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Testing of new Alfalfa varieties cultivated in the Zhambyl region of Kazakhstan using irrigated agriculture

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ABSTRACT

New alfalfa varieties, which were cultivated on prairie gray soils of the Zhambyl region (Kazakhstan) for the first time, are characterized by wide ecological plasticity and rapid regrowth after the first mowing. A relatively high yield of herbage and hay was observed in the varieties Kapchagai 80 (85.7 and 26.5 c/ha), Osimtal (85.0 and 26.0 c/ha), Saryagash (83.4 and 25.0 c/ha), Kokbalausa (83.2 and 27.0 c/ha), and Kokoray (85.5 and 27.1 c/ha). The yield increase compared to standards varied from 14.6 to 17.0% for herbage and from 12.0 to 18.8% for dry hay. The yield of herbage and hay for the standard Semirechenskayalocal was 71.0 and 22.0 c/ha, respectively. The new studied varieties exceeded the yield of the standard by 17.4% for herbage and by 17.5% for hay.

***Key words**: Alfalfa, Varietal hybrids, Variety, Green mass, Sowing methods, Row spacing, Hay yield.*

Introduction

The production practice of recent years shows that the level of productivity and production of fodder crops in Kazakhstanis affected by the lack of seeds produced in the country. Production of perennial herbs seeds in the Zhambyl region is one of the pressing challenges. The deficit of seeds, especially seeds of legumes, reaches large sizes, which leads to untimely meadow formation, radical amelioration, and preservation of oldlow-yielding lands. The average seed yield of perennial grasses in the region ranges from 0.6 to 1.8 c/ha, including alfalfa (from 0.5 to 1.0 c/ha).

Among perennial fodder grasses, alfalfa has gained the greatest popularity and is the most widespread in the world. It is cultivated in more than 80 countries on an area exceeding 35 million ha (Baitarakova and Meiirman, 2010).

In risky farming, the correct selection of fodder grass varieties is especially important for the development of fodder production, which was noted in the works of a large number of Russian researchers (Kosolapov, 2011; Zhuchenko, 2009; Kostenko, 2010).

Agroecological assessment of crops is closely related to the biological characteristics of agricultural plants, primarily with their requirements for the main factors of life: light, nutrition, water, air, on the one hand, and with the possibilities of satisfying these requirements in specific soil, climatic, environmental, and other conditions, on the other hand.

Different varieties have different resistance to drought or waterlogging, frost, diseases, pests,

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weeds, level of groundwater, acidity, or salinity of the soil, and other environmental conditions. The study of new varieties and hybrids in specific soil and climatic conditions makes it possible to accurately determine the agroecological areas for crop cultivation and to select varieties and hybrids that are most suitable for the growing conditions in a certain region.

The research of Meiirman and Masonichich-Shatunova (2012) shows that disperse uniform planting of plants in different soil and climatic conditions ensures the formation of highly productive haulm stands by improving airflow and root nutrition and providing better crops illumination, which maximizes the formation of generative organs.

Experiments of Ilyina (1951) show that the onset of reproductive organs formation and their further development in alfalfa and sainfoin occur much faster if sown in summer (July) than in the case of spring sowing. The dynamics of the development of individual parts of the alfalfa stem are different in the first and second half of autumn.

The aim of the researchis the study of new alfalfa varieties and the identification of well-adapted varieties with the further organization of primary and elite seed production in the southern region of Kazakhstan.

Materials and Methods

It was necessary to study the effect of soil and climatic conditions on new alfalfa varieties. The data in Table 1 shows that the humus content in the arable layer of the experimental plot was 1.21-1.46%, total nitrogen was 0.106-0.127%, and total phosphorus was 0.135-0.153%. These parameters decreased with depth. Nitrates (NO_3) content was 7.3-10.2 mg/kg; mobile phosphorus (P_2O_5) content was 12.3-26.7 mg/kg, and exchange potassium (K_2O) content was 250.0-360.0 mg/kg.

The profile of medium loamy soils was characterized by the following parameters: bulk weight was 1.30-1.55 g/cm^3, specific weight was 2.53-2.75 g/cm^3, and maximum field moisture capacity was 18.6-19.2% The reaction of the soil solution was slightly alkaline; pH was 7.2-7.3.

The studies were carried out by performing temporary field experiments and laboratory analyses of soil and plant samples.

The experiment was carried outin triplicate on an area of 1.0 ha (accounting area was 0.7 ha). The accounting area of plots was 150 m^2.

In the experiment, we used agricultural engineering that is generally acceptedfor southern parts of Kazakhstan.

The following varieties were used for the study: 1. Semirechenskaya local (standard);2. Kapchagayskaya 80; 3. Osimtal; 4. Saryagashskaya; 5. Uzgenskaya; 6. Kokbalausa; 7. Kokoray; 8. Nadezhda.

Results and Discussion

Observations of the growth and development of new alfalfa varieties showed that there were no significant differences in the time of the onset of the generative phase of development. However, patterns of transition betweenphenological phases of plant development differed.

As shown in Table 2, the beginning of the seedling phase was recorded on April 24-30 and lasted from 16 to 18 days, depending on the variety. The full germination phase ended on May 12-16. The branching phase also began unevenly and lasted until June 2 and 10. Earlier onset of the branching phase was observed in the varieties Kokbalausa andNadezhda (on May 15) and Kokorai (on May 18), which wastwo and five days earlier than in the standard Semirechenskaya local. The budding phase and the beginning of flowering in the first year of life in all studied alfalfa varieties occurred almost simultaneously and the difference was from

Table 1. Agrochemical characteristics of the soils of the experimental plot (village ofBesagash).

