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Commodity Intelligence Report

Brazil Wheat: Consecutive Years with Record Production Anticipated in MY 2022/23

Multiple factors have converged to lead to a large projected increase in wheat planted area for MY 2022/23 in Brazil. The primary reason is a historic rise in global wheat prices, 60 percent higher than at the beginning of the year (Figure 1), due to Russia's invasion of Ukraine (the fifth largest exporter globally). Other motivations are internal to Brazil; one is connected to the push for self-reliance because half of the domestic consumption has to be imported. The other driving factor is the demand for domestic animal feed. The government agricultural research institute, Embrapa, has developed several wheat cultivars to meet the forage demand in southern Brazil. The main variety grown though is common wheat, Triticum aestivum L., primarily used for bread making.

For MY 2022/23, USDA estimates a 17 percent increase in planted area for Brazil wheat (Figure 2) at 3.2 million hectares (mha), and another year with a record production of 8.5 million metric tons (mmt), 10 percent larger than the previous year's record crop of 7.7 mmt. Yield is estimated at 2.66 tons per hectare (t/ha). This would be the largest wheat area in Brazil in three decades; the most recent year when area was above 3.0 mha was in 1990/91 (Figure 2). Some of this area expansion will occur in the traditional rainfed wheat growing areas of southern Brazil, where the temperate climate is relatively more suitable for wheat cultivation (see next section on challenges). However, there is more area available in the tropical savannah of the *cerrado* when used in rotation with other crops. Moreover, the new high-yielding short-season varieties being developed by Embrapa are specifically adapted for irrigation in the tropical *cerrado* region (Figure 3). These cultivars are adapted to the large temperature swings and tolerance for aluminum in soils.

The two states comprising over 87 percent of total production are Paraná (about 50 percent of production) and Rio Grande do Sul (over 35 percent of production; Figure 4). São Paulo and Minas Gerais usually rank third and fourth respectively, together accounting for another 13 percent of national production. Planting begins in late April for Paraná and several other states, with harvest taking place from September through November. In Rio Grande do Sul, planting is generally a little later in May and June, following completion of the soybean harvest; wheat harvest occurs from October through early December. As of late-July, planting is complete in Paraná and 90 percent complete in Rio Grande do Sul. Planted area in the state of Rio Grande do Sul is the largest since MY 1979/80 and 15 percent larger than last year (Figure 5b).

The Department of Rural Economics (SEAB/DERAL) in Paraná estimates wheat production of 3.9 mmt for MY 2022/23 versus 3.2 mmt in MY 2021/22, a 21 percent increase on a reduced area of 1.2 mha (5 percent lower than last year). The state agency for Rio Grande do Sul, EMATER-RS, reports a consecutive record wheat crop of 3.8 mmt (13 percent larger than last year) on an area of 1.4 mha (15 percent larger than last year) at the start of the season (Figure 5a). The *Companhia Nacional de Abastecimento* (CONAB, an agency in the Brazilian Ministry of Agriculture) currently reports a 21 percent production increase for Paraná and 13 percent increase for Rio Grande do Sul, with both states' production roughly at 3.9 mmt. Compared to last year, national wheat area reported by CONAB is 7 percent larger at 2.9 mha, national production is 18 percent larger at 9.0 mmt, and yield is 10 percent higher at 3.09 t/ha. This level of production would meet over 65 percent of domestic consumption for Brazil, the 8th largest global importer of wheat.

Challenges to Wheat Production in Brazil

There is often the risk of adverse weather events affecting productivity potential for wheat grown during the southern hemisphere winter months in a temperate climate zone. Harvested area can differ from planted area by as much as 12 percent (Junior et al. 2021). Although initial yield prospects are often favorable, frost events that occur at flowering or grain-filling crop development stages often result in notable yield losses. Additionally, as the wheat crop is rainfed in southern Brazil, an ill-timed drought during reproductive stages can significantly impact yields. For example, a mid-season drought in 2006/07 and 2017/18 reduced outputs between 30 to 45 percent (Figure 6). Drought combined with heat stress further exacerbates these losses. Lastly, the wheat crop matures during the months of September through November, when there is a high probability of heavy rainfall that can also lower yields from higher pathogen and disease load, and reduce grain quality.

Yields in the *cerrado* biome in central Brazil (Figure 3) tend to be lower than in southern Brazil, and farmers need to build up soil fertility by applying lime, to lower soil acidity, and fertilizers. The high cost of fertilizers at the moment could be a barrier for small producers. However, a high adoption of new seed technology combined with better suited cultivars for the *cerrado* will continue to drive yields higher in this region. Finally, the insufficient number of mills to process the grain and high transport costs could pose short-term roadblocks for increases in the wheat area in central Brazil.

Summary of MY 2021/22

For the 2021/22 season, wheat production expectations were optimistic as the season began with a 17 percent acreage expansion from the prior year, and about 31 percent above the five-year average (Figure 7). However, lingering drought early in the wheat season combined with three separate frost events in Paraná, reduced yields by about 20 percent from initial expectations. The timing of frost events damaged the crop that was in sensitive reproductive stages as visualized with the 8-day satellite-derived Normalized Difference Vegetation Index (NDVI) for late August to early September (Figure 8). Lower

NDVI values are observed across central Paraná (brown to red hues) versus higher values (green hues) in Rio Grande do Sul and Santa Catarina, signaling healthier vegetation. The crop in Rio Grande do Sul was spared by a later sowing calendar. Although this state also experienced freezing temperatures, the wheat crop was mostly in earlier vegetative stages that are less susceptible to frost. Therefore, yields in Rio Grande do Sul and Santa Catarina showed double-digit gains over the five-year average (Figure 9). The states of the *cerrado* region displayed yields ranging from 8 to 50 percent below the five-year averages due to low moisture availability during the growing season.

