**THE UNIVERSITY OF CRAIOVA**
**THE FACULTY OF AGRICULTURE**

# PHD THESIS
# SUMMARY

## "RESEARCH ON THE PROPERTIES CHERNOZEM OF BAILESTI PLAIN AND ITS SUITABILITY FOR SOME OIL PLANTS"

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## IMPORTANCE

In a modern and efficient agriculture, soil is the main production means that, if used rationally, ensures qualitative and economically profitable agricultural products. To achieve these goals we must consider the scientific exploitation of land for keeping and raising its productive potential through the practice of modern agricultural activities based on the latest achievements of agricultural science and technology.

Soil as organic environment of life and productivity of plants, plays a decisive role in obtaining the necessary food and raw materials for food.

Of plants grown in our country, oilseeds occupy large areas, especially in areas with suitable climate, including sunflower, rapeseed, soybean, etc.

From the beginning, sunflower has been acclaimed as a useful plant, which the primitive world, impressed by the splendor of its inflorescences, used it mainly to beautify their faces, huts, objects of worship and ceremonial garments. The admiration for this species was amplified as they unlock new virtues: medicine to cure diseases and treat snake bites, food, and shortly after - source of cooking oil, sunflower oil is now so widely recognized as an important source for satisfying human food with vegetable fat and the need for protein for animal feed.

Therefore I considered useful that through this thesis to make some modern practical and theoretical contributions to the study of chernozem soils of Bailesti Plain and their fitness to different cultures and especially for some oilseeds.

## RESEARCH PURPOSE, OBJECTIVES PROPOSED AND METHODS OF EXPERIMENTATION USED

### RESEARCH PURPOSE

Knowledge of the natural conditions of formation of soil and its properties in a given area is a requirement requested by agricultural practice, as the development of a modern and efficient agriculture can be achieved only by applying the latest achievements of science and technology.

Soil is the basis of activity in agriculture as in terms of its characteristics and requirements are dependent all other measures that ensure the growth and fruiting of plants.

Thus, depending on soil it is recommended a specific technique of mechanization, different land preparation works apply, and are established the measures of fertilization, and the zoning and are made crop improvement works.

Research conducted in Bailesti Plain considered the knowledge of soil properties, of how they change under the influence of the anthropogenic factor and what measures should be implemented to maintain and increase the productive capacity.

## RESEARCH OBJECTIVES

The research in the field, laboratory and experimental field was aimed to achieve the following objectives:

- knowledge of the natural conditions of soil formation in Bailesti Plain to achieve this goal, a large amount of bibliographic material was studied, worked and purchased on climate, terrain, geology, lithology, hydrographs, hydrology and vegetation. Some data were acquired from three weather stations: Craiova, Calafat and Bechet.
- identifying and studying key chernozem in the researched area was done by several field trips, opening the soil profiles and their description in morphological terms.
- determining the main physical, chemical and hydro-physical properties of the soil. Was achieved by sampling of soil profiles and analyzing them in specialty laboratories.
- establishing chernozem fitness for different cultures and ways of purpose. Was achieved through the work of evaluation and characterization of soil technology.
- testing chernozem fitness of Bailesti Plain for some oil plants and for this purpose research were conducted in the experimental field. Thus, it was designed, installed and executed a bifactorial experience after the method of parcels subdivided with sunflower.

## THE BIOLOGICAL MATERIAL STUDIED AND RESEARCH METHODS

To achieve the objectives set were conducted field laboratory and experimental field research.

By the research carried out on land the major chernozem soils found in Bailesti Plain were identified and characterized. We used the methodology developed by I.C.P.A. Bucharest.

The tests performed in the laboratories of the Faculty of Agriculture and OSPA Dolj, have determined the main physicochemical properties of the soils identified in the field. These determinations were made:

- color, using color atlas Munsell Soil Color Charts;
- soil texture by granulometric analysis.
- density (D, g/cm$^3$) by pycnometer method;
- apparent density (Da, g/cm$^3$) through metal cylinders method;
- total porosity (Pt, %), by calculating the relation:

$$Pt, \% = (1-Da/D)x\ 100;$$

- maximum hygroscopicity coefficient (CH, %), after the Mitscherlich method.
- wilting coefficient (CO, %), by calculating the relation:

$$CO, \% - CH, \% \times 1,5;$$

- moisture equivalent (EU, %), by centrifugation;
- usable water capacity (CU, %), by calculating the relation:

$$CU = EU - CO;$$

- total nitrogen (Nt, %), by the Kjeldahl method.
- mobile phosphorus (P, ppm), by the Egner - Riehm – Domingo method;
- mobile potassium (K, ppm), by the Egner - Riehm – Domingo method;
- humus (%), by the Walklei Black (Doughnut modification);
- pH value, by the potentiometric method in aqueous solution 1/2.5.
- base saturation level (V, %), by calculating the relation:

$$V= S_B/T \times 100$$

In the experimental field was located after the method of subdivided parcels, a bifactorial experience with sunflower, with the following factors:

***Factor A*** (soil system works), with three graduations:

$a_1$ - driven each year (not plowed), from 10 to 12 cm deep;

$a_2$ – normal plow, from 18 - 20 cm deep, each year;

$a_3$ – deep plow, from 21 - 25 cm deep, each year.

