

# The Impact of Fertilizer and Fuel Price Changes on Expected Costs and Returns for Arkansas Row Crops

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Fertilizer and fuel represent major agricultural inputs across all agricultural enterprises. In recent months, prices for these inputs have soared to historically high – in many cases record – levels. This surge in prices has been the result of several factors. First, inflationary pressure has emerged across the economy with the waning of the COVID pandemic, as pent-up demand interacts with ongoing supply chain disruptions to result in higher prices on a wide variety of products. Second, bullish market fundamentals in both the fertilizer and fuel markets have supported higher prices for these products. In fuel markets, increasing demand due to a resumption of more normal travel patterns along with declining domestic production have supported higher prices. In fertilizer markets, the strong outlook for commodity prices that began to emerge last fall set the stage for strong fertilizer demand and higher prices. Finally, and most dramatically, the Russian invasion of Ukraine and the severe economic sanctions consequently imposed on Russia represent a major disruption of both fuel and fertilizer markets due to Russia's status as a major producer and exporter in both product markets.

Farmers generally make plans for the upcoming growing season throughout the late-fall and early winter. The sharp increases in fertilizer and fuel prices since that time have significantly altered expectations related to the costs and returns of crop production for the current growing season. To assess the potential financial impact of changing input prices, we have updated crop enterprise budgets for Arkansas' four largest row crops to account for increased fertilizer and fuel prices. This article focuses on these revised cost and return expectations related to the state's major crops.

### **Recent Impacts on Agricultural Commodities, Fertilizers and Energy Markets:**

Following the February 24<sup>th</sup> Russian invasion of Ukraine, sharp price increases in fertilizer and fuel have occurred. We believe these cost increases have been significant enough to warrant revisions to our initial enterprise budgets released in November 2021. In addition to input cost increases, wheat and corn prices have reached new highs in recent weeks.

## Grain Prices:

Russia and Ukraine play a significant role in global agriculture trade. According to data from USDA Foreign Agricultural Service, over the past five years, these two countries have accounted for nearly 20% of global corn exports and about 30% of global wheat exports. Following the invasion of Ukraine, sanctions on Russia have effectively removed its grain production from the global export market. Furthermore, Ukraine's ability to export grain has been shut down. Nearly half of Ukraine's projected corn exports – between 13 and 14 million tons – was still in storage when Russia invaded and overseas shipments stopped.

Of further concern to grain markets is Ukraine's inability to secure resources for crop production in the coming months. The UN Food and Agriculture Organization estimates that 20% to 30% of Ukraine's winter wheat, corn and sunflower crops may not be planted or else go unharvested this year, and yields may also be reduced (United Nations, 2022). Under normal circumstances, Ukraine would begin its wheat harvest in late June or early July. Corn planting would begin in early to mid-April.

Trade disruptions and future production uncertainty have pushed global wheat prices to record levels and lifted corn prices to within reach of all-time highs. Rising corn and wheat prices have in turn supported prices of other agricultural commodity such as soybeans, rice and cotton. Since the Ukraine conflict materialized, the price of wheat and corn futures contracts on the Chicago Board of Trade (CBOT) has risen 24% and 8% respectively. Uniformly tight supplies for all major commodities have led to competitive bidding for 2022 acreage. Soybean prices have held mostly firm, while rice and cotton prices have increased nearly 6% over the past month.

**Table 1. Agricultural Commodity Price Changes Following Invasion of Ukraine.**

	Futures Month	Feb. 23, 2022	Mar. 21, 2022	\$ change	% change
<i>Wheat (\$/bu.)</i>	July '22	\$8.78 <sup>3</sup> / <sub>4</sub>	\$10.93	\$2.14	24.4%
<i>Corn (\$/bu.)</i>	Sept. '22	\$6.28 <sup>3</sup> / <sub>4</sub>	\$6.81 <sup>3</sup> / <sub>4</sub>	\$0.53	8.4%
<i>Soybeans (\$/bu.)</i>	Nov. '22	\$14.87 <sup>1</sup> / <sub>2</sub>	\$14.90	\$0.03	0.2%
<i>Rice (\$/cwt.)</i>	Sept. '22	\$14.99 <sup>1</sup> / <sub>2</sub>	\$15.85 <sup>1</sup> / <sub>2</sub>	\$0.86	5.7%
<i>Cotton (\$/lb)</i>	Dec. '22	\$1.0248	\$1.0816	\$0.06	5.5%

Source: Chicago Board of Trade and Intercontinental Exchange.

