https://doi.org/10.26898/0370-8799-2023-11-3
УДК: 633.8.631.5
Тип статьи: оригинальная
Type of article: original

ВЛИЯНИЕ СРОКОВ ПОСЕВА НА ФЕНОЛОГИЧЕСКОЕ РАЗВИТИЕ И УРОЖАЙНОСТЬ ЛЕКАРСТВЕННЫХ КУЛЬТУР В ЗАБАЙКАЛЬЕ

(✉)**Андреева О.Т.**
Научно-исследовательский институт ветеринарии Восточной Сибири – филиал Сибирского федерального научного центра агробиотехнологий Российской академии наук
Чита, Россия
(✉)e-mail: chita@sfsca.ru

Представлены результаты полевых и лабораторных исследований за 2020–2022 гг. по созданию агрофитоценозов ценных и перспективных лекарственных растений: расторопши пятнистой *(Silybum marianum)*, фенхеля обыкновенного *(Foeniculum vulgare*) и скорцонеры испанской (*Scorzonera hispanica* L.). Исследования выполнены на лугово-черноземной мучнисто-карбонатной почве (по гранулометрическому составу – легкий суглинок) на опытном поле при разных сроках посева в условиях лесостепной зоны Забайкалья. Работа посвящена изучению влияния сроков посева (II декада мая, II декада июня, II декада июля) на продолжительность межфазных периодов развития растений, линейный рост, облиственность, полевую всхожесть, сохранность растений и урожайность лекарственного сырья. Установлена возможность формирования различной урожайности лекарственных культур за счет различных сроков посева. Наибольшая урожайность лекарственного сырья сформирована в посевах 15 мая и 15 июня. У расторопши пятнистой урожайность зеленой массы составила 15,4–16,0 т/га, сухой массы – 2,46–2,56 т/га, семян – 1,69–1,71 т/га; фенхеля обыкновенного – зеленой массы – 43,0–43,2 т/га, сухой массы – 6,66–6,71 т/га; скорцонеры испанской – с сырой массой корнеплодов – 32,1 т/га, листьев – 10,7 т/га. Высота растений к моменту уборки расторопши пятнистой была 163–166 см, облиственность – 54–57%; фенхеля обыкновенного – 144–147 см и 50–54%; скорцонеры испанской – 39 см и 98% соответственно. Отмечено отсутствие пораженности лекарственных растений болезнями и вредителями. Все культуры устойчивы к полеганию и засухе (5 баллов) в условиях Забайкалья.

Ключевые слова: лекарственные растения, расторопша пятнистая, фенхель обыкновенный, скорцонера испанская, межфазные периоды, урожайность, адаптивность, развитие растений, сроки посева

INFLUENCE OF SOWING DATES ON THE PHENOLOGICAL DEVELOPMENT AND YIELD OF MEDICINAL CROPS IN TRANSBAIKALIA

(✉)**Andreeva O.T.**
Scientific Research Institute of Veterinary Medicine of Eastern Siberia – Branch of the Siberian Federal Scientific Centre of Agro-BioTechnologies of the Russian Academy of Sciences
Chita, Russia
(✉)e-mail: chita@sfsca.ru

The results of field and laboratory studies for 2020, 2022 on the creation of agrophytocenosis of valuable and promising medicinal plants: milk thistle (*Silybum marianum*), common fennel (*Foeniculum vulgare*) and scorzonera (*Scorzonera hispanica* L.) are presented. The studies were carried out on meadow-chernozem mealy carbonate soil (light loam by granulometric composition) in the experimental field at different sowing dates in the conditions of the forest-steppe zone of Transbaikalia. The work is devoted to the study of the sowing dates influence (II ten-day period of May, II ten-day period of June, II ten-day period of July) on the duration of the interphase periods of plant development, linear growth, foliage, field germination, plant safety and yield of medicinal raw materials. The possibility of formation of different yields of medicinal crops due to different sowing dates has been established. The highest yield of medicinal raw material was formed in the crops of May 15 and June 15. Milk thistle had the yield of the herbage of 15.4–16.0 t/ha, dry mass – 2.46–2.56 t/ha, seeds – 1.69–1.71 t/ha; common fennel herbage – 43.0–43.2 t/ha, dry mass – 6.66–6.71 t/ha; scorzonera – with wet weight of root crops – 32.1 t/ha, leaves – 10.7 t/ha. Plant height by the time of harvesting of milk

thistle was 163–166 cm and 54–57%; common fennel – 144–147 cm and 50–54%; scorzonera – 39 cm and 98%, respectively. There was no infestation of medicinal plants by diseases and pests. All crops were resistant to lodging and drought (5 points) in the conditions of Transbaikalia.

