THE PRODUCTIVITY OF SOME RAPESEED GENOTYPES IN THE CLIMATIC CONDITIONS OF ARDS CARACAL

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Abstract. *The tendency for growing rapeseed areas from the USA and European Union has also shifted to Romania in the last 10 years. Several companies from Western Europe have launched an offensive on the Romanian market seeking large areas of land on which to grow rapeseed, which they later turn into oil, which is turn, as a result of the additive, into biodiesel. Biodiesel is a fuel used for automobiles instead of diesel, being cheaper and less polluting. The explosion of demand for biodiesel on the world market has influenced the areas where rape is grown in Romania. If in 2005 the cultivated area was about 50.000 ha, in 2006 was doubled up to 100.000 ha and in 2009 the increase was substantial - about 600.000 ha and now the cultivated area is around of 500 000 ha with small variations of this depending of the price market (404.715 ha in 2014, FAOSTAT 2017). European Union has over 30% from international market of rapeseed with France as fist exporter and Germany as first producer of rapeseed. In Romania, the average rapeseed yields are only of 2-2.5 tons/ha, quite low, and the price of one tone in the Constanta port varies between 220 to 225 USD/tone. The number of rapeseed varieties and hybrids increased as the cultivated area increased. Serious investments are being made in the improvement and testing activity, so that specific recommendations are made for certain areas and implicitly for different areas from countries. For this, there needs to be a well-documented information on cultivated rapeseed varieties and hybrids, knowing that the central area of Oltenia is known as an area with a dry climate. Considering that there are very different climatic conditions to Western Europe, where most varieties come from, it is necessary to make some very professional tests, aiming at highlighting the material that exhibits high adaptability (Iancu Paula et all, 2009). Taking in account those above mentioned in this paper we present the results obtained to an assortment of rapeseed from Euralis Company tested in climatic conditions of Agricultural Research and Development Station of Caracal, during of three years: 2015, 2016 and 2017.*

Key words: *colza hybrids, assortment, yields.*

INTRODUCTION

Food security will be challenged by the growth of the world's population, reaching over 9 billion people in the next 50 years (United Nations, 2013). The "Green Revolution" improved the yield of energy-dense crops like cereals and oil species, allowing the increase in food calories, fats and proteins consumed by mankind (KHOURY ET AL., 2014 CITED BY MARCELO H., 2017).

As a source of fats and proteins, one of the healthiest edible oils for human consumption (MOMOH ET AL., 2004), has globally increased seed production, reaching 73.8 million tonnes in 2014 (FAOSTAT, 2017) and partially powered by the rising demand for biofuels (RONDANINI ET AL., 2003, 2011).

In Switzerland, two more genotypes of KWS were added to the recommended ones for cultivation, namely Robust and the first type of *HOLL (high oleic law linolenic)* V141L, in which the oil is rich in oleic acid and low in linolenic oil. This cultivar is less productive than

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classical varieties. With an average precocity, he has a good fall behaviour and a good resistance to Phoma. In order to produce a *HOLL* quality cultivar it is necessary to ensure a distance of at least 50 m from the classic rapeseed crops and to apply a rotation of at least 3 years.

Also, in China a new variety of rapeseed with a record oil content has been set up called *Zongyou 0361* and has a content of oil of 54.72%. It was created to meet the demand for the bio energy market. Was designed as disease-resistant, it quickly reaches maturity and is not genetically modified.

In Romania the main providers of rapeseed genotypes are Multinational Companies who have a very rich offer of varieties and hybrids. The tendency in line of farmers is to use hybrids du their productive features and resistance to pest and diseases.

MATERIAL AND METHODS

On the argic chernozem from Agricultural Research and Development Station of Caracal, were tested 7 hybrids of rapeseeds during of three years: 2015, 2016 and 2017 in order to select those who have the capacity to capitalize the climatic conditions of the area.

From agrotechnical point of view were realized the follow actions, as follow: previous plant in each year was autumn wheat and after that we apply summer plowing – heavy disc – seed bed preparation. As background fertilizers, in autumn, we apply 250 kg/ha complex of 20-20-0-14 (sulphurs) and in spring time 250 kg/ha ammonium nitrate.

