"The Influence of Certain Climate Parameters on the Yield and Oil Content in Seed of Rapeseed"

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Abstract

Increase of vegetable oils production is a consequence of the increase of nutrition needs and biofuel production. Rapeseed is one of the most important oil species and is the third most important source of vegetable oil production in the world. Seed price, yield and seed oil content are major factors why manufacturers decide to produce rapeseed.

The aim of this paper is to obtain necessary information in all segments of breeding and production of rapeseed.

Five different rapeseed genotypes are used in the experiment. Examined is the influence of precipitation and average monthly temperature during vegetation on yield and oil content in seed of rapeseed.

Key words: climate factors, oil content, rapeseed, seed, yield

Introduction

Rapeseed is an important species from *Brassica* genus and high value crop for oil industries (Sadat et al., 2010). It is the third most important source of vegetable oil production in the world. Level of profitability in rapeseed production, as well as market situation, determine whether farmers will choose to produce it or not (Marjanović-Jeromela et al. 2009). Stable production of rapeseed depends on the higher number of factors. Considering that only variety and hybrids of rapeseed with high genetic potential are used in the production today, as for yield (over 5t per acre) so for the oil content (between 45 and 50%) in seed, as well as that serious manufacturers apply adequate (specialized sowing machines, chemical treatment, harvest and other) and opportune (application within optimal deadlines) agricultural engineering, it can be concluded that stable production of rapeseed is significantly influenced by various climate factors. According to Bray et al. (2000), the relative decreases in maximum crop potential yield (i.e., yield under ideal conditions) associated with abiotic stress vary between 54-82%.

Among the most important are amount and distribution of precipitation, air and soil temperature during vegetation, etc. Marjanović-Jeromela et al. (2002) ascertained that climate factors influence high oil content, especially in the phase of grain filling. The same authors further conclude that high oil content is primarily conditioned by low temperatures and precipitation in the spring.

New varieties are tested in different environmental conditions (year, locality) with the aim of selecting the variety and recommending the producers the variety for sowing.

Interaction of genotypes and the environment complicates agroeconomic and breeding research, since the value of a trait cannot be considered only on the basis of major effects: genotype and environment (Marjanović-Jeromela et al. 2011). Interaction makes it difficult to recommend varieties for a certain region, i.e., specific environment (Ebdon and Gauch, 2002).

We observed given results of yield and oil content in rapeseed among several genotypes to determined influence and interaction between locality and tested varieties of rapeseed.

Material and method

Testing took place on two localities in the Republic of Srpska, Bosnia and Herzegovina (Bijeljina and Brčko) in 2009/2010 production year. Five different rapeseed genotypes were tested. The experiment was laid out in three replications. Determining seed yield of certain genotypes was performed on an experimental plot while oil content was being determined in the laboratory of Oil Crops Department of the Institute of Field and Vegetable Crops Novi Sad.

During research, the following parameters were used:

1. Climate factors – determined on the basis of data obtained from the Federal Hydro Meteorological Institute for areas of Bijeljina and Brčko.

2. Seed yield – determining seed yield of certain genotypes was performed on experimental plot for each observed replication. Yield of rapeseed was expressed in relative value.
3. Seed oil content – seed samples from which oil content was determined by the conventional method by Ruskovski and expressed in relative values were taken from each replication.

GENSTAT computer program was used for the analysis of variance of two level factorial experiment.

Research results

Obtained seed yield – acquired results on the first locality show that seed yield of the observed genotypes was ranging from 1813 kg/ha for G-5 to the highest yield determined for genotype G-3 - 2677 kg/ha (Table 1). In the second locality, the lowest seed yield was determined for genotype G-2 (1830 kg/ha) while the highest yield was accomplished with G-3 (2410 kg/ha) (Table 1).

