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ECOLOGICAL AND ECONOMIC INDICATORS OF ADAPTED WINTER PEA VARIETIES OF FOREIGN BREEDING

Abstract. The purpose of the research is to increase the competitiveness of crop products by adapting winter pea varieties of foreign breeding to the conditions of the southeast of Kazakhstan.

The article presents the results of the adaptation of winter pea varieties of Serbian selection to local conditions. Among the studied varieties, the varieties "NS Moroz" (b_i=1.20) and "Kocmaj" (b_i=1.14) had the greatest response to adaptation to agroclimatic growing conditions. The maximum grain yield (39.4 centners/ha) was provided by the winter pea variety "NS Moroz", dry weight (77.3 centners/ha) by the "Kocmaj" variety. Accordingly, 448.5 and 344.8 thousand tenge of net profit were received from one hectare. The level of profitability was 160.2 and 146.7%. The content of ash and crude protein in adaptable varieties of winter peas "NS Moroz" (grain) and "Kocmaj" (fodder) directions exceeds the control variety "Shal" by 0.07-0.38% and 0.56-1.56%, respectively. In terms of elemental composition, the excess was 4.71-6.60% (zinc), 2.10-11.42% (iron), 1.85-3.42 (manganese), 0.09-0.28% (nickel) and 0.02-0.06% (cobalt).

In general, the adapted varieties of the Serbian selection NS Moroz (grain) and Kocmaj (fodder), which provided high environmental and economic performance in local conditions, are recommended for further introduction into production in the foothill zone of the southeast of Kazakhstan.

Key words: Winter peas, adaptability, productivity, quality of grain and green mass, elemental composition.

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ШЕТЕЛДІК СЕЛЕКЦИЯЛЫ КҮЗДІК АС БҰРШАҚТЫҢ БЕЙІМДЕЛГЕН СОРТТАРЫНЫҢ ЭКОЛОГИЯЛЫҚ ЖӘНЕ ЭКОНОМИКАЛЫҚ КӨРСЕТКІШТЕРІ

Аннотация. Жүргізілген зерттеудің мақсаты шетелдік селекциялы күздік ас бұршақ сорттарын Қазақстанның оңтүстік-шығыс жағдайларына бейімдеу арқылы өсімдік шаруашылығы өнімінің бәсекеге қабілеттілігін арттыру.

Мақалада Сербия селекциясы күздік ас бұршақ сорттарын жергілікті жағдайларға бейімдеу нәтижелері келтірілген. Зерттелген сорттардың ішінде "НС Мороз" (bi=1,20) және "Kocmaj" (bi=1,14) сорттары агроклиматтық жағдайларға бейімделудің ең үлкен дәрежесін көрсетті. Максималды дән өнімділігін (39,4 ц/га) күздік ас бұршағының "НС Мороз" сорты, ал құрғақ масса өнімділігін (77,3 ц/га) – "Космај"сорты қамтамасыз етті. Осыған сәйкес, бір гектардан 448,5 және 344,8 мың теңге таза пайда алынды. Рентабельділік деңгейі 160,2 және 146,7% болды. "НС Мороз" (дәнді) және "Космај" (жемдік) бағыттағы күздік ас бұршағының бейімделетін сорттарындағы күл мен шикі протеиннің құрамы бақылау ретінде алынған "Шал" сортынан тиісінше 0,07-0,38% және 0,56-1,56% - ға артық алынды. Элементтік құрамы бойынша бақылау сортынан 4,71-6,60% (мырыш), 2,10-11,42% (темір), 1,85-3,42 (марганец), 0,09-0,28% (никель) және 0,02-0,06% (кобальт) артты.

Жалпы, жергілікті жағдайларда жоғары экологиялық және экономикалық көрсеткіштерді қамтамасыз ететін НС Мороз (астық) және Космај (жемдік) бағытындағы Сербия селекциясының бейімделген сорттары Қазақстанның оңтүстік-шығысындағы тау бөктеріндегі аймақта өндіріске одан әрі енгізу үшін ұсынылады.

Түйін сөздер: Күздік ас бұршақ, бейімделу, өнімділік, астық және жасыл масса сапасы, элементтік құрамы.

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ЭКОЛОГИЧЕСКИЕ И ЭКОНОМИЧЕСКИЕ ПОКАЗАТЕЛИ АДАПТИРОВАННЫХ СОРТОВ ОЗИМОГО ГОРОХА ЗАРУБЕЖНОЙ СЕЛЕКЦИИ

Аннотация. Целью исследований является повышение конкурентоспособности растениеводческой продукции путем адаптации сортов озимого гороха зарубежной селекции к условиям юго-востока Казахстана.

