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ТҮЙІН

Қазақстанда бау-бақшалар мен жүзімдіктерд қалпына келтіру бағдарламасы жүзеге асырылуда. Мемлекет көпжылдық жеміс-жидек ағаштары мен екпелерінің жаңа алқаптарын қайта құру және отырғызу шығындарының бір бөлігін субсидиялайды, бірақ, соған қарамастан, өңірлердегі бау-бақша және жүзімдік алқаптарының көлемі іс жүзінде өспей отыр. Қазақстанда отандық тәлімбақ шаруашылығын қолдауға субсидия енгізілді, жеміс-жидек дақылдары мен жүзімнің көпжылдық екпелерін отырғызу материалдарын өндіруге кеткен шығындарды ішінара (50%) өтеу арқылы субсидияланады. Дегенмен, Қазақстан бойынша 2012-2020 жылдар аралығында жеміс-жидек ағаштары мен екпелерінің өсірілетін ауданы орта есеппен 58740,4 га құрайды. Ең көп алқапты алма ағаштары алып жатыр (32616,9 га), одан кейін жүзім – 14530,1 га, өрік – 3598,5 га, алмұрт – 2061,1 га, шие – 1575,2 га, қара өрік – 1334,7 га, таңқурай – 1259,7 га, құлпынай – 916,1 га және шабдалы 578,4 га егілген. Отандық аграрлық ғылымның саланы қолдау тақырыбы, оның ішінде білікті мамандарды даярлау тұрғысынан ерекше назар аударуға тұрарлық, оларсыз жеміс-жидек дақылдарының өнімділігін әлемдік стандарттарға жақындату мүмкін емес. Бұл мәселені шешу арқылы Қазақстан жеміс-жидек өндірісін, тіпті қазіргі уақыттағы қол жетімді бау-бақша алаңдарымен-ақ 5 есеге арттыруға мүмкіндік береді. Жеміс-жидек дақылдарының отырғызу материалдарын инспекциялау және сертификаттау жүйесін енгізу тәлімбақ шаруашылығында ашықтық пен объективтілікті қамтамасыз етеді, бұл тұқым шаруашылығына инвестицияларды айтарлықтай арттыруға және жеміс-жидек дақылдарының отырғызу материалдарын дамытуға алғышарттар жасайды.

РЕЗЮМЕ

В Казахстане реализуется программа восстановления виноградников и садов. Государство субсидирует часть затрат на реконструкцию и закладку новых площадей многолетних насаждений, но, несмотря на это, площади садов и виноградников в регионах практически не растут. В Казахстане внедрена субсидия с целью поддержки отечественного питомниководство субсидируются маточники многолетних насаждений плодово-ягодных культур и винограда, путем частичного (50%) возмещения затрат на производство посадочного материала. Однако, по всему Казахстану площадь плодово-ягодных насаждений составляет в среднем за 2012-2020 годы 58740,4 га. Наибольшую площадь составляет насаждение яблони (32 616,9 га), затем виноград – 14 530,1 га, абрикос – 3 598,5 га, груша – 2 061,1 га, вишня – 1 575,2 га, слива – 1 334,7 га, малина – 1 259,4 га, клубника – 916,1 га и персик – 578,4 га. Особого внимания заслуживает тема поддержки отрасли отечественной аграрной наукой, в том числе и в плане подготовки квалифицированных специалистов, без которых невозможно приблизить урожайность плодово-ягодных культур к мировым стандартам. Решение этого вопроса позволило бы Казахстану увеличить производство фруктов в пять раз даже при имеющейся площади садов. Внедрение системы инспекции и сертификации обеспечит прозрачность и объективность при выращивании посадочного материала плодовых культур, что создаст предпосылки для существенного роста инвестиций в семеноводство и развитие посадочного материала плодово-ягодных культур.

