

## PRODUCTIVITY AND ECONOMIC EFFICIENCY IN THE PRODUCTION OF SEEDS OF BIRD'S FOOT TREFOIL CULTIVARS

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### Abstract

*During the period 2017-2019 in the experimental field of RIMSA-Troyan by the block method in four replications, were tested the following bird's foot trefoil cultivars: 'Targovishte 1' (Bulgaria), 'Alvena', 'Lotanova' and 'Frilo' (Italy), 'Polom' (Slovakia), 'Bonnie' (France), 'Bull' (Canada). The economic efficiency and the economic indicators were determined on the basis of reported seed yield. The obtained results show that 'Lotanova' achieved the highest seed productivity ( $0.39 \text{ t}\cdot\text{ha}^{-1}$ ), with the lowest cost price (33.10 BGN/t) and the highest profitability rate (509.04%), which makes it suitable for growing in mountain conditions. The established strong correlation dependence between the yield with the gross income and the gross profit of 'Lotanova' determines the economic effect of the introduction of this cultivar for production in practice.*

**Key words:** bird's foot trefoil, cultivars, economic indicators, seed productivity

### INTRODUCTION

Bird's foot trefoil is a fodder legume suitable for haymaking, grazing and combined use [3]. The interest in it is because of its cultivation with low investment of production costs [6], which confirms its position as an economic species with low resource requirements. The high nutritional value of bird's foot trefoil [7, 13, 2] complements its advantages over many other legume species. Nitrogen-fixing ability of bird's foot trefoil [14] is important for reducing the costs of nitrogen fertilizers in the soil and improving environmental efficiency. The production of bird's foot trefoil seeds is quite limited. This is due to the low yield, which is the result of easy cracking of pods and high seed loss [8, 4]. The lack of sufficient yields has prevented its spread. The method of growing the crop and climatic factors [10, 5] are essential in the production of seeds of bird's foot trefoil. Research determining the economic efficiency, which compares the income from the sale of seed production and the costs involved in its implementation are quite scarce and incomplete. This requires the determination of economic efficiency, which gives an idea of how a production system

manages to generate the maximum desired volume of finished product with limited and predetermined quantities of production factors and technology used [11].

The aim of the present study is to analyze the economic indicators and determine the economic efficiency of seed production on the basis of the productivity obtained from bird's foot trefoil cultivars.

### MATERIALS AND METHODS

The experiment was conducted in the period 2017-2019 in the experimental field of RIMSA-Troyan with the following bird's foot trefoil cultivars: 'Targovishte 1' (Bulgaria), 'Alvena', 'Lotanova' and 'Frilo' (Italy), 'Polom' (Slovakia), 'Bonnie' (France), 'Bull' (Canada). Sowing was carried out in 2016, and seed harvesting in the second experimental year for three calendar years.

The technology for creating grassland includes: plowing, double disking, cultivation, sowing, rolling, harvesting the first regrowth for fodder, and the second for seeds. Seed collection is related to technological events, such as harvesting, transporting of seeds, cleaning and storage. These manual and mechanized activities are described in the

technological map for each cultivar and on the basis of the obtained seed yield the calculations concerning the economic indicators are made. From the obtained data the economic evaluation of the production of bird's foot trefoil seeds was performed, which included the following indicators: production costs (BGN/ha), cost price of 1 t of seed production, gross income and gross profit (BGN/ha), profitability (%). The prices of the used seeds, materials, fuel are indicated in BGN at market prices for each studied year separately.

The economic efficiency of costs in the seed production of bird's foot trefoil cultivars [1] actually is a ratio of the created effect to the costs. It gives an idea of which of the analyzed bird's foot trefoil cultivars is the most suitable for use from an economic point of view. The cost-effectiveness ratio used shows how much revenue is realized per unit cost [12].

Statistical data processing was performed by analysis of variance (ANOVA).

## RESULTS AND DISCUSSIONS

Table 1 shows the seed yield on the basis of which the analysis of economic indicators was made. In the first experimental year the seed productivity varied from 0.28 to 0.39 t ha<sup>-1</sup>. 'Lotanova' stood out as the most productive, and 'Alvena' and 'Frilo' registered the same seed productivity, 0.35 t ha<sup>-1</sup>, respectively. All tested cultivars are more productive than the standard variety 'Targovishte 1'. In the second seed-producing year, higher yields were reported for more cultivars compared to the previous year, with a maximum value again for 'Lotanova' (0.48 t ha<sup>-1</sup>). The third year also registered high levels of seed yield, with the highest values for 'Lotanova' (0.43 t ha<sup>-1</sup>) and Frilo (0.39 t ha<sup>-1</sup>). The variability of average seed yield values ranged from 0.30 to 0.43 t ha<sup>-1</sup> for the study period. Maximum productivity was reported for 'Lotanova', followed by 'Frilo' both over the years and on average for the period. To a large extent, seed productivity is determined by the combined impact of climatic factors and structural elements of seed production.