Table 1 – Obtained seed yield in the observed localities

Genotype	Obtained seed yield (kg/ha)		**Average**
	Locality I	Locality II	
G-1	2343	1973	**2158**
G-2	2513	1830	**2172**
G-3	2677	2410	**2543**
G-4	2017	2133	**2075**
G-5	1813	1863	**1838**
Average	**2273**	**2042**	**2157**

LSD	Yield		
	Genotype	Locality	Locality x genotype
1%	97.2	61.5	137.5
5%	71.0	44.9	100.4

On the basis of obtained seed yield, highly significant differences were determined between differences of G-3, G-4 and G-5 genotypes with respect to all the observed genotypes. Statistically significant difference was determined by observing G-4 and G-2 genotypes. No significant differences were determined by comparing G-1 and G-2 i.e., G-1 and G-4 genotypes. On the basis of obtained results, highly significant difference was determined between obtained yields in the localities. If interaction locality x genotype is observed, highly significant differences are being determined between all the observed genotypes in locality I. In locality II, highly significant differences between all the observed genotypes were also determined, except if genotypes G-2 and G-5 are being compared. There are no statistically significant differences between these two genotypes regarding obtained seed yield.

Oil content in seed – As for oil content and seed yield, lower values in the second locality were determined with respect to the first locality (Table 1 and 2). Obtained oil content in seed of rapeseed in the first locality ranged from 46.13% to 49.36%. The lowest oil content was determined in G-2, while G-4 had the highest oil content in seed (Table 2). As in the first locality, genotype G-2 in Bijeljina locality accomplished the lowest oil content (43.15%) while G-4 achieved the highest oil content in seed of rapeseed (46.94%) (Table 2). This genotype had the highest oil content in the first locality as well.

Table 2 Obtained oil content in seed in the observed localities

Genotype	Oil content in seed (%)		**Average**
	Locality I	Locality II	
G-1	48.39	45.49	**46.94**
G-2	46.13	43.15	**44.64**
G-3	46.77	43.84	**45.30**
G-4	49.36	46.94	**48.15**
G-5	46.28	43.26	**44.77**
Average	**47.39**	**44.54**	**45.96**

LSD	Oil content		
	Genotype	Locality	Locality x genotype
1%	0.684	0.433	0.968
5%	0.499	0.316	0.707

On the basis of determined oil content in seed and comparison of the obtained results it is determined that there is a highly significant difference with all observed genotypes. Significant difference, at the level of 5%, is determined during comparison of G-3 and G-5 genotypes, while by comparing G-2 and G-5 genotypes, statistically significant difference was not determined. If one compares average results obtained on the level of localities, a conclusion arises that there is a highly significant difference between the observed parameters. By comparing the results obtained in the locality, it was determined that there are no statistically significant differences between G-2, G-3 and G-5 genotypes. Significant difference of 5% was determined during comparison of G-1 and G-4 genotypes. By comparing these two genotypes with the rest of the genotypes, highly significant difference was determined. By observing the second locality, one reaches the same conclusion as in the second locality if we compare G-2, G-3 and G-5 genotypes. As opposed to the first locality, highly significant difference was determined here between G-1 and G-4 genotypes as during comparison of these two genotypes with the rest of the observed genotypes.

Lack of moisture and high temperature at the time of sowing, as well as low temperatures and high precipitation during April and May at the time of flowering and grain filling had an influence on varieties not to fulfill genetic potential for the yield (reduction of yield), while the obtained oil content in seed remained on the level of long-term average. On the basis of obtained results, influence of bad meteorological conditions was determined on the obtained yield of rapeseed seed during vegetation (site of the Federal Hydro Meteorological Institute of the Republic of Srpska). Marjanović-Jeromela et al. (2007, 2011) reached a similar conclusion in their research. In his doctoral dissertation, Balalić (2009) concludes that beside influence of the environment and choice of varieties, i.e., hybrids, locality has a high influence on obtained yield as well. Similar results were also obtained by Radić (2008) in his doctoral dissertation. Influence of meteorological conditions on oil content was not as influential as locality on oil content was. Obtained yield implies that varieties of rapeseed can have good yield despite bad meteorological conditions during vegetation. Determined oil content in seed of rapeseed varieties is on an enviable level and does not lapse in oil content which is obtained by some rapeseed hybrids.

On the basis of acquired results of the obtained rapeseed yield it can be concluded that there is a significant influence of locality on the choice of varieties, i.e., hybrids. Thereat, it is necessary to make an arrangement of varieties, i.e., hybrids for certain localities.

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