УДК: 502.3.7:581.9
DOI: 10.32782/2415-8240-2022-101-1-56-69

BIOINDICATIVE ASSESSMENT OF THE FORMATION OF SYNANTHROPIC VEGETATION AT THE INITIAL STAGE OF NO TILL IMPLEMENTATION

V. V. RASEVYCH, *candidate of biological sciences*
The Cherkassy state agricultural scientific research station of NRC «Institute of agriculture of the National Academy of Agrarian Sciences of Ukraine»
V. Ya. BILONOZHKO, *doctor of agricultural sciences*
Bohdan Khmelnytsky National University of Cherkasy
S. P. POLTORETSKYI, *doctor of agricultural sciences*
N. M. POLTORETSKA, *candidate of agricultural sciences*
Uman National University of Horticulture

Розкриваються питання використання методики геоботанічних досліджень підчас проведення дослідів з вивчення обробітків ґрунту, як доповнення гербологічних методик. З метою фіксації напрямків сукцесії на дослідних полях використано класифікацію рослинності за методом Браун-Бланке за різних систем обробітку ґрунту у п'ятипільній зерно-кормовій сівозміні (горох – ячмінь ярий – пшениця яра – соя – пшениця озима). Розглянуто можливість використання фітоіндикації для оцінки процесів, що відбуваються в агроценозах різних культур. Встановлено значну відмінність чисельності та видового складу бур'янової компоненти агроценозу, що зокрема впливає на визначення синтаксонів різного рангу від класу до асоціації. Запропоновано використовувати при характеристиці синтаксонів типи обробітків ґрунту як суттєвий чинник формування фітоценозів полів. Встановлено, що досліджувані рослинні угруповання відносяться до класу рослинності Stellarietea mediae Tx. et al. in Tx. 1950 та порядку Papaveretalia rhoeadis Hüppe et Hofmeister ex Theurillat et al. 1995. Виявлено, що ступінь забур'яненості після оранки і поверхневого обробітку переважно низький, тоді як за системи No-till середній. Наведено дані фітоіндикаційної оцінки для Зірочника середнього (Stelaria media L.), що досить часто трапляється в дослідах за наступними кліматичними та едафічними чинниками: терморежим (Tm), омброрежим (Om), кріорежим (Cr), континентальність (Kn), зволоження середовища (Hd), зміна зволоженості (fH), кислотність (Rc), трофність (Tr), карбонатність (Ca), азот (Nt), гумідність (Gm), аерація (Ae).

Ключові слова*: обробіток ґрунту, рослинність, фітоіндикація.*

Problem statement. Vegetation analysis, in particular, in crops and crop plantations, has been carried out for a long time according to the system developed by Braun-Blankuet, and has a significant database on a large geographical gradient [5].

Also, plant groups carry synphytoindicative information about ecosystems in particular and agroecosystems in which they occur and directions of vegetation development (succession and fluctuations), in particular competitive relations in these systems [1].

The complexity of using the Braun-Blanquet classification for the applied agronomic field led to the development of a compromise solution to the issue of agrotypes – crops of one type of field cultures (row crops, cereals), which are determined by a specific complex of weeds in certain types of edaphotopes, taking into account their water regime. As a result of such an approach, several dozen agrotypes were selected (mouse, mustard, thistle, flat-bellied, curly-loin, etc.) [9]. Instead, we believe that for fundamental science, the use of the Braun-Blanquet classification in parallel with classic agronomic studies will be more informative, in particular, in connection with the significant accumulated international base of the floristic classification of vegetation, which can be used for the purpose of comparative analysis of data over a significant period of time.

The previous experience of a number of studies at the Cherkasy State Agricultural Experimental Station of the National Scientific Center "Institute of Agriculture of the National Academy of Agrarian Sciences of Ukraine" regarding various approaches to soil research [10–19] indicates the need to expand the methodological component to identify new regularities in soil-forming processes at the ecosystem level. In our view, in combination with classic agronomic, phytocenotic and bioindicative studies with the implementation of the "No-till" system, can help reveal the hidden mechanisms of crop yield formation under the studied tillage systems. Such combined approach will make it possible for agrarian scientists, through correlation analysis in fundamental science, to take into account the interrelationships in agroecosystems of the influence of additional factors in soil-forming agrophysical and agrochemical processes that occur in fields of varying degrees weediness, such as density, sparcity, structure of aggregates, dynamics of available forms of nitrogen, phosphorus and potassium, etc. as you know, agricultural research both in Ukraine and in the world is mainly confined to certain small territories and farms, in particular at private enterprises that have their own scientific departments, are mainly applied in nature and are often not published for the general public.

