

УРОЖАЙНОСТЬ И КОРМОВЫЕ КАЧЕСТВА ТРИТИКАЛЕ В СМЕШАННЫХ ПОСЕВАХ С ВЫСОКОБЕЛКОВЫМИ КУЛЬТУРАМИ

Андреева О.Т., Пилипенко Н.Г., Сидорова Л.П., Харченко Н.Ю.

*Научно-исследовательский институт ветеринарии Восточной Сибири – филиал Сибирского федерального научного центра агrobiотехнологий Российской академии наук
Забайкальский край, г. Чита, Россия*

Представлены результаты полевых и лабораторных исследований по возделыванию тритикале в смешанных посевах с высокобелковыми культурами. Исследования выполнены в 2015–2017 гг. на лугово-черноземной мучнисто-карбонатной почве, по гранулометрическому составу – легкий суглинок, в лесостепной зоне Забайкалья. Дана оценка тритикале в одновидовых и смешанных посевах по адаптивности к условиям выращивания, урожайности, показаны хозяйственно ценные признаки данных посевов. Установлена возможность повышения урожайности и кормовых качеств агроценозов путем использования тритикале в смешанных посевах с высокобелковыми культурами. В среднем за годы исследований по урожайности и кормовым качествам смешанные посевы превосходили одновидовые агроценозы тритикале по зеленой массе в 1,6–1,9 раза, переваримому протеину в 2,6–3,7 раза. В смешанных посевах наилучшие результаты обеспечили тритикале с кормовыми бобами, урожайность зеленой массы составила 40,5 т/га, сухого вещества – 5,70 т/га, содержание кормовых единиц – 4,67 т/га, переваримого протеина – 785 кг/га, обменной энергии – 57,6 ГДж/га. Обеспеченность одной кормовой единицы переваримым протеином – 168 г. Смешанные посевы тритикале с кормовыми бобами увеличили продуктивность в сравнении с одновидовыми посевами по урожайности зеленой массы в 1,3–1,9 раза, сухого вещества в 1,4–1,9, по сбору кормовых единиц в 1,4–2,0, валовой энергии в 1,5–2,0 раза. Все культуры устойчивы по засухе и полеганию. Отмечено отсутствие пораженности тритикале вредителями и болезнями.

Ключевые слова: тритикале, редька масличная, рапс яровой, бобы, смешанные посевы, урожайность, качество, адаптивность

YIELD AND FEED QUALITIES OF TRITICALE MIXED WITH HIGH-PROTEIN CROPS

Andreeva O.T., Pilipenko N.G., Sidorova L.P., Kharchenko N.Yu.

*Research Institute of Veterinary Science of Eastern Siberia – Branch of the Siberian Federal Scientific Centre of AgroBioTechnologies of the Russian Academy of Sciences
Chita, Trans-Baikal Territory, Russia*

The results of field and laboratory studies on the cultivation of triticale mixed with high-protein crops are presented. The study was carried out during the period of 2015–2017 on meadow chernozem mealy-carbonate soil, light loam by granulometric composition, in the forest-steppe zone of Trans-Baikal Territory. The assessment of triticale in single-species and mixed crops for adaptability to growing conditions and yield is given. Economically valuable traits of these crops are shown. The possibility of increasing the yield and feed qualities of agroecosystems by sowing triticale with high-protein crops was established. On average, over the years of research, mixed crops outperformed single-species triticale agroecosystems in terms of yield and feed quality, green mass by 1.6–1.9 times, digestible protein by 2.6–3.7 times. In mixed crops, triticale with fodder beans provided the best results, the yield of green mass was 40.5 t/ha, dry matter – 5.70 t/ha, feed units – 4.67 t/ha, digestible protein – 785 kg/ha, exchange energy – 57.6 GJ/ha, availability of digestible protein per one feed unit – 168 g. Triticale crops mixed with fodder beans increased productivity compared with single-species crops in terms of green mass yield by 1.3–1.9 times, dry matter by 1.4–1.9 times, feed units by 1.4–2.0 times, gross energy by 1.5–2.0 times. All crops are resistant to drought and lodging. The absence of pest and disease infestation in triticale was noted.

