Summary

Rape (Brassica napus L ssp. Oleifera D.C.) is a plant of a Mediterranean origin, being very used in the Middle Age in Central and Northern European countries, due to the oil obtained from seeds, used for coking as well as for lighting.

The Canadian specialists consider the actual oil rape a plant genetically engineered by researchers, through conventional methods and distinguish it from the traditional rape by naming it canola (Canadian oil law erucic acid).

The increased oil content of the rape seeds - between 43 and 52 % for the „00" type cultivars and hybrids – as well as it's protein content, of 21-24 %, put the rape into the frame of the oleo-protein plants. Due to this, rape is highly appreciated in European Union, which recommends the extension of the surfaces occupied by this plant, but not in the detriment of the other grain cultures.

The surfaces cultivated with rape and the obtained productions registered through the years great fluctuations. During 1989 - 1991, there were approximately 18.2 million hectares cultivated with rape, in 2002, over 22.3 million hectares were cultivated with this plant and in 2007, the surface cultivated with rape exceeded 27.7 million hectares all over the world. The mean production of a hectare was of 1438 kg in 1996-1997 and 1675 kg in 2006-2007.

In Romania, big fluctuations were registered for the cultivated surface and the rape production. In 1980 there were 14.3 thousands hectares cultivated with rape, with a production of 1317 kg/ha, in 2006, there were cultivated 120 thousands hectares with 1666 kg/ha, being planned for 2007-2008 a surface of approximately 400 thousands hectares.

Considering the great importance and the spreading without precedent of the rape all over the world and in our country, we chose as a doctoral theme the fertilization of some winter rape and spring rape cultivars, as well as the establishing of the optimal seeding thickness in a zone where the rape is still cultivated on small surfaces, even if Transylvania is inside area I of rape culture.

For setting the scientific research protocol a large number of scientific papers from our country and abroad were consulted.

The synthesis of the scientific papers (chapter II) refers to the rape's nitrogen, phosphorus and potassium breeding particularities, emphasizing the critical nutrition phases for each element, doses of applied fertilizers and their influence on seed production, oil content and production for different winter and spring cultivars and the valuing of the plants density by these cultivars.

In the third chapter, in which the natural frame and the soil – climate conditions are presented, we made a pertinent analysis of the temperatures and the rainfall quantities registered in the experimented years, compared to the multiannual mean value, from which results that the agricultural years 2004-2005 and 2005-2006 were more favorable for the rape, while the year 2006-2007 was less favorable because of the reduced rainfall quantities.

In chapter IV the aim and the objectives of the research are underlined, presenting the three researched items : fertilization item with four graduations **(**$N_0P_0K_0$; $N_{60}P_0K_0$; $N_{60}P_{60}K_0$; $N_{90}P_{90}K_{90}$), cultivar item with three graduations: Valesca, Digger (Vectra), Kardinal – winter cultivars ; Bolero, Heros and Amica – spring cultivars ; seeding thickness with three graduations: 100 b.g./m^2, 200 b.g./m^2, 300 b.g./m^2.

Starting from chapter V, we present own research results for winter rape, in chapter VI, for spring rape, in chapter VII – the differences between the winter rape and the spring rape, and the economical efficiency, and in chapter VIII, the conclusions and the proposals.

The results synthesis from chapter V emphasizes the number of risen rape plants, expressed in percentages, varying between 72% and 97%, and the number of plants remained until harvest, from the risen ones, varying between 93.8% and 99.1%.

Plant height, ramification and capsule number on a plant, the number of seeds in a capsule and the seeds' weight on each plant were influenced by the climate conditions from each year, by fertilization, cultivar and seeding thickness.

As a mean value for the three agricultural years, the seed production was of 1261 kg/ha for Kardinal cultivar, 1384 kg/ha for Digger (Vectra) cultivar and 2166 kg/ha for Valesca cultivar, and related to the seeding thickness, the productions were of 1675 kg/ha with 200 b.g./m^2, 1615 kg/ha with 300 b.g./m^2 and 1520 kg/ha with 100 b.g./m^2.

The fertilization of the winter rape increased the seed production, thus for the variant $N_{90}P_{90}K_{90}$, there were obtained 1983 kg/ha, with 907 kg/ha more compared to the control, $N_0P_0K_0$; in $N_{60}P_{60}K_0$ variant, the production was of 1775 kg/ha, with a difference of 700 kg/ha, and in $N_{60}P_0K_0$ variant, the production was of 1582 kg/ha, with a difference of 506 kg/ha. The production differences compared to the control were very significant.