В статье приведены результаты адаптации сортов озимого гороха Сербской селекции к местным условиям. Среди изучаемых сортов наибольшей реакцией по адаптации к агроклиматическим условиям выращивания обладали сорта «НС Мороз» (bi=1,20) и «Kocmaj» (bi=1,14). Максимальную урожайность зерна (39,4 ц/га) обеспечил сорт озимого гороха «НС Мороз», сухой массы (77,3 ц/га) – сорт «Космај». Соответственно, с одного гектара получено 448,5 и 344,8 тыс. тенге чистой прибыли. Уровень рентабельности составил 160,2 и 146,7%. Содержание золы и сырого протеина у адаптируемых сортов озимого гороха «НС Мороз» (зернового) и «Космај» (кормового) направления превышает контрольный сорт «Шал» соответственно на 0,07-0,38% и 0,56-1,56%. По элементному составу превышение составило 4,71-6,60% (цинк), 2,10-11,42% (железо), 1,85-3,42 (марганец), 0,09-0,28% (никель) и 0,02-0,06% (кобальт).

В целом, адаптированные сорта Сербской селекции НС Мороз (зернового) и Космај (кормового) направления, обеспечившие высокие экологические и экономические показатели в местных условиях, рекомендуются для дальнейшего внедрения в производство в предгорной зоне юго-востока Казахстана.

Ключевые слова: озимый горох, адаптивность, урожайность, качество зерна и зеленой массы, элементный состав.

Introduction. Adaptation is a process or result of changes in the structure or functions of an organism that provides the ability to exist in a given environment. Adaptability is the ability of an organism to adapt to any particular or any environment. The property of a species to occupy different

habitats with different environmental factors is called ecological plasticity [1-3], which is well expressed in wheat, oats, barley, potatoes, rye, and to a lesser extent in crops of southern origin corn, soybeans, and peas.

The placement of crops and varieties in agricultural zones should be carried out taking into account the specific response to climatic and soil conditions, which provides better adaptation to growing conditions and greater resistance to stress factors [4.5]. The inconsistency of climatic and meteorological conditions with the needs of plants leads to a significant decrease in yield. In this regard, the adaptation of foreign varieties and hybrids with a wide genetic diversity, namely, in terms of ripening, attitude to drought, pathogens, quality indicators, etc., will contribute to more efficient use of bioclimatic resources in the intensive farming system of Kazakhstan.

Moreover, there is currently a growing interest in Kazakhstan in economically profitable crops that bring more income. These crops include peas and soybeans, which have a wide range of uses. [6-9]. The use of peas is varied: food in the form of mature seeds, fresh green peas, industrial (canned green peas), fodder (grain fodder, green fodder, silage, haylage, hay, hay grass), for green fertilizer [10.11]. In terms of its consumer and environment-forming qualities, pea rightfully occupies one of the leading places among legumes.

As a result of many years of research, Serbian breeders (NS SEME, Novi Sad) have developed varieties of winter peas, the advantages of which are: high winter hardiness (seedlings of winter peas normally tolerate frosts down to minus 17 degrees, which is fatal for other winter crops); effective crop rotation management (winter peas can be sown quite late, which means that this legume can be sown after harvesting corn with low and medium FAO (Food and Agriculture Organization) and more); early harvesting (the possibility of obtaining a second harvest); efficient use of early spring moisture (increase in potential yield); high profitability (quite comparable with the average results for soy). Cultivation of winter peas potentially yields 1.5-2 times higher than spring crops [12-14].

In this regard, for more efficient use of the bioclimatic resources of the southeastern region of Kazakhstan, solving the biological and environmental problems of modern agriculture, strengthening the forage base, and increasing the intensification of crop production in the educational and experimental farm "Agrouniversitet" of the Kazakh National Agrarian Research University in 2019-2021 studies were carried out on the adaptation of varieties of winter peas of the Serbian selection. The task of the research was to assess the ecological and economic efficiency of adaptable varieties of winter peas in the conditions of the foothill zone of the southeast of Kazakhstan.

Materials and methods. The territory of the experimental field is located in an arid foothill zone and is characterized by a sharply continental climate, low air humidity, an abundance of sunlight, and a short but rather cold winter. A feature of the weather and climatic conditions in the study area is the high-temperature regime and low availability of precipitation during the growing season.

