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LITERATURE REVIEW OF HYDROPONIC DEVICES FOR GROWING GREEN FODDER

Abstract.

Growing traditional green fodder requires a lot of land, but also grows with the absorption of large amounts of water and soil nutrients, depending on the metrological conditions in such cultivation. In this case certain costs of cultivation requires and the years when the sun was hot risk of burns. The influence of such factors one way to reduce the cultivation is by hydroponic method. During the study to plants nutrient transfer based on technology the following six types of hydroponic systems (HS) are considered: rising and falling water; HS in the nutrient solution; aeroponics; HS of aquatic crops; drip irrigation HS. At the same time, HS in the production of green fodder an overview of the design was made and their advantages and disadvantages are considered.HS is effective in the cultivation of green fodder nutrients as a technology the cultivation by transfer is. With this technology the cultivation of fodder grasses because it takes place in a closed system, feed solution into this system transfer automation is easy. Optimization of hydroponic feed technology for technological purposes trends control requires modernization of automation equipment (MAE).

***Key words*:** green fodder, hydroponic nutrient, hydroponic systems, feeding method.

Introduction. Efficiency is the main goal of any production. As much as possible production facilities strives to produce quality products at low cost. The growth of the world's population is leading to an increase in demand for agricultural products. Depreciation of arable land and climate change is having a negative impact on agricultural production. For these reasons, traditional reduction of soil fertility in agriculture due to which it was difficult to obtain a high quality product. Growing crops in areas with poor soil fertility in order to reduce costs soilless cultivation systems are widely used [1-10].

The use of a hydroponic system is effective in reducing the impact of the above causes. Hydroponics is a method of growing without soil. In this method it is grown by absorption of minerals [2;12]. Studies in the 19th century have shown that plants can be grown in nutrient solution without soil. According to researchers, plants can get their nutritional needs from inorganic elements and sunlight. Roots of plants by watering with nutrient solution cultivation hydroponics or called hydroponic cultivation [13;14].

This system based on on archeological researches pop up and hanging gardens hydroponic cultivation the oldest examples are, but later such cultivation technology was not widespread. Cultivation of hydroponic plants is mainly infertile in desert areas have recently shown interest [14;15]. In our country this year the joy of being is proof of this. Second world war during the British and American troops this method solves the food problem [14]. Currently hydroponic the use of this method is widespread in many countries [17].

Thus, the system of hydroponics allows to grow crops on barren agricultural lands, arid climates [16]. By using this method in places where they live allows you to grow crops on a regular

basis. It is also effective in urban areas. Growing plants in such a system increases the advantages of using traditional smart technologies. Cultivation by hydroponic methods used in places with short seasons [3]. Light and temperature can be controlled to increase performance [5;12-14;17-20].

Hydroponic operation management made a big difference in the direction of simplifying the work by using the machine view. Thus hydroponic installations is increasingly used for continuous production of greens and vegetables. These are places of production remote control is performed in this system the amount of green mass and its condition is determined. This saves time and improves the quality of work [8;11;21;22]. D. Boodenmiller (2017) stated that a certain concentration of nutrients in a solution and a certain pH value must be continuously monitored to ensure optimal plant growth. The process is regulated by chemical reagents that require special knowledge and skills. Provides a reagent-free method of maintaining the balance of influencing factors for optimal plant growth [23].

Hydroponics-based feed production is beneficial for livestock is an alternative technology (A.Adeke et al., 2020). The agro-industrial complex, which has introduced the technology of hydroponic fodder cultivation, has a number of economic and environmental advantages: 99% less land is used for fodder cultivation; water consumption will be reduced by 98%; reduces the need for agricultural machinery, equipment and fuel and lubricants traditionally used for fodder production; hydroponic forage animals 90–95% absorbs, this reduces the production of animal manure by up to 25%, and thus reduces the cost of manure utilization and processing [24].

Ancient from time immemorial since the hydroponic system on this basis, it is known that the fruit in the form of feed is used in the cultivation of berries the direction of growing fodder grass for livestock appeared. So far, the direction of forage cultivation needs to be fully explored. This is a study purpose hydroponic [12;14;25;26].

