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## OPPORTUNITIES FOR SUSTAINABLE DEVELOPMENT OF GRAIN PRODUCTION IN BULGARIA AGAINST THE BACKGROUND OF MARKET, NATURAL AND DEMOGRAPHIC CRISES

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**Abstract.** A considerable portion of the agricultural land in the plains of the country is currently used for grain production. This is an industry lying on rich traditions stemming from Bulgaria's favourable climate coupled with appropriate soil characteristics and valuable features of any such crops for various sorts of fodder fed to farm animals and used in the food industry. The main bulks of cereals open opportunities to guarantee strategic food reserves of Bulgaria. The remaining quantities enjoy good marketability internationally. While cereal crop production enjoys such favourable prerequisites it also faces a number of issues. The list of the latter may start from the lack of labour force in Bulgaria's rural regions, which would be supposed to apply new technology and make use of today's modern agricultural equipment or to follow the climatic changes entailing drought, substandard success in fight against natural disasters such as hail or floods, dynamics in the regulatory framework which the competitiveness of the sector would depend on (allowing duty-free imports of grain from other countries), or untimely payment of subsidies.

The goal of this article is, based on the trends in the production of some of the main cereals' crops, to discuss any opportunities to stimulate the sustainable development of cereal production in Bulgaria and overcoming the consequences of a variety of kinds of crises.

**Keywords:** grain production, sustainable development, trends, crises, technological innovations.

**JEL:** R11, Q18

### **Introduction**

Wheat is responsible for more than the half of crops produced within the EU. The crops following in the importance ranking list are maize, barley, followed by rye, oats and spelt wheat (*Agriculture and rural development*, 2024). This is the structure of EU's cereal production and it does not differ significantly from what the structure typical of Bulgaria's cereal production. The information presented in Table 1 may lead to the conclusion that the most significant difference between sown areas and harvested areas is valid in the cases of oats and sorghum. "With a 15.1% increase in the harvested area in 2022, oat production yielded an increase by 5, 7% compared to 2021. The most areas with oats were harvested in the South-West region (33% of the

total)”<sup>1</sup> (Ministry of Agriculture and Food, 2023). Wheat, grain maize and barley dominate as structural determinants of both the sown areas and the quantities produced.

Challenges faced by Bulgarian grain producers do not differ substantially from challenges faced by farmers all over the European Union. These are: variations in the exchange prices of cereals, the supply of suitable seeds, fertilizers and preparations, the climatic changes resulting in natural disasters and droughts, the socio-demographic phenomena related to the population ageing and the lack of sufficient labour force motivated to acquire experience and to be engaged in the cultivation of field crops for a long time. In Bulgaria, we are short of investments in field protection forest belts, which would retain the snow cover in the flat areas and thus protect the crops from frost. It is unfavourable to change the legal purpose status of some agricultural lands suitable for grain production in order to build transport infrastructure, commercial and other non-agricultural objects. For some rural areas, which are notorious for their aridity and insufficiency of irrigated land, some cereals would make one of the few successful options for the efficient use of land resources. It is worth noting that in Bulgaria there are varieties suitable for the country, which have been selected by Bulgarian scientists and are a prerequisite for sustainable and high-quality harvests. Last but not least, a noteworthy factor is the existence of direct payments by the State to support producers with the approval of the European Commission and the possibility of purchasing modern equipment with funds from the operational programmes agreed by Bulgaria and the European Union. Another positive trend is that the regulatory framework already provides for the possibility of buying land from foreigners, which is a chance for an inflow of investment and modern technologies.

Some of these challenges are particularly acute for small countries with a relatively low standard of living, such as Bulgaria. The reason is that the outflow of labour force to the large European economies does further depopulate rural areas. The slow pace of administrative reforms has sometimes allowed the misuse of agricultural appropriations or their untimely delivery to farmers.

