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B. A. Shalabayev[1], O. D. Shoikin[2],
Zh. Zh. Uakhitov[3], A. Zh. Beisembay[4]
[1,3,4]Toraighyrov Universty,
Republic of Kazakhstan, Pavlodar;
[2]Federal State Budgetary Educational
Institution of Higher Education
«Omsk State Agrarian University named after P. A. Stolypin»,
Russian Federation, Omsk.
[1]ORCID: https://orcid.org/0000-0002-4551-0042
[2]ORCID: https://orcid.org/0000-0001-8803-2645
[3]ORCID: https://orcid.org/0000-0002-7090-7834
[4]ORCID: https://orcid.org/0009-0003-0148-967X
*e-mail: baur_-08.87@mail.ru

STUDY OF PEA VARIETIES UNDER THE CONDITIONS OF NORTHEASTERN KAZAKHSTAN

The article presents the results of ecological variety testing of seeded peas conducted at experimental sites in the north-east of the Pavlodar region. The study involved 5 varieties of seeded peas. The assessment was carried out according to economically valuable and morphological characteristics. Experiments have shown high adaptability of the studied varieties to local climatic conditions and soil type. The average duration of the growing season of the studied cultivars was 78–84 days, with the exception of the ultra-early cultivar Kasib, which had a growing season of 65 days. The Ruslan variety showed the highest yield – 17.8 c/ha with a mass of 1000 seeds of 254.6 g and a protein content of 2.41 %, surpassing other varieties in terms of aggregate indicators. The tested cultivars, adapted to a short growing season, meet the requirements of the state standard and can increase the efficiency of feed production and solve the problem of protein deficiency in animal husbandry. High indicators of varietal samples confirm their importance for improving soil fertility and ensuring consistently high yields in the region, which contributes to food security and the maintenance of sustainable agricultural production. The

results obtained confirm the need for further research in this priority and promising area.

Keywords: ecological sorting test, peas, yield, protein, adaptability, sustainability, Pavlodar region.

Introduction

Plant protein deficiency is one of the key scientific challenges that need to be addressed. Growing leguminous crops is the most important way to combat this shortage [1; 2]. This crop's advantages include its wide application in food and feed purposes, as well as its ability to enhance soil fertility [3].

After growing peas in the soil, there is a significant amount of nitrogen up to 70 kg per hectare – which increases its fertility. In addition, peas are one of the best precursors for cereals and other crops because the yield of first wheat and barley after them is higher by 3-7 c/ha compared to the crop after cereals [4].

In Kazakhstan, peas are cultivated on an area of 130 thousand ha. Throughout the republic 21 varieties of peas are zoned: Ramonskii 77 (1962 y.); Kormovoy 24 (1968 y.); Karabalykskiy kormovoy (1971 y.); Neosypayushchijsya 1 (1979 y.) which was removed from the State Register in 1999 due to low technology; Donbass kormovoy (1984 y.); Ukosniy 5 kormovoy (1986 y.); Zernogradskiy Neosypayushchijsya (1989 y.); Kharkovskiy Usatiy kormovoy (1991 y.); Talovec 55 (1991 y.); Talovec 50 (1992 y.); Ukosniy Kormoviy kormovoi (1993 y.); Omsk Neosypayushchijsya (1993 y.); Usach Kazakhstanskiy 871 (1996 y.); Shal (2003 y.); Varyag (2008 y.); Aksaiiskii usatyi 55 (2011 y.); Yamal`skii (2012 y.); Zaural`skyi 3 (2015 y.); Kasib (2015 y.); Astronaut (2016 y.); Yamal 2 (2016 y.). In the Pavlodar region in 2016, the area under pea cultivation was 255 hectares.

One old variety of Neosypayushchijsya 1 was zoned in the region since 1979. The disadvantage of this variety is its "crop yield", which creates difficulties with mechanized harvesting, increasing grain losses. The absence of new zoned varieties as well as primary seed farming in the area leads to uncontrolled imports of varieties from other regions, which without prior assessment and study are unlikely to solve the problem [5; 6].

