THE BEHAVIOUR OF SUNFLOWER CROP UNDER DIFFERENT TREATMENTS FROM THE LACU SARAT TRIAL PLOT, BRĂILA

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Sunflower is the most important oil plant, being the third plant in oilseeds grass family, and being used in food and food industry. Being a heat and light loving plant , it is cultivated in the corn areal and it is forbidden to follow plants consuming much water and nutrients. In the natural background conditions on the trial plot, and taking into account the improvement scheme, the sunflower was sowing in all the years of experimentation (1998-1999, 1999-2000, 2002-2003, 2003-2004), achieving high yields. Sunflower responded well under most treatments, the yields being similar to the ones obtained under irrigation and fertilization. The main purpose of the research was to pursue the influence of agrofitotechnical measures on soil and yields for the main field crops in the trial plot Lacu Sarat, Braila county, and, in this paper, the behaviour of the sunflower crop has been presented.

***Key words**: trial plot, sunflower, yield, treatment variants*

Sunflowers (*Helianthus annuus L.*) is an annual herbaceous plant that is cultivated from almost 3000 years. Sunflower originates from North America, being brought to Europe in the XVIth century. Here, the yield increased during the first and second World War, practically becoming an important cultivated crop.

Sunflower is the most important oil plant, being the third as importance among grass oilseeds (13% of world oil production). The sunflower fruits (achenes) contain approximately 50% oil with exceptional food quality and high preservability, being used for human food (refined) and food (margarine, soap, lecithin, phosphatide, etc.) [3, 7].

Sunflower is a light and heat-loving plant, cultivated in the corn area. The best suited soils for sunflower are loamy and deep soils, rich in nutrient, having low-alkaline to neutral reaction and enough surface water.

The best previous crops for sunflower are autumn cereals and peas, and for wet areas: maize, linseed oil, potato. Generally speaking, it has not to be cultivated after plants consuming much water and nutrients, such as alfalfa, Sudan herb, sugar beet etc.

The present paper aims to present the experimental researches on sunflower crop in the Lacu Sarat trial plot which is located in Eastern Romanian Plain, called Braila Plain or Northern Baragan [4, 5].

MATERIAL AND METHOD

Lacu Sarat trial plot is located in a depresionary area which accumulates ground waters from neighbouring higher areas, this phenomenon also being the cause of soil degradation processes by salinization and recurrent water excess. Surface deposits are made of loess and the texture varies from loamy-sandy to loamy-clayey. On the bottom of the valley, where the trial plot is sited, groundwater table reaches levels of less than 2 m and, in some parts, less than 1 m depth. Trial plot was located on slightly-moderately salinized chernozem [6]. The trial plot is sited in the dry steppe [1], characterized by hot and dry summers, with an average multiannual temperature of 10.9^0C, precipitations of 452 mm annually, potential evapotranspiration of 705 mm and a climatic water deficit of 345 mm (Braila Weather Facility).

The natural conditions of the trial plot were the basis for the layout for several treatments: horizontal drainage, deep loosening, ameliorative irrigation, organic fertilization, chemical fertilization, soil tillage with soil material inverting, soil tillage without soil material inverting (paraplow) and mulching (*tab. 1*).

Table 1

Improvements applied to Lacu Sarat trial plot, Braila

Treatment variants	Treatments										
	Drainage			Deep loosening	Ameliorative irrigation	Fertili-zation		Soil tillage		Mulching	Amendment
	high intense (20 m)	moderately intense (40 m)	no drainage			organic	chemical	with soil material inverting	without soil material inverting (paraplow)		
V_1	✓			✓	✓	✓	✓		✓		✓
V_2	✓			✓	✓		✓		✓		✓
V_3	✓			✓	✓		✓	✓			✓
V_4	✓				✓		✓		✓		✓
V_5	✓			✓			✓		✓		✓
V_6	✓			✓			✓		✓	✓	✓
V_7		✓		✓	✓		✓		✓		✓
V_8			✓	✓	✓		✓		✓		✓
V_{8a} (B)			✓				✓	✓			

After applying ameliorative technologies, the trial plot was cultivated with the following crops: maize, sunflower, sorghum and Sudan herb. Each of the four crops covers all the eight treatments plots.

It should be mentioned that all technological components (plant species, fertilization, sowing, weed control) were of ameliorative nature [2].

