# ECONOMIC EFFICIENCY OF SWITCHGRASS SEEDS PRODUCTION IN UKRAINE

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**Abstract.** Scientific work presents the results of multi-year research of switchgrass seeds yield depending on the cultivation agrotechnical measures and the range of varieties of foreign and Ukrainian selection. It has been established that switchgrass varieties Cave-in-Rock and Zoriane, as well as new Liniia 1307 produce the highest seed yields in Ukraine under the optimised cultivation technology. Variety Zoriane and Liniia 1307 provide the greatest economic efficiency according to gross profit from seeds sales and the level of production profitability.

**Key words:** switchgrass, varieties, yield, seeds, economic efficiency.

Weather conditions, agrotechnical measures of cultivation, varietal characteristics, as well as yield structure significantly affect the formation of switchgrass productivity. Yield structure includes productivity elements: plant density per unit area, the number and height of stems, the number and weight of seeds per panicle, the weight of 1000 seeds, etc. [6].

To obtain the high yields of biomass or seeds, it is necessary to ensure the most optimal correlation of all elements of the yield structure of energy crops, in particular, switchgrass, which is achieved by improving elements of the varietal technology [4].

A great number of foreign and Ukrainian scientific works, which substantiate the ways of using agrobiomass and phytomass of energy crops have been devoted to the study of the chosen issue [1. 5]. There is very little information on the energy and economic substantiation of switchgrass growing. The publications [2. 3] only determine the effectiveness of growing switchgrass varieties for biofuel purposes, and contain little information on the efficiency and profitability of seed production.

Therefore, to determine the economic efficiency of switchgrass seed production in the conditions of the Forest-Steppe of Ukraine, the experiment provided for:

- to establish the influence of cultivation technology on the yield of switchgrass seeds,

- to calculate the indicators of economic efficiency of switchgrass growing depending on the cultivation technology.

The economic evaluation of efficiency of switchgrass varieties growing for seed production purposes under the conventional and optimized cultivation technologies involves comparative evaluation of the main economic indicators.

The production cost of switchgrass growing ($C_p$, UAH/t) includes all expenditures, deductions, payments and depreciation.

The total cost of switchgrass seeds growing ($C_t$, UAH/t) is the sum of the production cost and additional costs.

Revenue from switchgrass seeds sales (R, UAH) is determined by multiplication of sale volume by seeds price.

Gross profit from the switchgrass seeds sales ($P_g$, UAH) is determined by dividing the revenue from the sales by the total cost of switchgrass seeds growing.

A level of production profitability (P, %) is the ratio of gross profit from sales to the total cost of growing seeds, expressed as a percentage.

The optimized technology of switchgrass growing for seeds combined: placement of energy plantation on the thoroughly prepared field using semi-fallow primary tillage system, spring cultivations, including pre-sowing cultivation and rolling before and after sowing the crop; sowing in the second decade of April with the seeding rate of 300 germinated seeds per 1 $м^2$ (5.7 kg/ha); wide-row method of sowing (60 cm), the application of spring nitrogen fertilization of plants with a nitrogen dose of 15-30 kg/ha of reactant, starting from the third vegetation year. Application of the proposed complex of agrotechnical measures, in comparison with the conventional technology of switchgrass growing in the conditions of the Forest-Steppe of Ukraine, allows to increase seed yields (Fig. 1) and raise the indicators of production economic efficiency(Fig. 2, Table 1-2).

Among the studied varieties, Liniia 1307, varieties Zoriane and Cave-in-Rock produce the highest yields under the conventional cultivation technology – 0.26; 0.25 and 0.21 t/ha, respectively, and under the optimized technology – 0.61; 0.53 and 0.50 t/ha respectively.

