THE EFFECT OF VARIETY AND SOWING DATE ON OILSEED RAPE YIELD AND QUALITY

J. Crnobarac[1], B. Marinković[1], A. Jeromela-Marjanović[2], I. Balalić[2], G. Jaćimović[1], D. Latković[1]

[1] University of Novi Sad, Faculty of Agriculture, Dositej Obradovic Sq. 8, 21000 Novi Sad, Serbia

[2] Institute of Field and Vegetable Crops, Maxim Gorky Sq. 30, 21000 Novi Sad, Serbia

1. INTRODUCTION

Oilseed rape (Brassica napus L.) is one of the main oil crops in the world. The winter form is the most common rapeseed grown in Europe (Berry and Spink, 2006). This form has higher and more stable yield than the spring one does. Autumn sowing plants were taller, oil content was higher and days to flowering were more than doubled (Adamsen, 2005)

Considering sowing date of winter oilseed rape, next objectives should be taken into account: early uniform emergence; ensuring adequate growth to protect against early winter frosts; and ensuring that the leaf area index and taproot reserves after winter are sufficient to allow the crop to start growing quickly in spring. Date of sowing depends on latitude and the date of onset of winter (Rathke et al. 2006). European growing techniques of winter oilseed rape are almost the same, with the exception of the time of the sowing, which ranges from 1 August to 10 September. Moreover, a number of environmental factors interact with optimum sowing like soil temperature and moisture level affecting seedbed preparation and germination and also on temperature during the crops' reproductive stage, and disease occurrence. If the weather conditions during emergence and autumn growth period of oilseed rape were different, the same weather conditions in spring affect the plants with differently developed roots, and this influences their ability to uptake nutrients from the soil and synthesizes metabolites that at later stages are processed into storage compounds accumulated by the seed. Morrison and Stewart (2002) observed that flowering of rape is inhibited above 27 ^{o}C and planting date may be important to avoid high temperatures at the end of the growing season.

Sowing date is critical in cold climates due to the potential of frost damage both early and late in the winter season. It is proven that oilseed rape over-winter survival depended on the biometrical indicators of the rosette (number of leaves - 6 to 8 true-leaf stage, root collar thickness - is 8 to10 mm, and apical bud height - less than 30 mm) and its chemical composition (dry matter and total sugar contents), as well as on the sum of temperatures ≥+2°C. (Velička et al. 2012). Overwintering depends on numbers of growing-degree-days (base 5 ^{o}C) in the autumn vegetative period. Three years' data from Estonia, the most northern border for growing winter oil seed rape, showed that in the autumn period plants need 416 GDD (15.august) for developing a strong root system and to prepare for wintering. (Laaniste et al. 2007). More than 500 or less than 400 GDD means that the percentage of overwintered plants is less than 50%. Concerning seed yield, for Estonian condition a mid August sowing date is also optimal (Laaniste et al. 2008). But in the south, in Macedonia, the results showed that all genotypes achieved the significant heights plants, the most number of branches on plant and number of seeds in pod, the largest weight on 1000 seeds, the largest seed yield and oil content in seed in the seeding date of mid September (Spirkovska, 2014)

Bringing flowering forward into cooler days (for with 7 days) will increase the number of days required to achieve the 300 ^{o}C period over which, seed number is determined which will increase the radiation received during this period by about 2% (Berry and Spink, 2006). But extensive trials in Germany showed that drilling 2 weeks earlier (late August compared with early September) reduced yields by 0.1 to 0.2 t/ha (Baer and Frauen, 2003). Rape crops sown too early, in very favourable conditions in the autumn, tend to overgrow; the stem starts to grow, which makes the apical point sensitive to winter colds. Oilseed rape crops sown at late dates were not able to properly develop in autumn and consequently prepare for wintering, which determined a much poorer development in spring. Plants should be established early enough to provide complete ground cover by November, to

optimize winter survival and control erosion. When soil moisture is low, seeding should be done at the recommended dates instead of waiting for wetter conditions at a later date. Often higher seeding rates are used when seeding late into cool or dry soil conditions to compensate for potential stand reductions (Moore and Guy, 1997)

The aim of the study was to evaluate the effect of winter rapeseed sowing time in Serbia

2. MATERIALS AND METHODS

Field trials were conducted, during four years, at Institute of field and vegetable crops, 45°19' N, 19 ° 49' E, altitude 70 m, on a chernozem soil type. In a split-plot design, there were three sowing date (20.VIII, 01.IX and 10.IX) as the main plot and four varieties (Jet Neuf, Banacanka, Samuraj and Falcon) as the sub-plot (4m *1.7m), with four replication. This paper presents data of seed yield with 9,5% of moisture and oil content.

Data processed by ANOVA, using software MSTATC, Model 20, combined over year. LSD for 5% of probability used for testing significance of differences. The effect of each treatment /interaction was assessed by its partitioning in their total sum of squares.

3. RESULTS AND DISCUSSIONS

According to F-test high significant effect ($p<0.01$) on seed yield had year and variety while significant effect had interactions year*variety and date*variety. All other interactions and even sowing date had a nonsignificant effect (table 1). The partitioning of those significant effects in total sum of squares were 75, 5, 5 and 4%, respectively. It means that year had the most prominent effect, while variety and double interactions had much less and to each other similar effect.