The interaction between the researched items determined a production of 2789 kg/ha for variant Valesca x 200 b.g./m^2 x $N_{90}P_{90}K_{90}$, with a very significant difference of 1511 kg/ha compared to the variant Valesca x 100 b.g./m^2 x $N_0P_0K_0$ (control) .

On the next eight places remained still Valesca variant, with different densities and fertilization doses, with differences from 1395 kg/ha to 883 kg./ha.

Analyzing the seed production related to the items' interaction, we found the efficiency of this culture, the results being less plausible, when each item is taken separately. The oil content of the seeds was influenced by the cultivar, climate conditions, seeding thickness and fertilization.

The biggest oil content, as mean value for the three agricultural years (2004-2007) was registered for the Digger cultivar, with 50.0%, followed by Valesca cultivar, with 47.33% and Kardinal cultivar, with 42.99%.

The seeding thickness influenced less the oil content. However, along with the increase of the seeding thickness, thus of the number of the harvested plants, the oil content decreased.

The fertilization influence was impressive, with very significant differences, in minus, for all fertilized variants, compared to control, $N_0P_0K_0$. The oil production was more influenced by the seed production first and after that, by their oil content. The interaction of these three researched items determined the highest oil content (52.2%) at the variant Digger x 100 b.g./m^2 x $N_0P_0K_0$, and the biggest oil production at the variant Valesca x 200 b.g./m^2 x $N_{90}P_{90}K_{90}$, with 1315 kg for hectare. The results for the experiments with the same fertilization doses and seeding densities, but with spring cultivars determined us to say that, if winter rape is affected by very low temperatures during winter, spring rape can be seeded on that soil, with an economical efficiency.

The climate conditions for all three experimental years influenced, like at winter rape, plants' biology, obtained productions, oil content and production.

From the biometrical factors' analysis - plant height, ramifications and capsules on a plant, seeds in a capsule, seeds' weight on a plant - we observed that the researched items, as well as the climate conditions influenced these factors more or less.

The interaction between these three researched items, as mean value, underlined the variant Heros x 300 b.g./m^2 x $N_{90}P_{90}K_{90}$, with a mean production of 1945 kg/ha and a very significant difference of 1097 kg/ha compared to control, Bolero x 100 b.g./m^2 x $N_0P_0K_0$.

The oil content of the seeds was high, varying between 49.56% for the variant Bolero x 100 b.g./m^2 x $N_0P_0K_0$ in 2005 and 45.56% for the variant Heros x 100 b.g./m^2 x $N_{60}P_0K_0$, between 51.53% for variant Bolero x 100 b.g./m^2 x $N_0P_0K_0$ and 46.50% for variant Amica x 100 b.g./m^2 x $N_{60}P_0K_0$ in 2006; in 2007, the oil content was reduced, between 48.76% for variant Bolero x 300 b.g./m^2 x $N_0P_0K_0$ and 43.3% for variant Amica x 300 b.g./m^2 x $N_{60}P_0K_0$. As mean value, the highest oil content was obtained for the variants Bolero x 100 b.g./m^2 x $N_{90}P_{90}K_{90}$ and Bolero x 200 b.g./m^2 x $N_0P_0K_0$, with 49.75% oil.

The oil production, as mean value, was of 948 kg/ha for variant Heros x 300 b.g./m^2 x $N_{90}P_{90}K_{90}$, the second place being occupied by variant Bolero x 300 b.g./m^2 x $N_{90}P_{90}K_{90}$ with 889.3 kg

oil for one hectare. We also observe at spring rape that the oil production is primarily influenced by the seed production and after that, by their oil content.

Conducting a comparative synthesis for the winter rape and spring rape (chapter 7.1.), as mean value for three research years, plus and minus differences were registered between the two cultivar types (winter and spring ones). For winter rape, the mean production varied between 2789 kg/ha for variant 200 b.g./m^2 x $N_{90}P_{90}K_{90}$ x Valesca and 833 kg/ha for the variant 100 b.g./m^2 x $N_0P_0K_0$ x Kardinal, and for spring rape, between 1945 kg/ha for the variant 300 b.g./m^2 x $N_{90}P_{90}K_{90}$ x Heros and 848 kg/ha for the variant 100 b.g./m^2 x $N_0P_0K_0$ x Bolero. We observed a difference of 844 kg/ha, in minus, between the best variant for winter rape and the best variant for spring rape, while between the lowest productions for both forms there are practically no differences.

Heros spring rape cultivar gave bigger productions than the winter cultivar Digger, and Valesca winter cultivar gave bigger productions than the spring cultivar Bolero. Thus, there are spring cultivars more productive than winter cultivars, in certain climate conditions.

The plant culture technologies are permanently looking for ways and methods of increasing productions and their quality, yet protecting the environment and framing into the limits of economical efficiency.