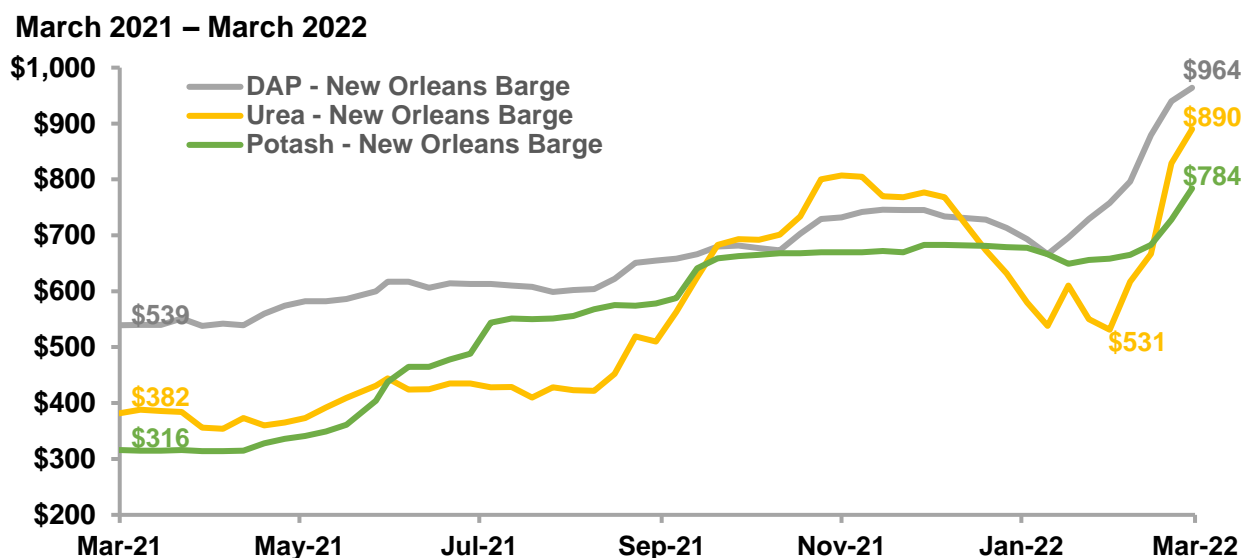
It is unknown at this time how long the current conflict will persist or when normal agricultural production and trade will resume in the Black Sea region. Answers to these questions will dictate the path of grain and oilseed prices over the coming months.

## Fertilizers:

Interruptions in fertilizer trade and production turned prices higher following the beginning of conflict in Ukraine. Russia plays a significant role in world fertilizer trade. This role has taken on added importance since September 2021 when China imposed significant restrictions on its urea and phosphate exports. These trade restrictions by China are expected to remain in place through the end of June 2022. Thus, global fertilizer availability was already viewed as tight prior to the Russian invasion of Ukraine. According to data from the International Food Policy Research Institute (IFPRI), Russia accounts for 11% and 14% of global phosphate and urea trade. Russia has previously accounted for 15% of U.S. nitrogen imports. Sanctions are hindering exports from Russia and Belarus which historically account for 19% and 21% of global potash trade. Moreover, the increase in the price of natural gas in Europe related to Russian sanctions has led to the closure of some nitrogen plants there.

