

## Agricultural soils characterization of two experimental stations located in southeastern Romania

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**Abstract:** The aim of this study is to present original results about several important chemical properties of soil located in the South – East region of Romania: Valul lui Traian (Constanta County) and Fundulea (Calarasi County) enhanced with two types of fertilizer, in august 2010. pH, soluble salts, mobile phosphorus and potassium, carbonates, humus (organic carbon) and nitrogen concentrations have been determined using common chemical and instrumental methods. The pH values show that the soil from Valul lui Traian has a neutral to weak alkaline character, while the soil from Fundulea has a weak acid to neutral character, almost close to weak alkaline. Both studied soils have very low traces of total soluble salts, 12 - 238 ppm mobile phosphorus, 122 - 138 ppm potassium, low level of total calcium carbonate (0.12 - 0.94%), medium humus concentration levels (2.64 - 4.12%) and from low to medium total nitrogen concentration (0.12 - 0.16%). In conclusion, both types of fertilizers used on the soils from Valul lui Traian and Fundulea contribute to a medium to very good nutritive element content.

**Keywords:** soils, pH, salts, phosphorus, potassium, carbonate, nitrogen, organic carbon, determination.

### 1. Introduction

Soil represents the most important component of lithosphere, being involved in environmental changes, through direct interaction with the atmosphere, hydrosphere and living organisms [1]. Soil consists of mineral particles, organic matter, water, air and living organisms, thus being an extremely complex and variable medium [2]. It is a vital and non-renewable resource increasingly under pressure, needing protection from future demands. Its degradation is caused and enhanced by human activities, reducing its potential of maintaining the key functions.

In order to influence a sustainable agriculture, several factors need to be taken into consideration. The number of nutrients, the ratio between them, the content and quality of soil organic matter, along with the physical conditions and soil structure must be examined in order to assess the level of soil fertility [3].

Analysing the soil nutrients status is also the basic element of fertilizer recommendation systems

[4]. While the fertilization with phosphorus and potassium has an insignificant influence on soil pH, the quantity of N-fertilizers applied has affected the level of organic matter. In addition to this, humus content has registered a significant linear increase on areas where an amount of organic manure has been applied at intervals of 4 years, during the same time period [5].

The aim of this study is to present original results about several important chemical proprieties of soil from southeastern Romania, by investigating samples enhanced with two types of fertilizer collected from two regions.

### 2. Experimental

For the proper evaluation of soil chemical proprieties, experiments have been conducted on samples from 2 experimental stations: Valul lui Traian, Constanta county and Fundulea, Calarasi county. Each of these soils was enhanced with 2 types of synthetic fertilizers: NP (30 – 200 kg/ha nitrogen and 40 – 160 kg/ha phosphorus) and NPK

(80 – 160 kg/ha nitrogen, 80 kg/ha phosphorus and 40 - 120 kg/ha potassium).

The samples were collected in August 2010 from depths of 0-20 cm and 20–40 cm for Valul lui Traian and 0-20 cm for Fundulea. Most of the samples are from soils planted with wheat. There are also some soil samples from Valul lui Traian used for corn crops cultivation.

Investigated samples from Valul lui Traian were 16 for each depth from the NP fertilized soil and 9 for each depth for the NPK fertilized soil. For Fundulea, 48 samples were collected from the NPK fertilized soil, and 25 samples of NP fertilized soil.

pH, soluble salts, mobile phosphorus and potassium, carbonates, humus (organic carbon) and nitrogen concentrations have been analysed [6], [7].

pH was determined using the potentiometric method with the pH Cond 707 apparatus.

When determining soluble salts, the level of inorganic soil components dissolved in water is evaluated. This is important because as this level gets higher, it can inhibit the plants growth [8]. This particular parameter was determined using also the pH Cond 707 apparatus, measuring the electrical conductivity of the soil.

In order to assess the mobile phosphorus concentration, a small amount from each soil sample, was extracted with ammonium acetate lactate. The phosphate was determined in the obtained solution as „molybdenum blue” using spectrometric measurements, performed with Cintra 404 UV-Vis apparatus [9, 10].

The concentration of mobile potassium was determined using a Sherwood Model 410 Flame photometer.

Apart from the parameters described above, several others were examined. Total calcium carbonate concentration was measured using gas volumetric method (Schleibler), and humus concentration by titrimetric method Walklei and Black. Total nitrogen was determined through calculus from the humus concentration.