The study of the adaptability of new varieties of peas in environmental tests, created and provided by breeding centers of Kazakhstan and Russia, is the most optimal and fast way to achieve practical results.

Materials and methods

In the experimental site of LLP «Pavlodar Agricultural Research Institute» in 2014–2016, an environmental test of pea varieties was conducted under conditions in the north-eastern part of Pavlodar region. The field experiments were

calculated using the standard method. The plot area is 6 m2 and the repetition is four times. Planting time in I decade of May, when the soil is physically ripe. The predecessor is pure steam. The agricultural technology of preparing the trial plot and pre-seeding treatment corresponds to the technology of cultivating field peas. In this regard, a complex of anti-erosion agricultural implements was used for soil cultivation, sowing of nurseries for environmental testing. The seeding of the breeding-grounds was carried out by a disc seeder SFK-7 at a depth of 5–6 cm from the bottom of the groove, followed by a ring roller. The rate of sowing is 1.0 million common seeds per hectare. Interlining is carried out manually. The productive moisture reserve was determined by method of N. M. Bakayev [7].

The following calculations and observations were carried out: agrometerological conditions – based on observations of the Krasnoarmeyskaya AMS, soil moisture – by weight method in a layer of 0–100 cm in layers, phenological observations, accounting for field germination and plant survival, assessment of plant lodging according to a five–point system, accounting for grain yield – continuous threshing of plots with reduction to basic humidity and 100 % purity, study of the elements of the crop structure (sheaves harvested from trial sites of 0.25 m^2 were used). All records and observations were conducted using the State crop-type testing methodology [8]. Technological analysis of pea quality on 9 indicators was carried out in accordance with the methods STST (2001) and the Methodology of State Crop Testing «Technological assessment of cereal, cereal and legume crops (1988)», Rating for resistance to wear on a 5-point scale [9; 10; 11].

Processing of crop data was carried out using the method of dispersion analysis at B.A. Dospekhov [12].

The objects of research were 5 varieties of peas: Kasib (LLP «SPCGF named after A. I. Barayeva»); Zaural`skyi 3 (JSC «Kurgansemena»); Ruslan (SSI Krasnoyarsk SRIA); Aksaiiskii usatyi 55 (SSI Donskoy Zonalnyi SRIA). The standard was to take a zoned – Neosypayushchijsya 1.

Results and discussions

To assess the quality of the seeds obtained, the following indicators were determined: purity, germination energy, germination, sowing season, humidity and weight of 1000 seeds (table 1).

Table 1 – Seed quality of pea seed varieties tested in the environmental variety test for 2014-2016.

№	Name	Purity, %	Viability, %	Planting grade, %	Humidity, %	Mass 1000 grains , g
1	Kasib	99,0	94,0	93,0	14,5	218,0
2	Zaural`skyi 3	99,6	98,0	97,6	14,0	255,0
3	Ruslan	99,6	99,0	98,6	15,0	255,5
4	Aksaiiskii usatyi 55	99,4	97,0	96,4	15,0	255,0
5	Neosypayushchijsya 1 gr.	98,5	95,0	93,5	14,3	220,0

Thus, the seed qualities of the pea seed varieties were classified as class 1 in the seed standard (GOST 28674-90). The largest mass of 1000 seeds before sowing was determined from the following samples: Zaural`skyi 3, Aksaiiskii usatyi 55 and Ruslan – 255,0-255,5. Low mass of 1000 seeds was observed in the following samples Kasib –218,0 g.

Growing season. According to the ripening groups of N.I. Vasiakin divides the peas into quick-ripened – 60-70 days, average – 75–90 days and late-ripened – 95–120 days or more [13].

In the ecological variety test, the development of pea plants from sowing to harvesting was divided into three periods: sowing-shooting, sowing-flowering, flowering-technical ripening.

Observations showed that 2014–2016 were characterized as contrasting in climatic conditions. The average duration of the growing season of the studied samples was 78–84 days. For the exception of the ultra-rare variety Kasib with a growing period of 65 days (table 2).

Table 2 – The ecological variety test in 2014–2016 found that pea varieties had an average length of growing season.

