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THE EFFECT OF FOLIAR TREATMENT OF ALFALFA CROPS DURING VEGETATION USING BIOPREPARATIONS ON SEED YIELD

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The article presents the results of a study on the influence of biopreparations BioSleepBW+Foliar, OrgamicaS+Foliar, (OrganitP+OrganitN+Biodux+Foliar), and Foliar on the seed yield of alfalfa when applied as foliar treatments at the beginning of flowering. The research on alfalfa cultivation was conducted using five different experimental variants. The experiments were carried out on ordinary chernozem soil. The Hydrothermal Coefficient (HTC) values in 2022-2023 were 0,73 – 0,76, respectively, indicating dry conditions. During the budding and flowering periods of alfalfa plants, there was a precipitation deficit, which negatively affected seed yield.

The composition of the biopreparations includes a complex of biologically active polyunsaturated fatty acids of the fungus Mortierella alpine with a consumption rate of 3,0-10,0 ml/ha and spores of the strains Beauveria bassiana, Bacillus megaterium-amyloliguefaciens with consumption rates of 1-3 l/ha, with a working solution consumption of 300 l/ha.

The research established that the applied biopreparations improve the sowing quality of the seeds. The weight of 1000 seeds remains largely unchanged, serving as a stable indicator, while the agricultural validity of the planting material increases from 79.2% to 84%. This ultimately leads to a 10-20% increase in alfalfa seed yield.

The most effective biopreparations influencing seed productivity are Orgamica S+Foliar with a seed yield of 2,0 c/ha, Foliar with 1,86 c/ha, and the OrganitP+OrganitN+Biodux+Foliar complex with 1,82 c/ha, which exceed the control variant by 0,37, 0,28, and 0,05 c/ha, respectively.

***Key words:** alfalfa; biopreparations; foliar treatment; economic validity; seed yield.*

ВЛИЯНИЕ ВНЕКОРНЕВОЙ ОБРАБОТКИ ПОСЕВОВ ЛЮЦЕРНЫ ПО ВЕГЕТАЦИИ БИОПРЕПАРАТАМИ НА УРОЖАЙНОСТЬ СЕМЯН

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В статье приведены результаты исследования по влиянию биопрепаратов BioSleepBW+Foliar, OrgamicaS+Foliar, (OrganitP+OrganitN+Biodux+Foliar) и Foliar на урожайность семян люцерны при внекорневой обработке посевов в период начала цветения. Исследования по возделыванию люцерны проводились по пяти вариантам опыта. Опыты проводились на черноземе обыкновенном. Величины гидротермического коэффициента (ГТК) в 2022-2023 годы составляли 0,73–0,76, соответственно, что являются засушливыми. В период бутонизации и цветения растений люцерны наблюдался недобор осадков, что отрицательно сказалось на урожайность семян.

Состав биопрепаратов представляют собой комплекс биологически активных полиненасыщенных жирных кислот гриба Mortierella alpine с нормой расхода 3,0-10,0 мл/га и спорами штаммов Beauveria bassiana, Bacillus megaterium- amyloliguefaciens с нормами расходов 1-3 л/га, расход рабочего раствора – 300 л/га.

Исследованиями установлено, что применяемые биопрепараты улучшают посевные качества семян. Масса 1000 семян практический не меняется как наиболее стабильный признак, и при этом хозяйственная годность посевного материала повышается с 79,2% до 84%, что в конечном итоге приводит к увеличению урожайности семян люцерны на 10-20%. Наиболее эффективными биопрепаратами по влиянию на продуктивность семян являются Orgamica S+Foliar с урожайностью семян-2,0 ц/га, Foliar-1,86ц/га и комплекс OrganitP+OrganitN+Biodux+Foliar-1,82 ц/га, что превышает контрольный вариант на 0,37, 0,28 и 0,05 ц/га соответственно.

