Banat's University of Agricultural Sciences and Veterinary Medicine from Timisoara

Contact: web: http://dse.usab-tm.ro, e-mail: bjb@usab-tm.ro

DEGREE OF WEED INFESTATION OF FIELD CROPS, GROWN IN CROP ROTATION UNDER CONDITIONS OF ORGANIC FARMING

Luba Nenova, Iliana Ivanova, Svetlana Stoyanova

Institute of Agriculture and Seed Science "Obraztsov chiflik", 7007–Rousse, str."Prof. Ivan Ivanov" №1, Bulgaria, e–mail: sv_stoianova@mail.bg

Abstract. During the period 2008–2010 at the Experimental field of IASS "Obraztsov chiflik"–Rousse a field experiment was conducted, including cultivation and rotation of crops: beans Obraztsov chiflik" variety, wheat Yantur variety, soybeans Zarya variety, and wintering oats line RS–2 in four–field crop rotation under conditions of organic farming. The experiment started after the Block method in two variants–controls (without fertilization) and foliar fertilization by the humate fertilizer Humustim in four replications, the size of harvesting plot being 52.5m^2. In crop growing in crop rotation technological schemes were applied according to the requirements of the organic farming without using chemicals, following the Regulation N 22 from 04.07.2001 of MAF for organic plant production. The field experience was located in an area, where two–year period of conversion was observed. During the period of investigation in crops of crop rotation, the density of perennial weeds had remained relatively constant. In variants with fertilization by Humustim the total number of weeds was lower than those without fertilization. It was founded from the monitoring that the lowest density of weed infestation was observed in wintering oats, grown after soybeans–100 pcs./m^2 and in wheat, grown after field beans–122 pcs./m^2.

Keywords**:** field crops, weed infestation, organic farming

Introduction

Organic farming is a current topic on the market niche. In recent years the beginning of research, adapting in other countries the principles of the organic farming to soil–climatic and production conditions of Bulgaria, was initiated. Organic farming, as a form of sustainable development is regarded as a production system, excluding the use of synthetic compounds–chemical fertilizers and pesticides. The technologies for organic farming of grain crops find increasing application, as the investigations are directed to increase of yield and improving the production quality. The possibilities are explored for weed, pest and disease control, to maintain and improve soil fertility and select varieties, suitable for extensive farming [ATANASOVA, *et al.*, 2009; KAROV, POPOV *et al.*, 1999; STOICHEV, 2004; FAHONG, *et al.*, 2009].

Harmful effects of weeds on cultural plants are multi and cause great loss of production.

Weeds compete with cultivated plants in terms of moisture, nutrients, light and heat.

In many of them strong root systems are developed compared to growing plants, thus export from the soil large quantities of water and nutrients [TONEV, *et al.*, 2007].

Agro technical events occupy an important part of weed control. A well cultivated area creates favorable conditions for rapid and uniform crop emergence with the result that they become more competitive to weeds and self–seeding.

Agro technical events themselves cannot provide stands clean from weeds.

In combination with rational crop rotations, the multiplication of harmful species and the inhibition of their growth and development to practically safe sizes are limited [MITOVA, 2008; MITOVA, 1998; TRUNKOV, *et al.*, 1993; RASSMUSSEN, ASKEGAARD, *et al.*, 2005].

The weed control to be successfully conducted, it is necessary the individual species infestation of each agricultural area and the factors, that influence on it over long period of time, to be identified.

The subjective of the present investigation was the degree of weed infestation of crops to be determined in crop rotation, grown under conditions of organic farming.

Material and methods

During 2008–2010 at the Experimental field of IASS "Obraztsov chiflik"–Rousse a field experiment was conducted, including growing and rotation of the crops: beans Obraztsov chiflik 12 variety, wheat Yantur variety, soybeans Zarya, and wintering oats line RS–2 in four–field crop rotation under conditions of organic farming.

The experiment started after the Block

Available on-line at http://dse.usab-tm.ro
Banat's Journal of Biotechnology
2011, II(4),

method in two variants–controls (without fertilization) and foliar fertilization by humate fertilizer Humustim in 4 replications, the size of the harvesting plot being 52.5m^2.

In crop growing in crop rotation technological schemes were applied according to the requirements of the organic farming without use of chemicals, following the

Regulation N 22 from 04.07.2001 of MAF for organic plant production. The field experience was located in an area, where two–year period of conversion was observed.

The experiment started on type soil strongly leached chernozem, characterized with poor humus content–1.75%, low reserved with mineral N (19.75mg/1000g soil) and mobile P_2O_5 (5.31mg/1000g soil) and well stocked with K_2O (22.75mg/1000g soil) in the layer 0–40cm.

The soil reaction was medium acid (pH in KCl–5.0%). The mechanical soil composition was heavy sandy–clay.

Fighting from weeds in crop rotation was mechanical, as in legumes were made: soles of the stubble to a depth of 15cm, deep plowing to 25cm, merged cultivation of 12 cm and 2 mechanized cultivations in inter–row spacing with 2 manually in a row.

