CONTRIBUTIONS REGARDING THE PROMOTION OF TECHNOLOGICAL ITINERARIES IN RAPE CULTURE IN THE CONTEXT OF APPLYING SUSTAINABLE AGRICULTURE IN THE DOBROGEA PLATEAU

CONTRIBUȚII CU PRIVIRE LA PROMOVAREA UNOR ITINERARII TEHNOLOGICE LA CULTURA RAPIȚEI ÎN CONTEXTUL APLICĂRII UNEI AGRICULTURI DURABILE, ÎN PODIȘUL DOBROGEI

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Abstract: *A series of physical and geographical factors, especially the south-eastern position of Dobrogea, its location within the Black Sea basin and the Danube valley, have determined a number of particularities in the structure, evolution and organization of the rural space in general and the agricultural one in particular. All these involve a certain structure of the cultures and a certain distribution of the categories of field utilization, as well as a distribution of the localities. Lately, rape has been a lucrative culture. Because the rape oil demand is higher than the supply, the whole harvest can be quickly sold for satisfying prices. This paper presents an analysis of the rape culture in the country and in Constanta county in the last few years, a technological itinerary applied in production conditions for rape cultivation in the Dobrogea plateau, in the context of applying a sustainable agriculture with environmentally-friendly technological links. Also, the paper presents the results obtained regarding the average number of siliques on a plant, the average number of grains in a silique, the mass of one thousand grains, the average mass of grains on a plant and the production obtained in some of the rape hybrids that were studied.*

Rezumat: *O serie de factori fizico-geografici şi mai ales poziția sud-estică a Dobrogei, încadrarea acesteia între bazinul Mării Negre şi valea Dunării, au determinat o serie de particularități în structura, evoluția şi organizarea spațiului rural, în general, şi al celui agrar în special. Toate acestea implică o anumită structură a culturilor şi o anumită repartiție a categoriilor de folosință a terenurilor, precum şi o anumită repartiție a localităților. În ultimii ani rapița a fost o cultură rentabilă. Datorită faptului că cerința de ulei de rapiță este mai mare decât oferta, întreaga recoltă poate fi repede valorificată la prețuri satisfăcătoare. În lucrare se prezintă o analiză a culturii rapiței în țară şi în județul Constanța în ultimii ani, un itinerariu tehnologic aplicat în condiții de producție la cultura rapiței din podişul Dobrogei, în contextul aplicării unei agriculturi durabile, cu verigi tehnologice prietenoase mediului. De asemenea, sunt prezentate rezultatele obținute cu privire la numărul mediu de silicve de pe o plantă, numărul mediu de boabe în silicvă, masa a o mie de boabe, masa medie a boabelor de pe o plantă şi producția obținută la unii hibrizi de rapiță luați în studiu.*

Key words: *rape hybrids, sustainable agriculture, technological itinerary*
Cuvinte cheie: *hibrizi de rapiță, agricultură durabilă, itinerariu tehnologic*

INTRODUCTION

High and profitable rape productions are obtained especially when the cultivators favour the positive interaction between the environment conditions and the technology applied.

Rape can be cultivated with good results in the maize and autumn cereals area, but it must not occupy large surfaces to the detrimental effect of sunflower in its main cultivation area (BÎLTEANU 2001). In these areas, the sum of temperature degrees accumulated in the vegetation period of 270-300 days is 2100-2500 in autumn rape and 1500-1800°C (in 110-130 days) in the spring varieties (BORCEAN 2006, TABĂRĂ 2005). From the point of view of frost

endurance, rape is much like autumn barley (BÎLTEANU 2001), being more sensitive than autumn wheat. In spite of all this, the specialized literature cites limits of -20°C and even -25°C where rape is not destroyed by frost (TABĂRĂ 2005). Most specialists consider rape a demanding plant regarding humidity. Favourable areas are those with 450-650 mm of rain yearly. Apparently paradoxically, even though the multi-annual mean of rain in Dobrogea is 350-400 mm, in the county of Constanta, the least favourable area from this point of view, is the place where rape is cultivated on the largest surfaces (table 1), sometimes even with good results (the example from 2004). Rape develops intensely in the spring and it uses fully the humidity accumulated over the winter, which is why it offers satisfactory results even in drier regions.

