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Prospects for the use of fallow lands in the TVER region for sowing long-stalked flax

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ABSTRACT

The Tver region is considered a region of the Central Federal District of the Russian Federation that has the largest amount of agricultural land (2,575.7 thousand ha). At the same time, the region traditionally occupies the last places in the structure and efficiency of their use, covering only 2% in the distribution of the agricultural significance of the regions from 17 entities comprising the Central Federal District. The main reasons for this condition are, first of all, the low efficiency of using farmland: in particular, only 39.3% of the arable land area is used for sowing. Consequently, the remaining area – more than 800 thousand ha – can be attributed to fallow or uncultivated lands without officially fixing their status and transferring them to other categories. To solve the tasks, in 2019, comprehensive scientific research on the development of individual techniques for growing seed crops of new varieties of long-stalked flax on fallow lands has been carried out based on the Tver State Agricultural Agricultural Academy by order of the Ministry of Agriculture of Russia. As a result of the development of separate methods for growing long-stalked flax on fallow lands, it has been found that for the optimal realization of the biological productivity potential of modern varieties, for the Tonus variety, a tank mixture of herbicides Agritox (1 l/ha) + Hunter (3 l/ha) + Sekator Turbo (0.1 l/ha) and foliar fertilizer with boron complexonate B-EDDYAK (381 g/ha) should be used in the herringbone phase and for the Nadezhda variety, Agritox (1 l/ha) + Fusilad Forte (1.5 l/ha) + Sekator Turbo (0.1 l/ha) and foliar fertilizer with zink complexonate Zn-EDDYAK (401 g/ha) should be used. The developed methods provide not only an increase in crop productivity but also an improvement in the sowing qualities of seeds of the cultivated flax varieties.

Key words : *Structure of agricultural land, Fallow land, Flax, Varieties, Herbicides, Trace elements, Productivity, Seed quality, Economic efficiency.*

Introduction

The long period of crisis in the agricultural sector of the Russian Federation has had an extremely negative impact on the use of the agricultural land fund (Report on the state and use of agricultural land of the Russian Federation in 2016, 2018; Golubeva and Nakvasina, 2017; Zeldner, 2018; Farinyuk *et al.*, 2013). Thus, once fertile, well-cultivated lands that produced stable crop yields have been transformed into heavily overgrown (in some cases, even with tree and shrub vegetation) and weed-infested lands with disturbed reclamation regime and a formed layer of perennial sod (Golubeva and Nakvasina, 2017). The development of fallow lands requires the implementation of such approaches that would allow not only using the land in the long term but also receiving high-quality products, starting from the

first years of use (Zeldner, 2018; Mameeva, 2017). In particular, long-stalked flax, which is quite demanding in terms of growing conditions, is one of the most promising crops for cultivation in a whole group of regions of the Central Non-Black Earth Region, including the Tver region (Rozhmina *et al.*, 2018; Novokhatskaya, 2018; Popelyaeva and Shtabel, 2014).

In this regard, the purpose of our work was to assess the state of fallow lands of the Tver region and to propose the production of separate techniques of the technology for growing new varieties of long-stalked flax on fallow lands.

Methods and Results

The Tver region is considered a region of the Central Federal District of the Russian Federation that has the largest amount of agricultural land (2,575.7 thousand ha). At the same time, the region traditionally occupies the last places in the structure and efficiency of their use, covering only 2% in the distribution of the agricultural significance of the regions from 17 entities comprising the Central Federal District. The main reasons for this condition are, first of all, the low efficiency of using farmland: in particular, only 39.3% of the arable land area is used for sowing (Report on the state and use of agricultural land of the Russian Federation in 2016, 2018; The site of the Territorial Authority of the Federal State Statistics Service in the Tver Region, n. d.). Consequently, the remaining area – more than 800 thousand ha– can be attributed to fallow or uncultivated lands without officially fixing their status and transferring them to other categories.