Ключевые слова: *люцерна; биопрепараты; внекорневая обработка; хозяйственная годность; урожайность семян.*

ЖОҢЫШҚА ӨСІНДІЛЕРІН БИОПРЕПАРАТТАРМЕН ВЕГЕТАЦИЯ БОЙЫНША ТАМЫРДАН ТЫС ӨҢДЕУДІҢ ТҰҚЫМ ӨНІМДІЛІГІНЕ ӘСЕРІ

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Бұл мақалада Biosleepbw+Foliar,OrgamicaS+Foliar, (OrganitP+OrganitN+Biodux+Foliar) және Foliar биопрепараттарының вегетация бойынша тамырдан тыс өңделген жоңышқа тұқымдарының өнімділігіне әсері бойынша зерттеу нәтижелері қарастырылады. Жоңышқа өсіру бойынша зерттеулер тәжірибенің бес нұсқасы бойынша қарапайым қара топырақта жүргізілді. 2022-2023 жылдардағы гидротермиялық коэффициенттің (ГТК) шамалары тиісінше 0,73–0,76 құрады, бұл құрғақ болып табылады. Осы уақытта бүршіктену және гүлдену кезеңінде жауын–шашынның жетіспеушілігі байқалды, бұл тұқым өнімділігіне теріс әсер етті.

Биопрепараттардың құрамы Mortierella alpine саңырауқұлақтарының биологиялық белсенді полиқанықпаған май қышқылдары кешенінен құрастырылған, тұтыну нормасы 3,0 – 10,0 мл/га және Beauveria bassiana, Bacillus megaterium – amyloliguefaciens штаммдарының споралармен, шығын нормалары бойынша 1-3 л/га, жұмыс ерітіндісінің шығыны-300 л/га.

Зерттеулер көрсеткендей, қолданылатын биопрепараттар тұқымның себу сапасын жақсартады. 1000 тұқымның массасы практикалық ең тұрақты белгі ретінде өзгермейді, сонымен бірге тұқымның шаруашылық жарамдылығы 79,2% – дан 84% – ға дейін артады, нәтижесінде жоңышқа тұқымының өнімділігі 10-20% – ға артады. Тұқым өнімділігі бойынша ең тиімділері Orgamica S+Foliar (2,0 ц/га), Foliar (1,86 ц/га) препараттары және OrganitP+OrganitN+Biodux+Foliar (1,82 ц/га) болды. Өнімділік көрсеткіштері бақылау нұсқасынан сәйкесінше 0,37, 0,28 және 0,05 ц/га-ға артық.

Түйінді сөздер: *жоңышқа; биопрепараттар; жапырақты өңдеу; шаруашылық жарамдылығы; тұқым өнімділігі.*

Introduction. The development of animal husbandry for 2020-2030 directly depends on feed production. The priority task of the industry today is to create a cost-effective highly productive base with high-quality dry matter feed, which should contain 15-25% protein and 8-11 MJ of metabolic energy. All these measures can be carried out with the help of state support for the implementation of long-term programs for the development of forage production, in particular, the development of seed production, raising the yield of forage crops, the acquisition of modern forage harvesting and forage preparation equipment [1, p.44].

The irrational structure of the acreage with 5-8% of perennial grasses, and 70-80% of cereals led to a decrease in the production of bulky and green feeds. As a result, it led to a decrease in 1 kg of dry matter of feed units less than 0,40 protein content – 8-9% and metabolic energy 7-8 MJ in the produced feeds [2, p.50;3, p.17].

Intensification of animal husbandry is impossible without expanding the acreage occupied by perennial grasses. It reduces the cost of producing grain feeds, and solves the problems of producing high-protein feeds with a high content of carotene, various vitamins, mineral salts, and trace elements [4, p.2705;5, p.380].

To improve the livestock feed base, the areas occupied for field feed production should account for 20-30% of the total sown area of the republic. Currently, Kazakhstan has 5,0 million hectares of hayfields,

186 million hectares of pastures, and 2,5 million hectares of arable land occupied for fodder crops, which is 12% of the total sown area [6, p.139;7, p.400].

The restoration and development of feed production directly depend on the cultivation of perennial grasses, which will improve the structure of acreage, and reduce the industry's financial, technical, and energy costs by 25-35%. To this end, it is necessary to create highly productive varieties of perennial grasses, with the help of which it is possible to solve the problems of providing livestock with high-grade feed. For each region with its natural and climatic conditions, the choice of specific perennial grass varieties is crucial for obtaining sustainable harvests [8, p.4].