Materials and methods of research. Hydroponic systems (HS) on six types a review of the scientific literature. Plants with nutrientssecurity technology was considered.

The results of research and their discussion. Hydroponic devices. According to the technology of plant nutrition, hydroponic systems can be divided into six types. All of these systems have some common components (pump, frame, pipe, etc.). Fibers, solutions, minerals and composites as a growing medium, which do not include soil [9;11;14;17;24;27].

Ebb and flow system. Plant roots through this system from time to time works by flooding, performed with nutrient solution (Nicolae et al., 2006) [5;10;14;21;28-30]. The main part of this system is 4 growing trays for growing plants (Fig. 1). Programmable timer 1 start the irrigation pump water or nutrient solution into the cultivation tray 4. With nutrient solution is filled to the set height (restart valve 8).

Of this kind watering and feeding the plant formed at the root reduces the likelihood of various pathogens [31]. Plants of this species watering and feeding for many years is in use. It is growing plants are placed in trays, is also replenished with nutrients [32]. This technology is used in feed production rarely used, because it is different hydroponic technologies compared to his showed ineffectiveness [12].

Advantages:

- reconstitute the nutrient solution can be used;
- pathogens in green fodder probability of occurrence to be low;
- uniform germination of seeds;
- low production costs.

Disadvantages:

-in the feeding medium salts and minerals sediments can be easily formed;
- roots of plants may interfere with the flow of the solution.

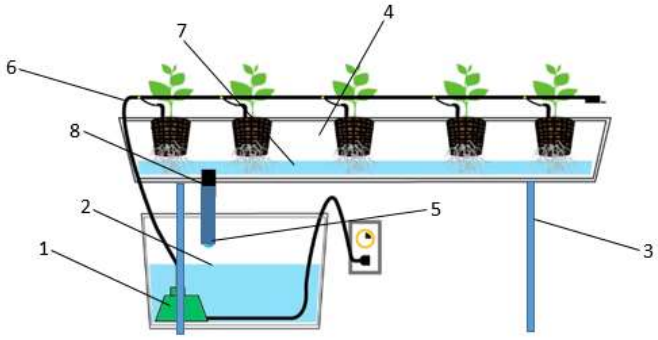

Figure 1. Technological scheme of the power supply system:
1 - pump, 2 - container containing nutrient solution, 3 - frame, 4 - cultivation tray, 5 - solution return pipe, 6 - solution supply pipe, 7 - solution level on the cultivation shelf, 8 - discharge valve

Nutrient film technique (NFT). The main purpose of the nutrient film it plants watering and nutrition [32]. This system is widely adapted to the cultivation of various plants and is suitable for cereals, salads, etc. is an excellent solution for growing short-cycle plants such as. The KPT system can be made in different ways, but the most commonly used technology is that the nutrient solution is fed through a pipe 6 to a sloping tray for growing 4 (Fig. 2) [5;9;13;17;22; 27;28;30;33-36].

The thickness of the thin layer was 2-3 mm the roots through water or solution the plants feed. This technology is the filling and return of water performed on the hydroponic system is similar for the following reason, used there the presence of a pipe that allows the discharge of water or nutrient solution [32;21;28].

At the same time, this cultivation system is completely dependent on the irrigation pump, which provides the plant feeding system [32].

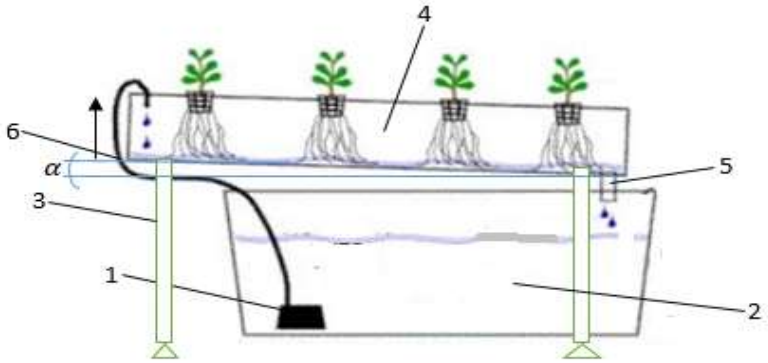

Figure 2. Floor correction method technological scheme:
1- pump, 2 - feed solution bowl, 3 - frame, 4 - cultivation tray, 5 - solution return tube, 6 - solution supply tube, α- shelf angle

Advantages:

- in the irrigation system feeding solution continuous movement;
- to grow green fodder is the most efficient hydroponic system;
- absence of clogged parts;
- low cost of nutrient solution.