### **Research and analysis**

Home markets of small countries is particularly sensitive to imports of low-priced products coming from technologically higher-ranking European nations or from countries like Ukraine that are third countries to EU and are therefore not liable to comply with all EU statutory bio-farming regulations

and hence these manage to forward a variety of forms of primary or ready-to-use cereal-based products at more competitive prices than the locals. In regard thereto, what is noteworthy is the FEB 2024 agreement dealing with aids offered to Ukraine and agreed between Bulgaria's farmers' organisations and Bulgaria's Government to support small-to-medium producers in this country in grain production. The tariffs contracted are as follows (VASILEVA, Hr. 2024):

- in the interval 1–300 ha: BGN 20 per 0.1 ha;
- in the interval 300 ha to 600 ha: BGN 10 per 0.1 ha;
- in the interval 600 ha to 1000 ha: BGN 5 per 0.1 ha ;
- farms covering over 1000 ha will receive benefits for their first 1000 ha.“

In addition, this agreement will include some measures addressing lowering of administrative burden applying legislative changes to a number of key acts. Moreover, two more laws are planned to be drafted (*Agri.bg.* 2024): Agrarian Chamber and Trade Organisations Act and Farming Produce and Foodstuff Supply Chain Act.

The above quoted aids appear to be vital to grain producers, because upon the onset of the War in Ukraine, export prices (*Agri.bg.* 2024): of such large-scale producers as are Russia and Ukraine, with their millions of tonnes marketed at international markets have experienced some substantial falls. The abatement of grain prices at world exchanges has some good reasons, with one of them being the favourable natural conditions and the high yields in US. Stock bulletins have noted falls in wheat prices to levels not seen since 2015/2016 (*Agri.bg.* 2024).

The past global COVID-19 pandemic has put to the test all sectors of the economy in which it proved impossible to work from the office. The war in Ukraine has reminded us that food stocks must be kept fresh and in sufficient quantities to meet any contingency such as the destruction by the warring parties of one of the nuclear power generation facilities or the escalation of the local military conflicts to engage other parts of the world, which would cause sharp jumps in grain prices.

In Bulgaria, the 2022 relative percentage share of the areas occupied by cereal crops from the total area of arable land was 56.024% (This indicator was calculated by the author based on data retrieved from Statistical Directory 2023, NSI, Sofia p.241).

Table 1 illustrates that the bulk of areas sown in cereal crops and the quantities yielded from those areas belongs to wheat, barley and maize. There is no indication of significant crop loss in the year under review. Only sorghum and oats show a significant difference between sown and harvested areas.

*Table 1. Cereal crops (including for seeds) grown in Bulgaria in 2022, sown areas, harvested areas, produced quantities, average yields (Ministry of Agriculture and Foods, 2024)*