MATERIALS AND METHOD

The research was focused on rape cultivation in the climate and soil conditions characteristic to the Dobrogea Plateau. The paper presents the results of the research regarding the behaviour of certain rape hybrids around the village of Ceamurlia de Jos in the county of Tulcea, as well as the advice of specialists or the personal conclusions regarding everything that involves a rape culture. In order to study what happens to rape hybrids on the field, in production conditions, a field was established in the vicinity of Ceamurlia de Jos, situated on the border between the county of Tulcea and the county of Constanta. On this field, there was a rape culture on which a special technology was applied, but according to the biological demands of the culture.

Three rape hybrids were chosen for the study, which were recommended for culture in the Dobrogea area: Valesca, Orkan and Vectra. The same cultivation technology was applied for all these hybrids as their behaviour was followed in the same conditions of climate, soil and cultivation technology. The established cultivation technology was followed over the vegetation period. Before combine harvesting, plant samples were collected and analyzed in the Laboratory of Phytotechny of the Faculty for Natural and Agricultural Sciences from Ovidius University Constanta. The analysis was also conducted in the field and it involved the average number of siliques on a plant, the average number of grains in a silique, TOM (the thousand grain mass), the average mass of grains on a plant, the average mass of grains on square meter. Also, there was a production estimation using the data obtained as a result of the mentioned analyses.

RESULTS AND DISCUSSION

The progress of the recent years in the improvement of rape and the multiple use of oil have led to an increase in the surface cultivated with rape, competing with sunflower culture. The productions obtained in rape in the recent years in Romania are shown in table 1. The revaluation of the agricultural potential by the encouragement of alternative cultures of technical plants, such as rape, in view of ensuring an alternative energetic source of fuel for tractors and self-propelled agricultural machines, represents a present energetic purpose with wide development perspectives for rape cultivation in Romania. In the recent years, in the county of Constanta, rape has been a lucrative culture, the productions obtained in 2004 (2006 kg/ha) and 2005 (1507 kg/ha) proved this (table 2). In the county of Tulcea as well, the rape culture developed increasingly especially in the recent years, the proportion within the oleaginous cultures cultivated in the county being much higher recently. However, sunflower still occupies important surfaces here (table 3).

Regarding the technological itinerary for rape culture in the conditions of the Dobrogea Plateau and in order to research the behaviour of some rape hybrids recommended for cultivation in this area, we established on a field in the vicinity of Ceamurlia de Jos a rape

culture in which a technology was applied according to the biological requirements of the culture. Three rape hybrids were chosen for the study, which were recommended for culture in Dobrogea: Valesca, Orkan and Vectra. The same cultivation technology was applied for all these hybrids as their behaviour was followed in the same conditions of climate, soil and cultivation technology.

Table 1

The surface cultivated and the production obtained for rape in Romania

Crt. no.	Year	Cultivated surface - thousands of ha-	Average production -kg/ha-
1.	1990	13.1	831
2.	1991	8.8	994
3.	1992	1.7	791
4.	1993	1.5	929
5.	1994	0.3	942
6.	1995	0.3	1178
7.	1996	1.7	1086
8.	1997	7.2	1620
9.	1998	25.3	1050
10.	1999	83.6	1294
11.	2000	68.4	1113
12.	2001	82.4	1235
13.	2002	74.6	481
14.	2003	17.1	473
15.	204	49.7	1984
16.	2005	87.8	1681
17.	2006	110.1	1590.0

*Romania's Official Gazette

Table 2

The surface cultivated and the production obtained for rape in the county of Constanta

Crt. no.	Year	Cultivated surface -ha-	Average production -kg/ha-
1.	2000	12 688	1 406
2.	2001	17 652	741
3.	2002	9 775	410
4.	2003	1 946	236
5.	2004	6 792	2 006
6.	2005	20 439	1 507

