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**VARIETIES AND AGROTECHNICAL CHARACTERISTICS IN
INCREASING OF THE PRODUCTIVITY OF CORIANDER IN THE
CONDITIONS OF NORTH STEPPE OF UKRAINE**

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There were presented the generalized results of studies on the effects of varietal characteristics, row spacing and terms of sowing on the productivity of coriander. It was founded that in the conditions of North Steppe higher productivity (1,35 t/ha) formed the sort of Oksanit with a row spacing of 0,45 m for the pre-winter term of sowing, and mass fraction – 1,53% and collection of the essential oil – 18,8 kg/ha formed the sort of Nectar.

***Keywords:** coriander, productivity, varieties, row spacing, terms of sowing, essential oil.*

Coriander is an annual herb. The main and the most valuable component of its essential oil is terpene spirit linalool (60–80 %). Linalool is a derivational product for producing 12 aromatic substances synthetically [3,4,7]. The variety of flavors taken from the essential oil of coriander places it into the row of the most valuable commodity crops [3,5-7]. Essential oil is also made use of when many different taste and smell forming nutritional supplements are produced [1-2, 5-6].

The average yield of coriander in the area of northern steppe of Ukraine is approximately 0.6–0.7 t/ha. Though on the area of the northern steppe of Ukraine it can give 2.0–2.5 t/ha of yield and high profitability. Its low level comes from the absence of the technology of its cultivation taking into consideration the

specifications of soil and climatic conditions of the zone and properties of new varieties. In recent years, the demand for the commodity coriander seeds got higher and it became the product for export. Therefore, there is a need to increase the acreage for this crop and promote more efficient use of land [8].

One of the ways to increase the production of seeds and the essential oil is to develop elements of the technology of its cultivation, considering the characteristics of soil and climatic conditions of the area that will deliver high quality yields. All the above given proofs lead to the need for scientific research on the impact of technological elements on growth, development of coriander plants and their productivity.

Methodology and source material. The study was conducted during the period 2007-2010 in the field of laboratory rotation, selection and initial seeding and research consultancy providing shuttle of innovations of Kirovograd State Agricultural Experiment Station IASZ NAAS. Soil of the test areas - Medium deep black soil, deep heavy-loamy, which was formed as a result of the sod process under the cover of turf grass in conditions of low moisture of carbonate loess.

The content of humus in one layer of soil is 4.63%, hydrolyzed nitrogen - 12 mg per 100 g of soil, moving phosphorus and potassium - 11.6 and 11.8 mg per 100 g of soil, respectively, pH - 5.4. The amount of boron contained is 1.0 mg Manganese - 7.6 and Zinc - 0.14 mg per 100 g soil. The amount of absorbed bases varies from 39.4 to 42.0 mg per 100 g soil. Predecessor is the winter wheat. The investigation comprised such varieties as Oksanit (selection KSARS IASZ NAAS), Nectar and Medun (varieties selection IELR NAAS). The sown area is 36 square meters, accounting - 18 square meters. Repeatedness is of four times. Experiments laid by the method of split plots, accommodation options systematical.

Oksanit - middle-ripe, vegetation period is 100 days. Plant height - 115-120 cm. Resistant to lodging. Inflorescence of flowers is pale pink. Fruit is round, with weakly detected ribbing of light brown color. The weight of 1000 seeds is 8.7 g, drought and shattering resistant. Potential yield is up to 2.6 t / ha. The content of essential oil is 1.8-2.4%.

Nectar - middle-ripe. The height of the lower attached umbrellas is 40-58 cm, flowers are pale pink, fruit are of dark straw color. The weight of 1000 seeds is 7.2g, yield – 2.2-2.7 t / ha. The Content of essential oil is 2.0-2.6%.

Medun - middle-ripe. The height of the lower attached umbrellas is 48-55 cm, flowers are pale pink, fruit are of dark straw color. The weight of 1000 seeds is 8.7 g, yield – 2.2-2.5 t / ha. The content of essential oil is 2.5%.

After harvesting the predecessor, the field was cultivated by the tilling machine and the plowing was done to the depth of 22-25 cm. The early spring cultivation included mulching and presowing cultivation to the depth of 4-5 cm. The sowing was performed by the selective drill SCS-6-10 and CH-10, depending on options. Seeding depth is 2-3 cm. Depending on the timing, sowing was held November 1, 2006 (the pre-winter period of sowing) and March 20, 2007 (early spring sowing period) November 1, 2007 (the pre-winter period of sowing) and March 26, 2008 (early spring sowing period); November 2, 2008 (the pre-winter sowing period) and April 4, 2009(early spring sowing period), November 3, 2009 (the pre-winter period of sowing) and April 1, 2010 (early spring sowing period).

The weather conditions of the growing season in 2007 differed significantly from the average long-term indicators of excessive temperatures and long periods without rainfall in the critical phase of coriander plants development. This had a negative impact on productivity of coriander. The weather conditions of the growing season in 2008 were relatively favorable for the growth and development of the crop. The most favorable taking into consideration the moisture conditions in the main phase of growth and development of coriander was the year 2009.

