ESTIMATES OF ENVIRONMENTAL CONDITIONS OF SOILS IN PLOVDIV REGION IN APPLYING THE NEW HERBICIDES FOR WEED CONTROL IN MAJOR FIELD CROPS

ОЦЕНКА НА ЕКОЛОГИЧНОТО СЪСТОЯНИЕ НА ПОЧВИТЕ В ПЛОВДИВСКИ РАЙОН ПРИ ПРИЛАГАНЕ НА НОВИ ХЕРБИЦИДИ ЗА БОРБА С ПЛЕВЕЛИТЕ ПРИ ОСНОВНИ ПОЛСКИ КУЛТУРИ

Rada POPOVA,[*] Ivan ZHALNOV, Ekaterina VALCHEVA, Plamen ZOROVSKI and Maya DIMITROVA

Agricultrural University - 4000 Plovdiv, 12 Mendeleev str.
Tel. ++359 32 654 389, E-mail – radapopova@abv.bg

ABSTRACT

In connection with the conduction of field experiments to evaluate new complex herbicides for weed control in corn, wheat and winter rape, analyzes of some soil parameteres were carried out in order to trace their dynamics as a result of cultivation and application of herbicides.

Key words: field crops,herbicides,soil,soil properties

РЕЗЮМЕ

Във връзка с провеждане на полски опити за комплексна оценка на нови хехбициди за борба с плевелите при царевица, пшеница и зимна рапица бяха извършени анализи на някои почвени показатели с цел да се проследи тяхната динамика в резултат от отглеждането на културите и прилагането на хербицидни препарати.

Ключови думи: почва, почвени свойства,полски култури,плевели, хербициди

INTRODUCTION

People have been using soil as a means for production since antiquity. They have replaced the naturally growing plants with cultivated ones and have conducted a number of activities such as farming of the land, fertilization, fight against the weeds, the diseases and the pests, irrigation and others. All of these activities cause significant changes in the natural structure and properties of the soil.

Under the conditions of intensive agricultural activities, the soil characteristics such as power of the humus horizon, humus content in A and B horizon, mechanical composition, texture coefficient, soil reaction, level of the underground water and others have a substantial influence on the development of the individual crops.

Herbicides contribute to the reduction of the type diversity and the density of weeds in the crops, thus providing conditions for obtaining higher yields of better quality.

The purpose of this survey is to establish the main soil parameters in the experimental fields of the Agricultural University – Plovdiv in relation to the application of new herbicides used to fight the weeds in the corn, the wheat and the winter rape. The obtained data will be used to follow the dynamics of these indicators at the end of the experiment.

MATERIAL AND METHODS

The survey was conducted within the period 2011-2012 in the experimental field of the Department of Agriculture and Herbology at the Agricultural University – Plovdiv on alluvium.

The research is part of a field experiment in which we examine the complex activity of soil (Guide with a list of permitted for marketing and use of plant protecting,2012) and leaf new herbicides in corn (Table 1).

Two weeks after the application of the soil herbicides in corn (Tonev,2000),(Tonev, et al, 2007) we took samples using a probe from the 0-20 cm layer with a repetition for each variant. The preparation and the analysis of the samples were conducted at the laboratory of the Department of Agrochemistry and Pedology at the Agricultural University – Plovdiv. The following soil indicators were analyzed:

- *Particle size composition of photosedimentografy on FRITISCH*
- *Organic matter by Tiurin*
- *pH (H_2O) value - potentiometric*
- *Total carbonates by Shaibler*
- *Exchange Ca^{2+}+Mg^{2+}* **-** *complexometric*
- *Mobile potassium - in 2n HCL*
- *Mobile forms of phosphorus – according to Egner - Reem*
- *Nitrate and ammonium nitrogen with 1% KCL*
- *Quantity of the water – soluble salts - conductometric*

