Organic World Congress 2020 | FRANCE

SEPTEMBER 21ST TO 27TH, 2020 IN RENNES
AT THE COUVENT DES JACOBINS • RENNES MÉTROPOLE CONFERENCE CENTRE
www.owc.ifoam.bio/2020

OWC 2020 Paper Submission - Science Forum

Topic 1 - Ecological approaches to systems' health

OWC2020-SCI-202

INSECTS DIVERSITY IN SOYBEAN CROPS UNDER ORGANIC AND CONVENTIONAL FARMING

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Preferred Presentation Method: Poster only

Full Paper Publication: Yes

Abstract: In the conditions of the Right-Bank Forest Steppe of Ukraine (Kyiv region), diversity of entomocomplex in organic soybean fields was investigated. Biodiversity indexes (Shannon's and Simpson's) were calculated. It was found that the total number of individuals, species and families was higher in organic fields on 88.5, 68.0 and 122.2%, compared to conventional respectively and on 33.3, 9.1, 20.7% in the protective forest plantations adjacent to the organic fields compare to conventional, respectively. Pests from 13 families were identified. On fields with conventional technology pests from 9 families were found (on 2.3% less from all individuals). It was investigated that the share of insect pests in protective forest plantations adjacent to organic fields was on 16.9% lower than in those adjacent to conventional fields. The values of biodiversity indexes in organic landscapes are greater.

Introduction: Biodiversity is valuable regardless of material costs, as it is a form of living matter and the basis of environment and natural ecosystems functioning. Therefore, the inhibition of the development or loss of certain taxa, structural elements of biodiversity not only leads to negative economic and natural consequences, it causes disruption of natural conditions for other species of biota and for humans.

According to current international standards, the basis for ensuring a sustainable use of natural resources is the harmonization of social, economic and environmental interests in time and space, cross-sectorally coordinated management of vertical and horizontal use of nature. Therefore, in recent years, the transition to integrated management of natural resources and associated environmental threats / risks has attracted increasing attention of scientists and professionals in the fields of economics and the environment in all countries.

Priorities for improving Ukraine's current environmental policy and practices are the approximation of its legislation to EU environmental standards in the development of the European Neighborhood and Eastern Partnership Policy (EPTISA-2012-2020). In particular, Ukraine implements: "National Concept for the Implementation and Development of Cleaner Production and Environmental Technologies up to 2020", "National Biodiversity Conservation Program 2005-2025", Convention on Biological Diversity (1992, Rio), principles of IPPC Directive, principles of integrated management in the economy, incl. into agriculture. According to the document "On the Concept of Conservation of Biological Diversity of

Ukraine" (the Decree of the Cabinet of Ministers of Ukraine No. 439 dated May 12, 1997), one of the tasks is to green the economic activity in order to improve the agricultural territories. One of the main promising areas is the replacement of conventional and intensive agricultural farming with organic. However, the sustainability of actions requires a systematic, co-ordinated cooperation between stakeholders. Therefore, in our opinion, when improving organic technologies and putting into practice the principles of organic agricultural production, the urgent task is to take into account the principles of integrated plant protection in accordance with the strategy of biodiversity conservation (agrolandscapes and adjacent territories). Organic agriculture can increase the adaptive potential of agricultural ecosystems and economic benefits (Liu et al., 2016). The aim of the study was to identify differences in entomo-diversity in organic and conventional agroecosystems with soybean production and to find out their environmental causes.

Material and methods: The studies were conducted at the Skvyra Organic Research Station of the Institute of Agroecology and Environmental Management (which has been certified as organic since 2013). The territory belongs to the Right-bank Forest Steppe of Ukraine and is located in the Kiev region, Ukraine. The climate here is temperate continental, soils are black typical leached, with low humus. The insect caught the standard entomological aerial insect net (100 waves). Entomo-diversity was determined in June 2017-2019 on soybean fields (organic –5.3 ha, conventional – 2.0 ha; accounting area – 1 ha (100 m x100 m)). The precrop was winter wheat. Pesticides, used in conventional field – Basagran (applied at BBCH 12 in amount 2.0-2.5 liters per ha) and Fusilade Forte (applied at BBCH 49 in amount 1.0-2.0 liters per ha). For comparison we studied biodiversity in adjacent protective forest plantations (adjacent to organic fields – 0.7 ha, adjacent to conventional fields – 0.2 ha; accounting area – 0.1 ha (10 m x 100 m)). Tree species in protective forest plantations: *Populus nigra* L., *Robinia pseudoacacia* L., *Ulmus laevis* Pall., also *Fraxinus excelsior* L., *Quercus robur* L., *Juglans regia* L. are found. Biodiversity indexes (Shannon's (H') and Simpson's (1-D)) were calculated.