Instead, the use of information by researchers about similar natural plant components of agrophytocenosis of other countries, which are available in the description when applying the classification of vegetation according to the Braun-Blanquet method, will give the opportunity to make generalizations on a wide geographical gradient, which are based on hundreds and thousands of geobotanical descriptions from essentially different agro-ecological regions of the world, for example, Poland [20] and the Czech Republic [21]. On the other hand, phytosociologists studying the vegetation of fields in the descriptive part of the selected syntaxons often do not indicate the names of the main crops and agrotechnical and agrochemical methods used in their sowing, limiting themselves to general agronomic terms, for example "arable land", "cereal crops", "winter crops", “spring crops”, “row crops”, “gardens”, “vineyards”, sometimes in more detail “rice checks”, “tobacco crops”, etc. [5–8].

The aim of the article: to establish the peculiarities of the formation of segetal vegetation at the initial stage under different tillage systems using a combined approach of herbological, geobotanical and phytoindicative methods of analysis.

The research was conducted in the stationary experiment of the Cherkasy State Agricultural Experimental Station of the National Scientific Center “Institute of Agriculture of the National Academy of Agrarian Sciences of Ukraine”, which is near the village Kholodnianske, Cherkasy district, Cherkasy region. The experiment is represented by a five-field grain-forage crop rotation, which includes the following of crops: peas, winter wheat, soybeans, spring wheat, spring barley. Crops were sown under the following soil tillage systems: tillage – systematic for 22–25 cm, System of zero tillage based on transitional minimum tillage and systematic plowing for 22–25 cm, System of zero tillage based on transitional minimum tillage and systematic plowing for 22–25 cm, System of zero tillage for surface tillage for 10–12 cm for 7 years, Surface tillage for 10–12 cm for 7 years.

Thus, segetal plant groups in the crop rotation are represented by a spring synusia of 29 species of mainly dicotyledonous plants belonging to 16 families. The most numerous is the group of plants of the aster family (9 species), the leguminous plants – four species, two of which are litter crops, buckwheat and cabbage, two species from each family. The rest of the Ruderals are represented by one family each. These are all mainly spring non-perennial crops [4]. The list of these families and species occurring in crop rotation is given below.

Asteraceae family (*Senecio vernalis* Waldst. & Kit., *Senecio papposus* (Reichenb. Less.) *Descurainia Sophia* (L.) Webb ex Prantl., *Ambrosia artemisiifolia* L., *Taraxacum officinale* Wigg., *Sisymbrium officinale* (L.) Scop.), *Erigeron canadensis* L., *Tragopogon major* Jacq., *Artemisia absinthium* L.), Poaceae family (*Setaria glauca* (L.) Beauv., *Avena fatua* L., *Hordeum vulgare* L., *Triticum aestivum* L.), Scrophulariaceae family (*Veronica hederifolia* L.), Brassicaceae family (*Thlaspi arvense* L., *Capsella bursa-pastoris* L.), Amaranthaceae family (*Amaranthus retroflexus* L.), Aceraceae family (*Acer negundo* L.), Polygonaceae family (*Polygonum aviculare* L., *Polygonum convolvulus* L.), Boraginaceae family (*Myosotis arvensis* (L.) Hill.), Violaceae family (*Viola pratensis* Mert. & WDJKoch), Plantaginaceae family (*Plantago salsa* Pall.), Rubiaceae family (*Galium aparine* L.), Convolvulaceae family (*Convolvulus arvensis* L.), Geraniaceae family (*Geranium molle* L.), Apiaceae family (*Conium maculatum* L.).

In order to fix the directions of successions of synanthropic vegetation in crop rotation, depending on the history of fields, in particular tillage, we established the syntaxonomic affiliation of plant groups based on geobotanical descriptions of the studied crops made in agrophytocenosis according to the European classification of vegetation according to Braun-Blanquet (Table 1).

It is established that these plant groups belong to the Stellarietea mediae Tx vegetation class. et al. in Tx. 1950 and the order Papaveretalia rhoeadis Hüppe et Hofmeister ex Theurillat et al. 1995.

1. Floristic (botanical) composition of segetal plant groups in a five-field crop rotation of a stationary experiment under different tillage systems (*April 10–28, 2022*)

Soil tillage system	Crop				
	Pea	Spring barley	Spring wheat	Soybean	Winter wheat
1	**2**	**3**	**4**	**5**	**6**
Tillage – systematic for 22–25 cm	Chenopodium album + Hordeum vulgare **r**, Acer negundo **r.**	Chenopodium album +, Senecio papposus +.	Chenopodium album +	Ambrosia artemisiifolia +, Chenopodium album +.	Chenopodium album 2. Polygonum Convolvulus +.
System of zero tillage based on transitional minimum tillage and systematic tillage for 22–25 cm	Senecio vernalis 1, Setaria glauca 1, <u>Descurainia Sophia</u> +, Veronica hederifolia 1, Stellaria media +, Thlaspi arvense +, Capsella bursa-pastoris +, Chenopodium album 2, Amaranthus retroflexus 1, Hordeum vulgare +, Acer negundo **r**, Fumaria officinalis **r.** Erigeron canadensis 2, Tragopogon major +, Artemisia absinthium +	Chenopodium album +, Senecio vernalis 1 Senecio papposus +, Capsella bursa-pastoris 1.	Chenopodium album 2, Senecio papposus +, Capsella bursac-pastora +, Myosotis arvensis +.	Chenopodium album 4, Triticum aestivum +, Capsella bursa-pastoris 1, Viola pratensis +, Galium aparine +, Plantago salsa 1, Lamium amplexicaule +, Thlaspi arvense +, Senecio papposus +, Setaria glauca +, Veronica hederifolia 2, Senecio vernalis +, Polygonum convolvulus +, <u>Descurainia Sophia +,</u> Ambrosia artemisiifolia +.	Ambrosia artemisiifolia 1, Chenopodium album 3, Avena fatua +.

