Influence of degree of density on growth rate and yield of oil-bearing flax under the conditions of South-Eastern Kazakhstan

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Abstract. The article presents data on the study of average influence of degree of density on growth rate and yield of oil-bearing flax under the conditions of South-Eastern Kazakhstan in 2012-2013. According to the results of the investigation we stated that the oil-bearing flax was most productive when sowing with planting width of 45 cm and seeding rate of 4.0 million units/ga. In this case the yield was 22.4 dt/ga, which is 2.7-3.1 dt/ga higher than in other variants.

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Introduction

Diversification of the crop science presupposes the implementation of the new field crops into the agriculture, review of the crop acreage structure by means of brief implementation of a crop rotation system and replacement of traditional crops with alternative ones that have bigger food, technical and feeding value. In this regard those main directions of agro-industry development in the Republic of Kazakhstan have foreseen the improvement of the current and development of new highly effective agro-technologies of non-traditional crops management while preserving and recovering soils fertility.

Oil-bearing flax is one of the most ancient crops. Initially it was managed mostly for fibres manufacturing, but today it is used for receiving oil which is used in engineering, food, medicine and production of biofuel. Thanks to the great number of valuable and medical properties, the interest of the people all over the world to the flax usage in food production has increased. The derived products of flaxseed make their production all over the world very beneficial.

Flaxseed contains 29 to 45% of oil, as well as omega-3 fatty acids and very important is alpha-linolenic acid [1-6].

On the South-East of Kazakhstan oil-bearing flax has not been managed earlier. That's why the development of adjustive resource saving technologies of its management is the acute task. In order to solve this task the modern conditions demand the development of innovative management technologies, which allow to get good yield of agricultural crops [7].

Materials and methods

Field investigations were founded in scientific experimental station "Agrouniversite" of Yenbekshykazakhskiy district (Almaty region) on chestnut-like meadow soils. Humus content of plough-layer is 4.38%, it gradually decreases as it goes deeper, total nitrogen and total phosphorus content is 0.258 and 0.211% respectively.

As for the available fertilizer elements content, the soil of the test area is characterised as highly provided with nitrogen and exchange potassium. Labile phosphorus content in the soil is low - 22 mg/kg. Thus, the hydrophysical properties and natural fertility level of chestnut-like meadow soil comply with the conditions of oil-bearing flax management.

Summarizing the above said we conducted investigations in 2012-2013 in order to study the influence of seeding rates on the growth rate and yield of oil-bearing flax in the conditions of South-Eastern Kazakhstan. Oil-bearing flax (breed Kazar) was the object of investigation.

The task of the investigation was as follows: influence of the seeding rates on field emergence and preservation of plants; growth rates, biomass accumulation according to the vegetative stages; formation and functioning of photosynthetic potential; elements of harvest and yield structures of oil-bearing flax.

Results and discussions

In order to achieving and planting pre-planned high and stable high-quality harvests of oil-bearing flax it is necessary to get and preserve

seedlings of the set density. This task can be solved by means of determining optimum terms, means and seeding rates, depth of seeding, as well as increasing of the seed quality, improving agricultural machines and conditions of sprouting of oil-bearing flax seeds.

Seeding rate is set with the account to not only the breed, but also the zonal conditions of management in order to get corresponding plant products. During the wet years, by the increased seeding rates lodging of flax is possible, it makes the harvesting and initial processing more difficult. Too dense sowing of oil-bearing flax on lean and weedage-contaminated soils makes the crops low. Less number of plants is preserved by the time of harvesting. Seeding rate of oil-bearing flax should be 10-15% higher [9].

Flax is to be sowed by means of all-over drill sowing, on contaminated fields - by means of wide-row sowing with spacing of 45 cm. Seeding rate is to be 40-50 kg/ga in steppe regions of Kazakhstan and Middle Asia. The best harvest can be provided if the degree of density of plants is 400 to 600 units per 1 m^2 by the time of harvesting. Seeding rate should be set taking into account breed peculiarities, seed quality and soil-climatic conditions [10-12].

Despite the fact that in 2012-2013 the planting width of 45 cm and seeding rate of 3.5-4.0-4.5 million units/ga were similar, yield indices were different. In 2013 the yield of oil-bearing flax was higher comparing to one of 2012, this can be explained by different natural-climatic conditions. In 2012 the precipitation depth was 127.8 mm for one growing season which is 2 times lower than in 2013, when the precipitation depth was 369.1 mm (Fig.1).