Nevertheless, the national wheat production was still a record for Brazil at 7.7 mmt on 2.74 mha, 38 percent above the five-year average. The largest year-over-year production gains were in the southern states of Rio Grande do Sul and Santa Catarina of 1.2 and 0.16 mmt respectively (55 percent and 86 percent, Figure 9). The 338,000 metric tons in Santa Catarina was a record production for the state. Corresponding to the area expansion, the state of Rio Grande do Sul also displayed the largest production increase over five years of roughly 1.5 mmt (73 percent), followed by Paraná at 470,000 tons (17 percent).

Historic Trends and Future Expectations

Wheat area decreased sharply since the mid to late 1980s when it achieved a record of 3.82 mha in 1986/87 and reached a low of 1.04 mha in 1995/96 (Figure 10). After rebounding somewhat in the early 2000s, area has fluctuated annually in response to grain prices. The greatest expansion was in the two largest wheat producing states; Rio Grande do Sul increased acreage by almost 400,000 hectares in the last 5 years (52 percent) and Paraná by 158,000 hectares (15 percent, Figure 7). Both of these major wheat producers also saw positive yield growth over the last 5 years (Figure 9). In comparison, while area has grown steadily in the *cerrado* states (Figure 11, 12), the yield picture is more mixed; while average yields are lower than in the southern states, a small farm in Goiás achieved a global yield record in kg/ha/day at 9.6 kg/ha in 110 days. These central states benefitted from the newer cultivars adapted for the *cerrado* climate by Embrapa, with Goiás expanding area by 43,000 hectares (over 300 percent) and Minas Gerais expanding area by 51,000 hectares (over 200 percent) in the last decade (Figure 11). National area in the last decade grew by 11 percent while production grew by 32 percent, reflecting improvements in productivity despite the challenges. Just 40 years ago, yields were below 0.9 t/ha compared to over 3.0 t/ha today.

The long term trends for Brazil wheat are greater area expansion, with possible doubling or tripling of area in the *cerrado,* along with investments in irrigation methods to improve yields. Roraima, Ceará, Piauí and Maranhão are some of the states that appear as new frontiers for wheat. Initial trials with a 66-day cultivar from Embrapa showed yields of 3.0 t/ha in Roraima (Noticias Agricolas 2022). However, production will remain concentrated in southern Brazil even with the challenges of drought, frost, and heavy rains at harvest. Additionally, climate models project an increased frequency of drought events during planting from April to May and a rise in maximum monthly mean temperatures during critical reproductive crop stages in July and August (Junior et al. 2021). This is likely to

dampen yield prospects for wheat and Brazil's long-term goals to become self-sufficient in wheat over the next 10 years.

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MercoPress 2022. Brazil planning to become a net exporter of wheat, harvesting a volume similar to that of Argentina, https://en.mercopress.com Accessed May 30 2022.

Figure 1. Global wheat prices surged in late February following the Ukraine invasion. Source tradingeconomics.com.

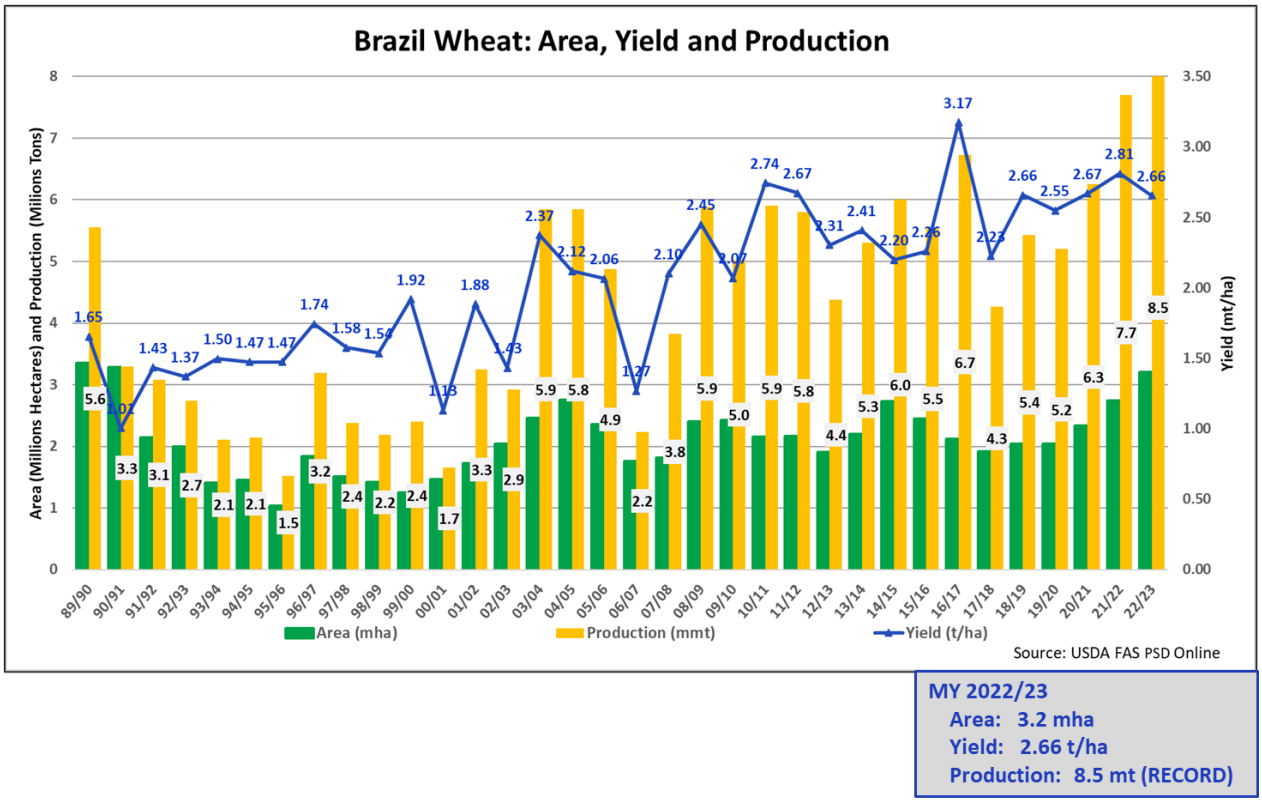


Figure 2. Brazil Wheat Area, Yield and Production time series chart over 30 years. Wheat area for MY 2022/23 is the largest since 1990/91. Source USDA PSD Online.