Keywords: triticale, oilseed radish, spring rapeseed, beans, mixed crops, yield, quality, adaptability

Для цитирования: Андреева О.Т., Пилипенко Н.Г., Сидорова Л.П., Харченко Н.Ю. Урожайность и кормовые качества тритикале в смешанных посевах с высокобелковыми культурами // Сибирский вестник сельскохозяйственной науки. 2021. Т. 51. № 1. С. 60–66. <https://doi.org/10.26898/0370-8799-2021-1-7>

For citation: Andreeva O.T., Pilipenko N.G., Sidorova L.P., Kharchenko N.Yu. Yield and feed qualities of triticale mixed with high-protein crops. *Sibirskii vestnik sel'skokhozyaistvennoi nauki* = *Siberian Herald of Agricultural Science*, 2021, vol. 51, no. 1, pp. 60–66. <https://doi.org/10.26898/0370-8799-2021-1-7>

Конфликт интересов

Авторы заявляют об отсутствии конфликта интересов.

Conflict of interest

The authors declare no conflict of interest.

INTRODUCTION

The creation of a solid fodder base for full-value feeding of farm animals and an increase in their productivity requires an increase in the production of all types of fodder and an improvement in their quality^{1,2} [1–13].

A significant role in the sustainable production of high-quality fodder is assigned to the creation of highly productive agrocenoses from bluegrass crops and their mixtures, adaptive to growing conditions. A properly selected set of crops in agrocenoses provides optimal density and density of the stand, formation of layering, the most even use of plant life factors (moisture, light, nutrients), allows to form high yields of vegetative mass and increase the nutritional value of feed.

Of the bluegrass crops cultivated in Transbaikalia, triticale, a new culture for the region, is of great importance. It has increased resistance to drought and shedding of grain, is an allopolyploid that combines the high productivity of wheat and the adaptive resistance of rye to adverse conditions and diseases. 100 kg of green mass contains 22–25 k. Units, 2.3–2.7 kg of digestible protein. Grain and bran are used for fodder as a high-protein and high-lysin feed for livestock and poultry. Fodder varieties of triticale yield up to 500–600 centners of green mass / ha. Triticale is a promising crop the use of which can increase the production of feed and grain in Transbaikalia [8–9].

Mixed crops of cultivated plants have been widespread since ancient times; they make it possible to effectively use agroclimatic resources due to the formation of highly produc-

tive agrocenoses [14]. It has been proven that mixtures of triticale with annual high-protein crops provide the richest in protein and better eaten by animals [15, 16].

The listed nutritional qualities in combination with high yield in mixed crops determine the great importance of triticale for strengthening the fodder base in animal husbandry of the Trans-Baikal Territory [2, 8–10, 17].

The aim of the research is to evaluate the effectiveness of using triticale in mixed crops with high-protein crops to increase the productivity and nutritional value of fodder agrocenoses.

MATERIAL AND METHODS

The studies were carried out in 2015–2017. on the fields of the Research Institute of Veterinary Medicine of Eastern Siberia - a branch of the Siberian Federal Scientific Center of Agrobiotechnology of the Russian Academy of Sciences, located in the Ingodinsko-Chita forest-steppe of the Trans-Baikal Territory.

The climate of the zone is sharply continental with little snow, cold winters, hot summers and a lack of precipitation. The frost-free period lasts 90–110 days. The sum of positive temperatures above 10 °C is 1500–1800 °. The annual amount of precipitation is 330–380 mm, their main amount (85–90%) falls in the warm period, the maximum - in July - August, the minimum - in May – June.

During the years of research, the weather conditions during the growing season were different. Growing seasons (April - September) 2015, 2016 are marked as typical of the forest-

¹Pirjo A., Pentti A., Pekka H. et al. Dairy cow feeding. Vantaa: Union of centers "ProAgria", 2009. 127 p.

²Vasina N.V., Bordyugovskaya A.V. Fodder productivity of the culture of mixtures of early sowing at different levels of mineral nutrition // *Advances in science to the agro-industrial complex*. Samara, 2014. pp. 16–19.

steppe zone of Transbaikalia showing 270.2; 194.7 mm of precipitation with an average long-term norm of 276 mm. The average monthly air temperature for these periods was 11.2; 11.4 °C with an average long-term rate of 11.2 °C. Hydrothermal coefficients (HC) of the growing seasons were (0.9; 0.7, respectively). The distribution of precipitation over the months of the growing seasons was uneven; in some periods, high air and soil temperatures were recorded. The growing season of 2017 was characterized by increased moisture supply. Total precipitation was 317.6 mm from April to September. The deviation from the average long-term indicator (276.0 mm) was 41.6 mm, or 15.1%. The average daily air temperature during the growing season did not exceed 15.4 °C.