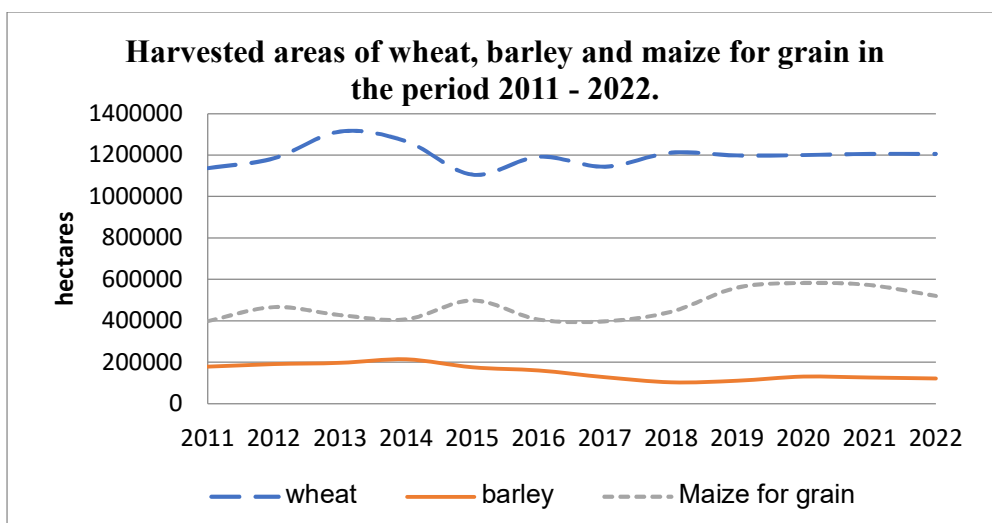
Grain and cereal crops	Sown areas in hectares	Harvested areas in hectares	Production in tonnes	Average yields in kg per hectare	Av. share* in % sown yet not harvested areas	Structure* of sown areas in %	Structure* of production in %
wheat	1209085	1206580	6230431	5164	0.207	63.402	65.644
rye	8384	8326	16345	1963	0.692	0.440	0.172
barley	122929	122411	603546	4930	0.421	6.446	6.359
oats	11726	11442	24931	2179	2.422	0.615	0.263
grain maize	522,502	520461	2496318	4796	0.391	27.399	26.301
triticale	14254	14136	41974	2969	0.828	0.747	0.442
sorghum	2683	2510	5624	2241	6.448	0.141	0.059
rice	10584	10577	65063	6151	0.066	0.555	0.686
Millet, buckwheat, canary seed, quinoa and other grains	4861	4210	7068	1679	13.392	0.255	0.074

\*This indicator was calculated by author

Given the dynamics of harvested areas, presented in fig.1, a conclusion may be derived concerning the reference period that there is a lasting interest in this type of crops, that is, exchange prices are not an obstacle to sustainable development. It is worth noting that the cultivation of cereals on large areas proves to be entirely mechanised, with this requiring investment in modern equipment for tillage, fertilisation, harvesting and storage of the crop. That is, it is desirable to have crop rotation using similar crops, but the cardinal change of plantings would entail some new investments. The deepening crisis in the nutrition of the population in some African countries and the impossibility of growing cereals in countries with a harsh climate makes grain production relevant and, in our opinion, interest in it will be growing.

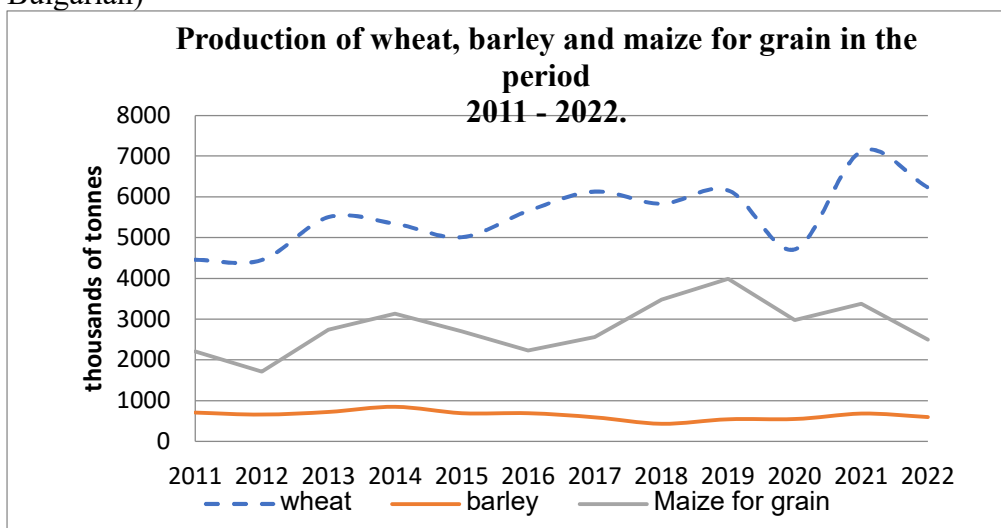
The total production of wheat, barley and grain maize in Bulgaria, presented in Fig. 2, shows certain fluctuations over time despite the stable size of harvested areas. The reason is clearly in the average yields per unit area presented in Figure, 3, which should be growing with the improvement of