This paper describes only sunflower behaviour, therefore only the following technological cultivation characteristics are presented:

- seedbed preparation was carried out by plowing with U 650 together with PP 30-3;
- disc harrowing with U 650 and HG 3.4 twice (the second time with coupled harrows);
- local cultivars Coril, Festiv şi Favorit were used;
- sowing was done by U 650 coupled with SPC-8 seedings machine, at a soil temperature of 6-8^{0}C, at sowing depth of 4-6 cm, with a density of 50,000 to 65,000 viable kernel/ha and the distance between rows 70 cm;
- fertilization was achieved by application of 400 kg/ha ammonium sulphate, which provided 80 kg N/ha for variant V_2 - V_{8a} and 100 kg/ha ammonium sulphate providing 20 kg N/ha in V_1 area, where manure was applied (60 t/ha dry manure) for the seedbed preparation;
- weed control was achieved by application of 2.5 l Guardian/ha in order to prepare the ground with shallow incorporation using combinatorial or disk + 2 mechanical cultivation with tractor U 650 in aggregate grower worn CPU 4.2 and partial manual weeding a turn;
- in order to control diseases and pests, maize seeds were treated with Furadan 28 l/ha;
- harvesting was done by hand on the treatments, at 16% grain moisture and then the yield was weighed for each treatment [2].

RESULTS AND DISCUSSIONS

The production results for the studied sunflower crop trial plot in the 1998 – 1999, 1999 – 2000, 2002 – 2003, 2003 – 2004 agricultural years (fig. 1), ranged between 525 and 3440 kg/ha.

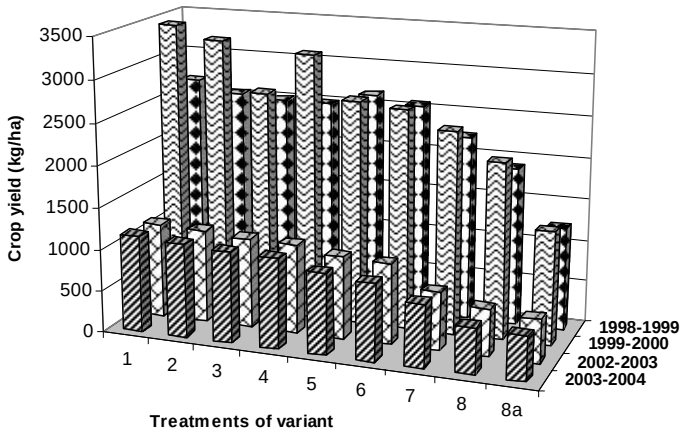

Figure 1 Yield of sunflower on variant of treatments and agricultural years

The variant V_{8a} (no drainage + chemical fertilization + soil tillage with soil material inverting + amendment) is considered the benchmark variant, because it undergone the least ameliorative tillage, a real benchmark (with no improvement) treatment missing.

In the first trial year, the yield varied from 2660 kg/ha for V_1 where the manure was applied and 1236 kg/ha for V_{8a}, in the second year from 3440 kg/ha for V_1 and 1361 kg/ha for V_{8a}, in the third trial year the yield varied from 1140 kg/ha for V_1 and 520 kg/ha for $V_{8a,}$, and last year of trial, in the first variant were obtained 1160 kg/ha and 525 kg/ha for V_{8a}.

The best yields were obtained in the agricultural year 1999 – 2000, when during the autumn - winter period, enough water has been provided: 208 mm (Meteorological Station Braila), exceeding the annual average of 184 mm, and the lowest production in the crop year 2002 - 2003, which was characterized as an medium year in terms of rainfall, 473 mm, but in terms of heat it was characterized as a cold year overall, annual average air temperature being 10.0^0C, multiannual average temperature being 10.9^0C, being the lowest in recent years. During the colder period of this year, 4 thermal stresses have been endured by fall crops which have been totally killed (barley, rape and, a part of wheat). The first three streses caused by very low temperatures occurred in December, February, April, and the fourth stress occurred in May.

The yields are presented both in absolute and in relative values (% of the benchmark treatment), which in the trial context can be considered V_{8a}. It can be seen that the best yields were obtained for the treatments with a distance of 20 m (*fig. 2*) [2].