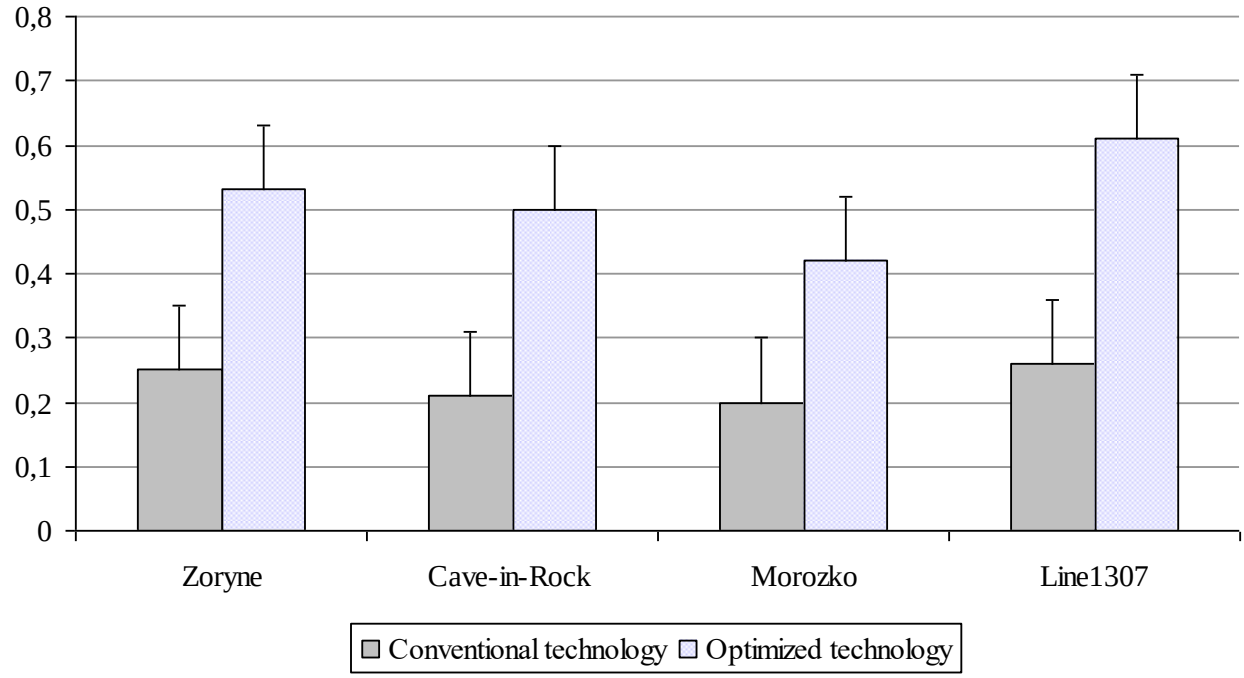


*Fig. 1. Yield of switchgrass varieties seeds depending on the cultivation technology, 2015-2019.*

Analysis of economic efficiency of switchgrass seed production under the conventional cultivation technology proves that, in comparison with other varieties, the revenue from the sales of 1 ton of seeds of variety Morozko is the lowest (7610.0 UAH), while a level of production profitability is only 8.7%. These indicators of variety Zoriane and Liniia 1307 were significantly higher, and they had an intermediate value for the variety Cave-in-Rock.

*Table 1. Economic efficiency of switchgrass seed production under the conventional cultivation technology, 2015-2019.*

| Variety | Yield, t/ha | Economic efficiency indicators* | | | | |
|---|---|---|---|---|---|---|
| | | $C_p$, UAH/ha | $C_t$, UAH/ha | R, UAH/ha | Pg, UAH/ha | P, % |
| Zoriane | 0.25 | 6379.2 | 7004.4 | 9512.5 | 28017.4 | 35.8 |
| Cave-in-Rock | 0.21 | 6402.5 | 7036.3 | 7990.5 | 33506.4 | 13.6 |
| Morozko | 0.20 | 6390.3 | 7002.9 | 7610.0 | 35014.3 | 8.7 |
| Liniia1307 | 0.26 | 6408.3 | 7106.8 | 9893.0 | 27333.9 | 39.2 |

*Note: $C_p$ – production cost, UAH/t; $C_t$ – total cost, UAH/t;
R – revenue from sales of seeds, UAH; Pg – gross profit from sales of seeds, UAH;
P – level of production profitability, %.

The profitability level of seed production of variety Zoriane, Liniia 1307 and variety Cave-in-Rock was 35.8%, 39.2% and 13.6%, respectively. Revenue from the unit of product sales was 9512.5; 9893.0 and 7990.5 UAH, respectively.

The optimized cultivation technology allowed to increase the main indicators of economic efficiency for all switchgrass varieties (Table 2).

