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INNOVATIVE METHOD FOR ACCELERATED CULTIVATION OF GREEN FEED FOR ANIMALS AND POULTRY

ИННОВАЦИОННЫЙ СПОСОБ УСКОРЕННОГО ВЫРАЩИВАНИЯ ЗЕЛЕНЫХ КОРМОВ ДЛЯ ЖИВОТНЫХ И ПТИЦЫ

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Abstract. It has been shown that to accelerate the germination of cereal seeds for green fodder for animals and birds, one can use protium (light) water, which has a lower deuterium content and has special properties. When germinating winter wheat seeds with protium water, the growth of seedling stems accelerated: on the first day - 2.5 times, on the second - 1.8 times, on the third - 2.1 times, on the fourth - 1.6 times, on the fifth – 1.3 times, on the sixth and seventh days – 1.2 times. The results of this experiment showed the effectiveness of using protium water for accelerated germination of winter wheat grain within a few days, which is very important in the production of hydroponic green feed for animals and poultry. All these experiments and implementations are proposed to be carried out on the territory of innovative agrobiotechnoparks.

Аннотация. Показано, что для ускорения проращивания семян злаковых культур на зеленый корм животным и птицам можно использовать протиевую (легкую) воду, имеющую более низкое содержание дейтерия и обладающую особыми свойствами. При проращивании семян озимой пшеницы с протиевой водой ускорялся рост стеблей проростков: в первый день – в 2,5 раза, во второй – в 1,8 раз, в третий – в 2,1 раза, в четвертый – в 1,6 раз, в пятый – в 1,3 раза, в шестой и седьмой день – в 1,2 раза. Результаты данного эксперимента показали эффективность использования протиевой воды для ускоренного проращивания зерна озимой пшеницы в течение нескольких дней, что очень важно при производстве гидропонного зеленого корма для животных и птицы. Все эти эксперименты и внедрения предлагается производить на территории инновационных агробиотехнопарков.

Key words: innovative territorial systems, agrobiotechnoparks, vertical farms, hydroponic green fodder, winter wheat, sprouts, protium water

Ключевые слова: инновационные территориальные системы, агробиотехнопарки, вертикальные фермы, гидропонный зеленый корм, озимая пшеница, проростки, протиевая вода

Introduction. In July, 2023, the Government of the RF opened a program of state-support for creation and development the agrarian, bio- and technological parks. The priority directions, there are: the production of the well-balanced fodders, processing of grain and oilseeds, selection and seed grow. In the agrarian, bio- and technological parks it is planned to investigate and realize the new achievements in the spheres of biotechnology, animal and poultry cultures, food and feed additions, remedies of plant protection. To realize such ideas, it is necessary not only the administrative resource, but the territory, with scientific and staff potential [1-2]. Thus, during the active development of the agricultural production and achievement of the state food security [3], it is necessary to create and to organize an innovative structure, on the base of a special training (testing) ground, at this case it is Chkalovsky on the territory of Losino-Petrovsky city district, Moscow region. And we propose to begin with the cultivation innovative fodders.

One of the types of feed that helps balance the diet of animals and poultry, improve their health, and, consequently, increase the production of environmentally friendly products, is hydroponic green feed (GF), which began to be used in agriculture back in the 60s of the 20th century.

This food is green biomass grown from the seeds of various cereals (wheat, rye, oats, barley, etc.) and leguminous crops (peas, vetch, soybeans, etc.) under the influence of water, heat and light. This “grass” grows in 7–9 days; it is fed to livestock along with the remaining grain and formed roots.

As you know, the health and full development of farm animals and birds directly depends on their feeding. To a regular diet containing a balanced feed mixture of mixed feed, silage, hay, and vegetable pulp, you can add GZK from sprouted grains of various agricultural crops. Hydroponic feed adds about 20% protein, natural vitamins B, A, C, selenium, carotene, and macroelements to the diet.

The high-quality food supplement GZK replaces the vitamin-mineral complex and provides disease prevention in livestock and poultry. It is easily digestible and improves the biochemical parameters of the blood of animals. Their appetite increases, morbidity decreases, milk yield increases, and the quality of eggs and meat improves.

