ECONOMIC IMPACT OF RISING FERTILIZER PRICES ON THE CEREALS BUDGET

PETRE IONUȚ LAURENTIU

RESEARCH INSTITUTE FOR AGRICULTURE ECONOMY AND RURAL DEVELOPMENT
Corresponding author e-mail: petre.ionut@iceadr.ro

Abstract:

This paper aims to assess the impact on the budget of the main cereal crops in Romania, following the disruptions in the fertilizer market that led to accelerated price increases for this category of inputs. The income and expenditure budgets will be studied, both for the technological framework developed in 2021 and for the one developed in 2022, in the framework of the ADER 23.1.1 project of the Research Institute for Agriculture Economy and Rural Development, and finally the data will be quantitatively analysed, determining the absolute and relative differences related to the main cost elements, as well as the weight of the financial effort made for the application of fertilizers in the different cost structures for the crops: wheat, barley and maize.

Keywords: *chemical fertilizer price, impact, cereals, Romania, budget.*

JEL classification: Q11, Q12.

INTRODUCTION

This paper aims to analyze the economic impact of the increase in the price of chemical fertilizers on the income and especially on the expenditure budget for the main cereal crops in Romania.

This accelerated increase in fertilizer prices has several causes, such as the increase in inflation in the last year, according to data and forecasts of the National Bank of Romania (2022), due to the increase in the cost of natural gas and energy sources, according to the European Council (2022), and these causes have led to the limitation of production or even the closure of certain fertilizer factories in Romania, an example would be the Azomures factory (Econmedia, 2021). Thus, a low supply of fertilizers at an increasingly high cost has been exponentially felt in the increase in prices for these products, given the observed demand for fertilizers for Romanian households, both small and especially competitive.

This is the main context from which the research question arose, i.e. what is the influence of these price increases on the expenditure budget for the main cereal crops, and the research hypothesis, given the constant level of production and thus the required quantities of active substance on fertilizers, is that the increase in fertilizer costs will be directly proportional to the price increase.

The importance of fertilizers can be found in any literature in the field, Iliev (2016) states that „*fertilisers contribute to the growth and development of plant mass, root system and other organs. Due to the plant's anatomical structure and developmental characteristics, it easily absorbs and efficiently uses the nutrients administered, resulting in increased production and improved quality.*".

Ciochina (2017) confirms in his paper that „*the application of scientifically supported chemical fertiliser rates to autumn wheat contributes substantially to increasing yield and quality*."

MATERIALS AND METHODS

This paper aims to determine the economic impact of the sharp increase in the price of chemical fertilizers on the income and expenditure budget for cereal crops in Romania. For this purpose, data on the technological estimates for the year 2021, taken from the publications of the Research Institute for Agricultural Economics and Rural Development, within the framework of the ADER 23.1.1 project, were used, and for the year 2022, technological estimates were elaborated and implicitly calculated the income and expenditure budgets for these crops. In the study, the following cereal crops were analysed, according to the share of cultivated areas in Romania, according to the National Institute of Statistics (2022): wheat, barley and maize. In order to determine the impact of the increase in fertiliser prices, the cost elements of the income and expenditure budgets were analysed, determining the absolute and relative differences between the values of the two agricultural years analysed, as well as the shares of fertiliser costs in total inputs.

RESULTS AND DISSCUSION

In order to determine the economic impact that may occur in cereal crops as a result of the increase in fertiliser prices, the data in the Income and Expenditure Budgets (IEB), calculated on the basis of the estimated technological estimates for each crop per unit area of one hectare, were analysed. Therefore, the current year 2022 and the previous year 2021 will be taken into account in order to identify the absolute and relative cost differences and the contribution of fertiliser costs to the various forms of expenditure per hectare.

Table 1. Determination of absolute and relative differences within IEBs for wheat crop

