Propagation methods of *Acorus Calamus* in Uzbekistan

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Abstract. This article is devoted to methods of reproduction of *Acorus calamus* L. in the conditions of Tashkent region. According to our three-year research and analysis of the literature, it was found that the pollen grains developed in *Acorus calamus* plants are sterile. It was noted that it does not produce seeds in Tashkent conditions. Therefore, the methods of vegetative reproduction of the plant have been thoroughly studied. Biological methods of growing *Acorus calamus* have been developed in running water ponds and propagation from rhizome joints in laboratory conditions. Based on the set of the most important indicators of biological properties, the scientific basis of the "Node" method was created, and promising agrotechnical methods were developed based on experiments. In the process of studying the reproduction of plant nodes, the growth of 1-10-noded cuttings was observed in different nutrient media. It was found that the cuttings of the plant were fully grown, and the rhizomes and leaves grew well. It was determined that it is appropriate to plant the plants in 7-10 joints in different reservoirs. Planted rhizome cuttings were found to grow intensively even at 13-18 Cº. For the first time, plants have been observed to grow faster in sheep manure-fed media than in cattle manure.

Keywords. *Acorus calamus*, rhizome, vegetative propagation, node method, medicinal.

1 Introduction

Medicinal plants have been widely used in folk medicine since ancient times. Continuous use of chemical preparations in highly developed modern medicine can cause certain diseases in

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the human body. In our independent Republic of Uzbekistan, the group of higher plants consists of 4650 species, of which 700 species form the group of medicinal plants. The demand for medicinal plants is increasing in recent years, because drugs made from synthetic drugs have little effect and can cause functional changes in the body when taken for a long time. That's why studying, breeding, restoring and adequately using medicinal plants is one of the most important issues.

The great scholar Abu Ali Ibn Sina [1], who grew up in Central Asia and contributed to the development of world science - medical science, obtained 811 plain medicines from plants and animals. He revealed ways to prepare and use medicine from many medicinal plants. One such plant is Acorus calamus. Ibn Sina used ointments made from this unique plant in the treatment of liver, black and gastrointestinal diseases and as a diuretic.

According to H.H. Kholmatov and A.I. Kasimov [2, 3], the rhizome of *Acorus calamus* contains up to 5% essential oil, acorin glycoside, additives, resin, glue, up to 25% starch and other substances. It also contains terpenes such as azarone, proazulene, pinene, calamene and camphene. The leaves contain up to 150 mg % of vitamin C, essential oil and flavoring substances. In modern medicine, it has been found that under the influence of acorin glycoside in the rhizomes of *Acorus calamus*, the secretion of gastric juice increases by the reflex way, the bile secretion function of the liver and the gall bladder are strengthened, and diuresis is increased. The extract from this plant causes the loss of pain sensation and lowers arterial pressure. *Acorus calamus* preparations are used to treat stomach and duodenal ulcers (gastritis, enteritis, colitis). Tinctures have the properties of accelerating digestion and appetite. In addition, it emits a pleasant smell, improves the composition of the air and cleans it from various microbes. The original homeland of *Acorus calamus* plant is tropical countries - China, Burma, India and Japan, where it is widely distributed [4-6]. Currently, it is grown by local residents in their backyards and used as a medicinal and ornamental plant. As we mentioned above, the range of application of this plant in folk medicine and scientific medicine is wide, and the demand for it is increasing. It is clear that if the raw materials of the plant are planted and propagated in our country, it will have a great economic effect and medicinal properties will have a good effect on the people living here.

Acorus calamus decorates rivers, lakes, ponds and marshes with a beautiful appearance, and does not allow the unique microclimate of those lands to be disturbed by environmental influences. At the same time, it prevents water pollution and erosion of river and lakeside soil. Today, the poisonous water and gases coming out of cities, factories, and factories are polluting our atmosphere, and are seriously affecting the health of plants, animals, and people. Some infectious diseases are emerging. As a result of planting crops in many areas, the ecological situation is disturbed and the land is filled with salt. Waters are becoming polluted, and the ecological condition of water bodies is deteriorating several times. Nowadays, an international problem, the island problem, has arisen in our Republic, and the ecological situation is getting worse. It is known that the deterioration of the ecological situation has a serious impact on the world of plants, leading to the loss of rare and medicinal plants. In order to prevent this problem, we must follow the laws of our independent Republic

