

IMPACT OF THE COVID-19 PANDEMIC ON THE VOLUME AND STRUCTURE OF AGRICULTURE PRODUCTION IN POLAND

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Abstract. The article aims to identify the impact of the COVID-19 pandemic on the volume and structure of agricultural production in Poland. The literature on pandemics in the past shows that plague influenced the volume and the structure of agriculture output. The consequences varied between the pandemics and in the frame of the same pandemic between countries. What's more, the length of the analysis period matters. The short-term effects were generally damaging however, the evaluation perspective matters. The assessment of long outcomes is complex. The positive, profound long-run effects were identified. The past pandemics impacted the economy and agriculture through the decrease in the availability of labour because of massive deaths. In the pandemic COVID-19, this channel of transmission occurred as well, but in the form of shortages of labour forces due to governments' restrictions on people's movement. The analyses found that in the first year of the COVID-19 pandemic in Poland, agriculture production did not decrease. It stemmed from the time gap between the production decisions and getting output. A modest reduction occurred in the second year of plague. The analyses of the structure and dynamics of the sown area show that farmers restrain themselves from the changes in plant production. Larger adjustments took place in the sector of animal products than in plant products. The most remarkable changes took place in branches of animal production depending on export. Because of the plummet in egg prices, egg production decreased in 2020 and 2021. The fall in meat prices in 2020 resulted in a drop in the meat production in 2021. Despite the unfavourable changes in milk prices, milk production was stable.

Key words: COVID-19, agricultural production, plant production, sown area, animal production.

JEL code: Q10, O13

Introduction

The research on the economic effects of pandemics in the past shows that pandemics can severely affect economies. Each plague has its specific characteristics, so the consequences vary between the pandemics and in the frame of the same pandemic between countries and sectors of the economy. What's more, the length of the analysis period matters. The short-term effects are generally damaging however, the evaluation perspective matters. The assessment of long ones is more complex, and the positive, profound long-run effects can occur at least in some areas of the socio-economic life (Danilowska A., 2022; Alfani G., 2020; Bell C. L. & Lewis M., 2005).

Agriculture is an important sector of the economy. Although in developed countries its share of the GDP is very small, the global pandemic reminds us that agriculture plays a fundamental role in the existence of humanity. Caring for access to food at a global level just at the COVID-19 pandemic beginning, the heads of the World Trade Organization and the UN Food and Agriculture Organization issued a joint statement calling on governments to minimise the impact of COVID-19-related border restrictions on food trade (WTO, 2020). During the first months of the pandemic, concern about food security was expressed in many research papers (Laborde D. et al., 2020; O'Hara S. & Toussain E. C., 2020; Kumar A. et al., 2020; United Nations, 2020). Although from the perspective of 2023, it seems that the pandemic is under control, the problem of food insecurity connected to the pandemic phenomenon persists in developed countries like the United States of America (Ridley W. et al., 2022, Vos R. et al., 2022) as well as in developing countries (Rahman T. et al., 2022; Abay K. A. et al., 2023). It shows why the examination of the pandemic channels and the pandemic consequences for the agriculture sector is an important issue.

The article aims to identify the impact of the COVID-19 pandemic on the volume and structure of Polish agriculture production.

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The research is to answer the following questions: (i) what were the past pandemic consequences for agriculture; (ii) what measures of pandemic influence on agriculture were implemented by the researchers examining past pandemics; (iii) was agriculture more sensitive to pandemics than other sectors of the economy; (iv) how pandemic COVID-19 influenced the Polish agriculture (output and its structure).

Data for the analysis concerns some years before the pandemic COVID-19: 2015-2019 and 2 years of the pandemic - 2020, 2021. In the case of particular problems, shorter periods were examined.

Statistics Poland was the basic source of data on Polish agriculture. The data on pandemics in the past were taken from relevant literature. Because of the distance in time, any figures for Black Death resulted from research on the problem estimations. They mainly relate to Western Europe. For the Spanish flu, the statistics are also scarce. Since it occurred just after the World War I, it is a problem of separating war outcomes from pandemic outcomes, especially for countries on which territories the fights took place. It is probably the main reason for scant economic analyses for the European countries. There are relatively many studies on plague economic effects on the United States economy and India's economy. It is worth mentioning that India was the most affected by the pandemic country over the world.