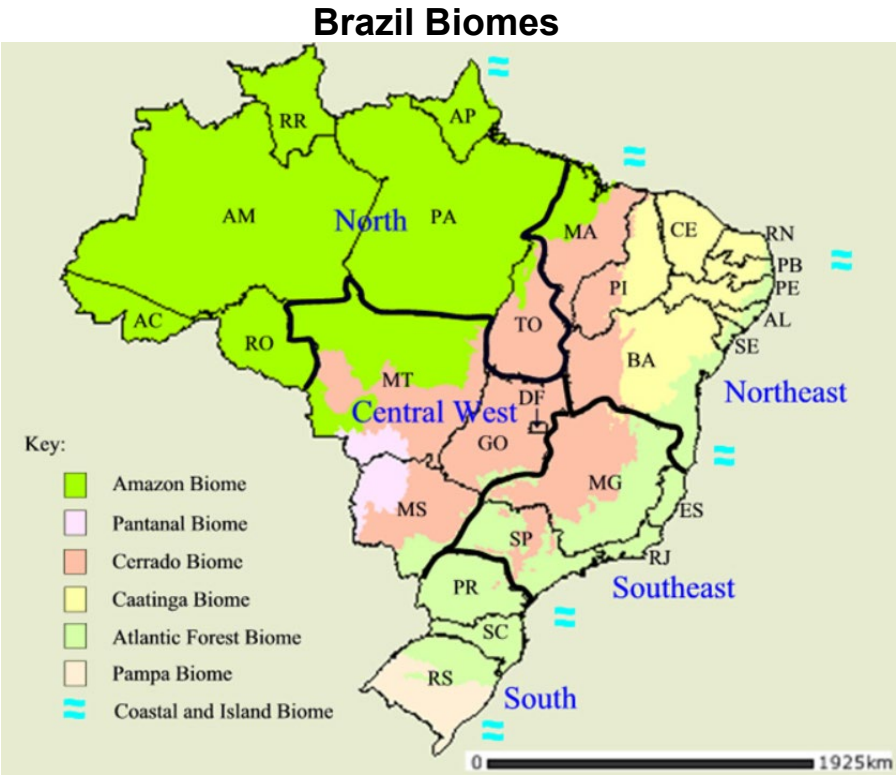
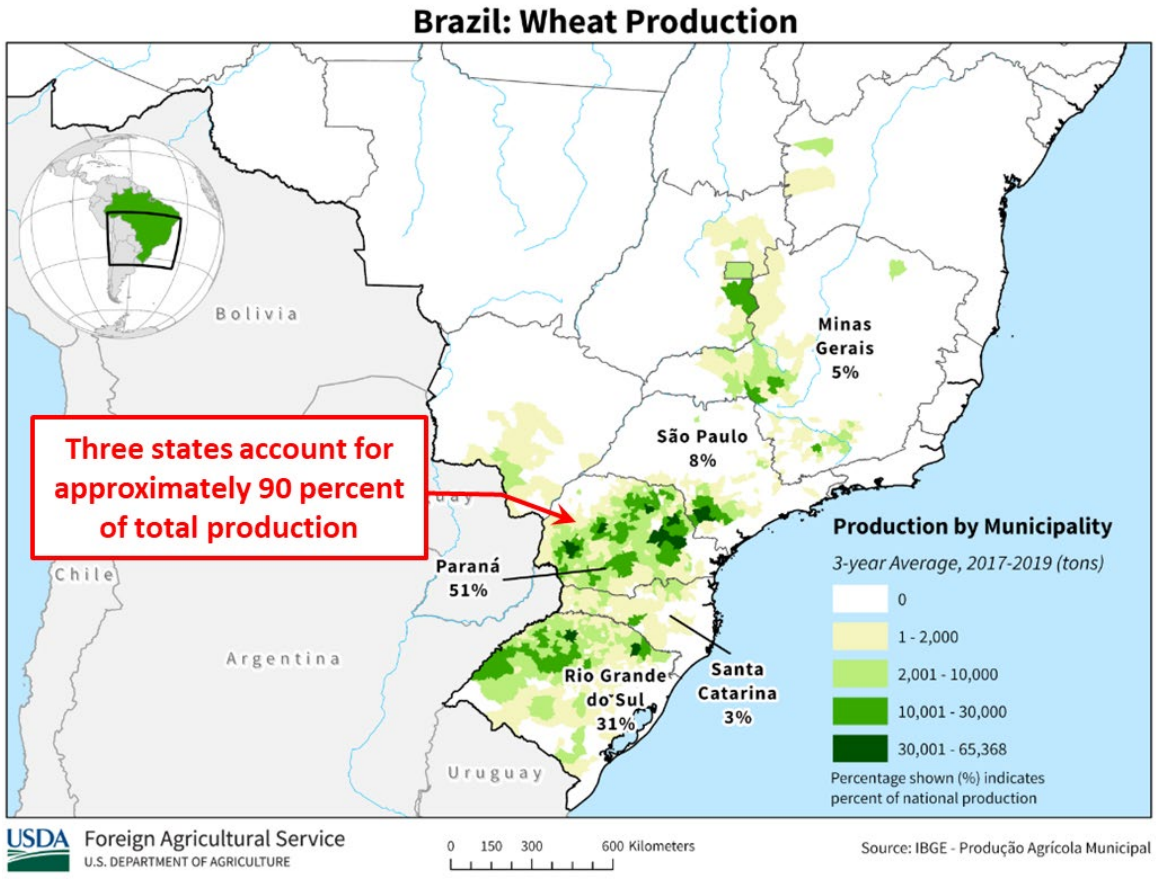


Figure 3. The majority of Brazil's wheat crop is grown in the temperate pampa and atlantic forest biomes. Future area expansion is expected in the tropical savannah biome of the *cerrado*. Source: IBGE data, Hargreaves, P. (2008). Phytosociology in Brazil. *J Plant Sci Biotechnol*, 2, 12-20.