№	Name	Growing season			Average
		2014 y.	2015 y.	2016 y.	
1	Kasib	61	65	70	65
2	Zaural`skyi 3	70	79	84	78
3	Ruslan	72	79	83	78
4	Aksaiiskii usatyi 55	76	82	84	80
5	Neosypayushchijsya 1 gr.	74	88	90	84

Field germination. To get a high yield of peas with good qualities it is important to have friendly, full-fledged shoots. The density of shoots does not

always depend on such indicators as the rate of sowing, the time of sowing. The agroclimatic conditions under which crops are cultivated, as well as the adaptation of a particular variety to these conditions, have a great influence on the field germination.

Table 3 shows the laboratory germination of seeds sown in the experiment and their field germination. The laboratory growth rate was high in almost all years and ranged from 94 to 100 % in three years. Field germination under the prevailing weather conditions was initially favorable for seed germination. Less difference was observed in the samples Ruslan (1,4 %), Zaural`skyi 3 (2,0 %), Aksaiiskii usatyi 55 (2,7 %).

Table 3 – Laboratory and field germination of pea seeds, 2014–2016

№	Name	2014 y.		2015 y.		2016 y.		Average	
		laborat. %	field, %	laborat. %	field,%	laborat. %	field,%	laborat.	field
1	Varyag	97,0	90,0	98,0	92,0	96,0	95,0	97,0	92,3
2	Altayskii usatyi	97,0	92,0	96,0	92,0	97,0	94,0	96,0	92,6
3	Avans	96,0	84,0	94,0	87,0	95,0	90,0	95,0	87,0
4	Omskii 9	95,0	87,0	96,0	92,0	95,0	90,0	95,0	89,6
5	Omskii 18	97,0	90,0	96,0	93,0	97,0	94,0	96,0	92,3
6	Demos	95,0	89.0	97,0	90,0	95,0	90,0	95,0	89,6
7	Blagovest	98,0	90,0	95,0	92,0	94,0	89,0	95,0	90,3
8	Kasib	94,0	87,0	95,0	89,0	95,0	90,0	94,0	88,6
9	Zaural`skyi 3	98,0	95,0	99,0	97,0	97,0	96,0	98,0	96,0
10	Ruslan	100,0	97,0	100,0	99,0	98,0	97,0	99,0	97,6
11	Aksaiiskii usatyi 55	98,0	92,0	97,0	96,0	97,0	95,0	97,0	94,3
12	Yamal`skii	97,0	86,0	98,0	90,0	93,0	89,0	96,0	88,3
13	Yamal 2	98,0	92,0	97,0	95,0	94,0	90,0	96,0	92,3
14	Astronaut	97,0	89,0	95,0	91,0	94,0	86,0	95,0	88,6
15	Neosypayushchijsya 1 gr.	95,0	88,0	96,0	94,0	95,0	92,0	95,0	91,3

The preservation of plants to harvest, capable of forming a crop yield was higher in the sample Ruslan. Compared to the standard Neosypayushchijsya

1, it had 10 plants more by harvest (90 plants), which exceeded the standard by 10 % (table 4).

Table 4 – Plant conservation and survival of pea varieties, 2014–2016

№	Name	Plant density, pieces/m^2		Conservation of plants for harvesting, %	Dead plants, %
		on waste	before harvest		
1	Kasib	88	79	79,0	21,0
2	Zaural`skyi 3	96	88	88,0	12,0
3	Ruslan	98	90	90,0	10,0
4	Aksaiiskii usatyi 55	94	86	86,0	14,0
5	Neosypayushchijsya 1 gr.	91	80	80,0	20,0

Main indicators of productivity of pea samples. The yield of any crop is composed of two main indicators – number of plants per unit area, which are left for harvesting and weight of grain per plant.

In our conditions, the elements of crop structure differed according to the varieties of peas and weather-climatic conditions of the year.

The highest plant height in years of research is observed at the sample Neosypayushchijsya 1 – (85 cm). The average plant height of the other specimens was almost the same and was 65–70 cm. Low plant height showed sample Kasib – (63 cm), (table 5).

