EVALUATION OF PEDOLOGICAL CONDITIONS AND THE ESTABLISHMENT OF AMELIORATIVE MEASURES ON THE PERIMETER OF AN AGRICULTURAL HOLDING IN TIMIS COUNTY

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Abstract. *From the perimeter of the agricultural holding, soil samples were collected under study in order to establish the state of soil fertility. The limiting factors of the soil fertility were identified. The production capacity of soils is influenced by a series of limiting factors, among which the most representative are: soil reaction, humus reserve, and the low content of nutritive elements. Depending on the restrictive elements presented, calcium amendment measures, ameliorative fertilizing, works to correct the aero hydric regime of the soil, and the professional application of agricultural technologies are required for intensive exploitation of agricultural land in ecological parameters. On the evaluated soils there can be observed an acidic and very acidic reaction which has started to block phosphorus. For now, the potassium levels are very good but the acidification process will continue, because calcium is being utilized as food, and is being consumed from the superficial layer, which causes the soil to continuously acidify. Acidification also occurs from most acidifying fertilizers. Acidic soils are soils lacking in basic cations and the colloidal complex transfer - the soil solution that is unfavorable for plant nutrition. As a result, it is recommended that the basic fertilization, when preparing the land, be carried out with manure, a complex fertilizer that improves activity in soil microbial life and nutritive elements in the soil*

Keywords*: ecological agriculture, fertilization, culture technologies*

INTRODUCTION

The present study, with elements of pedological characterization for the rational and efficient use of fertilizers and amendments as a basic work for the improvement of agricultural lands under agricultural exploitation, for the lands located in the town of Unip, Timiș county, aims to obtain information on the pedological condition and agrochemistry of the soils in the researched perimeter (COSTE I., ŢĂRĂU D., ROGOBETE GH., 1997; JORZA M., GAICA I., DANCEA L., 2017; IANOȘ GH., PUȘCA I., GOIAN M., 1997).

The content of mobile nutrients (accessible or assimilable) represents an indispensable vegetation factor for plants. In order to complete the lack of nutrients, natural and chemical, bio-prepared fertilizers, green fertilizers, sowing with bouncy soil, etc. are used (MIHUȚ CASIANA ET AL., 2023; SALA F., 2002). The need to supply the soil with nutrients is established based on the agrochemical analysis of the soil and the determination of the elements that are lacking (BORZA I., 1997; LIXANDRU GH. S.A., 1990; VINTILA IRINA S.A.,1984).

Nitrogen is the main element of nutrition involved in the processes of plant growth and development. It cannot be substituted with any other element. It has a plasticity role, of building the molecules of living matter, along with C, H, O, S, P, etc (BORLAN Z., S.A., 1994, 1997; DAVIDESCU D. S.A., 1981; TOMOȘ L., 2010).

Soil reaction is one of the most important properties of soil as a medium for plant growth. Agricultural practice has shown that the most valuable information regarding the need for amendments is obtained through the chemical analysis of the soil: pH, hydrolytic acidity (Ah), content of exchangeable hydrogen (SH) and in exchangeable bases (SB), the degree of saturation in bases (V), texture as well as the content of Al^{3+} and Mn^{2+} exchangeable form (GOIAN M., 2000 ; (MIHUȚ CASIANA ET AL., 2022).

MATERIAL AND METHODS

This study was carried out in stages, with the support of society in terms of providing information on the ways of carrying out agricultural activities, the materials used until now.

After taking the samples, the following laboratory analyzes were performed: soil reaction (pH) by the potentiometric method in aqueous solution, mobile phosphorus (P ppm), mobile potassium (K ppm) and humus by the modified Walkley Black acidimetric method with the Gogoasa modification (DUMITRU M S.A., 2003 ; FAO, 2020).

The interpretation of the laboratory analysis results were the preparation of the agrochemical plan, the agrochemical file, the agrochemical characterization of the soils and the recommendations regarding the application of fertilizers and amendments (TET DIANA, ET AL., 2022).

RESULTS AND DISCUSSIONS

The farm under study is located on the perimeter of Unip, Timis county. Soil samples were collected at the depth of 0-20 cm, to establish the initial state of soil fertility. The results are presented in the following table 1.