Keywords: medicinal plants, milk thistle, common fennel, scorzonera, interphase periods, yield, adaptability, plant development, sowing dates

Для цитирования: *Андреева О.Т.* Влияние сроков посева на фенологическое развитие и урожайность лекарственных культур в Забайкалье // Сибирский вестник сельскохозяйственной науки. 2023. Т. 53. № 11. С. 23–31. https://doi.org/10.26898/0370-8799-2023-11-3

For citation: Andreeva O.T. Influence of sowing dates on the phenological development and yield of medicinal crops in Transbaikalia. *Sibirskii vestnik sel'skokhozyaistvennoi nauki = Siberian Herald of Agricultural Science,* 2023, vol. 53, no. 11, pp. 23–31. https://doi.org/10.26898/0370-8799-2023-11-3

Конфликт интересов
Автор заявляет об отсутствии конфликта интересов.
Conflict of interest
The author declares no conflict of interest.

INTRODUCTION

Medicinal plants hold significant importance in the national economy. Due to their widespread occurrence and valuable properties, medicinal plants have been used since ancient times. The arsenal of medicinal plant-based drugs has been created as a result of the long historical experience of peoples around the world and the research efforts of numerous scientists [1–5]. Compared to synthetic drugs, plant-based preparations possess a broader and gentler therapeutic action, lower toxicity, and minimal side effects. Eco-products based on medicinal plants are used not only in the production of medical and veterinary drugs but also in the food industry, cosmetology, perfumery, etc. The huge demand for medicinal raw materials in China is due to the fact that this method of treatment is "in the blood" of the Chinese people, as the country has existed for many millennia and traditional medicine has become part of Chinese philosophy. The book on medicinal plants "Ben Cao", dated 2600 BC, describes 900 plants, many of which are still widely used in many countries today. The global market for medicinal drugs and dietary supplements is worth hundreds of billions of dollars and its capitalization volumes are growing every year. In global medical practice, there is a steady trend towards the use of therapeutic and prophylactic drugs of plant origin. In Russia, the domestic pharmaceutical industry's need for medicinal raw materials is not fully met. Significant volumes of plant medicinal raw materials are imported, although many species were previously grown and harvested in our country, particularly in Transbaikalia. In this context, the revival and development of medicinal plant cultivation in the Russian Federation at the current stage and in the future is a relevant task. Cultivating medicinal crops has great national economic significance, as it not only addresses the pharmaceutical industry's supply issues but also has social importance related to employment and import substitution [4].

Among the promising sources of medicinal remedies are lady's thistle (*Silybum marianum*), common fennel (*Foeniculum vulgare*), and Spanish salsify (*Scorzonera hispanica* L.). The medicinal raw materials of these plant species have healing properties for many diseases. For instance, lady's thistle (*Silybum marianum*) is used for liver diseases, gallbladder issues, improving metabolism, and in cases of poisoning. Therapeutic properties are not only in the fruits but also in the leaves, stems, and roots of the plant. Lady's thistle fruits contain about 3% silymarin, which is also present in the stems, roots, and leaves[1, 2] [6, 7]. Spanish salsify (*Scorzonera hispanica* L.) is beneficial and medicinal. Its healing properties include calming the nervous

[1]*Kshnikatkina A.N., Alenin P.G., Kshnikatkin S.A., Voronova I.A.* Milk thistle: Issues of biology, cultivation, application. Penza: EPD PSAA, 2016, 325 p.

[2]*Alenin P.G., Kshnikatkin S.A., Voronova I.A.* Productive process of seed agrophytocenoses of milk thistle, burnet polygam in the conditions of the forest-steppe of the Middle Volga region // Volga Region Farmland, 2017, N 1 (42), pp. 2-9.

system, alleviating insomnia, normalizing blood sugar levels, regulating heart rhythm, stopping the development of osteoarthritis and gout, and being useful in oncological diseases, liver cirrhosis, and atherosclerosis. The medicinal raw materials of black salsify (roots, leaves) are a source of antioxidants[3] [8–12]. Common fennel (*Foeniculum vulgare*) helps eliminate toxins and harmful substances from the body. Preparations made using common fennel are widely used in medicine. Various forms are used: infusions, decoctions, powder, oil. Crushed dry leaves serve as an effective expectorant[4] [13].

The content of biologically active substances in plant organs significantly depends on the growing conditions, the duration of vegetation, and the mass and size of these organs. In the complex of technological practices for cultivating medicinal crops, the timing of sowing plays a significant role. Sowing dates influence the yield and quality of the product to the extent that they coincide with favorable environmental conditions (in terms of moisture and heat supply) for plant growth, development, and crop formation. Through different sowing dates, it is possible to reduce the plants' dependence on unfavorable environmental factors and form a good yield of medicinal raw materials.

In the conditions of the Transbaikalia region, the sowing dates for medicinal plants have not been previously studied. Therefore, research to determine the optimal sowing dates for medicinal crops - lady's thistle, common fennel, and Spanish salsify - is timely, relevant, and has scientific and practical value.

