



FORMATION OF CROP PRODUCTION OF CORIANDER SEEDS DEPENDING ON THE TECHNOLOGICAL FACTORS

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KEYWORDS

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ABSTRACT

It is presented the results of studies on the effects of row spacing, seeding rate and method of harvesting on the structural parameters and productivity of coriander seeds in the western forest-steppe.

1. INTRODUCTION

One of the first ephironoses, which began to be sown in the countries of close foreign countries, in particular in Russia, was coriander. in the second half of the nineteenth century Russian coriander was highly prized in world markets. Industrial cultivation of coriander in Ukraine began somewhat later, it was preceded by a common fennel and fragrant dill.

Today coriander is one of the most demanded aromatic crops, which is successfully used in various sectors of the national economy: confectionery, perfumery and cosmetics, alcoholic beverages and others. in addition, coriander is a valuable medicinal plant. Fruits are part of a special collection of tea (with flowers tsemina, mint leaves), having medicinal properties. Coriander essential oil has choleric, analgesic, antiseptic, antihemorrhoids, and healing properties, and this is the basis for its use in both folk and official medicine. in addition, blooming coriander - a good honey, according to scientists from 1 hectare of crops 200 kg of nectar are received up. the demand for this culture indicates the expediency of its cultivation, in particular for the needs of medicine and the need for scientific research in the study of technological issues.

2. MATERIAL AND METODS

The research was carried out in the conditions of LLC "Obolon Agro" of the Khmelnytsky region of Chemerivtsy district.

Experiments were laid in the I-III decades of April (depending on the level of the thermal regime of the soil and the weather and climatic conditions of the year). Placement of variants in the experiment - the method of split areas (split-raft). the accounting area of the plot is 50 m². Experiment 1 included: factor a - row spacing: 15 cm (solid row method), 30 and 45 (wide-row methods); factor B - seeding rate: 50, 30 and 10 pieces per running meter of row; factor C - a method of harvesting (single-phase, two-phase). Experiment 2 included: factor a - growth regulator (Ivin and Agroemistim-extra for pre-sowing seed treatment at a dose of 15 ml / t and spraying of vegetative plants in the leaf socket phase - 20 ml / ha, growth regulator Vermesti D for pre-sowing seed treatment at a dose of 8 l / t and spraying of vegetative plants in the phase of the socket of leaves - 10 l / ha. Water supply for seed treatment is 10 l / t), for spraying crops - 250 l / ha. Factor B - the period of application of the growth regulator (seed treatment, spraying of crops in the phase of the leaf socket). the predecessor was winter wheat. the soil tillage system included peeling of stubble, plowing to a depth of 20-22 cm, pre-sowing cultivation of a hay at a depth of 6-8 cm. Before sowing, the studied cultures were introduced with full N16P16K16 fertilizer (2 centners / ha) (nitroamophosk). Herbicide triflurax 480 (5 l / ha) was used to control annual crop and dicotyledonous weeds. Seed of cultures was carried out with a sowing machine SCS-1,8. it was harvested partly combine harvester with Sampo-130.

During the period of conducting the experiments, the following analyzes, observations and records were performed: records of plant crop density were carried out on fixed sites at the beginning and at the end of the vegetation, according to the methodology outlined by V.F. Moiseychenko and V.O. Yeshchenko; the plant density was determined twice: after full stairs and before plant gathering in (plant survival); phenological observations were made during the onset of the phases of growth and development of plants in accordance with the "Methodology of state sorting testing of agricultural crops; determination of the area of the leaf surface of plants - in accordance with the methodology set forth in the works of Yeshchenko V.O., Kopytko P.G., and others; Indicators of photosynthetic activity of plants in crops were determined according to the method of Moiseichenko V.F., Yeshchenko V.O.; the structure of plants was established on the test shafts of 25 plants that were taken before harvesting from two non-adjacent repetitions in two places of the plot on the following grounds: plant height, number of branches, number of leaves, number of inflorescences (productive umbrellas), number of seeds (fruits), seed weight from the plant; crop accounting was carried out by the method of continuous batching with combine harvester Sampo-130, resulting in yields of exactly 100% purity and standard humidity. Mathematical