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INFLUENCE OF PRE-SOWING TREATMENT OF SOYBEAN SEEDS WITH AGROMINERALS ON THE MAIN ECONOMIC AND USEFUL INDICATORS OF THE CROP

ANNOTATION

In crop production, the usage of various microelements for seed treatment is of great importance, which have a stimulating effect on the growth and development of plants. This article presents the results of the effect of presowing treatment of soybean seeds with agrominerals based on tagan bentonite and fungicidal biostimulants. The agrominerals consist of complexes of succinic acid and ethylenediamine succinic acid with silver or copper ions in combination with a film-forming substance, as a starch,to increase economically useful qualities of the crop. Various effects of agrominerals were revealed, on the growing season of soybean, such as development, yield, weight of 1000 seeds, quantity of beans on plants, protein and fat content in seeds. It has been established that pre-sowing treatment with separate complexes ofSA-Cu, SA-Ag, and Starch-SA-Cu leads to a reduction in the vegetation period by 5-8 days. However, agromineral based onTgn-EDSA-Ag-Starch and Tgn-EDSA-Cu- Starchon the contrary, increases the duration of the vegetation period by 4-7 days. The yield increasesof (Nur+) 3.1-3.5 centner/hectar(cwt/ha) and (Progress) 3.0-4.1 cwt/ha in comparison with the control.Also, the influence of agrominerals on the weight of 1000 seeds, the number of beans on plants, the content of protein and fat in seeds were noted.

Key words: *soybean, vegetation season (period) (VS), productivity, seed treatment, agrominerals, biostimulants.*

Introduction Kazakhstan's accession to the WTO puts before the country special requirements for the quality and competitiveness of food, including agricultural products [1]. An analysis of the situation of agricultural production shows that, despite the increasing costs of chemical plant protection products, since the mid-1960s, with a significant increase in agricultural production and productivity, not only absolute, but also relative losses have increased on a global scale [2]. The main reason for this trend is the intensification of crop cultivation without an adequate level of application of modern plant protection measures.The total crop loss in the world, which includes wheat and soybeans, is 42.1% [2].

The soybean is an important leguminous crop with 124 million hectares of cultivated area in the world[3]. Due to the high protein content, the cultivation and processing of soybeans is becoming increasingly important and profitable for the economies of the world.The annual rise in prices and demand for legumes in foreign markets has led to great interest in increasing soybean production in Kazakhstan.Therefore, soybean production has become a promising economy in our country, and was included in the agricultural diversification program.

The sown area of soybeans in Kazakhstan over the past 10 years has increased by more than 2.5 and amounted to 127 thousand hectares in 2022 [4]. At the same time, the soybean yield in Kazakhstan is 18-21 cwt/ha, while in the world this figure fluctuates within 27.6 cwt/ha [5]. In Kazakhstan, work is underway to create new soybean varieties with a high genetic potential for productivity, disease resistance, and adapted to various soil and climatic zones of the republic [6-10]. The creation of early maturing soybean varieties allowed to increase the area of distribution of soybeans in the East Kazakhstan region [8, 10]. There are leading elite seed farms in East Kazakhstan region, where selection and seed production of oilseeds, legumes and grain crops is carried out, including LLP “PFOP”, where 580 hectares of land are allocated for soybeans. Kazakhstan, like other CIS countries, is characterized by an extremely unfavorable phytosanitary state of crop production, reaching the level of emergency situations [2]. The most harmful soybean diseases, which have a wide distribution area, are reflected in these works [11-17]. A large crop shortfall (up to 60%) confronts to scientists with the problem of protecting soybean plants from diseases and pests. The researches in the field of creating disease-resistant forms of soybeans are considered new in soybean breeding in Kazakhstan [18-21]. The urgency of this problem is that, in importance to create universal soybean varieties that combine such characteristics, as disease resistance, drought resistance, high productivity and quality. These traits are difficult to combine in one genotype of new soybean varieties. Accordingly, at present, a high yield and good commercial quality of soybeans is achieved through scientifically based pre-sowing seed preparation, which includes the preparation of seed material, its components and effective interaction during processing [22-29].

One of the most promising technologies for presowing seed treatment, which protects against pests, diseases, drought and at the same time prevents environmental pollution, is the creation of artificial protective and stimulating polymer shells, with organic and mineral fertilizers, necessary for seed development in the early stages of development [27-28]. This method allows using seed coaters, growth regulators and other biologically active compounds in one system in combination with the polymer. These factors necessitate the production of composites based on raw materials, which can be natural polymers with organic mineral components.