Completion of table 1

1	2	3	4	5	6
System of zero tillage for surface tillage for 10–12 cm for 7 years	Senecio vernalis 2, Setaria glauca 1, <u>Descurainia Sophia</u> +, Veronica hederifolia 1, Stellaria media +, Thlaspi arvense +, Capsella bursac-pastora +, Chenopodium album 3, Amaranthus retroflexus 1. Erigeron canadensis 3, Tragopogon major +, Artemisia absinthium +, Polygonum aviculare **r**, Conium maculatum **r.**	Chenopodium album 4, Senecio vernalis 1, Senecio papposus +, Capsella bursa-pastoris +, <u>Descurainia Sophia +,</u> Conium maculatum **r.**	Chenopodium album 3, Senecio vernalis 1, Capsella bursa-pastoris +, Convolvulus arvensis **r**, Geranium molle **r**., Sisymbrium officinale **r.**	Capsella bursa-pastoris 2, Chenopodium album 4, Senecio vernalis +, Senecio papposus 1, Polygonum aviculare **r**, Myosotis arvensis 1, Triticum aestivum +, Setaria glauca +, Ambrosia artemisiifolia 1, Viola pratensis +, Plantago salsa **r**, Veronica hederifolia +, Lamium amplexicaule +, Taraxacum officinale **r.**	Ambrosia artemisiifolia 2, Chenopodium album 2, Polygonum convolvulus 2, Avena fatua +.
Surface tillage for 10–12 cm for 7 years	Chenopodium album +, Amaranthus retroflexus + Hordeum vulgare 1. Taraxacum officinale **r.**	Chenopodium album +.	Ambrosia artemisiifolia +, Chenopodium album +, Senecio papposus +.	Chenopodium album 2, Triticum aestivum +, Capsella bursa-pastoris +/	Chenopodium album 2, Thlaspi arvense 1, <u>Descurainia Sophia +,</u> Polygonum convolvulus +, Capsella bursa-pastoris +, Stellaria media 1, Avena fatua +.

N o t e . * Scores of projective coverage of species according to the Pan-European classification according to Braun-Blanquet: (r) – <1% ; (+) – <5%; (1) – 5%; (2) – 5–25%; (3) – 25–50%; (4) – 50–75%; (5) – 75–100%

This class of vegetation is represented by segetal groups on arable lands in row crops and grain crops, gardens, vineyards, rose and lavender plantations, as well as ruderal groups of restoration stages of successions on all types of soil with a dominance of annual species. Annual species predominate here. The territorial differentiation of syntaxons of the class is mainly influenced by moisture conditions, soil types, the level of anthropogenic influence, such as the use of a complex of chemical and agrotechnical measures in agrocenosis). It is interesting that the groups of this vegetation class are characterized by an average level of price diversity compared to the coenosis of Western Europe. Researchers of segetal vegetation note that the crop rotation system determines the intermediate position of some units, especially at the level of associations and unions.

Features of the cenotic structure of most syntaxons of the class are high projective coverage with a small number of pollutant species [5]. As can be seen from Table 1, tillage according to the No-till system is included in the list of exceptions regarding the richness of the species composition, where only spring sinusia includes up to 15 species in the group. This is due to a significant reduction in the mechanical impact on the soil compared to other tillage systems.

It should be mentioned that plant groups of the Papaveretalia rhoeadis order belong to the agrophytocenoses of grain crops of the Forest-Steppe and Steppe zones [6]. Significant species diversity of weed plants in the plots under No-till tilage systems with the help of diagnostic species makes it possible to attribute these groups to the Panico-Setarion union Sissingh in Westhoff et al. 1946. Diagnostic species: *Amaranthus retroflexus, Convolvulus arvensis, Echinochloa crusgalli, Galinsoga parviflora, Raphanus raphanistrum, Setaria glauca, Setaria viridis, Sinapis arvensis, Stachys annua*. These are summer and late-summer groups of gardens of Forest and Forest-Steppe zones and row crops, vineyards, gardens, ruderal habitats of the steppe zone with the dominance of cereals on different types of soil in lighted and arid places.