Field experiments were carried out on meadow-chestnut soils of heavy mechanical composition, which are characteristic types of the foothill swamp belt. They have a dark chestnut color of the humus horizon, the thickness of which reaches 30-40 cm. The humus content in the plow horizon is 3.38%. The content of gross nitrogen and phosphorus is 0.258 and 0.211%, respectively. According to the availability of available nutrients, the soils of the experimental plot are characterized as medium-supplied with nitrogen and exchangeable potassium, the content of mobile phosphorus is low 22 mg/kg of soil.

The object of the research was winter pea varieties of the Serbian grain breeding"NS Moroz", "Partner" and fodder "Kocmaj" direction. The standard (control) is the Kazakh variety of spring peas Shal (LLP "Kazakh Research Institute of Agriculture and Plant Growing") recommended for use in the Almaty region.

According to the Institute of Field and Vegetable Growing (Serbia), the winter pea variety "NS Moroz" is intended for grain production, early ripe, characterized by uniform ripening, and tolerates low temperatures perfectly. Plants of limited growth, 50-70 cm high, with frequent nodules in the lower part of the stem, which increases tolerance to lodging, with a potential grain yield of up to 4.0 - 6.2 t/ha.

"Partner" is a two-handed variety. Mid-early variety of friendly maturation and medium height (60 and 80 cm), tolerant to lodging. A stable yield is achieved in the range of 3.5 - 4 t/ha.

"Kocmaj" is winter peas for fodder, haylage, and green manure. Stem length reaches up to 180 cm popular in organic production.

Shal peas (Pisum. sativum L.) belong to the group of early ripening varieties with a vegetation period of 60-65 days. It has a mustachioed leaf structure, as a result of which it does not lodge and is resistant to bacterial diseases.

The meteorological conditions during the research period were different, so the 2019-2020 agricultural year was more, and 2020-2021 was less favorable for the growth and development of winter crops. There was a shortage of precipitation, little snowy winter, freezing of the soil to a depth of 55 cm in the autumn-winter period of 2020-2021, and increased air temperature in the summer of 2021.

In the experiments, environmental (adaptability, biometrics, plant lodging, and product quality) and economic (green mass and grain yield, profitability) indicators of adaptable varieties were studied.

Results and discussions. In the 2019-2020 agricultural year, the prevailing favorable climatic conditions ensured good field germination, preservation, and winter hardiness of plants. Precipitation deficiency, deep freezing of the soil in the autumn-winter period, and increased temperature background in the summer periods of the following year had an unfavorable effect on the conditions of overwintering (winter hardiness) and the development of winter peas.

The adaptability of varieties to environmental conditions, first of all, is judged by the ecological plasticity and stability of their yield. According to the method of V.Z. Pakudin and L.M. Lopatina, the plasticity of varieties is estimated by the regression coefficient (b_i), and stability by the variance of the trait stability (Si^2). The more b_i, the more responsive the variety to changing growing conditions. If b_i is zero or tends to zero, then the variety does not respond to changes in environmental conditions. If b_i is equal to or close to unity, the change in yield fully corresponds to the change in growing conditions. Low Si^2 values indicate that the variety responds poorly to improved growing conditions [15].

Among the studied varieties, the varieties “NS Moroz” (b_i=1.20) and “Kocmaj” (b_i=1.14) had the greatest response to adaptation to agroclimatic growing conditions. The low index of plasticity (b_i=0.80) and stability (Si^2=14.4) in the variety Partner, indicates the presence of a specific response of this variety to changes in environmental conditions and low responsiveness to improved growing conditions.

The data of long-term studies have shown that the newly created varieties react poorly to negative changes in environmental factors, without reducing their productivity, and are more responsive to improvements in the agroclimatic background. According to I.A. Filatova and I.S. Brailova [16] found that varieties of past generations of peas Talovets 70 and Dudar had low genetic flexibility, reacted strongly to negative changes in environmental factors, while significantly reducing their productivity, and responded to a lesser extent to improvements in the agroclimatic background compared to the new generation ofvarious samples.

Adaptable varieties of winter peas, having a mustachioed leaf type, which contributes to the binding of plants in the early stages of plant growth and development, remain upright until harvesting, thereby contributing to a significant reduction in grain losses during harvesting. The results of our research showed that the lodging coefficient of grain pea varieties was at the

level of 1.08-1.10 and the suitability for mechanized harvesting was 4.5-4.6 points, i.e., the crops practically did not lodge. The lodging coefficient of winter peas for fodder in the phase of cutting ripeness was 1.60, while the suitability for mechanized harvesting was 3.1 points. In this case, interlinked plants created a continuous mass and allowed harvesting without losses.