applied agricultural techniques, but drought leads to the use of more resistant varieties that are lower yielding, and sometimes natural disasters such as hail, floods or rainfall at the wrong time stimulating the appearance of pests would cause lower average yields. In addition to the amounts of yields, the quality of the yielded products would also be important, with this largely determining the amount of income from their marketing. Fight against hail and its harmful consequences is a shared responsibility of the Bulgarian Executive Agency for Combating Hail under Bulgaria's Ministry of Agriculture and Food and the farmers themselves. Bulgaria stands quite high in the ranking of the most hail-exposed areas in Europe, with the regions of Vidin, Montana, Vratsa, Pleven, Pazardzhik, Plovdiv, Stara Zagora, Sliven and Haskovo being considered particularly threatened, yet protected by systematic surveillance and the use of rocket technology. (Agency hail suppression, 2024). Farmers are expected to insure their crops. Another reason for the reduction of average yields could be incorrect and insufficient fertilising, inappropriate selection of seeds, failure to observe the periods proved to be the most favourable for tillage, sowing and harvesting. The sudden onset of maturity on large areas sown with cereal crops does not allow the harvest to be completed in a short period of time. The influence of the meteorological situation on the development of the main cereal crops is carefully monitored and analysed by the specialists in the Directorate of Agrarian Statistics of the Ministry of Agriculture and Food (Ministry of Agriculture, 2024) and *Foods* and by the scientists at the National Institute of Meteorology and Hydrology (National institute of meteorology and hydrology, 2024). Reporting and forecast data are available for air temperatures, volume and distribution during rainfall, etc., which provide a good opportunity for analyses and preventive measures for crop protection and defence. That is, the risk of adverse climatic impacts on average yields proves to be unavoidable, yet applying skilful management could minimise any such impacts. It is of interest how grain producers could deal with crises of a socio-demographic nature. The essence of this problem is the uneven workload over the year of people operating with expensive and high-performance equipment and the need for their permanent retention, as well as the presence of unpredictable risks such as the COVID-19 pandemic in 2021 and 2022, which made it difficult to move people and goods and took I build for a long time not a few people of active age. Society gets an idea of the degree of organisation and mutual assistance of those employed in the agrarian sector, especially when organising protests/rallies on some occasions, but what is good in this case is that the very existence of industry associations by type of production, as well as associations of municipalities, could make a source of mutual assistance involving equipment and personnel in the event of regional crises in agriculture.



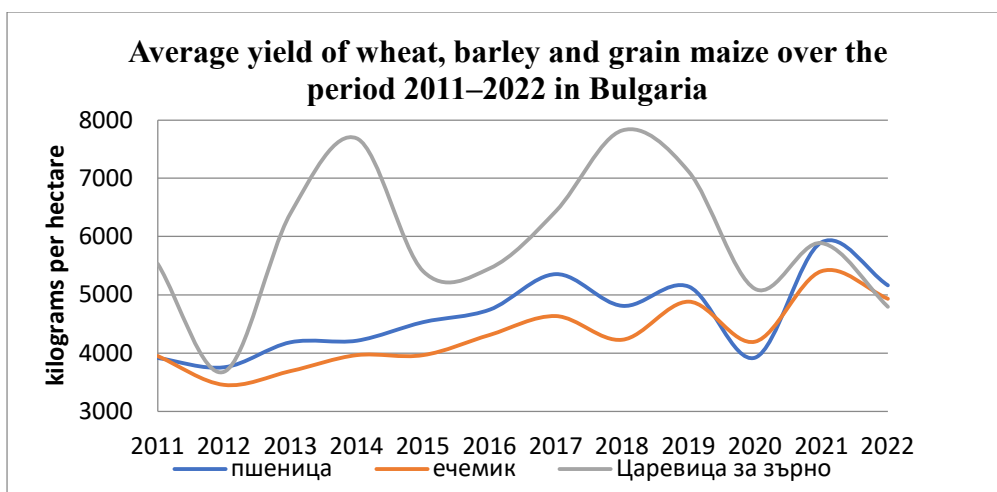
*Figure 1 Harvested areas of wheat, barley and grain maize over the period 2011–2022 in Bulgaria.*