Table 5 – Elements of the crop structure of peas in ecological sorttesting, 2014–2016

№	Name	Height of plants, cm	Quantity per plant, pcs.		Grain mass on 1 plant, g	Mass of 1000 seeds, g
			beans	grains		
1	Kasib	63	5	11	1,4	180,0
2	Zaural`skyi 3	70	7	19	2,0	250,2
3	Ruslan	70	7	20	2,0	254,6
4	Aksaiiskii usatyi 55	68	6	18	1,9	250,2
5	Neosypayushchijsya 1 gr.	85	4	11	1,4	190,0

Although the number of beans and seeds in the crop has changed significantly due to growing conditions, the variety has had a decisive influence on these indicators.

On average for the years of research, the maximum number of beans on the plant was in the varieties Ruslan and Zaural`skyi 3 number of beans on the plant was 7 pieces.

The total number of grains in the crop is one of the main components of the yield of the pea varieties.

The highest number of grains per plant had the following types: Ruslan – 20 pcs; Zaural`skyi 3–19 pcs. The following samples of Demos and Kasib – 11 grains per plant were at the level with the standard.

The mass of grain from 1 plant is determined primarily by the number of beans and seeds on the plant. Between the number of seeds in the seed stock and the yield I have not found a relationship, so this indicator cannot influence the choice of the variety. So, the largest mass of grain in 1 plant in the samples Ruslan, Zaural`skyi 3–2,0 g. and Aksaiiskii usatyi 55–1,9 g. The mass of the grain on 1 plant in the standard Neosypayushchijsya 1 was – 1,4 g.

The mass of 1000 grains is a fairly stable element of productivity and changes under weather conditions to a lesser extent than the number of beans and grains in the plant.

On average for three years of research the largest mass of 1000 grains were characterized by the samples Ruslan – 254,6 g, Zaural`skyi and Aksaiiskii usatyi 55 – 250,2 g, Blagovest – 250,0 g. Low mass of 1000 grains is marked in the samples Kasib – 180,0 g, (- 10.0 g).

Protein content in pea grain. The protein content in pea grain is relatively stable and changes mainly depending on varietal characteristics. However, the process of nitrogen fixation and protein accumulation in grain cannot be considered in isolation from soil-climatic conditions.

In the course of research, protein content in pea grain was higher in 2014 (2,40–2,45 %), as it was characterized more arid. In 2016, due to excess moisture, the protein content in pea grain was lower than in the previous year – 2,29–2,39 %. Average protein content in pea grain was – 2,33–2,41 %. (table 6).

Table 6 – Protein content (%) in pea grain in the ecological grade test, 2014–2016.

№	Name	2014 y.	2015 y.	2016 y.	Average
1	Kasib	2,41	2,32	2,30	2,34
2	Zaural`skyi 3	2,42	2,39	2,37	2,39
3	Ruslan	2,45	2,41	2,39	2,41
4	Aksaiiskii usatyi 55	2,41	2,25	2,33	2,33

5	Neosypayushchijsya 1 gr.	2,40	2,31	2,29	2,33

Thus, the highest protein content was found in the following samples Ruslan – 2.41 %. Protein content in the grains of the test samples varied mainly according to the variety and the weather conditions of individual years.

Yield of pea varieties. At the end of a crop, when certain factors and indicators interact, the final result is the yield of the crop. When we grow peas, we are interested in the yield of the crop.

Our studies have shown that the yield, as well as its dependence on growing seasons, was not unequal over the years.

2014 was more arid than the previous years. There is a negative relationship between the crop yield and the period of passage of the vegetative phase with the external conditions of the environment, that is those types which previously formed the generating organs, could use the remaining reserves of moisture.

Thus, in the case of increasing drought, the yield of pea varieties at the end of the growing season was between 10,0 and 14,2 c/ha. Low yield was observed for the Kasib sample –10,0 c/ha (- 1,2 c/ha) respectively to standard Neosypayushchijsya 1 (11,2 c/ha).

In 2015, with more favourable conditions for heat and moisture, the yield of all varieties was higher than in the previous year. Ruslan sample was particularly outstanding – 22,8 c/ha. The yield of the remaining samples ranged from 9,1 to 21,5 c/ha (table 7).

