

The *Brassica* crops yield potential in the south of Russia

S. L. Gorlov

Department of oil crops breeding, All Russia Research Institute of Oil Crops 17, Filatova str., 350038 Krasnodar, Russia

Email: vniimk-center@mail.ru

Abstract

The crops of *Brassica* species had occupied no more than 4-5%, or 260-350 ths. ha and 250-340 ths. ton respectively, in the structure of sowing areas under oil crops and in total production of commercial seeds in Russia till 2006. There are winter and spring rape (*Brassica napus* L.), mustard (*Brassica juncea* L.) and winter and spring turnip rape (*Brassica campestris* L.) among the cultivated crops.

Rape (*Brassica napus*) is the dominating crop among cruciferous in the present time and in foreseeable future in Russian Federation. Consequent increasing of total yield of rape oil seeds in last 5 years is caused by extension of sowing areas under the crop and yield rise. High demand of commercial seeds both at internal and international markets, stimulation of its production by producers of bio-diesel oil in the present time and in future as well as necessity of diversification of plant growing branch of agriculture predetermine possibility and necessity to increase the areas under rape in Russia perspective up to 2.0-2.5 mln. ha and further up to 5.0-7.0 mln. ha, and more.

Biological features of rape allow cultivating it at the wide range of soil-climate conditions, conformably to the Russian conditions it means in all regions of country, that can't be said about soybean and sunflower. If soil-climate and agroecological conditions of Russian Federation are able enough to provide the realization of perspective development plans of oil rape production, the social-economic and financial-technical factors, determining the state of the agrarian sector of economy, cause the existence of significant differences between potential and practical yield of registered varieties of oil cruciferous crops.

Winter rape is the absolute leader on seeds yield among other oil cruciferous crops. Now the area of its cultivation is bordered with south regions of Russia and Kaliningrad region, however, this crop, possessing the tremendous potential of productivity, is also of good potential of sowing area extension not only within abovementioned territories but outside.

It is guaranteed the annual rape seed yield 3.0 ton/ha and more in south regions of Russia, predominantly in Krasnodar and Stavropol regions, at experimental plots and working conditions where cultivation technology of crop is observed enough. The oil content is up to 47-49%.

Key words: rapeseed, mustard, turnip rape, sowing area, seed yield, seed oil content.

In Russia the crops of *Brassica* species occupied no more than 4-5%, or 260-350 ths. ha and 250-340 ths. ton respectively, in the structure of sowing areas under oil crops and in total production of commercial seeds in Russia till 2006 whereas sunflower occupied about 85% of oil market providing to Russian Federation a place among largest world producers. Historically prevalent monopoly of sunflower on oil market, on a background of extensive development of its areas and increase of seed yield year by year, did not promote formation of competitive demand on oil cruciferous (*Brassica*) crops resulting in low-profitable production and absence of interest from agriculture producers. In present time an interest to oil crops is growing. It is stipulated with increasing of production and use of bio oils in the world and can lead to substantial changes in sowing area structure in Russia (Table 1).

Table 1. Dynamics of main oil crops sowing areas and yield in Russia and South federal district (SFD).

Territory	Years	Sunflower		Soybean		Rapeseed*	
		areas, ths. ha	yield, ton/ha	areas, ths. ha	yield, ton/ha	areas, ths. ha	yield, ton/ha
Russian Federation	2004	4848	0,99	571	0,97	355	0,94
	2005	5546	1,16	720	0,93	351	1,04
	2006	6100	1,18	849	0,98**	628	1,10**
SFD	2004	2411	1,21	125	1,65	162	1,03
	2005	2810	1,41	198	1,32	154	0,97
	2006	3011	1,42	241	1,20**	173	1,10**

* rapeseed, mustard, turnip rape

** forecast for 2006

As a main source of increasing oil production volumes as well as fodder proteins in Russia can be considered oil *Brassica* crops. Traditionally cultivated rapeseed, winter and spring type (*Brassica napus* L.), mustard (*Brassica juncea* L.) and turnip rape (*Brassica campestris* L.), winter and spring, play the main role here.

Rapeseed is a dominating crop among oil *Brassica* crops in present time and future in Russia. Sequential increasing of total yield of oil rapeseed, observing last 5-years, is caused with extending of sowing areas under crops and increasing of it yield. A high demand on oil commercial seeds both on internal and international markets, a stimulation of it production by bio diesel producers as well as a necessity of diversification of a plant growing branch of an agriculture predetermine a possibility

and necessity of rapeseed sowing areas increasing in perspective to 2.0-2.5 mln. ha and in future to 5.0-7.0 mln. ha and more in Russia.