From the researches carried out in our country it follows that, from sowing to the winter entry, the rapeseed requires 800-1000^{o}C $\Sigma t > 0^{o}$C (Prodan I. 1985; Ionescu et al., 1989; Bîlteanu, 1993; Berea, 1998) or 540-700 UT ($\Sigma t > 5$°C) (Berea, 1998) for the formation of a strong root and a well-developed leaf rosette. Thus, in the south of the country, rapeseed can be sown in September 5-15 and in other areas (western, northern and eastern) between 1st and 10th of September.

Some studies realized on ARDS Secuieni - Neamț (Berea, 1998) pointed out that in the years 1994-1995, the best results were obtained in most varieties, in the case of rapeseed sowing on the last decade of August (between August 20 and August 31), followed by variants sown at September 5-10. Sowing after September 1 results losses in production, which after September 10 are enormous (72.2% loss) due the unfavourable regime of precipitations. Taking in account the previous research the sowing time was in each year in the first decade of September.

In order to ensure the cultural hygiene were applied herbicides: Sultan Top 2l/ha and Agil 0.8l/ha. Also to control diseases and pests were applied: Lamdex 0.2l/ha, and Biscaya 0.3l/ha in autumn, Miraj 1 l/ha + Lamdex 0.2l/ha, Zamir 0.75 l/ha + Mavrik 0.2 l/ha in spring and respectively late spring.

All collected data has been processed using statistical programs to ensure the repeatability of the experiment.

RESULTS AND DISCUSSION

Climatic conditions (figure 1 and 2) – had a very strong influence on the behaviour of rapeseed hybrids cultivated in non-irrigated conditions from ARDS Caracal during the three years 2015 to 2017.

As features the years were, as follow:

2015 year – from the *temperature* point of view was a normal year, with values close to the multiannual average, except month of May and June when the registered temperature was a little bit higher than the average , with +1^{o}C and respectively + 2^{o}C. *As precipitation*

regime the year had large variations of those, with an autumn with a favourable rain fall regime in October and December, but these quantities were stored in the ground because the vegetation plants in this period had at lowest level. In spring, starting with the last decade of March and from then to the end of the vegetation, the rain fall regime was under the standard for the area and that situation has been reflected into the levels of yields generated by the rapeseed assortment for 2015.

2016 year – was different as previous, from the temperature point of view considered as warmer from those three, with values of over the standard in almost entire vegetation period, with an exception, in winter time when the level of temperatures was situated below the standard, mostly in January when the average temperature was -3.7°C. *As precipitations regime*, the plant's vegetation starts in year of 2016 with a very good level of water in soil, which ensure a quick and uniform emergence. The levels of precipitations continues to be higher than the standard in the cold period and early spring which influenced the main stage of plant development. The last stages of plants development, especially the formation of seeds have been completed in the conditions of drought, but with a very good level of water in soil, which conduct to high levels of productions of all experimented hybrids.

