

With production in 2024 outstripping demand for the second year in a row (which has not been the case for the previous three years), as illustrated in Figure 2-5, there is an estimated increase in ending stocks in the past two years of 286 million bushels (76 million in 2023 and 210 million in 2024) which represents in percent terms a 108 percent increase from 264 million bushels in 2022 to 550 million bushels in 2024. Figure 2-5 illustrates that the market, in response to back-to-back years of production outstripping demand and adding to ending stocks, the higher prices averaging $14.20 per bushel in 2022, have declined significantly, retreating $3.40 or a decline of 24 percent for 2024/25. The 2024 ending stocks of 560 million bushels is a substantially greater buffer than the stocks on hand the previous five years prior, where ending stocks averaged 332 million bushels (average taken for 2019/20-2023/24). This build-up of higher ending stocks means the perilous tight supplies the market endured during the three years in 2020, 2021, and 2022, where there had to be considerable demand rationing to avoid running out of soybeans, has passed. The reverse is now true. With the lower prices in 2024/25, we should see continued growth in use and the possibility of fewer soybean acres planted in 2025, all of which will contribute to utilizing and using up these above-average stocks. Ending stocks are back to and even exceed the levels last experienced in 2019 when ending stocks were 525 million and the average market price was $8.57. Interestingly, the prices are projected to be $2.23 per bushel higher in 2024 at $10.80 with ending stocks of 560 million, compared to 2019 when ending stocks were 525 million and average prices were only $8.57 per bushel. This comparison suggests that the current

projection of $10.80 per bushel for 2024 could be overly optimistic, and prices could decline less in 2024 if 2019 is any guide. These lower prices in the 2024/25 marketing year will drag on new crop soybean planting decisions as soybean producers manage lower profits for their 20224 crop and will have limited upside potential on new crop prices in 2025 due to higher stocks. The lower prices for soybeans moving in 2024/25 and beyond without commensurate reductions in production costs will mean lower net returns to soybean producers in 2024/25 and beyond. Not only have U.S stocks of soybeans increased for 2024/25, but so have the ending stocks of the major soybean exporters, having increased to 79 MMT in 2024/25 from 62 MMT, an increase of 27 percent (USDA WASDE September 2024). Thus, higher ending stocks of soybeans domestically and globally in 2024/25 will mean lower soybean prices in the U.S. and worldwide in the shorter run and increased demand for these cheaper soybeans. Upside potential for soybean prices will not occur until these additional stocks are depleted due to the additional demand or future crop production being lowered due to fewer acres being planted in 2025 or unfavorable growing conditions in 2025 and beyond. In sum, current outlook conditions for soybeans reflect current demand and supplies in the U.S. and globally of higher ending stocks and a transition in 2024/25 from a period of higher prices in the past three years into a period of lower prices moving forward due to several years of production outstripping demand and the build-up of ending stocks in the U.S. and globally. These conditions of lower soybean prices without the unlikely commensurate decline in production costs will mean lower returns for U.S. soybean producers in 2024/25 and beyond.