As the leading research method we used analysis of empirical data on the volume and structure of agriculture production and sown area structures in Poland. The choice of indicators stemmed from the review of the literature on the past pandemic impacts on agriculture.

The paper proceeds as follows. In Section 2, we discussed the impact of past pandemics on agriculture. In Section 3, we examined the data on the size and structure of agriculture output in Poland before and during the pandemic COVID-19. In the next section, the conclusions were drawn out.

Research results and discussion

The pandemic influence on agriculture in the past

The international literature on pandemics in the past shows that plague influenced the volume and the structure of agriculture output. The first effects occurred quite fast after the pandemic outbreak, while the further ones stemmed from the adjustment of the farmers to conditions created by a pandemic.

According to Brenner R. (1985), the Black Death pandemic depopulated rural areas noticeably. It must be reminded that in the later Middle Ages, the vast majority of the population lived in rural areas. The plague spread quickly throughout the countries and continents, and the time between the infection and the fatal result was only a few days, so the consequences appeared immediately. The region by region depopulated very quickly and very deeply. However, there were spatial differences. Western Europe suffered much heavier than less populated Middle and Eastern Europe. The situation in rural areas was aggravated by the migration of the rural population to the cities that were affected even worse by the pandemic than rural areas but offered new possibilities for newcomers. The size of the phenomenon was so great that in many countries, the return to the pre-pandemic state took about two centuries. The phenomenon that rural areas close to higher-mortality cities recovered their populations around a century after the recovery in urban populations can illustrate the significance of migration in rural areas depopulation (Jedwab R. et al., 2019). These reasons resulted in severe shortages of rural labourers. The large areas of agricultural land were abandoned. The marginal land was forested or converted into pasture. The findings of Hasund S. (1920) illustrate the Black Death pandemic's consequences for Norway's agriculture. He showed that the pandemic caused the plummet in land rents and land prices and counteracted settlements. A similar phenomenon occurred in England (Saltmarsh J., 1941). In such circumstances, you can assume that agricultural production decreased. Due to a lack of data, it is difficult to find relevant estimations of the phenomenon scope in the literature. Although the very likely decrease

in food production occurred, the enormous drop in population led to a relative overproduction of agricultural products in the years following the epidemic (Zietz B. & Dunkelberg H., 2004). The proportion between the population and the available food improved with positive consequences in short-run and in long-run (Brenner R., 1985). The relationship between labour and land improved as well.

The Spanish flu pandemic in 1918-1920 caused much less population loss than the Black Death pandemic. There were very distinctive differences between the countries. In most European countries, the flu death rate³ was lower than 1.00%, but in African and Asia countries generally, the rates were higher. The highest rate of 5.22% was for India (Barro R. et al., 2020). However, in contrast to the Black Death pandemic, the flu targeted young and middle-aged, healthy people. Taking into consideration the fact that the rates of the decrease in the working-age population were much higher than such ones for the total population, the pandemic had to harm the economy. At the beginning of the XX century, societies were still rural, so the pandemic had to impact agriculture remarkably. The research of Donaldson D. and Keniston D. (2016) shows that the decrease in the population of India had a positive but short-term impact on agriculture output per capita, and hence on wealth, despite the decrease in farmed areas occurred. There was no effect of the pandemic on crop yields. The authors point out that after the pandemic the situation quickly normalised because the severe shortages of labour were overcome by the influx of workers, even from great distances. Although the labour deficit, the wages of agricultural workers did not change significantly. In light of the findings, it can be expected that the branches of agriculture based on hired labour were much more affected than those relying on family work. Such a situation occurred in Java in 1919, where sugar production dropped noticeably while aggregate food production did not decline (Gallardo-Albarran D. & De Zwart P., 2021).

Completely different situation occurred in Africa, where in many countries the deaths and illnesses hit the farmers' abilities to carry out regular farming⁴. As many young people fell sick, there was nearly nobody to plant or weed or take care of the animals (Musambachime M. C., 1993). The massive agriculture production abandonment caused famine in Tanzania and severe malnutrition in Nigeria, South Africa and Northern Rhodesia. Farmers tried to adjust to the situation by switching to fast-growing varieties of maize or beans. In Nigeria, they changed the cultivation of yams to cassava as a less labour-intensive plant (Ellison J. G., 2003; Phillips H., 2017).