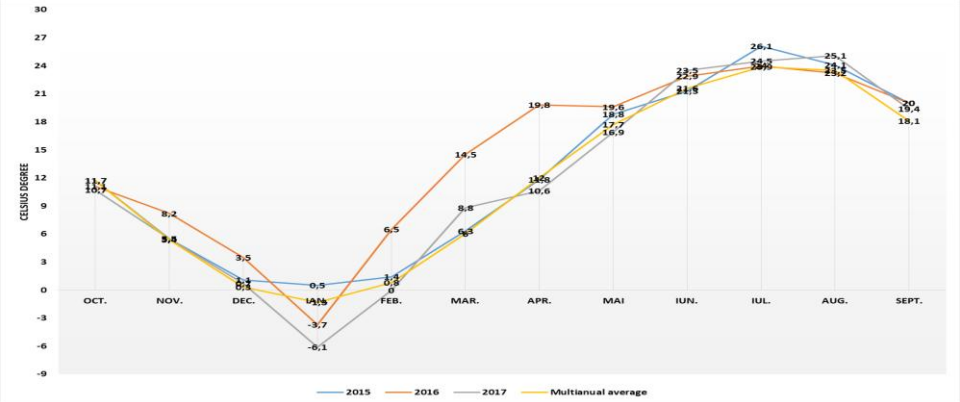

Figure 1 – Evolution of temperature in comparison with multiannual average

2017 year – was medium considered as favourability of rapeseed crop. The temperature regime has been under the usual level in autumn, with lower values that the standard until the beginning of March, with the highest differences registered in January, of -6.3°C. From the point of view of rainfall regime we can consider this year as favourable, with levels over the multiannual average of those, but on the background of an unfavourable temperature regime associated with some period with high nebulosity the experimented hybrids doesn't have the conditions to express their entire productive potential in the above mentioned conditions.

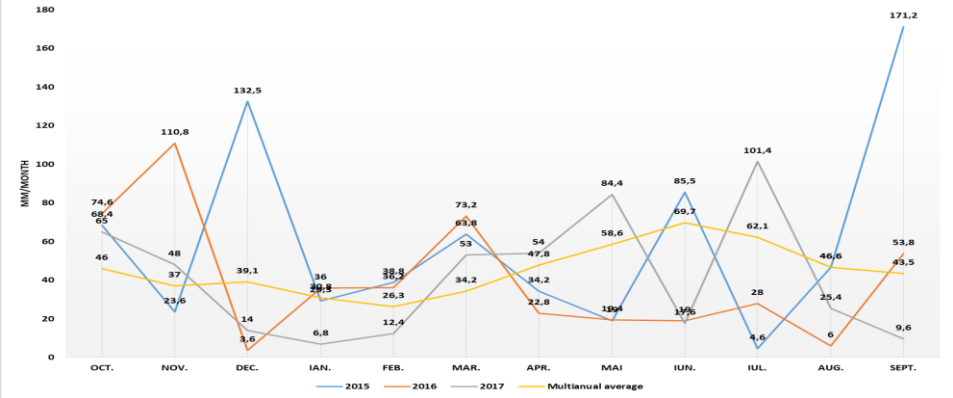

Figure 2 – Evolution of precipitations in comparison with multiannual average

Blooming period on the experimented rapeseed hybrids – was observed and registered during the experiment. We note the date of blooming start, the date when the entire crop has reach the point of full flowering and the number of days needed to reach that point. The situation is presented below, in the table 1 and figure no 3. As it can be observed, the mentioned climatic conditions of the period had a strong influence to the stage of plant developments, determining the start of blooming as follow: earlier in 2016 (from 1 to 7 of April), moderate in 2017 (from 8 to 12 of April) and late in 2015 (13 to 16 of April).

Generally, the temperature plays a very important role in the blooming process and in our study the influence of this vegetation factor determine also the length of the process with a different number of days (figure 3) for each monitored hybrid.

Table 1

Blooming period on the experimented rapeseed hybrids (2015 – 2017)

No.	Year	Hybrid	Start blooming	End blooming
1	2015	HYDROMEL	15.apr	19.mai
2		NEPTUNE	14.apr	09.mai
3		MERCURE	16.apr	12.mai
4		DANUBE	16.apr	19.mai
5		JASON	16.apr	12.mai
6		ODICE	16.apr	15.mai
7		DARKO	13.apr	15.mai
1	2016	HYDROMEL	03.apr	05.mai
2		NEPTUNE	01.apr	05.mai
3		MERCURE	05.apr	06.mai
4		DANUBE	03.apr	05.mai
5		JASON	05.apr	06.mai
6		ODICE	07.apr	04.mai
7		DARKO	01.apr	05.mai
1	2017	HYDROMEL	09.apr	27.mai
2		NEPTUNE	08.apr	26.mai
3		MERCURE	12.apr	27.mai
4		DANUBE	08.apr	25.mai
5		JASON	11.apr	27.mai
6		ODICE	12.apr	27.mai
7		DARKO	10.apr	21.mai