Following the February 24<sup>th</sup> invasion of Ukraine, fertilizer prices at the U.S. Gulf increased sharply, with Urea increasing \$359 per ton or 68% in the four (4) weeks following the invasion. Urea (46-0-0) barge prices are now \$508 or 133% higher than one year ago. Di-Ammonium Phosphate (DAP, 18-46-0) and Potash (0-0-60) have also increased since February 24<sup>th</sup> by 27% and 19% respectively. However, prices for DAP and Potash had begun to increase in the weeks leading up to the invasion. Fertilizer prices are expected to remain elevated in the short term on interruptions in the global export market.

**Figure 1. U.S. Gulf, Fertilizer Prices (\$/ton).**



Source: Green Markets, Mosaic Corporation.

## Energies:

Since February 24<sup>th</sup>, oil prices have built in a meaningful geopolitical risk premium. Russia accounts for around 12% of global oil trade, making it the world's largest exporter and third-largest oil producer. Russia produced about 11% of the world's oil supply and 37% of Europe's natural gas supply last year. The combination of disruption and uncertainty continues to underpin global energy prices. Global oil markets and international gas markets had already been tightening for the past 12 to 24 months as COVID began to unwind and economies opened. West Texas Intermediate (WTI) crude oil, as well as the major fuel markets, such as diesel, have experienced added volatility in recent weeks—with WTI rising above \$130 per barrel and falling below \$100 per barrel at times. The chart below of New York Mercantile Exchange (NYMEX) diesel futures illustrates price trends over the past six (6) months and the recent increase in price volatility. Most notable is the steep \$1.60 per gallon spike and correction in early March. Diesel futures prices currently trade near \$3.80 per gallon.

**Figure 2. NYMEX Diesel, Daily Nearby Contract**



Source: barchart.com

## Production Costs for Major Row Crops:

Production costs for the major row crops grown in Arkansas are projected to reach all-time highs in 2022. The following tables include the revised 2022 *Cost of Production* estimates for rice, corn, soybeans and cotton. Tables 2a thru 5b compare 2022 projected costs with 2021 and the previous 5-year average variable costs.

## Rice Variable Costs:

Table 2a contains estimates of variable costs for conventional hybrid rice. All cost estimates in the following tables are taken from the University of Arkansas enterprise budgets. Table 2a includes a simple five-year average of variable costs from 2017 to 2021, estimated 2021 costs, and projections for 2022.

For 2022, total variable costs for rice are projected at \$990 per acre, up \$318 per acre or 47% from the 2021 level of \$672 per acre. Fertilizer at \$259 per acre is the single largest component of variable costs for rice, making up 26% of the total. Fuel accounts for roughly 16% of variable costs. “Other” costs include: custom application, repairs, labor, crop insurance, drying and hauling.

**Table 2a. Rice, conventional hybrid: variable costs for 2022, 2021 and 5-year average.**

unit: \$/acre	5-Year Avg.	2021	2022 P
seed	\$ 147	\$ 135	\$ 143
fertilizer	\$ 100	\$ 94	\$ 259
chemicals	\$ 87	\$ 111	\$ 152
fuel	\$ 91	\$ 67	\$ 161
other	\$ 236	\$ 264	\$ 276
<b>Total Variable Costs</b>	<b>\$ 661</b>	<b>\$ 672</b>	<b>\$ 990</b>

The largest year-over-year cost increase is seen in fertilizer, which is projected to increase \$165 per acre or 175% from 2021 (Table 2b). Fuel costs are also projected to increase sharply in 2022, increasing \$94 per acre or 141% over last year. Chemical and seed costs in 2022 are projected to increase by 36% and 6% respectively over 2021 levels. At \$990 per acre, 2022 variable costs would be \$330 per acre above the previous five-year average of \$661 per acre – a 50% increase.