When assessing the formation of fallow lands, it is important to assess the state of land use in the context of municipalities, the number of which is equal to 36 in the Tver region. Thus, it was found that the most full-fledged use of sown areas was observed in the Lesnoy District (72%) in 2016-2018. This fact is directly explained by territorial zoning when most of the area is occupied by tree and shrub vegetation and a small part of the land suitable for agricultural use is at the disposal of existing enterprises interested in the production of crop products. Comprehensive analysis showed that only nine districts of the Tver region (25% of the total) effectively used more than half of the acreage; seven districts used less than 50%, eight – less than 40%, seven – less than 30%, and three – less than 20%. The Zharkovsky district was characterized by the lowest land use (less than 2%). Based on the material, it is possible to imagine the huge amount of land resources that could potentially be involved in the turnover for the sowing of promising crops (including long-stalked flax).

The balance of land use efficiency over the past three years, which considers land disposals and inputs, is positive (>7%). However, due to the high number of land disposals, it is insignificant and only 0.5% on the scale of the increase in acreage.

The reason for the low commissioning of fallow land is the weak interest of municipalities in this process, which is confirmed by the analysis of farmland put into circulation in districts of the Tver region in 2017-2018. It was revealed that only 27 districts of the Tver region (75%) were engaged in this problem, among which the leader was the Krasnokholmsky district. At the same time, 30% of the specified area was brought in by efforts of the "Naturprodukt" LLC, engaged in growing forage crops. Ten districts of the region put into operation more than 1,000 ha of land, including the Staritsky and Toropetsky districts with more than 3,000 ha. It should be noted that, as a rule, the main input of fallows is provided by individual large enterprises that seek to occupy a certain niche of the agricultural market in the shortest possible time.

The prospects for using fallow lands are determined by the demand for potentially produced products, as well as the existing structure of acreage. In the conditions of the Tver region, the largest areas are occupied by sowings of grain,leguminous crops and potatoes (Figure 1).

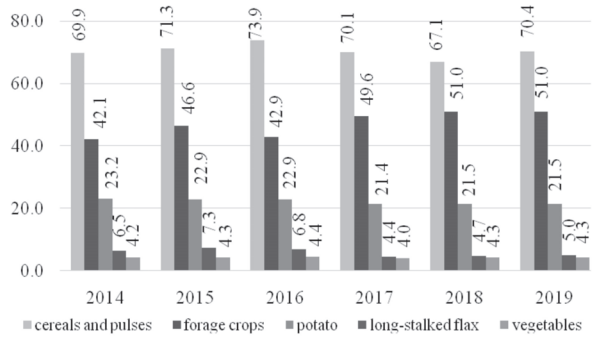

Fig. 1. Structure of crop acreage in the Tver region, thousand ha

A separate strategic direction of development is flax growing, which is characterized by high demand for products and requirements for favorable

soil and climate conditions, as well as weak development. The harmonious solution of two important national economic problems – putting fallow lands into operation to grow highly productive flax crops on them – would allow for a significant contribution to the economy of the Tver region.

To solve the tasks, in 2019, comprehensive scientific research on the development of individual techniques for growing seed crops of new varieties of long-stalked flax on fallow lands was carried out based on the Tver State Agricultural Agricultural Academy by order of the Ministry of Agriculture of Russia. For the research, a 2-ha plot of fallow land (under a fallow for more than 5 years) was selected.

The soil of the experimental plot was soddy medium-podzolic, residual carbonate gley on the moraine, light loamy. Agrochemical indicators of the arable soil layer before the experiment were follows: humus (according to Tyurin) – 2.73%; total nitrogen – 0.172%; mobile phosphorus (P_2O_5) – 395 mg/kg; exchange potassium (K_2O) – 150 mg/kg (according to Kirsanov); pH_{KCl} = 5.9; the capacity of the arable layer – 20-22 cm.

A three-factor field experiment was conducted on the selected site using the split plots method. The repetition in the experimentwas fourfold. Plot area of the first order was 2,496 m^2, the second order – 1,248 m^2, and the third order – of 416 m^2. The placement of options was randomized. The experiment scheme is presented in Tables 1 and 2.

Agronomics of long-stalked flax was generally accepted.