Animal husbandry needs a solid feed base that provides high-protein feeds. Solving this problem by sowing perennial grasses, especially alfalfa, is possible. Alfalfa is of great forage importance among perennial forage grasses, due to its high content of protein, carotene, various vitamins, mineral salts, and trace elements, Its crops can be used as pastures for canned feed (silage, haylage), hay harvesting, and grass flour. In addition, compared with other legumes used in forage production, alfalfa has higher winter hardiness, resistance to weed infestation, and the ability to grow a large green mass in one season [9, p.110].

Alfalfa is an easily digestible perennial plant for animals with a high content of protein, vitamins, trace elements, and all kinds of acids. The plant saturates the body with the necessary amount of iron, fluorine, potassium, magnesium, and calcium [10, p.60].

Alfalfa is a biological meliorant, which is an excellent precursor for all crops. Alfalfa frees the soil from harmful microorganisms and enriches it with useful ones [11,p.128].

Alfalfa is used for green fodder, grass flour, hay, and haylage. During the flowering period, 20-22% of crude protein is concentrated in its aboveground mass. The digestibility of alfalfa protein is 77% versus 65-75% for other perennial grasses. Drought resistance, deep root system, symbiotic nitrogen fixation, rapid regrowth, all these signs are characteristic of alfalfa changeable [12, p.110].

Alfalfa is provided with micro- and macroelements due to the fixation of atmospheric nitrogen with the support of nodule bacteria. But in natural conditions, alfalfa uses only 10-35% of its nitrogen-fixing capacity, which leads to a lack of nitrogen in the soil [13, p.182].

The use of pesticides in the cultivation of legumes negatively affects plant growth and soil fertility. Improvement of indicators of physical properties of soils, and leaf-stem mass of plants is possible with the introduction of bacterial fertilizers and seed treatment before sowing with elements of organic farming [14, p.50].

Nitrogen is a component of many legumes that is essential for plant growth. A significant part of nitrogen is contained in the atmosphere and its use is important to prevent nitrogen starvation. However, the ability to fix atmospheric nitrogen by nodule bacteria is limited. In this case, the application of biologized preparations based on *Rhizobium* strains increases the content of total organic carbon, nitrogen, phosphorus, and potassium in the soil, increases plant biomass, and increases the physical properties of soils [15, p.56;16, p.37;17, p.67].

The growth of the world population and the need for high-calorie quality products require the search for new ways to solve the food supply of the population with agricultural products obtained based on an ecological, biologized component of the crop industry [18, p.1062].

There is a need to practice the transition from traditional farming to organic farming. According to the data of the International Federation of Ecological Agricultural Movement (IFOAM) and the Research Institute (FIBL) for 2023, the land areas in the world allocated for organic agriculture for this period are: Europe – 17,8 million hectares, Oceania – 36 million hectares, Africa – 2,7 million hectares, North America – 3,5 million hectares, Latin America America – 9,9 million hectares, Asia – 6,5 million hectares. The largest markets for organic products are in the USA – 48,7 billion euros, Germany – 16 billion euros, France – 12,8 billion euros [19, p.2].

There are potential opportunities for Kazakhstan to provide the domestic sector with high-quality feed and breakthrough areas in the export of products outside the Republic. The global feed producer (APEHF), where the European Union and the United States are the leaders, exporting 3 and 5 million tons of hay per year, offers Kazakhstan, in particular, large-scale cultivation of alfalfa for export in the form of granular feed and pressed hay to the countries of the Middle East and China, where a ton of dry alfalfa hay costs 200-250 thousand tenge. In this case, the parameter determining the price is the high-protein quality of alfalfa feed with a protein content of 15% and higher[20,p.10].

Improving the technology of growing alfalfa in rainfed will always remain a priority in feed production. In this regard, one of the effective measures to increase the seed productivity of alfalfa is the use of biological products that help increase the yield of green mass and seeds, which made it possible to formulate the goal of our research – to study the effect of biological products on the yield of alfalfa seeds in the conditions of the Akmola region. The main objective of the study is to study the effect of biological products with seed inoculation and during the growing season on the growth, development and yield of alfalfa seeds.