***Factor B*** (care work), with three graduations:

$b_1$ - a mechanical breeding, with the grower:

$b_2$ - a mechanical and manual breeding on the plant row;

$b_3$ - a second mechanical cultivation and post-emergent herbicides.

Rehearsal number was three. Sown area was 8 m x 4.2 m = 33.6 $m^2$, and harvested area of 22.4 $m^2$ (66.67 %). The width of alleys was 1.5 m.

## RESULTS OBTAINED

Through the research carried out on land were identified and described these units of chernozem: typical chernozem, vermin chernozem; psamic chernozem; gleyic chernozem, saline chernozem; cambic chernozem.

**Typical chernozem,** occupies the largest place in the studied area, being found on flat land with groundwater less than 5 m deep. Were formed on loess and loess materials under a well developed herbaceous vegetation. It has a profile of the type Ap-Am-AC-Cca, with a heavy texture, are well structured, have good relationships with water and air and can be easily worked with. They are middle and well supplied with humus, have good reserves of nutrients, and therefore have a high productive potential.

**Vermin chernozems,** are met in the southern part of the studied area, on flat land with groundwater at 3-5 m depth. Closely resembles typical chernozems which differ by a very intense biological activity, and in this case shows frequent biological neoformation in the first horizons.

Are predominantly coprogen soil structures, are more loose and rich in humus and nutrients, being among the most fertile soils of the area studied. As in the previous they require completion of moisture deficit by applying irrigation.

**Psamic (sandy) chernozems,** are met in the south-west of Bailesti Plain, forming on sandy loess materials. Due to higher percentage of sandy material, these soils are poorly

structured, have higher permeability and are worked easier. The percentage of humus is lower and lower nutrient reserve, thus falls into the group of chernozems with low fertility

**Gleyic chernozems,** occur in micro-hilly areas with shallow groundwater (less than 2-3 m) and in this case presents issues of reducing the base or in the second half of the soil profile. Unlike previously presented soils, gleyic chernozems show restrictions on irrigation works.

**Saline chernozems,** were identified on small areas in the southern part of the area studied, forming on low land, with less than 1-2 m deep groundwater. From this depth, water rises by capillary rise, until the soil surface, which is lost by evaporation and soluble salts are deposited in the form of efflorescence, producing secondary process prone to become salted. These soluble salts in the profile make these soils contain more fine fractions, have an alkaline and strongly alkaline reaction and nutrient reserves to be lower. Have lower production capacity and require specific improvement works.

**Cambic chernozems,** are found over wide areas in the northern part of Bailesti Plain, being widespread on the higher terraces, where alteration and leaching processes were more intense. Greater intensity of soil formation processes led to the formation of larger amounts of clay that has accumulated in a specific horizon Bv (B cambic). These soils have a profile of type Am-Bv-C, which is more profound. These chernozems have a higher content of fine particle size fractions, for which they are more tamped and structural aggregates are more compact and show obvious edges and corners.

In determining the chernozem fitness from Bailesti Plain for different cultures and ways of usage, the work of evaluation was executed and their technological characterization. By interpreting the data obtained revealed that chernozems have high productive potential, because of evaluation grades and favorability classes tend to high limit.

Chernozem fertility is different from one group to another depending on their morphological and physicochemical properties. Thus, the soil with the highest fertility is the vermin chernozem which achieved scores of evaluation of over 80 in most cultures and favorability classes I, II and III.

Lower favorability was obtained from clover, flax bundle and some tree species, plants that prefer wetter and cooler areas. Also, high productive potential we find in the typical chernozem and cambic chernozem. The lowest fertility is in saline chernozem and psamic chernozem, which are characterized by less good morphological and physicochemical properties.

In summary, it can be argued that the chernozems in Bailesti Plain have a high natural productive capacity for getting large and profitable production being necessary to apply an appropriate agro-technique and, especially, to be complete the moisture deficit by irrigation.

For testing chernozem fitness a bifactorial experience was performed for some oilseeds with sunflower with different systems of soil works and maintenance works.

Relative to the soil system works revealed the following conclusions:

- Sunflower is a plant species with deep root system, so responds positively to deep plowing (21-25 cm), the largest production being 2658 kg / ha, averaged over the three experience years;
- If the soil is dry, in dry summers and autumns, and cannot run a deep plowing, we will also use a normal plowing (18-20 cm), in which case the average production cycle on trial was 2367 kg / ha, with a percentage of less 10.95% or with less production of 297 kg / ha significantly compared with deep plowing;
- For minimum system works, the paper version with disc harrow in two perpendicular passes to each other, in preparing the germinative bed, average sunflower production was the smallest, of 1596 kg / ha. In comparison to deep plowing is a less percentage of 39.95% or less production of 1062 kg / ha, very significant.