In general, the climatic conditions created during the years of research allowed the plants of the studied crops to realize their maximum productive potential and form a sufficiently high yield of fodder mass, which indicates their adaptability to the extreme conditions of the Trans-Baikal Territory.

The soil of the experimental site is meadow chernozem mealy-carbonate, the granulometric composition is light loam. The reaction of the soil solution of the arable horizon is weakly acidic, the subsoil one is neutral. The amount of organic matter in the 0–20 cm layer is 3.67%, total nitrogen 0.3%. The availability of mobile phosphorus is low, exchangeable potassium is average.

The area of the sowing plot is 100 m², accounting for forage purposes is 25 m², the replication is fourfold, the location of the plots is consistent.

The agrotechnology for the cultivation of fodder crops is common in the zone [18]. Mineral fertilizers under triticale and fodder beans were introduced under pre-sowing cultivation at the rate of N₆₀P₆₀R₆₀, under spring rapeseed and oil radish they were introduced fractionally - under pre-sowing cultivation N₆₀P₄₁K₆₀ and

P₁₉ during sowing. Sowing of fodder crops was carried out at the optimal recommended time (second half of May) in an ordinary way using a CH-16 seeder with a seeding rate: triticale 4.0–4.5 million germinating seeds / ha, spring rapeseed 3.0, oil radish 3.0, fodder beans 1.2 million germinating seeds / ha. The composition and seeding rate of crops in two-component mixtures: triticale - 70%, spring rapeseed, oil radish, forage beans - 50%. Seeding depth: triticale 5–8 cm, spring rape 2–4, oil radish 3–4, forage beans 6–8 cm. Sowing of fodder crops mixtures was carried out in one pass of the seeder. The recording of the green mass yield was determined by a continuous method from an area of 25 m².

The objects of research are zoned varieties of the studied crops: triticale Ukro, spring rapeseed Spar, oil radish Tambovchanka, Siberian fodder beans.

The experimental work was carried out in accordance with the guidelines for conducting field experiments with fodder crops, accompanied by laboratory field observations ³⁻⁶.

The crop data was statistically processed by analysis of variance according to R.A. Fischer as presented by B.A. Dospekhov (see footnote 4). The analysis of plant samples was carried out in the agrochemical laboratory of the Institute according to generally accepted methods.

RESULTS AND DISCUSSION

The research results showed that the studied crops reacted differently to the soil and climatic conditions of growth. The period from sowing to germination for the studied crops was 10–15 days. The period of germination - budding in cabbage crops is 26–37 days, for forage beans - 36 days. The period of shoots - tillering of triticale - 12 days, shoots - heading - 42; seedlings - flowering of triticale - 58, spring rapeseed and oilseed radish - 37–46, fodder beans - 52 days (see Table 1).

³Methodology for conducting field experiments with fodder crops. M., 1983.197 p.

⁴Dospekhov B.A. Field experiment technique. M., 1985.351 p.

⁵Experimentation in field cultivation. Moscow: Rosselkhozizdat, 1982.190 p.

⁶Methodology for state variety testing of agricultural crops. Moscow: Kolos, 1985.267 p.

According to the assessment of the reaction to drought, provided for by the method, the main criterion of which is yellowing of the basal leaves and loss of turgor, all studied crops are drought-resistant, at the same time respond well to moisture supply.

The observations of the linear growth of the studied crops showed that the most intensively developed crops during the growing season were triticale and spring rapeseed plants, in which the height to mowing maturity was 120 cm. Samples of oilseed radish and fodder beans had a height of 114–116 cm. Insignificant mutual suppression and decrease in plant height by 2–18 cm in comparison with single-species crops was observed in multi-species crops. (see Table 2).

The determination of plant foliage in triticale showed that plant foliage in mixed crops was 2–4% inferior to single species. The largest leafiness - 53–57% in single-species and mixed crops was obtained for triticale and fodder beans, the smallest - 43–46% for spring rapeseed and oil radish.

In the course of research, it was found that the productivity of triticale, spring rapeseed, oil

radish and fodder beans in single-species and mixed crops is different (see Table 3).

The studies have shown various patterns of growth, development, formation of yield and nutritional value of the studied crops in agrocenoses depending on the type of crops and the method of sowing.

