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Screening of Mangystau Flora for Wild Relatives of Cultivated Plants

¹Akzhunis A. Imanbaeva
²Margarita Yu. Ishmuratova
³Ainur T. Tuyakova

¹⁻³ Mangyshlak Experimental Botanical Garden, Republic of Kazakhstan
130000 Aktau city, 10th micro district

¹ PhD (biological sciences)

² PhD (biological sciences), associating professor

³ PhD (biological sciences)

E-mail: imangarden@mail.ru, margarita.ishmur@mail.ru

Abstract

In the article the analysis of specific structure and degree of prospects of wild relatives of cultural plants of Mangystau region's flora is conducted. The list of wild relatives of cultural plants of Mangystau includes 118 species from 62 genes and 21 families. The greatest specific species is revealed for the peninsula of Mangyshlak, the smallest is for the peninsula Buzachi.

The greatest number of species represented in Chenopodiaceae, Fabaceae, Nitrariaceae and Poaceae families.

The analysis of priority of wild relatives of cultural plants allowed distributing plants as follows: to the 1st group – 25 species; to the 2nd group – 4 species; to the 3rd group – 8 species; to the 4th group – 19 species; to the 5th group – 62 species.

Keywords: wild relatives of cultivated plants, Mangystau, floristic area, economic value.

Introduction

Creation of the new highly productive plant varieties used for production of quality foodstuff and forages, adapted for adverse environmental conditions, diseases and wreckers, demands widely a choice of the initial material, which important component are the wild relatives of cultural plants (WRCP). Priority method of preservation of WRCP [1] is preservation in places of natural growth.

Present times in the structure of WRCP are joining not only those species which are including in selection process, but also could take part in formation of grades of cultural plants.

In recent years there was an imperative need of preparation of the WRCP list for Kazakhstan, because without the special researches directed to the careful inventory of economic and valuable species plants of the republic, it is impossible to plan actions for their protection and practical uses.

Proceeding from the aforesaid, the aim of present research was detection of the full list of WRCP in Mangystau's flora and their ranging by levels of prospects and economic value.

Methodology

As material for drawing up the WRCP list of Mangystau region was herbarium fund of Mangyshlak Experimental Botanical Garden, the BD-Plant-KZ database, own field researches, republican [2-10] and regional [11, 12] lists of flora, literature references [13-23]. Due to the features of animal husbandry of Mangystau, the species, used as fodder for camels and sheets, also as local food plants, were included in the list of WRCP.

To degree of priority [21, 22] all WRCP were ranged by several indicators: participation in selection process (direct participation, participation in hybridization, use as donors of useful signs, as stocks, etc.), systematic proximity to the cultural species, and extent of use in human economic activities. As results 5 groups were allocated: the 1st group – the species, which have been directly presented in culture, have sorts; the 2nd group – the species, which are directly participating in crossings, used as sources of genes or stocks; the 3rd group – species of close relationship with cultivated plants (as a part of one section or a subgenus), perspective for economic use; the 4th group – other useful species of genus used for gathering and national selection; the 5th group – all other species of this genus.

Results and discussion

As result of literature overview and field investigation in the flora of Mangystau region 118 species from 65 genes and 21 families were allocated (table 1).

Table 1: The lists of wild relatives of cultivated plants of Mangystau flora

Family	Genus	Species	Group of perspectives	Growth in floristic areas				Practical using
				13. Northern Ust-Urt	13a. Buzachi	13б. Mangyshlak	19 Southern Ust-Urt	
<i>Alliaceae</i> J.Agardh	<i>Allium</i> L.	<i>A.albanum</i> Grossh.	5			+	+	fs,fd
		<i>A. caspium</i> (Pall.) Bieb.	4	+	+		+	fs,d,v
		<i>Allium decipiens</i> Fisch. ex Schult.et Schult.fil	5			+		fs
		<i>A.delicatulum</i> Siev. ex Schult.et Schult.fil	5			+		fs,v
		<i>A.iliense</i> Regel	5	+		+		d
		<i>A.sabulosum</i> Stev.ex Bunge	4	+		+		fs
<i>Amaranthaceae</i> Juss.	<i>Amaranthus</i> L.	<i>A.blitoides</i> S.Wats.	5			+		fd
		<i>A.cruentus</i> L.	4			+		fs,d,fd
		<i>A.retroflexus</i> L.	4	+	+	+	+	fd,m,d
<i>Apiaceae</i> Lindl.	<i>Ferula</i> L.	<i>F.karelinii</i> Bunge	5		+	+		fs
<i>Asparagaceae</i> Juss.	<i>Asparagus</i> L.	<i>A. breslerianus</i> Schult.et Schult.fil	5	+	+	+	+	fd
		<i>A.pallasii</i> Miscz.	5	+				d,fd
		<i>A.persicus</i> Backer	3	+		+		fs

