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THE OPTIMUM DENSITY FOR WINTER RAPE UNDER SUCEAVA PLATEAU CONDITIONS

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Abstract:*Important autumn oilseed rape has been bred considerably in the last period as a result of the fact that it provides raw materials for the manufacture of oil, which is an alternative to unconventional fossil sources of energy, as well as for themaking ofsome oils of superior quality used in human nutrition and not only.*
The experimental results from Suceavaarea during the period 2011-2012 regardingtwo winter rape genotypes bred at different densities are presented. The results show that at lower densities, the collum development is better and an increased resistance to wintering of the rape plant is noticed. At lower densities, higher plants, with a great number of branches per plant and a greater number of seeds and capsule per plant havebeen obtained. The largest grain production was achieved in both genotypes at the density of 50 plants/ m^2.

Keywords:*rape genotypes, grain production, annual precipitation, plants'densities*

1. Introduction

Three field trials and one greenhouse trial were conducted from 2008 to 2010 at two locations in South West and Northern Germany to assess the effect of cultivar, location and year on dormancy characteristics of open-pollinated winter oilseed rape cultivars. A simple selection was performed in the field and in the greenhouse for low-dormant individual plants, and the offspring of these plants (potential volunteers) were tested for the stability of the trait under field conditions [1].
Due to the high demand for rape, the profitability of its culture on surface unit,as well as any special requirementsfor these cultivars to be grown and developed under the conditions from the Big Island of Braila, makes this culture adapted in this area, which has been temporarily excluded from the agricultural circuit for many years to come.
By continuous improvement of this technology crops with a view to obtaining maximum yields and performance from all points of view, it must be clear, accurate and flexible [2].
Winter rape cropwas introduced recently in the Suceava Plateau area and the technological elements were accordingly to those recommended in areas where this crop was introduced some time ago, or even from the recommendations of seed production companies [3].
This crop tends to expand in this area because the new used hybrids have a high resistance to frost, the losses during the winter being very small and in good

technical conditions high yields per hectare are obtained.
The importance of these crops for the big output derives from the fact that there are in the first place certainties of capitalization at competitive prices, production settlement shall be carried out immediately before wheat, while, at the same time profitability much higher than other agricultural crops [4].
For old varieties, the following recommendation is made:to use the density of 150-200 plants /ha, whereas for new hybrids, the density recommended being much lower, namely 35-60 plants/m ^{2}.
The behavior regarding density is different from hybrid to hybrid depending on the plant height and capacity of the branch, which leads to research on different varieties, as the recommendation of the crop density on different genotypes could be made [5].

2. Materials and methods

The experiment was set on *faeoziomchernozem* soil with a clay content of 31.6% in the 0-20 cm layer, weakly acidic with a pH in water of 5.6 to 5.8, a humus content of 3.0% and medium stocked in phosphorus (32 ppm) and potassium (150 ppm). The conditions from the experimental period (2011-2012) are shown in Table 1.
The average annual temperature was 8.40^oC in 2010/2011 and 9.30^o C in *2011/2012*, being with 0.60^{o}C and respectively 1.5 higher than the annual average.
The average monthly temperature in both years was higher than the annual average during the entire period, with values between 0.5 and 4.40^o C, except for the months of October and February when it was lower than 1.60^o C and 3.30^o Crespectively [6].
Annual precipitation totalized 678.8 mm in the first year and 469.4mm in the second one, their average being lower than the annual average with 11.7 mm [7]. In autumn, (September and October) and in spring (March, April) the monthlyprecipitation average was higher than the annual one, while in the other months the rainfall was lower than the annual average.
The experiment was bi-factorial, with the following graduations:

Factor A – Advanced cultivar or hybrid
a_1 – Scelni CS mid-sized and medium branching
a_2 –TriptiCS high sized and very good branching

Factor B-plant density with 5 levels
b_1= 30 plants /m^2
b_2= 40 plants/ m^2
b_3=50 plants/ m^2
b_4=60 plants/ m^2
b_5= 70 plants/ m^2

The aim of this work is to ensure optimum density of oilseed rape fall under the conditions of north of the country, having regard to climatic conditions.
The seeding was carried out at a distance of 25cm between rows, with a larger quantity of seeds, of 5kg/ha. After emergence, the plants have been depleted by 13, 10, 8, 7, 6 cm distances to provide the proposed densities aimed at by experiments. In autumn and spring the counting was done in order to determine the losses over winter (Fig. 1).
During the growing season, observations were made concerning the diameter of the collum, plant height, the height of insertion of the first branch, the number of branches, the number of capsules/plant, the average number of seeds/capsule and seed production/ha.