Results: It was found that the total number of individuals, species and families was higher in organic fields with 88.5, 68.0 and 122.2%, compared to conventional respectively, than in the adjacent to the fields protective forest plantation with and on 33.3, 9.1, 20.7% in the adjacent to the fields protective forest plantations compare to conventional, respectively (Table 1). The share of pests in fields with conventional technology was on 2.3% lower than in organic fields, but with no significant difference. And in protective forest plantations adjacent to conventional fields, the percentage of pests was on 16.9% lower than near organic fields.

In organic fields we found pests from the families *Aphididae*, *Cicadellidae*, *Curculionidae*, *Elateridae*, *Miridae*, *Nitidulidae*, *Chloropidae*, *Nymphalidae*, *Agromyzidae*, *Curculionidae*, *Anthomyiidae*, *Plutellidae*, *Psyllidae*; in conventional from families *Miridae*, *Nymphalidae*, *Agromyzidae*, *Anthomyiidae*, *Chloropidae*, *Plutellidae*, *Nitidulidae*, *Psyllidae*, *Crabronidae*.

Table 1. Biodiversity of agroecosystems (average for 2017-2019)

Parametr	Soybean fields		Protective forest plantations, adjacent to the fields	
	organic	conventional	organic	conventional
Number of individuals	57.5±5.9	30.5±4.5	62.0±5.7	46.5±2.9
Species number	21.0±0.1	12.5±3.7	24.0±6.5	22.0±2.4
Number of families	20.0±0.8	9.0±3.3	17.5±3.7	14.5±0.4
Shannon's index (H')	3.11±0.5	2.05±0.3	2.87±0.2	2.64±0.1
Simpson's index of Diversity (1-D)	0.90±0.1	0.85±0.1	0.94±0.1	0.90±0.1
Pests, %	56.7±7.6	54.4±1.3	44.1±1.9	61.0±0.8

The values of biodiversity indexes in organic landscapes are higher on 1.06 and 0.23 (Shannon's); on 0.05 and 0.04 (Simpson's) compare to conventional in the fields and protective forest plantations, respectively.

Discussion: Pesticides used in conventional farming obviously reduce biodiversity. At the same time, the share of pests when refusing to use those remains almost at the same level (56.7%) and the number of entomophages increases. Studies by Put et al. (2018) confirm the presence of more species and greater biodiversity in organic farming. In our research Shannon index shows that the abundance and evenness of the species are much higher in organic farming. Organic fields have not only more species, but individuals in species are more evenly distributed. Simpson's indexes indicate that the diversity of communities is greater in organic agro-landscapes.

Thus, the pesticides used in conventional farming reduce the number of individuals, species and families not only in the fields, but also in adjacent protective forest plantations. This is due to the fact that some insects have topic, foric, trophic or fabrical relationships with other organisms in the complex ecosystems of protective forest plantations. According to FiBL, semi-natural areas serve as habitat and temporary storage for most animal species. This is also confirmed by ECONET construction experts: protective forest plantations play the role of eco-corridors in agricultural landscapes. That is, the applying of pesticides impoverishes not only biodiversity in the fields, but also in adjacent areas of the agro-landscape. Hamilton et al. (2015) confirm that pesticides kill entomophages not only in the fields but also in other areas of the agro-landscape.

According to Brzozowski and Mazourek (2018), despite lower yields in organic farming, we must reduce the chemical burden to preserve the environment by selecting pathways that are alternative to pesticides. Agrarians should not be aside the problem of biodiversity loss, since agriculture covers about 30 percents of the world's land and is one of the main activities affecting biodiversity (Altieri and Nicholls, 2018). Therefore, we propose, in line with the strategy for conservation of biodiversity, to implement more widely recognized by the scientists integrated protection of crops against harmful organisms: the use of natural regulatory factors aimed at reducing the number of populations of harmful species, such as entomophages species.

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Disclosure of Interest: None Declared

Keywords: agroecosystems, biodiversity, insects, organic farming, soybean