Biological features of a rapeseed allow its cultivating in wide range of soil-climate conditions. It means almost in all agriculture regions of country according to Russian conditions, and this can't be said about a sunflower and a soybean. If soil-climate and agro ecological conditions of Russia are able to prove realization of the perspective development plans of oil rapeseed production enough, social-economical and financial-technical factors determining an agrarian sector state of economy stipulate for existence of considerable difference between potential and real yield of registered oil cruciferous crop varieties.

A winter rapeseed is an absolute leader on seed yield among other oil cruciferous crops. Its cultivation area is restricted with south regions of Russia now. However, this crop having a substantial productivity potential possesses not less potential of sowing area extension, both into indicated territories and out. The driest period of year account for soil preparation, planting and first growing period, formation and development of future crop yield potential and this is one of the principal obstacles for increasing of sowing areas and yield of winter rapeseed on the territory of South federal district (Table 2).

Table 2. Dynamics of sowing areas and yield of main Brassica species oil crops in Russia and South federal district.

Territory	Years	<i>B. napus</i> , winter type		<i>B. napus</i> , spring type		<i>B. juncea</i>	
		areas, ths. ha	yield, ton/ha	areas, ths. ha	yield, ton/ha	areas, ths. ha	yield, ton/ha
Russian Federation	2004	88	1,78	163	0,84	103	0,59
	2005	83	1,77	166	1,10	108	0,65
	2006	80	1,65**	458	1,15**	91	0,70**
SFD	2004	72	1,66	4	0,93	86	0,62
	2005	58	1,55	3	0,65	92	0,65
	2006	70	1,65	29	0,90**	74	0,72**

** forecast for 2006

At the end of summer there is a little water resource in subsurface soil after forecrop harvesting and following soil treatments. At the background of high temperatures and low relative humidity there is a traditional dependence of sowing areas of winter rapeseed on amount and timeliness of precipitations in region. But never the less action of unsuitable conditions for rapeseed cultivation can be graded by means of strict observance of basic technological methods using modern soil treatment and planting machines.

A spring rapeseed is adapted to cultivation in regions with high relative air humidity and sufficient precipitations, temperate temperatures in vegetative period, especially in spring and at the beginning of summer. And it should be accounted a rapeseed low resistance to drought. It means in accordance with climate conditions of south of Russia that a spring rapeseed mainly should be considered as insurable crop if winter crops freeze. Considering a rapeseed as a crop of long day, one can receive a seed yield not less than 1.5 ton/ha only using early sowing dates (after 20th of March). In this case plants can use the most effectively winter resource of soil water and avoid an effect of extremely high temperatures in period of vegetation as possible.

Mustard is cultivated mainly in south droughty regions of our country – Volgograd, Saratov, Rostov and Stavropol regions where average annual precipitations does not exceed, as a rule, 280-400 mm. About 90% of this crop sowing areas is here. An average yield does not exceed 0.6-0.7 ton/ha, accounting extremely low water supply of the cultivated areas, with potential yield of modern varieties up to 2.0-2.4 ton/ha. The main advantages of the crop in comparison with rapeseed are exclusively high growth and development of plants at first stage of vegetative period, hot- and drought tolerance, resistance to bean bursting and disease affection.

The main region-producer of mustard is Volgograd region and bordering with it districts of Rostov and Stavropol regions. It is caused with this region specific nature and climate conditions and existence of oil seeds processing plants (Table 3).

Winter and spring rapeseed according to its biological features have not widely spread in Volgograd and Rostov regions till now and perspectives of its cultivation are not clear in zones traditionally occupied with mustard.

The same situation concerning perspectives of spring rapeseed production is observed in SFD in the whole. The regions with hard hydrothermal conditions are not suitable for cultivation of a spring rapeseed. There are no alternative to a winter rapeseed among oil Brassica crops in regions with sufficient or even unsteady moistening. And this is observed plain on the example of Krasnodar region and Adyge republic.

A wide range of agrarian climate zones on the territory of Stavropol region predetermines a possibility to cultivate mustard in droughty and heavy droughty regions and a winter rapeseed in regions with unsteady, sufficient and redundant moistening. Now a winter rapeseed is an oil crop of second importance after sunflower at Stavropol but exceeding it on average seed yield.

