PRODUCTIVITY AND ECONOMIC EFFICIENCY OF SOYBEAN CULTIVATION WITHIN DIFFERENT AGRICULTURAL SYSTEMS

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Abstract

The research of productivity and economic efficiency of the soybean cultivation within the classical and conservative systems was carried out in the northern part of the Republic of Moldova. There were analyzed the meteorological data specific to the given area, there were determined: the degree and type of weed growth (three evaluations: before sowing, during sowing and before harvesting), the apparent soil density, the productivity and economic efficiency of two technological systems applied at the soybean cultivation.

Keywords: Conservative agriculture, Degree of weed growth, Economic efficiency, Productivity, Soybean.

The agriculture, currently practiced in the Republic of Moldova, faces a number of serious problems that seriously affect rural development; especially it causes the decrease in the volume of global agricultural production. It is known that the conventional agricultural system is no longer profitable, involving new and new production costs; it also causes a number of ecological problems (Krupenikov I., 2011).

In order to solve these problems a new concept is being promoted, namely the replacement of the classical system with a more efficient system of conservative agriculture, which allows more efficient management of agro ecological resources, which ensures long-term rational use of the land, preventing and minimizing soil degradation, restoring both its productive capacity and the supporting life processes (Blevins RL, 1993; William A. Hayes).

MATERIAL AND METHOD

The research was carried out in the northern part of the Republic of Moldova, Izvoare village, Floreşti district, two agricultural systems were studied: traditional and conservative ones, during the agricultural year 2013-2014.

In the research year 2013-2014 the assessment of the degree of weeds growth was carried out in dynamics:

- I assessment - before sowing March 29, 2014;
- II assessment - during sowing 6 May 2014;
- III assessment - before harvest September 16, 2014.

The traditional (classical) system of soybean cultivation was studied on a field of 15 ha, and the conservative system of soybean cultivation according to the principle of direct sowing (0 works) was studied on a field of 40 ha.

The research area constituted 40 m2 in 4 repetitions, thus the total research area constituted 160 m2 per each studied field.

Within the conservative system, the sowing (May 6, 2014) was performed directly in stubble with the Great Plains seed drill at a 5-6 cm depth of incorporation of soybeans at a density of 50-55 grains/m2.

Prior to the emergence of the soybeans, the total herbicide Roundup Maxi 2.4 l/ha was used, after the emergence of the plants in the phase of 2 true leaves Bazagran 3 l/ha was applied against dicotyledonous weeds, and 6 days after the last herbicide application the herbicide Achiba 1.5 l/ha was used against monocotyledonous weeds.

The follicular fertilization was carried out with the Wuxal Boron complex fertilizer of 2.5 l/ha, and for the crop protection against diseases (Colletotrichumdematium, Pseudomonas glycinea, Sclerotiniasclerotiorum) Coronet 0,6 l/ha fungicide with systemic, preventive and curative action was applied mixed with Mero 0,4 l/ha.

The harvest was performed directly with the Class Dominator combine harvester at the standard humidity (14%) of the grains.

In the classical farming system, the technological procedure of the soybean cultivation does not differ much from the conservative system. After the harvesting of the precursory crop (maize) the basic soil work was carried out with the furrow turning to a depth of 25-27 cm. Two cultivations

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were carried out in the spring: one cultivation was carried out in order to destroy the crust and to prevent water evaporation from the soil and the second cultivation was carried out before sowing. The sowing, as in the conservative system, was performed with the same density per m2 and with the same seed drill. In order to establish a good contact of the seed with the soil after sowing, rolling was carried out. The herbicide use was the same during the vegetation period, except for the total Roundup Maxi herbicide 2.4 l/ha, which was replaced by cultivation before sowing. The harvesting was carried out identically to the conservative system.

RESULTS AND DISCUSSIONS

The distribution of precipitation during the vegetation period strongly influences the hydric regime and the productivity of crops.

Figures 1 and 2 present the data regarding the amount of atmospheric precipitation and the air temperature in Floresti district.