Polymers like, carboxymethylcellulose, starch, gelatin, alginate and chitosan have found wide application [30-37]. One of these, starch has a high ability to biodegrade, besides, this polymer is relatively cheap, can be obtained from various easily renewable types of agricultural crops, and is non-toxic.At the same time, the high hydrophilicity of starch and low mechanical properties make it unsuitable for obtaining films in its pure form [38]. The perspective of obtaining biodegradable stable composites based on starch with other polymers is noted [29, 39-42]. During the usage various microelement complexes and preparations in the pre-sowing treatment of soybean seeds, both stimulating and inhibitory effects on the development of seedlings and seed germination were established [43]. A positive effect of the influence of mineral substances (solution "Knopa", “azophoska” and “ammophoska”) on the germination and morphological parameters of soybean seedlings at an early stage of ontogenesis was revealed [44].

This work is devoted to the study of the effect of agrominerals based on tagan bentonite and fungicidal biostimulants succinic acid-Ag(Cu), ethylenediamine succinic acid-Ag(Cu) (EDSA-Ag(Cu)) with a film-forming substance – starch on the quality and yield of soybean, grown in rainfed conditions.

Materials and Methods. Agrominerals based on tagan bentonite (Tgn) and fungicidal biostimulants succinic acid (SA)-Ag(Cu), ethylenediamine succinic acid (EDSA)-Ag(Cu) (EDSA-Ag(Cu)) in combination with a film-forming substance - starch (Starch)were prepared on the basis of the laboratory of the engineering profile of the Kazakh National Research Technical University named after K. Satpayev.

Further, agrominerals, depending on the composition, were designated as: Tgn-SA-Ag-Starch; Tgn-SA-Cu-Starch; Tgn-EDSA-Ag-Starch; Tgn-EDSA-Cu-Starch. As a film-forming substance, corn starch of the Zharkent starch-treatment plant was used.

In order to adjust the water -absorbing, gas exchange and binding ability, as well as the mechanical strength of the capsulating composition, high -colloidal clay of the Tagan field was used.The use of this bentonite is dictated by the fact that it has an excellent binding, adsorbing property and a high exchange complex, also bentonite is a small dispersed and has a rich mineral composition (Table 1).

Table 1 – The average chemical composition of the clay of the Tagan field, % [45]

Clay	SiO2	Al2O3	Fe2O3	Na2O	K2O	CaO	MgO	TiO2	SO3	H2O
Tagan	57,7	18,14	0,65	0,89	0,12	1,21	3,01	0,46	0,1	19,8

Obtaining biostimulants based on SA-Ag (Cu)/EDSA-Ag (Cu)complexes. Copper (II) succinate was obtained by adding an aqueous solution of SA/EDSA acid (0.023 mol, 2.74 g) with constant stirring to an aqueous suspension of copper (II) carbonate. Copper carbonate was obtained by the interaction of aqueous solutions of Na_2CO_3 (0.023 mol, 2.74 g).46 g) and 20 ml (6.0 mmol) copper (II) sulfate ($CuSO_4$ $5H_2O$ (0.023 mol, 5.8 g). The precipitate was filtered off, washed several times with water and dried in air. The yield of the reaction was 92%.

Presowing treatment of soybean seeds with agrominerals. For the pre-sowing treatment of soybean, the solutions of SA-Ag(Cu) and EDSA-Ag(Cu) complexes were prepared, with a concentration $1*10^{-3}$ mol/l for complexes and 1% of starch solution. Then the soybean seeds were treated on a coating machine (SMBYC-400, China) with solutions of SA-Ag(Cu) and EDSA-Ag(Cu) complexes, after the starch solution in combination with bentonite were added. The temperature of process and mode of the coating machine was 55^0C and 600 rpm, respectively.

Sowing small plot vegetation experiments. The experiments were laid on the basis of the Pilot Farm of Oil Plants LLP (PFOP) in the field of selection crop rotation in rainfed conditions, on soybean varieties “Nur+” and Progress, of PFOP breeding. The variety "Nur+" refers to the early ripening group, the duration of the vegetation season is 90-95 days, the variety "Progress" is medium-early, as for its vegetation season is 111-115 days. Both varieties of the grain direction are designed for growing in rainfed conditions.