Materials and methods of research. Field experiments using biological products were conducted in the hill-plain zone in Kokshetau Experimental Production Farm LLP, Akmola region, Zerendinsky district,

Shagalaly village. In three-fold repetition. The sowing method is ordinary and wide-row, row spacing is 70 cm. The agricultural technology in the experiments is zonal. The area of the experimental plot is 20 m^2, the placement of plots is randomized. The predecessor is pure steam.

The technique and methodology of laying out field observations, accounting, analysis and processing of experimental data were carried out according to the generally accepted methodology of B.A. Dospekhov using the Excel computer program (AgCStat) [21, p.245].

The scheme of the experience included the following options:

1 – Control;
2 – BioSleep BW+Foliar;
3 – Orgamica S+Foliar;
4 – Organit P+OrganitN+ Biodux +Foliar;
5 – Foliar.

The soil of the experimental site is represented by ordinary medium–humus chernozem with a depth of humus horizon of 25-27 cm, and an average humus content of 4,01%. In the arable soil layer of nitrate nitrogen is 14,9 mg, mobile phosphorus is 7,5 mg, and exchangeable potassium is 66,8 mg per 1000 g of soil. Consequently, the nitrogen content is average, phosphorus is low, and potassium is high. According to the mechanical composition, the soil is heavy loamy, the volume weight in the arable horizon is 1,18 g/cm^3, and in the meter layer on average is 1,32 g/cm^3. The humidity of stable wilting is 12-13%.

Meteorological conditions during the research period were generally typical for the region. Some deviations in moisture and heat reserves corresponded to the definition of a sharply continental climate. Spring in the years of research was dry. According to data from the Chaglinsky meteorological post, 311 mm of atmospheric precipitation fell in the study year of 2022, which is almost equal to the long-term average norm of 315,5 mm (Table 1).

Table 1 – Comparative characteristics of meteorological conditions in alfalfa crops, meteorological post of Shagalaly village (2022-2023)

Years	Month											
	IX	X	XI	XII	I	II	III	IV	V	VI	VII	VIII
Air temperature, ºC												
2021-2022	+9,9	+4,3	-6,6	-9,5	-12,4	-9,2	-9,0	+8,5	+13,6	+17,7	+19,9	+16,7
2022-2023	+13	+3,8	-8,3	-15	-12,7	12,6	-3,1	+4,1	+12,7	+18,7	+22,8	+18
Avg. (multi-year average)	+10,8	+3,7	-5,3	-12,7	-16,2	-14,1	-5,9	+4,7	+12,3	+16,8	+18,0	+17,0
Precipitation, mm												
2021-2022	14,2	13,6	18	4,8	11,6	18,5	4,7	5,5	15,7	49,6	77,0	44,1
2022-2023	6,6	37,6	15,8	10,5	12,0	14,0	11,3	1,2	15,8	30,8	20,5	35,5
Avg. (multi-year average)	25,6	25	16,3	12,3	12,4	13,7	16,4	18,8	33,0	43	56,5	37,1

Over the years of research, the distribution of precipitation by month was extremely uneven. The highest amount of precipitation in 2022 was observed in July – 77,0 mm and in June – 49,6 mm, while the lowest figures were in September – 6,6 mm and April – 5,5 mm, which defines the year as dry with an HTC (Hydrothermal Coefficient) of 0,73. The precipitation in June and July positively influenced the formation of the leaf-stem mass of alfalfa plants, while the August precipitation of 44,1 mm positively affected the pod setting of the plants. In the weather conditions of 2023, 300,2 mm of atmospheric precipitation fell, which corresponds to the multi-year average norm of 305,7 mm.

From December to March, 44,5 mm of precipitation fell, compared to the multi-year average of 54,9 mm for this period. A distinctive feature of the autumn-winter period was the high temperature regime. Spring was cold. In March, the average air temperature was -3,1°C. The atmospheric precipitation that fell in March (15,8 mm) did not significantly influence moisture accumulation due to the deficit of pre-winter and winter precipitation. In 2023, the average monthly air temperature in May was +12,7°C, which corresponds to the

multi-year average of +12,4°C, while precipitation in May was 15,8 mm, below the multi-year average of 34,1 mm.

The air temperature in June and July 2023 was higher than the data of 2022 by 1,0°C and 2,9°C, respectively, which positively influenced the growth and development processes of alfalfa plants. Thus, the main indicators – the amount of precipitation and temperature regime – show that the conditions for the growth and development of alfalfa plants in 2023 were satisfactory.