The Results. It is pointed out that the introduction of the pre-winter period of sowing coriander is a promising area of its cultivation in the northern steppe zone of Ukraine, as it allows to use the soil moisture that accumulates over the winter period more efficiently and to reduce the load in spring.

One of the important conditions for obtaining high yields of coriander is proper selection of varieties that meet the zonal environmental conditions. The optimum density of plants per unit of area is one of the main factors that affects the yield of

plants. Indeed, crop productivity in general depends on the number of plants per unit of area that will participate in the formation of vegetative and generative organs.

At the time of sowing coriander (the early spring period), plants of pre-winter period were in a phase of complete germination. The phase of complete germination of plants (early spring sowing) in 2007 took place 18-April 20, 2008 - April 14-16, 2009 April 20-22. At this time, the plants of the pre-winter sowing period were in the phase of "plug" (3-4 pairs of leaves).

Forming the density of coriander plants begins during the sowing. However, it is impossible to save the number of plants that appeared after germination to the period of maturation and harvesting. During the growing season the amount of plants per unit of area gradually decreased and depended on the influence of agronomic factors and weather conditions.

The conclusion is made that the density of plants (pre-winter period) average for 2007-2009, was higher by 10-12% and the survival is by 9-11% higher relatively to the early spring (Table 1). The similarities on the fields, in some way, was influenced by varietal characteristics and with Oksanit it was - 89.1%, Nectar - 87.1% , Medun - 85.1%. Survival was 90.8, 89.7 and 87.7%, respectively.

The density and survival, regardless the sowing and varietal characteristics, were influenced by the row spacing. With the width between rows of 0.15 m the field similarities of coriander plants averaged 88.3%, and survival - 90.1%, and in versions with wide spacing 0.45 m - 86.0 and 88.7%, respectively.

Table 1 - Density of plants and survival of coriander depending on sowing time, varietal characteristics and row spacing, 2007-2009

variety	row spacing, m	sowing time					
		Pre-winter			Early spring		
		Density when rising, <i>pieces/square meter</i>	Density when harvestin g, <i>pcs/sq. m</i>	Survival, %	Density when rising, <i>pcs/sq. m</i>	Density when harvestin g, <i>pcs/sq. m</i>	Survival, %
Oksanit	0.15	235.3	216.2	92.0	217.4	198.6	91.4
	0.45	229.6	207.4	90.3	208.7	186.7	89.5
Nectar	0.15	232.3	214.0	92.1	207.9	184.3	88.6
	0.45	229.3	207.2	90.4	201.7	176.9	87.7
Medun	0.15	224.9	202.8	90.2	205.4	177.6	86.5
	0.45	220.3	195.0	88.5	200.3	171.7	85.7

The weather conditions of the coriander growing season had a significant impact on the productivity of plants, and the average for the experiment in 2007 was 0.83 t / ha in 2008 – 1.08 t / ha, and in 2009 – 1.19 t / ha. In the pre-winter period the yield was higher by 30% and was 1.21 t / ha, respectively for early spring 0.86 t / ha. With the width of 0.45 m between rows it was returned average – 1.05 t / ha, whereas at 0.15 m – 1.00 t / ha.

Table 2 - Yield of coriander depending on sowing time, varietal characteristics and row spacing, t / ha

sowing time factor A	variety factor B	row spacing, m factor C	2007	2008	2009	average	average to factor A	average to factor B	average to factor C
Pre-winter	Oksanit	0.15	0.96	1.38	1.55	1.29	1.20	1.11	1.00
		0.45	0.99	1.44	1.63	1.35			1.05
	Nectar	0.15	0.94	1.21	1.38	1.18		1.03	
		0.45	0.97	1.29	1.43	1.23			
	Medun	0.15	0.90	1.04	1.23	1.05		0.94	
		0.45	0.92	1.12	1.29	1.11			
Early spring	Oksanit	0.15	0.72	0.91	0.98	0.87	0.86		
		0.45	0.76	0.99	1.03	0.92			
	Nectar	0.15	0.70	0.90	0.94	0.84			
		0.45	0.73	0.94	1.01	0.89			
	Medun	0.15	0.68	0.84	0.87	0.79			
		0.45	0.71	0.89	0.89	0.83			
HIP₀₅		ABC	0.03	0.05	0.10				
		AB	0.02	0.03	0.07	2007	0.01	0.01	0.01
		AC	0.02	0.03	0.06	2008	0.02	0.02	0.02
		BC	0.02	0.03	0.07	2009	0.04	0.05	0.04

The results of analysis of variance showed that the yield of coriander in the years of research depended by 41.1% on the time of sowing, by 25.2% on the varietal characteristics and by 18.5% on row spacing. Interaction of the two factors: the time of sowing and row spacing were crucial for 4.6%, the interaction of the time of sowing and varietal characteristics factors - 3.1% and the total interaction was - 2.5%.

Fruit of coriander is the main raw material for extraction of essential oil, part of which is the spirit - linalool, the proportion of which is from 50 to 85%. So much emphasis in our research refers not only to increasing the yield of coriander fruit, but also to the content of essential oil. This, in general, will have a positive impact on the gathering of essential oil per unit of area.