Disadvantages:

- water flows down due to the slope of the seed tray;
- The upper surface may not be completely moistened due to water leaking from the bottom of the seed.

Structurally, this system consists of two main components: cultivation tray and a tank containing nutrient solution containing dissolved macro- and micronutrients. The support of the system is angled so that the water does not stop flowing along the tray. Spilled solution goes to the water reservoir [23;30;32].

This system produces green fodder can be used for. In the past, this technology was widely used in salad growing, but recently on this technology the green fodder is used for growing grass by growing different grains. These trays are usually much wider than the trays [5;7;10;11;14]. Trays grow lettuce will be faster than intended. Grows well in warm places with low humidity, but should be free of mold and pathogens [5;9;10;14;17;30-32;36]. It should be noted that this technology is currently an effective production of hydroponics is the only variant of the species. This system installation is easy. The slope of the racks increases productivity. When the slope is less than 5%, it indicates low productivity [1;3;5;10;34]. This indicates that the nutrient solution is not evenly distributed. On this basis, it is necessary to optimize the distribution of the solution on the shelves [5;8-10;14;17;18;23;29;31;37;38].

a) b)

Figure 3. In cultivation trays growing green grass LED (a) and a fluorescent lamp (b) using cultivation is shown

Aeroponics. In the root zone of the plant by humidifying the air cultivation of plants called aeroponics, it has roots spraying nutrient solution cultivation through called aerosols [2;4;7;19;39;40]. This is a concept and plants from the environment air feeding in use recently. This idea is natural near the waterfall in rocky places of plants came from the control of growth. They are waterfalls of plants on the nearby rocks observed to grow well, but the roots hung in the open air [5;10;11;14].

Water the roots without immersion from time to time high pressure solution through the injector sprayed, shown in Figure 4. This type of irrigation and nutrition the roots of plants with oxygen and nutrients with a high level provides. Unused water and nutrients substances nutrient solution returns to the tank, the nutrient solution from here used for re-irrigation [7;8;38].

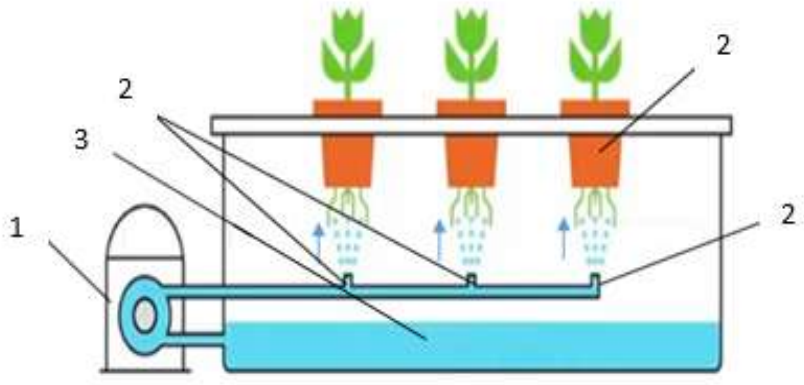

Figure 4. Technological plan of aeroponics:
1 - pump, 2 - nozzle, 3 - capacity for nutrient solutions, 4 - jars for growing plants.

Advantages:
- High oxygen content in plant roots;
- Plants rapid growth;
- Nutrient solution reuse.

Disadvantages:
- High pH fluctuations;
- The system is completely structured is fodder unfit for production;
- Common root diseases;
- Holes often clogged;
- If the roots are not watered, there is a risk of drying out.

The main disadvantage of this system is depends on the irrigation system. The roots of plants are permanent should be moist. When moisture evaporates, the roots dry out quickly. The roots die. To prevent this, in case of pump or injection system failure, Continuing the process of spraying (irrigation) receiving backup mechanisms it is important to have [41].