The soil cover of the experimental plot of LLP “PFOP” (EKR) is represented by ordinary heavy loamy black earth, widespread in the foothill steppe zone.The climate of the foothill-steppe zone is moderately humid with pronounced continentality. The average temperature of the coldest month (January) is -16.8ºC with a minimum of -48ºC and a maximum of +8ºC, and of the warmest month (July) +19.6±2.0 and +41ºC, respectively. The average long-term precipitation in the foothill-steppe zone is 490 mm per year. In winter (November-March) falls 162 mm, in summer (April-October) 328 mm. At the same time, there are significant fluctuations over the years from 263 to 778 mm.

The laying of nurseries was carried out in accordance with the guidelines for breeding and seed production of soybeans [46]. The predecessor is spring wheat, autumn plowing was carried out. Further, two cultivations were carried out - leveling and pre-sowing, as well as breaking down and marking the field. Sowing of nurseries was carried out with manual planters to a depth of 5 cm, row spacing 70 cm, area of one plot 10 m^2, repetition three times, seeding rate 450 thousand plants per hectare. During the growing season, manual weeding and inter-row cultivation were performed. The seed coating with fungicides, subsequent insecticidal and fungicidal treatments of plants were not used.

Phenological observations. These observations were carried out for all variants of experiments. The following phases are noted: germination, flowering and maturation. The beginning of the phase was registered at 10-20% of the plants entering and the complete one at 60-75%.

Duration of vegetation season**.** This duration is from germination till biological maturity.

Determination of the mass of 1000 seeds.The weight of 1000 seeds was measured at 13% humidity. In order to do this, two samples of 500 achenes were counted from the fraction of pure seeds. Further, the selected samples were weighed to the nearest 0.1 g and the weight of 1000 seeds was calculated as the arithmetic mean of these two samples to the nearest 0.1 g.If the discrepancy between the weights of two samples is more than 3%, then the 3^{rd} sample is counted and weighed and the weight of 1000 seeds is determined by those two samples that have the smallest discrepancy.

Number of beans per plant. In order to count beans on plant, before harvesting, 25 plants were selected from each plot for structural analysis [47], during which the number of beans was counted on plants that set seeds and the average value was determined.

Harvesting and determination of productivity. The harvesting was carried out at the ripeness of 90% of the plants on the plots by the SAMPO-130 selection combine. The yield of each plot was determined by dividing the gross grain harvest by the area, obtained resultlead to the standard moisture content (14%). The arithmetic mean and the coefficient of variation were determined by B.A.Dospekhov [48], analysis of variance using the STATISTICA 6 program.

Determination of protein and fat content**.** The content of protein and fat in soybean seeds was studied on the analyzer (Infrascan-1050, Russia). In order to do this, a seed sample weighing 50 g was ground and placed in the infrared region of the IR spectrum. Measurements were made in accordance with state standard (STST) 30131-96, STSTR 50852-96, STSTR 50817-95 [49].

Results and discussion. *Influence of agrominerals on the vegetation season and phases of soybean development.* During the growing season of plants, phenological observations were carried out, where the dates were marked: the beginning of flowering, full flowering and maturation (Table 1). The presowing treatment of soybean seeds with agrominerals based on tagan bentonite and fungicidal biostimulants Tgn-SA-Ag-Starch; Tgn-SA-Cu-Starch; Tgn-EDSA-Ag-Starch; Tgn-EDSA-Cu-Starchinfluenced the length of the vegetation season (Table 2). On the control plot of the "Nur+" variety, the beginning of flowering, full flowering and maturation was noted on 06.28.2022, 07.08.2022 and 09.04.2022, respectively, the length of the vegetation season (VS) was 96 days, which corresponds to the characteristics of this type (figure 1). The shortest VS 86 days noted on plots treated with biostimulants without the inclusion of tagan bentonite and SA-Ag and SA-Cu starch, as well as with a compositeStarch-SA-Cu without bentonite (Table 2). The longest VS 100 days was observed on plots treated with succinic acid derivatives Tgn-EDSA-Ag-Starch and Tgn-EDSA-Ag-Starch. In all other variants, the length of the VS was close in duration to the control and was in the range of 92-96 days.

