

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Dynamics of Agrofito-Cenosis Segetal' Flora of Winter Wheat in Long-Term Soil Treatment.

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ABSTRACT

Manuscript presents the results of the studies on the dynamics of weed vegetation in the agrophyto-cenosis of winter wheat at the beginning and the end of the fifth rotation of crop rotation (2009 and 2016), depending on the methods of basic tillage. During the period under study, the species abundance of the weed population was unchanged. It has been established that the dominants of the community are species possessing the characteristics of the R-strategists, to the biological group of the wintering species. Plowing with the turnover of the formation reduces the number of hard-to-breed populations in the crops to the Poatseae family, the Berger-Parker of *Apera spica-venti* L. is 4.4 times lower than when the is disc soil treat.

Keywords: soil cultivation, segetal flora, agrophytocenosis, Berger-Parker index.

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INTRODUCTION

Agrophytocenoses are created by humans when cropping is near, characterized by species diversity, the relationship of components and anthropogenic origin [1]. Composition and structure of agrophytocenoses in accordance with the nature and degree of anthropogenic impact [2].

In the structure of the emerging agrophytocenosis, the dominant plants are cultivated, and the weeds in the crops are invariably present as an undesirable component. Technologies of cultivation of agricultural crops are directed as much as possible on optimization of conditions of their growth and development, and for an increase of competitive ability concerning weed plants. Functions to regulate growing conditions are performed by crop rotations, fertilizers, tillage and other agrotechnical methods [3]. A harmonious combination of these techniques allows the crop plants to make maximum use of the limiting factors that are characteristic of this ecosystem and increase the competitive ability in relation to the segment vegetation [4].

Long-term soil cultivation is considered one of the priority methods in regulating the infestation of crops. Plowing in comparison with the non-brazed treatment ensures the best mechanical destruction of perennial and juvenile weed plants [5]. However, it is a fairly energy-intensive process, adversely affects the content of organic matter in the soil, enhances erosion processes [6]. Modern agriculture is focused on the introduction of a minimum resource-energy-conserving tillage, until its complete abandonment. Soil cultivation influences the structure of agrophytocenosis, its minimization leads to an increase in the proportion of the weed component in the structure of crops [7]. Discussions on the comparative evaluation of dump plowing and shallow tillage do not stop until now [8].

Long-term soil cultivation is considered one of the priority methods in regulating the infestation of crops. [8]. However, it is a fairly energy-intensive process, adversely affects the content of organic matter in the soil, enhances erosion processes [9]. Modern agriculture on the basis of a minimum resource-energy-saving tillage, until its complete abandonment. Soil cultivation on the structure of agrophytocenosis, its minimization leads to an increase in the share of the weed component in the structure of crops [10]. Discussions on the comparative evaluation of plowing and shallow tillage have not stopped until now [11].

In order to successfully control and regulate the contamination of crops, the study of the weed component acquires particular urgency, depending on the methods of basic tillage for a long period.

MATERIALS AND METHODS

The investigations were carried out in the experimental station of the Stavropol State Agrarian University in a long-term in-patient experiment. The experimental station is located on the Stavropol Upland in the zone of unstable hydration. A characteristic feature of the zone is the uneven precipitation during the year. The average long-term amount of precipitation is 623 mm. The soils of the experimental site are black humus earth leached heavy loam.

The manuscript presents a fragment of a multifactorial experiment where the main methods of soil treatment for winter wheat were studied: plowing at 20-22 cm, combined processing at 20-22 cm, disc soil treatment at 10-12 cm, after the predecessor of peas, according to the recommended fertilizer system.

Accounting for the weediness of winter wheat crops was carried out at the beginning and at the end of the fifth rotation of crop rotation (2009-2016).

The number of weeds in the agrophytocenosis was determined by the method described by I.P. Vasiliev [12].

The Berger-Parker index was calculated by the formula $D = N_{\max} \cdot N$, where N is the total number of the community; N_{\max} is the number of individuals of the most abundant species [13].

RESULTS AND DISCUSSION

Agrophytocenoses differ from natural phytocenoses by short-term character of formation, therefore they do not possess stability. Links formed during the growing season are destroyed when the next crop is replaced by a crop rotation.

Among the measures aimed at the destruction of weeds at the present time, soil cultivation plays an important role, it changes the conditions of the growth of cultural and weed plants, and, consequently, their mutual competitive ability, which is expressed in the amount of weed infestation. The population density of weed plants in winter wheat crops for a rotation of crop rotation varies in a certain way. The positive role of plowing in this respect is confirmed. The number of weeds in winter wheat in the full tillering phase in the spring from 2009 to 2016 is reduced from 82 to 65 pcs/m² or 20.7 % (Figure 1).