The advantage of this cultivation system is the productivity of plants in the process of watering / spraying and high oxygen content. Scientists use this technology grown using other crops alternative to soilless systems several times higher than that gives the product proved [3;5;12;19]. This is a great advantage, and the main reason is aerosol for root cultivation spraying technology on plants oxygen to other systems
gives much more than [14].

Despite the valuable advantages of this system, it is very difficult to grow large quantities of fodder. At the same time, in vertical agriculture it is a growing technology significantly increases the humidity in the room, this increases the likelihood of various pathogens in the feed [14].

Deep water culture system. Deep water culture (DWC) - the roots of these plants nutrients and in an oxygen solution filled with water hydroponic method of cultivation by continuous holding (Fig. 5) [5;8;9;11;12;14;27;31].

Plants in this system according to the schedule of irrigation differs from other systems in this way (Sardare, Admane 2013). The main part of this system - The plants grown in 1 - water reservoir. The tank is filled with water or nutrient solution. This is an important part of the system, so there water composition monitored and level observed [3;5;8-12;14;22;27;31;32;38].

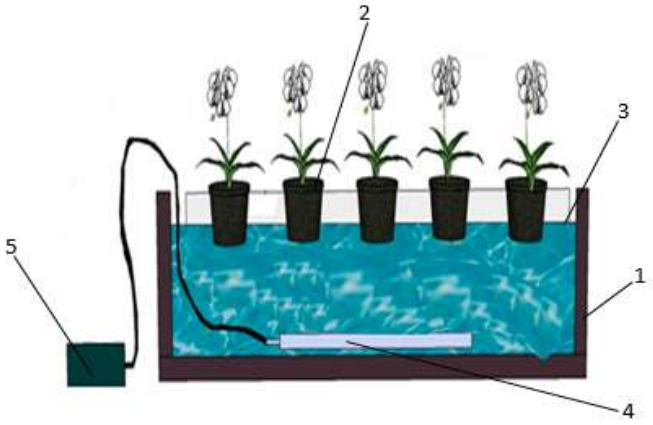

Figure 5. Cultivation in deep water technological plan:
1 - container of nutrient solution, 2 - capacity of plants for cultivation,
3 - level of nutrient solutions, 4 - air distributor, 5 - air pump

Advantages:
- loves moisture, suitable for short-cycle plants;
- the roots of the plant large mass allows to grow;
- plants are rarely grown, sheet performance is high.

- system device original installation low cost.

Disadvantages:

- To grow plants availability of the necessary environment;
- Grown by this system plants are prone to root diseases;
- Due to the large growth of roots, it closes irrigation cavities;
- Plants in this system the absolute volume of cultivation insufficient on the part of.

Wick system. In the capillary system, the roots of the plant are placed in a tray, in a jar or other absorbent medium in capillary form is fed by a strip of porous material immersed in the incoming liquid (Fig. 6) [6]. Usually for efficiency purposes such systems of plants with enough water or nutrients to provide irrigation uses multiple fields. The system itself is normal feeding solution [5;9;11-13;30;31;33].

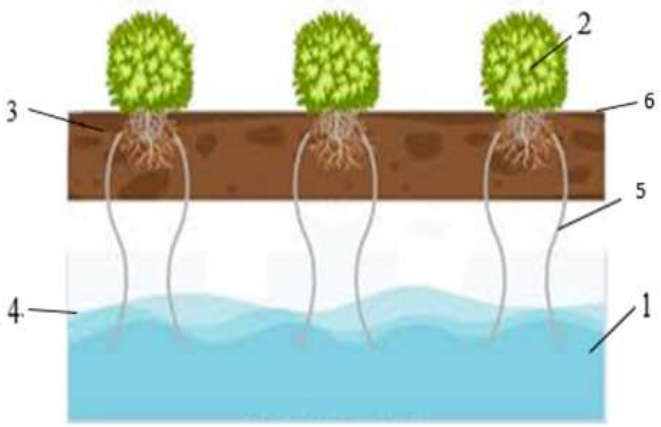

Figure 6. Technological plan of the capillary system:
1 - tank with nutrient solution; 2 - plant; 3 - solution absorption medium; 4 - level of nutrient solution; 5 - porous material strip; 6 - growing tray.