The above revision of literature shows the ambiguous pandemic impact on agriculture output in the past. In some countries, agriculture was not affected, while in others pandemic led to hunger. Moreover, the conclusions of evaluation depend on the applied indicators. The conclusions from the analyses in relative terms are more positive and sometimes adverse to those from the analyses in absolute terms. The past pandemic transmission channels to agriculture, as for the whole economy, were connected mainly to the pandemic impact on the workforce.

Contrary to the above aforementioned past pandemics, the COVID-19 pandemic was especially dangerous for not active professionally elderly people. That is why the channels of the pandemic to the economy were connected not to reduced workforce like in the past, but to the vast range of measures counteracting the spread of the pandemic undertaken by governments. The lockdown was an especially severe tool. Workers could work but not allowed to travel, so farm production was affected by the labour shortages. The restrictions on travel caused disruptions in transport to markets or processors. The limited availability of farm inputs like chemicals, equipment, feed, and seeds led to lower productivity

³ Death cases/total population

⁴ Death rates from influenza average between 3-5 per cent in Africa.

(The COVID-19 Global). To that list, Schmidhuber et al. (2020) add the international trade channel, exchange rates channel, energy markets channel, and credit channel.

After three years of the pandemic, the identification of the consequences of the COVID-19 pandemic for Polish agriculture based on empirical data are feasible and can be fruitful.

The COVID-19 pandemic impact on agriculture production in Poland

Like many governments all over the world, the Polish government reacted to the COVID-19 pandemic by introducing a lockdown. Due to the much lower rate of COVID-19 spread in Poland in comparison to other European countries, citizens' travels were not prohibited. The manufacturing, construction and transport sectors were allowed to conduct unlimited operations.

Despite that, the restrictions affected the Polish economy painfully and unevenly (Table 1). In 2020, the total added value in Poland decreased by 2% comparing 2019, but in many sectors, the fall was stunning. The spectacular drop amounted to 25%, occurred in the Accommodation and gastronomy industry. The sectors such as Financial and insurance activity, Transport, Construction, and Retail trade recorded a much smaller decrease. Contrary to the many industries, added value in agriculture soared. It was an effect of the farmers' decisions undertaken in the pre-pandemic year what characterised by quite favourable natural conditions. Szajner (2021) states that the impact of the pandemic on the production of cereals in Poland and in the world is practically unnoticeable, because weather conditions are decisive. The opposite situation occurred in the next year. The total added value in the economy increased by 6.6%. In almost all sectors it rose, in some industries like Transport or Accommodation the rate of growth was very high. But in Agriculture sector, the added value dropped remarkably – by 11%.

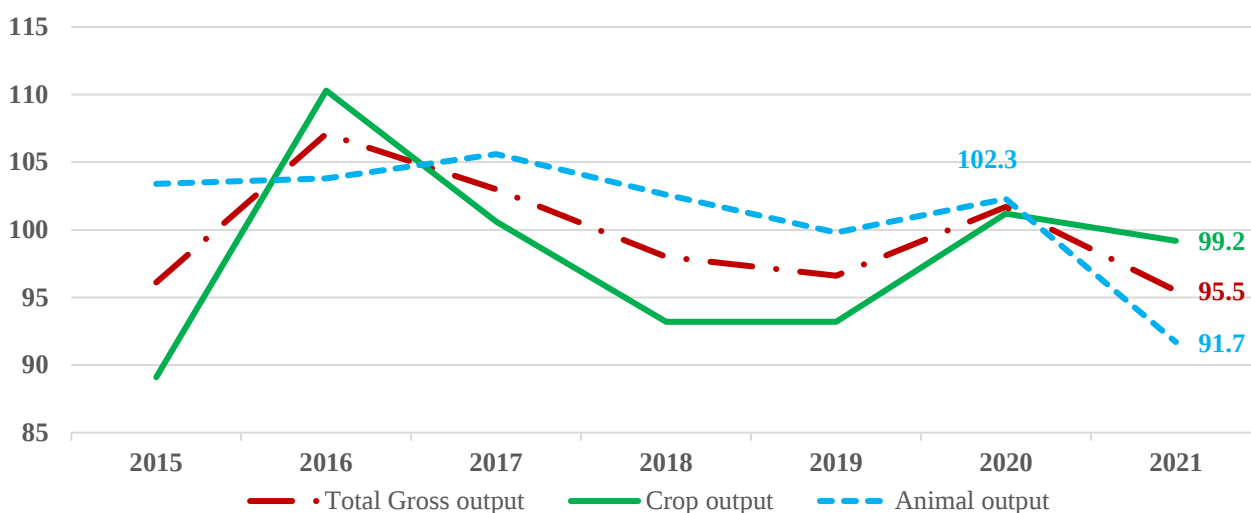
Table 1

Dynamics of gross added value in the main sectors of the Polish economy (constant prices, previous year = 100)