Table 2 –Influence of seed treatment with agrominerals on economically useful indicators of soybean varieties

№	Name of samples	DurationVS, days	Productivity, cwt/ha	Mass of 1000 seeds, g	Quantity of beans, pcs.
1	2	3	4	5	6
Variety «Nur+»					
1	Control	96	14,0	148,3	54
2	SA	90	13,9	144,7	37
3	Starch	95	15,0	148,7	49
4	SA-Ag	86	16,9	161,3	59
5	SA-Cu	86	15,7	140,8	55
6	Tgn-Ag	94	15,9	144,5	53
7	Tgn-Cu	92	13,4	138,6	60
8	Tgn-Ag-Starch	94	17,4	157,4	60
9	Tgn-Cu-Starch	94	14,1	148,0	42
10	Starch-SA-Ag	95	13,8	150,9	45
11	Starch-SA-Cu	86	15,2	143,1	36
12	Tgn-SA-Ag-Starch	96	14,7	137,1	46
13	Tgn-SA-Cu-Starch	94	14,7	150,5	50
14	Tgn-EDSA-Ag-Starch	100	17,0	159,0	61
15	Tgn-EDSA-Cu-Starch	100	17,1	156,5	58
	HCP_{005}		1,53	15,21	
Variety «Progress»					
1	Control	105	18,0	125,9	50
2	SA	102	18,0	123,6	53
3	Starch	105	20,4	132,5	63
4	SA-Ag	100	20,7	131,1	56
5	SA-Cu	100	21,0	129,0	64

1	2	3	4	5	6
6	Tgn-Ag	104	18,3	147,0	60
7	Tgn-Cu	102	20,1	111,3	57
8	Tgn-Ag-Starch	103	21,1	136,3	58
9	Tgn-Cu-Starch	103	20,3	130,3	49
10	Starch-SA-Ag	105	17,5	129,6	55
11	Starch-SA-Cu	100	17,4	127,7	61
12	Tgn-SA-Ag-Starch	105	21,5	135,0	72
13	Tgn-SA-Cu-Starch	105	18,3	119,0	56
14	Tgn-EDSA-Ag-Starch	112	21,0	134,3	65
15	Tgn-EDSA-Cu-Starch	112	22,1	138,4	67
	HCP_{005}		1,98	13,40	

The control sample of a later ripe variety began to bloom on 07.28.22, full flowering was noted on 08.07.22 and ripening on 08.26.22 (Table 2). Thus, the length of the VS was 105 days, which also corresponds to the declared characteristics of the variety. Reduction for 5 days in the VS was noted in plots treated with SA-Ag, SA-Cu and Tgn-SA-Ag-Starch. The longest VS 112 days was formed in the variants with Tgn-EDSA-Ag-Starch and Tgn-EDSA-Cu-Starch, in the other studied variants, the length of the VS was 102-105 days.

The phases of flowering and maturation in most variants on both varieties slightly deviated from the indications of the control plots. The data indicates that the obtained biostimulants based on SA-Ag and SA-Cu complexes using its separately, help to reduce the VS of both soybean varieties, includingby 10.54% for “Nur+” and by 4.7% for “Progress”. Previous studies have established, that the usage of SA as a growth stimulant, accelerates the process of removing incompletely oxidized metabolic products from cells and increasing the formation of ATP, respectively, stimulates seed germination and seedling growth, by increasing the content of the phytohormone β-indolylacetic acid [51-52]. The obtained data are in good agreement with the results of the previous study [52].