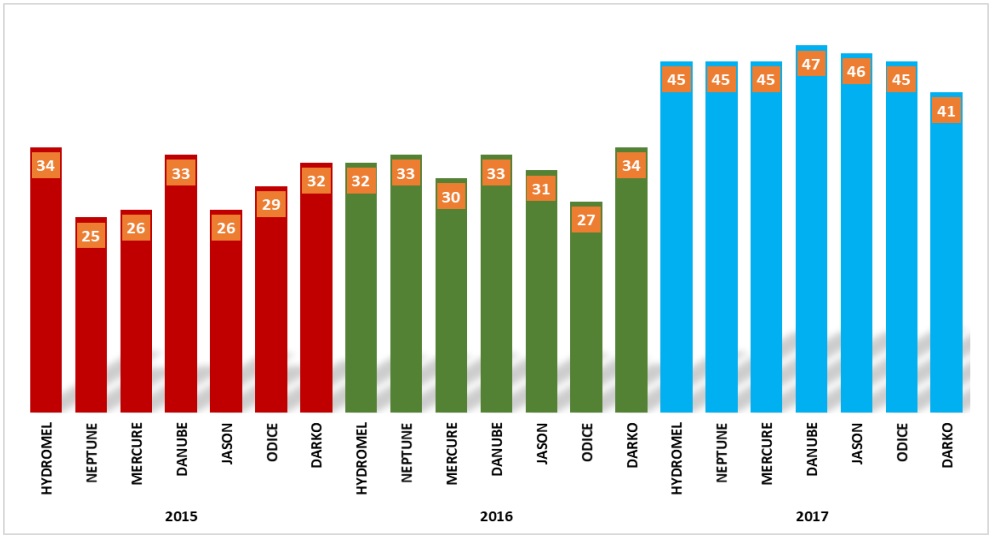

Figure 3 – Number of blooming days on experimented hybrids - 2015-2017

Days number for blooming varied in in large limits between years, from 25 days at *Neptune* hybrid in 2015 to 47 days to *Danube* hybrid in 2017. If we analize the hybrids behaiour in the same year group, the limits of variations were smaller thant the years group, which prove a very good homogenity of the rapeseed hybrids of Euralis Company.

The large differences registered between 2015 and 2017 years were explained by the temperature regime of the years, with lower values for 2017 and an accentuate nebulosity in some periods for the same 2017 year.

Seed's humidity at harvest time (figure 4) – on the rapeseed harvest, the humidity of the seeds is very important in order to ensure a harvest without losses due the features of the fruits to spread the seeds on maturity time. Another objective of the breeders is to create genotypes with a homogenies plants in the maturity stage, which allowed farmers to have start an earlier and easier harvest process (Pioneer Romania - Rapeseed Catalogue, 2016).

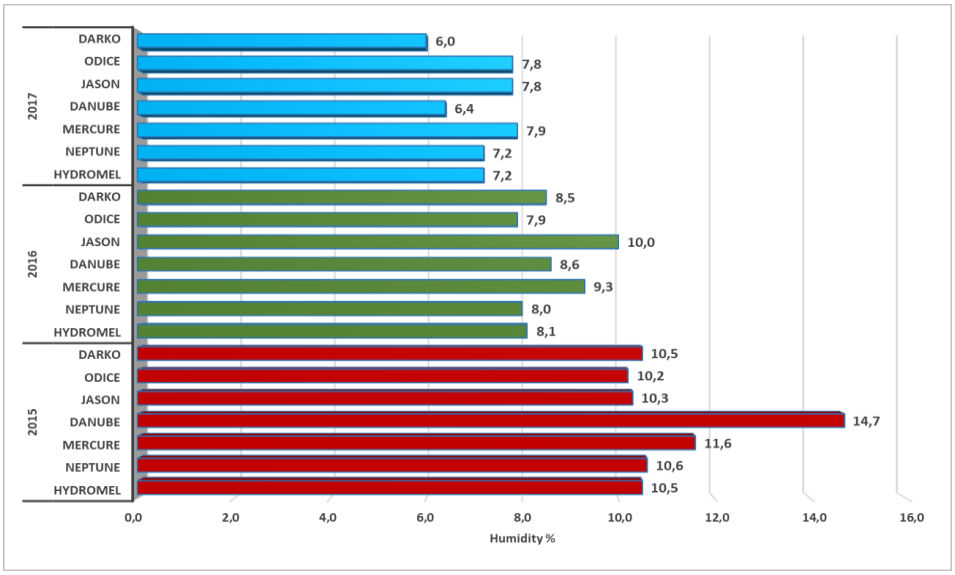

Figure 4 – Humidity at harvest time in the experimented years 2015 - 2017

Standard humidity on rapeseed is 9% - made with devices under the specifications of method described in SR EN ISO 665: 2003 - Determination of water and volatile matter content.