processing of data was carried out according to Dospheva B.O.; the determination of the weight of 1000 seeds (fruits) was carried out according to the existing methods of the State Standard of SSTU 3484-96 (SESP 170-81-97); the chemical composition of the seeds (fruits) was determined by the indicators: fat content, qualitative characteristics of the oils (iodine number, number of KOH), the content of essential oils; bioenergetic assessment of the elements of cultivation technology was established according to the methodology and reference data defined by O.K. Medvedovsky, P.I. Ivanenko, A.V. Cherenkov, V.S. Rybka, etc.; statistical processing of the results of the research was carried out using the methods of dispersion, correlation, regression analysis on a personal computer using special software packages (Excel 2003, Statistica 6.0) using the methodical materials of Ermantraut E.R., Prysazhnyuk O.I., Shevchenko I.L., Ushkarenko V.O., Marchenko O.V., Schmidt V.M. etc.

3. RESULTS

The practical experience of growing coriander shows that the sowing can be carried out both in the early spring and in the fall. the total length of the growing season can range from 85 to 120 days. Required amount of effective temperatures with this is 2000°C. in spring sowing, seeds sprout at a temperature of 6-8°C, but simultaneous sprouts appear at 10°C.

In our studies, depending on the conditions of the year, the sprouts appeared on the 14-17-th day. Coriander has several types of leaves. the lower ones are long petioles, rounded shapes, form a socket of leaves. in all variants, the phase-to- sprouts -socket formation continued on average over the years of research for 11 days. the next period of formation of the socket-stem was the shortest and lasted 6 days. During this period, stems of plants were formed, in which the lower stem leaves were formed twice, three times dissected to linear, almost filiform segments. Medium and upper leaves are seated.

The interphase period of stem-branching lasted for 14-16 days. the difference between variants is explained by the greater number of branches on plants of broad-row crops at a greater distance between plants in a row. Branching-budding is a period of development of plants, which lasted 12 days in all variants, as the appearance of buds on plants was simultaneous, the difference was only in their amount, which was reflected in the course of the next interphase periods. Regarding the duration of the flowering phase, there was some difference between the variations due to the number of formed inflorescences, which were more with less thickened crops.

Flowers of coriander are most commonly same-sex (predominantly male). Plants bloom in June-July months, the flowering usually lasts about a month. During flowering, plants have a very strong (bad) smell, so they should plant crops 5 kilometers from the village and livestock farms (with the direction of wind from the village). the flowering period in our studies averaged over the years of research lasted 16-18 days, it was more prolonged in less congested crops, which marked the greater number of umbrellas per plant.

Coriander ripens at the same time, first the fruits of the main umbrellas, later - lateral. Ripped fruits quickly crumble, so they should be collected on time and in short. So, in a separate way, they collected 50% of the ripening of the fruits. Collection in a single-phase method was carried out at 75% maturation of the fruits. the length of the growing season was determined by the day of harvesting, so it was 86-93 days for direct harvest, and 80- 86 days for separate harvesting.

In experiment 2, when examining the influence of growth regulators on the duration of the interphase and vegetation periods of the coriander, some differences between the variants were revealed. Thus, when processing seeds by the growth regulator Agroemistim-extra sprouts appeared faster than other variants, their simultaneity, and as a consequence of the rapid passage of the phase of the outlet in general, contributed to a reduction in the duration of the phase-to-phase of the sprouts-formation of the socket for 2 days.

An exception to the general picture of the phases and periods of growth and development of plants was the period of branching-budding, namely, under the influence of spraying plants with growth regulators Agroemistim-extra and Ivin, the period lasted for 1- 2 days due to the tightening of more buds. a similar explanation can be given regarding the course of the budding-flowering period, which in the best case lasted 2 days longer compared to other variants. the most prolonged vegetation period with seed treatment was growth regulator Agroemistim-extra and spraying crops with Agroemistim-extra and Ivin, respectively: 87 and 86 days, while in the control vegetation period lasted for 83 days.

