THE INFLUENCE OF CULTIVATION, FERTILIZATION AND PLANTING DENSITY ON BIOMETRIC INDICATORS OF AUTUMN RAPE (*BRASSICA NAPUS* L. SSP.OLEIFERA METZG)

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Abstract

To establish the influence of some factors on biometric identifiers of autumn rape were tested at SCDCB - Mures, in 2004-2007, more rape cultivations for autumn sown at different densities and that were administered different doses and combinations of chemical fertilizers.
In autumn rape, when analyzed separately the influence of those three factors, the results are not very convincing, while the interaction of factors is very promising for growers.
The interaction between the investigated factors determined the following maximum values: plant height in limestone. Digger bg/m^2 x 100 x N60, with 155.94 cm, the largest number of branches per plant was found in variant bg/m^2 Digger x 100 x N90P90K90 - of 6.93 branches / plant, the largest number of capsules per plant was formed in limestone. Valesca x 100 x N90P90K90 with 214.81 bg/m^2 capsules, number of seeds / capsule is constantly oscillating between 21.81 and 26.95 seeds / capsule, seed weight per plant ranged from 1.10 g lime. Kardinal x bg/m^2 x 100 x N0P0K0 and 7.29 g lime. Kardinal x 300 x N0P0K0 b.g./m^2.

Keywords: rape, biometric indicators, cultivation, sowing density, fertilization.

The improvement of rape recorded great achievements in recent years, both in terms of increasing the productive potential of an impressive number of cultivation in November, especially the growth of the seed. Seed quality was profoundly changed, as raw material for extraction of cooking oil and Oil cake in terms of quality protein for animal feeding. It is already known that rapeseed oil can be utilized not only for human consumption but also for obtaining bio-fuel.

Some recent research aimed at finding solutions to stimulate and intensify the pursuit of growth phase (autumn or spring).

A number of growth regulators applied to seeds were tested, in soil or on young plants (at different climatic conditions) in terms of the effect on recently sprouted plants, but also on the formation of the production component, output, content in different acids and even the behavior of seed storage, and some of them have acted in certain incentive levels in all directions (Mondale, RI and others, 1996).

The experiences organized S.C.D.C.B. - Mures have used growth regulators (Cycogan, Atonik) out of winter rape to boost start in growth (especially stem elongation), because, due to climatic conditions plant growth have slowed down and this phase was prolonged.

Biometric measurements are needed for enhanced research, because they relate to components of productivity and can thus be interpreted as direct or indirect effect on some factors on seed production, knowing the correlation between the components of biomass productivity and total production and / or primary production (Zamfirescu, N., 1977).

Rape is considered by many authors as:

- Plant size (height strains);
- Number of branches per plant (from which fertile);
- Capsule number / plant;
- Number of seeds / capsule;
- Capsules dimensions (length, diameter);
- Seed weight / plant etc.

Several authors have found a positive correlation between the above components and production of seed / ha (Ozer, H., etc. - 1999 - Turkey, Anil Kumar, etc. - in 1998, India), but most find that MMB is most closely correlated with seed production and seed oil percentage.

In turn, these production components, although sometimes quite different from one variety to another, may be modified, as already stated in Chapter I, the external environmental factors and the influence of several technological factors.

Montvillas, R. (1999 - Lithuania) notes that if the density of plants, does not influence too much the number of leaves and their size, it affects very significantly the number of capsules / plant that decreases with increasing density of 18-44%, 2 4 kg / ha seed varieties and the autumn variety interacts significantly with density in this respect.

Kuchtova, P., and Vasak, J. (1998 - Czech Republic) have found that along with density, a particular importance to the sowing period of autumn rape, have the fertilizers N, B and Mo in the formation and reduction of organ generation (capsules, seeds).

With the Secuieni, Neamt, Beer N. (1998) found that planting dates, and climatic conditions may influence not only the length of the growing phase, but also the processes that contributes to harvest and lead to changes in the number of capsules per plant and average number of seeds per capsules.

MATERIAL AND METHOD

To establish the influence of some factors on the biometric identifiers of autumn rape have been tried, in 2004-2007, several rape cultivation for autumn, sown at different densities and administered different doses and combinations of chemical fertilizers.

Factors experienced in autumn rape were:

- **Factor A** - fertilization with 4 graduations:
  - o a_1 - N0P0K0, a3 - N60P60K0;
  - o a_2 - N60P0K0, A4 - N90P90K90.
- **Factor B** - Variety rape three graduations:
  - o b_1 - variety Valesca (2004-2007);
  - o b_2 - variety Digger (2004 to 2006), Vectra (2006-2007);
  - o b_3 - Kardinal variety (2004-2007).
- **Factor C** - sowing density three graduations:
  - o c_1 - 100 bg/m^2;
  - o c_2 - 200 bg/m^2;
  - o c_3 - 300 bg/m^2.