Asteraceae Dumort.	<i>Artemisia</i> L.	<i>A. terrae-albae</i> Krasch.	4	+	+	+	+	fd,m	
	<i>Carthamus</i> L.	<i>C.gypsicola</i> Iljin	5			+		t	
		<i>C.lanatus</i> L.	2			+		fs,t,fd	
	<i>Cichorium</i> L.	<i>C.intybus</i> L.	1			+		fs,t,m, mf	
	<i>Inula</i> L.	<i>I.britannica</i> L.	5			+		m	
		<i>I.multicaulis</i> Kar.	5			+		fd	
	<i>Lactuca</i> L.	<i>L.serriola</i> L.	3			+		fs	
		<i>L.tatarica</i> (L.) C.A. Mey	5	+		+		fd	
	<i>Scorzonera</i> L.	<i>S.songorica</i> (Kar.et Kir) Lipsch.et Vass.	5			+		fd	
		<i>S.tuberosa</i> Pall.	5			+		fd	
Brassicaceae Burnett	<i>Crambe</i> L.	<i>C.edentula</i> Fisch.et C.A. Mey ex Korsh.	5			+		fd, fs	
	<i>Isatis</i> L.	<i>I.minima</i> Bunge	5			+		t	
	<i>Lepidium</i> L.	<i>L.latifolium</i> L.	5	+		+		fs	
		<i>L.perfoliatum</i> L.	5	+	+	+		fd	
	<i>Sinaps</i> L.	<i>S.arvensis</i> L.	1			+	+	fs	
Capparidaceae Juss.	<i>Capparis</i> L.	<i>C.herbacea</i> Willd.	3	+		+	+	fs,fd,m, v	
Caprifoliaceae Juss.	<i>Lonicera</i> L.	<i>L.tatarica</i> L.	5	+				d,t,m	
Chenopodiaceae Vent.	<i>Anabasis</i> L.	<i>A.salsa</i> (C.A. Mey) Benth.ex Volkens et Hook	5	+	+	+	+	fd,m	
	<i>Atriplex</i> L.	<i>A.canada</i> C.A. Mey	4	+				fd	
	<i>Ceratocarpus</i> L.	<i>C.arenarius</i> L.	3	+	+	+	+	fd,m	
	<i>Chenopodium</i> L.	<i>Ch.album</i> L.	1			+			fd,fs,t
		<i>Ch.botrys</i> L.	4			+			d,fd
		<i>Ch.glaucum</i> L.	5	+		+			fd
		<i>Ch.strictum</i> Roth	5					+	fd
	<i>Kochia</i> Roth	<i>K.iranica</i> Bornm.	5	+					fd
		<i>K.odontoptera</i> Schrenk	5	+					fd
		<i>K.prostrata</i> (L.) Schrud.	1			+	+	+	fd
	<i>Krascheninnikovia</i> Gueldenst.	<i>K.ceratoides</i> (L.) Gueldenst.	1			+	+		t,fd
	<i>Salsola</i> L.	<i>S.arbuscula</i> Pall.	5	+		+	+		fd
		<i>S.australis</i> R.Br.	5			+			fd
		<i>S.dendroides</i> Pall.	5			+			fd
		<i>S.foliosa</i> (L.) Schrud.	5	+	+			+	t
		<i>S.gemmascens</i> Pall.	5	+				+	fd
		<i>S.incanescens</i> C.A. Mey	5			+			fd
<i>S.nitraria</i> Pall.		5	+	+	+			fd	
<i>S.paulsenii</i> Litv.		5	+		+	+		fd	
<i>S.tamariscina</i> Pall.		5	+		+			d	