Foliar treatment of crops during vegetation with biological preparations showed different yields in the studied variants. The highest seed yield results were obtained in the second year of life with the use of biological preparations Orgamica S+Foliar -2,72 c/ha, Foliar -2,63 and Organit P, OrganitN, Biodux +Foliar - 2,40 which exceed the control variant without treatment by 0,37 c/ha 0,28 c/ha and 0,05 c/ha respectively. The BioSleep BW+Foliar variant was lower than the control variant by 0,1 c/ha. In the third year of using alfalfa crops, seed yield decreases by 2 times relative to the second year. (Table 2, Figure 1)

Table 2 – The effect of biological preparations on the yield of alfalfa seeds with foliar treatment for vegetation, c/ha

№	Variants	Seed yield, c/ha		
		2022 year	2023 year	average
1	Control	2,35	1,12	1,73
2	BioSleep BW+Foliar	2,25	1,09	1,67
3	Orgamica S+Foliar	2,72	1,29	2,0
4	Organit P,OrganitN, Biodux +Foliar	2,40	1,25	1,82
5	Foliar	2,63	1,10	1,86
	NSR_{05}	0,24	0,17	0,21

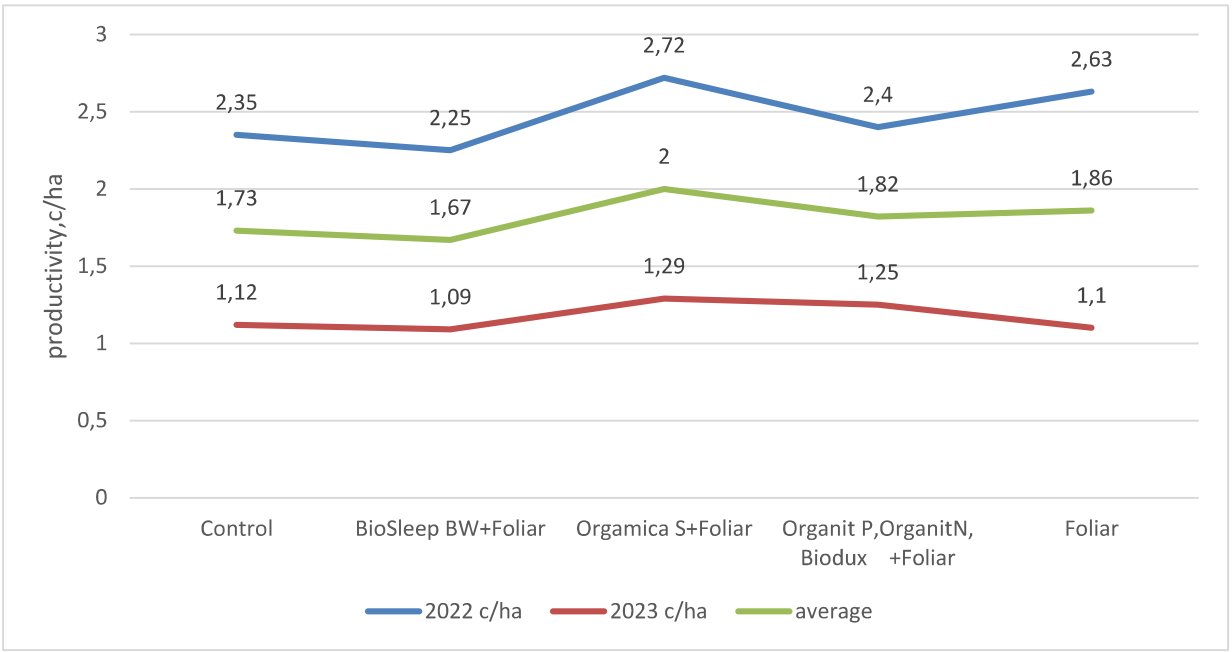

Figure 1 – The effect of biologics on the yield of alfalfa seeds with foliar treatment for vegetation, c/ha

The weight of 1000 seeds are a sign characterizing the quality of the seed material. Large seeds have a larger supply of nutrients than small ones, and as a result, the laboratory and field germination of seeds increases, which is the key to increasing seed yield.