The experiment was done following the method of "Parcel subdivided for polifactoriale experiences". The type of soil that was placed in the rape culture experiment was a luvosol stagnogleizat In the organized experiment biometric observations were made, such as measuring the average height of plants at harvest, the average number of branches per plant, average number of capsules / plant, average number of seeds in capsules (all at harvest), seed weight per plant. Observations were made on 10 plants taken randomly.

RESULTS AND DISCUSSIONS

Analyzing the experimental data from *table 1* concerning the influence of cultivar, the sowing density and fertilization on biometric indicators were found as follows:

Of the three cultivation, the greatest height was a Digger with 147.04 cm Kardinal variety having the lowest height - 141.34 cm difference from the control variety (Valesca) is statistically assured (4.64 cm). Largest number of branches - 6.25 was recorded in Digger variety, which had the greatest height, and the highest number of capsules per plant (163.48), the difference from the Valesca variety being very significant.

The number of seeds in capsule did not make a significant difference, oscillating between 24.51 and 24.84. Although the average weight of seeds per plant, does not significantly differ, it still exists, Digger variety having seeds per plant 11.06 g, 10.27 g to 10.62 g Valesca and Kardinal varieties.

The influence of sowing density (*table 1*) was observed in all biometric identifiers. The plant height and density is significantly reduced increased with the growth of density from100 to 300 bg/m^2 bg/m^2 200 bg/m^2, the number of branches decreases with the sowing density increase, so does the number of capsules, of seeds in the capsules and the weight of the seeds per plant, with statistical provided differences, with the exception of the number of seeds in capsule which was more stable, and the differences were not statistically assured.

The influence of fertilization (*table 1*) stimulated positively, with statistical differences, the plant height and number per plant, and the differences were not statistically assured for the number of branches / pl., the number of seeds / capsule and seed weight per plant. We can not explain the decrease in seed weight per plant of control fertilized variant, the fertilized variants, which finally gave higher production per unit area.

Investigated factors influence the interaction averaged over three agricultural years (2004-2007) was manifested differently, with positive and negative deviations from the version control - Valesca variety bg/m^2 100 x N0P0K0 (*table 2*).

Highest plant height was recorded on the version bg/m^2 Digger x 100 cm x N60P0K0 with 155.94, followed by the version Vlesca x 100 x N90P90K90 bg/m^2 with 152.81 cm high.

The shorter plants were recorded under the version bg/m^2 Kardinal x 300 x 135.73 cm N60P0K0 with variant Kardinal x 300 x N60P60K0 bg/m^2 with 135.81 cm.

Highest number of branches per plant, 6.93, was found in variant Digger x 100 x $N_{90}P_{90}K_{90}$ bg/m^2 and lowest in variant bg/m^2 Kardinal x 300 x $N_{60}P_{60}K_0$, with 4.73 branches per plant.

Table 1

The influence of the observed factors on some biometrical indicators at winter rape
Mean values 2004 – 2007

Specification	Plant size		Branches / plant		Capsules/plant		Seeds in capsule		Seed weight/plant	
	cm	Diff. from Mt.	Nr	Diff. from Mt.	Nr	Diff. from Mt.	Nr	Diff. from Mt.	g	Diff. from Mt.
Influence of cultivar										
VALESCA	145,98	Mt.	5,83	Mt.	146,25	Mt.	24,51	Mt.	10,27	Mt.
DIGGER (VECTRA*)	147,04	1,06	6,25	0,42	163,48	17,23	24,84	0,33	11,06	0,35
KARDINAL	141,34	-4,64^{0}	5,94	0,11	155,32	9,07	24,57	0,06	10,62	0,35
DL 5 %		3,90		1,70		9,23		2,10		1,60
DL 1 %		5,52		2,46		12,57		2,77		2,20
DL 0,1 %		7,49		3,01		16,40		3,60		3,10
Influence of sowing density										
100b.g./m^2	148,47	Mt.	6,54	Mt.	180,50	Mt.	5,15	Mt.	12,47	Mt.
200b.g./m^2	144,13	-4,34^{0}	5,93	-0,61	148,53	-31,97^{000}	24,42	-0,73	10,37	-2,10^{0}
300b.g./m^2	141,76	-6,71^{00}	5,89	-0,65^{0}	136,02	-44,48^{000}	24,34	-0,81	9,12	-3,35^{00}
DL 5 %		4,30		0,61		13,80		1,11		2,0
DL 1 %		6,70		0,78		14,70		1,62		2,8
DL 0,1 %		8,90		1,02		15,80		2,10		3,5
Influence of NPK fertilization										
$N_0P_0K_0$	142,39	Mt.	5,72	Mt.	148,14	Mt.	24,56	Mt.	10,92	Mt.
$N_{60}P_0K_0$	145,85	3,46**	6,13	0,59	154,66	6,52*	24,67	0,11	10,34	-0,58
$N_{60}P_{60}K_0$	145,59	3,20**	5,87	0,15	157,61	9,47**	24,74	0,18	10,48	-0,44
$N_{90}P_{90}K_{90}$	145,33	2,94**	5,61	-0,11	165,13	16,99**	24,71	0,15	10,89	-0,03
DL 5 %		1,82		0,70		6,21		1,2		1,6
DL 1 %		2,90		1,10		8,44		1,7		2,5
DL 0,1 %		3,88		1,72		9,78		2,4		3,7