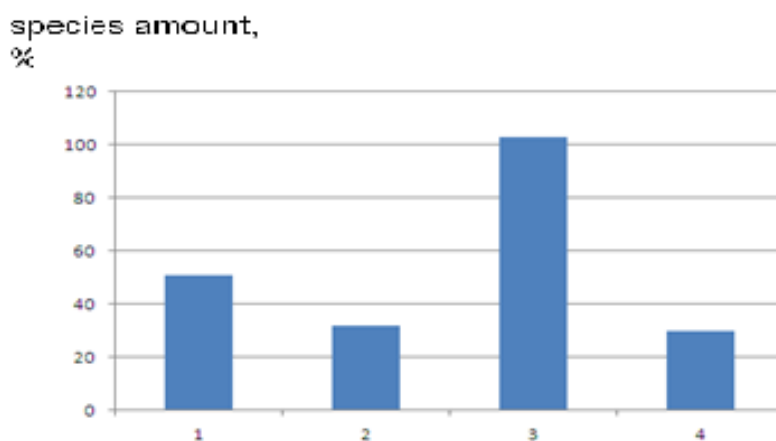
<i>Elaeagnaceae</i> Juss.	<i>Elaeagnus</i> L.	<i>E.angustifolia</i> L.	1	+		+		fs,t,d,v
		<i>E.oxycarpa</i> Schlecht.	2			+		fs,t,d,v
<i>Fabaceae</i> Lindl.	<i>Alhagi</i> Hill	<i>A.persarum</i> Boiss.et Buhse	5			+	+	fd
		<i>A.pseudoalhagi</i> (Bieb.) Fisch.	5	+	+	+	+	fd,m
	<i>Amoria</i> C.Presl	<i>A.fragifera</i> (L.) Roskov	5			+		fd
	<i>Glycyrrhiza</i> L.	<i>G.aspera</i> L.	5	+		+		fd,m
		<i>G.glabra</i> L.	2	+		+		fd,m,mf
		<i>G.korshinskyi</i> Grig.	5			+		fd,m
	<i>Lathyrus</i> L.	<i>L.incurvus</i> (Roth) Roth	5	+	+	+		fd,m
	<i>Medicago</i> L.	<i>M.caerulea</i> Less.et Ledeb.	1	+	+	+	+	fd,mf
		<i>M.romanica</i> Prod.	3			+		fd,mf
		<i>M.sativa</i> L.	1			+	+	fd,mf
		<i>M.trautfetterii</i> Sumn.	4			+		fd,mf
	<i>Melilotus</i> Hill.	<i>M.albus</i> Medik.	1	+	+	+	+	fs,fd,mf
		<i>M.officinalis</i> (L.) Pall.	1			+		fs,fd,m, v,mf
	<i>Onobrychis</i> Hill	<i>O.arenaria</i> (Kit.) DC.	2			+		fd,mf
	<i>Trigonella</i> L.	<i>T.arcuata</i> C.A. Mey.	5	+		+		fd,mf,m
<i>T.cancellata</i> Desf.		5			+		fd,mf	
<i>T.orthoceras</i> Kar.et Kir.		5			+		fd,mf	
<i>Grossulariaceae</i> DC.	<i>Ribes</i> L.	<i>R.aureum</i> Pursh	1			+		fs,v,mf
<i>Lamiaceae</i> Lindl.	<i>Lallemantia</i> Fisch.et C.A. Mey.	<i>L.royleana</i> (Benth.) Benth.	5			+		mf,fd
	<i>Mentha</i> L.	<i>M.longifolia</i> (L.) Huds.	1			+		m,fs, md
<i>Malvaceae</i> Juss.	<i>Malva</i> L.	<i>M.neglecta</i> Wallr	4			+		fs,m,fd
		<i>M.pusilla</i> Smith	5	+		+		fd
<i>Moraceae</i> Link	<i>Morus</i> L.	<i>M.alba</i> L.	1			+		fs,t,m,v
		<i>M.nigra</i> L.	1			+		fs,t,v
<i>Nitrariaceae</i> Bercht.et J.Presl.	<i>Nitraria</i> L.	<i>N.schoberi</i> L.	3	+	+	+	+	fd,m
		<i>N.sibirica</i> Pall.	5			+		fd,t
<i>Peganaceae</i> (Engl.) Tiegh.ex Takht.	<i>Malacocarpus</i> Fisch.et C.A.Mey	<i>M.crithmifolius</i> (Retz.) C.A. Mey.	4	+		+		fs,v
<i>Poaceae</i> Barnhart	<i>Agropyron</i> Gaertn.	<i>A.desertorum</i> (Fisch.ex Link.) Schult.	1		+	+		fd,d
		<i>A.fragile</i> (Roth) Candargy	1	+	+	+	+	fd
		<i>A.pectinatum</i>	1	+	+	+	+	fd