The purpose of the research is to determine the optimal sowing dates that allow for high yields of medicinal raw materials (lady's thistle, common fennel, Spanish salsify) in the forest-steppe zone of Transbaikalia.

MATERIAL AND METHODS

The research was conducted from 2020 to 2022 at the experimental field of the East Siberia Research Institute of Veterinary Science - a branch of the Siberian Federal Scientific Centre of Agro-BioTechnologies of the Russian Academy of Sciences, located in the Ingodinskaya-Chita forest-steppe. The study examined the influence of the sowing dates on the growth, development, and yield of medicinal plants such as lady's thistle (*Silybum marianum*), common fennel (*Foeniculum vulgare*), and Spanish salsify (*Scorzonera hispanica* L.).

The soil at the experimental site is meadow-chernozem sandy loam with carbonate content, granulometric composition – light loam. The soil solution of the arable horizon is slightly acidic, while the subsoil horizon is neutral. The organic matter content in the 0–20 cm soil layer is 3.67%, with total nitrogen at 0.21%. The availability of mobile phosphorus is low, and exchangeable potassium is medium. The sowing area of each plot is 20 m², with an accounting area of 10 m² and a four-fold repetition of the experiments. The layout is systematic.

Mineral fertilizers were applied before sowing at the rate of $N_{60}P_{60}K_{60}$. Sowing was carried out mechanically using a CH-16 seeder in a row method with 30 cm spacing between rows at three different times: in the second ten-day period of May, the second ten-day period of June, and the second ten-day period of July. The seeding rate for lady's thistle was 18 kg/ha, for common fennel 10 kg/ha, and for Spanish salsify 12 kg/ha, with a seed planting depth of 3–4 cm. For uniform sowing, the seeds were mixed with granulated superphosphate (at a ratio of 1:3). All registrations and observations were carried out in accordance with methodological guides[5–10].

[3]*Galyuk, N.G.* Processing of inulin-containing raw materials for inulin and its derivatives / N.G. Galyuk, N.D. Lukin, T.S. Puchkova, D.M. Pihalo // Achievements of science and technology of AIC, 2017, vol. 31, N 8, pp. 76-79.

[4]*Karomatov I.D., Muzaffarova S.K., Turaev P.T.* Therapeutic properties of fennel // Biology and Integrated medicine, 2017, N 9, pp. 23-43.

[5]Methodological instructions for conducting field experiments with forage crops. Moscow, 1983, 197 p.

[6]Experimental work in field farming. Leningrad, 1982, 190 p.

[7]*Dospekhov B.A.* Methodology of field experiment. Moscow, 1985, 357 p.

[8]Methodology of state variety testing of agricultural crops. Moscow, 1985, 267 p.

[9]Instruction for zonal agrochemical laboratories on fodder and plant analysis. Moscow, 1968, 56 p.

[10]GOST 34221-2017 Seeds of medicinal and aromatic crops. Sort and sowing qualities. Technical conditions. Moscow: STANDARDINFORM, 2017, 23 p.

The climate of the area is sharply continental with a cold, low-snow winter, a hot summer, and a lack of atmospheric precipitation. The average annual precipitation is 330–380 mm, with the majority (85–90%) falling in the warm period, the maximum in July-August, and the minimum in May-June. Overall, the regime is characterized by variability in moisture. Years with good moisture are followed by satisfactory and often dry ones. The sum of temperatures above 10 °C during the summer months is 1500…1800°, with a high average daily temperature in July of 19.1 °C.

The weather conditions during the vegetation periods of 2020–2022 were mainly rainy and warm. From April to September, precipitation totaled 320.2; 349.0 and 406.0 mm against the long-term average norm of 276.0 mm. Exceeding the long-term average was 44.2; 73.6; 130 mm, or 16.0; 26.6; 47.0%. The average daily air temperature for this period exceeded the norm by 0.7; 0.9 and 1.9 °C with a long-term average of 11.2 °C. Hydrothermal coefficients (HTC) for the months of the vegetation periods on average were: in May – 1.0, June – 1.2, July – 2.6, August – 1.1, September – 2.4 units. According to these coefficients, May, June, and August are characterized as sufficiently moistened, while July and September – as excessively moistened.

Overall, the weather conditions that developed during the vegetation period contributed to the timely emergence of seedlings, good plant development, and the formation of sufficiently high yields of the studied crops in agro-phytocenoses.

The studied medicinal crops were resistant to diseases and pests. No diseases or damage caused by pests and diseases were noted.

RESULTS AND DISCUSSION

The research established that the hydrothermal conditions and biological characteristics of the culture significantly influenced the development of the studied crops, the timing of phenological phases, and their duration.