Looking in the data show in figure 4 we can see the values of seed's humidity in years of 2015 and 2016 are mostly under the STAS, with values which varied between 6.0% at *Darko* hybrid in 2017 to 10.0% registered at *Jason* hybrid in 2016. Higher values, over the STAS has been registered in 2015 on the entire assortment, with values between10.2 % at *Odice* hybrid to 14.7 at *Danube* hybrid. The year of 2015 is characterized by the high content of free water in seeds at maturity of seeds mainly due the climatic conditions in the harvest time, with some short rainfall regime.

Hectolitre weight (figure 5) – For rapeseed the ordinary values of hectolitre mass varied around 61-68 kg/hl. This features is influenced by seed's specific mass, humidity of seeds, seed's geometry and the way how the seeds were placed in the volume and foreign bodies content and their nature.

From this point of view we can observe also some variations between experimented years, with highest values of this in 2016 of 64.7 kg/ha at *Danube* hybrid and 67.5 kg/hl registered on *Hydromel* hybrid, followed by those from 2017 and 2015.

The hybrids *Mercure, Danube and Janson* seems to be less influenced by the climatic conditions related this feature, the variations of the registered levels having small differences between experimented yeas. On the other side the hybrids *Hydromel, Odice, Janson and Darko* were those who react in large limits related the hectolitre mass between years.

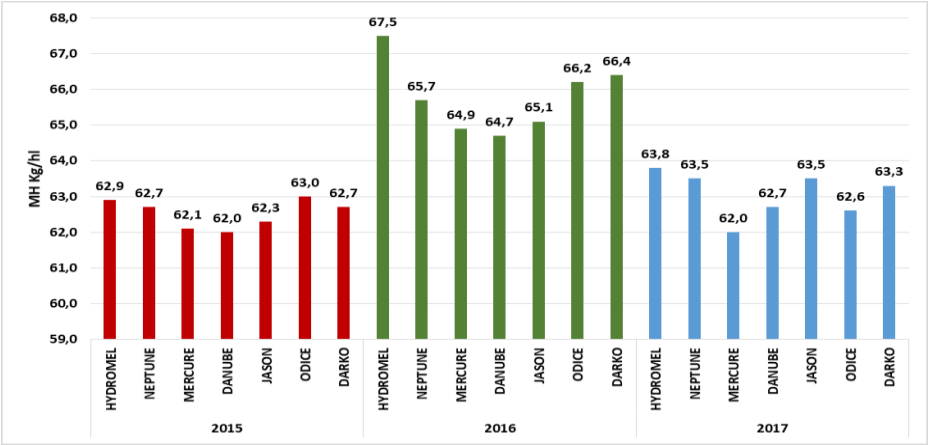

Figure 5 – Hectolitre weight – kg/hl - in the experimented years 2015 - 2017

Definitevely, the most appreciated feature for farmers is the **capacity of production or level yields** which in the climatic conditions of ARDS Caracal, in average of the three experimented years per entire assortment – was of 4539.5 kg/ha (figure 6).