The mass fraction of essential oil in coriander changed, as depending on the factors and weather conditions during the formation and maturation of seeds. On average, in versions in 2007, the mass fraction of the essential oil was - 1.62%, in 2008 - 1.27% and in 2009 - 1.22% (Table 3).

Table 3 - Mass fraction of essential oil in coriander and the collection from 1 ha / kg depending on the sowing time, the varietal characteristics and row spacing

the sowing time factor A	Variety Factor B	Row spacing Factor C	Mass fraction of essential oil, %				The essential oil harvested kg / ha, 2007-2009	average to factor A	Average to factor B	Average to factor C
			2007	2008	2009	average				
Pre-winter	Ok sanit	0.15	1.68	1.25	1.15	1.36	17.5	16.8	14.9	13.8
		0.45	1.75	1.18	1.10	1.34	18.1			14.5
	Nectar	0,15	1.64	1.42	1.30	1.45	17.1		15.0	
		0.45	1.66	1.48	1.45	1.53	18.8			
	Medun	0.15	1.71	1.22	1.20	1.37	14.4		12.6	
		0.45	1.70	1.19	1.15	1.34	14.9			
Early spring	Ok sanit	0.15	1.54	1.32	1.25	1.37	11.9	11.5		
		0.45	1.58	1.16	1.15	1.29	12.0			
	Nectar	0.15	1.46	1.36	1.45	1.42	12.1			
		0.45	1.48	1.26	1.25	1.33	1.8			
	Medun	0.15	1.62	1.09	1.05	1.25	9.9			
		0.45	1.60	1.31	1.15	1.35	11.2			

When planting Oksanit, the mass fraction of essential oil in the fruit was - 1.34%, Medun - 1.33% and Nectar - 1.43%. Thus, sowing and row spacing had no significant effect on the mass fraction of essential oil in fruit of coriander.

One of the key elements of productivity of coriander is essential oil per 1 ha. This is affected by the yield and the content of essential oil in the fruit. Depending on the time of sowing and varietal characteristics, gathering essential oil ranged from 9.9 to 18.8 kg / ha. During the pre-winter period, the collection of essential oil was 16.8 kg /

ha, which is 31.5% higher than in early spring (11.5 kg / ha). Significant impact on gathering of essential oil have varietal characteristics and with Oksanit it was 14.9 kg / ha, Nectar - 15.0 kg / ha, Medun - 12.6 kg / ha. Increasing row spacing from 0.15 m to 0.45 m promoted the growth of the content of the essential oil from 13.8 to 14.5 kg / ha or the gain was 0.7 kg / ha. Higher level of this indicator was obtained during the pre-winter sowing period with Nectar row spacing of 0.45 m and it gave 18.8 kg / ha, and the lowest it was in early spring with Medun with row spacing of 0.15 m - 9.9 kg / ha.

Conclusion. In Northern Barrens the higher yield (1.35 t / ha) was gained with Oksanit, where the width between rows was 0.45 m, during the pre-winter sowing period. And the mass fraction of 1.53% and the content of the essential oil of 18.8 kg / ha was reached with Nectar. The best period for sowing coriander in this zone is pre-winter with the yield of 1.20 t / ha and gathered essential oil - 16.8 kg / ha, whereas in the early spring period – 0.86 t / ha and 11.5 kg / ha. High yield 1.05 t / ha was obtained when the width between rows was 0.45 m, and when it was 0.15 m the yield was 1.0 t / ha.

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СОРТОВІ ТА АГРОТЕХНІЧНІ ОСОБЛИВОСТІ ПІДВИЩЕННЯ ПРОДУКТИВНОСТІ КОРИАНДРУ В УМОВАХ ПІВНІЧНОГО СТЕПУ УКРАЇНИ

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Наведено узагальнені результати досліджень з вивчення впливу сортових особливостей, ширини міжрядь та строків сівби на продуктивність коріандру. Встановлено, що в умовах Північного Степу вищу врожайність (1,35 т/га) сформував сорт Оксаніт при ширині міжрядь 0,45 м за підзимового строку сівби, а сорт Нектар забезпечував більшу масову частку (1,53 %) та збір ефірної олії (18,8 кг/га).

Ключові слова: коріандр, продуктивність, сорти, ширина міжрядь, строки сівби, ефірна олія.

СОРТОВЫЕ И АГРОТЕХНИЧЕСКИЕ ОСОБЕННОСТИ ПОВЫШЕНИЯ ПРОИЗВОДИТЕЛЬНОСТИ КОРИАНДРА В УСЛОВИЯХ СЕВЕРНОЙ СТЕПИ УКРАИНЫ

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Приведены обобщенные результаты исследований по изучению влияния сортовых особенностей, ширины междурядий и сроков сева, на производительность кориандра. Установлено, что в условиях Северной Степи

высшую урожайность (1,35 т/га) сформировал сорт Оксанит при ширине междурядий 0,45 м при подзимнем сроке сева, а массовую долю – 1,53% и сбор эфирного масла – 18,8 кг/гектара сорт Нектар.

Ключевые слова: кориандр, производительность, сорта, ширина междурядий, сроки сева, эфирное масло.