Crt. No.	Indicatori	Unit*	2021		2022		Abs. Diff.		Rel. Diff.
			lei	euro	lei	euro	lei	euro	%
1	A. VALUE OF PRODUCTION	c.u.	4215	852	5966	1206	1751	354	41.6%
2	D (-)TOTAL EXPENDITURE	c.u.	3794	767	5419	1095	1625	328	42.8%
3	I. VARIABLE EXPENSES	c.u.	3470	701	4993	1009	1523	308	43.9%
4	1. Expenditure on materials	c.u.	1476	298	2718	549	1242	251	84.2%
5	- Seed and planting material	c.u.	460	93	460	93	0	0	0.0%
6	- Chemical fertilisers	c.u.	793	160	2023	409	1230	249	155.1%
7	- Pesticide	c.u.	224	45	235	48	11	2	4.9%
8	2. Expenditure on mechanised works	c.u.	1862	376	2069	418	207	42	11.1%
9	3. Irrigation expenditure	c.u.	x	x	x	x	x	x	x
10	4. Supply costs	c.u.	44	9	82	16	38	8	85.3%
11	6. Insurance	c.u.	87	18	125	25	38	8	43.6%
12	II. FIXED COSTS	c.u.	324	65	426	86	102	21	31.4%
13	PRODUCTION COST	c.u./to	862	174	1220	247	358	72	41.6%

Source: calculations based on ADER 23.1.1 project data.* currency units

As regards wheat cultivation, the calculations in Table 1 were made for a wheat production level of 4,400 kg/ha in the lowland area with an average potential level for both periods analysed.

Given the increase in inflation in the current year, there are increases in the expenditure items in the Income and Expenditure Budget for this crop for most items, except for seed and planting material, the cost of which has remained constant.

Analysing the level of total expenditure, it increased in 2022 compared to the previous year by €328 per hectare, an increase of 42.8%. Analysed by the two main components, there is an increase in variable expenditure of 308 euros per hectare, i.e. 43.9%, and an increase in fixed expenditure of 21 euros per hectare, i.e. 31.4%.

Although the cost level recorded for planting material has remained constant, the largest increase in the variable expenditure items is recorded in the expenditure on raw materials and materials (inputs), given the increase in the cost of chemical fertilisers for this crop at this level of production in a non-irrigated system, the costs being higher by 249 euros per hectare, i.e. by 155.1%, in other words the fertiliser expenditure in this case has increased by 2.55 times.

Therefore, adding these additional costs to the volume of production obtained results in a cost per unit of product (tonne) of 247 euros, which is 72 euros per tonne higher than the previous year, i.e. 41.6% higher. This percentage is therefore also recorded in the value of production, given that the level of productivity is the same the recovery price should maintain the same rate of increase as the cost in order to cover the economic effort made in the wheat production process.

Table 2. Determination of the share of fertiliser costs in wheat crop expenditure

Indicators	U.M.	2021	2022	Diff. p.p
Share of fertiliser cost in expenditure on raw materials and materials	%	53.7%	74.4%	20.7 p.p.
Share of fertiliser cost in variable expenditure	%	22.9%	40.5%	17.7 p.p.
Share of fertiliser costs in total expenditure	%	20.9%	37.3%	16.4 p.p.

Source: own calculations

Analysing the share of the cost of fertilisers used in the technological estimate for the wheat crop in the various cost levels for both 2021 and 2022, but also analysing the dynamics, the following can be seen.

Analysing the share of the cost of fertilisers in the category to which it belongs, i.e. in the total costs of raw materials and materials (inputs), in 2021, fertilisers had a contribution of 53.7% and in the following year, this contribution increased to 74.4%, i.e. by 20.7 percentage points.

Looking at the share of fertiliser cost in total variable (direct crop) expenditure, in 2021 the fertiliser cost had a contribution of 22.9% and in 2022 this contribution increased by 17.7 percentage points to 40.5%.

Finally, analysing the share of fertiliser costs in total expenditure for the crop under study, it can be seen that in 2021, 20.9% of total expenditure represented fertiliser costs, and in 2022, these costs increased to 37.3%, i.e. an increase of 16.4 percentage points.

Table 3. Determination of absolute and relative differences within IEBs for barley crop

Crt. No.	Indicatori	Unit*	2021		2022		Abs. Diff.		Rel. Diff.
			lei	euro	lei	euro	lei	euro	%
1	A. VALUE OF PRODUCTION	c.u.	4062	821	5580	1128	1518	307	37.4%
2	D (-)TOTAL EXPENDITURE	c.u.	3655	739	4955	1002	1300	263	35.6%
3	I. VARIABLE EXPENSES	c.u.	3344	676	4560	922	1216	246	36.4%
4	1. Expenditure on materials	c.u.	1378	279	2363	478	985	199	71.5%
5	- Seed and planting material	c.u.	426	86	360	73	-66	-13	-15.5%
6	- Chemical fertilisers	c.u.	729	147	1770	358	1041	210	142.8%
7	- Pesticide	c.u.	224	45	233	47	9	2	4.1%
8	2. Expenditure on mechanised works	c.u.	1840	372	2011	407	171	35	9.3%
9	3. Irrigation expenditure	c.u.	x	x	x	x	x	x	x
10	4. Supply costs	c.u.	41	8	71	14	30	6	72.9%
11	6. Insurance	c.u.	84	17	114	23	30	6	36.0%
12	II. FIXED COSTS	c.u.	312	63	396	80	84	17	26.8%
13	PRODUCTION COST	c.u./to	812	164	1116	226	304	61	37.4%