For the spring sowing date of May 15th, the average daily air temperature during the sowing-emergence period was 8.8 °C, significantly affecting soil warming and the emergence of seedlings. Seedlings of medicinal plants in the May 15th sowings appeared on the 23rd–25th day after sowing. June sowings of medicinal herbs accelerated the emergence of seedlings by 8–9 days, and July sowings by 16–18 days (see Table 1). The period from emergence to budding (branching) for lady's thistle was 50 to 55 days, and for common fennel 52 to 62 days. The duration of the emergence-flowering period for May and June sowings for lady's thistle was 70–73 days, for common fennel 77-81 days; in June sowings, this period for lady's thistle was 3 days shorter, for common fennel 4 days. In July sowings, the plants did not reach the flowering phase. Seed ripening in lady's thistle was achieved only in May and June sowings, with a period of 91—95 days.

The interphase period from emergence to root formation in Spanish salsify in May sowings was 118 days, in June sowings 110 days. In July sowings, harvesting was carried out 55 days after emergence (at the stage of plant row closure – beginning of root crops formation).

In sowings of lady's thistle and common fennel, field germination ranged from 77–78 to 86–87%, and for Spanish salsify from 75 to 81% (see Fig. 1), increasing from the early sowing date (May 15th) to the later ones (June 15th by 3-4% and July 15th by 6–9%). Plant survival in medicinal herb crops was quite high, at 98-99%.

Weed infestation in spring sowings during emergence (with one pre-sowing cultivation) was high, at 97–114 plants/m²; June 15th (with two pre-sowing cultivations) at 73-80 plants/m²; July 15th (with three pre-sowing cultivations) at 32–37 plants/m². Before harvesting, the overall level of weed infestation in sowings was low, ranging (depending on sowing dates) from 15-16 to 2-8 plants/m², decreasing from early to later sowing dates.

The maximum height of medicinal plants at the time of harvesting was reached in sowings of May 15th and June 15th: for lady's thistle 163–166 cm, for common fennel 144–147 cm, for Spanish salsify 39 cm, which was higher than in the July 15th sowings by 97–100, 82-85, and 12–13 cm respectively for the crops; the

Табл. 1. Продолжительность межфазных периодов лекарственных растений, дни (среднее за 2020–2022 гг.)

Table 1. Duration of the interphase periods of medicinal plants, days (average for 2020–2022)

Culture	Periods							
	Sowing – sprouts	Sprouts – 4 – 6 pairs of true leaves	Sprouting – closing of crop	Sprouting – budding (branching)	Sprouting – flowering	Sprouting – seed ripening, beginning of fruit formation	Sprouting – leaf rosette, root formation	Sprouting – harvesting
Sowing May 15								
Lady's thistle	23	–	–	55	73	95	–	95
Common fennel	25	–	–	62	81	85	–	85
Spanish salsify	25	26	48	–	–	–	118	118
Sowing June 15								
Lady's thistle	14	–	–	51	70	91	–	91
Common fennel	17	–	–	52	77	81	–	81
Spanish salsify	17	22	44	–	–	–	110	110
Sowing July 15								
Lady's thistle	7	–	–	55	–	–	–	55
Common fennel	7	–	–	55	–	–	–	55
Spanish salsify	7	21	41	–	–	55	–	55

leaf coverage was 54-57%, 50–54%, and 98% respectively. In the late sowing date (July 15th), the height of the plants was the lowest, being 66, 62, and 27 cm for the respective crops, with high leaf coverage – 64, 61, and 98% (see Fig. 2).

In assessing the plants' response to drought, where the methodology is based on the yellowing of basal leaves and loss of turgor, it was noted that the studied crops did not suffer from drought (drought resistance – 5 points).

The assessment of medicinal crops showed that under the conditions of the vegetation periods, lady's thistle and common fennel in the May 15th and June 15th sowings formed maximum productivity: herbage – 15.40–16.00; 43.00–43.20 t/ha; dry matter – 2.46-2.56; 6.66–6.71 t/ha; seeds (for lady's thistle) – 1.69–1.71 t/ha, with good qualities – 1000 seed weight – 31–32 g, fat content in seeds – 23.6–25.2% (see Tables 2, 3).

In the July 15th sowings, the yield of medicinal raw materials was less: herbage by 12.5-13.1 t/ha (or 81.7-81.9%); dry matter by 2.00-2.10 t/ha (or 81.3-82.0%); seeds did not form in this sowing period for lady's thistle.

In agro-phytocenoses of Spanish salsify, root crops and leaves were accounted for (see Table 3). The highest total yield of medicinal raw materials (42.8 t/ha) of Spanish salsify was formed in the spring sowing (May 15th): including root crops – 32.1 t/ha, leaves – 10.7 t/ha, total biomass 42.8 t/ha, exceeding the later sowings by 9.5-29.0 t/ha (or 22.2-68.0%).