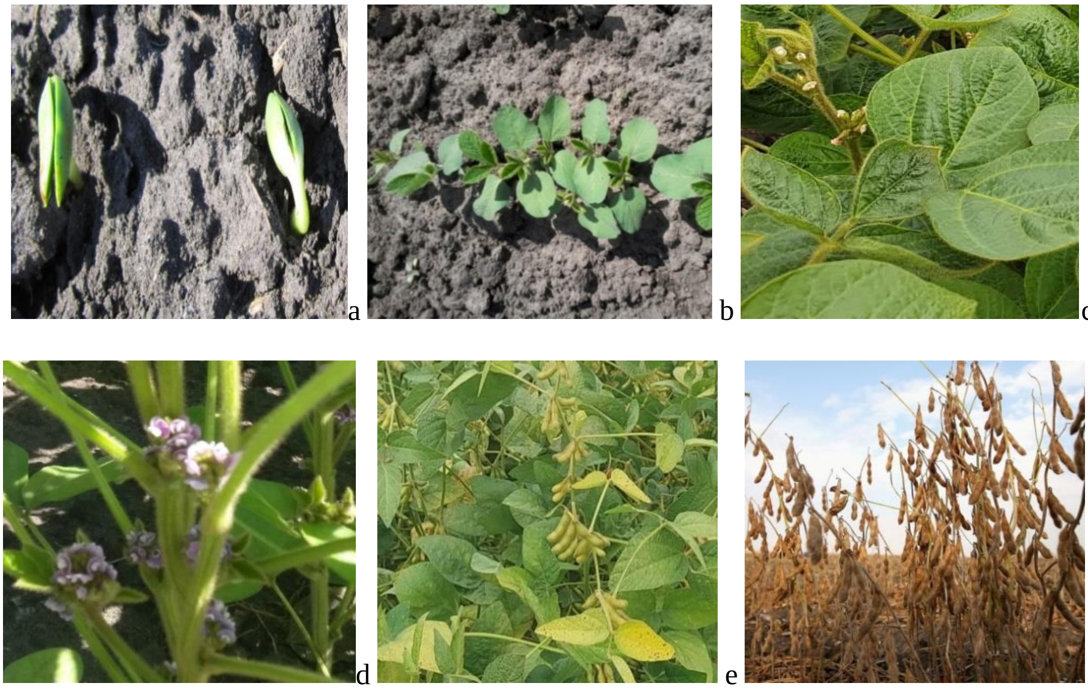

Figure 1 – Soybean growth phases: a) seedlings;b) the appearance of the first trifoliate leaf; c) the beginning of flowering; d) full bloom; e) the beginning of maturation; f) full maturity

It has been established, that the addition of Tagan bentonite to the composition of agrominerals increases the VS by 4 days for the early ripening variety "Nur+" and by 7 days for the late ripening variety "Progress". This is especially noticeable for the succinic acid derivative EDSA (Table 2). Perhaps this is due to the fact that the EDSA biostimulating agent is present in Tgn-EDSA-Ag-Starch and Tgn-EDSA-Cu-Starch and accordingly, its release takes a certain period.

Influence of agrominerals on soybean productivity, weight of 1000 seeds and number of beans per plant. The quantity of beans per plant and the weight of 1000 seeds are among the main productivity indicators. Treatment with agrominerals influenced the mass of a thousand seeds, the formation of the number of beans on plants and, as a result, the productivity (Table 2). The productivity on the control plot of the "Nur+" variety was 14.0 cwt/ha, the weight of 1000 seeds was 148.3 g. and the quantity of beans on the plants was 54 (Table 2). A significant increasing in productivity was obtained in variants with the SA-Ag biostimulant - 16.9 cwt/ha, i.e. increased by 2.9 cwt/ha; Tgn-EDSA-Ag-Starch - 17.0, 3 cwt/ha higher; Tgn-EDSA-Cu-Starch - 17.1 cwt/ha and Tgn-Ag-Starch -17.4 cwt/ha, increased by 3.1 and 3.4 cwt/ha respectively. On the same variants, the weight of 1000 seeds was 161.3; 157.4; 156.5 and 157.4 g, the number of beans on plants - 59;60;58 and 60 pieces respectively (Table 2). On plots with agrominerals SA, Tgn-Cu and Starch-SA-Ag g., the productivity was lower than the control, in other variants it varied from 14.1 to 15.9 cwt/ha, the weight of 1000 seeds was formed in the range from 137 to 158 g., and the number of beans on plants from 36 to 60 (Table 2).

In the variety "Progress", the control productivity was 18.0 cwt/ha, the weight of 1000 seeds was 140.9 g, the number of beans was 66. The highest productivity was obtained in five variants: SA-Cu - 21.0 cwt/ha, Tgn-Ag-Starch -21.1 cwt/ha, Tgn-SA-Ag-Starch and Tgn-EDSA-Ag-Starch at 21.5 cwt/ha and 21.0 cwt/ha respectively, as well as Tgn-EDSA-Cu-Starch - 22,1 cwt/ha.

The weight of 1000 seeds in the same variants was from 129 to 137 g, and the number of beans on the plants was from 58 to 72. In other variants, the productivity varied from 17.4 to 20.7 centners per hectare, the weight of 1000 seeds was from 111.3 to 147 g, and the number of beans on plants is from 49 to 61.