Table 1.

Climatic conditions in the period 2011-2012 at ARDS Suceava

Specify	VIII 2011	IX 2011	X 2011	XI 2011	XII 2011	I 2012	II 2012	III 2012	IV 2012	V 2012	VI 2012	VII 2012	Average or total
Precipitation (mm)													
Decade I	23.3	23.6	7.2	0.6	0.3	0.9	9.9	4.3	**14.8**	**1.6**	**26.9**	**1.9**	
Decade II	0.1	0.4	7.3	0.3	10.4	5.6	4.6	5.4	**45.9**	**36.8**	**13.1**	**34.2**	
Decade III	-	2.8	2.8	-	1.4	17.7	5.7	3.4	**29.8**	**42.7**	**6.3**	**12.9**	
Monthly total	23.4	26.8	17.3	0.9	15.4	24.2	20.2	13.1	**90.5**	**81.1**	**46.3**	**49.0**	**457.2**
Annual Average	62.8	40.8	29.5	30.6	26.5	24.2	25.6	36.2	**48.2**	**80.2**	**93.6**	**88.6**	**586.8**
Standard deviation ±	-39.4	-14.0	-12.2	-29.7	-11.1	0.0	-5.4	-23.1	**+42.3**	**+0.9**	**-47.3**	**-39.6**	**-129.6**
Temperature (^{0}C)													
Decade I	18.6	14.8	13.3	4.5	4.4	1.5	-17.0	-2.8	**6.7**	**15.7**	**18.4**	**24.6**	
Decade II	19.2	18.1	5.5	0.4	1.5	-2.6	-9.7	4.9	**9.0**	**13.0**	**20.6**	**20.8**	
Decade III	19.4	14.5	3.9	0.8	-1.2	-8.4	-1.2	7.9	**15.1**	**15.7**	**20.1**	**22.5**	
Monthly total	19.1	15.8	7.6	1.9	1.5	3.2	-9.3	3.3	**10.3**	**14.8**	**19.7**	**27.2**	**9.2**
Annual Average	18.3	14.2	8.4	2.4	-1.9	-4.1	-2.9	1.2	**0.8**	**13.7**	**16.9**	**18.4**	**7.1**
Standard deviation ±	+0.8	+1.6	-0.8	-0.8	+3.4	+7.3	-6.4	+2.1	**+2.3**	**+1.1**	**+2.8**	**+4.3**	**+2.1**

ARDS Suceava

Fig. 1 Location of experiment in the experimental field at ARDS Suceava

3. Results and Discussion

a) Winter resistance

Before enteringthe dormant period, the plants' number in one row and plants' number/plot were counted. In spring, after the beginning of vegetation, the same plants were counted; the percentage of dead plants due to winter conditions was determined. The data in Table 2 show relatively low losses in the two experiment years at this crop. The winter conditions were difficult, the temperatures were very low, and namely bellow -31^{o}C in 2012, but the plants have survived very well because they were covered with a thick layer of snow. The two testedgenotypeshad small losses, the variety ScelniSC up to 7.2% and 12.3% the variety Tripti CS. Also we noticed that the smallest losses were registered by the plants oflow densities. The losses were higher when the plants'densities have been increased, reaching more than double at the plants' highest densities. The reason is due to the development of autumn plants,plants' low densities caused the plants to develop their foliage system better and the collum was developed better containing many more reserve substances, thusproviding passage over winter in good conditions.

Table 2

Frost resistance of winter rape by plant densities

Genotype	Density (pl number/m^2)	Losses over winter (%)			
		2011	2012	Average 2011-2012	Average on genotype
Scelni CS	30	4.0	-	2.0	7.2
	40	5.0	5.5	5.2	
	50	7.2	8.4	7.8	
	60	8.5	10.0	9.3	
	70	10.2	12.5	11.5	
Trepti CS	30	5.5	7.2	6.4	12.3
	40	8.2	10.4	9.3	
	50	10.6	13.5	12.1	
	60	17.0	15.5	16.3	
	70	17.5	17.0	17.2	

b) Plant growing

During the growing season we made a series of observations concerning plant development in two varieties of rape: collum diameter, plant height, and number of branches, number of capsules/ plant and the average number of seeds in a capsule (Table 3).