Based on the species composition of the weed component of soybean crops under No-tillage system, we attribute the plant groups to the association Echinochloo-Setarietum pumilae Felföldy 1942 corr. Mucina in Mucina et al. 1993. Diagnostic species: *Chenopodium album, Echinochloa crusgalli, Fallopia convolvulus, Galinsoga parviflora, Setaria glauca, Setaria viridis*. In fact, these are adjacent areas of cultivated land, groups of perennial grasses, abandoned gardens, leguminous, grain, row crops, on typical, ordinary, podzolized, southern, sandy soils, on sod-podzolic, gray forest, brown earth-podzolic soils, in the mountains – up to a height of 400 m above sea level on brown mountain-forest soils, precursors of rice (oats, alfalfa) on dark chestnut soils, in plantations of ornamental plants and on disturbed growth areas within settlements. Groups of this association within Ukraine are widespread in forest, forest-steppe, steppe zones, in the Carpathians, Zakarpattia, in Steppe and South Coastal Crimea [5, 8].

Analyzing the history of the experimental field, we record the entry of a number of new species into the agrocenosis of crop rotation and the approximate ways of weed seeds entering the field.

A large number of weed seeds have been in the soil bank for a long time and were periodically renewed from nearby coenosis, waiting for time to germinate.

Another smaller part, in our opinion, accidentally entered the agrocenosis and does not have significant chances of consolidation. Belo w we present individual characteristics of these species according to crop rotation.

According to the scale for assessing the actual weediness of crops by the number of seedlings, the weediness is low in plowing (less than 20 plants/m^2) and medium in other cultivations (20–60 plants/m^2). Projective coverage of the soil surface by synanthropant plants indicates a low degree of weediness (up to 30%) [4].

Peas (precursor spring barley). Under the No-till system, weed species diversity is 4–5 times higher than under plowing and surface tillage (Table 1). In all options, except for the system of zero tillage, we fix the fallow of barley on the spring seed, which is obviously problematic to preserve germination in the winter period on the surface of the soil. This field is characterized by the presence of green-barked maple seedlings, the only perennial phanerophyte among all detected species, whose life form is a bush and a tree. Maple seeds are spread by the wind (anemochoria) from a forest strip nearby and, in the absence of economic activity, can quickly transform fields into secondary shrub communities. The situation is similar with spring yellow-green and ivy-leaved veronica, these species did not manifest themselves in the previous periods, moreover, they are absent from plowing and surface tillage and did not have competitive advantages even with minimal tillage. These species had a relatively significant projective cover in the spring synusia, which indicates the presence of a significant number of their similar seeds in the soil bank. Spring yellowwort spreads anemochorously, while ivy-leaved veronica uses gravity (barochory) and anthropogenic (anthropochory) and zoogenic (zoochory) propagation. In this case, we associate the presence of a significant number of representatives of the last species in the field, as well as the medicinal rue, precisely with anthropochory, since these species are widespread in the roadside strip near the field and could be introduced either directly by people or by agricultural machinery.

Such biennials as spotted hemlock and dwarf dandelions are also found here, as well as perennials such as dandelion, wormwood, and a fairly invasive species of Canadian sedge, the seeds of which are dispersed by wind. Some of these species may take a significant part in the agrocenosis of the No-till system in the future.

The number of weeds was also determined according to the tillage options (Table 2). The average weediness was 32.5 plants/m^2. The highest weediness was observed on the System of zero tillage by surface tillage on 10–12 cm for 7 years, 75.2 plants/m^2, the lowest on the option of systematic plowing on 22–25 cm – 2.2 plants/m^2.

Spring barley (precursor spring wheat). Weeds on surface tillage are represented by seedlings of white quinoa in the amount of 8.6 plants/m^2. Zero tillage system was the weediest among all crop rotation options – 84.1 plants/m^2. The main ruderal species here was the white quinoa, and 1 spotted hemlock plant was also found.

Table 2. The number of segetal plants in a five-field crop rotation of a stationary experiment under different systems of plant tillage per 1 m^2 (April 10–28, 2022)

Soil tillage system	Crop					The average number of weeds by tillage
	Pea	Spring barley	Spring wheat	Soybean	Winter wheat	
Tillage – systematic for 22–25 cm	2,2	3,2	2,1	1,1	12,1	4,1
System of zero tillage based on transitional minimum tillage and systematic tillage for 22–25 cm	44,9	48,2	40,2	58,7	28,2	44,0
System of zero tillage for surface tillage for 10–12 cm for 7 years	75,2	84,1	60,3	57,3	32,4	61,9
Surface tillage for 10–12 cm for 7 years	7,8	8,6	6,4	20	24,5	13,5
The average number of weeds by agrocenosis	32,5	36,0	27,3	34,3	24,3	30,9
LSD_{05}	*2,3*	*3,2*	*2,9*	*2,3*	*2,9*	–

The entry of this biennial into the coenosis is considered temporary due to the peculiarities of its biology, which does not allow it to bear fruit in conditions of intensive chemical protection. The average weediness under spring barley was 36 plants/m^2.