Table 1. Variants of experiment

Preparation	Active substance	Dose
1. Untreated – undug		
2. Lumax 538 SC	s-metolachlor - 375 g/l + terbuthylazin - 125 g/l + mezotrione – 37.5 g/l	400 cm^3/da
3. Gardoprim plus gold 500 SC	s-metolahlor - 312.5 g/l + terbuthilazin - 18.,5 g/l	450 cm^3/da
4. Wing P	pendimethalin - 250 g/l + dimethenamid-p – 212.5 g/l	400 cm^3/da
5. Merlin flexx 480 SC	isoxaflutole - 240 g/l + cyprosulfamide safener - 240 g/l	42 cm^3/da

RESULTS AND DISCUSSION

The examined region is located to the east of the city of Plovdiv, bordering on the outskirts of the city to the west, on the river Maritsa to the north, to the east is reaches the sixth kilometer of the city and to the south it borders on the Plovdiv-Asenovgrad road.

The eastern section of the examined region used to be marshy almost throughout the year. When it rained, most of the surface waste water gathered here and the swamps were also supplied with underground water coming from the higher southern parts of the region – from the Rhodopes. Later, due to the construction of drainage canals, the terrain was considerably drained and the land started being farmed.

In accordance with more detailed surveys conducted so far, the following types and subtypes of soil were established in the region: marsh soil, meadow-marsh soil, alluvium, meadow-maroon soil and saline soil .

The soil in the experimental field of the Agricultural University-Plovdiv has been determined as alluvium, which based on the international classification of FAO belongs to the category of *Mollic Fluvisols*.

In terms of geographical distribution, they belong to the Thracian-Strandzha area and the first subregion of the same area. They cover the valley of the river Maritsa from Pazardzhik to Dimitrovgrad, the valley of the river Tundzha between Sliven and Yambol.

The soil in this region has been developed on sandy-clay and sandy-gravel quaternary deposits. They fall within the scope of the second soak high terrace of the river Maritsa and have been formed by the same quaternary deposits – sandy and gravel quaternary alluvial deposits, in places scattered with clay sands and clay with a power of 0,5 to 10-12 m as in the first soak terrace of the river Maritsa. The power of the alluvium is more than 54 m. The width of this plain ranges from 300 m to 4-5 km. It is of great agricultural importance – there are fields, vegetable and orchard gardens and others on it. The level of the underground water is usually 1-3 m.

It has been laid on alluvial deposits and has a well-formed humus-accumulative horizon, which gradually goes into C horizon and deep (under 100 cm) in the soil-forming materials we can observe gley - profile A-C-G.

These types of soil (Gjufov G, Artinova N,2001)can evolve depending on the changes in the hydrological regimen of the territory and when the level of the underground water approaches the surface, they turn into meadow-marsh soil and when the level of the underground water drops (formation of a non-flood plain) they gradually turn into the types of soil typical of the region.

Under these conditions of soil-formation, (Treatise, Zemizdat, Sofia,1960) soil profile of the type A-C-Go-Gr is formed. The humus horizon most often has a power of 20-40 cm but it can be more powerful as well. Depending on the humus content, its colour varies from dark grey to black. Most of the rivers in our country are not big and the central flood plain is not well expressed, due to which the colour of the humus horizon is mainly greyish-brown. This type of horizon usually has a well expressed close texture. It gradually turns into soil-forming materials – horizon C, which is a fine-layer alluvial ungley deposit reaching 100 cm. Between 100 and 150 cm there is the Go horizon (with predominant oxidizing processes), where the level of the underground water fluctuates and for that reason in it we can observe rusty spots from ferrous hydroxide and black spots from manganese oxides and often there are ferrous-manganese concretions. In most cases under 150 cm we can find the real Gley horizon (Gr), where the level of the underground water does not fluctuate, the reduction processes predominate and whose bluish-grey colour is typical of the Gley horizons.

Based on the data in Table 1, we can see that the mechanical composition of the examined types of soil is moderately sandy-clay. In terms of depth, these types of soil are layered and their layers have a finer structure.

The humus content is not high – it ranges from 1.01% to 1.32%. The humus is of a humate type and the humic acids have completely bound with calcium.

Most of the alluvium is carbonate (Yanchev I, Popova R,2000) with a weak alkaline reaction (pH 7.3-7.7) and for the non-carbonate soil it is neutral to slightly acid. The cation absorption capacity is usually about 20-30 cmol/kg of soil. The saturation rate of the exchange bases (Ca^{2+}+Mg^{2+} cmol/kg) is high – from 10.3 to 12.3 cmol/kg (Table 2).