and use plants sparingly and wisely. Therefore, planting and breeding of medicinal plants is the demand of the times. We need to use plants properly and expand their cultivation. That is why the development of methods of mass reproduction of ornamental, rare and medicinal plants such as *Acorus calamus*, studying their chemical composition and growing and using them on a large scale remains one of the urgent problems of today. According to the analysis of literature sources, pollen grains in *Acorus calamus* anthers were found to be sterile. It was found that the number of chromosomes is 2p-33.34 in the species of the cotton plant population spread in Armenia, and 60-70% of the pollen grains in the flowers are sterile. A defect in this reduction division caused the formation of anomalous gametes. Aneuploidy has been found to be one of the main reasons why a plant almost does not produce seeds [7, 8]. *Acorus calamus* does not produce seeds even in its natural range. According to the scientific point of view of K. Fegri and L. van der Peil [9], the species in the European populations were created as "unmatched clones".

2 Materials and methods

The object of research is *Acorus calamus* L., a perennial herbaceous plant belonging to the Acoraceae Agardh family, the Acorales ordo, the subclass of the Aridae [4].

The rhizome is creeping, slightly flattened and covered with tiny rhizomes. Leaflets grow from the rhizome, the leaves are linear or lanceolate, 60-120 cm long. The stem grows upright, is unbranched and leafless, tube-shaped on one side, and sharp on the opposite side. A spadix inflorescence develops on the plant. The length of the stem is 4-12 cm, it is covered with small yellow flowers of both sexes. P**erianth** is simple, six-leaved, blooms from May to June. The fruit is a red multi-seeded berry. The seeds usually do not ripen, this plant reproduces only from rhizomes [5, 6, 10, 11].

We used the "Node" method in the propagation of medicinal and ornamental - *Acorus calamus* L. in running water under conditions of introduction. When propagating from the joints of the plant, 1 to 10:5:1 and 12:1:1 ratios of pre-prepared soil, sand and manure (cattle manure) in nutrient mediums prepared at 5g/l of cattle manure and 5g/l of sheep manure and glass plastic trays up to 10 noded rhizomes were planted in 3 rows. In this case, the distance between the pens was 15 cm, and the distance between the rows was 20 cm. In running water conditions, 3 kinds of experiments were conducted. Scientific research work was carried out at the experimental farm of Tashkent State Agrarian University and F.N. Glass plastic trays and artificial ponds in the territory of Rusanov Botanic Garden were completed for three years.

Experiments in flowing water conditions were carried out on plants growing in the place of the Salar canal flowing through the city of Tashkent, flowing through the territory of the "Tashkentkabel" production association, and in the place where the Karasuv canal enters the Burjar canal, which exits from the territory of Sirgali district. The effects of soil and water chemical composition, temperature, nutrient medium, pH index, air temperature and amount

of light on plants in the experimental areas were studied and experiments were carried out. Scientific work was carried out based on the recommendations of B.A. Dospekhov [12].

3 Results and discussion

The *Acorus calamus* is propagated in Russia and Western Europe only vegetatively - using rhizome cuttings. The herb does not produce seeds, because these regions are not suitable for it, and its pollinating insects are not found here [13, 14].

Scientific observations were made on young seedlings and older plants. The reproduction of young seedlings was studied under natural and laboratory conditions. In this case, observations were made on young seedlings planted along the Salar and Karasuv canals under natural conditions from April until the end of vegetation. Laboratory conditions during the growth period of the plant in the botanical garden, the beginning of spring growth, active growth, the appearance and shedding of leaves: the growth of the generative branch, budding, flowering and formation of the node and their shedding before fully ripening were monitored during the development period. Vegetative reproduction of the plant. It was carried out in different periods, taking into account different phases of the growing season and the number of joints. We divided the rhizome of *Acorus calamus* into joints and observed how many of them increase in number. In the first experiment, 1-3 new vegetative nodes were produced from each node. The experiment was observed from April to November, until the end of vegetation. During their first year of growth, the number of leaves was 1-6, the old leaves turn yellow and new leaves grow. At the end of the growing season, the height of the plants reached 60-130 cm. During the growth and development of *Acorus calamus*, it was observed that air temperature changed to 13-29-45 Cº, water temperature to 13-30-45 Cº, pH 5.5-7.0.