It has been established that SA and its derivatives enhance the respiration of germinating plants, respectively, activate hydrolytic enzymes, the rate of hydrolysis of reserve substances and the synthesis of ascorbic acid and anthocyanins involved in the redox processes of a living cell [51]. According to the obtained data, coated and pre-treated with agrominerals based on SA-Ag, SA-Cu, EDSA-Cu and EDSA-Ag complexes have a positive effect on productivity, weight of 1000 seeds and the number of beans per plant, also as an effective chelating agent deactivates soil microorganisms, causing themdeath.

Influence of agrominerals on the content of protein and fat in seeds. On average, soybean seeds contain about 40% protein and 20% fat [50].The content of protein in the seeds of the control plot of the variety "Nur +" was 38.5% and fat 18.3%. In all other studied variants of this variety, the content of fat and protein in the seeds was higher than in the control plot (Table 3) and varied from 38.8 to 41.1%.

Table 3 –Influence of agrominerals on protein and fat content in soybean seeds of "Nur+" and "Progress" varieties

№	Name of samples	Content, %			
		protein	fat	protein	fat
		Nur +		Progress	
1	2	3		4	
1	Control	38,50	18,30	38,90	21,1
2	SA	39,00	19,55	38,85	19,70
3	Starch	39,10	19,78	38,80	20,00
4	SA-Ag	38,85	19,10	39,20	19,50
5	SA-Cu	38,90	18,55	39,70	20,05
6	Tgn-Ag	40,25	18,60	40,2	19,60
7	Tgn-Cu	39,05	19,40	39,05	20,45
8	Tgn-Ag-Starch	40,45	18,45	37,60	20,40

1	2	3		4	
9	Tgn-Cu-Starch	39,75	18,40	39,25	20,20
10	Starch-SA-Ag	38,80	19,40	37,45	20,85
11	Starch-SA-Cu	39,25	18,75	37,70	20,60
12	Tgn-SA-Ag-Starch	39,45	18,70	38,40	19,90
13	Tgn-SA-Cu-Starch	40,60	19,35	38,75	20,0
14	Tgn-EDSA-Ag-Starch	39,40	18,70	40,60	21,60
15	Tgn-EDSA-Cu-Starch	41,10	18,40	38,40	20,10
	HCP_{005}	1,61	0,98	0,94	0,61

The highest protein content of 41.1% was in the variant: Tgn-EDSA-Cu-Starch. The fat content in the seeds varied from 18.3 to 19.55%, all variants were significantly at the level with the control. However, in variety "Progress", the content of protein in the seeds of the control plot was 38.9% and fat 21.1%.In six studied variants, the protein content in the seeds was somewhat lower than in the control plot, in 7^{th} it was higher. The highest content of protein and fat in the Tgn-EDSA-Ag-Starch variant is 40.6 and 21.6%, respectively. The fat content of the rest of the samples was lower than in the control plot.

Conclusion. Thus, pre-sowing treatment with agrominerals based on tagan bentonite and fungicidal biostimulants, SA-Ag(Cu) and EDSA-Ag(Cu) in a combination with film-forming substance – starch, of early-ripening and late-ripening soybean varieties, led to an increasing in the VS compared to controls by 4 dayson the "Nur+" variety and for 7 days on the "Progress" variety. At the same time, an increasing in productivity of 3.1 and 3.4 cwt/ha compared to the control was obtained on the Nur+ variety and 3.1 and 3.5 cwt/ha on the Progress variety in variants with agromineralsTgn-EDSA-Ag-Starch, Tgn-EDSA-Cu-Starcand Tgn-Ag. In the same variants, a high weight of 1000 seeds and the number of beans on plants were noted.It should also be noted, that the pre-sowing treatment with agrominerals of the early-ripening "Nur+" variety led to an increase in the protein content by 0.5-1.6% and fat by 0.1-1.25% in all studied variants compared to the control. However, in the variety "Progress: in 6 studied variants, the protein content in the seeds was lower by 0.05-0.45% than in the control plot, in 7^{th} variant it was 0.05-1.5% higher.The highest content of protein and fat in the Tgn-EDSA-Ag-Starch variant 40.6 and 21.6%, respectively.

