MONITORING OF WEEDS IN CROPS OF LEGUMES AND CEREALS GROWN UNDER CONDITIONS OF ORGANIC FARMING

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Abstract: During the period 2011 - 2013 a field experiment was conducted at the experimental field of IASS “Obraztsov chiflik” – Ruse, with ecologically grounded crop rotation, including the cultivation of two legumes (field beans, peas) and two cereals (wheat, malting barley) on an area of 52.5 m². The experiment started after the eightfold scheme of Georges Ville in 3 replications, situated after Ryumker, the size of the harvesting plot being 5.2 m². Pesticides were not applied on the crops, also and synthetic fertilizers and improvers of soil, prohibited for the organic production.

The objective of the study was to observe and describe the biological regulation of weeds in cereals and legumes, grown under conditions of organic farming.

In the organic field, the diversity of weed species was influenced by climatic conditions, soil tillage and crops. There were differences in weed infestation of crops only in terms of quantity of weeds per m². In that case the differences in weed infestation were in direct relationship with certain biological characteristics of the crops. The species Matricaria chamomilla (L.), Anthemis arvensis (L), Capsella bursa-pastoris (L.), Setaria viridis (L.), Echinochloa crus-galli (L.), Digitaria sanguinale (L.), Lamium purpureum (L.), Convolvulus arvensis (L.) u Cirsium arvense(L.) were reported over the whole three-year period.

KEY WORDS: ORGANIC FARMING, MONITORING, WEEDS, FIELD BEANS, PEAS, WHEAT, MALTING BARLEY

INTRODUCTION

Weeds, along with diseases and pests, are one of the main factors limiting the opportunities for obtaining optimal and qualitative crop yields (Rice, 1974; Golubinova et al., 2015). The relatively low competitiveness of the crops in the early stages of their development determines the weed species as a limiting factor in the formation of the yield (Marinov-Serafinov, Dimitrova, 2007). Establishing methods for successful weed control in organic farming systems is of particular importance for limiting production risk. For good phytosanitary control relies on a complex of agrotechnical measures: strict observance of crop rotation with alternating grain-legumes and grain-cereals for suppressing the weed vegetation (Kostadinova, Popov, 2012); introducing mechanical methods for destroying the available weed groups (Nikolich et all, 2011; Farmeselli et all, 2013); balanced use of nutrients and organic matter in the soil; recycling of nutrients (composted manure, plant residues, etc.); growing of local varieties of plants, if possible. (Atanasova et al., 2014, Ilieva, Mitova, 2014, Atanasova et al., 2008).

One of the main ways for the biological regulation of weeds is to create conditions that enhance the competitiveness of crop plants through appropriate crop rotation, varieties, time limits and sowing standards, etc. (Spar, 2004). The purpose of this study is to observe and describe the biological regulation of weeds in cereal crops and cereal crops grown in organic farming conditions.

MATERIAL AND METHODS

Since 2005, the Institute of Agriculture and Seed Science "Obrazcov Chiflik" - Ruse has started a focused research on the development of technologies for organic growing of grain cereals and grain legumes after conversion. As a preparatory study, the period up to 2008, during which preliminary studies on the productivity of individual cereals and pulses without the use of mineral fertilizers and level of entanglement without the use of chemical plant protection chemicals were made. The first stage includes the selection of an appropriate agricultural plot and its preparation for the establishment of a field for organic farming, complying with the requirements of Ordinance No 1 of 7 February 2013 of the Ministry of Agriculture and Food for applying the rules of organic production of plants, animals and aquaculture, products, aquaculture products and food, their labeling and production and labeling control, Prom. SG. February 16, 19 February 2013.

A location that is located for this purpose is located on the territory of the Institute with an area of 5 da. The soil type on which the experiment is based is a highly leached black earth and is characterized by a poor humus content of 1.65%, poorly stocked with mineral N (10.75 mg / 1000 g soil) and mobile P₂O₅ (6.31 mg / 1000 g soil) and well stocked with K₂O (22.50 mg / 1000 g soil) in the 0 - 40 cm layer. The soil reaction is medium acidic (pH in KCL - 5.01%). The mechanical composition of the soil is heavily sandy-clayey. Leached chernozems are soils of high natural fertility and, when properly treated, yield the highest yields of arable crops.

In 2011-2013, field experiment with ecologically well-rotated crop rotation, including the cultivation of: Venka 1 wheat variety, Rousy 1 spring peas, Obzor brewed barley, and Obrazcov chiflik 12, were carried out after conversion. The experience is based on Georges Villa's eight-replicated Osmobile scheme, located on Rûmker, with a harvest size of 52.5 m². Leguminous crops are included to improve the nitrogen regime of the soil and winter-crops for good anti-erosion effect.