*Table 2. Economic efficiency of switchgrass seed production under the optimized cultivation technology, 2015-2019*

| Variety | Yield, t/ha | Economic efficiency indicators* | | | | |
|---|---|---|---|---|---|---|
| | | $C_p$, UAH/ha | $C_t$, UAH/ha | R, UAH/ha | Pg, UAH/ha | P, % |
| Zoriane | 0.53 | 6560.2 | 7203.1 | 20166.5 | 13590.8 | 180.0 |
| Cave-in-Rock | 0.50 | 6540.0 | 7187.5 | 19025.0 | 14374.9 | 164.7 |
| Morozko | 0.42 | 6458.3 | 7117.0 | 15981.0 | 16945.3 | 124.5 |
| Liniia1307 | 0.61 | 6558.3 | 7273.2 | 23210.5 | 11923.2 | 219.1 |

**Note: $C_p$ – production cost, UAH/t; $C_t$ – total cost, UAH/t; R – revenue from sales of seeds, UAH; Pg – gross profit from sales of seeds, UAH; P – level of production profitability, %.*

Cultivation of variety Zoriane (180.0%) and Liniia 1307 (219.1%) was the most profitable, cultivation of varieties Cave-in-Rock (164.7%) and Morozko (124.5%) was less profitable, but at a high level.

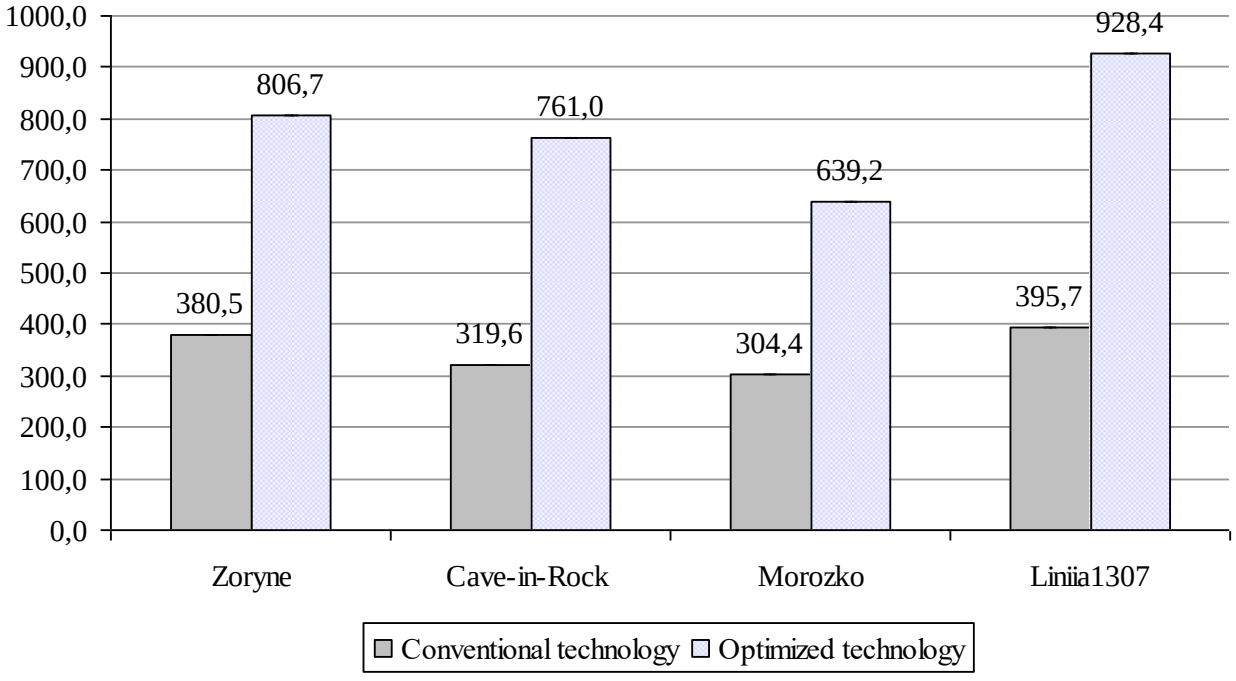


*Fig. 2. Revenue from switchgrass seeds sales, dollars*

*Conclusions.* Variety Zoriane and Liniia 1307 provide the highest seed yields (more than 0.50 t/ha) and the greatest economic efficiency according to gross profit from the sales of seeds and the level of production profitability (more than 180.0%) under the optimized cultivation technology. Placement of new energy plantations of the studied switchgrass varieties will allow to obtain energy intensive plant raw material, to decrease cost of energy carriers as well as to increase the social and economic development of territorial communities.

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