

## EXPERIMENTAL RESULTS ON NON-GMO SOYBEAN VARIETIES PRODUCTIVITY IN TULCEA COUNTY CONDITIONS

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### Abstract

*25 years ago Soybean was an important component of crop rotations in South Romania and Romania was the most important Soybean grower with more than 500 thou ha total sown area. Nowadays, Soybean is minor crop with only 45-72 thou ha. In order to promote Soybean crop the authors elaborated a research program included in Danube Soya European initiative, based on experiments in the field and laboratory, organized in Tulcea County, Macin area. The research program included an experiment with Soybean varieties of different origin: Romanian (Triumf, Columna, Daciana, Victoria, Oana F, from National Agricultural R&D Institute of Fundulea; Eugen, Perla, Felix, Onix, Daciana TD from Agricultural R&D Station of Turda; PS1012, PS1020, of Procera Agrochemicals Company; Sigalia, from Probsdorfer Saatucht Romania) and Serbian (Neoplanta, Galina, NS Rubin, NS Trijulf, Venera).*

*The research carried out in 2010-2011 in Dobrudja region, Macin area showed that the soil and climatic conditions are very suitable for Soybean crop, which produced between 3027 and 5788 kg/ha in 2010 and between 2785 and 4393 kg/ha in 2011. In this context the research illustrated the high productivity potential of semi-early and semi-late varieties, characterized by high number of pods (57 pods) and grains (149 grains) per plant, grain production per plant (22.6 g) and TGW (151.7 g).*

*Based on these results, the authors recommended the extension of Soybean crop in the area, first of all in the irrigated areas, as an important component for better crop rotations and very suitable previous crop for winter wheat and a valuable source of fodder for animal production units and source of profit for Tulcea County farmers.*

**Key words:** soybean crop, Tulcea County, soybean varieties, productivity.

### INTRODUCTION

Covering a larger percentage of protein needs by own production is a priority of the European agricultural-food policy, stated as such in the Horizon 2020 strategy. Among the plant sources of protein for Romania (and Europe too), together with sunflower (about 800 thou ha) and rape (400-500 thou ha), Soybean can contribute to the production of increased amounts of proteins, of high quality, for food and feed purpose. In this regard, currently Europe secures only 3-5% of the soybean needs from its own production, the rest being covered by imports of seeds and cakes from the USA, Brazil and Argentina.

Prerequisites for increasing soybean acreage in Romania are very favorable: natural conditions (climate, soil) meet the requirements of soybean; there is an assortment of valuable varieties adapted to our conditions, including

Romanian creation; Romanian farmers have experience in soybean cultivation, if given the expansion of the agricultural crop in the past, up to 500 thou ha.

As a result, research on soybean crop in doctoral thesis initiated in 2009-2010 fits well in European and national priorities, and present paper, which includes some of the results of this research, is part of the requirements of current times.

### MATERIALS AND METHODS

The research was organized in Dobrogea region, Tulcea County, the polder near Macin City, an area with groundwater supply, in SC Lombardi Agro Ltd farm, within soybean crop occupies large areas each year (Figure 1). Conditions in this area are favorable for soybean crop: 10.5°C average annual temperature; 489 mm annual rainfall; 2195

hours of sunshine duration; an aluvosoil with 2.6 Nitrogen Index, 62 ppm of Phosphorus and 140 ppm of Potassium contents and pH 7.7.



Figure 1. Tulcea County location in southeast of Romanian territory (www.rovt.ro/romania\_map\_ro)

Experimental years were different in terms of weather (Table 1): agricultural year 2009-2010 was characterized by 11.0°C average temperature, 445.7 mm annual rainfall and favorable evolution of meteorological parameters during soybean growing season.

Table 1. Climatic features of the experimental area (multiannual values - Galati Meteo Station, National Institute of Meteorology and Hydrology)

Months	Sunshine duration (hours)	Air temperatures (°C)			Rainfall (mm)
		maximum values	mean values	minimum values	
I	76.0	13.3	-2.9	-23.4	31
II	35.7	17.6	-0.4	-19.4	34
III	138.2	24.6	4.0	-15.2	27
IV	192.1	29.2	11.0	-3.6	37
V	259.9	33.4	16.5	2.9	58
VI	293.6	34.6	20.3	3.7	50
VII	307.6	36.7	22.0	7.3	51
VIII	291.7	35.3	21.4	7.4	49
IX	230.3	35.7	17.1	-6.8	46
X	185.2	28.3	11.0	-6.8	29
XI	85.1	25.1	6.0	-10.2	36
XII	62.6	17.6	0.2	-14.5	31
Yearly values	2195.1	36.7	10.5	-23.4	489

By comparison, the 2010-2011 year was less favorable in terms of ensuring water, with only 365.5 mm annual rainfall and only 4.7 mm rainfall in August and September (compared with 107.6 mm annual average) in the growing stages of Soybean grains setting up and maturation, which was reflected in the yields level.