		(Bieb.) Beauv.							
	<i>Alopecurus</i> L.	<i>A.arundinaceus</i> Poir.	1	+		+		fd,d	
	<i>Botriochloa</i> O.Kuntze	<i>B.ischaemum</i> (L.) Keng	1			+		fd	
	<i>Bromus</i> L.	<i>B.japonicus</i> Thunb.	5		+			fd	
		<i>B.oxydon</i> Schrenk	5		+	+		fd	
		<i>B.squarrosus</i> L.	5		+	+		fd	
	<i>Cynodon</i> Rich.	<i>C.dactylon</i> (L.) Pers.	1	+	+	+	+	fd	
	<i>Digitaria</i> Hall.	<i>D.sanguinalis</i> (L.) Scop.	4			+		fd,d	
	<i>Echinochloa</i> Beauv.	<i>E.crusgalli</i> (L.) Beauv.	4			+		fd	
	<i>Elytrigia</i> Desv.	<i>E.repens</i> (L.) Neski	1			+		fd,m	
	<i>Eremopyrum</i> (Ledeb.) Jaub.et Spach	<i>E.bonaepartis</i> (Spreng.) Nevski	5		+	+		fd	
		<i>E.orientale</i> (L.) Jaub.et Spach	5	+	+	+	+	fd	
		<i>E.triticeum</i> (Gaertn.) Nevki	5	+	+	+	+	fd	
	<i>Festuca</i> L.	<i>F.arundinacea</i> Schreb.	1			+		fd	
	<i>Hordeum</i> L.	<i>H.brevisibulatum</i> (Trin.) Link	5		+			fd,d	
	<i>Leymus</i> Hochst.	<i>L.multicaulis</i> (Kar.et Kir.) Tzvel.	4			+		fd	
		<i>L.ramosus</i> (Trin.) Tzvel.	3			+		fd,d	
	<i>Lolium</i> L.	<i>L.sabulatum</i> Vis.	5	+				fd,t	
	<i>Poa</i> L.	<i>P.angustifolia</i> L.	1		+			fd	
		<i>P.bulbosa</i> L.	5	+	+	+	+	fd	
	<i>Psathyrostachys</i> Nevski	<i>P.juncea</i> (Fisch.) Nevski	5	+	+	+	+	fd	
	<i>Secale</i> L.	<i>S.sylvestre</i> Host	3			+	+	fd,fs	
	<i>Setaria</i> Beauv.	<i>S.verticillata</i> (L.) Beauv.	4			+		fd	
		<i>S.viridis</i> (L.) Beauv.	4			+		fd	
Polygonaceae Juss.	<i>Fallopia</i> Adans.	<i>F.convolvulus</i> (L.) A.Love	5	+				fd	
	<i>Polygonum</i> L.	<i>P.acetosum</i> Bieb.	5	+		+		fd	
		<i>P.aviculare</i> L.	5		+	+		fs,m	
		<i>P.patulum</i> Bieb.	5			+		fd	
	<i>Rheum</i> L.	<i>Rh.tataricum</i> L.	1			+	+	fd,t,m	
	<i>Rumex</i> L.	<i>R.crispus</i> L.	4	+					fs,m,fd
		<i>R.marschallianus</i> Reichenb.	4			+			fs,fd
<i>R.ucranicus</i> Fisch.ex Spreng.		5	+		+			fs,fd	
Rosaceae Juss.	<i>Crataegus</i> L.	<i>C.ambigua</i> C.A.Mey ex A.Beck.	4			+		fs,mf,d, t,m,v,fd	