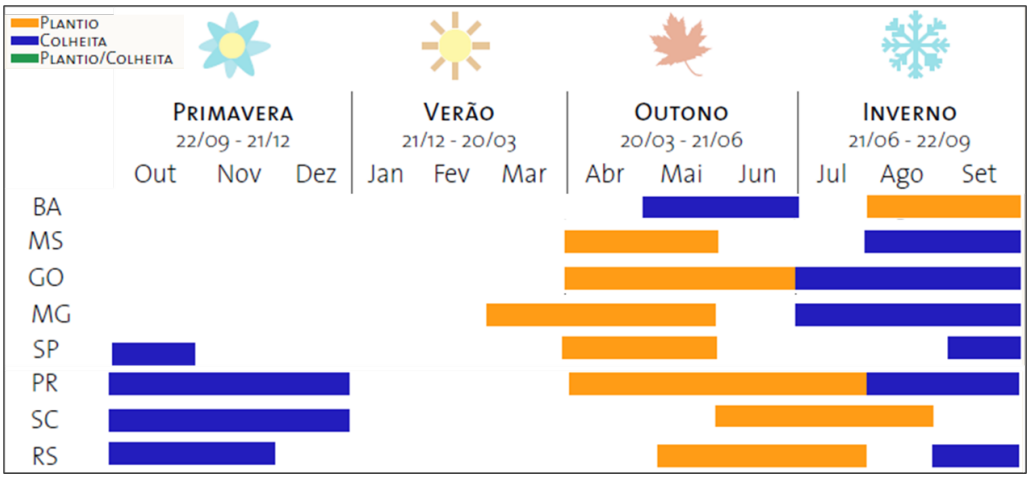


Figure 4. The states of Paraná (PR), Rio Grande do Sul (RS), and São Paulo (SP) comprise 90% of national wheat production. This crop is planted in the autumn/winter months and harvested in the spring. Source: IBGE and CONAB calendar.

Brazil Wheat Area: Annual Percent Change in Main Wheat Growing States for MY 2022/23

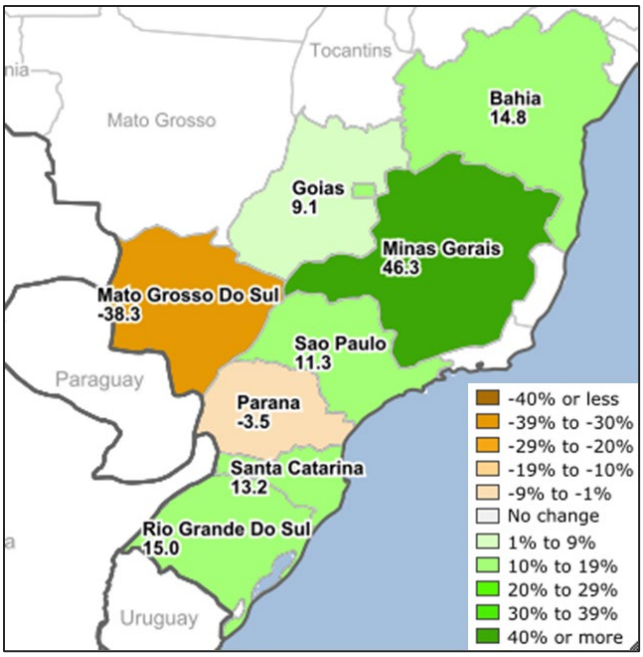


Figure 5. (a) State-level annual area percent difference from CONAB. The state reporting agency in Rio Grande do Sul reports a similar increase in area (about 175,000 hectares), whereas the state agency in the state of Paraná reports a greater area reduction of 5 percent compared to last year (43,000 hectares). National area is 7 percent greater than last year at 2.9 mha. Source: CONAB.