In cereals two disking were made in preparation for sowing and one hand weeding during the vegetation. Foliar fertilization by Humustim was applied during the phases–3–rd triple leaf and bud–formation period, dose being 40ml for one spraying for legumes, and during the phases–early stem–extension stage and the beginning of milk ripening in cereals.

The applied humate fertilizer was environmentally friendly organic product and did not contain chemical forms of nutrients.

The liquid formulation of the fertilizer contained 58.95% organic substances–7.83% potassium, 3.00% nitrogen, 1.14% phosphorus, humic acids–23.40% and all microelements in optimal quantities for plant growth. It had alkaline reaction, pH–9 [MALINOVA, 2004]. For the purposes of the survey in the stands of the four crops–wheat, wintering oats, field beans and soybeans, monitoring was made for species composition of weeds, number per square meter and their mass (g/m^2).

They were registered in phase tillering (March) and ear–formation (May) in wheat and oats.

In root crops the registration was before the first and after the last vegetation cultivation of the soil.

Results

Agro–meteorological conditions during the years of study were different which determined the specific development of crops and weeds over the years. The sum of the average annual rainfall during the period of biological growth of cereals and weeds (October–June) for the period 1896–2005 was 432.4mm/m^2 (*figure 1*).

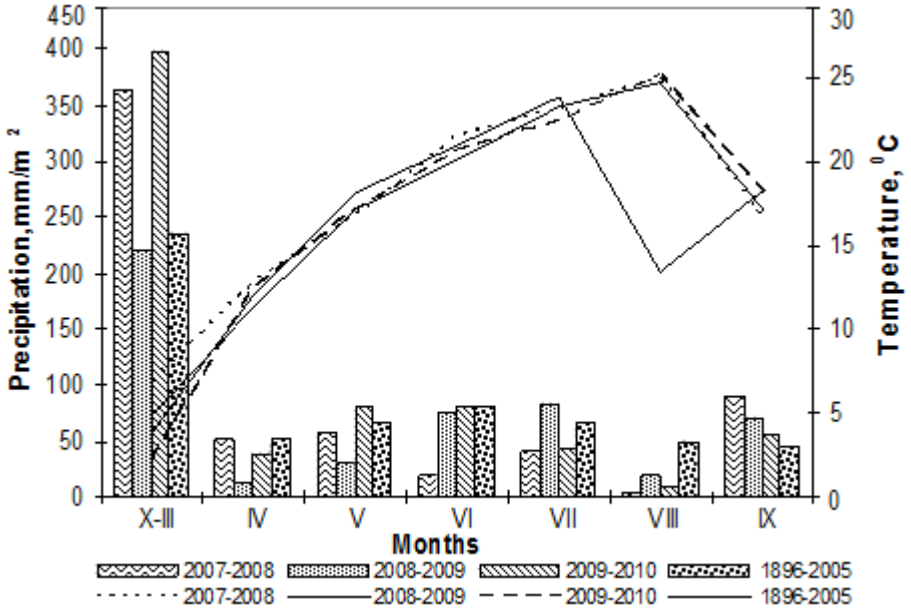

Figure 1. Precipitation and average monthly air temperatures, 2007–2010.

Compared to that sum, during the same period of the harvesting 2007 it was 47.8mm/m^2 higher, in 2009–29.3mm/m^2 and in 2010–158.3mm/m^2, respectively.

During the harvesting 2008 precipitation sums were 159.7 mm/m^2 lower than the average data. Soil moisture reserves during the autumn–winter period of 2007, did not allow performance of qualitative pre–sowing cultivations and sowing of cereals, so the uniformity of plants was not good.

Spring drought in 2008 adversely affected tillering of cereals and emergence and growth of root crops.

Critical phases of crop development–emergence, tillering (cereals), flowering and pod–formation took place on the background of strongly expressed water deficit.

That created a prerequisite for reduced competitive ability of crops and stronger weed infestation. Scarce rainfall and high average daily temperatures proved to be determinant for the formation of yield.

The fallen heavy rain in July 2008 accompanied with hail caused falling out of about 10% of grains of oats and beans and caused damages on soybeans plants.

The pointed meteorological conditions during the period of investigation created favorable prerequisites for winter emergence, early–spring development and late spring growth of weeds. The observations showed that the experimental area was with natural background of weed infestation: spring–autumn weeds–*Stellaria media* (L.), *Veronica agrestis* (L.), *Lamium purpureum* (L.) etc., and late spring weeds–*Amaranthus retroflexus* (L.). *Chenopodium album* (L.), *Setaria veridis* (L.), *Echinochloa crus–golli* (L.), *Digitaria sanguinale* (L.), *Solanum nigrum* (L.), etc., winter–spring weeds–*Matricaria chamomilla* (L.), etc.