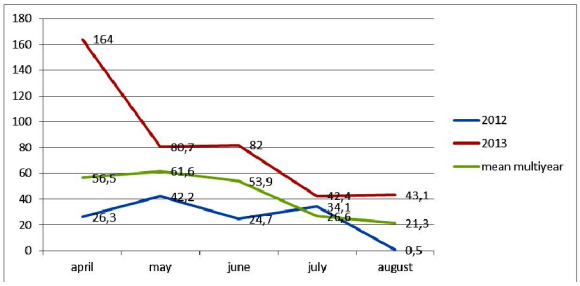

Figure 1. Precipitation (mm) for 2012-2013

Considering the date of the table we can note the increasing of seeding rate from 3.5 million units/ga to 4.0 and 4.5 million units/ga, field emergency decreases from 94.2% to 93.4 and 87.4% respectively.

Recording of height of oil-bearing flax that depends on the seeding rates (Figure 2) showed that the oil-bearing flax which has been sowed with seeding rate of 4.0 million units of emerged seeds per 1 ga was the highest. Its average height was 61.9 cm with planting width of 45 cm.

Table 1. Influence of the seeding rates on the average field emergence of oil-bearing flax in 2012-2013

Method of sowing	Seeding rate, million units /ga	Sowed for 1 m^2, units	Emerged, units /m^2	Field emergence, %	Degree of density, thousand units /ga	
					full seedlings, thousandunits/ga	before harvesting, thousand units /ga
Wide-row sowing of 45 cm (K)	4.5	450	393	87.4	3935	3659
Wide-row sowing of 45 cm	4.0	400	373	93.4	3735	3545
Wide-row sowing of 45 cm	3.5	350	330	94.2	3185	3096

Decreasing of the seeding rate up to 3.5 and increasing up to 4.5 million units/ga decreased these indices up to 60.8 and 59.3 cm respectively.

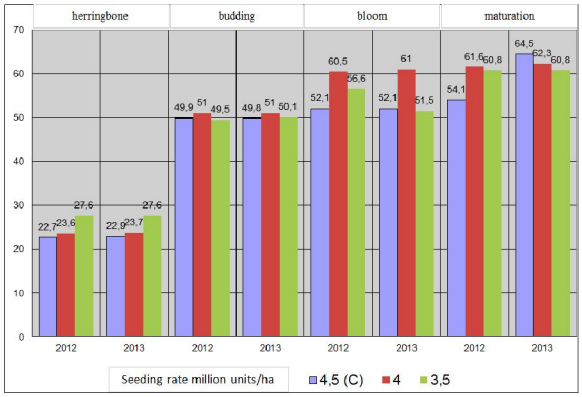

Figure 2. The dynamics of oil-bearing flax height depending on the seeding rate (for 2012-2013)

From data of Table 2 we can see that the highest yield of oil-bearing flax was at sowing with seeding rate of 4.0 million units/ga, where the number of buds was 16.7 units from a plant, number of seeds - 107.3 units and seeds weights was 0.63 g. The yield of this variant was 22.4 dt/ga.

With the seeding rate of 3.5 million units/ga the yield was lower for 3.1 dt/ga, the structure indices were almost similar. This can be explained by the lower preharvesting degree of density of oil-bearing flax in this variant.

The control variant has lower indices of structure elements comparing to other variants. But thanks to the sufficient preharvesting degree of density the yield in this variant was 19.7 dt/ga.

Table 2. The harvest and yield structure of oil-bearing flax depending on the average seeding rate (for 2012-2013)

Methods of sowing	Seeding rates million units /ga	Number of buds for 1 plant, units.	Number of seeds in 1 bud, units.	Number of seeds from 1 plant, units.	Seeds weight from 1 plant, g	Weight of 1000 seeds g	Yield dt/ga
Wide-row sowing of 45 cm (k)	4.5	14.4	6.3	92.6	0.54	5.9	19.7
Wide-row sowing of 45 cm	4.0	16.7	6.4	107.3	0.63	5.9	22.4
Wide-row sowing of 45 cm	3.5	16.8	6.4	107.0	0.62	5.9	19.3
HCP 05, dt/ga							0.81

Report

In order to get high and stable harvests of oil-bearing flax in the conditions of South-Eastern Kazakhstan it is necessary to perform wide-row sowing with planting width of 45 cm and seeding rate of 4.0 million units of emerged seeds per 1 ga or depending of purity, emergency, weight of 1000 seeds, weight rate of 24-26 kg/ga.

Conclusion

Basing on the results of investigation for 2012-2013 we can point out the following:

Those plants of oil-bearing flax were the highest which had seeding rate of 4.0 million units of emerged seeds per 1 ga, where their average height was 61.9 cm with planting width of 45 cm. Shortage of seeding rates to 3.5 and increasing up to 4.5 million units /ga decreased these indices up to 60.8 and 59.3 cm respectively.

Oil-bearing flax was most productive when planting width was 45 cm and seeding rate was 4.0 million units /ga. The yield in this case was 22.4 dt/ga, which is 2.7-3.1 dt/ga higher than in other variants.

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