Stavropol region is one of the leaders producing oil commercial seeds both in South federal district and in Russia in the whole, but for all that perspectives of future increasing of oil cruciferous crops production in this region are the most favourable.

Table 3. Dynamics of sowing areas and yield of main oil Brassica crops in main regions-producers in SFD of Russian Federation.

Territory	Years	<i>B. napus</i> , winter type		<i>B. napus</i> , spring type		<i>B. juncea</i>	
		areas, ths. ha	yield, ton/ha	areas, ths. ha	areas, ths. ha	yield, ton/ha	areas, ths. ha
Adage republic	2004	9,4	1,56	0	-	0	-
	2005	3,3	1,48	0	-	0	-
	2006	5,3	1,60	0	-	0	-
Krasnodar region	2004	18,2	1,74	1,3	1,20	0,5	0,66
	2005	10,7	1,63	1,2	0,57	2,2	0,78
	2006	17,6	1,75	4,8	1,40**	0,7	1,00**
Stavropol region	2004	35,7	1,76	0,2	0,90	21,7	0,84
	2005	38,1	1,62	1,0	1,12	17,7	0,61
	2006	39,2	1,65	6,4	1,20**	12,2	0,90**
Volgograd region	2004	0	-	0,9	0,77	38,0	0,55
	2005	0	-	0	-	45,1	0,68
	2006	0,4	1,50	10,2	0,70**	44,3	0,70**
Rostov region	2004	0,5	1,35	0	0,37	12,2	0,57
	2005	0,1	1,10	0	-	21,0	0,66
	2006	0,3	1,50	4,7	0,70**	12,6	0,70**

In whole the data of tables 2, 3 do not leave doubts in high potential possibilities of increasing of sowing areas and oil Brassica crops yield subsequent to growth of technical equipment of agricultural processing plants and proper perfection of crop management. The results of trial conducting at All Russia Research Institute of Oil Crops by the name of Pustovoit V.S. (VNIIMK) argue about far from absolute potential use of breeding achievements registered in State Variety Register in 2006 (Table 4).

Table 4. The results of oil Brassica crops trials at VNIIMK*Krasnodar city*

Index	Years	<i>B. napus</i>		<i>B. juncea</i>		Sinapis alba	<i>B. campestris</i>	
		Winter type	Spring type	Winter type	Spring type		Winter type	Spring type
Sedd yield, ton/ha	2004	3,05	2,10	3,01	2,10	1,12	1,71	1,20
	2005	3,11	1,72	2,64	1,45	1,05	2,07	1,15
	2006	3,10	2,28	2,20	1,28	1,23	2,20	1,18
Oil content, %	2004	49,2	47,3	45,5	45,0	29,4	46,4	45,7
	2005	47,0	47,5	43,3	43,8	28,4	45,7	47,8
	2006	45,4	45,5	42,1	44,2	29,8	45,9	44,2

VNIIMK is one of the leaders among scientific institutions of Russia on volumes and results of breeding works with oil cruciferous crops. In 2006 36 varieties of oil cruciferous crops of VNIIMK's breeding: five varieties of winter rapeseed, 10 varieties of spring rapeseed, 10 varieties of spring mustard and two of winter one, two varieties of white mustard, five varieties of spring turnip rape and two of winter one, are included into State Variety Register.

The present breeding achievements of VNIIMK are characterized with free erusic acid in oil of rapeseed, mustard and turnip rape. Glucosinolate content does not exceed 15-20 mkmol/g in seeds of registered varieties, oil content is up to 44-49% in seeds of spring and winter type varieties of these crops. Varieties of spring and winter types of mustard and turnip rape have yellow coloring of seed coat.

Variety and zone cultivation technologies of cruciferous crops allowing realizing maximally biological potential of variety productivity on definite soil-climate conditions are developed at VNIIMK.

A winter rapeseed has annually assured seed yield up to 3.0 ton/ha and more in sought region of Russia, predominantly in Krasnodar and Stavropol regions, at experimental and seed growing plots as well as in commercial sowing where cultivation technologies are maintained enough. Oil content is up to 47-49%.

Varieties of spring rapeseed and mustard of VNIIMK's breeding are not only adjusted to cultivation on Northern Caucasus in the best way, but can be cultivated successfully on all territory of Russian European part and West Siberian region.