Studies have found that the weight of 1000 seeds for 2022 in the control variant was 2,01 g, and the highest indicator was 2,04 g in the variant of biological preparations Organit P, OrganitN, Biodux +Foliar, treated according to vegetation (Table 3). The coefficient of variability in the experiment by weight of 1000 seeds averaged 3,23%.

Table 3 – The effect of biological preparations on the sowing qualities of seeds with foliar treatment during vegetation

№	Variants	Weight of 1000 seeds, grams			Economic validity of seeds,%		
		2022 year	2023 year	average	2022 year	2023 year	average
1	Control	2,01	1,90	1,95	83,0	75,5	79,2
2	BioSleep BW+Foliar	1,98	1,90	1,94	85,3	75,0	80,1
3	Orgamica S+Foliar	2,05	2,0	2,02	88,5	80,0	84,2
4	Organit P,OrganitN, Biodux +Foliar	2,02	1,95	1,98	84,5	79,7	82,0
5	Foliar	2,03	2,0	2,0	87,2	80,7	84,0
	V%	2,54	3,42	3,23	2,85	3,42	2,75
	Sx%	2,1	2,6	2,4	2,41	2,64	2,23

Conclusion. The research results confirm two main biological hypotheses of alfalfa culture when cultivated for seeds with foliar top dressing during vegetation:

- firstly, alfalfa generates the highest seed yield in the second year of life, due to the transition to a more complete formation of generative organs. So, if in the second year of plant life, the seed yield is calculated depending on the experimental options from 2,35 to 2,72 c/ha, then in the third year, the level of seed productivity decreases to 1,12 c/ha. Therefore, alfalfa seeds should be left from crops in the second year of life, or at least the third year of life. Then there is a sharp decrease in seed yield and old–age crops do not form economically suitable seed collections;

- secondly, the use of biological products, as one of the main elements of biologized technology, significantly increases seed productivity. So, if the seed yield at the control was 2,35 c/ha, then the use of these biological products increased the yield level to – 2,72 c / ha, that is, by 10-20%.

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ДОМИНИРУЮЩИЕ ВИДЫ НАСЕКОМЫХ-ВРЕДИТЕЛЕЙ, ПОВРЕЖДАЮЩИЕ ДИКОРАСТУЩИЕ ПОПУЛЯЦИИ ЯБЛОНИ СИВЕРСА (*MALUS SIEVERSII*) В ИЛЕЙСКОМ АЛАТАУ

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Статья посвящена проблемам сохранения диких популяций яблони Сиверса (Malus sieversii) в Казахстане, которые имеют глобальное мировое значение как природная генетическая основа для поддержания и производства яблок во всем мире. В связи с этим целью публикации является определение степени повреждение яблони Сиверса тремя основными вредителями (Yponomeuta malinella Zell., Archips rosana L., Cacoecia crataegana Hb.) в Илейском Алатау 2018, 2019 годах. Также дается карта распространения и влияния яблонной горностаевой моли (Yponomeuta malinella Zell.), розанной листовертки (Archips rosana L.), боярышниковой листовертки (Cacoecia crataegana Hb.) на территории Иле-Алатауского ГНПП. Научная значимость исследований заключается в том, что среди основных современных угроз для существования диких популяций яблони Сиверса в последние 20 лет стал местный комплекс видов насекомых-вредителей. Одним из основных условий защиты растений от вредителей, является своевременность проведения различных защитных мероприятий. По этой причине изучение современного видового состава, экологических и биологических особенностей доминантных и потенциальных видов насекомых-вредителей яблони Сиверса является неотложной исследовательской задачей, имеющей большое практическое значение.

Ключевые слова: *яблоня Сиверса, насекомые-вредители, Илейский Алатау, Yponomeuta malinella Zell., Archips rosana L., Cacoecia crataegana Hb.*

ІЛЕ АЛАТАУЫНДАҒЫ СИВЕРС АЛМА АҒАШЫНЫҢ (*MALUS SIEVERSII*) ЖАБАЙЫ ӨСЕТІН ПОПУЛЯЦИЯЛАРЫН ЗАҚЫМДАЙТЫН ЗИЯНКЕС ЖӘНДІКТЕРДІҢ БАСЫМ ТҮРЛЕРІ

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