

UDC 633.88: 582.998.1: 631.5: 631.53.04

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EFFECT OF AGROTECHNICAL MEASURES ON STAND DENSITY OF MILK THISTLE PLANTS

It is shown the results of studies of the impact of row spacing, seeding rate and terms of growth regulators application on the germination and survival of milk thistle plants. As a result of analyses it is found that with increasing of row spacing and a decrease in the number of plants per linear meter, there was a tendency to higher field germination and survival of plants at the end of the growing season. In the application of growth regulators the highest germination and survival of plant growth were provided by regulator Agroemistim-extra.

Keywords: milk thistle, row spacing, seeding rate, germination, survival, growth regulator

Introduction. There are conditions for the cultivation of medicinal plants and processing them into pharmaceuticals in Ukraine. However, the area under medicinal plants are very small and not expanding, mainly due to imperfect cultivation technology. Method of sowing, seeding rate, use of biologically active agents and others play important role among agro activities which are able to adjust the optimum conditions for plant growth and development. These issues are partially studied in medicinal plants such as marigold medicinal, valeriana officinalis, datura purple, nigella crop and so on in different soil-climatic zones of Ukraine. In addition to these crops, milk thistle is also valuable medicinal plant. Almost all known pharmaceutical companies produce medications from milk thistle, namely in the form of oil from seeds, meal, powder, tablets, tinctures, dry and wet biomass plants. They are produced in many countries under different names, but they are similar in their structure and mechanism of action in humans [1, 2]. This multifaceted use of milk thistle and compliance of the forest-steppe zone of biological characteristics of culture led us to choose the direction of research.

Review of existing publications on this issue. In terms of Poltava researches were performed on milk thistle growing in small areas with a predominantly manual labor. According to studies by the methods of wide row sowing only 30% of inflorescence lasts for one-two weeks, 90% - 24-40 days from the beginning of harvest. The largest increase in seed yield was observed at the 12-16th day. [3] In the South of Ukraine on irrigated lands of Kherson it was carried out the research of the impact of growing technology elements on the productivity of milk thistle. According to Ushkarenko V.A. and Filippov I.M, fertilizers and sowing have the greatest impact on plant productivity, share of voice is respectively: 39.2 and 26.2%, whereas row spacing and depth of tillage are less influential factors (3,3-5 3%). Thus, on the background of N₉₀P₉₀ at sowing at the end of March it was received the maximum yield of milk thistle seed - at 16.0 kg / ha [4].

Purpose. The aim of our research was to set the best method of sowing of milk thistle and determine the effect of terms of growth regulators application on the indicators of crop structure in forest steppes of Ukraine.

Materials and methods. Research was conducted during 2009-2013 years in terms of "Obolon Agro" Khmelnytsky region Chervonohirsk district (the branch of breeding, seed production and general biological sciences PSATU). The studies were laid in the link rotation after winter wheat. Variety of milk thistle Boykivchanka was studied. Area of accounting area is 25 m², repetition of the experiment is four times. Accounting, analysis and monitoring were carried out in accordance with the method of "Conducting of field research on medicinal plants" [5], "Foundations of scientific research in agronomy" [6].

Results and discussion. Getting of full plants shoots is a key to productivity of any culture. Field germination of different plants varies depending on soil and climatic conditions.

It should be noted that when growing herbs much attention should be paid to seed material, as the seed of these crops are usually characterized by low seeding properties. Sowing must be held with varietal seeds of high reproductions, field germination should not be less than 85 % according to current standards.

Given density of plants depending on row spacing and number of plants per linear meter is formed in studies.

Shooting of milk thistle is within 88,3-93,2%, it was identical to the number of plants - 206-2.943 thousand units per one hectare of crops (Table 1).

Table 1

**Stand density of milk thistle plants depending on row spacing and seeding rate
(average for 2009-2013), %**

Row spacing, cm	Seeding rate, th.units/ha	Field germination		Survival of plants	
		th.units/ha	%	th.units/ha	%
15	3.333	2.943	88,3	1.777	60,4
	1.999	1.839	92,0	1.279	69,3
	666	614	92,2	557	90,8
30	1.666	1.546	92,8	1.140	73,8
	999	929	93,0	810	87,2
	333	310	93,1	290	93,6
45	1.111	1.029	92,7	911	88,6
	666 (K)	620	93,2	561	90,6
	222	206	93,0	194	94,5
LSD _{0,05} , %:		A – 0,80; B – 0,80; AB – 1,39		A – 1,50; B – 1,50; AB – 2,60	

Options that were available with greater density per unit area had lower germination compared with those that were sown with greater nutrition area.