Table 1

Weed infestation of field crops, 2008–2010, pcs./m^2

Crops /Species weeds	Years			Average
	2008	2009	2010	
Wheat				
Control				
Annual	40	32	88	53
Perrenia	18	18	14	17
Total weeds	58	50	102	70
Humustim				
Annual	36	25	68	43
Perrenia	30	13	10	18
Total weeds	66	38	78	61
Wintering oats				
Control				
Annual	58	33	66	52
Perrenia	6	14	8	9
Total weeds	64	47	74	62
Humustim				
Annual	41	26	44	37
Perrenia	24	8	7	13
Total weeds	65	34	51	50
Beans				
Control				
Annual	66	59	390	172
Perrenia	10	17	4	10
Total weeds	76	76	394	10
Humustim				
Annual	75	55	286	139
Perrenia	6	11	8	8
Total weeds	81	66	294	147
Soybean				
Control				
Annual	90	65	376	177
Perrenia	15	37	0	17
Total weeds	105	102	376	194
Humustim				
Annual	97	48	296	147
Perrenia	10	22	0	11
Total weeds	107	70	296	158

Among the perennial weeds, representatives of soboles prevailed–*Convolvulus arvensis* (L.) and Cirsium arvense (L.), from rhizomes–*Corgum halrprnse* (L.) The density of weeds was from 8 to 194 pcs./m^2.

During the period of investigation, the crops, grown in crop rotation (*table 1*) in wheat and oats significantly reduced the density of perennial and sobole weeds *Convolvulus arvensis* (L.) and *Cirsium arvense* (L.), of rhizomes–*Sorgum halrprnse* (L.). In annual weeds *Veronica agrestis* (L.), *Lamium purpureum* (L.), etc., the density increased several times in 2010 (*table 1*).

At the same time, in stands with merged surface new weed species appeared, that were not registered in the initial observations. In root crops beans and soybeans, the wide inter–row spacing created favorable conditions for emergence and development of weeds. The top–common weed associations were *Enchinochloa spp* (L.), *Setaria viridis* (L.), *Amaranthus retroflexus* (L.), *Chenopodium album* (L.), *Solanum nigrum* (L.), *Portulaca oleracea* (L.), *Anagallis arvensis* (L.), *Falopia convolvulus* (L.), *Matrikaria inodora* (L.), *etc*.

In later phases of crop development, secondary weed infestation was observed with representatives of sobole and rhizome weeds–*Convolvulus arvensis* (L.), *Cirsium arvense* (L.) and *Sorgum halrprnse* (L.).

The density of perennial weeds had remained comparatively constant throughout the period of investigation. Results of the monitoring of the field crops showed that the highest density of weed infestation, average for three–year period was registered in soybeans–704 pcs./m^2, and the lowest one–in wintering oats, 223 pcs./m^2. In the variants without fertilization by Humustim, the total number of weeds in all crops was higher than that with fertilization, as in wheat by 15%, in oats–19%, beans–19%, and soybeans–19%.

Conclusions

1. During the period of investigation in crop rotation, the density of the perennial weeds had remained comparatively constant.
2. During the period of investigation in variants with foliar fertilization by Humustin, the total number of weeds was lower than the control.
3. The monitoring showed that wintering oats had the lowest degree of weed infestation, grown after soybeans–100 pcs./m^2, also and wheat, grown after field beans–122 pcs./m^2.

References

1. Atanassova D., V. Koteva, **2007**, Weed infestation in field crops, grown in crop rotation without chemization. Plant sciences, 44, 439–444.
2. Karov St., V. Popov, Pl. Paraskevova, El. Blagoeva, **1999**, Transition to organic farming, HAI Plovdiv, 17–23.
3. Malinova R., **2004**, Humustim and its significance for the agricultural production, Agrospeis Ltd., Velingrad, Agro BG, http://agrobg.test.antipodes.bg/
4. Mitova T., Crop rotation and its role in ecological and sustainable agriculture, Agricultural science, 3, 67–89.
5. Mitova T., **2008**, Restricting of weed infestation of crops in organic farming, journal Zemedelie plus, 7–7, 15–17.
6. Regulation N 22 from 04 July 2001 for organic production of plants, plant products and foods of plant origin and its labeling. Renewed Official Gazette, 68/04.08.2001, amendment Official Gazette, 13/10.02.2006
7. Stoichev K., **2004**, Ecological and technological aspects of the contemporary agriculture, Sofiya, 17–27.
8. Tonev T., M. Dimitrova, Sht. Kalinova, et al., **2007**, Herbology, Plovdiv.
9. Trunkov I., G. Moskov, M. Doikova, et al., **1993**, Growing of agricultural crops, DIONIS, Sofiya.
10. Rasmussen I., M. Askegaard and J. Olesen, **2005**, Longterm organic crop rotation experiments for cereal production–perennial weed control and nitrogein leaching, Archived at http://orgprints.org/6072.
11. Fahong W., Zhonghu He *et all*, **2009**, Wheat cropping systems and technologies in China, journal Field Crops Research, pp. 181–188

Received: October 5, 2011
Accepted: November 28, 2011