The graphic was made by the author based on data from Statistical Reference Book 2023, 2021, 2019, 2017, 2015, , NSI, Sofia, p .240-245 (in Bulgarian)



*Figure 2. Production of wheat, barley and grain maize over the period 2011–2022 in Bulgaria*

The graphic was made by the author based on data from Statistical Reference Book 2023, 2021, 2019, 2017, 2015, , NSI, Sofia, p .240-245 (in Bulgarian)



*Figure 3. Average yield of wheat, barley and grain maize over the period 2011–2022 in Bulgaria*

The graphic was made by the author based on data from Statistical Reference Book 2023, 2021, 2019, 2017, 2015, NSI, Sofia, p .240-245 (in Bulgarian).

The 2023 annual report (Ministry of Agriculture and Food 2023) on Bulgaria's agriculture condition and development made out by the Bulgarian Ministry of Agriculture and Food, the analysis of cereal yields referred to the presence of correct sowing across the main part of the sown areas and failed to mention that somehow the COVID-19 pandemic had affected the size of the areas sown or the cultivation of crops and the harvesting of crops. The lower wheat yields in 2022 compared to the previous year were attributed to some unfavourable climatic conditions, and concerning the other cereals, only the changes owed to the differences in the areas sown with a variety of cereal crops were considered.

Analyses (Ministry of Agriculture and Foods, 2020) made by Ministry of Agriculture and Food's experts show some substantial fluctuation in the average wheat yields by provinces in 2020 versus the average yields characterising the period 2015–2019. An example of this is wheat production where 10 of Bulgaria's provinces featured a reduction within the interval 15–68%. The provinces in question were: Dobrich, Varna, Sliven, Burgas, Yambol, Silistra, Shumen, Ruse, Targovishte and Razgrad. Another ten provinces of the country, reported an increase in the average yield somewhere within the range of 15 to 68%. These were: Haskovo, Lovech, Stara Zagora, Sofia Province, Montana, Gabrovo, Vidin, Plovdiv, Pazardzhik, and Kardzhali. Provinces with relatively stable average yields (deviation from -6% to +6%) were: Kyustendil, Vratsa, Sofia City, Pleven, Pernik, Blagoevgrad, and Veliko

Tarnovo. It was concluded that the ongoing global changes in the climate would make it necessary to work on the selection of suitable crops and varieties that would be well adapted to the characteristics of individual regions and to the upcoming climate changes.

The data provided in Table 2 were used to study the influences of certain weather conditions on the average wheat yields in 2020.

*Table 2. Measured meteorological indicators by measuring meteorological stations and average yields of wheat in the adjacent areas for 2020*

meteorological stations	winter 2020			spring 2020			average wheat yields by provinces in kg per 0.1 ha for 2020
	average seasonal temperatures	seasonal precipitation in mm	number of snow cover days	average seasonal temperatures	seasonal precipitation in mm	number of days with precipitation of over 1 mm	
Sofia City	2.3	81	22	10.7	197	27	393
Vidin	3.4	71	1	11.5	198	22	573
Montana	4.4	97	5	11.8	188	25	568
Vratsa	5.3	143	10	12.4	255	29	475
Pleven	4.7	83	7	12.5	137	16	529
V. Tarnovo	4.5	97	14	12.7	154	20	552
Ruse	4.6	117	10	13.5	161	19	466
Razgrad	4.3	94	12	11.7	123	18	480
Dobrich	3.8	72	9	11.3	65	10	178
Varna	6.5	48	0	11.8	67	15	256
Burgas	6.3	73	1	12.1	98	18	244
Sliven	5.4	45	1	12.8	109	18	242
Kardzhali	5	99	8	11.9	233	30	403
Plovdiv	4.7	79	4	12.7	235	30	469
Blagoevgrad	3.2	85	5	12	183	24	221
Kyustendil	2.5	57	3	11.4	229	24	275
correlation coefficients between the respective factor and the average yield	-0.072	0.541	0.290	0.232	0.453	0.354	