Advantages:

The system is like that does not require much maintenance

Disadvantages:

- This system is a nutrient solution which requires a lot not suitable for plants;
- System installation the cost is high;
- For upright plants is inconvenient;
- This system is fodder not suitable for cooking.

Irrigation system most important is part of, because of the plants moisture is not delivered properly the necessary nutrients amount can't get it. Such systems when using choose the most effective it is better to use. Wet absorbent material when you choose large amounts of water absorbent properties it depends and the right choice also protected from rot should be taken into account [5;9;11] - [13;30;31;33]. In such systems most commonly used materials include: fibrous ropes; propylene felt manufactured belts; cotton threads; knitted polyurethane yarns; wool felts; wool ropes or ribbons; nylon cords; old clothes or blankets fabrics, etc.

Drip dystem. Drip technology - active hydroponic system. It plants with nutrients and for regular feeding with water uses a pump (Fig. 7). This system is in the literature "Leakage" or micro-irrigation system also called [15]. As the name suggests, system water or nutrient solutions to the root zone of the plant uses small hoses for direct delivery [12].

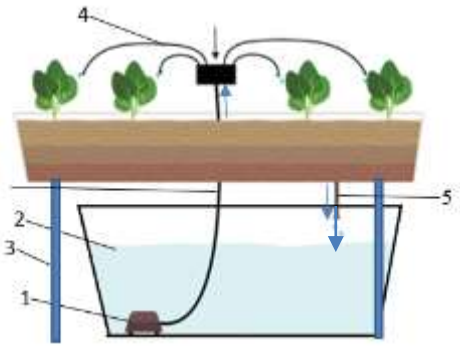

Figure 7. Technological plan of drip irrigation system:
1 - pump, 2 - nutrient solution in the tank, 3 - carcass, 4 - irrigation hose,
5 - solution return pipe

Advantages:
- In any environment can be used;
- Nutrient solutions high absorption.

Disadvantages
- The system can easily become clogged;
- the system for fodder production is inefficient;
- requires frequent maintenance.

The main advantage of this technology is that the system uses less water. Such cultivation technology in plants in the open with water and nutrients both to ensure widely used. This is the advantage of the system - it is in both soil and hydroponics works well in growing environments.
Its purpose is use of water for crops is to increase efficiency. Subsequently mentioned above drip method in hydroponics successfully used.

Animals in the country all year round balanced feeding provided farms a large number is constant there is no feed base. Therefore, fodder production than grain production requires little attention, writes on the pages of the publication. KazakhZerno.kz Employee of "ASSRC" LLP. A. И. Baraev "VA Yurchenko. In these farms the cultivation of green fodder hydroponic technology input first, necessary in winter microclimate maintenance braked at a high cost. It should be noted that to heat and heat water part of the fixed cost as electricity.

Hence the dung material working on the basis of cheap, exploitation simple and upper quality electricity the development of electric (heat and gas) generators that can produce and provide heat (at zero cost) is an urgent scientific and practical problem.

Conclusion.

In this article we have considered the main types of hydroponic systems. This system is used in the preparation of animal feed we have seen that key issues can be addressed. Cultivated by hydroponic methods green fodder for small farms high quality product economic result is effective. But in our country this system of farms the reason for the low prevalence among it is the necessary microclimate with high losses in winter is calculated. So this is our system widespread in the country efficient heating installation of installations is directly related.

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ЖАСЫЛ МАЛ АЗЫҒЫН ӨСІРУГЕ АРНАЛҒАН ГИДРОПОНИКАЛЫҚ ҚҰРЫЛҒЫЛАРҒА ӘДЕБИЕТТІК ШОЛУ

Аңдатпа.