In the conditions of excess rainfall in the middle of the growing season in 2016, the soil structure deteriorated, compacted and soaked, creating stressful conditions for the growth and development of pea plants. Which caused low crop yields. In such extreme conditions, yield ranged from 14,8 to 16,5 c/ha (table 7).

Thus, among the samples tested, the greatest increase in yield over three years was observed in the Ruslan sample 17,8 c/ha (+ 3,1 c/ha), respectively. Also according to the results of the three-year test he was given a high score on shedding, planability and phenotype – 5 points.

Table 7 – Pea yield in ecological sortotest, c/ha, 2014–2016

№	Name	Yield c/ha			Average	± к st.	The average score for		
		2014 y.	2015 y.	2016 y.			crumbling	lodging	phenotype
8	Kasib	10,0	19,1	15,0	14,6	- 0,1	4	4	4
9	Zaural`skyi 3	13,0	21,5	16,3	16,9	+ 2,2	5	4	5
10	Ruslan	14,2	22,8	16,5	17,8	+ 3,1	5	5	5

11	Aksaiiskii usatyi 55	12,7	21,1	15,8	16,3	+ 1,6	4	4	5
15	Neosypayushchijsya 1 gr.	11,2	19,0	14,0	14,7	-	4	3	4
НСР 05		-	-	-	-	0,9	-	-	-

Analyzing the data obtained in the ecological variety test, it can be said that all tested varieties are adapted to the conditions of the Pavlodar region.

Sample Ruslan. Whose originator is SSI Krasnoyarsk SRIA and JSC «Kurgansemena» exceeded the standard and other grades by all indicators: field growth – 97,6 %, crop yield – 17,8 c/ha (+ 3.1 c/ha), lake coverage of one plant 20 pcs., the mass of 1000 seeds – 254,6 g, and raw protein content 241 %. It does not fall short of the standard and other grades in the resistance to eating and falling – 5 points.

Conclusions

1 In the 2014-2016 environmental test, there were 5 varieties of peas: Kasib (LLP «SPCGF named after A.I. Barayeva»); Zaural`skyi 3 (JSC «Kurgansemena»); Ruslan (SSI Krasnoyarsk SRIA); Aksaiiskii usatyi 55 (SSI Donskoy Zonalnyi SRIA). The standard was to take a zoned – Neosypayushchijsya 1.

2 The highest protein content was found in Ruslan – 2,41 %. Protein content in the grains of the test samples varied mainly according to the variety and the weather conditions of individual years.

3 Highest yield increase in sample Ruslan 17,8 c/ha (+ 3,1 c/ha). Whose originator is SSI Krasnoyarsk SRIA and JSC «Kurgansemena» exceeded the standard and other grades by all indicators: field growth – 97,6 %, crop yield – 17,8 c/ha (+ 3.1 c/ha), lake coverage of one plant 20 pcs., the mass of 1000 seeds – 254,6 g, and raw protein content 241 %. It does not fall short of the standard and other grades in the resistance to eating and falling – 5 points.

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**Б. А. Шалабаев[1], О. Д. Шойкин[2], Ж. Ж. Уахитов[3], А. Ж. Бейсембай[4]*
[1,3,4]Торайғыров университеті,
Қазақстан Республикасы, Павлодар қ.;
[2]«П. А. Столыпин атындағы
Омбы мемлекеттік аграрлық университеті»
Жоғары білім берудің федералды мемлекеттік
бюджеттік білім беру мекемесі,
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ҚАЗАҚСТАННЫҢ СОЛТҮСТІК-ШЫҒЫСЫ ЖАҒДАЙЫНДА АСБҰРШАҚ СОРТТАРЫН ЗЕРТТЕУ

Мақалада Павлодар облысының солтүстік-шығысындағы тәжірибелік учаскелерде жүргізілген егістік бұршақтың экологиялық сұрыптық сынағының нәтижелері келтірілген. Зерттеуге бұршақ тұқымының 5 түрі қатысты. Бағалау экономикалық құнды және морфологиялық белгілер бойынша жүргізілді. Тәжірибелер зерттелетін сорттардың жергілікті климаттық жағдайларға