Source: calculations based on ADER 23.1.1 project data.* currency units

As regards barley, the calculations in Table 3 were made for a wheat production level of 4,500 kg/ha in the lowland area, with a medium potential level, in a non-irrigated system for both periods analysed. Given the increase in inflation in the current year, there are increases in the expenditure items in the Income and Expenditure Budget for this crop for most items, except for seed and planting material, the cost of which has decreased.

Analysing the level of total expenditure, it increased in 2022 compared to the previous year by € 263 per hectare, an increase of 35.6%. Analysed by the two main components, there is an increase in variable expenditure of 246 euros per hectare, i.e. 36.4%, and an increase in fixed expenditure of 17 euros per hectare, i.e. 26.8%.

Although the level of cost recorded for planting material has decreased, the largest increase in the variable expenditure items is recorded in the expenditure on raw materials and materials (inputs), given the increase in the cost of chemical fertilisers for this crop at this level of production in a non-irrigated system, the costs being higher by 210 euros per hectare, i.e. by 142.8%, in other words fertiliser expenditure in this case has increased 2.43 times.

Therefore, adding these additional costs to the volume of production obtained results in a cost per unit of product (tonne) of 304 euros, which is 61 euros per tonne or 37.4% higher than the previous year. This percentage is therefore also recorded in the value of production, given that the level of productivity is the same it was necessary for the recovery price to maintain the same rate of increase as the cost in order to cover the economic effort made in the barley production process.

Table 4. Determination of the share of fertiliser costs in barley crop expenditure

Indicators	U.M.	2021	2022	Diff. p.p
Share of fertiliser cost in expenditure on raw materials and materials	%	52.9%	74.9%	22.0 p.p.

Share of fertiliser cost in variable expenditure	%	21.8%	38.8%	17.0 p.p.
Share of fertiliser costs in total expenditure	%	19.9%	35.7%	15.8 p.p.

Source: own calculations

Analysing what is the share of the cost of fertilizers used in the technological estimate for the barley crop in the different cost levels for both 2021 and 2022, but also analysing the dynamics, the following can be observed.

Analysing the share of the cost of fertilisers in the category to which it belongs, i.e. in the total costs of raw materials and materials (inputs), in 2021, fertilisers had a contribution of 52.9% and in the following year, this contribution increased to 74.9%, i.e. by 22 percentage points.

Looking at the share of fertiliser cost in total variable (direct crop) expenditure, in 2021 the fertiliser cost had a contribution of 21.8% and in 2022 this contribution increased by 17 percentage points to 38.8%.

Finally, analysing the share of fertiliser costs in total expenditure for the crop under study, it can be seen that in 2021, 19.9% of total expenditure represented fertiliser costs, while in 2022, these costs increased to 35.7%, i.e. an increase of 15.8 percentage points.

Table 5. Determination of absolute and relative differences within IEBs for maize crop

Crt. No.	Indicatori	Unit*	2021		2022		Abs. Diff.		Rel. Diff.
			lei	euro	lei	euro	lei	euro	%
1	A. VALUE OF PRODUCTION	c.u.	4677	945	5638	1139	961	194	20.5%
2	D (-)TOTAL EXPENDITURE	c.u.	4210	851	5535	1119	1325	268	31.5%
3	I. VARIABLE EXPENSES	c.u.	3514	710	5147	1040	1633	330	46.5%
4	1. Expenditure on materials	c.u.	1218	246	2623	530	1405	284	115.4%
5	- Seed and planting material	c.u.	344	70	375	76	31	6	9.0%
6	- Chemical fertilisers	c.u.	773	156	2139	432	1366	276	176.7%
7	- Pesticide	c.u.	101	20	109	22	8	2	8.3%
8	2. Expenditure on mechanised works	c.u.	2162	437	2317	468	155	31	7.2%
9	3. Irrigation expenditure	c.u.	x	x	x	x	x	x	x
10	4. Supply costs	c.u.	37	7	79	16	42	8	112.7%
11	6. Insurance	c.u.	97	20	128	26	31	6	31.5%
12	II. FIXED COSTS	c.u.	696	141	388	78	-308	-62	-44.3%
13	PRODUCTION COST	c.u./to	765	155	922	186	157	32	20.6%