When consuming GZK, changes are observed in cattle after 1.5 - 2 months: the wool acquires shine, becomes cleaner and softer, the amount and fat content of milk increases, good weight gain occurs, an increase in fertilization is noticeable, and mortality decreases.

GZK is available at any time of the year, since grain germination occurs indoors; The harvest can be harvested daily throughout the year at the peak of maximum accumulation of nutrients and vitamins. During a germination cycle, 25-50 kg of forage biomass of grain crops is obtained from 1 m2.

With this germination, 1 kg of grain with a digestibility of 40% turns into 5 - 10 kg of grains with a digestibility of 95%, which corresponds to 2 kg of feed. Feeding hydroponic green food can almost completely replace a vitamin-mineral premix.

To obtain GZK, it is enough to use high-quality grain of cereals and legumes and purified water.

To speed up seed germination, you can use protium (light) water, which has a lower deuterium content and has special properties. Deuterium is an isotope of hydrogen with a molecular weight of 2 and has one proton and one neutron in the nucleus of the atom. In a heavy water molecule, unlike ordinary water, instead of two hydrogen atoms linked by a covalent bond to an oxygen atom, two hydrogen atoms are replaced by deuterium.

A number of studies have proven that heavy water - deuterium - belongs to the category of “dead”, since it is destructive to living organisms; it also inhibits seed germination. Partial removal of deuterium significantly stimulates life processes.

In the dissertation work of Ponomareva A.L. [4] showed that heavy water (2300 ppm deuterium) suppressed the germination of wheat seeds, since after incubating the seeds in this water, their germination was significantly lower than in the control (56 ±

11.2% and 98.1 ± 19.6 %, respectively). In such water, a decrease in the size of seedlings was noted. Thus, on the 3rd day, the length of the stem and root of wheat seedlings in heavy water and in the control was 0.36±0.09 and 0.67±0.14 cm, 0.8±0.13 and 1.89±0 .29 cm, respectively.

The biological activity of water with a reduced deuterium content was also assessed by other scientists [5-6]. Research carried out by scientists of the Kuban State Agrarian University on the production and use of light water [7] showed the possibility of increasing the rate of seed germination by 1.3 times and the germination of bulbs by 1.5 times compared to the control.

In Russia, several methods and devices have been patented to obtain light water, which make it possible to purify tap water from various harmful impurities [8-9].

The purpose of our research was to develop a new method for the accelerated cultivation of hydroponic green food for farm animals and poultry.

Objects and methods of research

The technological process of growing hydroponic green food includes such main stages as preparation and soaking of seed materials, distribution of seed materials over the vegetative surface of the plant, growing green seedlings, harvesting the grown feed mass for feeding it to animals and poultry.

In order for the seeds to germinate, they must swell, i.e. absorb a certain amount of water, which depends on their size and chemical composition. For example, rye seeds absorb 55-65% of water by weight, wheat - 47-48%, barley - 48-57%, oats - 60-75%, corn - 37-44%. To swell the seeds of grain legumes, 100-125% of their weight is required. After swelling, biochemical and physiological processes occur in the seeds. Under the influence of enzymes, complex chemical compounds (starch, proteins, fats, etc.) are transformed into simple soluble compounds. They become available for nutrition of the embryo, which, upon receiving nutrition, moves from a state of rest to active life. Seeds begin to germinate, and at this time they need moisture, oxygen and their certain temperature conditions.

To access the effect of protium water on accelerating seed germination, we conducted comparative tests of two methods of growing GZK: 1) moistening winter wheat grains with tap water; 2) moistening winter wheat grains with protium water.

In the experiment in Petri dishes, 30 grains of wheat were germinated with the addition of tap water (sample «A», control) and 30 grains of wheat with the addition of protium water (sample «B», experimental). For swelling, the seeds were soaked for 12 hours with the addition of 100 ml of tap water (sample «A») and 100 ml of protium water (sample «B») in a room without daylight. Every day, the seeds were moistened by adding 20-30 ml of water (tap water to sample «A», protium water to sample «B»).