Figure 2-3: U.S. Soybean Production, Demand, Ending Stocks, and Price 2020-2024P

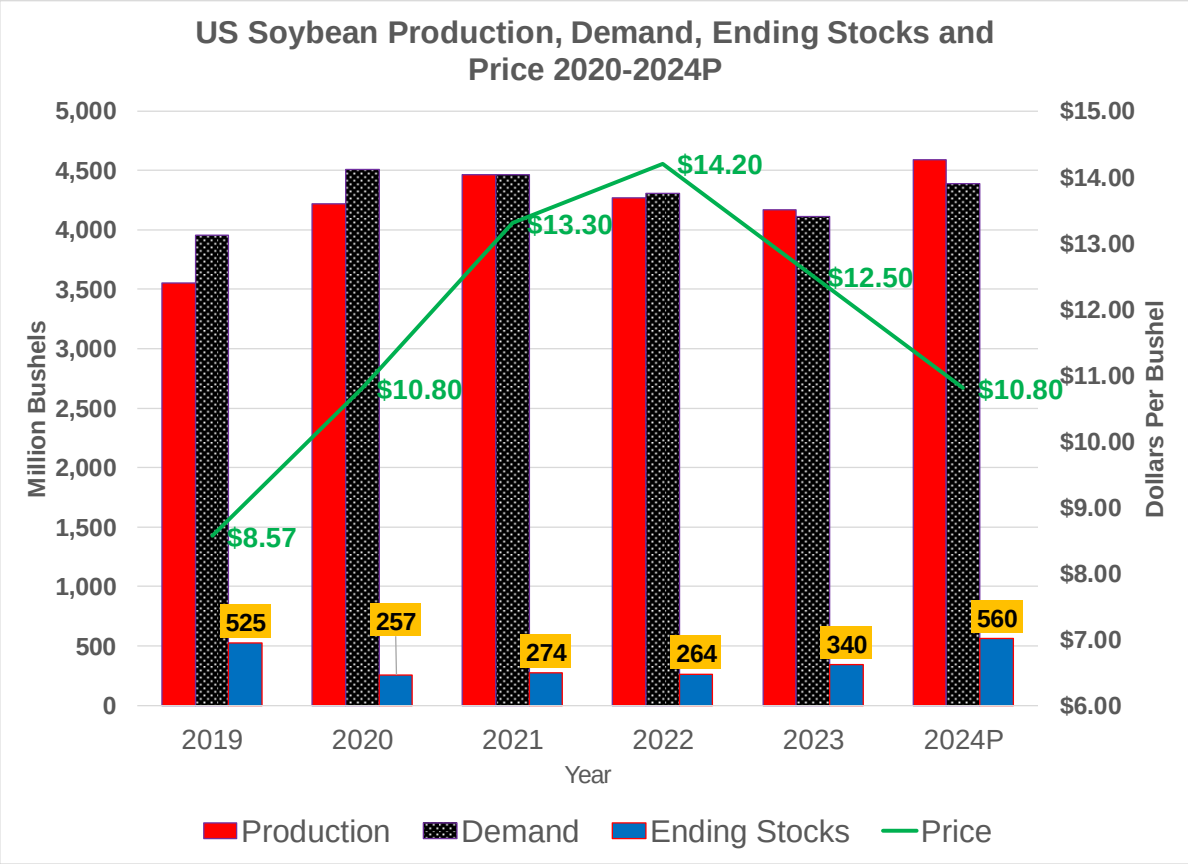


Table 2-3. USDA Supply/Demand Balance Sheet for Soybeans

Category	Item/Use	2022/23	2023/24	2024/25 Proj	%Δ 2024/25 Proj vs.
Production Acreage	Acres Planted (millions of acres)	87.5	83.6	87.1	**4.2%**
	Acres Harvested (millions of acres)	86.2	82.4	86.3	**4.7%**
	Bu/Harvested Acre (millions of acres	49.6	50.6	53.2	**5.1%**
Supply	Beginning Stocks	274	264	340	**28.8%**
	Production	4,270	4,165	4,586	**10.1%**
	Total Supply	**4,569**	**4,449**	**4,941**	**11.1%**
Use	Crushing	2,212	2,295	2,425	**5.7%**
	Exports	1,980	1,700	1,850	**8.8%**
	Seed and Residuals	114	114	116	**1.8%**
	Total Use (Demand)	**4,305**	**4,109**	**4,391**	**6.9%**
Stocks	Ending Stocks	264	340	550	**61.8%**
	Ending Stocks, % of Use	6.1%	8.3%	12.5%	**51.4%**
Pricing	U.S. Season Average Farm Price, $/ Bu	$14.20	$12.50	$10.80	**-13.6%**

Source: World Agricultural Supply and Demand Estimates (WASDE), USDA Sept, 2024

Enterprise Budgets

Variable Costs

The soybean enterprise budgets input costs are based on data collected in the fall of 2024 and is not predictive for the coming year. Actual costs of inputs are subject to change based on supply and demand moving into the planting season. Land rent is not included and should be added based on what each individual grower will pay given their arranged agreements. Consulting services includes the cost for soil sampling, analysis, and scouting per acre. Fertilizer spreading is the cost of one custom application. Maintenance in the title of budget refers to a level of maintenance applied to a given field based on is best historical yield potential. It is assumed that growers apply the best level of care to any given field based on its potential and annual needs.