Favorable conditions of heat and moisture supply and nutritional regime during the years of research had a positive effect on the passage of physiological processes in plants and contributed to the formation of elements of the structure of the yield and yield according to the variants of the experiment (see Tables 2, 3). The maximum yield of green and dry mass was obtained in the variant of triticale + fodder beans (40.5 and 5.7 t / ha). This variant exceeded the mixture of triticale with spring rapeseed and oilseed radish by 5.4–7.2 and 1.45–1.50 t / ha. The lowest yield of green mass (20.8 t / ha) and dry matter (3.0 t / ha) was obtained when sowing triticale in single-species sowing. One-species sowing was inferior in terms of these indicators to mixed sowings of triticale with high-protein crops, respectively, by 12.5–19.7 and 1.20–2.70 t / ha. So, in the mixed sowing of triticale + fodder beans, a higher yield of fodder units of 4.67 t / ha, of digestible protein - 785 kg / ha, gross energy -

Табл. 1. Продолжительность межфазных периодов, дни (среднее за 2015–2017 гг.)

Table 1. Duration of interphase periods, days (on average for 2015–2017)

Option	Period				
	sow- ing – germi- nation	germi- nation – bud- ding	germi- nation – tiller- ing	germi- nation – head- ing	germi- nation – flower- ing
Triticale	15	–	12	42	58
Spring rapeseed	11	37	–	–	46
Oilseed radish	10	36	–	–	37
Fodder beans	15	36	–	–	52
Triticale + spring rapeseed	15 11	– 37	12 –	42 –	58 46
Triticale + oilseed radish	15 10	– 26	12 –	42 –	58 37
Triticale + fodder beans	15 15	– 36	12 –	42 –	58 52

Табл. 2. Высота и облиственность растений в агроценозах (в среднем за 2015–2017 гг.)

Table 2. Height and leaf formation of plants in agrocenoses (on average for 2015–2017)

Culture	Stem height, cm	Leaf formation, %
Triticale	120	57
Spring rapeseed	120	45
Oilseed radish	116	46
Fodder beans	114	56
Triticale + spring rapeseed	107 102	53 43
Triticale + oilseed radish	110 114	54 44
Triticale + fodder beans	115 110	53 54

Табл. 3. Продуктивность и питательная ценность тритикале в смешанных посевах с высокобелковыми культурами (среднее за 2015–2017 гг.)**Table 3.** Productivity and nutritional value of triticale mixed with high-protein crops (average for 2015–2017)

Culture	Green mass, t/ha	Dry matter, t/ha	Fodder units, t/ha	Digestible protein, kg/ha	The amount of digestible protein for 1 f. u., g	Gross energy, GJ/ha
Triticale	20,8	3,00	2,30	212	92	29,1
Spring rapeseed	28,9	3,60	3,30	627	190	38,2
Oilseed radish	30,2	3,62	2,82	558	198	35,5
Fodder beans	30,0	4,05	3,12	702	225	39,7
Triticale + spring rapeseed	33,3	4,20	3,60	572	159	43,3
Triticale + oilseed radish	35,1	4,25	3,36	541	161	42,1
Triticale + fodder beans	40,5	5,70	4,67	785	168	57,6
LSD ₀₅	2,8	0,15	0,13			

Note. The ratio of components in mixed crops was as follows: triticale - 25% + spring rapeseed - 75%; triticale - 25% + oilseed radish - 75%; triticale - 40% + fodder beans - 60%.

57.6 GJ / ha was obtained with the provision of one fodder unit with digestible protein of 168 g.

CONCLUSIONS

1. In the forest-steppe zone of the Trans-Baikal Territory, the maximum fodder productivity is formed by agrocenoses of mixed crops of triticale with fodder beans. As a result of the research, the following indicators were achieved: the yield of green mass 40.5 t / ha, the collection of feed units 4.67 t / ha, the amount of digestible protein 785 kg / ha, gross energy content 57.6 GJ / ha with provision of digestible protein 168 g / ha. to units.

2. Mixed crops of triticale with fodder beans increased productivity in comparison with single-species crops of triticale in terms of collection of feed units by 2.0 times, digestible protein by 3.7 times, and gross energy by 2.0 times.

СПИСОК ЛИТЕРАТУРЫ

- Новиков С.А., Шевченко В.А. Экономическая целесообразность возделывания программируемых урожаев яровой тритикале и пелюшки в чистых и смешанных посевах в условиях Верхневолжья // Кормопроизводство. 2014. № 1. С. 7–12.
- Бенц В.А., Кашиеваров Н.И., Демарчук Г.А. Полевое кормопроизводство в Сибири: монография. Новосибирск: издательство СО РАСХН, 2001. 240 с.