Table 1. Seed yield (t ha<sup>-1</sup>) year and per Mean for the period 2017-2019

Cultivars	2017	2018	2019	Average for the period
'Targovishte 1'	0.28	0.33	0.31	0.30
'Alvena'	0.35	0.36	0.33	0.34
'Lotanova'	0.39	0.48	0.43	0.43
'Frilo'	0.35	0.36	0.39	0.36
'Polom'	0.34	0.31	0.32	0.32
'Bonnie'	0.33	0.33	0.31	0.32
'Bull'	0.37	0.34	0.35	0.35

Source: Own calculations.

The economic analysis (Table 2) on the impact of production costs in the production of bird's foot trefoil from different cultivars shows that their size increases from 1,238.00 BGN/ha to 1,423.00 BGN/ha. The differences in the investments made for seed production between the different cultivars are determined mainly by the costs of transporting and cleaning of the seeds on the basis of the obtained yield. The main factors determining the amount of costs incurred are the price of fuel for mechanized equipment and the

amount of increased number of working hours for cleaning. The lowest costs were made for 'Targovishte 1' (1,238.00 BGN/ha), and the highest in the production of seeds for 'Lotanova'.

With the increase in production costs, a decrease in the cost price of 1 t of seeds of different cultivars is registered. Production cost price expressed by the relationship between production costs and yield obtained, ranged from 33.10 BGN/t to 41.30 BGN/t, with the lowest value reported for 'Lotanova'.

Table 2. Economic analysis of seed production of bird's foot trefoil for the period 2017-2019

Cultivars	Production costs	Cost price	Gross revenue	Gross profit	Profitability
	BGN/ha	BGN/t	BGN/ha	BGN/ha	%
'Targovishte 1'	1,238.00	41.30	6,133.30	4,895.30	395.42
'Alvena'	1,312.00	38.60	6,933.30	5,621.30	428.45
'Lotanova'	1,423.00	33.10	8,666.70	7,243.70	509.04
'Frilo'	1,338.00	37.20	7,333.30	5,995.30	448.08
'Polom'	1,301.00	40.60	6,466.70	5,165.70	397.06
'Bonnie'	1,301.00	40.60	6,466.70	5,165.70	397.06
'Bull'	1,323.00	37.80	7,066.70	5,743.70	434.14

Source: Own calculations.

This cultivar showed the highest production costs and the highest seed yield. 'Targovishte 1' had the highest cost price of the seed production.

Gross revenues ranged from BGN 6,133.30 to BGN 8,666.70 BGN/ha, with the highest value for 'Lotanova'. This is explained by the highest seed yield of this cultivar (0.43 t/ha). It exceeded the control ('Targovishte 1') by 2,533.40 BGN/ha, which was directly related to the highest gross profit (7,243.70 BGN/ha) of 'Lotanova'. Minimum gross profit was realized by the control cultivar (4,895.30 BGN/ha), followed by 'Polom' and 'Bonnie' (5,165.70 BGN/ha). Their value is the same due to the duplicate seed yield of these two cultivars. It is necessary to emphasize their equal value of cost price, gross revenue and profitability, which makes these two cultivars completely equal in the realization of economic benefits in their use.

As with the previous economic indicators, so with the most generalizing one - profitability, 'Lotanova' marked its superiority by 509.04%. For other cultivars, profitability rate varied from 395.42% ('Targovishte 1') to 448.08% ('Frilo').

Figure 1 shows the effectiveness of the application of different cultivars of bird's foot trefoil. Here it is considered not only as a ratio of the effect obtained and the costs incurred, but also as a criterion for evaluation (Bazitov et al., 2013).

In a given period of time, each farm has the need to perform a summary analysis of income and expenses to determine the

direction of development of its activities, [9] defines economic efficiency as the amount of economic effect that is created with the participation of a unit of expenditure or unit of resources, or as the amount of costs or resources involved in creating a unit of economic effect.