The differences regarding the control variant were not statistically assured.

The capsules number per plant, averaged over the three years, ranged from 214 on plant on the interaction bg/m^2 Valesca x 100 102 x N $_{90}P_{90}K_{90}$ and capsules / plant interaction bg/m^2 Valesca x 300 x $N_0P_0K_0$. Within each variety, capsules number per plant density decreased from 100 to 300 bg/m^2 bg/m^2 and as was expected.

The number of seeds in capsule was more stable, the differences between interactions, not statistically assured. The largest number of seed on capsules has been found at the interaction of factors capsule Valesca x 300 x $N_{60}P_0K_{60}$ bg/m^2 with 26.95 grains, and the lowest number in version bg/m^2 Kardinal x 300 x $N_{60}P_0K_0$.

The seed weight per plant indicator shows that with increasing density at sowing and then harvested, seed weight per plant decreased, distinguishing and depending on cultivar.

Highest seed weight per plant was found to interact bg/m^2 Valesca x 100 x $N_{60}P_{60}K_0$c 14.72 g and the lowest interaction bg/m^2 Kardinal x 300 x $N_0P_0K_0$, with 7.09 g.

CONCLUSIONS

The conclusion that emerges from these discussions can be formulated as the main byomorfologic indicators are influenced by different climatic conditions of the year, or hybrid varieties cultivated by sowing density and especially NPK fertilization.

Averaged over the three years of experimentation it was found that most plant height was recorded in variety Digger, by 147 cm, forming 6.25 branches / plant, 163.48 capsules / plant, 180.5 capsules / plant, 25 15 seeds / capsule and 12.47 g of seed / plant, standing in first position.

Fertilization positively influenced all biometric indicators of rape plants with higher values $N_{90}P_{90}K_{90}$ fertilization.

Investigated the interaction between the factors determined the following maximum values:

- Plant height in limestone. Digger b.g./m^2 x 100 x N_{60}, with 155.94 cm
- The highest number of branches per plant was found in variant bg/m^2 Digger x 100 x $N_{90}P_{90}K_{90}$ - of 6.93 branches / plant;
- Capsules highest number per plant was formed in limestone. Bg/m^2 Valesca x 100 x $N_{90}P_{90}K_{90}$ with capsules 214.81;
- Number of seeds / capsule is constantly oscillating between 21.81 and 26.95 seeds / capsule;
- Seed weight per plant ranged from 1.10 g lime. Kardinal bg/m^2 bg/m^2 x 100 x $N_0P_0K_0$ and 7.29 g lime. Kardinal x 300 x $N_0P_0K_0$ b.g./m^2.

Table 2

The influence of the factors' interaction on some biometrical indicators at winter rape. Mean value 2004-2007