To control germination conditions (temperature and air humidity), a Climate Sensor (Xiaomi Mi Temperature and Humidity Monitor 2 NUN4126GL) was placed at the germination site to record temperature and humidity. Data on changes in temperature and humidity are presented in Table 1. The room temperature was 18.9-25.8C°, humidity - 42-81%. The period of grain germination was 7 days.

Table 1. Temperature and humidity indicators during wheat seed germination, day by day

Indicators		0 day	1 day	2 day	3 day	4 day	5 day	6 day	7 day
Temperature, C^0	upper value	25,3	23,7	24,6	24,9	24,6	23,6	23,4	25,8
	lower value	21,6	18,9	20,4	21,5	21,1	20,3	20,4	20,5
Humidity, %	upper value	60	71	78	68	66	65	71	81
	lower value	42	48	57	44	52	52	55	63

In order to ensure light supply for wheat seedlings, an installation with a household LED phytolamp was used. The height of the lamp above the Petri dish was 30 cm. Illumination was measured using a «Sverdlovsk-4» exposure meter; it was 6760 lux. Every day, changes in wheat seeds were photographed, and the stem length of each seedling was determined.

Research results and discussion

The results of a comparison of testing two liquid media during germination of winter wheat grains (average values of the stem length of the seedlings) against the background of optimal lighting are presented in Table 2 and Figure 2.

When germinating wheat seeds with protium water, the growth of seedling stems accelerated: on the first day - 2.5 times, on the second - 1.8 times, on the third - 2.1 times, on the fourth - 1.6 times, the fifth – 1.3 times, on the sixth and seventh days – 1.2 times.

Table 2. Results of determining wheat seed germination indicators during 7 days of observation

Days	Sample	Number of sprouted seeds, pcs.	Average length of sprout stems, mm	Increase in stem length of seedlings moistened with protium water compared to control	
				how many, mm	how many, times
1 day	A	28	0,52		
	B	29	1,31	0,79	2,5
2 day	A	28	2,64		
	B	29	4,86	2,22	1,8
3 day	A	28	9,26		
	B	29	19,30	10,04	2,1
4 day	A	28	30,29		
	B	29	47,84	17,55	1,6
5 day	A	28	50,91		
	B	29	65,84	14,93	1,3
6 day	A	28	75,21		
	B	29	88,19	12,98	1,2