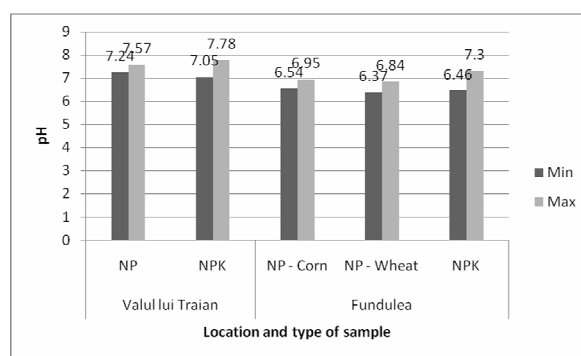
### 3. Results and Discussions

The reported results represent the average values of each parameter measured on investigated soil samples. There will be presented the minimum and

maximum value of the mean parameters obtained during the experiments.

#### 3.1. pH

The pH values show that the soil from Valul lui Traian has a neutral to weak alkaline character, while the soil from Fundulea has a weak acid to neutral character, almost close to weak alkaline, given the maximum value obtained for soil enhanced with NPK fertilizer (**Fig. 1**).



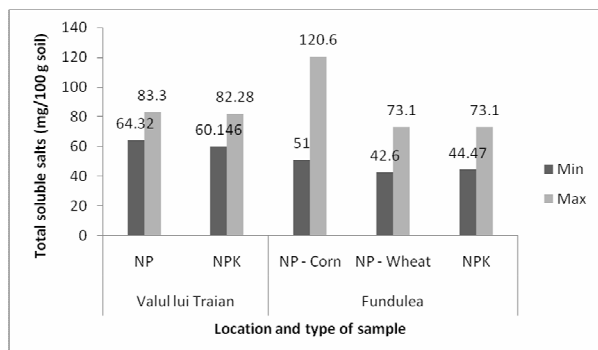
**Fig. 1.** The pH values for the investigated soils (mean values, August 2010).

#### 3.2. Soluble salts

Given the maximum and the minimum values obtained after the conductometric measurements, both soils from Valul lui Traian and Fundulea have very low traces of total soluble salts. However, taking into consideration the maximum value obtained for the soil fertilized with NP, on which corn was previously grown, this particular area is weakly salinized (**Fig. 2**).

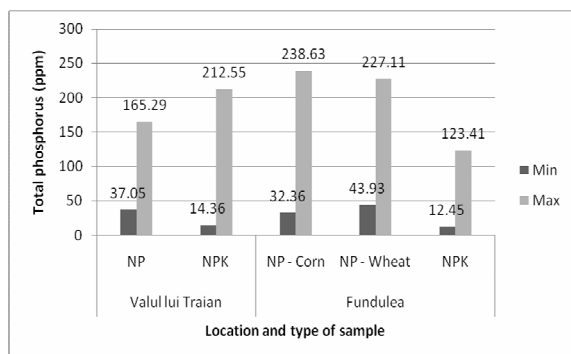
#### 3.3. Mobile phosphorus

Phosphorus is important because it enhances the resistance of plants during drought, balancing the excess of nitrogen. Soils lacking this element will barely support the development of plants [11]. Regarding mobile phosphorus, the results are similar for both types of soils. The minimum value obtained indicates a weak provision of mobile phosphorus. On the other hand, the maximum value points out that these soils have areas where mobile phosphorus can be found in appropriate concentrations.



**Fig. 2.** The total soluble salts values in the investigated soils (mean values, August 2010).

Greater values have been obtained for NPK fertilized soils from Valul lui Traian, and for NP fertilized soils from Fundulea (**Fig. 3**).

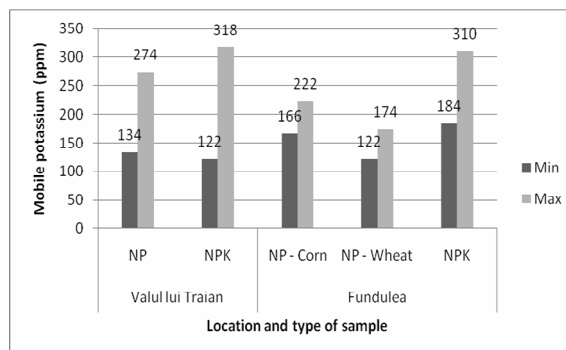


**Fig. 3.** The mobile phosphorus concentration in the investigated soils (mean values, August 2010).

### 3.4. Mobile potassium

Potassium is the most important cation for living organisms, fulfilling numerous physiological and biochemical functions. It also influences many enzymatic reactions that contribute to the organic synthesis in plants.