Here are the sources of information:

Annual Hydro-meteorological Bulletin 2020, National Institute of Meteorology and Hydrology (Godishen hidrometeorologichen byuletin 2020, Natsionalen Institut po meteorologiya i hidrologiya) (in Bulgarian), [https://www.meteo.bg/meteo7/sites/storm.cfd.meteo.bg/meteo7/files/godishen\\_buletin\\_NIMH\\_2020.pdf](https://www.meteo.bg/meteo7/sites/storm.cfd.meteo.bg/meteo7/files/godishen_buletin_NIMH_2020.pdf)

Report on the effect of the impact of the main agrometeorological factors on the development and yields of the main field crops in the country in 2019/2020 (Doklad of efekta ot vazdeystviето nqa osnovnite agrometeorologichni faktori varhu razvitiето i dobivite na osnovnite polski kulturi v stranata prez 2019/2020 g.) (in Bulgarian) [https://www.mzh.government.bg/media/filer\\_public/2020/10/01/doklad\\_zh\\_e\\_fekta\\_ot\\_vzdeystviето\\_na\\_osnovnite\\_agrometeorologichni\\_faktori\\_vrkhu\\_razvitiето\\_i\\_dobivite\\_na\\_osnovnite\\_polski\\_kulturi\\_v\\_stranata\\_prez\\_2019-2020\\_g-1.pdf](https://www.mzh.government.bg/media/filer_public/2020/10/01/doklad_zh_e_fekta_ot_vzdeystviето_na_osnovnite_agrometeorologichni_faktori_vrkhu_razvitiето_i_dobivite_na_osnovnite_polski_kulturi_v_stranata_prez_2019-2020_g-1.pdf)

By means of the Pearson (Stoenchev, Hrischeva, 2023) correlation coefficient, the direction and strength of the relationship between the presented climatic factors in the time and place of development of wheat crops and the average yields of wheat obtained in some of Bulgaria's provinces were measured. What was found was that a moderately strong positive correlation existed between average yields and the seasonal amount of precipitation in both winter and spring. There was a weaker yet significantly positive correlation between average yields and the number of days with precipitation over 1 mm in spring and number of days of snow cover in winter. In order to be able to use the potential of these factors for non-irrigated crops such as cereals, it is important to promote afforestation in the territory and to maintain, renew and develop the protective forest belts, whose beneficial effects have long been known to foresters, who claim that such afforestation may increase crop yields up to 30% (Trud, 2016).

## **Conclusion**

The following conclusions can be drawn from the research:

1. Grain production in Bulgaria is highly vulnerable to the volatility shown by international markets, and therefore, to guarantee competitiveness of local production of main cereal crops, a system of care and interaction between executive power actors and farmers would be necessary.
2. It proves necessary to improve the coordination between the farming industry associations on a territorial basis, as well as their interaction with the regional associations of municipalities and with the National Association of

Municipalities in the Republic of Bulgaria for the exchange of technologies, specialists, equipment, etc.

3. The revealed relationship of the average yields of wheat with the seasonal volume of precipitation, number of days of precipitation and number of days of snow cover give reason to consider that the creation and maintenance of field protection forest belts in agricultural areas would have a favourable effect on the average yields of wheat.

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