*Romania's Official Gazette, 2006

Table 3

The surface cultivated with oleaginous plants in the county of Tulcea

Crt. no.	Year	Total surface cultivated with oleaginous plants -ha-	Surface cultivated with sunflower -ha-
1.	1990	34995	18686
2.	1995	40760	35585
3.	2000	62363	54905
4.	2001	61910	56033
5.	2002	64389	55632
6.	2003	75904	69801
7.	2004	57709	49151
8.	2005	67054	57155

*Romania's Official Gazette, 2006

Regarding the rotation, it is well-known that appropriate previous cultures are those that free the land by the beginning of August in order to ensure good conditions for soil tillage and accumulation of the water necessary for sprouting. Rape is not cultivated after sunflower and soybean because of the extension of attack by *Scerotinia sclerotiorum*. On the same field, the culture may be resumed after three years and, in the case of *Scerotinia sclerotiorum* attack, after seven-eight years. In this case, the previous plant was autumn wheat.

In what regards fertilization, rape is a great consumer of nutritive substances. This is why it is very demanding in terms of fertilization. Taking into account the desired production, the following were applied: a whole dose of phosphorus (60 kg P_2O_5), 1/3 of the nitrogen dose (30 kg N) under the basic ploughing and the remaining 2/3 of the nitrogen dose (60 kg N) in the early spring. The normal ploughing was done at the depth that does not produce clods, 20 cm. Immediately after ploughing, the disc procedures were done while the soil was still moist.

The preparation of the germination bed was executed by repeated works by disk harrow. The last one was done at the sowing depth and perpendicularly to the sowing direction. The seed, as well as the soil used, are a very important biological factor for the efficiency of rape cultivation. In fact, the seed comprises in its embryo all the valuable characteristics of the variety. Moreover, the seed must fulfil a number of other features that, once accomplished, have the purpose of uniform and quick sprouting in the field, vigorous and healthy plants with deep roots. The rapeseed used for sowing was fresh, from the sowing year, with 98% purity and 88% germination capacity. The TOM in the Vectra variety was 4.7g, in the Valeska 4.2g and in the Orkan 4.3g. The sowing was done by the SUP-29 sowing machine for stalk cereals. The seed treatment before sowing was done by Sumilex WP in a dose of 1 kg/t.

The sowing period. The researches developed in our country have shown that for autumn vegetation, colza rape needs 800-900 degrees of active temperatures higher than zero. With this warmth quantity and appropriate humidity conditions, the plant forms a strong root and a rosette of 6-8 well-developed leaves, a biological state that gives the plant endurance to unfavourable factors over the winter, especially at low temperatures.

Colza rape was sown between September 11th and 12th.

The seed quantity per ha which ensures the optimal thickness of plants depends on the soil used and the culture conditions. In order to ensure at least 100 plants proper for harvesting per square meter and taking into account the seed TOM for he three varieties, the seed quantity resulted from the calculation and necessary for sowing a ha with Vectra was 5.5 kg/ha, with Valeska 5.0 kg/ha and with Orkan 5.9 kg/ha. The sowing was done at a distance of 25 cm between the rows. The sowing depth varies according to texture and soil humidity. In heavy and moist soils, the seed is buried at a depth of 2-3 cm; when the soil is dry, the seed is sown 1-2 cm deeper. In the studied field, the sowing depth was 3 cm.

The land was crushed after sowing so that it should not have clods after the preparation of the germination bed and the seed should not be incorporated. The soil was monitored to be well drained so that it should not adhere to the clod crusher and press excessively. The curly clod crusher was used. In the favourable years, the production may be very high without pesticide application. In most cases, these are the exceptions that stress the rule: without a coherent protection strategy for plants, rape is a culture that can be totally compromised by pests and, to a large extent, by weeds or disease. We can say that most times the pesticides must be applied curatively, at warning.

Seed treatment before sowing was done with Sumilex WP, in a dose of 1kg/t.