In the field was located an experiment with 20 varieties of Soybean, of Romanian and Serbian creation (Table 2), provided by breeders from NS Seme Novi Sad, NARDI Fundulea, ARDS

Turda, Probsdorfer Saatzucht Romania. In the experimental field has applied the growing technology recommended for Soybean in the area. In the research has developed a program of phenological observations (dates of emergency, flowering, and physiological maturity) and biometric measurements (plant height, basal pods insertion height, number of pods/plant, number of grains/plant, grain weight/plant, TGW). The results were averaged and processed by analysis of variance.

## RESULTS AND DISCUSSIONS

Weather suitability of the agricultural year 2009-2010 is reflected by the yields obtained in soybean (Table 2). In the experiment were harvested 3021.1-5788.3 kg grains/ha, on average 4550.2 kg/ha, which illustrates the high productivity of the tested biological material. Differences between varieties productivity were significant - from simple to double -, which is due to the diversity of biological material and its adaptability to natural conditions of the research.



Figure 2. View on Soybean crop in Macin Experimental Field (June 2010)

The semi-late and semi-early varieties posted the higher productions (over 5200 kg/ha): Zora (5788.3 kg/ha), PS2012 (5633.3 kg/ha), Galeb (5551.7 kg/ha), PR92B63 (5489.3 kg/ha), Sponsor (5417.5 kg/ha), Sigalia (5293.6 kg/ha). These varieties were characterized by the following morphological characteristics: 101.7 cm plant height; 10.9 cm basal pods insertion height; 57.1 pods/plant; 135.2 grains/plant; 2.3 grains/pod; grain yield 22.0 g/plant; TGW=166.1 g.

Table 2. Soybean varieties productivity in 2010 experimental year (kg/ha) (Macin Experimental Field)

Nr. crt.	Varieties	Grain yields (kg/ha)	(%)	Differences (kg/ha)	Significance
1.	Zora	5788.3	127.2	1238.1	*
2.	PS1012	5633.3	123.8	1083.1	*
3.	Galeb	5551.7	122.0	1001.5	*
4.	PR92B63	5489.3	120.6	939.1	*
5.	Sponsor	5417.5	119.1	867.3	*
6.	Sigalia	5293.6	116.3	743.4	*
7.	PS1020	5195.2	114.2	645.0	*
8.	NS Rubin	5137.5	112.9	587.3	*
9.	Tea	4906.6	107.8	356.4	*
10.	NS Trijulf	4900.0	107.7	349.8	*
11.	Forteza	4896.6	107.6	346.4	*
12.	Triumf F	4820.8	105.9	270.6	
13.	Galina	4782.5	105.1	232.3	
14.	Condor	4717.5	103.7	167.0	
15.	Venera	4624.1	101.6	73.9	
16.	Columna	4600.8	101.1	50.6	
<b>Mean</b>		<b>4550.2</b>	<b>100.0</b>	<b>Mt.</b>	-
17.	Julija	4324.3	95.0	-225.9	
18.	Neoplanta	4261.6	93.6	-288.6	o
19.	NS Mercury	4231.4	93.0	-318.8	o
20.	Dukat	4172.5	91.7	-377.7	o
21.	Eugen TD	4005.0	88.0	-545.2	o
22.	Perla	3860.8	84.8	-689.4	o
23.	Felix	3820.8	84.0	-729.4	o
24.	Onix	3710.0	81.5	-840.2	o
25.	Victoria	3706.6	81.4	-843.6	o
26.	Daciana TD	3453.1	75.9	-1097.1	o
27.	Diamant	3078.3	67.6	-1471.9	o
28.	Oana F	3027.1	66.5	-1523.1	o
LSD 5%				242.75 kg/ha	

By comparison, early varieties produced less than 4000 kg/ha, and 689.1-1523.1 kg/ha less in comparison with average yield of the experiment. The majority of these varieties belong maturity groups early and very early (Pearl, Felix, Oana F, Onyx, Diamond), who developed and matured early and were unable to efficiently use the full heat potential of the area. These varieties were characterized by the following traits: 103.4 cm plant height; 11.0 cm basal pods insertion height; 46.1 pods/plant; 110.3 grains/plant; 2.2 grains/pod; grain yield 17.3 g/plant; TGW=151.5 g.

In the second experimental year, atmospheric drought and insufficient rainfall especially in the latter part of the growing season, limited the productive potential of the tested varieties, so yields ranged from 2785.0 to 4393.3 kg/ha, in average 3564.6 kg/ha.