Year	Total added value	Manufacture	Agriculture	Construction	Transport	Trade	Accommodation and gastronomy	Financial and insurance activity
2019	104.3	104.7	97.8	99.2	102.6	103.8	100.8	110.1
2020	98.0	96.5	115.3	92.0	90.3	96.7	74.2	87.0
2021	106.6	102.8	88.9	105.3	116.0	109	115.0	96.7

Source: Statistics Poland (2022). Statistical Yearbook of the Republic of Poland 2022, Warsaw

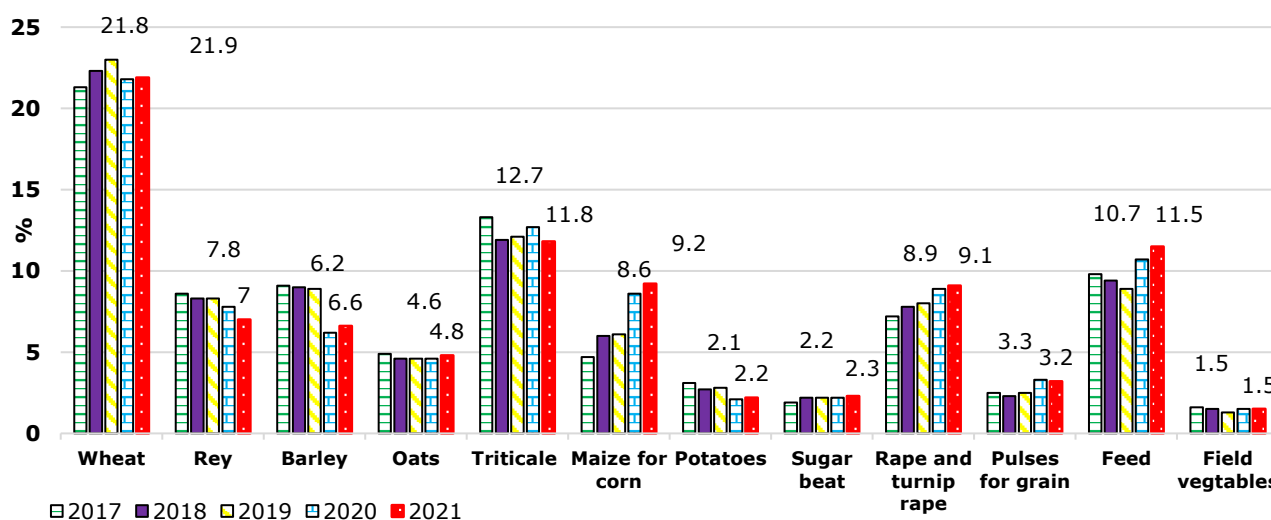
The decline in the agriculture sector in 2021, illustrated by the dynamic of added value, stemmed from a fall both in crop production and animal production. The gross crop output decrease was rather small – less than 1%, whereas gross animal output amounted to more than 8% (Fig. 1). The fall can only be partly explained by the pandemic. As determinants, Statistics Poland (2022b) indicated unfavourable natural agrometeorological conditions during the growing season and the reduction of some crops area. Although the aforementioned decrease in volume, the value of global agricultural production at current prices increased by 6.5% compared to 2020 due to the rise of prices of agricultural products in domestic and international markets. In the sector of plant production, the price increased by 8.3% and in animal production by 4.6% (Statistics Poland, 2023).