Spring wheat (precursor soybeans) is different from spring barley, where the precursor of spring eared crop is another spring eared crop. In spring wheat, soybean weediness is lower in all cultivations, although the dominance of white quinoa in the agrocenosis remains at the same level as in spring barley crops. On the variants with zero tillage, species new to the field such as geranium mole (anthropochoria) and bankweed (anemochoria) occur. Among the perennial root-sprouting synanthropic plants, one should note the isolated presence of such a hemicryptophyte as field birch, which in the future can significantly increase its presence in agrophytocenoses under conditions of zero tillage. The average number of weeds according to the variants under spring wheat is 27.3 plants/m^2, the minimum number is found under plowing – 2.1 plants/m^2, the maximum number is 60.3 plants/m^2 on the system of zero tillage according to the seven-year surface.

Soybean (precursor winter wheat). Before sowing soybeans, before applying herbicide based on glyphosate salt, the species composition of the weed coenosis was established on different tillage options under the future crop. The richest species composition of the ruderal component was revealed on zero tillage systems compared to other crops of crop rotation, 14–15 species, while only 3 species were represented by plowing and surface tillage. The average number of weeds was 34.3 plants/m^2, the minimum (for the entire crop rotation as well) after plowing was 1.1 plants/m^2, the maximum at zero tillage after plowing was 58.7 plants/m^2. In this coenosis, a number of species new to the site appear on the system of zero tillage: field violet, madder, stem-wrapped nettle, salt plantain, and ivy-leaved veronica. Perennial birch and dandelion appear. Winter wheat drops also occurs.

Winter wheat (precursor peas). The lowest species diversity and number of weed plants among the studied agrocenosis of crop rotation is found in winter wheat, which is associated with a longer period of competition of this crop with the components of natural pioneer vegetation basically from the fall of 2021. As a result, the most species diversity can be seen on surface tillage – 7 species, it is also the largest compared to all options with surface tillage, which is again explained by the relative antiquity of the last mechanical tillage under winter wheat. It is characteristic that, along with white quinoa, under No-till systems, ragweed acquires a significant influence, which was not observed under other crops. The number of weeds in wheat crops is relatively even, although in the version with plowing it is more than 2 times lower compared to other tillage systems. Thus, the average number according to the experiment is 24.3 plants/m^2, and the largest is 32.4 plants/m^2 at zero tillage with unchanged surface tillage.

In general, the average number of segetal plants in crop rotation by tillage is as follows: plowing – systematic at 22-25 cm – 4.1 plants/m^2; system of zero tillage to transitional minimal tillage by systematic plowing at 22–25 cm – 44 plants/m^2; system of zero tillage by surface tillage for 10–12 cm for 7 years – 61.9 plants/m^2; surface treatment for 10–12 cm for 7 years – 30.9 plants/m^2 (see Table 2).

The highest number of weeds in almost all cases, except for the variant with soybeans, is observed in the system of zero tillage on the surface, while the lowest on plowing, a little more weediness than on plowing takes place on the surface tillage. In terms of species diversity, no clear regularity has yet been established in relation to the various variants of zero tillage.

The presence of a significant phytocoenotic diversity in crops makes it possible to conduct a bioindicative assessment of the ecosystem (biogeocenosis) of fields. The method of phytoindication developed in this way based on environmental factors makes it possible to determine the limits of 12 ecological factors of the ecosystems in which they occur, based on the totality of overlapping ecological amplitudes of species. Among them, there are four climatic ones: thermoregime (Tm), ombroregime (Om), cryoregime (Cr), continentality (Kn) and eight edaphic ones: humidity of the environment (Hd), change of humidity (fH), acidity (Rc), trophicity (Tr), carbonate (Ca), nitrogen (Nt), humidity (Gm), aeration (Ae) [1].

After the analysis of all synusiae of the current growing season, it will be possible to carry out a phytoindicative assessment of ecosystems and change their dynamic parameters formed under zero tillage in the experimental plots. Also, based on literature data, [2] below we present a sample of phytoindication for one of the weeds occurring in the studied agrocenosis. Cheekweed (*Stelaria media* L.) has the following characteristics: (Tm) submicrotherm (the amount of heat received per year is 30–40 kcal/cm^2), (Om) no information, (Cr) subcryophyte (the seeds of the plant retain germination within temperature limits at least from minus 34 °C to plus 18 °C), (Kn) hemicontinental (the temperature change during the year is used according to the formula of M. M. Ivanov, 1959), (Hd) hygromesophyte (a plant of moist forest-meadow ecotopes with temporary excessive moisture of the root layer of soil with soil water), (fH) hemihydrocontrastophob (plant of fresh forest-meadow ecotopes with moderately uneven moisture of the root layer of the soil when it is completely soaked by precipitation and meltwater), (Rc) neutrophil (plant of neutral ph (6.5–7.1) soils), (Tr) eutroph (rich, best supplied with salts, chernozems in the absence of signs of salinity (HCO-3 30–50 mg/100 g of soil, SO2–4, Cl- – traces), (Ca) acarbonatophilous (a plant of neutral ecotopes, which can withstand a small amount of carbon tives in the soil (CaO, MgO = 0.5–1.5%)), (Nt) nitrophilous (plant relatively supplied with nitrogenous compounds in soils (0.3–0.4%)), (Gm) humophilic (plant grows on highly humus-rich soils, chernozems (more than 600 t/ha in a meter layer)), (Ae) hemiaerophobe (a plant of moderately aerated dry clay or wet sandy soils with complete wetting of the root layer of the soil by precipitation and melt water or temporary excessive moistening of its soil water (Ae = 50–35%)) [3]. The given ecological amplitudes are valid for all agroecosystems where cheekweed occurs.