	<i>Malus</i> Hill	<i>M.sieversii</i> (Ledeb.) M.Roem.	1			+		fs,mf,d,v
	<i>Rosa</i> L.	<i>R.laxa</i> Retz.	5	+				fs,m,fd,d,v
	<i>Rubus</i> L.	<i>R.caesius</i> L.	1			+		mf,fs,v,m
<i>Solanaceae</i> Juss.	<i>Solanum</i> L.	<i>S.nigrum</i> L.	4			+		fs,fd,m
		<i>S.persicum</i> Willd.ex Roem.et Schult.	5	+		+		fs
Total: 21	65	118		51	32	103	30	

Note. The groups of practical use: fs - food, v - vitamin, fd – fodder, m - medicinal, t - technical, mf - melliferous, d – decorative

The most specific variety of WRCP is revealed at the territory of the floristic area Mangyshlak - 103 species (figure 1); twice smaller number of species grows at Northern Ust-Urt - 51; the smallest number is noted at the Southern Ust-Urt and Buzachi - 30 and 32 species respectively.



Floristic areas: 1 – Northern Ust-Urt, 2 – Buzachi, 3 – Mangyshlak, 4 – Southern Ust-Urt

Figure 1. WRCP distribution by floristic area of Mangystau region

This distribution of species is caused by soil and climatic conditions. So, the condition at the peninsula of Mangyshlak more favorable, therefore the maximum specific structure is observed.

Species of WRCP from different families are distributed unevenly (table 2), the most widespread are plants from Chenopodiaceae, Fabaceae, Nitrariaceae and Poaceae families. Other families mainly grow at the territory of the floristic area Mangyshlak.

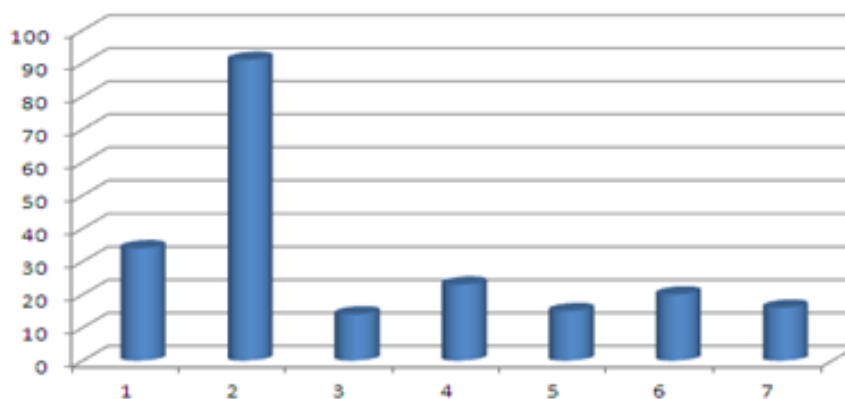
Table 2: Distribution of species number by families at floristic areas of Mangystau region

Family	Floristic areas				Total
	13. Northern Ust-Urt	13a. Buzachi	13б. Mangyshlak	19 Southern Ust-Urt	
<i>Alliaceae</i> J.Agardh	3	1	5	2	6
<i>Amaranthaceae</i> Juss.	1	1	3	1	3
<i>Apiaceae</i> Lindl.	-	1	1	-	1
<i>Asparagaceae</i> Juss.	3	1	2	1	3

<i>Asteraceae</i> Dumort.	2	1	10	1	10
<i>Brassicaceae</i> Burnett	2	1	5	1	5
<i>Capparidaceae</i> Juss.	1	-	1	1	1
<i>Caprifoliaceae</i> Juss.	1	-	-	-	1
<i>Chenopodiaceae</i> Vent.	11	5	13	7	19
<i>Elaeagnaceae</i> Juss.	1	-	2	-	2
<i>Fabaceae</i> Lindl.	7	4	17	5	17
<i>Grossulariaceae</i> DC.	-	-	1	-	1
<i>Lamiaceae</i> Lindl.	-	-	2	-	2
<i>Malvaceae</i> Juss.	1	-	2	-	2
<i>Moraceae</i> Link	-	-	2	-	2
<i>Nitrariaceae</i> Bercht.et J.Presl.	1	1	2	1	2
<i>Peganaceae</i> (Engl.) Tiegh.ex Takht.	1	-	1	-	1
<i>Poaceae</i> Barnhart	9	14	21	8	25
<i>Polygonaceae</i> Juss.	4	1	6	1	8
<i>Rosaceae</i> Juss.	1	-	3	-	4
<i>Solanaceae</i> Juss.	1	-	2	1	2