According to *figure 1*, the precipitation in March and April was insufficient (-11 mm and -17.2 mm) compared to the multiannual average. In May and June, the amount of precipitation exceeded the multiannual average by 44.8 mm and 53.6 mm respectively, which led to a good development of soybean plants. In July and August there was a drought, the amount of precipitation was insufficient by 31.2 mm and 12.5 mm respectively, compared to the multiannual average, but the reserve of soil water accumulated at the end of spring- in early summer led to a good development of the soybeans with increased productivity of this crop.

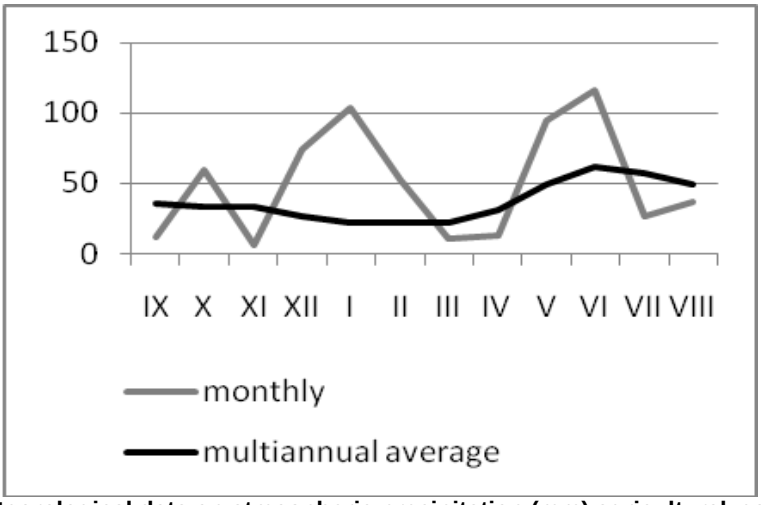

Figure 1. **Meteorological data on atmospheric precipitation (mm),agriculturalyear 2013-2014**

According to *figure 2* the air temperature distribution was uneven throughout the growing season of the soybean, there was an increase in temperature by 1.4°C compared to the multiannual average. In the spring, March was the warmest month, which exceeded the multiannual average by 1.8°C, April and May were ther mally exceeded by 0.9C. The warmest months were July and August, which exceeded the multiannual average by 2.4°C and 2.5°C respectively.

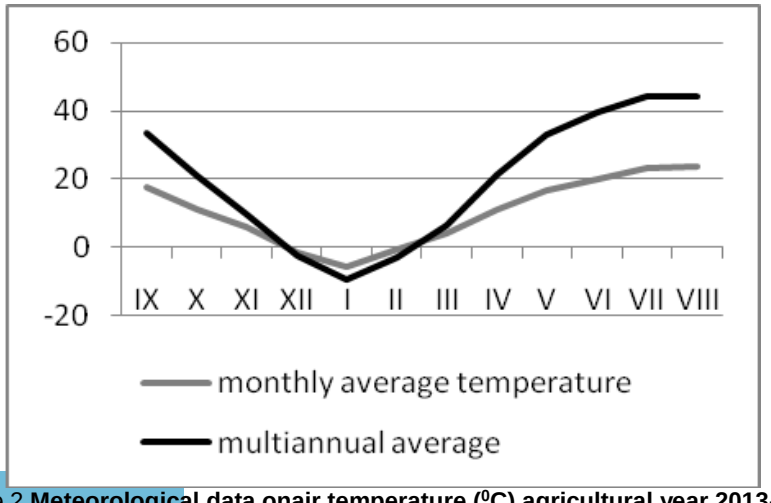

Figure 2 **Meteorological data onair temperature (°C),agricultural year 2013-2014**

Weed growth has a negative role in the cultivation technology of each crop, but especially in the soybean, because with this crop weed control is difficult. One of the research objectives was to assess the degree, type and extent of weed damage to soybean agrocenosis, depending on the climatic conditions of the year and the applied agricultural system.