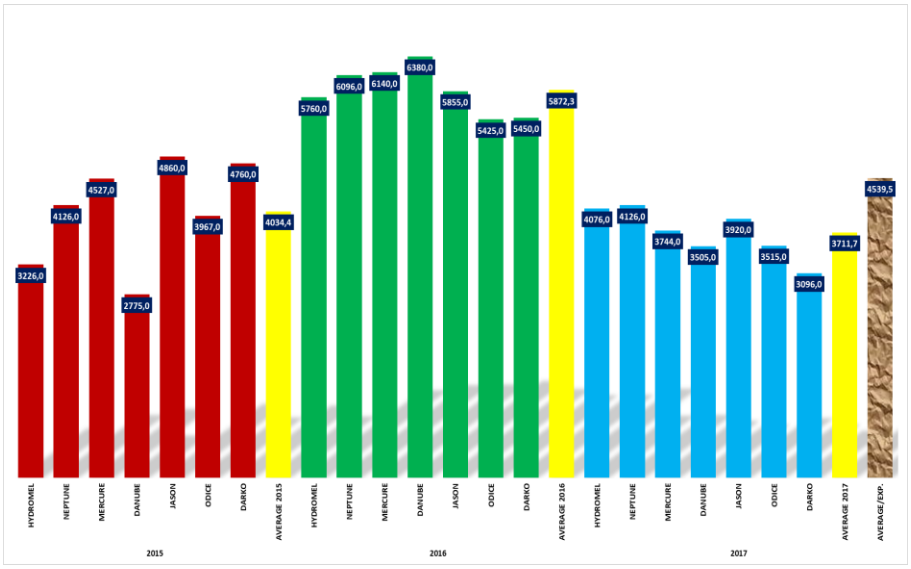

Figure 6 – Yields obtained in 2015-2017 in comparison with average/experience

The hybrids prove their capacity of productivity in the conditions described on climatic conditions comment above. The most valuable year have been 2016, with an average production of 5872.3 kg/ha and with yields which varied between 5425 kg/ha registered at *Odice* hybrid and 6380 kg/ha at *Danube* hybrid. The year of 2016 is also the most homogeny as level of production that the hybrids gave in comparison with others two, 2015 and 2017 where the stability of productions were smaller.

In comparison with the average/experiment in the interval 2015 – 2017, the average/experiment in 2015 was of 4034.4 kg/ha and in 2017 of 3711.7 kg/ha. The main level of yields was determined by the capacity of the hybrids to capitalize the climatic conditions from the area of ARDS Caracal in the 2015 – 2017 years.

If we take into consideration the levels of productions, comparatively between 2015 and 2017, even in case of the average /year in 2015 being higher than those of the 2017, the variations of the yields in the assortment were obviously higher, with values between 2775 kg/ha on *Danube* hybrid to 4860 kg/ha at *Jason* hybrid. The level of productions in 2017 range between 3096 kg/ha at *Darko* hybrid and 4126 kg/ha at *Neptune* hybrid.

From all experimented hybrids, those who prove to have a stability of yields, in different conditions of climatic favourability, *we can highlight Jason, Mercure and Neptune hybrids*, with a very good and stable capacity of production. A particular positions in our experiment was occupied by *Danube* hybrid, with over 6.3 tones/ha in 2016, but whit large differences related 2015's yield, of 2775 kg/ha, which put as in situation of not place this hybrid in our top three of assortment.

CONCLUSIONS

A few important conclusions that we can synthesizing after the three different years as climatic conditions for the area of Caracal Plain, as follow:

- The genotypes of rapeseeds of the Euralis Company that we tested in the conditions of ARDS Caracal prove to be very valuable, with a high capacity of generate yields in different conditions of climatic conditions, that being an extra motivation for farmers to choose for cultivation some of the experimented hybrids;
- The climatic conditions of the years had powerful influenced the both stages of rapeseed: the vegetative and generative ones;
- The blooming period was broadly within the usual range for rapeseed, with a large interval registered in 2017, of over 40 days due the climatic regime;
- A short period of maturity was appreciated to the rapeseeds hybrids and from this point of view the tested assortment prove to be very valuable, in the harvest time the levels of humidity of seeds being around the STAS values on all hybrids;
- The level of yields have been in all years very competitive for the tested area, with high efficiency and most of them with stability of productions that the hybrids registered. The average of the three years was over 4.5 tones/ha, which in the conditions of South of Romania represent a very valuable and efficient level.
- The most productive and stabile hybrids proved to be Jason, Mercure and Neptune with yields, in average, around 5 tonnes/ha.

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