In some nodes of the *Acorus calamus*, only one stem emerged and grew well until the end of the growing season. When the length of the root is 10-15 cm, it produces 2-3 stems. When we observed the artificially propagated plants the second year, it was observed that 1-3 stems were produced, and then the development of their roots decreased. During the growing season, rotting of old roots and frequent formation of new roots was observed.

No generative organs were produced during the two-year follow-up. In order to study under natural conditions, weed plant was planted on the waterside (Salar canal water). Each bush produced 1-3 stems from the root, as a result, the plant developed well and the leaves grew to 60-130 cm. Old leaves, that is, the first leaves, turn yellow and stop growing. Observation was carried out until the end of vegetation. When the observations were carried out the second year, it was observed that the plant produces stems and starts growing through root nodes from April.

Up to 15-18 vegetative (stem) organs emerged from one rhizome, rotting of the rhizome was not observed. The fescue grew well and developed, even growing to the sides and taking the place of some aquatic plants. In the experiment, we did not allow weeds to grow, we created conditions for the direct sunlight and good development of the plant. We cleaned it of foreign plants.

At present, for the cultivation of plants, it is necessary to protect the plant by a man. In addition, the plant was also planted along the Karasuv canal. It was observed that the planted seedlings were well developed. Cultivated plants (in natural state) did not develop generative organs. Rhizomes prepared for propagation in November without buds, rooted stems; b) stem with side shoots and roots. Rhizomes prepared for propagation in November; c) rhizomes with side shoots, various nodes; g) stems with tip shoots, roots.

As a result of the observations, it was found that the rhizome of the plant in its natural state is well developed. *Acorus calamus* should be propagated in the margins of flowing water areas, by building special ponds. According to J.A. Abdullaev [15], the growth and development of plants planted from Samarkand region to Fergana valley is given. Plant cuttings are planted to a depth of 5-10 cm. After 2 months, the length of the leaves has grown to 60.7-66.8 cm, width 1.32-1.53 cm. The next year, the development of the plant continued longer, and at the end of the growing season, the number of plant leaves was up to 12-15. Summer leaves are reported to be 156.2-172.5 cm long or spring leaves are 32-47 cm long. The flowering process lasted until June. The plant has been found to reproduce only from rhizomes.

Acorus calamus was brought to Tashkent by T. Taubaev from Samarkand region in 1968 and its biology was observed. The flowering of the plant lasted from May to the end of June, and during this period the height of the leaves was up to 120 cm. The plant is mainly propagated by rhizomes [16]. The following are found in the plant communities growing in the Siyob and Koksuv rivers of Samarkand region: *Tlersia oryzoides*, *Phragmites australis*, *Alisma plantago-aquatica*, *Sagittaria trifotia*, *Typha latifolia* are rare. According to its ecological status, it is a hydrophytic plant [17].

It is recognized by many authors that the pollen grains in the anther of *Acorus calamus* are sterile. But the property of reproduction from the rhizome is very high, and its suppression of other useful plants is also reported in the literature. These data are the basis for the development of methods of propagation of *Acorus calamus* using rhizomes and to conclude that its future perspective is a plant. From a biological point of view, there is no doubt that propagation from rhizomes is useful for this species, because this condition allows the rhizome to grow in the soil for a long time, and crops can be propagated under human protection. That's why we aimed to do such things as propagation of rhizomes from nodes, study of their reproduction in different waste water basins, different nutrients, how many nodes are planted, this plant will give good results.

Acorus calamus was grown in April 2019 with 5 joints and 5% cattle feed. The cuttings were cut and broken in 3 rows, 10 pieces per row 40 cm long and 1.7 cm diameter cuttings were planted in portable trenches (the length of the container is 7 m, the width is 45 cm). Observation work started from May to September. The following table shows the biology of the cultivation of cuttings (Table 1).

Table 1. Biological parameters of transplanted rhizome cuttings (cut/broken).