**Table 2b. Rice, conventional hybrid: 2022 costs compared to 2021 and 5-year average.**

	2022 Proj.	\$/ac. change v. 5-yr Avg.	\$/ac. change v. 2021	% change v. 5-yr avg.	% change v. 2021
seed	\$ 143	<b>(-\$4)</b>	\$8	<b>(-3%)</b>	6%
fertilizer	\$ 259	\$159	\$165	159%	175%
chemicals	\$ 152	\$65	\$40	75%	36%
fuel	\$ 161	\$70	\$94	77%	141%
other	\$ 276	\$40	\$12	17%	5%
<b>Total Variable Costs</b>	<b>\$ 990</b>	<b>\$330</b>	<b>\$318</b>	<b>50%</b>	<b>47%</b>

### Corn Variable Costs:

Driven largely by substantial increases in fertilizer, 2022 total variable costs for corn are projected at \$888 per acre (Table 3a.). This would be an increase of \$364 per acre or 69% from 2021. Fertilizer at \$434 per acre is the single largest component of variable costs for corn, making up 49% of the total. “Other” costs include: custom application, repairs, labor, crop insurance, drying and hauling.

**Table 3a. Corn, stacked gene, furrow irrigation, variable costs 2022, 2021 and 5-year average.**

unit: \$/acre	5-Year Avg.	2021	2022 P
seed	\$ 120	\$ 112	\$ 120
fertilizer	\$ 161	\$ 156	\$ 434
chemicals	\$ 51	\$ 53	\$ 67
fuel	\$ 49	\$ 36	\$ 89
other	\$ 169	\$ 167	\$ 178
<b>Total Variable Costs</b>	<b>\$ 550</b>	<b>\$ 524</b>	<b>\$ 888</b>

Fertilizer costs for 2022 are projected to increase \$278 per acre or 179% from last year. Fuel cost is also projected to be well above 2021 levels, increasing 143% or \$52 per acre. Chemical and seed costs for 2022 are projected to increase by 27% and 7%, respectively, over 2021 levels. At \$888 per acre, total variable costs would be 61% above the previous 5-year average of \$550/acre.

**Table 3b. Corn, stacked gene, furrow irrigation, variable costs: 2022 costs compared to 2021 and 5-year average.**

	2022 Proj.	\$/ac. change v. 5-yr Avg.	\$/ac. change v. 2021	% change v. 5-yr avg.	% change v. 2021
seed	\$ 120	\$ 0	\$ 8	0%	7%
fertilizer	\$ 434	\$ 273	\$ 278	170%	179%
chemicals	\$ 67	\$ 16	\$ 15	31%	27%
fuel	\$ 89	\$ 39	\$ 52	80%	143%
other	\$ 178	\$ 9	\$ 11	5%	6%
<b>Total Variable Costs</b>	<b>\$ 888</b>	<b>\$ 338</b>	<b>\$ 364</b>	<b>61%</b>	<b>69%</b>

### Soybean Variable Costs:

For 2022, total variable costs for soybeans are projected at \$463 per acre, up \$137 per acre or 42% from the 2021 level of \$326 per acre (Tables 4a and 4b). Chemical expense is the single largest component of variable costs for soybeans, making up 28% of the total. Increases in chemical costs over the past year have largely been the result of supply-chain disruptions and increases in transportation costs. Projected fuel and fertilizer costs are expected to increase significantly over 2021 levels. At \$463 per acre, projected variable costs are well above the previous five-year average of \$339 per acre.

**Table 4a. Soybeans, Roundup Ready, furrow irrigation: variable costs for 2022, 2021 and 5-year average.**

unit: \$/acre	5-Year Avg.	2021	2022 P
seed	\$ 70	\$ 74	\$ 83
fertilizer	\$ 34	\$ 31	\$ 86
chemicals	\$ 109	\$ 108	\$ 129
fuel	\$ 41	\$ 33	\$ 80
other	\$ 86	\$ 79	\$ 85
<b>Total Variable Costs</b>	<b>\$ 339</b>	<b>\$ 326</b>	<b>\$ 463</b>

Shown in Table 4b, variable costs with the largest year-over-year increases are fertilizer and fuel, which are projected to increase 181% and 143% respectively. Chemical and seed costs in 2022 are projected to increase by 19% and 11% respectively over 2021 levels.