Horizon, cm	Humus,%	Total nitrogen,%	Total phosphorus,%	Mobile forms, mg/kg		
				NO_3	P_2O_5	K_2O
0-10	1.46	0.127	0.153	8.0	21.6	250.0
10-20	1.32	0.127	0.140	10.2	26.7	-
20-30	1.21	0.106	0.135	7.3	12.3	360.0
30-40	0.95	0.082	0.125	5.0	11.2	-
40-50	0.89	0.055	0.095	3.9	3.1	-

two to seven days.

The vegetation period from the beginning of spring vegetation to the first mowing lasted around 62-72 days.

Studies conducted by Umbetaev *et al.* (2013) ("Kazakhstan Research Institute of Cotton Production" LLP) in the South Kazakhstan region showed that the plant height in selected new alfalfa specimens was greater by 5.1-11.2 cm, depending on the studied variety. In a competitive variety trial, yield (dry weight from three mowings) of new specimens was 5.5 c/ha higher compared to the standard, for which the average hay yield was 22.1 c/ha.

The yield accounting for the first mowing showed an increase in the herbage and hay yield in comparison with the standard for all studied variety specimens. The plant stand density during the growing season ranged from 16.0 to 17.5 plants/m^2, depending on the variety. According to the account, the greatest plant height was recorded in the varieties Kapchagayskaya80 (84.5 cm, Kokbalausa (85.2 cm),Kokoray (85.3 cm), and Saryagashskaya (83 cm).In the standard Semirechenskaya local, the height was 80 cm. The herbage and hay yield data is presented in Table 3.

A relatively high herbage and hay yield were observed in the varieties Kapchagayskaya80 (85.7 and 26.5 c/ha), Osimtal (85.0 and 26.0 c/ha), Saryagashskaya (83.4 and 25.0 c/ha), Uzgenskaya (82.3 and 25.0 c/ha), Kokbalausa (83.2 and 27.0 c/ha), and Kokoray (85.5 and 27.1 c/ha) (Table 3). It should be noted that all studied alfalfa varieties showed faster development and had higher yield than the standard, however, these parameters were equivalent in them. The yield increase compared to the standard varied from 14.6 to 17.0% for herbage and from 12.0 to 18.8% for dry hay. Herbage and hay yield of the standard Semirechenskayalocal was 71.0 and 22.0 c/ha, respectively.

Conclusions

New alfalfa varieties, which were cultivated on prairie gray soils of the Zhambyl region for the first

Table 2. Phenological observations before the first mowing.

Varieties	Plant development phases							
	Seedlings		Branching		Budding		Beginning of flowering	First mowing date
	Start	Full	Start	Full	Start	Full		
Semirechenskaya local	27.04	16.05	22.05	7.06	7.06	27.06	28.06	30.06
Kapchagayskaya80	28.04	15.05	21.05	5.06	5.06	24.06	25.06	26.06
Osimtal	30.04	16.05	23.05	7.06	7.06	27.06	30.06	30.06
Saryagashskaya	28.04	15.05	21.05	5.06	5.06	27.06	29.06	30.06
Uzgenskaya	27.04	15.05	22.05	7.06	7.06	27.06	29.06	30.06
Kokbalausa	25.04	14.05	20.05	4.06	5.06	23.06	27.06	28.06
Kokoray	24.04	12.05	18.05	2.06	3.06	20.06	25.06	26.06
Nadezhda	25.04	14.05	20.05	4.06	5.06	23.06	27.06	28.06

Table 3. Herbage and hay productivity (c/ha) in one mowing for the studied varieties.

Varieties	Plant stand density, plants per m^2	Plant height, cm	Yield, c/ha			
			Herbage	Increase	Hay	Increase
Semirechenskaya local	17.0	80	71.0	-	22.0	-
Kapchagayskaya80	16.0	84.5	85.7	14.7	26.5	4.5
Os³mtal	17.5	82	85.0	14.0	26.0	4.0
Saryagashskaya	17.0	83	83.4	12.4	25.0	3.0
Uzgenskaya	16.5	82	82.3	11.3	25.0	3.0
Kokbalausa	17.5	85.2	83.2	12.2	27.0	5.0
Kokoray	17.0	85.3	85.5	14.5	27.1	5.1
Nadezhda	16.0	78	78.4	7.4	24.4	2.4
HCP 05, c/ha			3.2		2.3	
V, %			2.4		5.2	

time, are characterized by wide ecological plasticity, rapid regrowth after the first mowing, and relatively high herbage and hay yields.

The herbage and hay yields of the following studied new varieties exceeded the standard (the yield of which was 71.0 and 22.0 c/ha, respectively): Kapchagayskaya80 (85.7 and 26.5 c/ha, Osimtal (85.0 and 26.0 c/ha), Saryagashskaya (83.4 and 25.0 c/ha), Uzgenskaya (82.3 and 25.0 c/ha), Kokbalausa (83.2 and 27.0 c/ha), and Kokoray (85.5 and 27.1 c/ha). The yield increase compared to the standard varied from 14.6 to 17.0% for herbage and from 12.0 to 18.8% for dry hay.

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