- Косолапов В.М., Трофимов И.А. Кормопроизводство – важнейшее направление в экономике сельского хозяйства России // АПК: Экономика, управление. 2011. № 1. С. 22–27.
- Андреева О.Т., Пилипенко Н.Г., Сидорова Л.П., Харченко Н.Ю. Мятликовые культуры в одновидовых и поливидовых посевах с редькой масличной в кормопроизводстве Забайкалья // Кормопроизводство. 2019. № 6. С. 34–37.
- Андреева О.Т., Пилипенко Н.Г., Сидорова Л.П., Харченко Н.Ю. Перспективные малораспространенные мятликовые и зернобобовые кормовые культуры // Сибирский вестник сельскохозяйственной науки. 2020. № 4. С. 32–39. DOI: 10.26898/0370-8799-2020-4-4.
- Агафонов В.А., Бояркин Е.В., Матаис Л.Н. Эффективность возделывания проса кормового в смешанных посевах с высокобелковыми культурами в условиях Предбайкалья // Вестник ИрГСХА. 2018. Вып. 84. С. 7–13.
- Андреева О.Т., Сидорова Л.П., Харченко Н.Ю. Повышение продуктивности мятликовых агроценозов в Забайкальском крае // Кормопроизводство. 2017. № 6. С. 16–22.
- Шашкова Г.Г., Цыганова Г.П., Андреева О.Т. Возделывание сельскохозяйственных культур в Забайкальском крае: монография. Чита: Экспресс-издательство, 2012. С. 240–241, 275–279.
- Шашкова Г.Г., Андреева О.Т., Цыганова Г.П. Агротехнологии производства и качество

- кормов в Забайкальском крае: монография. Чита: Читинская городская типография, 2015. 390 с.
10. Кашеваров Н.И., Данилов В.П., Полюдина Р.И., Андреева О.Т., Мустафин А.М. Агротехнологии производства кормов в Сибири: монография. Новосибирск: издательство СО РАСХН, 2013. 248 с.
11. Щукис Е.Р. Кормовые культуры на Алтае: монография. Барнаул: ГНУ Алтайский НИИСХ Россельхозакадемии, 2013. 182 с.
12. Агафонов В.А., Бояркин Е.В., Глушкова О.А., Гренда С.Г. Поливидовые фитоценозы новых сортов зернофуражных культур с бобовыми в лесостепи Предбайкалья // Кормопроизводство. 2014. № 10. С. 14–18.
13. Насиев Б.Н. Подбор одновидовых и смешанных посевов кормовых культур для адаптивного земледелия Западного Казахстана // Кормопроизводство. 2014. № 3. С. 35–38.
14. Баранова В.В., Логуа М.Т., Малаев В.А. Эффективность высокопродуктивных многокомпонентных смесей с бобовыми // Кормопроизводство. 2003. № 6. С. 16–19.
15. Гамко Л.Н., Подольников В.Е., Малякко И.В., Нуриев Г.Г., Мысик А.Т. Качественные корма – путь к получению высокой продуктивности животных и птицы и экологически чистой продукции // Зоотехния. 2016. № 5. С. 6–7.
16. Томмэ М.Ф. Корма СССР. М., 1959. С. 272–350.
17. Андреева О.Т., Сидорова Л.П., Харченко Н.Ю., Хлебникова Е.Н. Повышение продуктивности силосных агроценозов в Забайкальском крае // Кормопроизводство. 2015. № 11. С. 6–9.
18. Андреева О.Т., Цыганова Г.П., Климова Э.В. Зональные системы земледелия Читинской области: монография. Чита: Областное книжное издательство, 1988. 182 с.