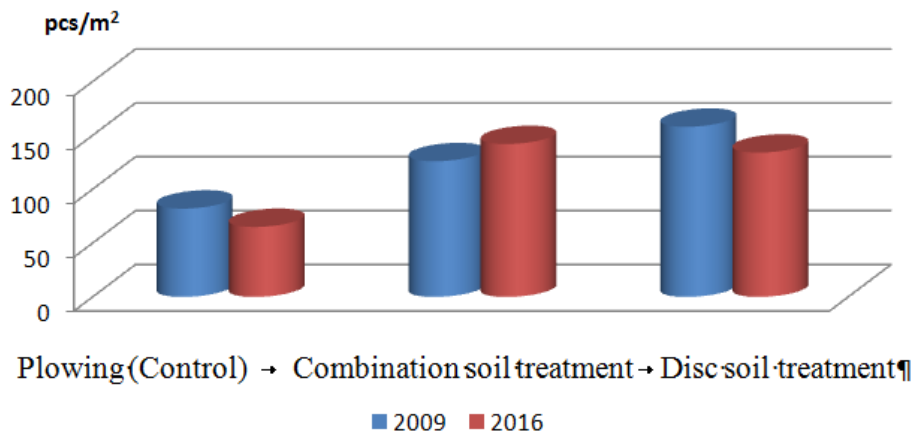


Figure 1: The number of weeds in tillering node phase of winter wheat, depending on soil treatment, pcs/m²

Soil cultivation without recirculation of the reservoir by a combined tillage unit leads to an increase in segmental vegetation in winter wheat crops by 12.6 %. In comparison with plowing, the amount of weed plants on this variant of the experiment increases by 2.2 times 15.2 %. Duration: up to 15.5 %. At high volumes of the population, a mechanism works to increase the contact between plants, increasing competition for factors of life, which causes stress and death of plants. It is 106 % higher than in plowing.

The structural element of the segmental community of agrophytocenosis is a species population that is subject to changes under the influence of the external environment and human production activities. Species that are more adapted and resistant to natural and anthropogenic factors, replace the less adapted species and occupy their place. During the period from 2009 to 2016, significant changes in the species diversity of weed plants in the agrophytocenosis of winter wheat did not occur. On variants of the main soil cultivation, 14-15 weed species are noted, and at the same time the ratio between them changes. Among the segetal vegetation, difficult-to-recover and dominant species are identified in the agrophytocenosis of winter wheat.

Table 1: Berger-Parker index of weed, depending on soil treatment

Species of weed	Plowing		Combination soil treatment		Disc soil treatment	
	2009	2016	2009	2016	2009	2016
Wintering						
Centaurea cyanus L.	0,30	0,32	0,15	0,18	0,11	0,17
Galium aparine L.	0,32	0,27	0,19	0,20	0,20	0,19
Apera spica-venti L.	0,05	0,09	0,33	0,24	0,16	0,22
Winter-crops						
Bromus tectorum L.	0,02	0,03	0,04	0,07	0,08	0,07
Sprouting grasses						
Cirsium arvense L.	0,04	0,03	0,05	0,04	0,08	0,09
Convolvulus arvensis L.	0,02	0,05	0,11	0,13	0,18	0,14
Another species	0,25	0,21	0,13	0,14	0,19	0,12

The role of soil cultivation in the phytosanitary respect is the violation of optimal conditions for the growth and development of weed plants. Long-term use of plowing contributes to the formation of conditions in which the populations of cornflower blue (*Centaurea cyanus* L.) and crustacean (*Galium aparine* L.), possessing the characteristics of R-strategists, firmly hold the ecological niche and are the dominants of the weed component of the agrophytocenosis of winter wheat. The Berger-Parker index of *Centaurea cyanus* L. ranges from 0.30 to 0.32, and the *Galium aparine* L. ranges from 0.32 to 0.27 (Table 1).

Plowing with the turnover of the bed contributes to the reduction in the agrophytocenosis of hard-rooted weed species belonging to the same family as the winter wheat - the meadow (*Poáceae*). During the period of the fifth rotation of the rotation on this variant of the experiment, there is only a tendency to increase in the fields of the metrose of the field (*Apera spica-venti* L.) and the fire of the roof (*Bromus tectorum* L.). After combined soil cultivation, in which the seeds of weed plants are not embedded in the underlying layer, *Apera spica-venti* L. occupies a dominant position, the Berger-Parker index ranges from 0.33 to 0.24.

Long fine machining with a disk tool also leads to an increase in the conservation of winter wheat crops *Apera spica-venti* L. and by 2016 this species is the dominant agrophytocenosis, with a Berger-Parker index of 0.22. The density of the population of the hard-toothed grass weed of the fire roof (*Bromus tectorum* L.) varies little depending on the methods of the main treatment of the soil over an 8-year period and stably maintains an ecological niche with a low level of the Berger-Parker index.

CONCLUSION

The phytosanitary effect of different methods of soil cultivation is ambiguous. When disc soil treatment to shallow depths, the number of weed plants in the agrophytocenosis of winter wheat decreases from 2009 to 2016, which is a consequence of their high population density and species competition among themselves. Along with this, the number of weed plants in this version of the experiment is 106 % higher than in plowing.

In the agrophytocenosis among the segmental component of agrophytocenosis, one-year species dominate, possessing the characteristics of R-strategists. Soil tillage methods, done in a no-waste way, contribute to the domination of hard-to-break weeds of the *Poáceae* family in winter wheat crops.

Combined and shallow treatment lead to an increase in the degree of dominance of root-cropping species in the agrophytocenosis of winter wheat. Berger Parker's *Convolvulus arvensis* L. is 7 times higher than disc after plowing after plowing.

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