Brazil Wheat: Area and Yield Time-Series for Rio Grande do Sul

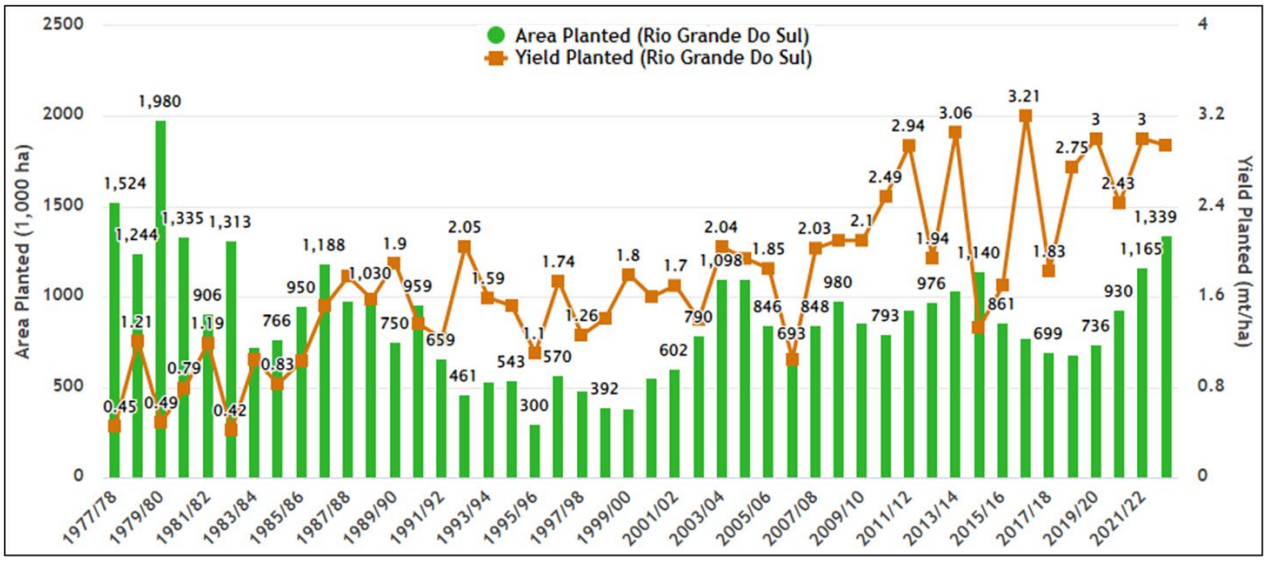
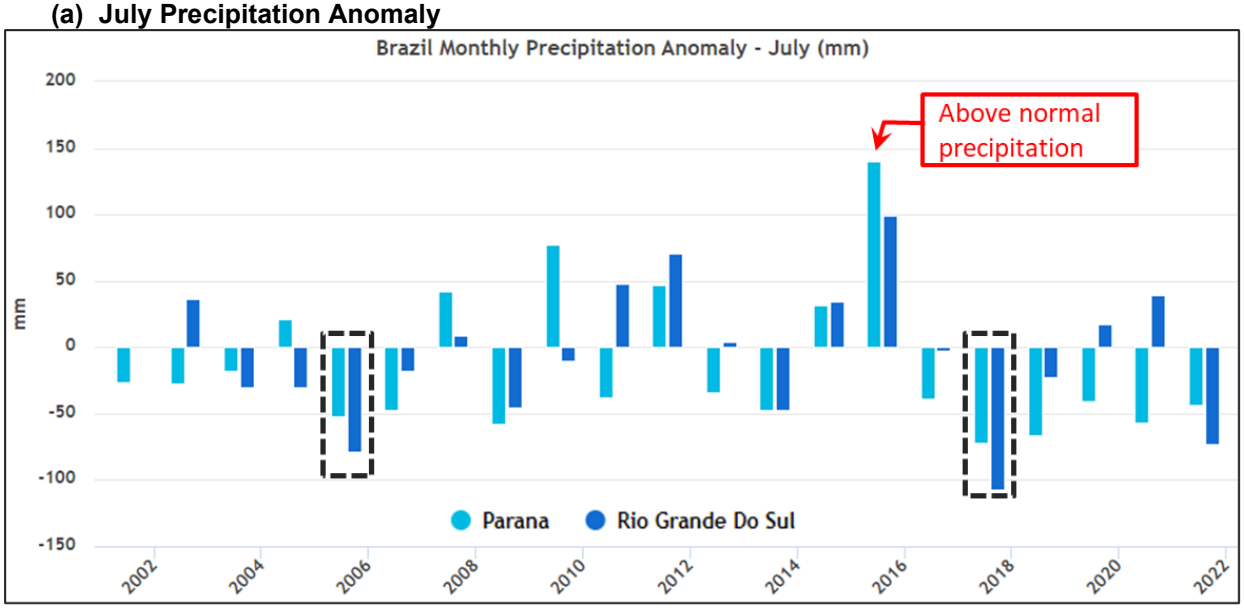


Figure 5. (b) The state of Rio Grande do Sul planted the largest area since MY 1979/80 this season. Planted area, at 1.34 mha, is 15 percent larger than last year and 59 percent above the five-year average in the state. Source: CONAB.

Brazil Wheat: Precipitation and Yield Connections

(a) July Precipitation Anomaly



(b) Brazil Wheat Yields in Parana and Rio Grande do Sul

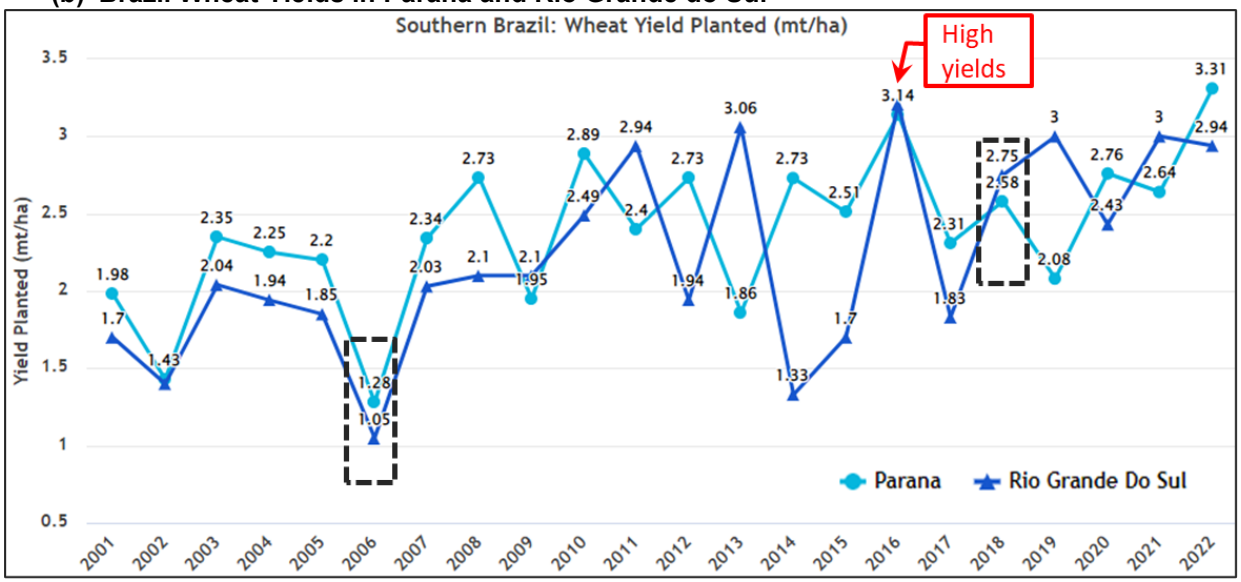


Figure 6. The low yields in 2006/07 and 2017/18 correspond to years when mid-season rainfall was markedly below the long-term average for the month of July. The association appears clearer for Paraná when we observe reduced yields and July precipitation from 2017-2019 and 2021. In 2016, both major wheat producing states saw the best yields in recent history when July precipitation was above normal. Source: UCSB CHIRPS, CONAB.