***Acorus calamus* L.**			**Rhizome**		**Leaf**		
Planting time	**Planting condition**	**Planting method**	**Length, cm**	**Diameter, cm**	**Length, cm**	**Width, cm**	**Amount, quantity**
2019 IV	Laid down	Whole	10 8 7	1.2 1.1 1	20 17 12	1.5 1.3 1.2	5 4 3
2019 IV	Laid down	Whole	9 7 6	0.9 0.7 0.8	19 16 18	1.4 1.3 1.1	4 3 5

In the spring, the leaves of the cuttings planted in the following form are 25-40 cm long, and the summer leaves are 60-70 cm long. The number of leaves increased to 8-9 in spring and 10-13 in summer. The temperature of the food medium was 15-35-450, the air temperature was 13-28-450, the light was 400-450 W/m2 FAR, pH 5.5-7. In the process of observation, it was observed that the first leaves stopped developing and formed a new rhizome. Hence, joint formation also produces a new rhizome joint during each leaf shedding process. Table 2 shows the results of determining how much the number of experimental plants increased or decreased in September.

Table 2. Biological characterization of cuttings planted by cutting and breaking rhizomes nodes.

End of experiment	**Dried leaf**	**Saved**		**Rhizome**		**New leaf**		
		New rhizome, quantity	**Bruised plant, quantity**	**Length, cm**	**Diameter, cm**	**Length, cm**	**Width, cm**	**Quantity**
2019 IX	7 6 5	3 1 2	10 8 9	35 31 28	2.4 2.2 2	70 68 65	1.5 1.4 1.1	13 12 10
2019 IX	4 3 5	2 1 -	8 7 6	26 24 20	2.1 1.9 1.7	66 60 62	1.2 1.3 1.1	11 10 9

From the data presented in Table 2, it can be seen that the number of nodes in the rhizome has increased to 9-13. The best result was observed when the rhizome of the plants was cut. 27 seedlings germinated in cuttings, 90%, and 21 seedlings germinated in broken seedlings, 70%. These observational experiments were carried out in the 2nd year as well. Spring leaves grew to 40-70 cm, summer leaves to 60-105 cm. The observation was continued until the end of vegetation. In this case, the air temperature was 13-29-48 0C, the temperature of the food environment was 13-30-49 0C, the light was 410-440 W/m2 FAR pH 5-7. The results

obtained about the growth and development of the plant, how much it multiplied, are given in Table 3 below.

Table 3. Biological description of cut and broken cuttings planted in the second year of vegetation.

End of experiment	Dried leaf, grain	Saved		Rhizomes		New leaf		
		New rhizome drain	Blue-green plant, grain	Length, cm	Diameter, cm	Length, cm	Width, cm	Quantity, grain
2020 IX	11	35	-	15	1.2	104	1.5	14
	10	22	-	11	1.1	105	1.4	12
	9	29	-	10	1.0	95	1.1	10
2020 IX	4	25	-	8	0.8	98	1.1	11
	3	20	-	7	0.7	94	1.0	10
	5	14	-	5	0.6	85	0.9	9

In our experiment, it was observed that the plant rotted old rhizomes and produced new rhizomes with a length of 5-15 cm and a diameter of 0.6-1.2 cm with 14-35 nodes. The number of leaves is 9-14, their length is 85-104 cm, width is 0.9-1.5 cm. During the growing season, the old leaves of the plant die and produce new leaves. It was observed that the air temperature changed up to 14-33-480 C during the vegetation. The number of rhizomes that were cut and planted reached 86, and when they were broken, they reached 59. At the end of the experiment, the bruising of cut rhizomes increased by 409 % compared to the initial state, and the bruising of broken rhizomes increased by 315 %. In March 2021, experimental works were carried out on the basis of 4 repetitions in the Salar and Karasuv canals flowing from Tashkent and in the artificial basins in the Botanical Garden. These seedlings were observed for 3 years. A rhizome with a length of 4-10 cm was selected for propagation. The number of leaves in them was 1-3, and the length was 5-12 cm. Prepared stems were planted to a depth of 5-8 cm and observed until the end of vegetation. Tables 4, 5, 6 below show the results of 3-year follow-up.

Table 4. Biological description of cuttings propagated from rhizomes in the first year.

End of experiment	Dried leaf, pc	Saved		Rhizomes		New leaf		
		New rhizome, drain	Blue-green plant, grain	Length, cm	Diameter, cm	Length, cm	Width, cm	Quantity, grain

2021 X Botanical Garden	6	3	2	20	2.7	110	3.0	16
Salar canal	8	5	3	19	2.8	115	2.4	14
Karasuv canal	7	4	3	18	2.5	106	1.9	12

Table 5. Biological description of cuttings transplanted from rhizome nodes in the second year.