Considering these desiderates we presented also the economical efficiency of the obtained results, because we worked with different cultivars, which increased the costs for different seeds and fertilizers, which brought different inputs for each variant, adding also the different climate conditions for each year.

Analyzing the profit installment related to the researched items' interactions, we observed that in the year 2004 – 2005, the biggest profit installment was registered for the variant Valesca x 200 b.g./m^2 x $N_{60}P_0K_0$, of 125% for winter rape and Heros x 300 b.g./m^2 x $N_{60}P_{60}K_0$ for spring rape with the profit installment of 78.2%; during 2005-2006, the interaction Valesca x 200 b.g./m^2 x $N_{60}P_0K_0$ had a profit installment of 126.6%, and for spring rape, variant Heros x 200 b.g./m^2 x $N_{60}P_0K_0$ had a profit installment of 42.81%; in 2006-2007, variant Vectra x 200 b.g./m^2 x $N_0P_0K_0$ registered a profit installment of 80.1%, and from the fertilized variants, Vectra x 300 b.g./m^2 x $N_{60}P_{60}K_0$ with a profit installment of 53.20% or variant Valesca x 200 b.g./m^2 x $N_{60}P_0K_0$, with 56% profit installment at winter rape, and fr the spring rape, variant Amica x 100 b.g./m^2 x $N_{60}P_0K_0$, with 35,77%.

As mean value for the three experimental years, fr the winter rape we obtained a profit installment of 69.35% for Valesca cultivar, with 200 b.g./m^2 seeding thickness, with 33.99% and 37.19% for the variant fertilized with $N_{60}P_0K_0$, and app. 32% for $N_{90}P_{90}K_{90}$ and $N_{60}P_{60}K_0$.

The items' interaction revealed, as the most profitable variant, with 105.45% profit installment the variant Valesca x 200 b.g./m^2 x $N_{60}P_0K_0$.

For spring rape, Amica cultivar, with 22.32% profit installment and Heros, with 21.89% profit installment, as well as the fertilization with $N_{60}P_0K_0$, having a profit installment of 26.77% proved the most profitable variants. The items interaction determined the highest profit installment at variant Amica x 100 b.g./m^2 x $N_{90}P_{90}K_{90}$, of 40.97%, followed by Heros x 300 b.g./m^2 x $N_{60}P_0K_0$, with 40.88% profit installment.

Comparing the economical efficiencies for the most productive winter and spring cultivars in two years, one favorable, one less favorable for rape, we noticed the followings:

In 2005-2006, favorable for rape, the best winter cultivar, Valesca and the best spring cultivar, Heros, had a profit installment of 96.03% and 26.66%, with a difference of 79% in favor of the winter cultivar. Comparing the two cultivars with the lowest productions, Kardinal winter cultivar and Bolero spring cultivar, we observe a bigger profit installment at the spring cultivar. Analyzing the fertilization influence, we observed that the winter rape registered bigger profits than spring rape, when fertilized and almost equal, when not. In fertilized variant $N_{60}P_0K_0$ we obtained a profit installment of 53.9 % for winter rape and of 31.02% for spring rape, while for the fertilization dose of $N_{90}P_{90}K_{90}$, the profit installment was of 45.75 % for winter rape and only 7.61% for spring rape.

In a less favorable year (2006 - 2007), the best winter rape cultivar was Digger, and the best spring cultivar Amica, with a profit installment of 36.20 %, respectively 22.16 %. For Kardinal winter rape cultivar and Bolero spring rape cultivar – the lowest productive in this agricultural year – we observed that the winter rape cultivar registered losses, and Bolero spring rape cultivar obtained a profit installment of 3.18%, however insufficient for this culture.

Fertilization influenced the profit installment, meaning that for the control variant, the winter rape registered losses in this less favorable year (2006-2007); in fertilized variant $N_{60}P_0K_0$, spring rape obtained a profit installment with 23% smaller than the winter rape; in fertilized variant $N_{60}P_{60}K_0$, spring rape obtained a profit installment with 7.8 % smaller than the winter rape, and for the fertilization with $N_{90}P_{90}K_{90}$, with 15.4% smaller than the winter rape.

Conclusion is that even in the less favorable years for rape, profit can be obtained when using certain variants. The obtained results for all three experimental years (2004-2007) allow us to say that, in the ecological conditions from the Transylvanian Plateau, the winter rape and spring rape cultures can be profitable by choosing the right cultivars, seeding thickness values and fertilization doses.

Because not all rape cultivars are equal productive, it is necessary to establish comparative cultures with cultivars and other plant technology measures in order to choose the most eligible cultivars, fertilization doses and seeding densities.