Important indicators of the yield structure of Spanish salsify root crops are their diameter and length. The largest (18.5 mm in diameter) and longest (28 cm) root crops were formed in the May 15th sowings (over 118 days of vegetation) (see Table 3).

In the May 15th sowings, the highest yield of root crops was 32. 1 t/ha, which was 22.4% higher than in the June 15th sowings, and 95% higher than in the late (July 15th) sowing, confirming the yield structure. A close positive correlation (r = 0.98) was noted between the yield and the diameter of the root crops, and the yield and the length of the root crops.

CONCLUSIONS

1. In the forest-steppe zone of Transbaikalia, the most favorable conditions for the growth, phenological development, and formation of medicinal raw material yields – for lady's thistle (*Silybum marianum*) and common fennel (*Foeniculum vulgare*) – are the second ten-day period of May (May 15th) and the second ten-day pe-

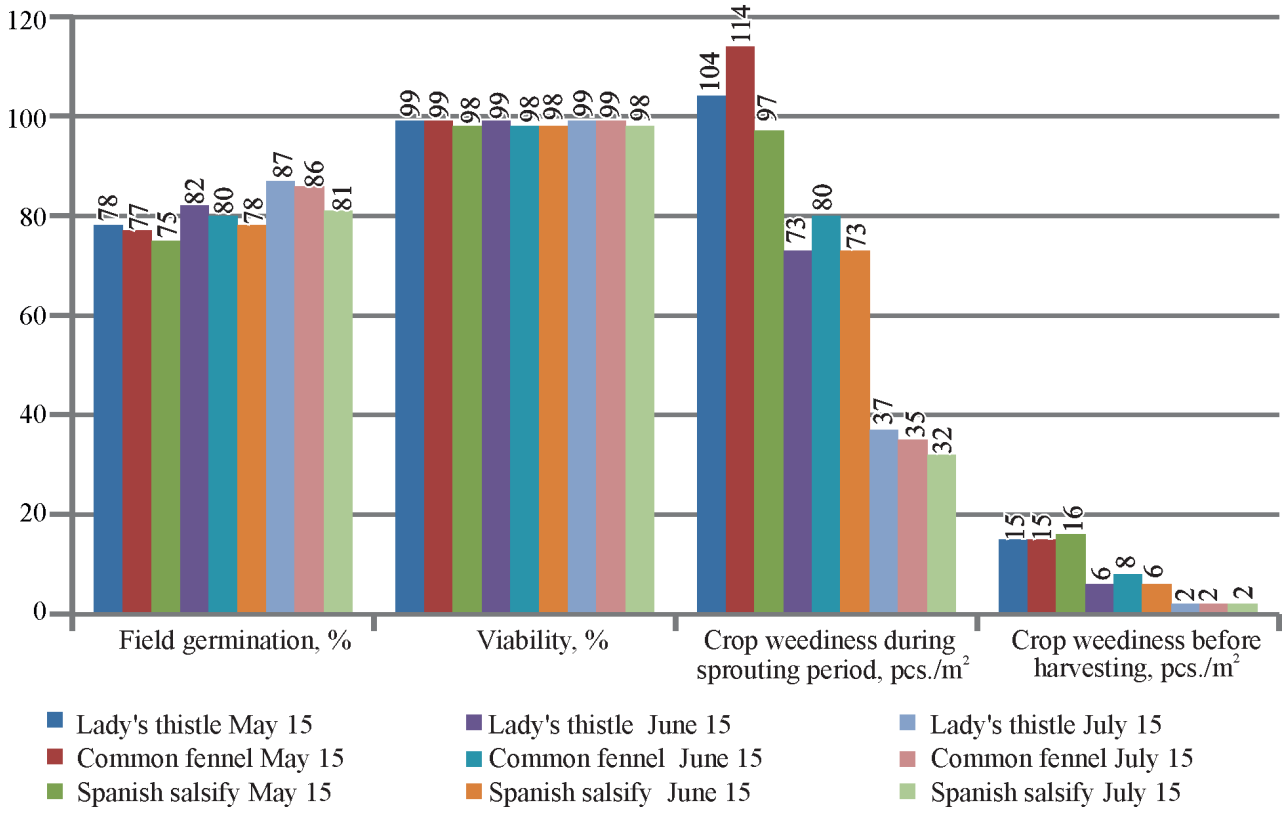

Рис. 1. Полевая всхожесть, сохранность и засоренность посевов лекарственных растений в разные сроки посева: 15 мая, 15 июня, 15 июля (среднее за 2020–2022 гг.)