It is possible for the carbonate types of soil the flooding of the rivers to wash the carbonates or, if the underground water is rich in calcium bicarbonate, it rises along the profile (most often in the transitional AC horizon). The carbonates may be found in the lower section and even when there are no carbonate materials. The content of carbonates in the examined areas ranges from 1.2 to 1.65%. The salt content is insignificant. With a norm of under 0.2%, in the examined area it ranges from 0.06 to 0.07%, which determines the soil as non-saline.

The analysis of the reserve of basic nutrients in the soil (Table 3) characterizes the soil as not sufficiently supplied with assimilable nitrogen, moderately supplied with phosphorus and potassium, which is regarded as a trend in most of the farmed areas in our country.

Herbicide movement in soil depends on soil structure, soil hydrology and climatic condition. There are many authors working in this area (Leibman M, Davis A S,2000) , (Carter A D, 2000), (Oliveira R S, Koskinen W C , Ferreira F A, 2001),(Valcheva Ek, 2010), (Valcheva Ek, Sevov A, Popova R, 2011) and other. Soil water and herbicide can move to deeper layers, and the pathways it may then follow depend on the characteristics of the topography of the land. Land drainage design has the objective of removing excess water from soil or the land surface. Describing the interaction of the processes and patways concerning herbicide movement in soil is complex and the results are different. In our case we did not establish any significant changes in this type of soil in the study region.

Table 2. Physico – chemical characteristics of *Mollic Fluvisols* in depth 0-20 cm

Variants	pH (H_2O)	eversce ncy of HCL about $CaCO_3$	Salts , %	Ca^{2+}+ Mg^{2+} cmol/kg	CaCO_3%	Organi c matter, %	Particle size compositio n (≤ 0,01 mm), %	Sand 1-0,25 mm %
1 . No treat – No digging	7.6	no	0.07	12	1.2	1.03	36	4.5
2. Lumax 538 SC	7.8	low	0.07	11.4	1.38	1.21	33	4.1
3. Gardoprim plus gold 500 SC	7.6	no	0.06	10.3	1.65	1.01	34	5.9
4. Wing P	7.6	no	0.07	10.2	1.47	1.32	32	5.5
5. Merlin flexx 480 SC	7.9	low	0.06	12.3	1.39	1.03	35	6

Table 3. Agro-chemical properties by variants

Variants	NO_3^{2-} mg/kg	NH_4^+ mg/kg	NO_3^{2-} NH_4^+ mg/kg	P_2O_5 mg/100g	K_2O mg/100g
1 . No treat – No digging	15.67	3.84	19.51	14.21	11.88
2. Lumax 538 SC	15.82	3.56	19.38	15.58	11.19
3. Gardoprim plus gold 500 SC	15.02	4.00	19.02	15.77	10.73
4. Wing P	16.42	4.24	20.66	16.48	11.31
5. Merlin flexx 480 SC	16.08	4.17	20.25	15.34	11.49

CONCLUSION

Considering the conducted soil surveys in the experimental field of the Department of Agriculture and Herbology, we can make the following conclusions:

1. The soil in the examined region is classified as alluvium. Based on the international classification of FAO, it is defined *as Mollic Fluvisols*.
2. It is characterized by average sandy-clay mechanical composition, not high humus content of 1.01-1.32%,, a weak alkaline reaction of the soil (pH от 7.6 до 7.9), carbonate content of up to 1.65% and lack of salts (0.06-0.07%).
3. The nitrogen content in the soil is low, the content of phosphorus varies from low to average (14.21-16.48) and the content of potassium is high (10.73-11.88). This reserve of the basic nutrients can be explained with the long processing of the soil, which reduces the humus content, the content of nutrients and powedering the structure in the farmed horizons. The sufficient reserve of potassium in the soil is due to the content of potassium soil-forming materials (illite), which is typical of most of the soil types in our country.
4. When applying the soil herbicides, we did not detect any significant changes in the soil indicators compared to the unprocessed control sample.

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