Plants compete with each other for light, moisture and nutrients. Depending on the species, the genotype, they have different weight and volume root systems and terrestrial biomass, so differently use the allocated feeding area. in crops, plants should be located at such a distance that vital factors (nutrients, light, air, etc.) were maximally accessible to each plant and there was no competition between them.

The plants of coriander in our research were formed not very tall, on average, during the years of research - 57,2-67,2 cm tall, whereas in conditions of southern Ukraine plants can

reach more than 100 cm in height. Variants of a continuous row method of sowing were characterized by the smallest linear sizes.

Leaves in plants of coriander are of two types: the lower (basal) round forms form a single socket, and gradually topped over into a multifaceted periosteum dissected. the total number of leaves per plant varied within the limits of 20,1-26,4 pieces, the least of them was formed on plants of the continuous method of sowing, and most of all - 26,3-26,4 - in variants with a width of rows of 45 cm and a given density of plants 10- 30 pieces per meter running (table 1).

Umbrellas that are formed on a plant can form seeds before harvest time or become unproductive, as harvesting is carried out when burying 50% of umbrellas. Consequently, before the harvest time, a structural analysis of the plants was carried out, and only productive inflorescences were taken into account, which, on average, amounted to 8,5 to 17,0 pieces per plant per year. on plants of continuous sowing, the index was 8,5-10,9, while in broad-leaved crops with width between rows of 30-45 cm the number of productive inflorescences was within the range of 16,7-17,0 per plant, that is, the difference between these variants was insignificant or was within the limits of error.

Tab.1. Biometric and structural indicators of coriander plants depending on the investigated factors

Row spacing (A)	Seedingrate, th.pcs/ha (B)	Indicators				
		Height of plant, cm	Number of leaves on the plant, pcs.	Number of productive umbrellas on the plant, pcs.	Number of seeds on the plant, pcs.	Weight of seeds per plant, h
15	3.333	60,5	20,1	8,5	142,3	0,85
	1.999	57,2	23,0	10,7	163,1	0,97
	666	58,1	23,1	10,9	165,2	0,99
30	1.666	66,1	24,5	16,9	270,6	1,62
	999	64,8	25,0	17,0	273,2	1,62
	333	64,6	25,1	17,0	274,6	1,63
45	1.111(K)	67,2	25,2	16,8	269,1	1,61
	666	67,0	26,4	16,7	268,3	1,64
	222	66,2	26,3	16,9	273,8	1,67

Accordingly, a larger number of inflorescences resulted in more seeds. Thus, in a continuous sowing, on average, 142,3-165,2 pcs. of seeds were obtained from the plant, while when sown by wide-row methods - almost twice as much – 268,5-274,6 pcs.

The weight of the seeds from the plant depended on its amount, therefore on the variants of continuous sowing the index was 0,85-0,99 g, and in the sowing with the width between rows of 30 and 45 cm - within the range of 1,61-1,67 g from the plant.

Some improvement in plant structure parameters is possible with the use of growth regulators, if the seed treatment prior to sowing did not produce the expected effect, the spraying of vegetative plants contributed to an increase in the number of productive umbrellas by 0,6-1,7 pcs. from the plant, the amount of seed from the plant - by 15,7-32,4 pcs., and the weight of the seeds from the plant - by 0,8-0,19 grams (Table 2).

Tab.2. Biometric and structural indices of coriander plants depending on application of plant growth regulators

Indicators	Seeds treatment before sowing				Crop spraying in the phase of socket leaves			
	Control (water)	Agroemistim-Extra	Ivin	Vermystym D	Control (water)	Agroemistim-Extra	Ivin	Vermystym D
Height of plant, cm	65,2	66,1	65,8	66,6	65,6	67,2	66,5	66,6
Number of leaves, pcs.	23,7	24,4	24,0	23,9	23,8	25,2	24,9	24,7
Number of productive umbrellas, pcs.	16,0	16,5	16,3	16,4	16,2	17,9	17,7	16,8
Number of seeds on the plant, pcs.	262,5	270,6	267,4	268,9	263,4	295,8	292,0	279,1
Weight of seeds per plant, h	1,60	1,62	1,61	1,61	1,59	1,78	1,75	1,67

The most effective was the growth regulator Agroemistim-Extra, which contributed to the formation of an average of 17,9 pc of productive umbrellas, which is 1,7 pc higher than the control version, with the total number of umbrellas per plant was similar. When

detecting the mechanism of action of this agent, scientists argue that it promotes accelerated cell division, resulting in activating all vital processes that occur in the plant organism.