Within the classical system, at the first assessment of the degree of weed growth, a total number of 22 weeds/m^2 with a green weight of 110 g (average degree and mixed type of weed growth) corresponding to an economic damage threshold, was recorded. Within the conservative system, a number of 10 weeds per m^2 with a green weight of 29 g (low and mixed type of weed growth) was recorded at the first assessment of the degree of weed growth, which corresponds to the phytocenotical, towards the critic, damage threshold.

Within the classical system, at the second assessment of the degree of weed growth, 27 weeds/m^2 were identified. From the total spectrum of identical weeds 23 weeds were annual and 4 weeds were multiannual (average degree of weed growth) with a green weight of 56 g (low gravimetric degree of weed growth) forming phytotechnical damage threshold. Within the conservative system, a number of 16 weeds per m^2 with a green weight of 49 g was recorded which corresponds to a low degree of weed growth and to the phytocenotical damage threshold.

The third assessment of the degree of weed growth was carried out before harvesting. In soybeans, when applying the classical agricultural system, the degree of weed growth was medium which corresponds to the economic damage threshold. Within the conservative agricultural system there were recorded 14 weeds/m^2 with a green weight of 286 g that constitutes a medium degree of weed growth, according to the numerical and gravimetric mass, and an economic damage threshold.

The researches on agrophysical indicators oriented towards the assessment of apparent density. When practicing the conventional agricultural system the apparent soil density values varied within the range of 1.1-1.29 g/cm^3 with the increase to depth (*table 1*). The same applies to the application of the conservative system, this indicator ranging from 1.2-1.32 g/cm^3.

Table 1

Apparent density values (g/cm^3) of the soil in the soybean agrocenosis when applying the classical and conservative agricultural systems, 2014

Experiment's variants	Soil layer, cm				Ad (g/cm^3) in 0 – 40 cm layer	Degree of tillage
	0 – 10	10 – 20	20 –30	30 –40		
Classical agriculture	1.1	1.2	1.25	1.29	1.21	poorly compacted
Conservative agriculture	1.2	1.2	1.29	1.32	1.26	poorly compacted

The average apparent density in 0-40 cm layer was 1.21 g/cm^3 in the classical system and 1.26 g/cm^3 in the conservative system, demonstrating a low degree of soil compaction in both variants.

The level of soybean productivity varied according to the influence of the climatic factors of the agricultural year and the applied agricultural system.

In the agricultural year 2013-2014, the average harvest in the conservative agricultural system constituted 2.6 t/ha, 0.5 t/ha more compared to the traditional agriculture system (2.1 t/ha).

The calculations of the economic efficiency of soybean cultivation technology in various agricultural systems showed that the net income in the application of the agricultural conservative system was 7948 lei/ha and in the classical system a net income of 5226 lei/ha was obtained.

CONCLUSIONS

Precipitation and temperature variations are so crucial that agriculture's efficiency is highly dependent on weather conditions.

The reserve of soil water accumulated at the end of spring and in early summer led to a good development of the soybean with the increase of its productivity.

The degree of weed growth before sowing in the classical system was medium and of mixed type, which corresponds to the economic damage threshold. Within the conservative system, the degree of weed growth was low and of mixed type corresponding to the phytocenotical, towards the critic, damage threshold.

On the field with the application of the classical system at the second assessment of the weed growth, the numerical degree of weed growth was medium and the gravimetric degree was low, forming a phytocenotic threshold of damage. In the

conservative system a low degree of phytocenotic damage threshold was observed.

The third assessment of the weed growth degree of the soybean, with the application of the classical agricultural system, recorded a medium level of weed growth and an economic damage threshold. Within the conservative farming system, a medium degree of weed growth was established according to the numerical and gravimetric masses, forming an economic damage threshold.

This research demonstrates that the conservative agricultural system applied in the cultivation technology of the soybean has a positive influence on the level of its productivity and on the level of weed growth.

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