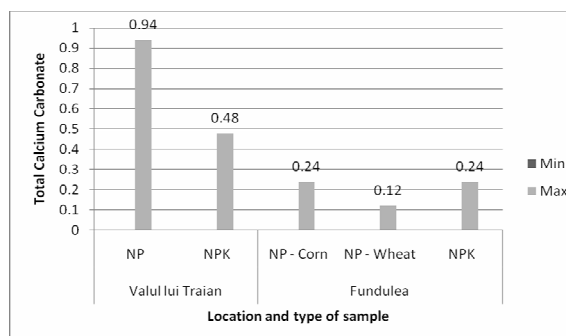
The mobile potassium concentration in both types of soils varies from medium to very good, except for the soil fertilized with NP, used for wheat cultivation, which varies from medium to good (**Fig.4**). The highest values were registered for soils from both Valul lui Traian and Fundulea, which were enhanced with NPK fertilizer. A maximum close to these values has been observed for the NP fertilized soil from Valul lui Traian.



**Fig. 4.** The mobile potassium concentration in the investigated soils (mean values, August 2010).

### 3.5. Total calcium carbonate

Taking into account that all the total calcium carbonate values registered are below 1%, both analyzed soils have a low level of total calcium carbonate (**Fig. 5**). The highest values have been registered for the soil treated with NP fertilizer, and collected from Valul lui Traian.

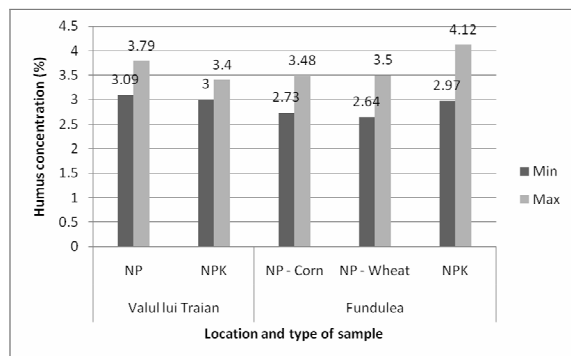


**Fig. 5.** Total calcium carbonate concentration values (% weight) in the investigated soils (mean values, August 2010).

### 3.6. Humus

Humic matter is part of the soil organic matter, along with living matter and matter in decomposition [12]. The enrichment of soil organic matter is important because it improves soil aeration, physical structure, drainage, water-holding capacity, nutrient availability and microbial activity [13].

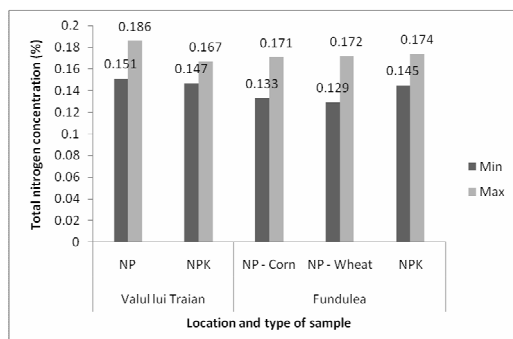
Both type of soils presented medium humus concentration levels, the maximum level being registered for the NPK fertilized soil from Fundulea (**Fig. 6**).



**Fig. 6.** Comparative data regarding humus concentration values for the investigated soils.

### 3.7. Total nitrogen

The NP fertilized soil from Fundulea has a total nitrogen concentration varying from low to medium, while the soil from Valul lui Traian and the NPK fertilized soil from Fundulea have a medium concentration (**Fig. 7**).



**Fig. 7.** Comparative data regarding total nitrogen values for the investigated soils.

## 4. Conclusions

Researches conducted to assess the quality parameters of soils from the south East Romania enhanced with two types of fertilizers show that all the nutritive element content ranged from medium to very good (comparison made with the data found in literature).

In conclusion both types of fertilizers represent a good option to provide the nutritive elements in

studied soils in order to assure positive crop evolution.

## 5. References

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