Table 1

Soil analysis results at sowing

Location	pH (H_2O)	Nt (%)	P mobil (ppm)	K mobil (ppm)
Sola 1	5,00	0,23	1,32	191
Sola 2	7.82	0,36	105,0	2731
Sola 3	4,96	0,17	0,69	180
Sola 4	4,81	0,17	41,34	325
Sola 5	4,90	0,15	37,6	247

Maize requires soils with high fertility, having a high consumption of nutrients. Depending on the expected production, maize will consume, per hectare, 120-160 kg of nitrogen, 40-60 kg of phosphorus, 130-170 kg of potassium, 30-45 kg of calcium, 25-35 kg of magnesium and significant amounts of essential micronutrients.

The sunflower has a strong root system and high nutrient requirements. This plant grows in most soils, preferring light, well-drained soils with a pH of 6.5 to 7.5.

From table 1, it can be seen that the soils on which corn and sunflower were grown have acid values, between 4.81 and 5, except for sample 2, which has a slightly alkaline soil reaction.

Growing maize on acid soils will reduce maize (*Zea mays L.*) production, causing yield losses of up to 69%. Acidic soils, with low pH, can cause aluminum (Al), manganese (Mn) or iron (Fe) toxicities. Genetic variability for tolerance to low soil pH exists among maize genotypes, which can be exploited in the development of high-yielding, acid-tolerant maize genotypes.

Plant height, vigor and survival are adversely affected by soil acidity. Sunflower production can be reduced by 10% at soil pH values between 4.7 to 5.3 depending on location and soil type.

The total nitrogen content varies between 0.15 and 0.36%, being lower on acid soils (table 1). With the exception of samples 1 and 2, the value of the nitrogen content of the studied soils is very low, both for the maize and sunflower crops.

Inadequate supply of nitrogen to young maize plants will cause yellowing of the leaves, along the main vein to the base of the leaves, and the production of green mass and grains will be reduced. In the case of sunflower, application of amounts of nitrogen of 50-75 kg/ha are generally sufficient, deficiency symptoms appearing as reduced growth and general chlorosis.

The phosphorus content of the soils cultivated with maize and sunflower varies between very low – sample 3 with 0.69 ppm and very high sample 2 with 105 ppm mobile P.

Due to phosphorus, maize produces a high yield of cobs with well-filled and valuable grains. Phosphorus deficiency is manifested by stiffness and reddening of the lower leaves that curl downwards. Young leaves will take phosphorus from mature leaves, causing them to turn red and die. A single application of phosphorus fertilizer in a maize crop rotation does not provide a sufficient amount of this essential element.

Sunflower crop response to applied P occurs on soils with low or medium levels of extractable P. Placement of P fertilizers in the root zone is important because phosphorus is not mobile in the soil. Band application of phosphate fertilizers at planting is the most efficient method of P fertilization, and the suggested rates for broadcast application are approximately double those for band application.

The potassium content of the studied soils is in the range of good and very good supply in this element, the highest value being determined in the case of sample 2, namely 2731 ppm mobile K.

Maize needs large amounts of potassium. The deficiency in this main macroelement causes brown necrotic spots to appear between the veins of the leaves, while the main vein remains green for a long time. The plants produce fewer cobs that are short with poorly developed grain at the top. Potassium deficiency leads to a significant reduction in yield, while a good amount of this element increases corn's resistance to drought and guarantees a good yield of green mass and grain, as well as ensuring a good biological value of the resulting fodder.

Potassium (K) nutrition plays a particularly important role for sunflower crops. The crop is very sensitive to soil K deficiency, and lack of K results in both low seed yields and low oil concentrations. Sunflower plants have greater resistance to drought and salinity stresses when they are well supplied with K. Reduced water stress usually allows greater allocation of dry matter during the seed filling process leading to higher yields.

The second series of soil analyzes were carried out during the phenophase of vegetative growth of maize and sunflower plants, when reduced nutrition and an imbalance between nutrients can cause deficiencies in the process of plant growth and development.

In the case of the vegetative growth phenophase, following the application of urea and the 16:16:16 complex fertilizer, an increase in pH values is observed, but it remains in the acid range, except for samples 1 and 2, which are in the range slightly alkaline (table 2).

Table 2

Soil analysis results in the phenophase of vegetative growth

Location	pH (H_2O)	Nt (%)	P mobil (ppm)	K mobil (ppm)
Sola 1	7,56	0,37	22,57	180
Sola 2	7,64	0,34	182,96	2135
Sola 3	5,56	0,15	23,82	112
Sola 4	5,47	0,23	109,78	655
Sola 5	5,09	0,19	40,85	177

The total nitrogen content is between 0.15 and 0.37%, being lower on soils with acid pH. The values of the content of mobile phosphorus in the soil vary between 23.82 for sample 3 and 182.96 ppm for sample 2. The amount of exchangeable potassium in the soil is between 112 ppm for sample 3 and 2135 ppm in the case of sample 2.