Fig. 1. Field germination, safety and contamination of medicinal plant crops at different sowing dates: May 15, June 15, July 15 (average for 2020–2022)

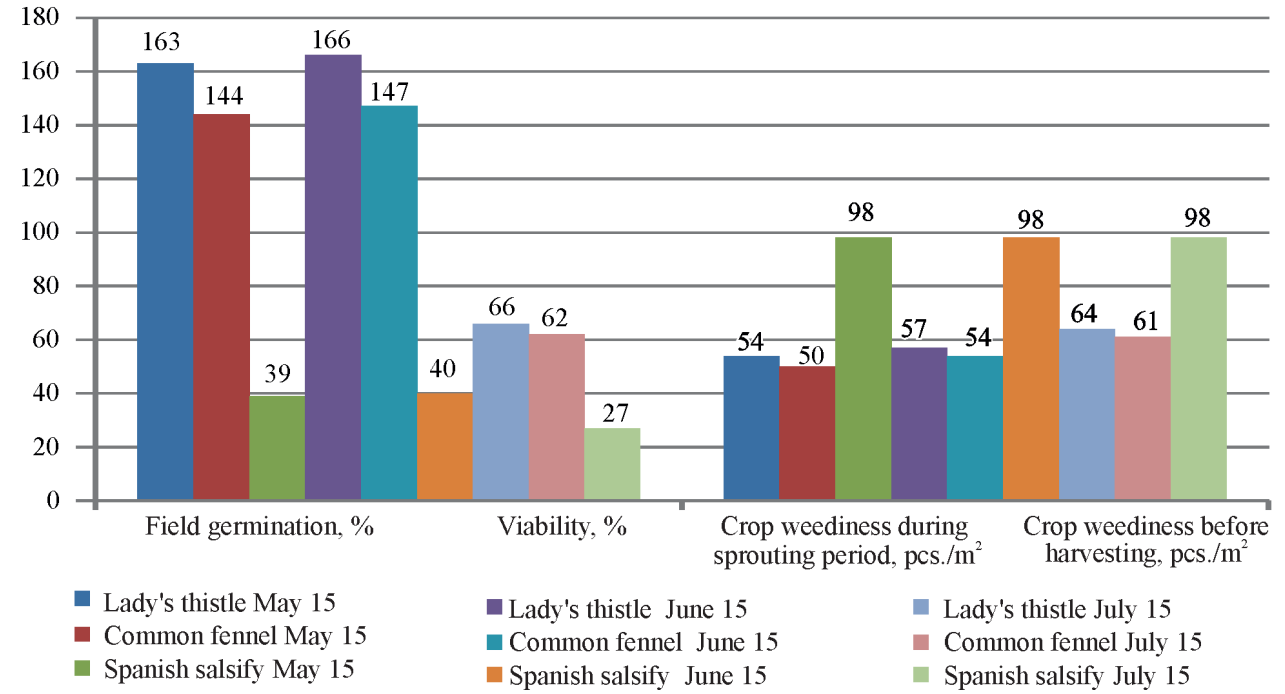

Рис. 2. Высота и облиственность лекарственных растений в разные сроки посева: 15 мая, 15 июня, 15 июля (среднее за 2020–2022 гг.)

Fig. 2. Height and foliage of medicinal plants at different sowing dates: May 15, June 15, July 15 (average for 2020–2022)

Табл. 2. Урожайность лекарственного сырья расторопши пятнистой и фенхеля обыкновенного (среднее за 2020–2022 гг.)
Table 2. Yield of medicinal raw materials of milk thistle and fennel (average for 2020–2022)

Culture	Sowing date	Yield, t/ha			Weight of 1000 seeds, ha	Fat content in seeds, %
		Herbage	Dry matter	Seeds		
Lady's thistle	15 May	15,40	2,46	1,69	32,0	25,2
	15 June	16,00	2,56	1,71	31,0	23,6
	15 July	2,89	0,46	–	–	–
$LSD_{0,5}$		2,22	0,28			
Common fennel	15 May	43,00	6,66	–	–	–
	15 June	43,20	6,71	–	–	–
	15 July	10,47	1,54	–	–	–
$LSD_{0,5}$		1,88	0,96			

Табл. 3. Структура и урожайность биомассы скорцонеры испанской (среднее за 2020–2022 гг.)
Table 3. Structure and yield of scorzonera biomass (average for 2020–2022)

Culture	Sowing date	Yield, t/ha			Root crop length, cm	Root crop diameter, mm
		Root crops	Leaves	Total weight		
Spanish salsify	May 15	32,1	10,7	42,8	28	19,0
	June 15	24,9	8,4	33,3	25	17,2
	July 15	1,6	12,2	13,8	10	7,0
$LSD_{0,5}$		1,42				

riod of June (June 15th), and for Spanish salsify (*Scorzonera hispanica* L.) – the second ten-day period of May (May 15th). These sowing dates ensure the highest yields of medicinal raw materials for lady's thistle – herbage 15.4–16.0 t/ha, dry matter – 2.46–2.56 t/ha, seeds – 1.69–1.71 t/ha; for common fennel – herbage – 43.0–43.2 t/ha; dry matter – 6.66–6.71 t/ha; for Spanish salsify yield with raw mass of root crops – 32.1 t/ ha, leaves – 10.7 t/ha.