Equipment Cost

Tractor and machinery costs utilize an average purchase price of equipment assuming it was purchased new three years in the past. New equipment prices are highly variable based on horsepower, brand, equipment specifications, and attachments. Median prices are used given a possible high and low purchase price. All fixed costs of equipment incudes insurance, depreciation, and taxes on an economic basis. This captures the actual costs of the equipment as it is used per hour and is not the same as the

tax liability depreciated out based on schedule F rules. In general, it is assumed power units are used between 300-500 hours annually. Fixed and variable cost of equipment are based on time over field estimates given width of equipment and speed. Speed estimates are based on equipment specifications, specialist recommendations, and grower conversations about actual utilization in the field. The costs that are included assume the actual time for each activity for that specific crop with inefficiencies included for travel, equipment setup, and cleaning. Carrying costs of equipment are not included, but overhead is included to capture some cost that are incurred not directly related to crop planting, maintenance, harvest, and transport.

Gross Receipts

Gross receipts are estimated assuming a futures prices for the fall of 2025 plus the average basis date for the past three years for the state of North Carolina. On average, growers received a $0.32 positive basis above the market price for soybeans between 2022 and 2024. This assumes an average of all sales points for grain across the state. Wheat gross receipts in the double crop budget assume a positive $0.75 basis based off the average corn basis for the state during the same time frame and assumes the crop is sold as feed wheat on contract. Futures prices for wheat in the spring of 2025 were used as a best estimate of possible returns.

Online Budgeting Tools: https://go.ncsu.edu/enterprise-budgets

Please visit our liked site above to find interactive budgets tools. There are a variety of spreadsheets you can download to assist you in planning the 2025 crop year including the crop comparison tool. Included with each budget set are comparison tables that allow you to look at various costs and returns with various crops simultaneously based on your rotational scenarios. If you have any questions, edits, or feedback reach out to Derek Washburn at dawashbu@ncsu.edu or call 919-515-4614

Budget Tables

Table 2-5. Soybean Conventional 2025 — 70 Bushel Actual Yield

Estimated Costs and Returns Per Acre for High Maintenance Soybeans

Category	Item	UNIT	QUANTITY	PRICE OR COST/UNIT	TOTAL PER ACRE	YOUR FARM
1. GROSS RECEIPTS	SOYBEANS	BU.	70	$11.34	$793.80	
	TOTAL RECEIPTS:				**$793.80**	
2. VARIABLE COSTS	SEED (CERTIFIED)	THOU.	130	$0.55	$71.50	
	FERTILIZER, PHOSPHATE (0-46-0)	LBS	122	$0.35	$42.70	
	FERTILIZER, POTASH (0-0-60)	LBS	164	$0.23	$37.72	
	LIME (PRORATED)	TON	0.33	$82.00	$27.06	
	HERBICIDES	ACRE	1	$39.28	$39.28	
	INSECTICIDES	ACRE	1	$22.32	$22.32	
	FUNGICIDES	ACRE	1	$14.44	$14.44	
	FERTILIZER SPREADING	ACRE	1	$12.00	$12.00	
	CONSULTING SERVICES	ACRE	1	$26.00	$26.00	
	HAULING	BU.	70	$0.60	$42.00	
	TRACTOR/MACHINERY	ACRE	1	$78.37	$78.37	