Among the most important rape pests is the pollen beetle (*Meligethes aeneus*). The damage is extensive in the years with cool springs. The EDT (economic damage threshold) is one adult/plant in stage D1 (the floral sprouts are united, covered by terminal leaves) and 2-3 adults/plant in stage E (the floral sprouts are separated and the floral peduncles elongate, starting with the marginal ones). Determinations are made on 50 plants, of 250 plants on the same row (a plant out of five). The insecticides against the pollen beetle are applied before flowering. After this phenophase, the treatments are no longer efficient against this pest. Thus, Mavrik 0.2 l/ha was used in the case of the pollen beetle.

Irrigation is necessary in the south of the country but, as this was not possible, it was not effected.

The direct harvesting by combine is a practical method. It is efficient only if the losses are minimal and we have possibilities to dry the seed. The harvesting began when the seeds were brown and the humidity 17%. The work was done only in the morning or in the evening. In order to dry, the seeds were kept in thin layers on tarpaulins in the sun.

The production results. In order to estimate the production, little before harvesting, we collected plant samples for each variety. We monitored the average number of siliques per plant, the average number of grains per silique, the average mass of grains per plant and the average mass of grains per square meter.

Table 4

Production results regarding the average number of siliques per plant in some rape hybrids

Crt. no.	The hybrid	Average number of siliques per plant
1.	Vectra	158
2.	Valesca	186
3.	Orkan	163

The data in table 4 show that the average number of siliques that are formed on a plant is different according to hybrid. Thus, in Vectra, there were approximately 158 siliques per plant. In Valesca, there were approximately 186 siliques per plant, the highest value among the three studied hybrids, while in Orkan, there were approximately 163 siliques per plant.

Table 5

Results regarding the average number of grains per silique in some rape hybrids

Crt. no.	The hybrid	Average number of grains per silique
1.	Vectra	26
2.	Valesca	28
3.	Orkan	25

The data in table 5 show that the average number of grains per silique is also different according to hybrid. Thus, in Vectra there were approximately 26 grains per silique, in Valesca there were approximately 28 grains per silique, the highest value among the three studied hybrids, while in Orkan there were approximately 25 grains per silique.

Furthermore, the production analysis monitored the average mass of the grains per plant. With this indicator, the mass of a thousand grains (TOM) was determined for each hybrid. The data obtained regarding TOM are shown in table 6.

Table 6

Results regarding the mass of a thousand grains (TOM) in some rape hybrids

Crt. no.	The hybrid	TOM (g)
1.	Vectra	4,9
2.	Valesca	4,1
3.	Orkan	4,4

The results obtained regarding the average mass of grains per plant in the studied rape hybrids are shown in table 7. It can be seen that the average mass of grains per plant varied from 17.93 g/plant in Orkan to 21.35 g/plant in Vectra.

Table 7

Results regarding the average mass of grains per plant in some rape hybrids

Crt. no.	The hybrid	Average mass of grains per plant (g)
1.	Vectra	20.12
2.	Valesca	21.35
3.	Orkan	17.93

Analyzing the data shown in table 8, we can estimate the rape production for the three cultivated hybrids. The data were corroborated with the determinations executed on field regarding the average density of plants per square meter. Thus, in Vectra, the production was 3018 kg/ha, in Valesca the production was 3203 kg/ha (the highest value among the three hybrids), while in Orkan, the production was 2689 kg/ha.

Table 8

Results regarding the average mass of grains per square meter in some rape hybrids

Crt. no.	The hybrid	Average mass of grains per square meter (g)
1.	Vectra	301.8
2.	Valesca	320.3
3.	Orkan	268.9

CONCLUSIONS

The conclusion is that in the cultivation conditions of 2004-2005, for the rape cultivated in the conditions of the Dobrogea Plateau, the productions obtained can be compared to the ones obtained by large rape cultivation units in the Romanian Plain and Baragan. The average number of grains per silique varied between 25 and 28 grains per silique.

The mass of a thousand grains had values between 4.1g and 4.9g. The average grain mass per plant was between 17.93g and 21.35g. The production obtained varied between 3203 kg/ha for Valesca, 3018 kg/ha for Vectra and 2689 kg/ha for Orkan.

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