2. The duration of interphase periods for medicinal plants at these sowing dates was for lady's thistle: sowing – emergence – 14–23 days, emergence – budding – 51–55 days, emergence – flowering – 70–73 days, emergence – seed ripening (harvesting) – 91–95 days. For common fennel, the respective durations were 17–25 days from sowing to emergence, 52–62 days from emergence to budding, and 77–81 days from emergence to flowering. For Spanish salsify, the intervals were 17 days from sowing to emergence, 21 days until the formation of 4–6 pairs of true leaves, 41 days until plant closure in rows, and 118 days from emergence to the formation of root crops (harvest).

3. The height of lady's thistle plants at the time of harvest was 163–166 cm, with a leaf coverage of 54–57%; for common fennel, it was 144–147 cm and 50–54%; and for Spanish salsify, it was 39 cm with a leaf coverage of 98%.

4. The medicinal plants were not affected by diseases or pests. All crops were resistant to lodging and drought (5 points) under the conditions of Transbaikalia.

5. Weed infestation in the crops (depending on the sowing dates) ranged from 15–16 to 2–8 plants/m², decreasing from the early sowing date to the later ones.

СПИСОК ЛИТЕРАТУРЫ

1. *Ли М., Ткаченко К.Г., Цицилин А.Н., Чурилов Л.П.* Традиционно китайские лекарственные средства и российская медицина: прошлое, настоящее и будущее // Клиническая патофизиология. 2019. Т. 25. № 4. С. 3–25.

2. *Маланкина Е.Л., Цицилин А.Н.* Лекарственные и эфиромасличные растения: монография. М.: ИНФРА. М., 2018. 368 с.
3. *Сидельников Н.И., Тхаганов Р.Р., Хазиева Ф.М.* Особенности применений микроудобрений на лекарственных культурах //Агрохимический вестник. 2018. № 6. С. 57–60.
4. *Аникина А.Ю., Басалаева И.В., Бушковская Л.М., Быкова О.В., Грязнов М.Ю.* Лекарственные и эфиромасличные культуры: особенности возделывания на территории Российской Федерации: монография. М., 2021. 248 с.
5. *Цицилин А.Н.* Необходимость и важность применения САСР в России при получении лекарственного сырья // Фармация. 2018. Т. 67. № 4. С.13–17.
6. *Джашеев А-М.С., Джашеева З. А-М., Акбаева Ф.А., Токова Ф.М.* Опыт возделывания расторопши пятнистой *(Silybum marianum* L.), в условиях предгорной зоны Северного Кавказа // Успехи современного естествознания. 2019. № 7. С. 7–13.
7. *Кшникаткин С.А., Аленин П.Г., Воронова И.А., Поликарпова Н.Н.* Экологически безопасная технология возделывания расторопши пятнистой // Нива Поволжья. 2021. № 3 (60). С.60–66.
8. *Сампиев А.М., Шевченко А.И., Хочаева Е.Б., Быкова О.А.* Исследования флавонидов, фенолкарбоновых и органических кислот скорцонеры испанской (*Scorzonera hispanica* L.) // Вопросы биологической, медицинской и фармацевтической химии. 2018. № 21 (1). С. 25–29.
9. *Хочава М.Р., Шевченко А.И., Никифорова Е.Б., Быкова О.А.* Морфолого-анатомическое исследование скорцонеры испанской // Вопросы биологической, медицинской и фармацевтической химии. 2018. № 21 (5). С. 34–42.
10. *Онбыш Т.Е., Хочава М.П., Доркина Е.Г.* Гипохолестеринемическое действие скорцонеры испанской на модели острой гиперлипидемии, индуцированной эталоном // Здоровье и образование в XXI веке. 2018. № 20 (5). С. 113–116.
11. *Кайшев В.Г., Кайшев В.Г., Лукин Н.Д., Серегин С.Н., Корниенко А.В.* Рынок инулина в России: возможности развития сырьевой базы и необходимые ресурсы для создания современного отечественного производства // Пищевая промышленность. 2018. № 5. С. 8–17.
12. *Орбинская В.Н.* Использование инулиносодержащих растений в качестве источника биологически активных соединений антиоксидантного типа // Современная наука и инновации. 2016. Вып. 2. С. 87–94.
13. *Савельева Л.Н., Бондарчук М.Л.* Влияние фитобиотических препаратов на морфохимические показатели крови телят при диспепсии // Сибирский вестник сельскохозяйственной науки. 2022. Т. 52. № 5. С. 98–104. DOI: 10.26898/0370-8799-2022-5-12.

