Environmental aspects of plant introduction in the context of global climate change

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Abstract. The results of analytical and practical research on expanding the range of cultivated crops that are of strategic importance for the development of the crop industry forming feed production in the Moscow region of the Russian Federation on the basis of the introduction of highly productive crops, without the use of chemically synthesized fertilizers and plant protection products that pose a threat to indemic agrophytocenoses and soil microbiota are presented.

1. Introduction

Despite the fact that only about 10% of the earth's land area is plowed, soils have been and remain an irreplaceable asset and source of wealth for mankind.

However, the value of the soil is determined not only by its economic significance for agriculture, forestry and other sectors of the national economy; it is also determined by its irreplaceable ecological role as the most important [1].

The increase in the intensity of industrial and agricultural production, and the increasing anthropogenic load on the natural environment leads to soil degradation. According to FAO, the world's degraded and diseased (conductive) soils cover more than 1.2 billion hectares. ha or 22% of the world's land, 12% of the world's soil resources are chemically degraded. More than 80% of agrocenoses of grain crops in the Russian Federation are populated with phytopathogens. And this trend is only growing. In General, up to 17 million hectares of the world's soil resources are lost annually due to degradation [2]. The need to take urgent measures to create an environmentally balanced agricultural landscape is becoming more and more obvious every year [3].

Part of the phytocenosis component of a balanced symbiotic way of existence of living organisms. For example, the grass of the weedy shepherd's bag is an extremely valuable hemostatic agent, and a number of mold fungi serve as a source of penicillin, which has already saved millions of human lives [4].
Improving the quality of life is the most acute problem facing the leadership of every state focused on the development of the social sphere. Its solution can only be complex. But one of the main components is the production and consumption in sufficient volumes of a wide range of full-fledged biochemical composition of food products [5].

Therefore, currently the most enterprising farmers have decided to return to "clean farming" without the use of mineral fertilizers and pesticides [6].

Biologization of agricultural production was started in the Soviet Union, and continues today, but in cost terms, the biologics used are estimated at less than 1% of the total cost of plant protection. At the same time, the residual amounts of chemicals entering the soil, air and water bodies due to anthropogenic pollution are increasing both qualitatively and quantitatively. Currently, more than 55 thousand people have been identified in the natural environment. various chemical compounds that are products of human economic activity and every year it becomes more and more obvious the need to take urgent measures to form environmentally balanced agricultural landscapes [3, 7, 8, 9].

In this respect for the soil, as the main means of production was included in the documents of the Soviet time - in claim 9, Chapter III of the Approximate Charter of the collective farm, stated that the farm undertakes: "the most complete and correct use and continuous improvement of the land assigned to it, increase its fertility; involve unused land in agricultural production" and in the Constitution of the Russian Federation: "Everyone is obliged to preserve nature and the environment, and take care of natural resources" [11, 14].

Since January 1, 2020, the Federal law "on organic products and amendments to certain legislative acts of the Russian Federation" No. 280-FZ, signed on 03.08.2018 by the President of the Russian Federation V. V. Putin, has entered into force. It is aimed at regulating relations related to the production, storage, transportation, labeling and sale of organic products [15].

2. Methods and materials

In 2018-2019, the possibility of cultivating crops introduced in the Moscow region: sugar sorghum, Sudanese grass and chickpeas without the use of chemically synthesized agrochemicals was studied in the fields of the experimental production base of vniif. As the objects of research were taken: sugar sorghum, Galia variety, sudanskaya grass, Sputnitsa variety, chickpeas-selection form No. 15.

The experiments were based on various backgrounds of the endemic clogging characteristic of the soils of the Western Moscow region.

In the species composition of plants-weeds of crops dominated: white pigweed, sow Thistle, dead-nettle amplexicaul.

White Mar (common Mar, Swan) Chenopodium album L. It belongs to the mareva family. Prefers fertile soil. Seeds that have overwintered on the soil surface germinate in the spring. Immature seeds can germinate up to 20%. Having a hard shell, up to 55% of quinoa seeds are not digested by animals and birds, so in large quantities they fall into the manure, which can be brought to the fields. It is a distributor of harmful insects-beet flies, shield flies, bean lice, etc.