**Table 4b. Soybeans, Roundup Ready, furrow irrigation: 2022 costs compared to 2021 and 5-year average.**

	2022 Proj.	\$/ac. change v. 5-yr Avg.	\$/ac. change v. 2021	% change v. 5-yr avg.	% change v. 2021
seed	\$ 83	\$12	\$8	18%	11%
fertilizer	\$ 86	\$53	\$56	156%	181%
chemicals	\$ 129	\$20	\$21	19%	19%
fuel	\$ 80	\$39	\$47	96%	143%
other	\$ 85	<b>(-\$0.3)</b>	\$6	<b>(-0.3%)</b>	7%
<b>Total Variable Costs</b>	<b>\$ 463</b>	<b>\$ 124</b>	<b>\$ 137</b>	<b>37%</b>	<b>42%</b>



### Cotton Variable Costs:

Total variable costs for cotton in the upcoming year are projected at \$753 per acre, up \$208 per acre or 38% from last year (Tables 5a and 5b.). Chemical expense is the single largest component of variable costs for cotton, making up 29% of the total. However, fertilizer costs will be significant as well in 2022 at \$201 per acre, an increase of 174% from 2021 levels. Projected fuel costs are expected to increase by roughly \$50 per acre or 142% in 2022. At \$753 per acre, projected variable costs are 30% above the previous five-year average of \$580 per acre.

**Table 5a. Cotton, B2XF, furrow irrigation: variable costs for 2022, 2021 and 5-year average.**

Unit: \$/acre	5-Year Avg.	2021	2022 P
seed	\$ 119	\$ 119	\$ 133
fertilizer	\$ 78	\$ 73	\$ 201
chemicals	\$ 221	\$ 212	\$ 221
fuel	\$ 54	\$ 36	\$ 86
other	\$ 109	\$ 104	\$ 111
<b>Total Variable Costs</b>	<b>\$ 580</b>	<b>\$ 544</b>	<b>\$ 753</b>

**Table 5b. Cotton, B2XF, furrow irrigation: 2022 costs compared to 2021 and 5-year average.**

	2022 Proj.	\$/ac. change v. 5-yr Avg.	\$/ac. change v. 2021	% change v. 5-yr avg.	% change v. 2021
seed	\$ 133	\$ 14	\$ 14	12%	12%
fertilizer	\$ 201	\$ 123	\$ 127	157%	174%
chemicals	\$ 221	\$ 0	\$ 9	0%	4%
fuel	\$ 86	\$ 33	\$ 51	61%	142%
other	\$ 111	\$ 3	\$ 7	2%	7%
<b>Total Variable Costs</b>	<b>\$ 753</b>	<b>\$ 173</b>	<b>\$ 208</b>	<b>30%</b>	<b>38%</b>

## 2022 Projected Returns:

Tables 6 and 7 provide a comparison of returns over variable costs for the major row crops in 2022.<sup>1</sup> Returns in Table 6 are based on the producer receiving 100% of production. Table 7 provides a comparison of returns under a 75% / 25% share rent arrangement.<sup>2</sup>

**Table 6. Comparison of Returns Over Variable Costs, 100% Producer Share.**

<i>Commodity</i>	<b>Rice</b>	<b>Corn</b>	<b>Soybeans</b>	<b>Cotton</b>
	hybrid	furrow irrigated	furrow irrigated	furrow irrigated
<i>Expected Yield</i>	190	215	60	1250
<i>Producer Share of Yield</i>	100%	100%	100%	100%
<i>Futures Price</i>	\$7.14	\$6.82	\$14.90	\$1.08
<i>Basis</i>	<b>(-0.14)</b>	0.12	0.22	0.00
<i>Projected Cash Price</i>	\$7.00	\$6.94	\$15.12	\$1.08
<i>Producer Share of Production</i>	190	215	60	1250
<i>Gross Revenue</i>	\$1,330	\$1,492	\$907	\$1,350
<i>Total Variable Costs</i>	\$990	\$887	\$463	\$753
<i>Returns Over Variable Costs</i>	<b>\$340</b>	<b>\$604</b>	<b>\$444</b>	<b>\$597</b>