Conclusions. A significant difference in the number and species composition of the weed component of the agrocenosis was established, which in particular affects the definition of syntaxons of different ranks from class to association. It is proposed to use the types of tillage as an essential factor in the formation of field.

Література

1. Дідух Я. П., Плюта П. Г. *Фітоіндикація екологічних факторів*. К.: Наук. думка, 1994. 280 с.

2. *Екофлора України*: монографія. Наук. ред. Я. П. Дідух та ін. К.: Фітосоціоцентр, 2000. Т. 1. 2000. 284 с.

3. *Екофлора України*: монографія. Наук. ред. М. Федоранчук та ін. К.: Фітосоціоцентр, 2002. Т. 3. 2002. 495 с.

4. Петриченко В. Ф., Борона В. П., Задорожний В. С. *Бур'яни та заходи їх контролю*: навч. посіб. Вінниця: ФОП Горбачук І. П., 2010. 152 с.

5. Дубина Д. В., Дзюба Т. П., Ємельянова С. М. та ін. *Продромус рослинності України*. К.: Наукова думка, 2019. 784 с.

6. Соломаха Т. Д., Соломаха В. А., Шеляг-Сосонко Ю. Р. Основні асоціації рудеральної рослинності Лівобережного Лісостепу України. *Український ботанічний журнал*. 1986. Т. 43. № 3. С. 70–75.

7. Соломаха В. А., Шеляг-Сосонко Ю. Р., Костильов О. В. Синантропна рослинність України. К.: Наукова думка, 1992. 252 с.

8. Соломаха В. А. *Синтаксономія рослинності України. Третє*

наближення. К.: Фітосоціоцентр, 2008. 296 с.

9. Тихонова О. М. Типологія агроценозів зернових культур Лівобережного Лісостепу (Сумська область). *Український ботанічний журнал*. 2007. Т. 64, № 6. С. 840–849.

10. Boyko P., Litvinov D., Demidenko O. et al. Prediction humus level of black soils of forest-steppe ukraine depending on the application of crop rotation, fertilization and tillage. *International journal of ecosystems and ecology science* (IJEES). 2019. Vol. 9 (1). P. 155–162. DOI: https://doi.org/10.31407/ijees9118.

11. Bulygin S. Yu. Demydenko O. V., Velychko V. A. et al. Evaluating agrogenic structurization of soil variants under different application modes in the Forest-Steppe. *Agricultural science and practice*. 2020. Vol. 7. № 3. P. 40–53. DOI: https://doi.org/10.15407/agrisp7.03.040.

12. Demydenko O. V., Boyko P. I., Velychko V. A. Long-term dynamics of humus content under different technologies of soil tillage. *Agricultural science and practice*. 2018. Vol. 5. P. 3–16. DOI: https://doi.org/10.15407/agrisp5.01.003.

13. Demydenko O. V., Bulygin S. Yu., Velychko V. A., et al. Soil moisture potential of agrocenoses in the Forest-Steppe of Ukraine. *Agricultural science and practice*. 2021. Vol. 8. №2. P. 49–61. DOI: https://doi.org/10.15407/agrisp8.02.049.

14. Demydenko O. V., Prybluda V. V., Zapasna Yu. M., at al. Agrogenesis of regraded chernozem and the performance of grain crops under organic system of fertilization. *Agricultural science and practice*. 2017. Vol. 4. № 3. P. 50–61. DOI: https://doi.org/10.15407/agrisp4.03.050.

15. Demydenko O. V., Velichko V. A. Microagrogenesis of chernozem in agrocenosis. *Agricultural science and practice*. 2017. Vol. 4 № 1. P. 28–45. DOI: https://doi.org/10.15407/agrisp4.01.028.

16. Demydenko O. V., Velychko V. A. Humus state of chernozem at different ways of tillage in the agrosystems of the Left-Bank Forest Steppe of Ukraine. *Agricultural science and practice*. 2015. Vol. 2. № 3. P. 61–76. DOI: https://doi.org/10.15407/agrisp2.03.061.

17. Demydenko O. V., Velychko V. A. Climatic change impact on the grain crops' yielding capacity at various soil cultivation ways within crop-sugar beet rotation agrocenoses in the Left-Bank Ukrainian Forest-Steppe. *Agricultural science and practice*. 2014. Vol. 1. № 2. P. 61–71.

18. Demydenko O. V., Zapasna Yu. M., Velychko V. A. Sequestration of carbon oxide in different fertilization systems in agrocenoses. *Agricultural science and practice*. 2018. Vol. 5. №2. P 37–51. DOI: https://doi.org/10.15407/agrisp5.02.037.