Varieties highlighted in the previous year were again Sponsor, Zora, Galeb, PR93B63 with over 3700 kg/ha, plus Galina Dacian TD and Tea. Varieties with lower production, remain early varieties Oana F, Pearl, Onyx, Diamond, with under 3400 kg/ha.

This year, obviously Soybean plants growth was affected by the evolution of meteorological parameters, the plants of best varieties developed following characteristics: 85.0 cm plant height; 18.6 cm basal pods insertion height; 32.5 pods/plant; 76.7 grains/plant; 2.3 grains/pod; grain yield 10.5 g/plant; TGW=137.1 g.

Table 3. Soybean varieties productivity in 2011 experimental year (kg/ha) (Macin Experimental Field)

Nr. crt.	Varieties	Grain yields (kg/ha)	(%)	Differences (kg/ha)	Significances
1.	Sponsor	4393.3	123.2	828.7	*
2.	Triumf F	4031.6	113.1	467.0	*
3.	Zora	3969.3	111.3	404.7	*
4.	Galina	3920.8	109.9	356.2	*
5.	Daciana TD	3898.3	109.4	333.7	*
6.	Galeb	3880.0	108.8	315.4	*
7.	Tea	3845.8	107.9	281.2	*
8.	PR92B63	3700.0	103.8	135.4	
9.	Sigalia	3694.2	103.6	129.6	
10.	Neoplanta	3690.8	103.5	126.2	
11.	NS Rubin	3680.8	103.3	116.2	
12.	PS1020	3651.0	102.4	102.4	
13.	PS1012	3650.0	102.4	85.4	
14.	NS Mercury	3573.3	100.2	8.7	
<b>Media</b>		<b>3564.6</b>	<b>100.0</b>	<b>Mt.</b>	-
15.	Forteza	3555.8	99.7	-8.8	
16.	NS Trijulf	3541.0	99.3	-23.6	
17.	Columna	3538.3	99.3	-26.3	
18.	Eugen	3535.0	99.2	-29.6	
19.	Julija	3511.6	98.5	-53.0	
20.	Condor	3465.0	97.2	-99.6	
21.	Felix	3400.8	95.4	-163.8	
22.	Venera	3400.0	95.4	-164.6	
23.	Dekat	3338.3	93.6	-226.3	o
24.	Oana F	3319.2	93.1	-245.4	o
25.	Perla	3120.0	87.5	-444.6	o
26.	Diamant	2870.8	80.5	-693.8	o
27.	Onix	2850.8	80.0	-713.8	o
28.	Victoria	2785.0	78.1	-779.6	o
LSD 5%				184.20 kg/ha	



Figure 3. View on Soybean crop in Macin Experimental Field (September 2011)

## CONCLUSIONS

Experimental area offers very favorable conditions for Soybean growing: fertile soil characteristics and climatic parameters, supplemented by groundwater and water from irrigation intake.

As a result, the area can achieve very cost-efficient high Soybean yields, near biological potential of Soybean varieties available to growers (about 6000 kg/ha).

In a year with normal meteorological parameters evolution Soybean varieties of semi-late and semi-early maturity groups can produce over 5000 kg/ha. In the research in Macin Experimental Field were detached varieties Zora, Sponsor, PR92B63, Galeb. By these varieties, in a low-rainfall year, but with the right growing technology, the grains productions may exceed 3500 kg/ha, just 4000 kg/ha.

Growing varieties with shorter vegetation season is recommended in the area in cases of late sowing or successive crop.

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## REFERENCES

- Berbecel O., Valuta Gh., 1960. Ecological Zoning of agricultural crops. "Romanian Academy" Publishing House, Bucharest.
- Djordjevic V., Roman Gh.V., 2013. Soybean - Handbook for Danube region. Institute for Vegetable and Field Crops, Novi Sad.
- Lombardi R.A., Epure L.I., Roman Gh.V., 2013. Studies on soybean growing in Tulcea County. Scientific Papers. Series A. Agronomy. Vol. LVI. USAMV, Faculty of Agriculture, Bucharest.
- Mihalache M., 2006. Soils genesis, properties and taxonomy. "Ceres" Publishing House, Bucharest.
- Roman Gh.V., Tabara V., Pirsan P., Axinte M., Stefan M., Robu T., 2013. Field Crops - Cereals and Grain Legumes. "Universitara" Publishing House, p. 307-329, Bucharest.
- Romanian Statistical Yearbook. 2013. National Institute of Statistics, Bucharest.
- The Official Catalogue of varieties for agricultural crops for Romania. 2013. ISTIS, Bucharest.
- Waters National Council. National Institute of Meteorology and Hydrology. Weather and Waters. "Technical" Printing House.