Notes: Futures prices correspond to the following contracts: corn and rice, September 2022; soybeans, November 2022; cotton, December 2022. Basis for corn and soybeans was for fall delivery to Mississippi River terminals. Rice basis was for fall delivery to any eastern Arkansas mill location (Stuttgart, Waldenburg, or Jonesboro). No basis was included for cotton.

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<sup>1</sup> For purposes of projecting gross revenues, yields were based on high productivity soils and intensive management. Futures prices were daily settlements for March 21, 2022. Grain basis for corn and soybeans was obtained from elevators located along the Mississippi River. Grain basis is normally stronger at elevators located along the Mississippi River compared to elevators on the Arkansas River or smaller interior elevators. Rice basis was determined from fall 2022 delivery bids to mill facilities in eastern Arkansas. The projected cotton price was derived from the daily settlement of the December 2022 futures contract. No basis was included.

<sup>2</sup> In eastern Arkansas, farm rents are predominantly crop share, wherein the landowner receives a percentage of the crop as rental payment. In some instances, crop input costs are shared between the landowner and the tenant. However, the predominant arrangement in the region is a “net” share, in which the landowner does not contribute to input costs. A 25% net crop share is the most common share lease structure for eastern Arkansas. That is the lease arrangement this is evaluated here. Total variable costs for rice and corn under this lease arrangement differ from the 100% producer share due to differences in drying costs on the landowner’s share of production.

**Table 7. Comparison of Returns Over Variable Costs, 75% Producer Share.**

<b>Commodity</b>	<b>Rice</b>	<b>Corn</b>	<b>Soybeans</b>	<b>Cotton</b>
	hybrid	furrow irrigated	furrow irrigated	furrow irrigated
<i>Expected Yield</i>	190	215	60	1250
<i>Producer Share of Yield</i>	75%	75%	75%	75%
<i>Futures Price</i>	\$7.14	\$6.82	\$14.90	\$1.08
<i>Basis</i>	(0.14)	0.12	0.22	0.00
<i>Projected Cash Price</i>	\$7.00	\$6.94	\$15.12	\$1.08
<i>Producer Share of Production</i>	143	161	45	938
<i>Gross Revenue</i>	\$998	\$1,119	\$680	\$1,013
<i>Total Variable Costs</i>	\$971	\$876	\$463	\$753
<i>Returns Over Variable Costs</i>	<b>\$27</b>	<b>\$242</b>	<b>\$218</b>	<b>\$260</b>

Tables 6 and 7 project positive returns over variable costs for all crops. However, based on current input and crop prices, expected returns for corn, cotton and soybeans appear more favorable than expected returns for rice in both land tenure scenarios. Comparative differences in returns among rice and other commodities are more pronounced in a 75/25 net share rent situation. While gross revenue for rice is comparable to corn, cotton, and soybeans, significantly higher input costs for rice erode net returns in a typical share rent arrangement. Given its considerably lower total variable costs relative to the other crops considered here, soybean returns look particularly favorable under net share lease terms.

Total variable costs for major row crops are projected to reach all-time highs in 2022. Individual farm returns will be highly influenced by the timing of key input purchases, particularly fuel and fertilizer, and commodity marketing decisions. Producers are encouraged to re-evaluate comparative crop returns considering the recent volatility in commodity prices and input costs. Updated *2022 Cost of Production Estimates* can be found on the University of Arkansas' Cooperative Extension Service website at this link: [Arkansas Field Crop Enterprise Budgets](#) . Enterprise budgets for the major row crops are available for download in Microsoft *Excel* format.

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