19. Litvinova O., Litvinov D., Degodyuk S. et al. Effect of fertilizers sysnems on accumulation of hevy metals in gray forest soil. *International journal of ecosystems and ecology science (IJEES)*. 2020. Vol. 10 (4). P. 603–608. DOI: https://doi.org/10.31407/ijees10.404.

20. Matuszkiewicz W. Przewodnik do oznaczania zbiorowisk roślinnych Polski. Warszawa: Naukowe PWN, 2001. 537 p.

21. Moravec J. Roslinna spolecenstva Cesceh republiky a jejich ohrozeni. Pruchonice, 1995. 206 p.

References:

1. Didukh, Ya. P., Spit P. G. (1994). *Phytoindication of ecological factors*. Kyiv: Nauk. dumka, 1994. 280 p. (in Ukrainian).

2. *Ecoflora of Ukraine* (2000). Science. ed. Y. P. Didukh, at al. Kyiv: Fitosociotsentr, 2000. 284 p. (in Ukrainian).

3. *Ecoflora of Ukraine* (2002). Science. ed. M. Fedoranchuk, at al. Kyiv: Fitosociotsentr, 2002. 495 p. (in Ukrainian).

4. Petrychenko, V. F., Borona, V. P., Zadorozhny, V. S. (2010). *Weeds and their control measures*. Vinnytsia: FOP Gorbachuk I. P., 2010. 152 p. (in Ukrainian).

5. Dubina, D. V., Dzyuba, T. P., Yemelyanova, S. M. (2019). *Prodromus vegetation of Ukraine*. Kyiv: Naukova dumka, 2019. 784 p. (in Ukrainian).

6. Solomakha, T. D., Solomakha, V. A., Shelyag-Sosonko, Yu. R. The main associations of ruderal vegetation of the Left Bank Forest Steppe of Ukraine. *Ukrainian Botanical Journal*, 1986, Vol. 43, no. 3, pp. 70–75. (in Ukrainian).

7. Solomakh, V. A., Kostylov, O. V., Shelyag-Sosonko, Yu. R. (1992). *Synanthropic vegetation of Ukraine*. Kyiv: Naukova dumka, 1992. 252 p. (in Ukrainian).

8. Solomakh, V. A. (2008). *Syntaxonomy of vegetation of Ukraine. The third approach*. Kyiv: Fitosociotsentr, 2008. 296 p. (in Ukrainian).

9. Tikhonova, O. M. (2007). Typology of agrocenoses of grain crops of the Left Bank Forest Steppe (Sumy region). *Ukrainian Botanical Journal*, 2007, Vol. 64, no. 6, pp. 840–849. (in Ukrainian).

10. Boyko, P., Litvinov, D., Demidenko, O., et al. (2019). Prediction humus level of black soils of forest-steppe ukraine depending on the application of crop rotation, fertilization and tillage. *International journal of ecosystems and ecology science (IJEES)*, 2019, Vol. 9 (1), pp. 155–162 (2019). DOI: https://doi.org/10.31407/ijees9118.

11. Bulygin, S. Yu. Demydenko, O. V., Velychko, V. A., et al. (2020). Evaluating agrogenic structurization of soil variants under different application modes in the Forest-Steppe. *Agricultural science and practice*, 2020, Vol. 7, no. 3, pp. 40–53. DOI: https://doi.org/10.15407/agrisp7.03.040.

12. Demydenko, O. V., Boyko, P. I., Velychko, V. A. (2018). Long-term dynamics of humus content under different technologies of soil tillage. *Agricultural science and practice*, 2018, Vol. 5, pp. 3–16. DOI: https://doi.org/10.15407/agrisp5.01.003.

13. Demydenko, O. V., Bulygin, S. Yu., Velychko, V. A., et al. (2021). Soil moisture potential of agrocenoses in the Forest-Steppe of Ukraine. *Agricultural science and practice*, 2021, Vol. 8, no. 2, pp. 49–61. DOI: https://doi.org/10.15407/agrisp8.02.049.

14. Demydenko, O. V., Prybluda, V. V., Zapasna, Yu. M., et al. (2017). Agrogenesis of regraded chernozem and the performance of grain crops under organic system of fertilization. *Agricultural science and practice*, 2017, Vol. 4, no. 3, pp. 50–61. DOI: https://doi.org/10.15407/agrisp4.03.050.

15. Demydenko, O. V., Velichko, V. A. (2017). Microagrogenesis of chernozem in agrocenosis. *Agricultural science and practice*, 2017, Vol. 4, no. 1, pp. 28–45. DOI: https://doi.org/10.15407/agrisp4.01.028.

16. Demydenko, O. V., Velychko, V. A. (2015). Humus state of chernozem at different ways of tillage in the agrosystems of the Left-Bank Forest Steppe of Ukraine. *Agricultural science and practice*, 2015, Vol. 2, no. 3, pp. 61–76. DOI: https://doi.org/10.15407/agrisp2.03.061.