Source: author's elaborations based on Statistics Poland 2020, 2022b

Fig. 1. Indices of agricultural output (constant prices)

As the experiences from the past show, the pandemic can cause changes in the structure of output due to farmers' attempts to adjust to new conditions of farming, for example, shortages of labour. Agriculture output depends on many factors, some of which are unpredictable, so for the identification of the Polish farmers' adaptation to challenges stemming from the COVID-19 pandemic, the changes in the structure of sown area were examined (Fig. 2). Such approach is recommended by Alfani G. (2020).



Source: author's elaborations based on Statistics Poland 2020, 2022b

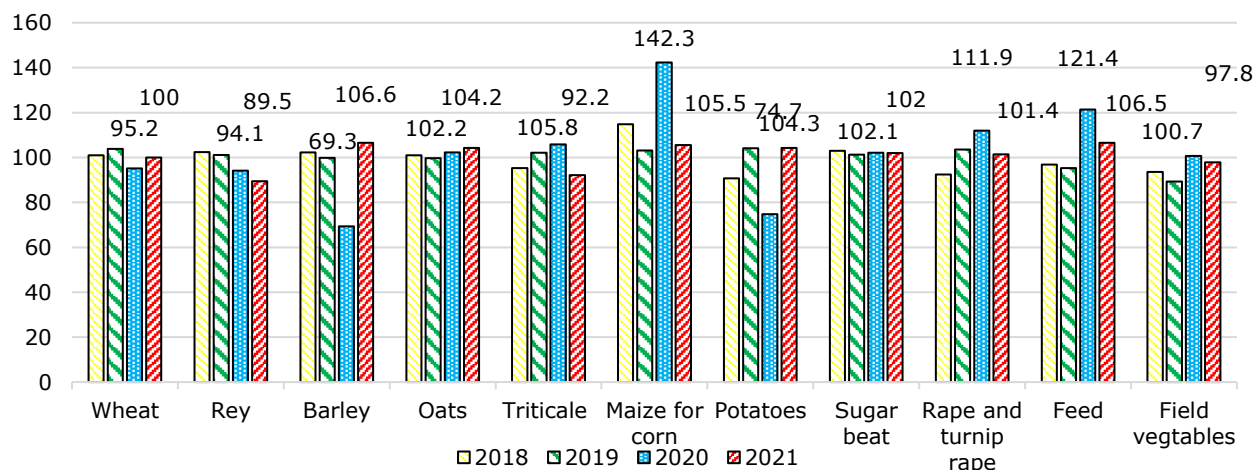
Fig. 2. The share of the particular crops in the sown area in 2017-2021

The analysis of the share of particular crops in sown areas in the pre-pandemic and pandemic years gives rather ambiguous results. In 2020, the first year of the COVID-19 pandemic, the structure of sown area was the result of farmers' decisions undertaken in pre-pandemic 2019 year. Only when making decisions about production in 2020 for 2021, farmers had to take into account the factors related to the pandemic. It was similar in 2021 when they decided on the production directions in 2022.

In 2021, in comparison with 2020, there were very few changes in the share of wheat, barley, oats, potatoes, sugar beet, field vegetables, and pulses for grain in the total sown area. Although the share of some crops changed, it could have been a result of the trend, not a pandemic. It was in the case of rye and maize for corn. Only for triticale and feed the share changes were more significant and they did not result from the trend, as in previous years their shares fluctuated. It is difficult to assess whether their

changes resulted from the pandemic or other factors. Unfortunately, there is no available data on 2022 yet.

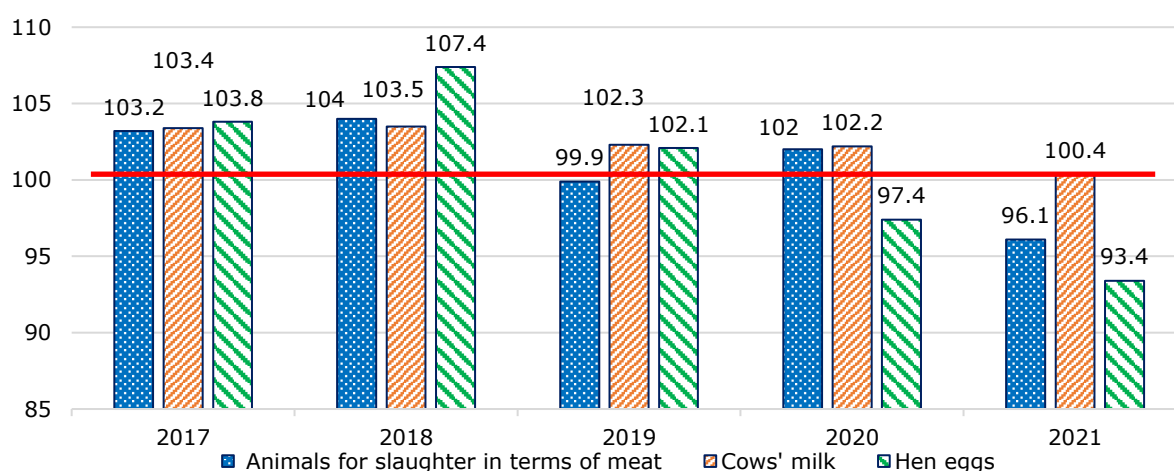
The analyses of the dynamics of the sown area of each cultivated plant can help to explain if Polish agriculture responded to the pandemic.