Yellow osprey (milkweed) Sonchus arvensis L. A plant from the family of compound flowers. Blooms from June to September. Propagated by seeds and root growth. One plant can produce up to 20 thousand seeds. Emerging shoots develop very quickly and after 80-90 days form long roots with adventitious buds, which next year give fruit-bearing stems. The main root deepens to 50 cm. From it depart horizontal roots that lie in the arable soil layer and reach 1-1.5 m in length. It clogs all crops, especially spring [12].

Lamium amplexicaule L. is an annual plant with a height of 20 – 30 cm. A weed plant, found in crops mostly rowed, in gardens, near housing, in garbage places, more often in the North of the European part of the Russian Federation. It is less common in Siberia and the far East [13].

When laying the experiments, we used agricultural equipment recommended for the Moscow region, with the exception of chemically synthesized fertilizers and plant protection products.
Were taken into account: the number and composition of weeds per unit area of crop, number of plants of each crop per unit area, the productivity of crops under conditions of natural contamination, the species composition of weeds.

3. Results and discussion

The natural and climatic conditions of the Russian Federation are quite severe. The capital city of Moscow is located at 55° North latitude, which is considered not yet critical for farming in the country. However, due to the short vegetation period, there is a pronounced seasonality of field work in the agro-industrial complex, which requires maximum concentration and coordination of actions. All the United States is comparable in climate to Western Europe, geographically located South of the Kuban. New York - approximately at the latitude of Sochi [10]. However, the processes of global climate change in the direction of warming allowed us to carry out a planned introduction of highly productive forage crops from the southern regions of the Russian Federation to the more Northern regions – the Moscow region. Crops of sugar sorghum, Sudanese grass, chickpea in 2018-2020 showed positive results in the conditions of the Moscow region, both in productivity and in the ability to resist clogging with endemic weeds due to the intensive growth and development of the studied crops, without using fertilizers and plant protection products.

![Figure 1. The dependence of the height of plants from plant density of sorghum sugar](image1.png)

![Figure 2. The dependence of the height of plants from plant density of herbs Sudanese](image2.png)

Table 1. Dependence of the species composition of weed vegetation on the density of standing plants of sorghum sugar Galia, OPB FGBNU VNIIF 2019-2020.

| Density of crop standing, PCs / m² | Height of crop plants, cm | species composition of weeds | Number of plants, PCs / m² |
|----------------------------------|--------------------------|-----------------------------|----------------------------|
|                                  |                          | Shepherd's bag              | 12                         |
|                                  |                          | Woodlouse                   | 30                         |
| 29                               | 132                      | Mar white                   | 8                          |
|                                  |                          | bedstraw tenacious          | 28                         |
|                                  |                          | Total:                      | 88                         |
| 63                               | 80                       | dead-Nettle                 | 13                         |
|                                  |                          | amplexicaul                 | 89                         |
|                                  |                          | bedstraw tenacious          |                             |
|                                  |                          | Total:                      | 102                        |
Sugar sorghum plants for harvesting had a height of 130 cm, including the length of the inflorescence was 10 cm, Sudan grass had a height of 223 cm, including the length of the inflorescence of 30 cm, chickpeas formed plants with a height of 60 cm and up to 20 beans per plant. The degree of contamination on all crops was approximately the same: 102 weeds per m² on crops of sugar sorghum and chickpea, and 94 plants per m² on crops of Sudanese grass.

The productivity of plants was: sugar sorghum-12,600 kg/ha, Sudanese grass-23,960 kg/ha of dry weight. At the same time, the plants of the sudanic grass managed to form seeds, the germination rate of which reached 60%. The Sudanese grass did not have time to form ripened seeds, their maturation only reached milky ripeness.

According to an expert assessment, [16] the nutritional value of sugar sorghum grown in the Moscow region is comparable to corn: protein in the dry mass is 8.2%, sugar is 2 times more-30.0%, with minimal costs for growing-16,170 rubles/ha. compared with the silo laying – 37704 rubles/ha.