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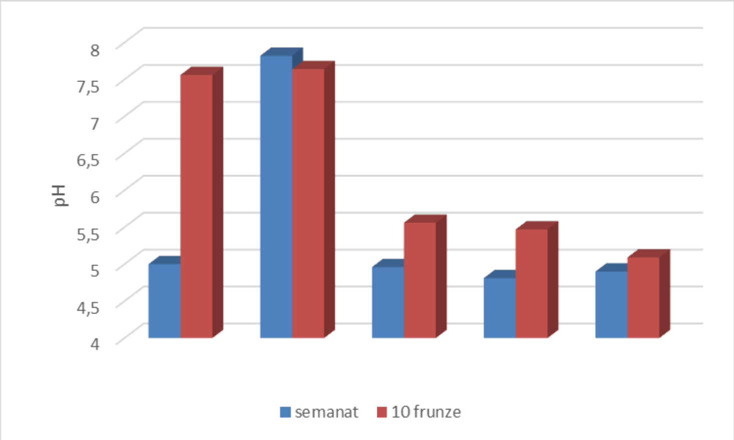

Fig.1 Soil pH values at sowing and in the 10-leaf phenophase
(*Legend: sowing; 10 leaves*)

Figure 1 shows an increase in soil pH values following the application of fertilizing resources. The most significant increase occurs in the case of sample 1, from 5.00 to 7.36, passing from the acidic to slightly alkaline range. The application of the complex fertilizer 16:16:16 cannot cause such an increase in the pH value. Hydrolysis of superficially incorporated urea can cause a temporary increase in pH to some extent by releasing ammonia.

Lower increases in the pH value are also observed in the case of samples 3, 4 and 5, but the soil reaction is still in the acid range. In the case of sample 2, there is a slight decrease in pH from 7.84 to 7.62. This soil was not fertilized with mineral fertilizers, only manure was applied.

Total soil nitrogen content increases for all samples, except sample 2-Garden, at the 10-leaf phenophase compared to sowing. Urea, a fertilizer containing 46% N s.a, was used to prepare the land. and complex fertilizer 16:16:16 containing 16% N s.a.

Regarding the content of mobile phosphorus in the studied soils, an increase in its content is observed for all 5 samples collected in phenophases of 10 leaves. The soil was fertilized at sowing with 200 kg/ha complex fertilizer containing 16% P_2O_5. Phosphorus fertilizers are hardly soluble in the soil, the release of phosphorus from them is slow. This fact can explain the increase in phosphorus content in the soil during the phenophase of vegetative growth. Also, the culture was foliarly fertilized with Lithovit fertilizer, which contains the nutrients in easily soluble and therefore easily assimilable forms for the plants. As a result, in this phenophase of growth, when the root system is not fully developed, the plants used the foliar-applied form of phosphorus, which caused an increase in the soil content of this main microelement

CONCLUSIONS

Following the analysis of the changes occurring in the soils on the perimeter of the farm, cultivated with corn and sunflower and fertilized with urea and complex mineral fertilizer 16:16:16, we can draw the following conclusions:

With the exception of sample 2 for which the pH value is in the slightly alkaline range, all other samples have acidic soil reaction values;

The values of the total nitrogen content are between 0.15 and 0.37%, which means a low to average supply of this macroelement;

The content of mobile phosphorus is between 0.69 and 182 ppm P, i.e. a very poor to very good supply of this nutrient;

Mobile potassium in the studied soils is found in amounts between 112 and 2731 ppm, which means a low to very good supply of this major element.

Taking into account everything presented, we can formulate the following recommendations regarding the protective fertilization of maize and sunflower crops:

Considering the reaction of the studied soils, it is recommended to use nitrolime as a simple nitrogen fertilizer, instead of urea. Nitrolime contains, in addition to ammonium nitrate, calcium carbonate – the main amendment used to correct the acid reaction of soils;

Acidic soils are soils poor in basic cations, and the colloidal complex transfer - the soil solution is unfavorable for plant nutrition. As a result it is recommended that the basic fertilization, when preparing the land, be carried out with manure, a complex fertilizer that improves your activity soil microbial life and nutrient supply.

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