Source: author's elaborations based on Statistics Poland 2020, 2022b

Fig. 3. The dynamics of the particular crops area 2018-2021 (previous year = 100)

The examination of Figure 3 shows that in 2021, farmers did not change the wheat sown area. It is an important observation as this crop occupies the largest area. In the case of three plants - rye, triticale and field vegetables - the cultivated areas were reduced. The remarkable fall was for rye and triticale, whereas the area of vegetables decreased slightly. For rye, it was a continuation of the downward trend, but for two other plants, the situation was different. In the case of field vegetables, their cultivation area fluctuated in 2018-2020. In 2021, it decreased compared to 2020 but remained higher than before the pandemic. The area of triticale in three constitutive years (2018-2020) rose, so the drop in 2021 below the 2018 level is rather an unexpected outcome. In 2021, the cultivation of other plants covered larger areas than in 2020, but the rates of change were low. The biggest increases were for barley and feed. The results of the analyses correspond with the conclusions on the change in total agriculture output.



Source: author's elaborations based on Statistics Poland 2020, 2022b

Fig. 4. The dynamics of the production of particular animal products in 2017-2021 (previous year = 100)

The pandemic had almost no effect on plant production, but its impact on animal production was noticeable. It is illustrated in Figure 4. In 2017-2018, the dynamics of the particular animal product outputs

were high and even in 2018 were higher than in 2017. In the pre-pandemic year, milk and egg production still rose, although, at a lower speed, while meat production decreased slightly. In the first year of the pandemic, meat and milk production climbed by about 2 %, but egg production fell by 3.6 %. Due to the short period, it is difficult to tie the changes in 2020 to the pandemic; however, the shortages in labour or disturbances in international trade could influence eggs' production negatively. In the next year - 2021, egg production plummeted again. Although in 2020 meat production rose by a little, the fall in meat prices resulted in a decrease in meat production in 2021. The production of cow's milk was stable despite the drop in the milk price. The adjustments of meat and egg production to the changing production conditions are faster and easier than in milk production.

Conclusions

- 1) The past pandemic impacted the economy and agriculture through the decrease in the availability of labour due to massive deaths. In the pandemic COVID-19, this channel of transmission occurred as well, but not in the form of the physical reduction of the labour force but the restrictions on people's movement introduced by governments that generated complex consequences.
- 2) As can be expected, in the first year of the pandemic COVID-19, agriculture production in Poland did not decrease. It stemmed from the time gap between the production decisions and getting output. The production in 2020 resulted from the sowing decisions and the livestock in 2019. The scope of adjustment was very limited in a short time. Moreover, no one knew how long the pandemic would last and how severe it would be. But gradually, farmers tried to adjust to a new situation. There were no drastic changes but rather attempts to keep the previous level of output. Crop production was stabilized. The larger scope of changes occurred in sectors with higher sowing area fluctuations in the previous years.
- 3) The pandemic impacted the animal production sector more than the plant production sector. A distinctive high reaction took place in meat and egg production. The products are important for export and the same their prices and production are sensitive for the changes on international markets. Because of the plummet in egg prices, egg production decreased in 2020 and 2021. The fall in meat prices in 2020 resulted in a drop in the meat production in 2021. Despite the unfavourable changes in milk prices, milk production was stable.
- 4) The signal data on the 2022 agriculture output indicates that the restriction easing and other positive factors like vaccination stimulated agriculture to increase production.

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