Table 1. Quality indicators of received long-stalked flax seeds

Variety (À)	Tank mixture of herbicides (B)	Foliar fertilizer (C)	Sproutingrate, %	Laboratory germination, %	Weight of 1,000 of seeds, g
Tonus	Agritox +Fusilad forte +	Without plant feed	81.5	85.0	4.72
	Sekator Turbo	B-EDDYAK	91.5	93.5	5.40
		Zn-EDDYAK	94.0	94.0	5.41
	Agritox + Hunter +	Without plant feed	87.5	89.0	5.39
	Sekator Turbo	B-EDDYAK	93.0	94.0	5.84
		Zn-EDDYAK	95.0	95.0	5.43
	On average		90.4	91.8	5.37
Nadezhda	Agritox + Fusilad forte +	without plant feed	98.0	99.0	5.51
	Sekator Turbo	B-EDDYAK	96.0	97.0	5.31
		Zn-EDDYAK	94.5	96.0	5.51
	Agritox + Hunter +	without plant feed	96.0	97.0	5.33
	Sekator Turbo	B-EDDYAK	99.5	99.5	5.32
		Zn-EDDYAK	99.0	99.0	5.54
	On average		97.2	97.9	5.42

Table 2. Economic efficiency of long-stalked flax cultivation

Variety (À)	Tank mixture of herbicides (B)	Foliar fertilizer (C)	Production costs, thousand rubles/ha	Crop value, thousand rubles/ha	Level of profitability, %
Tonus	Agritox +Fusilad Forte +	without plant feed	62.07	60.95	-1.8
	Sekator Turbo	B-EDDYAK	66.70	75.66	13.4
		Zn-EDDYAK	70.13	74.31	6.0
	Agritox +Hunter +	without plant feed	58.72	70.44	20.0
	Sekator Turbo	B-EDDYAK	63.02	78.88	25.2
		Zn-EDDYAK	67.43	80.29	19.1
Nadezhda	Agritox + Fusilad Forte +	without plant feed	54.77	64.80	18.3
	Sekator Turbo	B-EDDYAK	57.38	72.03	25.5
		Zn-EDDYAK	58.29	76.78	31.7
	Agritox + Hunter +	without plant feed	47.93	56.37	17.6
	Sekator Turbo	B-EDDYAK	50.43	65.92	30.7
		Zn-EDDYAK	51.49	68.64	33.3

The amount of precipitation during the sowing period was 90.9% of the norm and the amount of effective temperatures was 102.0% of the norm.

Records and observations were made in the experiment following the "Guidelines for conducting field experiments with long-stalked flax" (1978).

According to the results of the comprehensive assessment of the productivity of the long-stalked flax varieties, the most effective for the Tonus variety was the use of a tank mixture of herbicides Agritox + Hunter + Sekator Turbo and for the Nadezhda variety – Agritox + Fusilad Forte + Sekator Turbo (Figure 2).

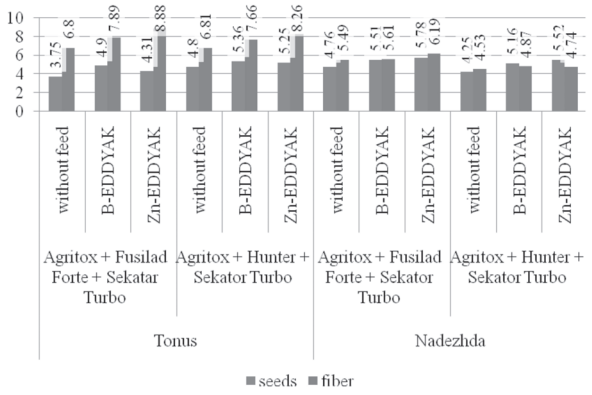

Fig. 2. Yield of long-stalked flax, c/ha

Spraying the crops with boron complexonate was preferred for the Tonus variety and with zinc complexonate – for the Nadezhda variety. The revealed regularities were due to the genetic characteristics of the studied varieties, which, under general equal conditions, are responsible for mobilizing the process of forming generative organs of plants, thereby increasing seed productivity. The catalytic function in these processes is performed by microelements, contributing to the activation of the genetic potential of varieties. The indicated tendency was maintained when the content of bast fibers was formed in the stems of long-stalked flax.