және топырақ түріне жоғары бейімделуін көрсетті. Зерттелетін сорттардың вегетациялық кезеңінің орташа ұзақтығы 78-84 күнді құрады, касибтің ультра ерте сорттарын қоспаганда, оның вегетациялық кезеңі 65 күнді құрады. Ең жоғары өнімділікті «Руслан» сорты көрсетті — 17,8 ц/га, салмағы 1000 тұқым 254,6 г және ақуыз мөлшері 2,41%, индикаторлар жиынтығы бойынша басқа сорттардан асып түсті. Қысқа вегетациялық кезеңге бейімделген сыналатын сорт үлгілері мемлекеттік стандарт талаптарына сәйкес келеді және жемшөп өндірісінің тиімділігін арттырып, мал шаруашылығындағы ақуыз тапшылығы мәселесін шеше алады. Сорт үлгілерінің жоғары көрсеткіштері олардың топырақ құнарлылығын жақсарту және азық-түлік қауіпсіздігіне және тұрақты Ауыл шаруашылығы өндірісін қолдауға ықпал ететін аймақ жағдайында тұрақты жоғары өнімділікті қамтамасыз ету үшін маңыздылығын растайды. Алынған нәтижелер осы басым және перспективалы бағытта одан әрі зерттеу қажеттілігін растайды.

Кілтті сөздер: экологиялық сортты сынау, бұршақ, өнімділік, протеин, бейімделу, төзімділік, Павлодар облысы.

**Б. А. Шалабаев[1], О. Д. Шойкин[2], Ж. Ж. Уахитов[3], А. Ж. Бейсембай[4]*
[1,3,4]Торайгыров университет,
Республика Казахстан, г. Павлодар;
[2]Федеральное государственное
бюджетное образовательное
учреждение высшего образования
«Омский государственный
аграрный университет имени П. А. Столыпина»,
Российская Федерация, г. Омск.
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ИЗУЧЕНИЕ СОРТОВ ГОРОХА В УСЛОВИЯХ СЕВЕРО-ВОСТОЧНОГО КАЗАХСТАНА

В статье представлены результаты экологического сортоиспытания посевного гороха, проведённого на опытных участках на северо-востоке Павлодарской области. В исследовании участвовали 5 сортов посевного гороха. Оценка проводилась по

хозяйственно ценным и морфологическим признакам. Эксперименты показали высокую адаптивность исследуемых сортов к местным климатическим условиям и типу почвы. Средняя продолжительность вегетационного периода изучаемых сортообразцов составила 78–84 дня, за исключением ультрараннего сортообразца Касиб, у которого вегетационный период составил 65 дней. Наибольшую урожайность показал сорт «Руслан» — 17,8 ц/га с массой 1000 семян 254,6 г и содержанием белка 2,41 %, превосходя другие сорта по совокупности показателей. Испытуемые сортообразцы, приспособленные к короткому вегетационному периоду, соответствуют требованиям государственного стандарта и могут повысить эффективность кормопроизводства и решить проблему дефицита белка в животноводстве. Высокие показатели сортообразцов подтверждают их значимость для улучшения плодородия почвы и обеспечения стабильно высокой урожайности в условиях региона, что способствует продовольственной безопасности и поддержанию устойчивого сельскохозяйственного производства. Полученные результаты подтверждают необходимость дальнейших исследований в этом приоритетном и перспективном направлении.

Ключевые слова: экологическое сортоиспытание, горох, урожайность, протеин, адаптивность, устойчивость, Павлодарская область.

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«Toraighyrov University» баспасынан басылып шығарылған
Торайғыров университеті
Павлодар мемлекеттік университеті
140008, Павлодар қ., Ломов к., 64, 137 каб.

«Toraighyrov University» баспасы
Торайғыров университеті
140008, Павлодар қ., Ломов к., 64, 137 каб.
8 (7182) 67-36-69
e-mail: kereku@tou.edu.kz
www.vestnik-cb.tou.edu.kz