End of experiment	Dried leaf, pc	Saved		Rhizome		New leaf		
		New rhizome	Blue-green plant, grain	Length, cm	Diameter, cm	Length, cm	Width, cm	Quantity, grain
1999 X Botanical garden	10	12	5	24	2.8	116	2.8	19
Salar canal	11	15	8	25	3.0	120	3.0	20
Karasuv canal	9	13	7	23	2.4	114	2.6	18

Table 6. Biological description of cuttings transplanted from rhizome nodes in the third year.

End of experiment	Dried leaf, pc	Saved		Rhizome		New leaf		
		New rhizome	Blue-green plant, grain	Length, cm	Diameter, cm	Length, cm	Width, cm	Quantity, grain
2000 X Botanical garden	12	31	14	28	2.9	121	2.9	21
Salar canal	14	35	20	34	3.0	120	3.0	24
Karasuv canal	13	32	16	27	2.8	117	2.8	20

When we observe the planted rhizomes until October, the length of the leaves is 110-115-116 cm, the width is 3.0-2.4-1.9 cm, the number is up to 12-14-16, the number of leaves is 6-7-8, and at the end of October the rest of the leaves also stopped developing.

The rhizomes are 20-19-18 cm long, 2.5-2.7-2.8 cm in diameter, of which 2-3-3 plants have grown up to 3-5 new rhizomes from the main rhizome, leaves are 7-9-10 , the length was 25-45 cm. Air temperature changed to 13-32-47ºC, water temperature to 12-30-46ºC, pH-5-7. Thus, we continued to observe the growth and development of the plant in the 2nd year. Autumn rhizomes begin to produce new leaves to replace them in early spring in March. During the observation, the number of leaves and rhizomes of the plant was studied. At the end of vegetation, leaves are 116-120-114 cm long, 2.8-3-2.6 cm wide, 18-19-20 in number, rhizomes are 2.4-2.8-3 cm in diameter, 24-25-23 in length was up to cm. 5-7-8 bruised rhizomes, 12-13-15 new rhizomes. Leaf fall was 9-10-11. At the end of November, the plants began to go into a dormant period. Air temperature varied from 13-33-450, water temperature to 14-30-47^{0}C, pH-5-7.

Observations were carried out as in previous years. By the third year, the length of the leaves is 121-124-117 cm, the width is 2.9-3-2.8 cm, the number is 20-21-24, the newly formed rhizomes are 14-20-16, the rhizomes formed by sympodial branching are 31 - increased to 32-35. The length of the rhizome is 27-28-34 cm, the diameter is 2.9-3-2.8 cm, the dead leaves are 12-14-13. Thus, the number of Acorus calamus plants in the Salar Canal increased by 4-20 compared to the Botanical Garden and the Karasuv Canal. Stem joints increased to 4-17.

In addition, under the conditions of the Botanical Garden, water was given to the plant and the soil, and its growth was observed. For the experiment, in October, 120 rhizomes with 3-4 joints were planted in 4 rows, with 30 cuttings per row, 10-15 cm long, with 3-4 leaves. Planted cuttings began to grow in early spring. 5-7 new leaves have grown in place of the winter leaves. Spring leaves grew to 25-45 cm, 2-2.5 cm wide, and summer leaves grew to 60-85 cm, 2-2.7 cm wide. The plant grew 12-19-17-12 from 30 plant cuttings on April 12, 17-12-24-14 on April 24, and 17-13-24-15 on May 6 (Table 7). These numbers did not change in the next determination.

Table 7. Biological characterization of rhizome cuttings germination.

When planted, row	When planted, rhizome	12 April	24 April	6 May	Leaf		Root	
					Length, cm	Width, cm	Length, cm	Diameter, cm
1	30	12	17	17	85	1.6	9	1.3
2	30	19	12	13	70	1.5	7	1.1
3	30	17	24	24	73	1.4	8	1
4	30	12	14	15	68	1.2	7	0.8

The plant has 7-10 leaves, and the autumn leaves have died. 3-4 new leaves with a length of 10-14 cm were formed from the rhizome. These leaves protect the plant from cold in winter. Air temperature reached 14-34-49^{0}C, light reached 400-460 W/m^2 FAR.