Similar results were obtained under conditions of sufficient moisture in the Middle Volga region in the Stepnyak variety, where the stem length did not exceed 1 meter, and resistance to lodging was 4–5 points (high). And in conditions of excessive moisture, intensive growth of the stem was observed, reaching an average height of 1.5 meters. In this case, the resistance to the lodging of plants for harvesting decreased to 3, rarely to 2 points. However, the complete lodging of the plants did not occur, they were in a suspended state, which ensured their unhindered cutting by the reaper [17].

Adaptable varieties of winter peas of the Serbian selectionin the conditions of Kazakhstan in terms of ashandcrudeprotein content exceeded the control variantby 0.07-0.38% and 0.56-1.56%, respectively. Interms of elemental composition, theyalsoexceeded the control variety. Forzinc, theexcesswas 4.71-6.60%, foriron 2.10-11.42%, formanganese 1.85-3.42, fornickel 0.09-0.28% andforcobalt 0.02 -0.06%. Itshouldbenoted that according to the content of zinc, nickel,andcobalt, adaptable varieties, i.e. according to the content of heavy metals, they didn ot exceed the maximum permissibl econcentration.

Due to good winter hardiness and structural indicators, on average over the years of the study, the maximum grain yield (average 39.4 c/ha) was provided by the winter pea variety of the Serbian selection NS Moroz. The variety two-handled Partneris 22.8 kg/ha. The spring pea variety of the local selection Shal providedwithin the limits of 18.8 centners of grain per 1 hectare. The variety of winter peas Kocmaj, used for fodder purposes, in the conditions of the south-east of Kazakhstan provided a dry mass yield of 77.3 c/ha. The yield of the dry mass of the control variety “Shal” of local selection was at the level of 31.8 q/ha.

According to V.V. Grechko, L.V. Valko, L.I. Valiullina and L.A. Aksenova, high winter hardiness and yields were obtained during testing of winter pea varieties of Serbian selection in the conditions of Ukraine and Russia. Thus, in the Kherson and Nikolaev regions of Ukraine (2017-2018), the winter pea crops of the Serbian selection NS Moroz successfully survived the temperature drop, in some places to -19°C in the absence of snow cover and showed high results in terms of productivity and plant resistance in critical weather conditions. The average yield was 46-48 c/ha, with a potential yield of 60 c/ha [18]. In the Zaporizhzhia region of Russia, from 30 to 40 centners/ha of winter peas were obtained. For comparison, the spring yielded 12-13 c/

ha, i.e., the excess was 2-3 times and, in the area, where there is very little precipitation (240-250 mm per year), for the use of autumn-winter moisture in crop rotation, winter peas can be an excellent addition to wheat and barley [19].

In our studies, economic efficiency is calculated based on physical and cost indicators: yield, gross output, production costs, selling price, etc. At the same time, high economic indicators (net profit per 1 hectare amounted to 448.5 thousand tenge, profitability level was160,2%) compared with the control (spring peas Shal) in winter peas of the grain direction NS Moroz. Below (net profitwas201.8 thousand tenge, profitability level is 91.7%) in the two-handled variety "Partner" (Figure 1).

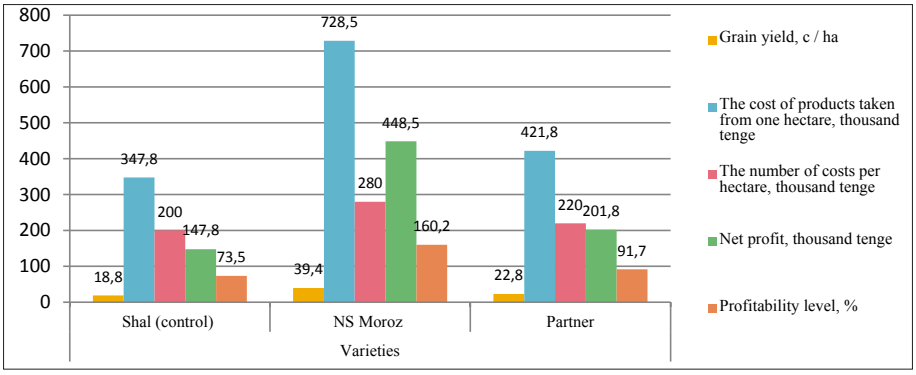

Figure 1 - Economic efficiency of pea grain production

Calculations of the economic efficiency of pea hay production showed that the highest net profit was 344.8 thousand tenge and the level of profitability was 146.7% was provided by winter peas of the Serbian selection of the Kocmajfodder direction (Figure 2).