Source: calculations based on ADER 23.1.1 project data.* currency units

As regards maize, the calculations in Table 5 were made for a wheat production level of 5,500 kg/ha in the lowland area, with a medium potential level, in a non-irrigated system for both periods analysed. Given the increase in inflation in the current year, there are increases in the expenditure items in the Income and Expenditure Budget for this crop for most items, except for fixed costs, the level of which has decreased, given that in 2022 the manual work of hoeing between plants in turns has been eliminated due to labour issues and increased tariffs.

Analysing the level of total expenditure, it increased in 2022 compared to the previous year by €268 per hectare, representing an increase of 31.5%. Analysed by the two main components, there is an increase in variable expenditure of 330 euros per hectare, i.e. 46.5%, and a decrease in fixed expenditure of 62 euros per hectare, i.e. 44.3%.

The largest increase in the variable expenditure items is recorded in the expenditure on raw materials and materials (inputs), given the increase in the cost of chemical fertilisers for this crop at this level of non-irrigated production, the costs being higher by 276 euros per hectare, i.e. by 176.7%, in other words the fertiliser expenditure in this case increased by 2.77 times.

Therefore, adding these additional costs to the volume of production obtained results in a cost per unit of product (tonne) of €186, i.e. €32 per tonne higher than the previous year, i.e. 20.6% higher. This percentage is therefore also recorded in the value of production, given that the level of productivity is the same it was necessary for the recovery price to maintain the same rate of increase as the cost in order to cover the economic effort made in the maize production process.

Table 6. Determination of the share of fertiliser costs in maize crop expenditure

Indicators	U.M.	2021	2022	Diff. p.p
Share of fertiliser cost in expenditure on raw materials and materials	%	63.5%	81.5%	18.1 p.p.
Share of fertiliser cost in variable expenditure	%	22.0%	41.6%	19.6 p.p.
Share of fertiliser costs in total expenditure	%	18.4%	38.6%	20.3 p.p.

Source: own calculations

Analysing the share of the cost of fertilisers used in the technological estimate for maize in the various cost levels for both 2021 and 2022, but also analysing the dynamics, the following can be seen.

Analysing the share of the cost of fertilisers in the category to which it belongs, i.e. in the total costs of raw materials and materials (inputs), in 2021, fertilisers had a contribution of 63.5%, and in the following year, this contribution increased to 81.5%, i.e. by 18.1 percentage points.

Looking at the share of fertiliser cost in total variable (direct crop) expenditure, in 2021 the fertiliser cost had a contribution of 22% and in 2022 this contribution increased by 19.6 percentage points to 41.6%.

Looking at the share of fertiliser cost in total variable (direct crop) expenditure, in 2021 the fertiliser cost had a contribution of 22% and in 2022 this contribution increased by 19.6 percentage points to 41.6%.

CONCLUSIONS

The aim of the study was to assess the impact of the recent increase in fertiliser prices on cereal crop budgets. Thus, the income and expenditure budgets for the years 2021 and 2022 were analysed for the crops: wheat, barley and maize, in a non-irrigated system, in a lowland area with average potential.

Given the high level of inflation in 2022, most of the cost items for the three cereal crops have seen increases over the previous year, but by far the largest increases have been for the input category, fertiliser.

Clearly each crop has its own technical and technological peculiarities, but nevertheless, the increase in the cost of fertiliser application for the three crops ranged from +210 euros/hectare to +276 euros/hectare, resulting in a relative difference of between +142.8% and +176.7%, or in other words, the cost of chemical fertilisers increased by 2.43 to 2.77 times. In this case, of the three main cereal crops, the most affected was maize, due to its technological specificity, but the differences with the other crops in terms of costs were not large.

Each cost increase in the cost elements ultimately led to an increase in the cost per unit of product, ranging from +20.6% (maize crop) to +41.6% (wheat crop), and obviously the price of these products had to keep pace with the increase in costs in order to break even.

An analysis of the share of fertiliser costs in the various categories of expenditure shows an increase of between 15.8 and 22 percentage points.

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