According to the results of the above experiments, in order to determine the best results if the rhizome of the plant is planted into several nodes, the rhizomes are divided into 10 nodes, i.e. 1 node, 2 nodes, 3 nodes, etc. was grown on sheep and cattle manure in the environment (Table 8).

Table 8. Biological characterization of cuttings transplanted from rhizome joints into nutrient medium prepared from sheep manure.

Nodes	Saved		Rhizome		New leaf		
	When planted	When blue-green	Length, cm	Diameter, cm	Length, cm	Width, cm	Quantity, piece
1	3	-	-	-	-	-	-
2	3	-	-	-	-	-	-
3	3	1	12	1	68	2.1	10
4	3	2	24	1.1	80	2.3	11
5	3	2	25	1.3	84	2.5	13
6	3	3	27	1.4	88	2.7	19
7	3	3	31	2.4	96	2.9	22
8	3	3	32	2.5	97	2.9	24
9	3	3	35	2.7	103	3	25
10	3	3	36	2.8	108	3	26

The rhizomes of the plant with 1-2 nodes are not blue-green, the remaining joints have up to 1-2-2-3-3-3-3-3, the length of the leaves is up to 68-80-84-88-96-97-103-108 cm, the number of leaves up to 10-11-13-19-22-24-25-26, rhizome length 12-24-25-27-31-32-35-36 cm, width 1-1,1-1,3-1, It was 4-2.4-2.5-2.7-2.8 cm.

1-2-3 noded cuttings planted on cattle manure medium did not germinate. The cuttings in the next joints are blued up to 1-2-3-3-3-3-3. The number of leaves is 9-11-11-13-15-22-23 pieces, the length of the rhizome is 10-15-16-20-22-24-29 cm, the diameter is 1-1,2-1,4-2-2, It reached 1-2.4-2.7 cm. Plant growth was faster on the sheep manure medium than on the cattle manure medium (Table 9).

Table 9. Biological characterization of cuttings transplanted from rhizome joints on nutrient medium prepared from cattle manure.

Nodes	Saved		Rhizome		New leaf		
	When planted	When blue-green	Length, cm	Diameter, cm	Length, cm	Width, cm	Quantity, piece
1	3	-	-	-	-	-	-
2	3	-	-	-	-	-	-
3	3	-	-	-	-	-	-
4	3	1	10	1	65	2	9
5	3	2	15	1.2	67	2.2	11
6	3	3	16	1.4	69	2.4	11
7	3	3	20	2	73	2.6	13
8	3	3	22	2.1	78	2.8	15
9	3	3	24	2.4	85	2.9	22
10	3	3	29	2.7	94	3	23

When analyzing the composition of manure chemically, it was found that N_2-0.55, K_2O-0.15, P_2O_5-0.31 in sheep manure, N_2-0.29, K_2O-0.15, P_2O_5-0.17 in cattle manure (Table 10). So, sheep manure has much higher biogenic elements.

Table 10. Chemical analysis of cattle and sheep manure, %.

Animal manure	Composition of substances					
	N_2	K_2O	CaO	Mg	P_2O_5	H_2SO_3
Cattle	0.29	0.10	0.35	0.13	0.17	0.04
Sheep	0.55	0.15	0.46	0.15	0.31	0.14

4 Conclusions

Methods of propagation of *Acorus calamus* L. by vegetative means were developed for the first time in Uzbekistan under conditions of introduction.

Biological methods of growing *Acorus calamus* have been developed in running water ponds and propagation from joints in laboratory conditions. Based on the set of the most important indicators of biological properties, the scientific basis of the "Node" method was created, and promising agrotechnical methods were developed based on experiments. In the

process of studying the reproduction of plant joints, it was found that it is possible to grow cuttings with 7-10 nodes in both nutrient media. The cuttings of the plant are fully green, and the development of the rhizome and leaves is high. It was determined that it is appropriate to plant the plants in 7-10 nodes in different reservoirs. Planted rhizome cuttings were found to grow intensively even at 13-18ºC. Methods of propagation of *Acorus calamus* by vegetative means were developed for the first time in Uzbekistan under conditions of introduction.

Plants were first observed to grow faster in sheep manure media than in cattle manure. It was found that the productivity of plants grown in certain environments is high. It was determined that the demand can be met as a result of planting. It has been proven that it can be grown on an industrial scale depending on the demand. The results of the research can be used in lectures and practical training in higher educational institutions.

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