Brazil Wheat: Area Changes over 5 Years

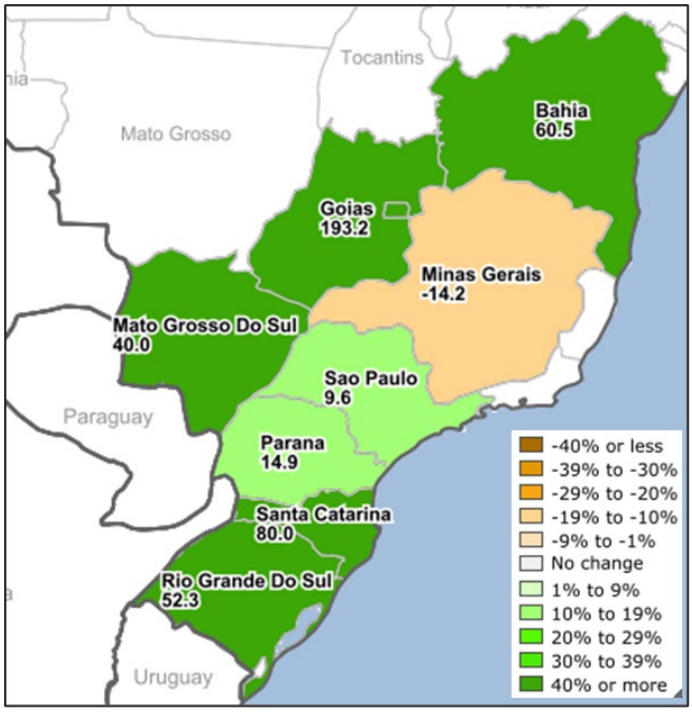


Figure 7. Percent area difference from the 5-year average area in MY 2021/22. The largest acreage increases occurred in the South (Rio Grande do Sul and Paraná) with large gains in the *cerrado*. Source: CONAB.

Brazil Wheat 2021/22: Crop Conditions, NDVI Anomaly (Aug 29 – Sep 5)

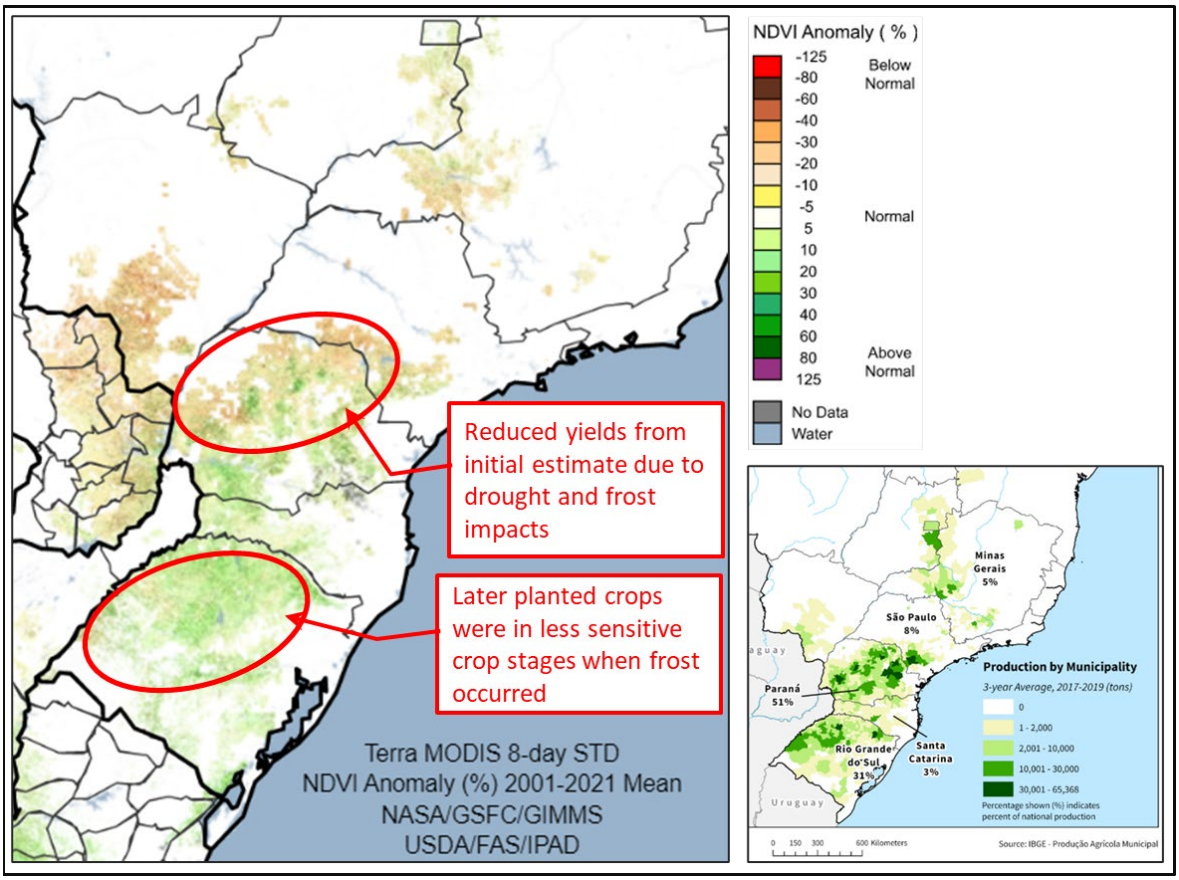


Figure 8. Satellite-derived Normalized Difference Vegetation Index (NDVI) at the end of August for the MY 2021/22 season displaying vegetation vigor. Source: USDA/NASA Global Agricultural Monitoring (GLAM), MODIS 8-day NDVI Anomaly, IFPRI SPAM 10 km wheat crop mask.