Category	Item	UNIT	QUANTITY	PRICE OR COST/UNIT	TOTAL PER ACRE	YOUR FARM
	LABOR	HRS	1.58	$15.81	$24.98	
	INTEREST ON OP. CAP.	DOL.	$185.19	5.375%	$9.95	
	TOTAL VARIABLE COSTS:				**$448.32**	
3. INCOME ABOVE VARIABLE COSTS:					**$345.48**	
4. FIXED COSTS	TRACTOR/MACHINERY	ACRE	1	$148.34	$148.34	
	TOTAL FIXED COSTS:				$148.34	
5. OTHER COSTS	GENERAL OVERHEAD	DOL.	$448.32	7.0%	$31.38	
	TOTAL OTHER COSTS:				$31.38	
6. TOTAL COSTS:					**$628.04**	
7. NET RETURNS TO LAND, RISK, AND MANAGEMENT:					**$165.76**	

Break-Even Yield
Variable costs: 40 bu.
Total costs: 55 bu.

Break-Even Price
Variable costs: $6.40
Total costs: $8.97

Table 2-6. Soybean Conventional 2025 — 50 Bushel Actual Yield
Estimated Costs and Returns Per Acre for Mid Maintenance Soybeans

Category	Item	UNIT	QUANTITY	PRICE OR COST/UNIT	TOTAL PER ACRE	YOUR FARM
1. GROSS RECEIPTS	SOYBEANS	BU.	50	$11.34	$567.00	
	TOTAL RECEIPTS:				**$567.00**	
2. VARIABLE COSTS	SEED (CERTIFIED)	THOU.	130	$0.50	$65.00	
	FERTILIZER, PHOSPHATE (0-46-0)	LBS	87	$0.35	$30.45	
	FERTILIZER, POTASH (0-0-60)	LBS	117	$0.23	$26.91	
	LIME (PRORATED)	TON	0.33	$82.00	$27.06	
	HERBICIDES	ACRE	1	$39.28	$39.28	
	INSECTICIDES	ACRE	1	$22.32	$22.32	
	FUNGICIDES	ACRE	0			
	FERTILIZER SPREADING	ACRE	1	$12.00	$12.00	
	CONSULTING SERVICES	ACRE	1	$ 26.00	$ 26.00	
	HAULING	BU.	50	$0.60	$30.00	
	TRACTOR/MACHINERY	ACRE	1	$75.23	$75.23	
	LABOR	HRS	1.96	$15.81	$30.99	
	INTEREST ON OP. CAP.	DOL.	$164.62	5.375%	$8.85	
	TOTAL VARIABLE COSTS:				**$394.09**	
3. INCOME ABOVE VARIABLE COSTS:					**$172.91**	
4. FIXED COSTS	TRACTOR/MACHINERY	ACRE	1	$141.81	$141.81	
	TOTAL FIXED COSTS:				$141.81	
5. OTHER COSTS	GENERAL OVERHEAD	DOL.	$394.09	7.0%	$27.59	
	TOTAL OTHER COSTS:				$27.59	
6. TOTAL COSTS:					**$563.49**	
7. NET RETURNS TO LAND, RISK, AND MANAGEMENT:					**$3.51**	

Break-Even Yield
Variable costs: 35 bu.
Total costs: 50 bu.