Interaction			Size		Branches/plant		Capsules/plant		Seeds/capsule		Seed weight/pl	
Cultivar	Density b.g./m^2	Fertilization NPK	cm	Diff. from Mt.	Nr	Diff. from Mt.	Nr	Diff. from Mt.	Nr	Diff. from Mt.	g	Diff. from Mt.
Valesca	100	$N_0P_0K_0$	148,09	Mt.	6,50	Mt.	179,57	Mt.	25,40	Mt.	14,38	Mt.
		$N_{60}P_0K_0$	151,14	+3,05	6,45	-0.05	135,49	-44,08	24,57	-0,83	10,74	-3,64
		$N_{60}P_{60}K_0$	147,01	-1,08	6,53	+0,03	203,47	23,90	24,46	-0,94	14,72	0,34
		$N_{90}P_{90}K_{90}$	152,81	+4,72	6,74	+0,24	214,81	35,24	24,59	-0,81	13,07	-1,31
	200	$N_0P_0K_0$	146,30	-1,79	5,39	-1,11	112,32	-67,25	23,66	-1,74	7,52	-6,86
		$N_{60}P_0K_0$	140,37	-7,72	5,85	-0,65	125,57	-54,00	23,74	-0,34	9,17	-5,21
		$N_{60}P_{60}K_0$	147,76	-0,33	4,85	-1,65	116,31	-63,26	22,81	-2,59	7,74	-6,64
		$N_{90}P_{90}K_{90}$	145,65	-2,44	6,60	+0,10	164,84	-14,73	23,54	-1,86	10,76	-3,62
	300	$N_0P_0K_0$	139,59	-8,50	5,15	-1,35	102,32	-77,25	25,59	+0,19	7,59	-6,79
		$N_{60}P_0K_0$	143,14	-4,45	5,55	-0,95	131,00	-48,57	26,95	+1,55	8,97	-5,41
		$N_{60}P_{60}K_0$	143,64	-4,45	4,94	-1,56	129,19	-50,38	26,03	+0,63	9,28	-5,10
		$N_{90}P_{90}K_{90}$	146,30	-1,79	5,55	-0,95	140,13	-39,44	22,89	-2,51	9,46	-4,92
Digger (Vectra 2006-2007)	100	$N_0P_0K_0$	149,81	+1,72	6,20	-0,30	200,00	+20,43	24,86	-0,54	12,72	-166
		$N_{60}P_0K_0$	155,94	+7,85	6,79	+0,29	196,90	+16,83	25,73	0,33	11,69	-2,69
		$N_{60}P_{60}K_0$	143,31	-4,78	6,61	+0,11	157,66	-21,91	24,69	-0,71	11,08	-3,30
		$N_{90}P_{90}K_{90}$	150,95	+2,86	6,93	+0,43	165,69	-13,88	25,70	+0,30	11,02	-3,36
	200	$N_0P_0K_0$	141,14	-6,95	5,11	-1,39	158.14	-21,43	24,19	-1,21	12,71	-1,67
		$N_{60}P_0K_0$	150,54	+2,45	6,51	+0,01	171,40	-8,17	25,14	-0,26	10,91	-3,47
		$N_{60}P_{60}K_0$	146,77	-1,32	6,21	-0,29	154,16	-25,40	25,27	-0,13	11,04	-3,34
		$N_{90}P_{90}K_{90}$	143,38	-4,71	6,29	-0,21	159,20	-20,37	24,85	-0,55	10,30	-4,08
	300	$N_0P_0K_0$	140,77	-7,32	6,01	-0,49	164,84	-14,73	24,01	-1,39	10,94	-3,44
		$N_{60}P_0K_0$	143,79	-4,30	5,53	-0,97	133,80	-45,77	23,46	-1,94	9,22	-5,16
		$N_{60}P_{60}K_0$	151,78	+3,69	6,29	-0,21	145,37	-34,20	25,29	-0,11	10,44	-3,94
		$N_{90}P_{90}K_{90}$	146,40	-1,69	6,62	+0,12	154,70	-24,87	24,92	-0,48	10,73	-3,65
Kardinal	100	$N_0P_0K_0$	143,23	-4,86	5,80	-0,70	147,62	-31,95	25,29	-0,11	13,37	-1,10
		$N_{60}P_0K_0$	147,82	-0,27	6,82	+0,32	184,59	+5,02	24,97	-0,43	11,82	-2,56
		$N_{60}P_{60}K_0$	148,06	-,03	6,77	+0,27	199,17	+19,60	26,41	+1,01	12,55	-1,83
		$N_{90}P_{90}K_{90}$	143,50	-4,59	6,37	-0,13	181,09	+1,52	25,26	-0,14	12,59	-1,79
	200	$N_0P_0K_0$	135,87	-12,22	5,83	-0,67	153,76	-25,81	25,03	-0,37	12,03	-2,35
		$N_{60}P_0K_0$	144,19	-3,90	6,52	+0,02	180,63	+1,06	24,87	-0,53	12,43	-1,95
		$N_{60}P_{60}K_0$	146,19	-1,87	5,97	-0,53	136,62	-42,95	24,53	-0,87	10,08	-4,30
		$N_{90}P_{90}K_{90}$	141,47	-6,62	6,12	-0,38	149,44	-30,13	25,56	+0,16	9,82	-4,56
	300	$N_0P_0K_0$	136,73	-11,36	5,57	-0,93	114,76	-64,80	23,07	-2,33	7,09	-7,29
		$N_{60}P_0K_0$	135,73	-12,36	5,17	-1,33	132,61	-46,96	22,65	-2,75	8,12	-6,26
		$N_{60}P_{60}K_0$	135,81	-12,28	4,73	-1,77	127,39	-52,18	23,23	-2,17	7,39	-6,99
		$N_{90}P_{90}K_{90}$	137,54	-10,55	5,72	-0,78	156,27	-23,30	24,09	-1,31	10,26	-4,12

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