The sowing and all agro-technical measures have been carried out according to the accepted technology for organic farming in Bulgaria (Ordinance No 1 of 7 February 2013 of the Ministry of Agriculture and Food), observing the agrotechnical terms, depending on the biological requirements of the crop, crops in rotation alternating in time place. No pesticides, fertilizers and soil improvers prohibited for organic farming have been applied to the crops grown. Fighting weeds in spring crops is mechanically guided, carried out - a stalk at the depth of 15 cm, a deep tillage of 25 cm, a fusion of 12 cm deep, two mechanized and two manual treatments / a mowing in the field of beans and weeding for feed peas).

In order to increase the yield and the quality of the seeds, the foliar feeding with Biohumus liquid organic fertilizer was carried out in the phasing and grading phases for wheat and brewing barley, blooming and rounding of field beans and fodder peas with a dose of 25 l/ha working solution for one spray , at a concentration indicated by the manufacturer (10%).

The organic manure is presented for testing by a production farm for Biohumus in the village of Nikolovo Rousse. Biohumus is a completely organic “live fertilizer” that is produced by growing Red Californian worms (Lumbricus rubellus). Biohumus does not contain harmful substances and pathogenic organisms. It is rich in useful microorganisms, enzymes, vitamins, amino acids and is applicable in all fields of plant breeding. Biohumus increases crop yield by 30 to 70% depending on culture, and the effect increases proportionally to the duration of its use. Increases the resistance of plants to diseases and stress. It stimulates the growth of soil microflora, which leads to the accelerated transformation of soil organogenic elements into a form which is assimilated to the plants.
An additional effect of the increase in the quantity of beneficial soil microorganisms is the suppression of the development of soil phytopathogens. Increases the resistance of plants to diseases and harmful insects. As a result of the complex effects on soil, soil microflora and plants, there is a significant increase in yields.

For the purposes of the survey, the monitoring plots have been monitored for the area of 5 da. The survey was carried out according to the adopted methodology for reporting and mapping of the weediness in the main arable crops. Experimental plots have reported the species composition and density of weeds. The weed counting was carried out by the quantitative weighing method (g/m²; g/m²) in the breeding and start-up phases of the grain-cereals and buttoning and the beginning of flowering in the cereal-leguminous crops.

Differences are observed with regard to the amount and distribution of rainfall during the experimental period. Nearest to the multiannual period are precipitations in 2011 (255.7 mm), which has a positive effect on the formation of yields. Temperatures is favorable for growing crops (rainfall 215 mm at 196 norm.). The summer period in terms of precipitation and temperatures is favorable for growing crops (rainfall 215 mm at 196 norm.). The months of April and May are with an air temperature close to the climate norm. The summer period in terms of precipitation and temperatures is favorable for growing crops (rainfall 215 mm at 196 mm), which has a positive effect on the formation of yields. 2012 was meteorologically not favorable for cultivated crops. Month March is dry (7.8 mm) and warm. Precipitation in April (32.0 mm) is spread over 14 days and is of no particular economic significance. The amount of rainfall in May (114.6 mm) exceeds twice the area norm (66.1 mm). The bulk of them fell in the second half of the month, with an average daily temperature lower than normal. For early and medium-early spring crops, weather conditions are favorable. The exception is made by the Polish bean, which has germinated with colorful moisture and an uneven seed.

The largest rainfall during the vegetation of the crops tested was recorded in 2013 (451 mm), which exceeded the norm by 151.1 mm - 299.9 mm on average over the multiannual period. The experimental area has a natural background of swallowing with predominant participation of: winter-spring ephemeres - the Field Easter - Veronica agrestis (L.), red dead nettle - Lamium purpureum (L.), holly oyster - Holosteum umbellatum .) and others.; spring - autumn weeds - starlings (sparrows) - Stellaria media (L.) etc.; early spring weeds - woodgrass - Adonis aestivalis (L.), etc.; late spring weeds - Amaranthus retroflexus (L.), white dog bob - Chenopodium album (L.), green hawthorn - Setaria viridis (L.), millet - Echinochloa crusgalli (L.) (L.), black dog grapes - Solanum nigrum (L.), etc.; winter-spring weeds - matricaria chamomilla (L.), anthemis arvensis (L), shepherd's bag - Capsella bursa-pastoris (L.) and others. Of the perennial weeds predominates the representatives of the root plants: Polish bellowter - Convolvulus arvensis (L.) and pallamidas - Cirsium arvense (L.), of the rhizomes - Baller - Sorghum halepense (L.). The distribution of weeds in wheat and brewing barley is similar, and the differences in weed are directly related to some biological features of crop plants. The fight against weeds in wheat and barley occupies an important place in autumn-crop growing technology; ensuring high yields and grain quality.

Assessing the complex impact of meteorological factors - the amount of rainfall and average daily air temperatures in relation to the biological requirements of crops, the years under study can be characterized conditionally as favorable - 2011 and 2013 and with less favorable conditions - 2012.

