# Substantiation of the weed control system when placing grain production in microzones of the Central Chernozem region

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**Abstract.** The most important link in modern farming systems is the protection of crops from weeds. Only by taking effective measures to reduce the weediness of crops one can get a high yield of cultivated crops and high-quality products. On a field or plot with high weediness all other agricultural activities aimed at increasing crop yields will be ineffective. When planning for weed control, the grower must give priority to preventive and organizational measures. It is much easier to prevent weeding of agricultural land than to try to weed an already weeded area. Preventive measures include: seed cleaning; preparation of feed for feeding, allowing them to be cleaned of viable weed seeds; preparation of organic fertilizers (manure, composts) before applying them to the fields. An important measure that reduces the weediness of fields is the destruction of weeds on lands adjacent to fields: on unused plots, field edges, roadsides, edges of forest belts. Cleaning of weed seeds from wastes is necessary by means of agricultural machines and vehicles, as well as by means of containers.

## 1 Introduction

Preventive measures also include the correct determination of the timing of harvesting. Thus, the harvesting of agricultural crops for green fodder should be carried out before the formation of viable seeds in weeds. The timing of the harvesting of grain crops is planned in such a way as to prevent shedding of weed seeds and an increase in the weediness of the field as a result. It should be noted the essential role of protecting crops from weeds in ensuring food security. The timing of sowing is also important. So, according to A.M. Shpanev and A.B. Laptiev [1,2] the transfer of the sowing date of winter wheat for the conditions of the southeast of the Central Chernozem region to the second decade of September reduces the contamination of the soil and, as a rule, makes it possible to abandon the autumn use of herbicides.

Weed control should be systematic, not a set of one-time activities. The farm should have a field weediness map, the data of which are adjusted in accordance with the annual surveys of fields for weediness. This map should reflect not only the degree of weediness of the field (plot), but also the species composition of weeds. Organizational measures also include the

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correct placement of crops on the sown region. Clogged fields should be allocated for crops, the cultivation technology of which will reduce the weediness.

## 2 Research methods

The main regulatory measures to reduce the infestation of crops are crop rotation, tillage and the use of herbicides.

An important role is played by crop rotation, which is the least expensive means. Properly designed crop rotation can significantly reduce the use of chemicals used to control weeds, or even completely abandon them.

It is necessary to make a crop rotation so that the cycles of development of cultivated plants and weeds that prevail on the field do not coincide. This will increase the phytosanitary efficiency of crop rotation.

## 3 Research results and discussion

Agricultural crops differ in their ability to compete with weeds for life factors in the agrophytocenosis and suppress them. Traditionally, there are three groups. The first group includes highly competitive crops - winter wheat and rye, winter rapeseed, sunflower for silage, winter vetch, perennial grasses. Medium edificatory - barley, oats, buckwheat, millet, corn, sunflower. Sugar and fodder beets, peas, all gourds, and most vegetable crops are characterized by a weak ability to compete with weeds [3,4]. When growing low- and medium-edificatory crops, it is more often necessary to carry out destructive chemical measures.

In agrophytocenosis, in which there is an intersection of phytogenic fields of plants - territories or volumes of the environment from which each individual plant consumes resources that ensure their life, there are always competitive relations between plants and, in particular, between crop plants and weeds. K.A. Kurkin [5] gives the following definition of competition in a plant community. Phytocenotic competition is a systemic unity of the mode of shortage of material and energy resources, created by their absorption by the phytocenosis, with the opposite effect on the phytocenosis of the deficit mode created by it.

Phytocenotic measures were built on the use of weed suppression by crops [6]. Methods that contribute to the phytocenotic suppression of weeds are an increase in the seeding rate of agricultural crops, a cross or narrow-row method of sowing grain crops, sowing variety mixtures, and creating mixed and combined crops. Belarusian farmers have developed a phytocenotic method of dealing with creeping wheatgrass, which makes it possible to clear the fields of this weed without resorting to the use of chemicals.

When constructing a crop rotation system, one should take into account the possibility of the spread of certain biological groups of weeds in the crops of a particular crop. In crops of winter wheat and rye, the probability of infestation with spring weeds is very low and, conversely, it is high with winter and wintering species. In crops of spring grain crops, one should expect the spread of early spring species of weeds and a low probability of growth of wintering, winter, biennial and spring late weeds.

In crop rotations, fallow fields are of great importance for clearing sorrows. Black steam is especially effective. Carrying out 4-5 mechanical treatments during the period of fallowing allows you to significantly clean the arable layer of soil from the seed rudiments of weeds and vegetative organs of perennials. The phytosanitary effect of black fallow is observed not only on the fallow sown crop, but also on subsequent crops.

In the Central Chernozem region, the link most often used in crop rotations is black fallow - winter wheat - sugar beet. In this link, due to the cleansing of the soil from weeds in the

black fallow and the cultivation of a highly edificatory crop of winter wheat, which does not allow the development of weeds, sugar beet, which weakly competes with weeds, falls into relatively favorable phytosanitary conditions. Our studies carried out in the Kursk region showed [7] that the crops of winter wheat were the cleanest from weeds in the grain-fallow crop rotation with black fallow.

According to All-Russian Research Institute of Sugar Beet and Sugar (VNIISS) [8], beets after steam winter were 1.3-2 times less clogged than after placing them after other predecessors. In modern agricultural science, much attention is paid to the biologization of agriculture. Green manure is one of the main factors in the creation of biologized farming systems. Green manure fallow is an effective means of reducing weediness in crops, as our studies have shown. In a green manure fallow, the destruction of weeds occurs as a result of mechanical tillage in preparation for sowing a green manure crop and when mowing and planting green mass in the soil, which includes weeds that have not had time to form seeds.