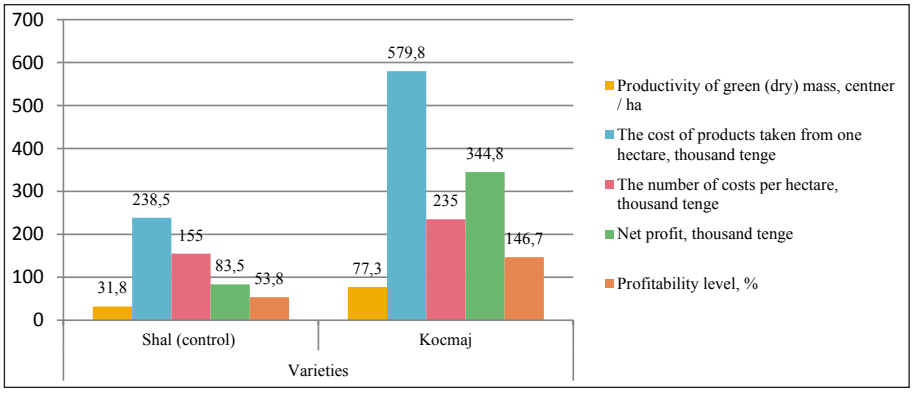

Figure 2 - Economic efficiency of hay production (dry weight) of peas

Conclusions. 1. Among the studied varieties, the varieties "NS Moroz" (b_i=1.20) and "Kocmaj" (b_i=1.14) had the greatest response to adaptation to agroclimatic growing conditions. The low index of plasticity (b_i=0.80) and stability (Si^2=14.4) in the variety Partner, indicates the presence of a specific response of this variety to changes in environmental conditions and low responsiveness to improved growing conditions.

2. The content of ash and crude protein in adaptable varieties of winter peas of the Serbian selection exceeds the control variant by 0.07-0.38% and 0.56-1.56%, respectively. In terms of elemental composition, the excess was 4.71-6.60% (zinc), 2.10-11.42% (iron), 1.85-3.42 (manganese), 0.09-0.28% (nickel) and 0.02-0.06% (cobalt).

3. The maximum grain yield (39.4 c/ha) was provided by the winter pea variety of the Serbian selection NS Morozdue to good adaptability to environmental conditions, on average over the years of research. The variety two-handled Partner is 22.8 kg/ha. The spring pea variety of the local selection Shal provided within the limits of 18.8 centners of grain per 1 hectare. The variety of winter peas Kocmaj, used for fodder purposes, in the conditions of the south-east of Kazakhstan provided a dry mass yield of 77.3 c/ha.

4. High levels of net profit (448.5 and 344.8 thousand tenge) and profitability (160.2 and 146.7%) were provided by winter pea varieties NS Moroz grain and Kocmajfodder.

In general, the adapted varieties of the Serbian selection NS Moroz (grain) and Kocmaj(fodder), which provided high environmental and economic performance in local conditions, are recommended for further introduction into production in the foothill zone of the southeast of Kazakhstan.

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REFERENCES

Zhuchenko A.A. (2008) Adaptive crop production (ecological and genetic foundations). Theory and practice [Adaptivnoerastenievodstvo (e`kologo-geneticheskie osnovy`). Teoriyaipraktika]. M.: Izd-voAgrorus,Vol.I., 815 p. ISBN 978-5-903413-01-0 (in Russian.).

Botero C.A., Weissing F.J., Wright J., Rubenstein D.R. (2015). Evolutionary tipping points in the capacity to adapt to environmental change. Proc. Natl Acad. Sci. USA 112, P.p.184–189. (10.1073/pnas.1408589111).

Kenenbayev S., Djura Karagic, Yessenbayeva G. (2021) Climate change and priority research areas in agriculture. Bulletin of nation-al academy of sciences of the Republic of Kazakhstan. Volume 1, Number 389, P.p. 111-116. https://doi.org/10. 32014/2021.2518-1467.15.

Dobrosmyslova I.A., Sazanova A.A., Semenov V.G., Mamyrova L.K., Yesimbekova Z.T., Agroecological aspects of the use of sodium selenite and zeolites in the cultivation of peas [Agroekologicheskie aspekty ispol'zovaniya selenitanatriya i ceolitovprivyrashchivanii goroha]. Bulletin of nation-al academy of sciences of the Republic of Kazakhstan. Volume 3, Number 345 (2021), P.p. 30– 36. https://doi.org/10. 32014/2020.2519-1629.77 (in Russian.).