REFERENCES

1. Li M., Tkachenko K.G., Tsitsilin A.N., Churilov L.P. Traditional Chinese medicines and Russian medicine: Past, present and future. *Klinicheskaya patofiziologiya = Clinical pathophysiology,* 2019, vol. 25, no.4, pp. 3–25. (In Russian).
2. Malankina E.L., Tsitsilin A.N. *Medicinal and essential oil plants: textbook*. Moscow, INFRA – M, 2018, 368 p. (In Russian).
3. Sidelnikov N.I., Tkhaganov R.R., Khazieva F.M. Particularities of micro fertilizers application for medicinal plants. *Agrokhimicheskii vestnik = Agrochemical Herald*, 2018, no. 6, pp. 57–60. (In Russian).
4. Anikina A.Yu., Basalaeva I.V., Bushkovskaya L.M., Bykova O.V., Gryaznov M.Yu. *Medicinal and essential oil crops: peculiarities of cultivation in the territory of the Russian Federation*. Moscow, 2021, 248 p. (In Russian).
5. Tsitsilin A.N. The necessity and importance of the use of SASR in Russia in obtaining medicinal raw materials. *Farmatsiya = Pharmacy*, 2018, vol. 67, no. 4, pp. 13–17. (In Russian).
6. Dzhasheev A-M.S., Dzhasheeva Z.A-M., Akbaeva F.A., Tokova F.M. Experience of milk thistle (*Silybum marianum* L.) cultivation in the Northern Caucasus piedmont conditions. *Uspekhi sovremennogo estestvoznaniya = Advances in current natural sciences*, 2019, no. 7, pp. 7–13. (In Russian).
7. Kshnikatin S.A., Alenin P.G., Voronova I.A., Polikarpova N.N. Environmentally friendly technology of milk thistle cultivation. *Niva Povolzh'ya = Volga Region Farmland*, 2021, no. 3 (60), pp. 60–66. (In Russian).
8. Sampiev A.M., Shevchenko A.I., Khochaeva E.B., Bykova O.A. The researching of fla-

vonides, phenol carbonic and organic acids in *Scorzonera hispanica* L. *Voprosy biologicheskoi, meditsinskoi i farmatsevticheskoi khimii = Problems of biological, medical and pharmaceutical chemistry*, 2018, no. 21 (1), pp. 25–29. (In Russian).
9. Khochava M.R., Shevchenko A.I., Nikiforova E.B., Bykova O.A. The morphological and anatomical study of Scorzonera hispanica L. *Voprosy biologicheskoi, meditsinskoi i farmatsevticheskoi khimii = Problems of biological, medical and pharmaceutical chemistry*, 2018, no. 21 (5), pp. 34–42. (In Russian).
10. Onbysh T.E., Khochava M.P., Dorkina E.G. Hypocholisterinemic action of the Spanish scorzonera on the model of acute hyperlipidemia induced by ethanol. *Zdorov'e i obrazovanie v XXI veke = Health and education in the XXI century*, 2018, no. 20(5), pp. 113–116. (In Russian).
11. Kaishev V.G., Kaishev V.G., Lukin N.D., Seregin S.N., Kornienko A.V. Inulin market in Russia: possibilities of raw materials base development and necessary resources for creation of modern domestic production. *Pishchevaya promyshlennost' = Food industry*, 2018, no. 5, pp. 8–17. (In Russian).
12. Orbinskaya V.N. The use of inulin-containing plants as a source of biologically active compounds of the antioxidant type. *Sovremennaya nauka i innovatsii = Modern Science and Innovations*, 2016, is. 2. pp. 87–94. (In Russian).
13. Savelyeva L.N., Bondarchuk M.L. The effect of phytobiotic preparations on morphochemical blood parameters of calves with dyspepsia. *Sibirskii vestnik sel'skokhozyaistvennoi nauki = Siberian Herald of Agricultural Science,* 2022, vol. 52, no. 5, pp. 98–104. (In Russian). DOI: 10.26898/0370-8799-2022-5-12.

ИНФОРМАЦИЯ ОБ АВТОРЕ

(✉)**Андреева О.Т.** кандидат сельскохозяйственных наук, ведущий научный сотрудник; **адрес для переписки:** Россия, 672010, Забайкальский край, Чита-10, ул. Кирова, 49, а/я 470; e-mail: chita@sfsca.ru

AUTHOR INFORMATION

(✉)**Olga T. Andreeva,** Candidate of Science in Agriculture, Lead Researcher; **address:** PO Box 470, 49, Kirova St., Chita-10, Trans-Baikal Territory, 672010, Russia; e-mail: chita@sfsca.ru

Дата поступления статьи / Received by the editors 30.08.2023
Дата принятия к публикации / Accepted for publication 03.10.2023
Дата публикации / Published 15.12.2023