A slightly smaller production of productive umbrellas (17,7 pcs.) was provided by Ivin growth regulator, which is characterized by the effect of increasing the pollination capacity of the flowers. In these variants, the amount of seed produced per plant was within the range of 292,0-295,8 pcs., and its weight was 1,75-1,78 grams, i.e. 0,16-0,19 grams more than in the control version.

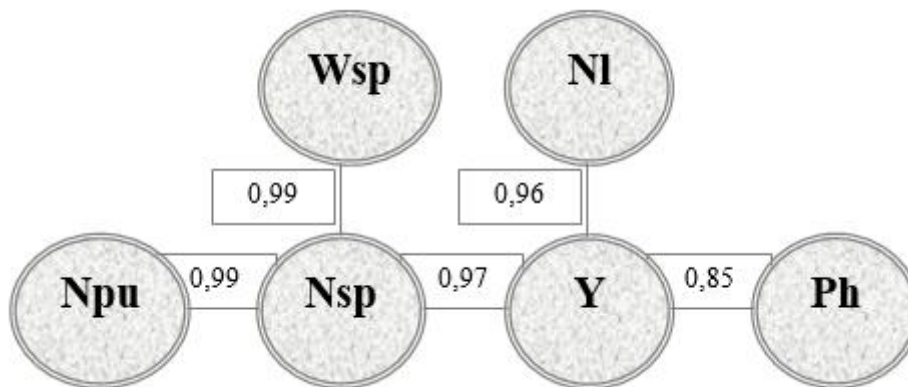


Fig.1. Correlation galaxy of connections system of coriander biometric indices depending on application of plant growth regulators

Content of variants: Npu- number of productive umbrellas per plant, Nsp - number of seeds from a plant, Wsp - weight of seeds from a plant, NI- number of leaves per plant, Ph - plant height, Y - yield.

Figure 1 shows that under the influence of growth regulators, the structure of plants was correlated with each other. Strong correlation bonds ($r = 0,85-0,99$) are noted between plant structure indices. The yield of seeds is correlated directly: the number of leaves, the height of the plant and the amount of seeds from the plant.

To increase the weight of the seeds from the plant by 0,19 grams is possible with the use of growth regulator Agroemistim-extra for spraying vegetative plants in the phase of the leaflet socket.

Coriander varieties have a high potential yield and fruit quality. Coriander is an early sowing culture, rather moisturizing, during seed germination absorbs about 125% of moisture from its own weight.

On average, over the years of research, the highest yield of 1,85-1,87 t / hectares was selected in variants with a width of 15 and 30 cm and the number of plants 50 pcs per running meter with a separate method of harvesting.

Coriander umbrellas mature unevenly. it is important to correctly define the term to reduce losses during assembly. it is possible to harvest directly by combing during rowing of 70% of umbrellas, or separately - when riding 40-50% of umbrellas. it should be noted that in the one-phase collection, more money was spent on drying seeds, and in addition, losses were much higher. it should be noted that for separate harvesting, beveled rolls should be thawed in the morning or evening hours, in order to reduce the yield halves, which crack the dry fruit of the coriander.

Of course, it is possible to accelerate the ripening of plants by conducting a preliminary desiccation, but we did not exclude this measure, since we recommend the use of raw materials for medical purposes. Hence, a separate method of harvesting was better, the difference in the yield of one- and two-phase harvesting was about 9-11%.

In the context of variants, the trend in the formation of seed yield of coriander was similar in both methods of harvesting. Thus, in more thickened crops due to the number of plants per unit area the yield was higher, and in the more lean crops - the opposite.

It should be noted that according to biometric and structural indices of plants, the difference between variants of continuous and broad-leaved crops was quite significant, but the limiting factor was the number of plants per unit area. the most optimal correlation between the indices of the structure of plants (seed quantity, seed weight) and the number of plants per unit area was at sowing at 15 and 30 cm and with a given plant density of 50 pcs. per meter running of row.