Phenotypic plasticity in response to climate change: the importance of cue variation Suzanne Bonamour, Luis-Miguel Chevin, Anne Charmantier, and Céline Teplitsky (2019) Mar 18; 374(1768): 20180178. Published online 2019 Jan 28.doi: 10.1098/rstb.2018.0178.

Clement, S. L., McPhee K.E., Elberson L.R., Evans M.A. (2009) Plant Breed V.128. P.p.478-485.

Broka S.,Giertz Å., Christensen G., Rasmussen D., Morgounov A., Fileccia T., Rubaiza R. (2016) Agricultural sector risk assessment (Kazakhstan) World Bank Group Report Number 103076.

Kosolapov V.M., Ficzev A.I., Gaganov A.P. et al. (2009) Peas, lupin, vetch, beans: evaluation and use in feeding farm animals [Gorokh, lyupin, vika, boby`: oczenkai ispol`zovanie v kormlenii sel`sko khozyajstvenny`kh zhivotny`kh]. M.: OOO «Ugreshskaya tipografiya». – 374 p. (in Russian).

https://agrostory.com/info-centre/fans/gorokh-posevnoyopisanie-poleznye-svoystva-vyrashchivanie/

Jezierny D., Mosenthin R., Bauer E. (2010). The use of grain legumes as a protein source in pig nutrition: A review. Anim. Feed Sci. Technol, 157, P.p.111–128. [Google Scholar].

Watson C., RecklingM., Preissel S., Bachinger J., Bergkvist G., Kuhlman T., Lindström K., Nemecek T., Topp C., Vanhatalo A. (2017) Grain Legume Production and Use in European Agricultural Systems. Adv. Agron. P.p.144, 235–303. [Google Scholar].

Urbatzka P., Graß R., Haase T., Schüler C., Trautz D., Heß J. (2011) Grain yield and quality characteristics of different genotypes of winter pea in comparison to spring pea for organic farming in pure and mixed stands. Org. Agric. 1, P.p.187–202. [Google Scholar].

Neugschwandtner R., Bernhuber A., Kammlander S., Wagentristl H., Klimek-Kopyra A., Kaul H.P. (2019) Agronomic potential of winter grain legumes for Central Europe: Development, soil coverage and yields. Field Crops Res. 241, 107576. [Google Scholar].

Neugschwandtner R.W., Bernhuber A., Kammlander S., Wagentristl H., Klimek-Kopyra A., Kaul H. (2020) Yield structure components of autumn- and spring-sown pea (Pisum sativum L.). Acta Agric. Scand. B Soil Plant Sci. 70, P.p.109–116. [Google Scholar] https://doi.org/10.1080/09064710.2019.1676463.

Pakudin V.Z., Lopatina L.M. (1984) Assessment of ecological plasticity and stability of agricultural varieties [Oczenka e`kologicheskoj plastichnostii stabil`nosti sortovsel`sko khozyajstvenny`khkul`tur] Sel`skokhozyajstvennaya biologiya. N. 4. P. P.p.109 – 113. (in Russian).

Filatova I.A., Brailova I.S. (2016) Ecological plasticity and stability of pea varieties and varietals in the conditions of the stone steppe [E`kologicheskaya plastichnost` istabil`nost` sortov i sortoobrazczovgorokha v usloviyakh kamennojstepi] Nauchno – proizvodstvenny` jzhurnal «Zernobobovy`eikrupyany`ekul`tury`. N3 (19). P.p.41-45. (in Russian).

Majstrenko O.A. (2016) Pea variety Steppe for the conditions of the Middle Volga region [Sort gorokha Stepnyak dlya uslovij Srednego Povolzh`ya] Molodojucheny`j. N27.3 (131.3). P.p.42-44. (in Russian).

Grechko V.V., Val`ko L.V., Valiullina L.I. (2000) Problems of pea cultivation in the conditions of the Krasnodar Territory and ways to solve them [Problemy` vozdely`vaniyagorokha v usloviyakh Krasnodarskogo kraya i puti i khresheniya] Sibirskijvestnik s/khnauk. Novosibirsk. N 3-4. P.p.39-64. (in Russian).

Aksenova L.A. (2001) Peas [Gorokh] Geografiya. N 25. P.p.3–6. (in Russian).

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