REFERENCES

1. Novikov S.A., Shevchenko V.A. Economical expedience of cultivating spring triticale and field pea for the programmed yields in pure and mixed crops in the Upper Volga. *Kormoproizvodstvo = Fodder Production*, 2014, no. 1, pp. 7–12. (In Russian).
2. Benz V.A., Kashevarov G.A., Demarchuk G.A. *Field fodder production in Siberia*. Novosibirsk, SB RAS Publ., 2001, 240 p. (In Russian).
3. Kosolapov V.M., Trofimov I.A. Feed produc- tion is the most important direction in the economy of agriculture of Russia. *APK: Ekonomika, upravlenie = AIC: Economy, management*, 2011, no. 1, pp. 22–27. (In Russian).
4. Andreeva O.T., Pilipenko N.G., Sidorova L.P., Harchenko N.YU. Poaceae as monocultures and mixtures with oilseed radish in forage production of Transbaikalia. *Kormoproizvodstvo = Fodder Production*, 2019, no 6, pp. 34–37. (In Russian).
5. Andreeva O.T., Pilipenko N.G., Sidorova L.P., Harchenko N.Yu. Promising uncommon poaceous and leguminous fodder crops. *Sibirskii vestnik sel'skokhozyaistvennoi nauki = Siberian Herald of Agricultural Science*, 2020, vol. 50, no. 4, pp. 33–39. (In Russian). DOI: 10.26898/0370-8799-2020-4-4.
6. Agafonov V.A., Boyarkin E.V., Matais L.N. The efficiency of forage millet cultivation in mixed sowings with high-protein crops under conditions of Pre-Baikal region. *Vestnik IrGSKhA = Vestnik IrGSHA*, 2018, is. 84, pp. 7–13. (In Russian).
7. Andreeva O.T., Sidorova L.P., Harchenko N. Yu. Increasing productivity of gramineous agrocnoses on the Trans-Baikal Territory. *Kormoproizvodstvo = Fodder Production*, 2017, no. 6, pp.16–22. (In Russian).
8. Shashkova G.G., Tsyganova G.P., Andreeva O.T. *Crop cultivation in the Trans-Baikal Territory*, Chita, Express Publishing, 2012. pp. 240–241, 275–279. (In Russian).
9. Shashkova G.G., Andreeva O.T., Tsyganova G.P. *Agricultural production technologies and feed quality in the Trans-Baikal Territory*. Chita, Chita City Printing House, 2015, 390 p. (In Russian).
10. Kashevarov N.I., Danilov V.P., Polyudina R.I., Andreyeva O.T., Mustafin A.M. *Agrotechnologies of feed production in Siberia*. Novosibirsk, SB RAS, 2013, 248 p. (In Russian).
11. Shchukis Ye.R. *Fodder crops in Altai*. Barnaul: Altai Research Institute of Agriculture of the Russian Agricultural Academy, 2013. 182 p. (In Russian).
12. Agafonov V.A., Boyarkin E.V., Glushkova O.A., Grenda S.G. Multispecies phytocenoses of new varieties of cereals and pulses in the forest-steppe of the Cis-Baikal region. *Kormoproizvodstvo = Fodder Production*, 2014, no. 10, pp. 14–18. (In Russian).
13. Nasiev B.N. Selection of single-species and mixed crops of forage crops for adaptive agriculture in Western Kazakhstan. *Kormoproizvodstvo = Fodder Production*, 2014, no. 3, pp. 35–38. (In Russian).
14. Baranova V.V., Logua M.T., Malaev V.A. Ef-

- iciency of highly productive multicomponent mixtures with legumes. *Kormoproizvodstvo = Fodder Production*, 2003, no. 6, pp. 16–19. (In Russian).
15. Gamko L.N., Podol'nikov V.Ye., Malyavko I.V., Nuriyev G.G., Mysik A.T. Qualitative feeds is a way to obtain high productivity and ecologically safe foodstuffs. *Zootechniya*, 2016, no. 5, pp. 6–7. (In Russian).
 16. Tomme M.F. *Feed USSR*. Moscow, 1959, pp. 272–350. (In Russian).
 17. Andreeva O.T., Sidorova L.P., Kharchenko N. Yu., Khlebnikova E.N. Increasing the productivity of silage agrocenoses in Trans-Baikal Territory. *Kormoproizvodstvo = Fodder Production*, 2015, no. 11, pp. 6–9. (In Russian).
 18. Andreeva O.T., Cyganova G.P., Klimova E.V. *Zonal farming systems of Chita Region*. Chita, Oblastnoe knizhnoe izdatel'stvo, 1988, 182 p. (In Russian).

ИНФОРМАЦИЯ ОБ АВТОРАХ

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

Пилипенко Н.Г., кандидат сельскохозяйственных наук, старший научный сотрудник

Сидорова Л.П., старший научный сотрудник

Харченко Н.Ю., научный сотрудник

AUTHOR INFORMATION

✉ **Olga T. Andreeva**, Candidate of Science in Agriculture, Lead Researcher, **address:** P.O. Box 470, 49 Kirov st., Chita-10, Trans-Baikal Territory, 672010, Russia; e-mail: vetinst@mail.ru

Natalya G. Pilipenko, Candidate of Science in Agriculture, Senior Researcher

Lyudmila P. Sidorova, Senior Researcher

Nadezhda Yu. Kharchenko, Researcher

*Дата поступления статьи 30.12.2020
Received by the editors 30.12.2020*