The difference between variants reflects the distribution of homogeneous groups according to the Duncan criterion. Thus, the reliable difference between the variants was noted at the width of the rows of 45, 15 and 30 cm. Variants with spacing of 30 and 15 cm spaced in the same homogeneous group, the yield of these variants in the two-phase harvesting varied by 0,07 t / ha. a similar trend was observed in the one-phase harvesting of coriander, but with somewhat lower yields.

Tab.3. the dependence of the yield of coriander seeds on the width of the row and seeding rate at two phase harvesting (by Duncan's criterion)

Variant	Productivity of fruits, t/ha	Homogeneous group		
		I	II	III
Row spacing (A): 45 cm	0,75		****	-
30 cm	1,12	****		-
15 cm	1,19	****		-
Seeding rate(B) 10 pcs/meter of row	0,35	****		
30 pcs/meter of row	1,06		****	
50 pcs/meter of row	1,65			****

Depending on the number of plants per running meter, the difference in yield between variants was reliable, and the value of yield at both harvesting periods was in different homogeneous groups, which were determined as three. Thus, variations with the number of plants from 50, 30 and 10 pcs per meter running are well suited, since each of them, in combination with the width of the rows, reflects the individual productivity, indicating the influence of the factors.

As regards the neural network, the productivity of coriander it has been manifested the minimization of interaction of hidden layers of radial functions of the natural and agrotechnical factors from five to seven elements to three (Figure 2).

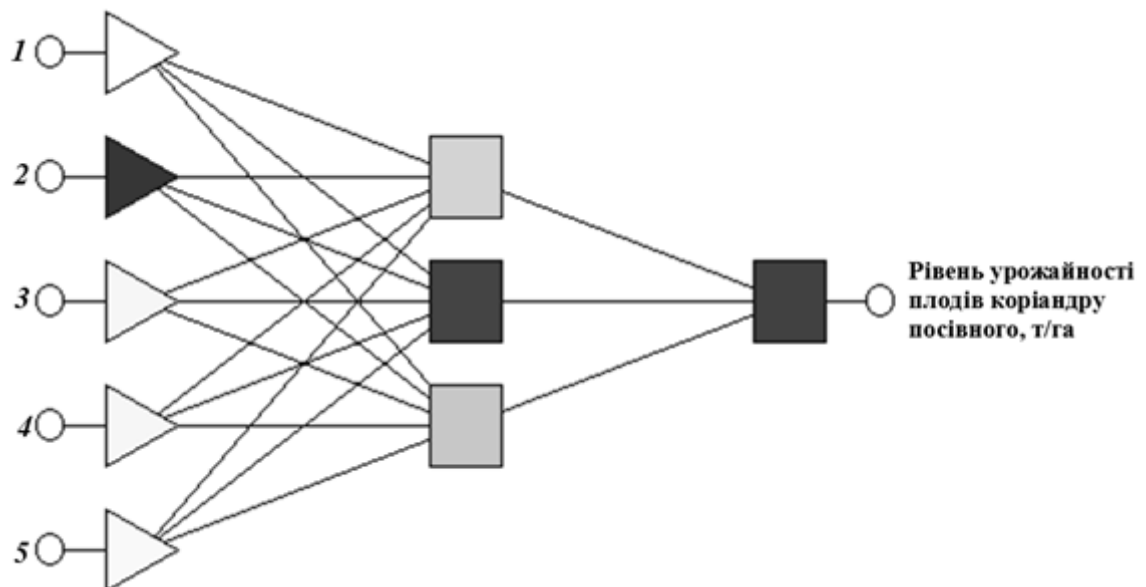


Fig.2. Neural network of coriander productivity (architecture: RBF 5: 5-3-1: 1; N = 5; educational productivity = 0,1609; control productivity = 0,0576; test productivity = 0,1016) depending on agrotechnical and natural factors: 1 is the width of the row, cm; 2 - the norm of seeding, pcs / m; 3 - the sum of effective temperatures over 10°C; 4 - duration of sunshine, hour .; 5 - amount of precipitation, mm

With regard to direct positive effect on seed yield, the advantage was the seeding rate, which, when interacting with the sum of effective temperatures and the duration of the sun's brightness, provided the highest level of the hidden layer of radial functions. the coriander neural network was characterized by low (less than one) values of training, control and test productivity.