There are special anti-weed crop rotations designed in such a way as to reduce the infestation of crops. In agricultural practice, they are usually used when the field is clogged with certain especially dangerous types of weeds, such as wild oat or root weeds. The following links are used in crop rotations: black fallow - winter rye - tilled, black fallow - winter rye - late spring crops, corn for green fodder - winter cereals - corn for silage [9].

Tillage is a key link in farming systems and the core of crop cultivation technologies. It takes the most energy and money to carry it out. Soil cultivation performs many important functions. One of the main ones is the elimination of weeds. Weeds are effectively destroyed during autumn plowing, pre-sowing cultivation, inter-row cultivation of tilled crops, pre-emergence and post-emergence harrowing.

Soil tillage systems must necessarily take into account the features of the landscape and, to the necessary extent, provide a solution to the problem of soil protection from erosion. There is no single scheme for tillage for a particular crop for all conditions. Science and practice have long developed a differentiated approach to choosing a tillage system. In addition to landscape characteristics and the ability to resist soil erosion, one should take into account soil and climatic conditions, the biological characteristics of cultivated crops, and the ability to maintain a favorable phytosanitary state of crops.

Recently, in practice, less attention has been paid to the agrotechnical method of reducing the infestation of crops, shifting the solution of this problem to the chemical method. VNIISS materials show [10] that even in crops of such a weakly competitive crop as sugar beet, weeds can be effectively controlled by mechanical tillage. The main tillage should be carried out as a semi-fallow or improved plowing with obligatory plowing with two-tier plows or a plow with a full rotation of the layer. In the Central Chernozem zone, a differentiated system of basic tillage has become widespread. With such a system, plowing is carried out once every 4-5 years under tilled crops, and in other years - non-moldboard tillage. The effectiveness of primary tillage systems in weed control varies depending on the type of crop rotation [11].

In modern agricultural technologies, chemical means of weed control - herbicides are widely used. According to Kalichkin V.K. et al. [14], the use of herbicides reduced the infestation of crops below the economic threshold of harmfulness (EWL) in all years of research. Their biological effectiveness against dicotyledonous weeds ranged from 70 to 100%, against cereals - from 71 to 98%.

This effective method has not only advantages, but also disadvantages. The problem is the anti-environmental nature of the chemical method. The action of herbicides is not limited to agrophytocenoses, but they have a negative impact on the whole nature. Therefore, while solving the problem of increasing the efficiency of crop production, at the same time, environmental protection should be ensured.

At the end of the last century, researchers found [12] that with the regular use of herbicides on the same field, the increase in yield decreases over time. There was an idea of "herbicide exhaustion" of the soil.

In addition, when using the same or the same type of preparations, unstable species fall out of the agrophytocenosis, while resistant ones remain. Also, within the weed species itself, under the action of herbicides, there is a selection of resistant biotypes. All this reduces the effectiveness of chemical weed control. It has been noted that in recent decades, the rate of emergence of resistant weeds has been increasing.

The economic aspect of chemical protection against weeds should not be overlooked. This method of clearing fields from weeds requires a large investment of money. Therefore, the search for ways to increase the economic and economic efficiency of this method, reduce the use of herbicides, and replace chemical weed control with other less expensive methods will be relevant.

It is necessary to design such machines for the application of chemical plant protection products, which could reduce the loss of chemicals and, consequently, soil pollution.

An important direction is the selection of cultivated crops for their resistance to herbicides. The creation of transgenic plants is recognized in the world as a modern, developing and effective method of genetic engineering. However, it should be noted that plants with altered genetics, not without reason, raise concerns from the point of view of safety among many scientists and practitioners.

Weed control achieves the best results when a complex application of organizational, economic, preventive, agrotechnical, biological and chemical measures is carried out. The role of individual methods, even very effective ones, should not be exaggerated.

The effectiveness of herbicides increases with timely and high-quality tillage. Then the necessary phytosanitary effect from their use can be achieved at lower drug consumption rates. One of the main links in farming systems is the use of fertilizers. Fertilizers are not a means of weed control, but they have a significant impact on the number, weight and species composition of weeds.

## 4 Conclusion

In turn, weeds are a factor affecting the effectiveness of fertilizers. In weedy fields, a significant part of the nutrients goes not to cultivated, but to weeds, as a result of which the result of fertilization is lower than expected. As a rule, the use of fertilizers leads to a decrease in the number of weeds in crops and an increase in their mass. The species composition is also changing. Weeds that can use nutrients more efficiently get an advantage.

The effect of fertilizers on the emerging competitive relations between crops and weeds, as shown by our studies [13], depends on the relief. On the slope of the south-south-east exposure, with a lack of moisture, the efficiency of mineral fertilizers was lower than on the slope of the north-north-west exposure.

Mineral fertilizers can have a stimulating effect on the germination of weeds, in particular wild oats.

As a positive aspect of the presence of weeds in the fields, an increase in the circulation of mineral elements between the surface and deeper soil horizons is noted [14].

The complex use of chemicals, in particular, herbicides and mineral fertilizers, has a positive effect on the effectiveness of protective measures.

When developing a system of protective measures, one should strive for the main goal - increasing the productivity of agricultural crops and obtaining products of the required quality. At the same time, the interests of both the economy and the environment should be taken into account.

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