7 day	A	28	96,02		
	B	29	112,07	16,05	1,2

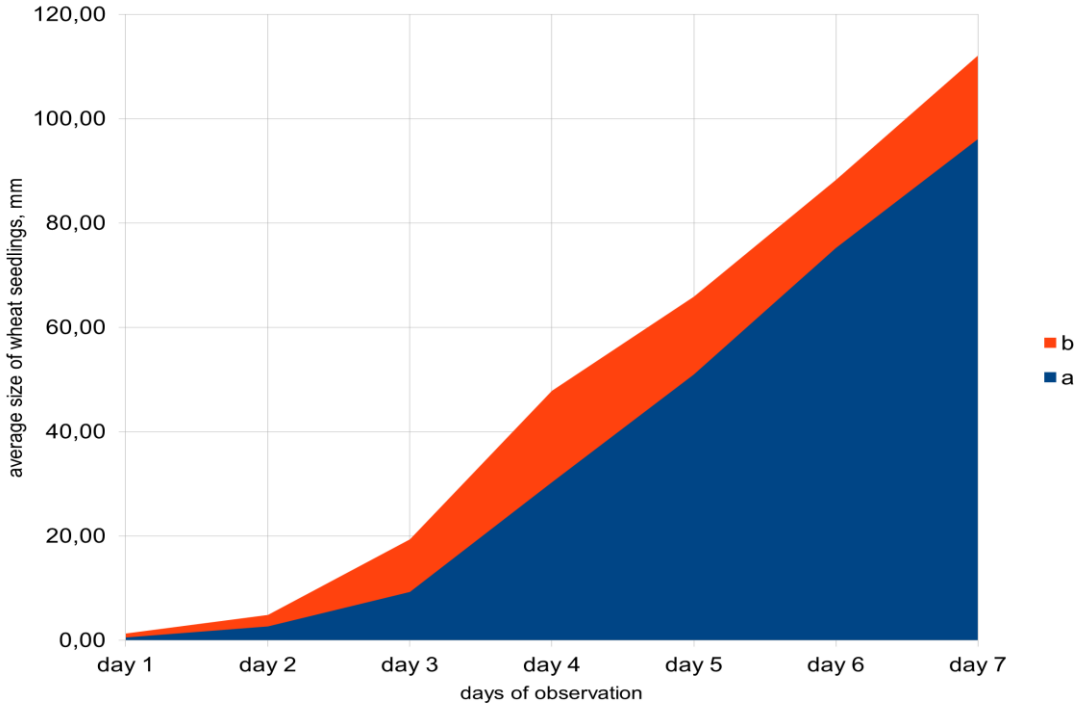

Figure 1. Change in the average length of wheat seedlings by observation days (a - with tap water, b - with protium water)

Figures 2-3 show photographic recording of the results of observations of the germination of wheat seeds on the third and seventh days.

Figure 2. Sprouted wheat seeds with tap (sample A) and protium (sample B) water on the third day

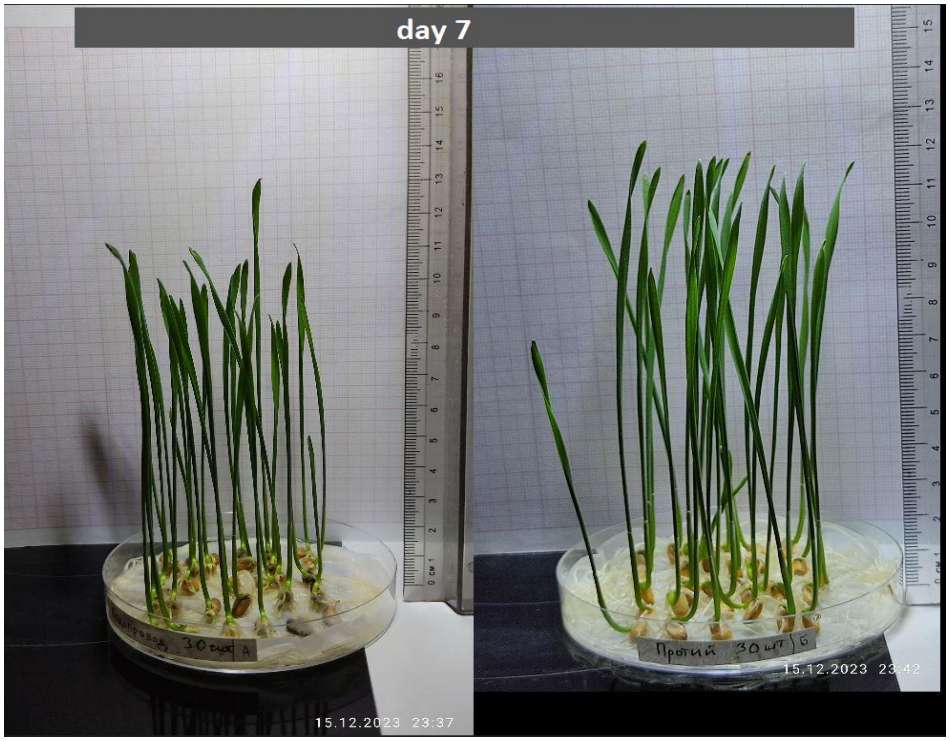

Figure 3. Sprouted wheat seeds with tap water (sample A) and protium water (sample B) on the seventh day

The results of this experiment showed the effectiveness of using protium water for accelerated germination of winter wheat grain within a few days, which is very important in the production of hydroponic green feed for animals and poultry.

Conclusions

The positive effect of the innovative method of germinating grain with protium water can be expressed in the following areas: economic (cheaper method for the accelerated cultivation of hydroponic green fodder); environmental (grain sprouts grown using protium water are superior to similar samples in some respects); biological (acceleration of the formation of biomass of stems and roots of plant seedlings for use as green hydroponic food).

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