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Compared to rye, oats and wheat, barley develops a weaker power-absorbing root system. In its early phases, it develops more slowly, in the winter often frosts, it is diluted, its stems are lower than the wheat stems. For this reason, there are large gaps in the crops where massive weeds of weeds appear in autumn and early spring. The harvesting of the crops prior to the start of the spraying phase is of great importance in the formation of the yield because in the presence of weeds during this period the crops are thinned and the conditions for secondary entanglement are created. In dense and well-developed crops there is no entanglement because crop plants are competitive, they quickly conceal the soil surface and do not allow a number of weeds, especially the more lush, to develop.
Figure 1 shows that weeding varies in individual years, with the total number of weeds during the three years being about 50 pcs / m² with a slight fresh biomass of 12.6 g/m². The largest number of weeds was reported in 2012 - 74 pcs / m² with fresh biomass 18.13 g/m².

![Figure 1](image.png)

**Fig. 1. Weeding (quantity and weight of weeds) during the winter barley vegetation in 2011 – 2013**

One-year-old weeds are the main biological group, with the main species of winter-spring species: leegrass - *Matricaria chamomilla* (L.), Polish ant - *purpureum* (L.), holly oyster - *Holosteum umbellatum* (L.) and sheep pouch - *Capsella bursa-pastoris* (L.) which is typical of this reporting period. The significance of this weed group by number and biomass is about 80%. Perennial weeds are represented by a field bush - *Convolvulus arvensis* (L.), which is not a dangerous species and could be expected to be constrained by subsequent rotation and agrotechnical events.

Greater barrenness in winter barley is due to the late sowing of the crop, which required, at a later stage, manual cleaning of the experimental plots.

Wheat is closely related to overwintering, harrowing and the quality of its sowing. The variety of sailplanes in wheat crops is large and the species weeding them are over 100. Mainly in the crops are: Black Grass Dog - *Solanum nigrum* (L.), Polish Easter - *Veronica arvensis* (L.), Striped Chamomile - *Matricaria Chameleon*, Capella bursa-pastoris (L.), *Senecio vernalis* WK, *Erigeron Canadensis* (L.), Polish ant - *Anthemis arvensis* (L.), *Convolvulus arvensis* (L.) and others.

In wheat, weeding is less pronounced than winter barley, with the total number of weeds varying from 14 to 57 m² with a negligible fresh biomass of 10.88 g/m² on average over the period (Figure 2). As with the previous crop, one-year weeds are the major biological group, with their total significance (determined by the number and biomass weight) of 91%.
In the case of the field bean, the broader bands create favorable conditions for the emergence and development of a large number of weeds, the main species in the weed associations being: green hawthorn - Setaria viridis (L.), millet hen - Echinochloa crusgalli (L.), blood mildew - Digitaria sanguinale (L.), Chenopodium album (L.), Common Shag - Amaranthus retroflexus (L.), Striped Chamomile - Matricaria chamomilla (L.), Butterfly - Agrimonia Eupatoria (L.). In the later stages of the development of the Polish beans there is a secondary catch-up with representatives of the root-lobster - Convolvulus arvensis (L.) and the palamid - Cirsium arvense (L.) and the rhubarb - Sorghum halepense (L.). In Polish beans, weeding is more pronounced compared to Polish forage, the total number of weeds ranging from 88 to 156 pcs/m² and a significant fresh biomass of 59.56 g/m². Figure 3 shows that one-year-old weeds have greater significance in terms of their number but less significance in terms of total biomass, whereas in the case of perennial weeds it is back. Although in single units they have higher biomass. As the bean vegetation advances and increases its roofing capacity and after the second chopping, the phytosanitary status of the weed culture is very good.

The field fodder peas is a crop that grows slowly and easily in the first days after germination and is easily mutilated by weeds. In the crops, mainly early-spring weeds - bean - Polygonum convolvulus (L.) and red dead nettle - Lamium purpureum (L.), and more limited late-leaved - white dog bob - Chenopodium album (L.), Amaranthus retroflexus (L.), green hazel - Setaria viridis (L.), millet hen - Echinochloa crusgalli (L.). Of the perennial species with the most prevalent and most densely populated species are the Convolvulus arvensis (L.) and the palamid - Cirsium arvense (L.). The weed vegetation in
forage peas averaged between 46 and 104 pcs/m² with significant fresh biomass - 73.53 g/m² (Figure 4).

Peach weed population shows that there is no significant increase in overall weedness, despite the late-spring weeds emerging as the vegetation period progresses. The main entanglements are from the group of annual weeds. The total significance of this group of weeds, expressed by the relative share in the total entanglement, is significant in number of 90% and in biomass - 80%.

CONCLUSIONS

• In the biological field, the species diversity of weeds is influenced by climatic conditions, soil treatments and crops.
• Cultivation differences exist only in terms of the amount of weeds per m². In this case, the differences in wilting are directly related to some biological features of the crop plants.
• Species of the mature Matricaria chamomilla (L.), Anthemis arvensis (L.), Capsella bursa-pastoris (L.), Setaria viridis (L.), Echinochloa crusgalli L., Digitaria sanguinale L., Lamium purpureum L., Convolvulus arvensis (L.) and Cirsium arvense (L.) have met in the three years.

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