If the components of yield were analyzed, the biometric indices and indicators of the crop structure (plant height, number of productive umbrellas, number and weight of seed from the plant) were more biometric than the technological (weight of 1000 fruits). the weight of 1000 coriander fruits fluctuated within 5,9-6,6 grams (Table 4).

Tab.4. Weight of 1000 fruits of coriander depending on row spacing, seeding rate and harvesting method, g

Row spacing, cm (A)	Seeding rate (B), pcs/running meter	One-phase harvesting (C)		Two-phase harvesting (C)	
		In fact	± to control	In fact	± to control
15	50	5,9	-0,3	6,1	-0,1
	30	6,0	-0,2	6,3	0,1
	10	6,2	-	6,4	0,2
30	50	6,2	-	6,6	0,4
	30	6,4	0,2	6,6	0,4
	10	6,3	0,1	6,5	0,3
45	50 (K)	6,2	-	6,5	0,3
	30	6,3	0,1	6,5	0,3
	10	6,3	0,1	6,6	0,4

LSD_{0,05}, h: A – 0,14; B – 0,14; C – 0,11; AB – 0,24; AC – 0,19; BC – 0,19; ABC – 0,33

Maximum control over (0,3-0,4 grams) is obtained from the variants of wide-range crops during biphasic harvesting.

The chemical composition of coriander fruits is affected by the same characteristic, in particular the content of essential oils (Table 5).

Tab.5. Content of essential oil in the seeds of coriander depending on the width of row spacing, seeding rate and harvesting method,%

Row spacing, cm (A)	Seeding rate(B), pcs/running meter	One-phase harvesting (C)		Two-phase harvesting (C)	
		In fact	± to control	In fact	± to control
15	50	1,3	-0,4	1,7	-
	30	1,4	-0,3	1,7	-
	10	1,3	-0,4	1,8	0,1
30	50	1,7	-	2,0	0,3
	30	1,7	-	2,0	0,3
	10	1,8	0,1	2,1	0,4
45	50	1,7 (K)	-	2,0	0,3
	30	1,8	0,1	2,1	0,4
	10	1,9	0,2	2,1	0,4

The discrepancy in the weight of 1000 fruits and in the chemical composition of the various methods of harvesting of coriander is due to the fact that when drying plants in the rolls is a process of re-utilization, the seed continues to ripen, gaining weight and, as a rule, improving their qualitative characteristics.

The accumulation of essential oils is influenced by various factors: climate, light, soil, phase of plant development, age, etc. the content of essential oils in coriander fruits in our studies varied within the range of 1,3-2,1%, that is, the difference between the variants was quite substantial. the largest amount of essential oil was accumulated in plants of broad-leaved crops at 30 and 45 cm with a given plant density of 10 and 30 pieces per meter of sequential line, an index of 2,1%.

3. CONCLUSION

The most optimal correlation between the indices of the structure of plants (the number of seeds, the weight of seeds) and the number of plants per unit area was formed at a seed of 15 and 30 cm with a seeding rate of 50 pcs. per meter running of row. on average, over the years of research yields on these variants with biphasic harvesting were 1,85-1,87 t / ha. with regard to the content of essential oil in the coriander seeds, the maximum values were on the variants of broad-leaved crops with the norm of seeding 10 pcs per running meter of row, the index was 2,1%.

Using the growth regulators Ivin and Agroemistim-extra for spraying the crops, the yield of coriander seeds increased by 0,25-0,31 t / ha, which was 14,1-17,5%.

Maximum control over (0,3-0,4 grams) by weight of 1000 seeds is obtained from the variants of wide-range crops during two-phase harvesting. with regard to the content of essential oil in the coriander, the maximum values were on the variants of broad-leaved crops with the norm of seeding 10 pcs per running meter of row, the index was 2,1%.

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