17. Demydenko, O. V., Velychko, V. A. (2014). Climatic change impact on the grain crops' yielding capacity at various soil cultivation ways within crop-sugar beet rotation agrocenoses in the Left-Bank Ukrainian Forest-Steppe. *Agricultural science and practice*, 2014, Vol. 1, no. 2, pp. 61–71.

18. Demydenko, O. V., Zapasna, Yu. M., Velychko, V. A. (2018). Sequestration of carbon oxide in different fertilization systems in agrocenoses. *Agricultural science and practice*, 2018, Vol. 5, no. 2, pp. 37–51. DOI: https://doi.org/10.15407/agrisp5.02.037.

19. Litvinova, O., Litvinov, D., Degodyuk, S. et al. (2020). Effect of fertilizers sysnems on accumulation of hevy metals in gray forest soil. *International journal of ecosystems and ecology science (IJEES)*, 2020, Vol. 10 (4), pp. 603–608. DOI: https://doi.org/10.31407/ijees10.404.

20. Matuszkiewicz, W. (2001). Przewodnik do oznaczania zbiorowisk roślinnych Polski. Warszawa: Naukowe PWN, 2001. 537 p. (in Polish).

21. Moravec, J. (1995). Roslinna spolecenstva Cesceh republiky a jejich ohrozeni. Pruchonice, 1995. 206 p. (in Polish).

Annotation

Rasevych V. V., Bilonozhko V. Ya., Poltoretskyi S. P., Poltoretska N. M.
Bioindicative assessment of the formation of synanthropic vegetation at the initial stage of no till implementation

The issues of using geobotanical research methods during soil tillage experiments as a complement to herbological methods are revealed. In order to determine the direction of succession in the experimental fields, the classification of vegetation according to the Braun-Blanquet method was used for different tillage systems in a five-field grain-forage rotation (peas – spring barley – spring wheat – soybean – winter wheat). The possibility of using phytoindication to evaluate the processes occurring in agrocenosis of various crops is considered. A significant difference in the number and species composition of the wed component of the agrocenosis was established, which in particular affects the definition of syntaxons of different ranks from class to association. It is proposed to use tillage as an essential factor in the formation of field phytocenoses when characterizing syntaxons. It was established that the studied plant groups belong to the Stellarietea mediae Tx vegetation class. et al. in Tx. 1950 and the order Papaveretalia rhoeadis Hüppe et Hofmeister ex Theurillat et al. 1995.

It was found that the degree of weediness after plowing and surface treatment is *mostly low, while it is average under No-till system. The data of the phytoindicatieve assessment for winterweed (Stelaria media L.), which occurs quite often in experiments on the following climatic and edaphic factors, are given: thermoregime (Tm), ombroregime (Om), cryoregime (Cr), continentality (Kn), humidity of the environment (Hd), change in humidity (fH), acidity (Rc), trophicity (Tr), carbonation (Ca), nitrogen (Nt), humidity (Gm), aeration (Ae). A significant difference in the number and species composition of the weed component of the agrocenosis was established, which in particular affects the definition of syntaxons of different ranks from class to association. It is proposed to use the types of tillage as an essential factor in the formation of field.*

Key words: *soil tillage, vegetation, phytoindication.*

УДК: 631.52:633.11
DOI: 10.31395/2415-8240-2022-101-1-69-77

ПАРАМЕТРИ КОЛОСА СОРТОЗРАЗКІВ ПШЕНИЦІ ТВЕРДОЇ ЯРОЇ ТА ЇХ ВАРІАЦІЯ ЗАЛЕЖНО ВІД ПОГОДНИХ УМОВ

Ж. М. НОВАК, *кандидат сільськогосподарських наук*
М. А. НОВАК, *студентка*
Уманський національний університет садівництва

До колекції сортозразків пшениці твердої ярої Уманського національного університету садівництва належить 23 біотипи. У статті проаналізовано параметри колоса, зокрема: його довжину та кількість колосків у колосі даного селекційного матеріалу. Визначено генотипову та екологічну дисперсію, а також коефіцієнт варіації аналізованих показників залежно від погодних умов 2017–2022 рр.

Ключові слова: *сортозразок, колекція, пшениця тверда яра, довжина колоса, кількість колосків у колосі*

Вступ. Пшениця тверда — цінна культура, джерело високоякісного білка, використовується переважно для виготовлення пасти, макаронних виробів, круп. Створення сортів і гібридів, які максимально ефективно можуть використовувати біокліматичний ресурс конкретного регіону, виявляти толерантність до стресових умов середовища, забезпечувати достатньо високу реалізацію генетичного потенціалу продуктивності, є стратегічним завданням сучасної селекційної науки.

Одним з нових методів у підвищенні ефективності селекційного процесу є адаптивна селекція. При зміні лімітуючих факторів навколишнього середовища відповідно змінюється і набір функціонуючих алелів, які формуються в процесі природного та штучного добору з вихідного селекційного матеріалу [1]. Це обумовлює необхідність поглиблення досліджень ознак продуктивності, а