Brazil Wheat: Yield and Production Percent Difference from 5-Year Average

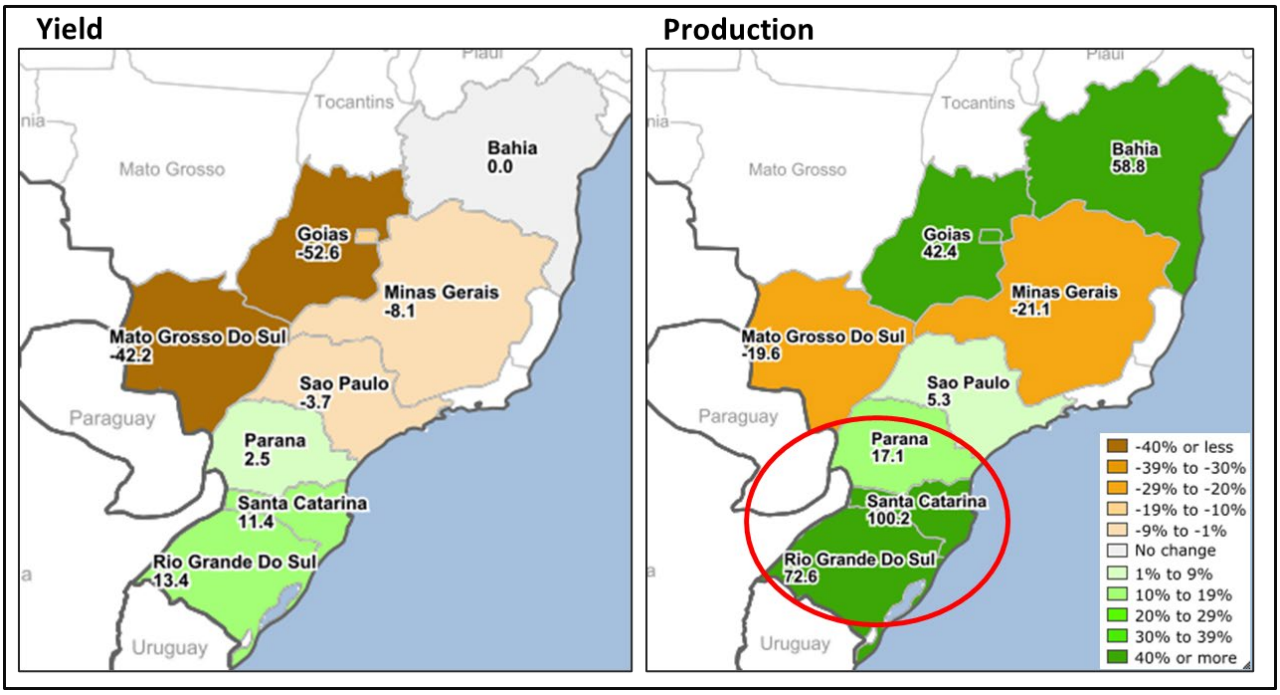


Figure 9. State-level yield and production percent difference from the 5-year averages. Yield gains were the greatest in the southern region where the majority of production is located. Source: CONAB.

Brazil Wheat: Area Harvested and Annual Change

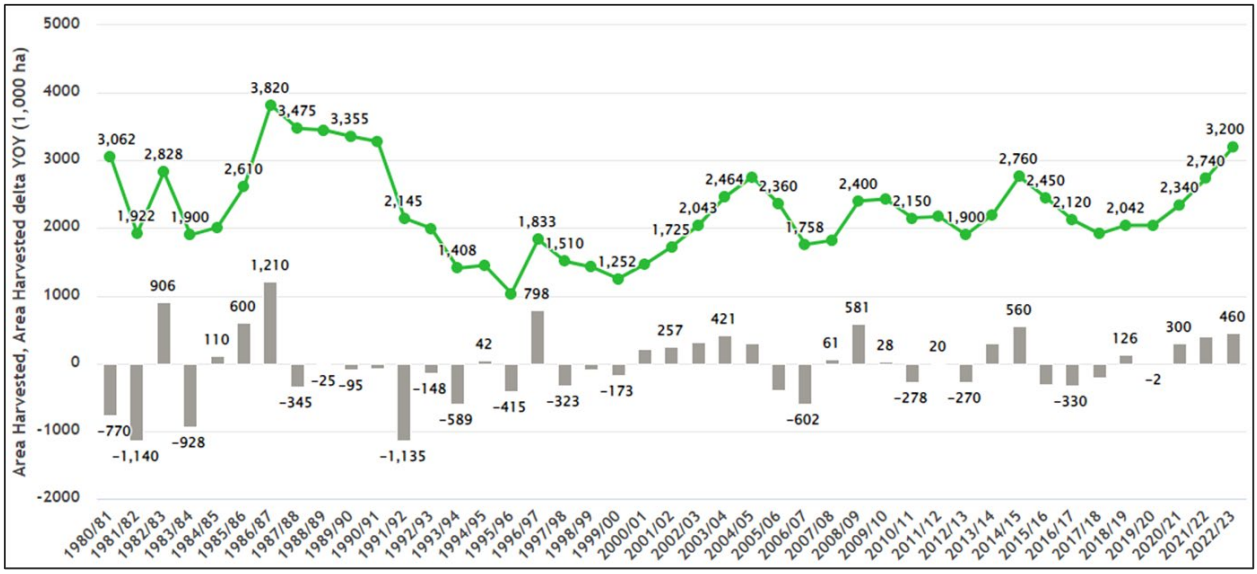


Figure 10. Record area posted in 1986/87 at 3.82 mha and declined for the next 10 years. In the last three seasons, acreage increased by double digit percents. Source: USDA PSD Online.