In terms of the ratio of revenues to production costs, the highest coefficient of economic efficiency (6.09) is found in 'Lotanova'. Of all the studied economic indicators, 'Lotanova' is the most recommended for the practice, because of its high seed yield, high revenues and respectively gross profit. Compared to the control cultivar, 'Lotanova' surpassed it by 22.93% in terms of economic efficiency.

The same trend was observed when calculating economic efficiency as a ratio of profit to production costs. The excess in 'Lotanova' compared to 'Targovishte 1' (control) is 29.34%. Immediately after it is 'Frilo', which exceeds the Bulgarian variety (var. 1) by 10.63% in terms of revenue and expenses and by 13.52% in terms of net income (profit) and expenses.

The lowest efficiency coefficient was registered for 'Polom' and 'Bonnie' - 4.97 and 3.93 in the ratio of the two studied economic effects on costs.

Their values are the same due to the obtained yield value, which in both variants is 0.32 t/ha.

This leads to the equal use of labor and payment for it, as well as the same amount of material resources spent on the output.

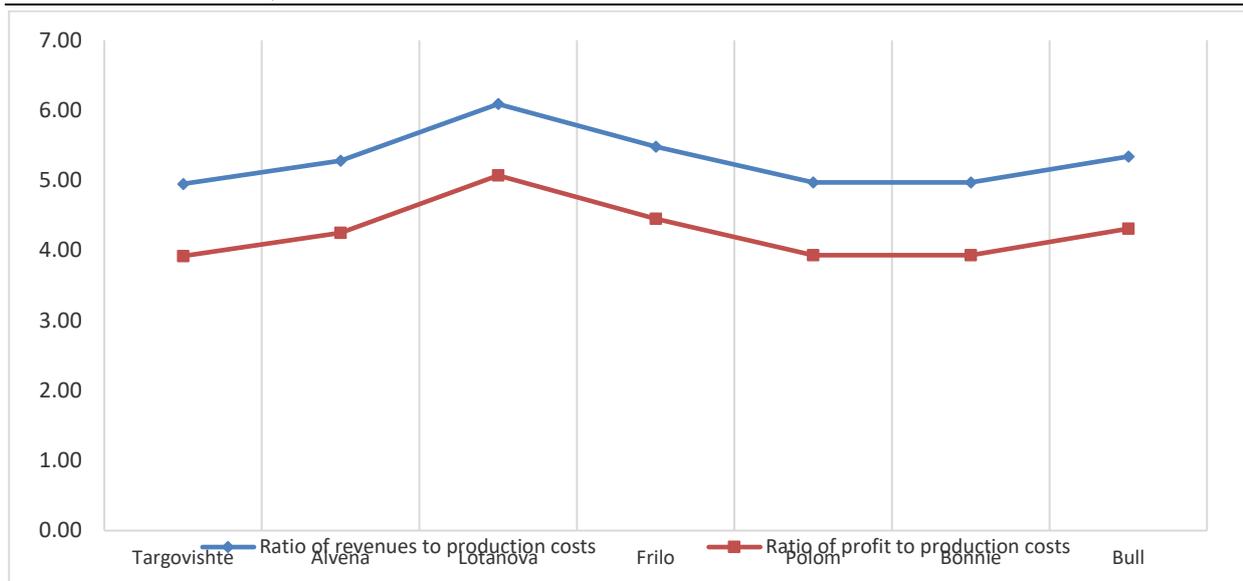


Fig. 1. Economic efficiency of costs in the seed production of bird's foot trefoil cultivars for the period 2017-2019  
 Source: Own calculations and design.

This shows that these two cultivars are the most unprofitable for farmers who have decided to invest in the sowing and production of bird's foot trefoil, as the value of additional seed production cannot offset the costs incurred.

## CONCLUSIONS

Of the studied bird's foot trefoil cultivars, Lotanova is the most cost-effective for seed production, proving itself over the other cultivars with the highest yield (0.43 t/ha), highest gross revenue (8,666.70 BGN/ha) and profit (7,243.70 BGN/ha) and the lowest cost price (33.10 BGN/t). Despite the highest costs for the production with 1,423.00 BGN/ha, it is the most economically advantageous because it compensates the costs with the additional production.

'Polom' and 'Bonnie' are economically unprofitable in terms of seed production due to the low yield (0.32 t/ha) and the low value of the profitability rate (397.06%).

The economic efficiency of the production of seeds from different cultivars of bird's foot trefoil gives us reason to recommend 'Lotanova' for cultivation by farmers, due to its efficiency from a fodder and economic point of view.

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