Analysis of seed quality showed that they met the requirements of GOST R 52325-2005 "Seeds of agricultural plants. Varietal and sowing characteristics" (GOST R 52325-2005, 2009). The use of zinc complexonate provided an increase in germination by 5-9%, compared with the control, increasing the category of seeds to original seeds. The use of boron complexonate turned out to be more effective in the Nadezhda variety; the increase relative to the control was 2.5% (Table 1).

The economic assessment of the research results, performed at the current prices for the sale of flax products, convincingly showed that the cultivation of long-stalked flax by the prevailing number of variants of the trial was cost-effective and the return on the costs incurred reached 33.3% (Table 2).

The highest profitability was obtained when using the boron microelement with the Tonus variety (13.4 and 25.2%) and zinc with the Nadezhda variety (31.7 and 33.3%). At the same time, an increase in profitability (25.2%) was achieved when using the tank mixture of herbicides Agritox + Hunter + Sekator Turbo and foliar fertilizer B-EDDYAK for the Tonus variety and when cultivating the Nadezhda variety on a similar background of the tank mixture of herbicides using Zn-EDDYAK.

Conclusion

The Tver region has a significant reserve of land resources represented by unused agricultural land, which is a potential base for expanding the area of sowing traditional crops that have sufficient genetic resistance to local abiotic stresses. In particular, long-stalked flax is of strategic importance for the Tver region.

As a result of the development of separate methods for growing long-stalked flax on fallow lands, it has been found that for the optimal realization of the biological productivity potential of modern varieties, for the Tonus variety, a tank mixture of herbicides Agritox (1 l/ha) + Hunter (3 l/ha) + Sekator Turbo (0.1 l/ha) and foliar fertilizer with boron complexonate B-EDDYAK (381 g/ha) should be used in the herringbone phase and for the Nadezhda variety, Agritox (1 l/ha) + Fusilad Forte (1.5 l/ha) + Sekator Turbo (0.1 l/ha) and foliar fertilizer with zink complexonate Zn-EDDYAK (401 g/ha) should be used.

References

Farinyuk, Yu.T., Migulev, P.I. and Glebova, A.G. 2013. The innovative development of the agro-industrial complex of the Tver region: a monograph. Tver: Tver *State Academy of Agricultural Sciences.* pp. 175.

Golubeva, L.V. and Nakvasina, E.N. 2017. Transformation of post-agrogenic lands on carbonate deposits: monograph. Arkhangelsk: KIRA, pp. 152.

GOST R 52325-2005. *Seeds of agricultural plants. Varietal and sowing qualities.* 2009. Moscow: Standart in form, pp. 22.

Guidelines for conducting field experiments with long-stalked flax. (1978). Torzhok: VNIIL, pp. 71.

Mameeva, V.E. 2017. Rehabilitation of fallow lands in the Bryansk region. *Agrokonsultant.* 1 : 13-15.

Novokhatskaya, D.M. 2018. The influence of agrotechnical methods of cultivation of flax flax on the yield and quality of fiber in the conditions of the Leningrad region: Master of Agriculture dissertation. St. Petersburg, pp. 139.

Popelyaeva, N.N. and Shtabel, Yu.P. 2014. Long-stalked flax in the low mountains of the Gorno-Altaisk: monograph. Gorno-Altaisk: RIO GAGU, pp. 119.

Report on the state and use of agricultural land of the Russian Federation in 2016. (2018). Moscow: FGBNU "Rosinformagrotekh", pp. 240.

Rozhmina, T.A., Pavlova, L.N., Ponazhev, V.P. and Zakharova, L.M. 2018. Flax industry on the path to revival. Zashchita i karantin rastenii, 1: 3-8.

The site of the Territorial Authority of the Federal State Statistics Service in the Tver Region. (n. d.). https://tverstat.gks.ru/ (reference date: January 17, 2020).

Zeldner, A.G. 2018. The state of agricultural land in Russia is an article for webeconomy.ru.http://www.webeconomy.ru/index.php? page=cat&newsid=2492&type=news# (reference date: March 25, 2019).