We carried out the analysis of economic and valuable groups of plants. So, it was defined that among WRCP the greatest number belongs to fodder plants – 91 species (fig. 2), the second position is taken by food plants – 34 species, on the third place is medicinal herbs – 23 species. Melliferous plants are presented by 20 species, technical – 14 species, vitamin – 14 species, decorative – 15 species.

amount of species, %



Group of plant by economic and valuable species:

1 – food, 2 – fodder, 3 – vitamin, 4 – technical, 5 – decorative, 6 – medicinal, 7 – melliferous

Figure 2. Distribution of WRCP species of Mangystau region by economic and valuable groups of plants

By priority degree species were distributed not evenly. So, in the 1st WRCP group (plants, which are introduced into culture and have grades) was included 25 species, among them by *Cichorium intybus*, *Sinaps arvensis*, *Elaeagnus angustifolia*, *Mentha longifolia* and others. To the 2nd group (plants, which are participating in breeding crossing), 4 species are carried: *Carthamus*

lanatus, *Elaeagnus oxycarpa*, *Glycyrrhiza glabra* and *Onobrychis arenaria*. 8 species of WRCP are carried to the 3rd group (plants, which are closely related to cultural plants). Among them: *Asparagus persicus*, *Capparis herbacea*, *Lactuca serriola* and others. To the 4th group were referred 19 plants, including *Allium sabulosum*, *Amaranthus retroflexus*, *Artemisia terrae-albae*, *Chenopodium botrys* and others. To the 5th group, including all other species of useful genus, the greatest number of plants - 62, is carried.

Conclusion

So, at the territory of Mangystau region grows 118 species of WRCP from 65 genera and 21 families. The greatest specific variety is dated for the floristic area 136. Mangyshlak. The most widespread are represented plants from *Chenopodiaceae*, *Fabaceae*, *Nitrariaceae* and *Poaceae* families. By economic and valuable groups of WRCP possessing fodder, food and medicinal properties prevail.

The analysis of priority of WRCP allowed to distribute plants as follows: to the 1st group – 25 species; to the 2nd group – 4 species; to the 3rd group – 8 species; to the 4th group – 19 species; to the 5th group – 62 species.

Results of researches show wide biological diversity of WRCP of Mangystau flora and prospect of their wide use and introduction into culture.

Researches are executed within the theme "The Botanical Variety of Wild Relatives of Cultural Plants of the Western Kazakhstan as a Source of Enrichment and Preservation of a Gene Pool of Agro Biodiversity for Realization of Food Program", entering into the scientific and technical program: "The botanical variety of wild relatives of cultural plants of Kazakhstan as a source of enrichment and preservation of a gene pool of Agro Biodiversity for realization of a food program".

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Скрининг флоры Мангистау на дикие сородичи культурных растений

¹ Акжунис Алтаевна Иманбаева
² Маргарита Юлаевна Ишмуратова
³ Айнур Таджибаева Туякова

¹⁻³ Мангышлакский экспериментальный ботанический сад, Республика Казахстан
130000, Актау, 10-ый микрорайон

¹ Кандидат биологических наук

² Кандидат биологических наук, доцент

³ Кандидат биологических наук

E-mail: imangarden@mail.ru, margarita.ishmur@mail.ru

Аннотация. В статье проведен анализ видового состава и степени перспективности диких сородичей культурных растений флоры Мангистауской области. В результате обработки литературных данных и собственных полевых исследований перечень диких сородичей культурных растений флоры Мангистау составил 118 видов из 62 родов и 21 семейства. Наибольшее видовое разнообразие выявлено на полуострове Мангышлаке, наименьшее – на полуострове Бузачи.

Наиболее широко распространенными являются представители сем. Chenopodiaceae, Fabaceae, Nitrariaceae и Poaceae.

Анализ приоритетности диких сородичей культурных растений позволил распределить растения следующим образом: к 1-ой группе – 25 видов; ко 2-ой группе – 4 вида; к 3-ей группе – 8 видов; к 4-ой группе – 19 видов; к 5-ой группе – 62 вида.

Ключевые слова: дикие сородичи культурных растений, Мангистау, флористический район, хозяйственные свойства.