The slightest resemblance 88.3% were marked at sowing with 15 cm row spacing and seeding rate of 3.333 thousand per hectare. The greatest shooting 93.2% was provided by sowing at 45 cm with a given rate of sowing 666 th.units/ha. The difference between the options of wide row crops with row spacing 30 and 45 cm at different rates of seeding ranged 0.1-0.2%.

An important metric that determines standing density of plants at the end of the growing season is the percentage of survival, as the growing season for some number of plants can be damaged and dies as a result of environmental factors. Typically, the largest number of cultural plant species, including milk thistle, died in the early period of growth - from germination to the formation of 5-6 rosette leaves.

Wide row crops were characterized by more survival of plants with a given stand density of 10 units per linear meter, the figure was within 90,8-94,5 %. By the way, the control variant was characterized as one of the best indicators, which was 90.6 %.

The smallest percentage of plant survival was 60.4 with a continuous -row planting method with a given plant density of 50 units per linear meter. This low indicator is explained by excessive density of milk thistle crops, which leads to competition between plants in the struggle for life factors.

Study of the influence of growth regulators on the germination and survival of plants was performed at sowing with a width of 30 cm between rows and the number of plants 10 units per linear meter, that is, at seeding rate 333 thousand units per hectare.

Table 2 shows that all agents used in varying degrees increased field germination of milk thistle at preliminary treatment of seeds, the rate ranged from 93,5-95,3%.

As for the survival of plants, growth regulator Agroemistim-extra influenced this indicator mostly, survival of plants 97.3% was observed on the variant of seed processing, whereas in the control rate was 94.0%.

Stand density of milk thistle plants depending on the terms of application of growth regulators (average for 2010-2013 years)

Indicator	Treatment of seeds before sowing				Spraying of plants in the phase of leaves sockets			
	Control (water)	Agroemistim-extra	Ivin	Vermystym D	Control (water)	Agroemistim-extra	Ivin	Vermystym D
Field germination th.units/ha	310	317	311	311	309	310	309	310
%	93,1	95,3	93,5	93,7	93,0	93,2	92,9	93,1
LSD _{0,05} , %: A – 0,49; B – 0,35; AB – 0,70								
Survival of plants th.units/ha	291	308	298	298	291	235	293	295
%	94,0	97,3	96,1	96,0	94,2	95,4	95,0	95,2
LSD _{0,05} , %: A – 0,48; B – 0,34; AB – 0,68								

Thus, we can state the fact of efficiency of influence of growth regulators at preliminary treatment of seeds, so good starting conditions are associated with preservation of plants during the growing season, particularly their resistance to adverse environmental factors.

Conclusions. Accounting of stand density of milk thistle plants showed that these rates were dependent on factors that were studied. Thus, with increasing of row spacing and a decrease in the number of plants per linear meter, there was a tendency to higher field germination and survival of plants at the end of the growing season. With the width between rows 30 and 45 cm and the number of plants of 10-30 units per linear meter difference between the options was insignificant.

The best survival rates of plants were characterized by variations of the width between rows 30 and 45 cm and 10 units of plants per meter of row, the percentage of plants that survived the end of the growing season was, respectively, 93.6 and 94.5.

In the application of growth regulators the greatest shooting 95.3% was provided by Agroemistim-extra on the variant of treatment of seeds and excess control was 2.2%. Survival of plants has increased on 3.3% using this agent.

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Анотація

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Вплив агротехнічних заходів на густоту стояння рослин розторопші плямистої

У статті висвітлено результати досліджень впливу ширини міжрядь, норми висіву насіння та строків застосування регуляторів росту на схожість і виживання рослин розторопші плямистої. Встановлено, що із збільшенням ширини міжрядь і зменшенням кількості рослин на метрі погонному, спостерігалась тенденція до підвищення польової схожості і виживання рослин на кінець вегетації. При застосуванні регуляторів росту найбільшу схожість та виживання рослин забезпечив препарат Агроемістим-екстра.

Ключові слова: розторопша плямиста, ширина міжрядь, норма висіву, схожість, виживання, регулятор росту

Аннотация

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Влияние агротехнических приёмов на густоту стояния растений расторопши пятнистой

В статье приведены результаты исследований влияния ширины междурядий, нормы высева семян и сроков применения регуляторов роста на всхожесть и выживание растений расторопши пятнистой. Установлено, что при увеличении ширины междурядий и уменьшении количества растений на метре ряда, наблюдалась тенденция к повышению полевой всхожести и выживания растений на конец вегетации. При применении регуляторов роста наибольшую всхожесть и выживание растений обеспечил препарат Агроэмистим-экстра.

Ключевые слова: расторопша пятнистая, ширина междурядий, норма высева, всхожесть, выживание, регулятор роста