Significantly lowest yield of only 664 kg/ha was in year 2002/3 because of poor overwintering, while in 2001/2 (1632) and 2005/6 (1678) were the highest without significant difference. The highest yield had variety Jet Neuf (1416 kg/ha), and it was significantly higher than varieties Samuraj and Falcon. Domestic variety Sremica had significantly higher yield than Samuraj. Variety Jet Neuf had the highest, while variety Samuraj had the lowest yield in 3 out of 4 years. Variety Sremica was always on second or third place, while Falcon had the most unstable seed yield. Concerning interaction sowing date*variety, Jet Neuf had the highest yield in the third sowing date, while other three varieties in second sowing date.

According to F-test high significant effect ($p<0.01$) on oil content had year, variety and double interaction year*variety while all other interactions and even sowing date had a non-significant effect (table 2). The partitioning of those significant effects in total sum of squares were 49, 9 and 24% respectively. It means that year had the most prominent effect on oil content, but less than on seed yield (75 and 49 respectively). The effect of variety and especially double interactions year*variety were higher on oil content than on seed yield. Sowing date had lower influence on oil content than on seed yield because double interactions of variety*sowing date was non-significant.

Significantly lowest oil content of only 38.9% was in year 2002/3, while in 2004/5 was the highest (49.8%). The difference in average oil content between this two year was even 10,8%. On four year average significantly highest oil content had variety Jet Neuf (48,0%). There were no significant differences in oil content between other varieties and it ranged were from 43,6% to 44,5%.

Variety Jet Neuf had the highest oil content in each year, while variety Samuraj had the lowest yield in 3 out of 4 years. Variety Sremica was on second place and variety Falcon on third place, in 3 out of 4 years. If we compare range of oil content between sowing dates in each variety, the lowest was in Jet Neuf 0.8% and the highest in Samuraj 4.8% (45,9%-41,1%).

Table 1. The effect of sowing date and variety on oilseed rape seed yield

Year (Y)	Sowing date (D)	Variety (V)				Average Y*D	Average Y
		Jet Neuf	Sremica	Samuraj	Falcon		
2001/2	20.VIII	1658	1918	1385	1254	1554	1632
	01.IX	1608	1814	1864	1494	1695	
	10.IX	2516	1440	1307	1330	1648	
	Average Y*V	1927	1724	1519	1359		
2002/3	20.VIII	778	669	350	650	612	664
	01.IX	744	895	437	727	701	
	10.IX	960	794	290	679	681	
	Average Y*V	827	786	359	685		
2004/5	20.VIII	1212	1123	995	969	1075	1110
	01.IX	1058	1071	1090	1268	1122	
	10.IX	1152	1082	1175	1118	1132	
	Average Y*V	1141	1092	1086	1119		
2005/6	20.VIII	1873	1537	1537	2232	1795	1678
	01.IX	1706	1680	1798	1822	1752	
	10.IX	1723	1641	1295	1288	1487	
	Average Y*V	1767	1620	1543	1781	Average D	
Average D*V	20.VIII	1380	1312	1067	1276	1259	
	01.IX	1279	1365	1297	1328	1317	
	10.IX	1588	1239	1017	1104	1237	
	Average V	1416	1305	1127	1236		

	Y	D	V	Y*D	Y*V	D*V	Y*D*V
F-prob	**	ns	**	ns	*	*	ns
LSD 5%	168	145	142	291	294	255	510

Table 2. The effect of sowing date and variety on oilseed rape oil content

Year (Y)	Sowing date (D)	Variety (V)				Average Y*D	Average Y
		Jet Neuf	Sremica	Samuraj	Falcon		
2001/2	20.VIII	48,1	42,7	45,0	45,8	45,4	44,9
	01.IX	47,5	42,3	45,1	44,7	44,9	
	10.IX	46,7	43,0	44,8	43,2	44,4	
	Average Y*V	47,4	42,7	45,0	44,5		
2002/3	20.VIII	46,7	43,1	41,1	42,0	43,2	38,9
	01.IX	46,3	42,6	21,4	32,8	35,8	
	10.IX	46,2	42,6	31,1	31,2	37,8	
	Average Y*V	46,4	42,8	31,2	35,3		
2004/5	20.VIII	50,7	45,7	49,4	50,6	49,1	49,8
	01.IX	51,4	47,8	49,7	50,3	49,8	
	10.IX	51,0	48,5	51,0	51,6	50,5	
	Average Y*V	51,0	47,3	50,0	50,8		
2005/6	20.VIII	45,8	44,6	48,1	45,8	46,1	46,7
	01.IX	47,5	45,1	48,1	45,7	46,6	
	10.IX	47,7	45,8	48,2	47,3	47,3	
	Average Y*V	47,0	45,2	48,1	46,3	Average D	
Average D*V	20.VIII	47,8	44,0	45,9	46,1	46,0	
	01.IX	48,2	44,5	41,1	43,4	44,3	
	10.IX	47,9	45,0	43,8	43,3	45,0	
	Average V	48,0	44,5	43,6	44,3		

	Y	D	V	Y*D	Y*V	D*V	Y*D*V
F-prob	**	ns	**	ns	**	ns	ns
LSD 5%	3,4	3,0	2,4	5,9	5,2	4,5	9,1

4. CONCLUSIONS

According to the results of four year oilseed rape field trials in Serbia:

- There are no significant differences in seed yield and oil content between sowing dates from end of August to the beginning of September.
- Year or environment had the most prominent effect on seed yield and oil content. Difference in seed yield was 1014 kg/ha and in oil content 10,8%.
- Domestic variety Sremica was just after variety Jet Neuf, which had significantly highest seed yield and oil content.

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