Brazil Wheat Area Planted by State Over 30 Years

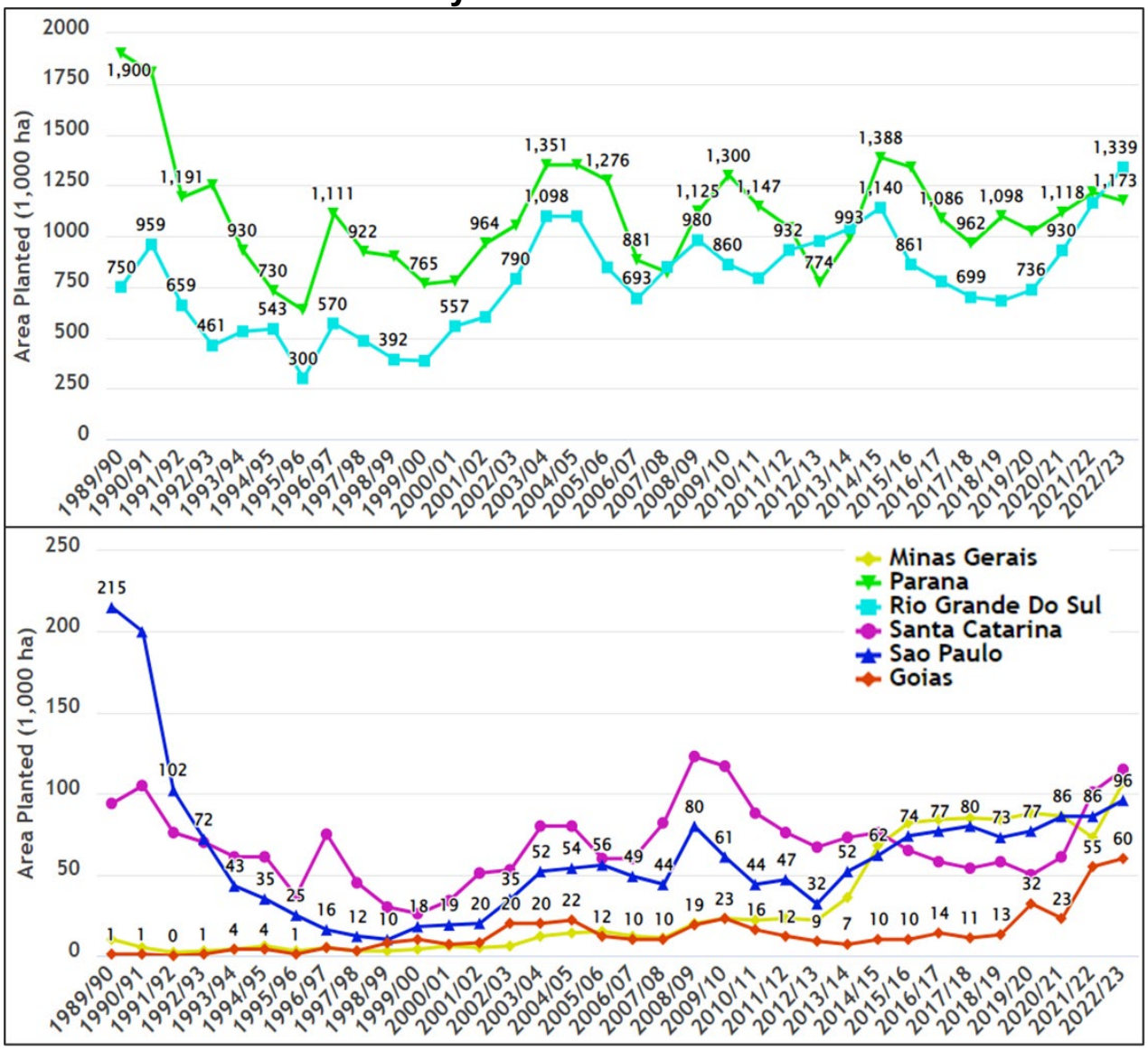


Figure 11. Area is rebounding in the southern states after declines following the recent highs in 2014/15. Increasing area in the *cerrado*: Goiás, Minas Gerais, and São Paulo. Source: CONAB.

Brazil Wheat Yields by State

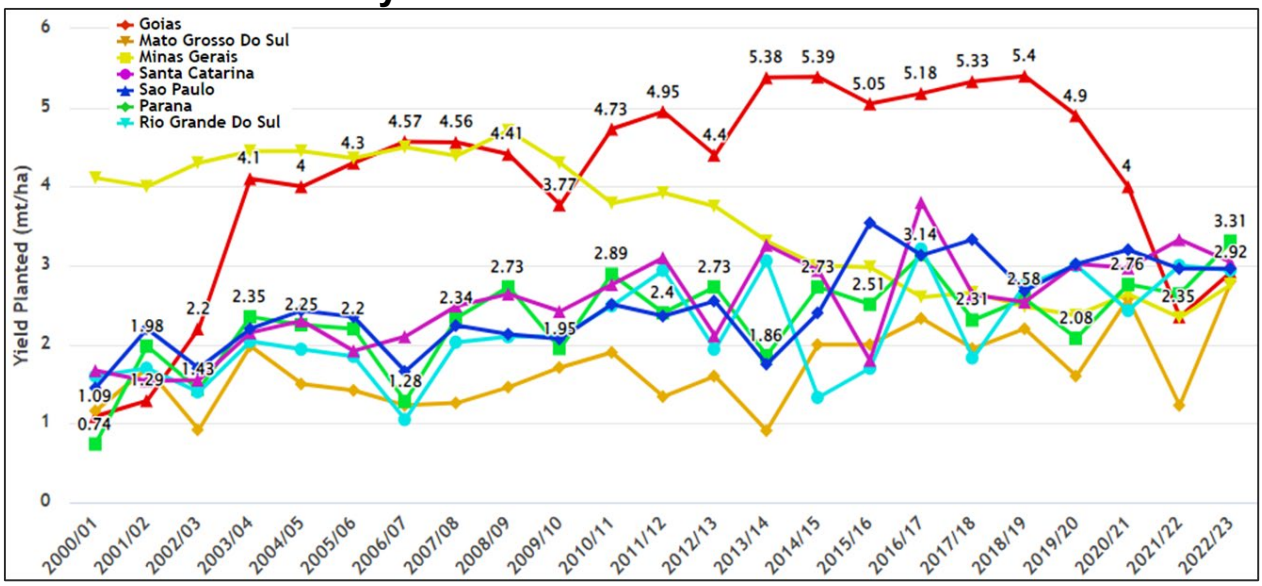


Figure 12. State yields over 20 years for most wheat producing states with Goiás and Paraná labeled. The highest yield in MY 21/22 was Santa Catarina at 3.33 t/ha. Source: CONAB
NOTE: mt/ha = metric tons per hectare.

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