Break-Even Price
Variable costs: $7.88
Total costs: $11.27

Table 2-8. Soybean No-Till 2025 — 50 Bushel Actual Yield

Estimated Costs and Returns Per Acre for High Maintenance No-Till Soybeans

Category	Item	UNIT	QUANTITY	PRICE OR COST/UNIT	TOTAL PER ACRE	YOUR FARM
1. GROSS RECEIPTS	SOYBEANS	BU.	50	$11.34	$567.00	
	TOTAL RECEIPTS:				**$567.00**	
2. VARIABLE COSTS	SEED (CERTIFIED)	THOU.	130	$0.50	$65.00	
	FERTILIZER, PHOSPHATE (0-46-0)	LBS	87	$0.35	$30.45	
	FERTILIZER, POTASH (0-0-60)	LBS	117	$0.23	$26.91	
	LIME (PRORATED)	TON	0.33	$82.00	$27.06	
	HERBICIDES	ACRE	1	$46.03	$46.03	
	INSECTICIDES	ACRE	1	$22.32	$22.32	
	FUNGICIDES	ACRE	1	$14.18	$14.18	
	CONSULTING SERVICES	ACRE	1	$26.00	$26.00	
	HAULING	BU.	50	$0.60	$30.00	
	TRACTOR/MACHINERY	ACRE	1	$91.21	$91.21	
	LABOR	HRS	2.27	$15.81	$35.89	
	INTEREST ON OP. CAP.	DOL.	$179.53	5.375%	$9.65	
	TOTAL VARIABLE COSTS:				**$424.70**	
3. INCOME ABOVE VARIABLE COSTS:					**$142.30**	
4. FIXED COSTS	TRACTOR/MACHINERY	ACRE	1	$140.01	$140.01	
	TOTAL FIXED COSTS:				$140.01	
	GENERAL OVERHEAD	DOL.	$424.70	7.0%	$29.73	
5. OTHER COSTS	TOTAL OTHER COSTS:				$29.73	
6. TOTAL COSTS:					**$594.44**	
7. NET RETURNS TO LAND, RISK, AND MANAGEMENT:					**-$27.44**	

Break-Even Yield

Variable costs: 37 bu.

Total costs: 52 bu.

Break-Even Price

Variable costs: $8.49

Total costs: $11.89

Table 2-9. Soybean/Wheat Conventional 2022 — 35/60 Bushel Actual Yield

Estimated Costs and Returns Per Acre for Soybean/Wheat

Category	Item	UNIT	QUANTITY	PRICE OR COST/UNIT	TOTAL PER ACRE	YOUR FARM
1. GROSS RECEIPTS	SOYBEANS	BU.	35	$11.34	$396.90	
	WHEAT	BU.	60	$7.01	$420.60	
	TOTAL RECEIPTS:				**$817.50**	
2. VARIABLE COSTS	SEED (WHEAT)	BU.	2	$22.50	$45.00	
	SEED (SOYBEANS)	THOU.	150	$0.55	$82.50	
	FERTILIZER, UAN-32	LBS	235	$.42	$98.70	
	FERTILIZER, PHOSPHATE (0-46-0)	LBS	66	$0.35	$23.10	
	FERTILIZER, POTASH (0-0-60)	LBS	37	$0.23	$8.51	
	LIME (PRORATED)	TON	0.33	$82.00	$27.06	
	HERBICIDES	ACRE	1	$33.94	$33.94	
	INSECTICIDES	ACRE	1	$26.77	$26.77	
	FUNGICIDES	ACRE	1	$18.58	$18.58	
	FERILIZER SPREADING	ACRE	1	$12.00	$12.00	
	CONSULTING SERVICES	ACRE	1	$26.00	$26.00	
	HAULING	BU.	95	$0.60	$57.00	
	TRACTOR/MACHINERY	ACRE	1	$160.44	$160.44	
	LABOR	HRS	3.4	$15.81	$53.75	
	INTEREST ON OP. CAP.	DOL.	$289.18	5.375%	$15.54	
	TOTAL VARIABLE COSTS:				**$688.89**	
3. INCOME ABOVE VARIABLE COSTS:					**$128.61**	
4. FIXED COSTS	TRACTOR/MACHINERY	ACRE	1	$173.51	$173.51	
	TOTAL FIXED COSTS:				$173.51	
5. OTHER COSTS	GENERAL OVERHEAD	DOL.	$688.89	7.0%	$48.22	
	TOTAL OTHER COSTS:				$48.22	
6. TOTAL COSTS:					**$910.62**	
7. NET RETURNS TO LAND, RISK, AND MANAGEMENT:					**-$93.12**	

Break-Even Yield

Variable costs: 92 bu.

Total costs: 124 bu.

Break-Even Price

Variable Costs: $10.68

Total Costs: $14.32

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