About care work options on sunflower crop following conclusions were found:

- the weed problem in this area is *balaurul* or *costreiul* - *Sorghum halepense* (L.) Pers., a perennial monocotyledonous species, geophytes, which multiply both sexually by seeds and asexually through rhizomes, which appear after the fourth leaf, reaching up to 20-25 (50) cm deep. A plant produces 1200-6000 caryopses wrapped in piers and glumes. Rhizomes are resistant to most herbicides.

- effective against the dominant species of chernozems we recommend using a nonselective herbicide (with total share) glyphosat based applied to wheat stubble, at about 2-3 weeks after harvesting cereal straw, while the *balaur* shoots are 20-25 cm high. After applying herbicides the soil will not work for 3-4 weeks to give the possibility to the active substance of the herbicide to be translocated to the rhizome to destroy it. To control the *balaur*, especially from seeds, are also recommended imazetapir, nicosulfuron, glufosinate, setodixin, Clethodim, primsulfuron-methyl, rimsulfuron-methyl etc. based herbicides;

- the best results were obtained in the combinatorial variant with twice mechanical plowing at intervals depending on the dynamics degree of weeding, and herbicides, preem., with

Acetoclor Super – 2 l / ha and in post-emergence with Pantera 40 EC at a dose of 1.75 liters / ha, a graminicid herbicide. In this case the average sunflower production was greatest, of 2.674 kg/ha;

- In the twice plowing variant (once mechanically on the interval of rows and once manually in the plant rows), the average production was intermediary, of 2.188 kg/ha;

- The lowest results (1759 kg / ha) were recorded in the version that was once plowed mechanically, with the grower because of the high degree of weeding.

Of the nine combinations tested, the highest production of sunflower - of 3186 kg / ha was obtained in combination $a_3b_3$ (mechanical deep plowed twice and herbicides preem. Acetoclor Super – 2 l / ha and post-emergent with Pantera 40 EC, 1.75 l / ha. The lowest production of 1226 kg / ha was recorded in combination $a_1b_1$, driven twice when preparing the germinative bed, not plowed, and mechanical cultivated only once.

Between the two production extremes there is an amplitude of 1.960 kg/ha.

## RECOMMENDATIONS

In Romania, agriculture is a fundamental branch of the national economy because the natural conditions provide a favorable environment for plant growth and crops. To achieve a modern agriculture, great attention should be given to the soil as their principal means of production in agriculture which, if used properly, can maintain a high productive potential. For rational farming in the chernozems of Bailesti Plain the following recommendations are made for production.

- Timely performance of agricultural works and good quality for keeping moisture in the soil and weed, diseases and pests control. Because they naturally have high productive potential, chernozems can give productions insurances only and only through proper agro-technique;

- Because the percentage of humus in agricultural soils decreases continuously to prevent this process and organic fertilization is recommended on the chernozems. All the organic waste resources can be used from agricultural activity or other origins;

- Chernozems respond well to mineral fertilization that must be rationally applied depending on soil nutrient reserves, but also depending on the requirements of each plant;

- Being rich in limestone, fertilization with superphosphate fertilizers must be made in smaller doses and repeated often to avoid blocking phosphorus in the form of tricalcium phosphates, which are hardly soluble;

- Chernozems have a high natural reserves of potassium, so the application of potassium salt fertilizers is only recommend to high consumer plants;

- In the chernozem zone is felt a great lack of water during the growing season of plants, thus irrigation application is an urgent first need. We cannot conceive an efficient and safe agriculture in the steppe and forest steppe areas without irrigation;

- The application of irrigation restrictions are found only in gleyic and saline chernozems, but they are also found in small zones in the area studied;

- For an efficient agricultural activity is recommended the reorganization of the land system in micro-farms, farms and agricultural associations. We cannot speak of modern mechanization, of correct chemicalization, zoning or rotation of crops than in a well organized and systematized agriculture.

In the culture technology of sunflower these measures important are recommended:

- As good prior plants stand out straw cereals, mainly autumn wheat and autumn barley;

- 2-3 weeks after harvesting straws we will apply on the stubble, with M.E.T. - 2500, M.E.T. -1.200 etc., a nonselective herbicide, such as Glyphosat 360, 2-4 l / ha, Roundup 2000 EC, 2-3 l / ha, Touchdown4-6 1/ha, etc. Soil will not be worked in any way for 3-4 weeks as the herbicide to be translocated to the rhizomes;

- Then we will run a deep plowing (21-25 cm) or a normal plowing (18-20 cm), with the moldboard plow in aggregate with harrow starry for shredding and leveling the ground in order to diminish water evaporation. Age and depth of the plowing execution will be determined depending on soil moisture which depends on rainfall levels. In the spring will be prepared the germinating bed by combinatorial or harrow starry in aggregate with adjustable harrows, 2-3 days before sowing before the last pass with the aggregate of germinative bed preparation will be applied the preemergent herbicide Acetoclor Super – 2 l/ha;

- For chemical fertilization, depending on the recommendations of agrochemical mapping;

As maintenance works will be applied two mechanical plowings with the grower on the interval between rows of plants, and for annual and perennial monocotyledonous weed control we will apply the post-emergent graminicid herbicide Pantera 40 EC at a dose of 1.75 1/ha;