4. Conclusion

Organic farming - as an extensive method of production will not require the allocation of significant financial resources from the country's budget. The main item of expenditure in this type of activity is the cost of fuel, seed and planting material. Thus, if in 2017 in the Russian Federation more than 10 million tons of agricultural seeds were sown for a total of 238 billion rubles, while the import of seeds was more than 85 thousand tons for the amount of 24 billion rubles, then, respectively, to involve unused land in agricultural turnover, only seeds for the amount of about 115 billion rubles will be required. It is not advisable to buy seeds for organic farming abroad, since domestic varieties have a large adaptive potential.

Thus, 115 billion rubles is the taxable base for the state and the amount that breeders and seed growers of our country can earn additionally [3].

The development of biologized cultivation technologies for the introduction of plants to the Northern regions of the Russian Federation is a very relevant and achievable task. The main element of such technologies should be a culture that has an intensive growth and development dynamics, which allows it to occupy ecological niches in the existing agrobiocenoses and have the prospect of economic use with minimal costs for cultivation.

Growing sugar sorghum, Sudanese grass, chickpeas for food allows you to significantly expand the feed base of crops rich in plant protein, create a basis for the transition of livestock production to the production of organic and environmentally friendly products with high economic efficiency of production.

References

[1] F Afanasieva T. V., Vasilenko V. I., Tereshina T. V., Sheremet B. V.-Moscow: Mysl, 1979. - 380 p.)
[2] Glinushkin A. P., Sokolov M. S., Toropova E. Yu. Phytosanitary and hygienic requirements for soil health. - Moscow, "Agrorus publishing House", 2016. - 288 p.
[3] Startsev V. I., Startseva L. V. Creating conditions for the development of biologized technologies for agricultural plant production. - Innovative processes in agriculture-Innovative in Agriculture: collection of articles of the XI International scientific and practical conference. Moscow, 25-27 April 2019 under the General editorship of V. G. Plyuschikova.- Moscow.: RUDN, 2019. - 320 p.
[4] Alekseev Yu. E. and others. Herbaceous plants of the USSR. Vol. 1. M.: "Thought", 1971, 487 p.
[5] P. A. Chekmarev, Glinsky A. P., Startsev V. I. organic Production – competitive advantage of agriculture of the Russian Federation, the achievements of science and technology of APC, 2018, vol. 32, No. 3, pp. 5-6.
[6] Alekseev Yu. V. Quality of crop production. - L.: Kolos. Leningrad Department, 1978. - 256 p.
[7] Bondarenko N. V. Biological protection of plants. - 2nd ed., pererab. And add. - M.: Agropromizdat, 1986. - 278 p.
[8] Lagunov A. G. Pesticides in agriculture. - Moscow: Agropromizdat, 1985. - 142 p.
[9] Sokolov M. S., Monastyrsky O. A., pikushova E. A. Ecologization of plant protection, Pushchino, 1994. - 456 p.
[10] Parshev A. Why Russia is not America. A book for those who stay here/a. Parshev. - M.: AST: Astrel, 2007. - 350 p.
[11] Zaitsev L. I. Handbook of the Chairman of the collective farm. Under the General editorship of A. p. Chubarov. M.: "Kolos", 1972, 639 p.
[12] Zotova A. P. Weeds and the fight against them._ L.: Lenizdat, 1971. - 143 p.
[13] Nikitin V. V. Weed-plants of the flora of the USSR. - L.: Nauka. 1983. - 454 p.
[14] "the Constitution of the Russian Federation" (adopted by popular vote 12.12.1993) (as amended, amended Laws of the Russian Federation on amendments to the Constitution of the Russian Federation from 30.12.2008 № 6-FKZ, from 30.12.2008 № 7-FKZ, from 05.02.2014 No. 2-FKZ, from 21.07.2014 No. 11-FCL)
[15] Federal law "On organic products and on amendments to certain legislative acts of the Russian Federation" No. 280-FZ of 03.08.2018 year
[16] Duborezov V. M., Vinogradov V. N., Duborezov I. V., Altunina M. E. Cultivation of sugar sorghum for silage in non-Chernozem conditions, Achievement of science and technology of the agro-industrial complex, No. 3, 2012 p. 33