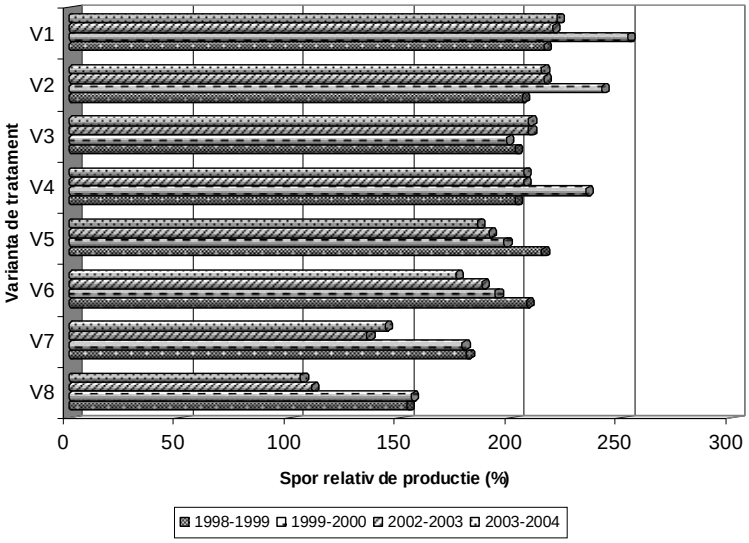

Figure 2 Average yields obtained at different variants for sunflower

For the first variant $V_{1,}$ with the most improvement methods, sunflower has annual relative yields between 215 to 253%, close in the four study years.

Fot the V_2 variant, similar to V_1, but without organic fertilization, relative sunflower yields are closed and between 205 and 241%, varying with approx. 10 to 12% from V1, differences could be caused by the application of organic fertilizers.

In the third variant V_3, where the tillage is done with with soil material inverting, should be noted that the largest relative increases for this variant occur for relative yields from 198 to 208%, lower with 7 to 33% comparing with V_2.

In the fourth variant V_4 which have not applied organic fertilizers and raising deep the relative yields increases are 202 to 234%, from the V_2 with approx. 3 to 7%, differences that may be caused by the deep loosening and the organic fertilizers application.

In the fifth variant V_5 in the absence of irrigation improvement methods, the relative increases are 185 to 214%, lower with approx. 20-27% of V_2.

The sixth variant V_6 relative yields increases vary between 175 and 207% and are lower with approx. 7 to 10% compared to the V_5, where the mulcing has not been done.

The seventh variant V_7, with moderate drainage, has relative yields increases varying between 135 and 180%, higher with ca. 27 to 30% of the increases obtained in the absence of drainage.

The eighth variant, V_8, in the absence of drainage, leads to relative yield increases between 105 and 155%, lower by 88 - 100% compared to V_2 when drainage was placed at 20 m.

Taking into consideration how sunflower responded under the treatments, it can be said that the highest relative yields were obtained in the first variant V_1 with 227%, and under the other treatments, the relative yield was between 131 and 219% (*fig. 3*).

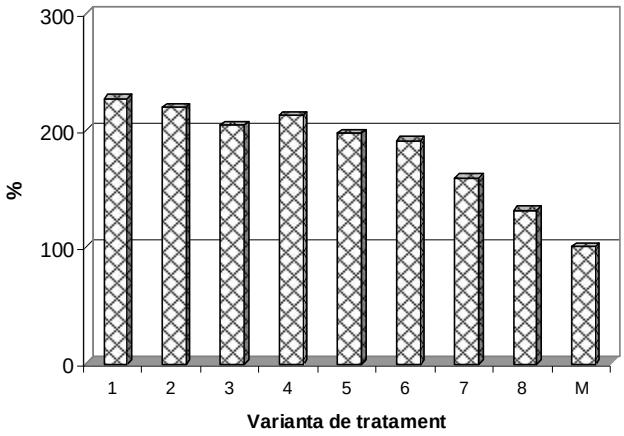

Figura 3 Variation of averaged relative sunflower yield (M = 100) under different treatments

CONCLUSIONS

1. Sunflower responded favorably to most variants of treatment, best yields being obtained for variants V_1, V_2, V_3, V_4, V_5, V_6 with the distance between drains being 20 m.

2. The highest yield has been obtained for V_1, this treatment having the following improvements: drainage with 20 m between drains + deep loosening + ameliorative irrigation + organic fertilization + chemical fertilization + paraplowing + amendment.

3. By comparing the yields obtained in the trial plot with the ones obtained at Braila-county-wide, it can be noticed that, even for the conditions of Lacu Sarat trial plot, the average sunflower yields under irrigation and fertilization were 133% of the county average of 1405 kg/ha. With no irrigation and drainage (the reference treatment), the sunflower yield reaches only 65% of the corresponding average in Braila county.

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