- *Collum diameter* was primarily influenced by plant density and less by genotype. So at the variety Scelni, the collum diameter was 10.6 mm to the density, 70 plants/m^2, and 14.4mm at 30 plants /m^2 and at the variety Trepti, the collum diameter was 10 mm at density 70 plants/m^2 and 13.9 mm at a density of 30 plants/ m^2. The collum diameter is important in order to create a support base for future plant and resistance to harsh conditions during winter time.

-*Plant height* of winter rape was between 127 cm and 142 cm in variety Scelni and between 165 cm to 137cm in Tripti variety and at higher densities the plant height was lower. On the other hand the height of the insertion of the first branches of the two genotypes was higher in higher densities.

- *The number* of branches was higher at fewer densities, ranging from 5 to 10.8 for Scelni variety and between 8.3 and 12.5 for the other variety.

- *Number of capsules/ plant* was 139 capsules/plant at density of 30 plants/m^2 at the variety Scelni, and decreased to 64 capsule at a density of 70 plants/m^2, at the variety Tripti, number of capsule per plant was 156 at the density of 30 plants/$m^2$and continuously decreased to 100 capsules/plant at density of 70 plants/m^2.

- *The average number of seeds* in a capsule in both varieties was higher at low densities (24 to 24.6) and lower at higher densities (19-20).

Table 3

Biometric measurements at winter rape hybrids according to density

(Average of the years 2011-2012)

Geno-type	Density Plants/m^2	Collum diameter (mm)	Plant height (cm)	The height of insertion of the first branch (cm)	Number of branches	Number of capsules/ plant	Medium number of seeds in a capsule
Scelni CS	30	14.4	142	58.8	10.8	139	24.6
	40	13.2	139	59.0	10.4	148	25.4
	50	13.0	128	58.9	10.4	126	24.6
	60	12.8	127	63.4	6.4	90	21.6
	70	10.6	127	73.4	5.0	64	20.0
Tripti CS	30	13.9	165	60.0	12.5	156	24.0
	40	12.8	158	65.0	11.4	152	23.0
	50	12.8	142	65.5	10.9	146	20.0
	60	11.6	140	72.0	8.5	120	20.0
	70	10.0	137	80.0	8.3	100	19.0

c) The yield of seeds in the two varieties of winter rape according to plant densities is shown in Table 4. High potential for production of the varietyTripti (3573 kg / ha) in comparison with the varietyScelmi (3187 kg/ha) can be noticed.

Table 4

The yield of seeds (kg/ha)

Genotype	Density (pl/m^2)	The yield of seeds (kg/ha)					
		2011	2012	Ave-rage	Diferences		
					kg/ha	%	Signification
Scelni CS	30	2880	2700	2790	-397	87	00
	40	3560	3180	3370	183	106	
	50	3840	3280	3560	373	112	xx
	60	3260	3025	3143	-44	99	
	70	3340	2804	3072	-115	96	
The average of the variety		3376	2998	3187	-	100	
Trepti CS	30	3220	2017	3019	-554	84	000
	40	4150	3285	3718	145	104	
	50	4060	3876	3968	395	111	xx
	60	3850	3514	3682	109	103	
	70	3615	3340	3478	-95	97	
The average of the variety		3779	3366	3573	-	100	
		DL 5 %			203		
		DL 1 %			304		
		DL 0.1 %			407		

The two varieties grown at different densities, have produced the highest yield of seeds at the density of 50 plants/ m^2, being of 3560 kg / ha for Scelni and 3968 kg/ha for Tripti. The yield increased in both varieties, being statistically assured. By increasing the rape density, an yielddecrease was registered at the cultivars ScelniandTripti, more exactly the greatest decrease being noticed at the density of 30 plants/m^2, the absolute value of this reduction was the following:397 kg/ha and 554 kg/ha.

4. Conclusion

In the two experiment years, the winter rape genotypes, Scelni and Trepti, behaved differently to the wintering conditions, depending on density. The biggest losses in the variety Tripti were recorded at lower densities; the plants were well developed, registering lower losses over winter period.

The winter rape plants' density influenced their development, in the sense that at the lower densities the collum diameter, plant height and the number of branches were bigger, and the height of the main branches was lower. Production information: the number of capsules/plant and the number of seeds per plant were larger at low densities.

The highest losses were registeredat the density of 50 plants/m^2.When the density varied between 40 and 60 plants /m^2, the losses were statistically assured. The biggest losses were recorded at the density of 30 plants /m^2,taking into consideration that the optimum density of autumn rape culture is to be determined according to the area to be bred in.

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