The obtained results showed significant efficiency of pre-sowing treatment of soybean seeds with agrominerals based on tagan bentonite and fungicidal biostimulants SA-Ag (Cu) and EDSA-Ag (Cu), which ensures high resistance of these crops to phytopathogenic bacteria, improves the physiological, biochemical and biometric parameters of plants.

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ТҮЙІН

Өсімдік шаруашылығында тұқымдарды өңдеу үшін өсімдіктердің өсуі мен дамуына ынталандырушы әсер ететін әртүрлі микроэлементтерді қолданудың маңызы зор. Бұл мақалада таган бентонит негізіндегі агроминералдар мен фунгицидтік биостимуляторлар, ол янтар қышқылы және күміс және мыс иондары бар қаптама түзетін крахмалмен біріктірілген этилендиамин янтарь қышқылы кешендерімен соя тұқымын егіс алды өңдеудің өңдеудің дақылдың экономикалық пайдалы қасиеттеріне әсері туралы нәтижелері берілген. Соя дамуының вегетациялық кезеңіне агроминералды заттардың әр түрлі әсері, шығымдылығы, 1000 тұқымның салмағы, өсімдіктердегі бұршақ саны, тұқымдардағы ақуыз және май мөлшері анықталды. SA-Cu SA-Ag, және Starch-SA-Cu жеке кешендерімен себу алдында өңдеу вегетациялық кезеңнің 5-8 күнге қысқаруына әкелетіні анықталды. Tgn-EDSA-Ag-Крахмал негізіндегі агроминералды. және Tgn-EDSA-Cu-Starch вегетациялық кезеңнің ұзақтығын 4-7 күнге ұзартады. Бақылау үлгісімен салыстырғанда өнімділік 3,1-3,5 ц/га (Нұр+) және 3,0-4,1 ц/га (Прогресс) алынды. Агроминералды заттардың 1000 тұқымның салмағына, өсімдіктердегі бұршақ санына, тұқымдардағы ақуыз бен майдың мөлшеріне әсері де атап өтілді.

РЕЗЮМЕ

В растениеводстве большое значение имеет применение различных микроэлементов для обработки семян, которые оказывают стимулирующее действие рост и развитие растений. В данной статье приведены результаты влияния предпосевной обработки семян сои агроминералами на основе бентонита таган и биостимуляторов фунгицидного действия, который состоит из комплексов янтарной кислоты и этилендиаминаянтарной кислоты с ионами серебра и меди в сочетании с пленкообразующим веществом крахмалом на хозяйственно полезные качества культуры. Выявлено различное влияние агроминералов на вегетационный период развития сои, урожайность, на массу 1000 семян, количество бобов на растениях, содержание белка и жира в семенах. Установлено, что предпосевная обработкаотдельными комплексами SA-CuSA-Ag, и Starch-SA-Cu приводит к сокращению вегетационного периода на 5-8 дней, агроминерал на основеTgn-EDSA-Ag-Starch и Tgn-EDSA-Cu- Starch наоборот

увеличивает длину вегетационного периода на 4-7 дней. Получена прибавка урожая на 3,1-3,5 ц/га (Нур+) и 3,0-4,1 ц/га (Прогресс) по сравнению с контролем. Так же отмечено влияние агроминералов на массу 1000 семян, количество бобов на растениях, содержание белка и жира в семенах.

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АУЫЛ ШАРУАШЫЛЫҒЫ ДАҚЫЛДАРЫН ТАМШЫЛАТЫП СУАРУ ЖАҒДАЙЫНДА ӨСІРУ ТЕХНОЛОГИЯСЫ
TECHNOLOGY OF CULTIVATION OF AGRICULTURAL CROPS UNDER DRIP IRRIGATION

Аннотация

Шет елдерде жүргізілген көптеген зерттеулер суармалы суды ұтымды пайдаланудың ең тиімді жолы егіс алқаптарын тамшылатып суару екенін көрсетеді. Осыған байланысты табиғи және су ресурстарын тиімді пайдалануды, суармалы егістік алқаптарының өнімділігін арттыруды қамтамасыз ететін егін шаруашылығы жүйесін дамытуға бағытталған ұлттық және халықаралық ауқымда стратегиялық маңызы бар зерттеулердің өзектілігі сөзсіз. Ауыл шаруашылығын интенсификациялап, егін өсірудің жаңа серпінді ғылымды қажет ететін