Дәстүрлі жасыл мал азығын өсіру көп жерді қажет етеді, сонымен қатар мұндай өсіруде метрологиялық жағдайға байланысты су мен топырақтың қоректік заттарын көп сіңіріп өседі. Бұл жағдайда өсіруге белгілі бір шығындар қажет және күн ыстық болған жылдары күйіп қалу қаупі бар. Мұндай факторлардың әсері өсіруді азайтудың бір жолы - гидропоникалық әдіс. Технология негізінде өсімдіктерге қоректік заттардың берілуін зерттеу барысында гидропоникалық жүйелердің (HS) келесі алты түрі қарастырылады: көтерілетін және түсетін су; қоректік ерітіндідегі HS; аэропоника; су дақылдарының HS; тамшылатып суару HS. Сонымен бірге, жасыл мал азығын өндіруде HS дизайнына шолу жасалып, олардың артықшылықтары мен кемшіліктері қарастырылды.

HS трансферттік өсіру технологиясы ретінде жасыл жемшөп қоректік заттарын өсіруде тиімді. Бұл технологиямен азықтық шөптерді өсіру жабық жүйеде өтетіндіктен, жем ерітіндісін осы жүйеге көшіруді автоматтандыру оңай. Технологиялық мақсатта тенденцияларды бақылау үшін гидропоникалық жем технологиясын оңтайландыру автоматтандыру құралдарын (МАЕ) жаңғыртуды талап етеді.

Кілттік сөздер: *жасыл жем, гидропоникалық қоректік зат, гидропоникалық жүйелер, азықтандыру әдісі.*

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ОБЗОР ЛИТЕРАТУРЫ ПО ГИДРОПОННЫМ УСТРОЙСТВАМ ДЛЯ ВЫРАЩИВАНИЯ ЗЕЛЕНЫХ КОРМОВ

Аннотация.

Выращивание традиционных зеленых кормов требует много земли, но также растет с поглощением большого количества воды и питательных веществ из почвы, в зависимости от метрологических условий при таком выращивании. В этом случае определенных затрат на выращивание требует и годы, когда палящее солнце рискуют получить ожоги. Влияние

таких факторов одним из способов уменьшения посевов является гидропонный метод. В ходе исследования передачи питательных веществ растениям на основе технологии рассматриваются следующие шесть типов гидропонных систем (ГС): восходящая и нисходящая вода; HS в питательном растворе; аэропоника; HS водных культур; капельное орошение HS. В то же время ГС в производстве зеленых кормов был сделан обзор конструкции, рассмотрены их достоинства и недостатки.

HS эффективен при выращивании питательных веществ зеленых кормов как технология выращивания путем передачи. С помощью этой технологии выращивание кормовых трав, поскольку оно происходит в закрытой системе, кормить раствор в этой системе автоматизации передачи легко. Оптимизация технологии гидропонного питания для управления тенденциями в технологических целях требует модернизации средств автоматизации (МАЭ).

Ключевые слова: *зеленый корм, гидропонное питательное вещество, гидропонные системы, способ кормления.*

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ДОЛАНА ҚАЛЕМШЕЛЕРІНІҢ РЕГЕНЕРАТИВТІК ҚАБІЛЕТІ

Андатпа

Мақалада Қазақстанның оңтүстік-шығысындағы жылыжайларда долананың бес түрін вегетативті көбейту туралы материалдар ұсынылған. Жасыл қалемшелерді жинау үшін, оларды бұтақтану басталғанға дейін жылдық өсінділердің қалыптасу кезеңін қамтитын күндер анықталды. Қалемшені отырғызу алдында ынталандыру үшін келесі өсу заттары қолданылды: гетероауксин (100, 150 мг/л) және корневин (100, 150 мг/л) 24 сағат экспозицияда; қарапайым су тәжірибеде бақылау ретінде қызмет етті. Тәжірибе жүзінде зерттелген өсімдіктердегі тамыр түзу процесінің гетерогендігі анықталды. Жалпы, зерттелген долана түрлерінің жасыл қалемшелерінің тамырлану деңгейі төмен болып шықты және 6-дан 32% -ға дейін. Долананың қалемшелерін кесу үшін ең жақсы кезең - мамырдың екінші он күндігі. Қазақстан аумағында долананы барлық облыстардағы орман алқаптарына енгізуге болады, бірақ бұл ретте орман тұқымдарын аудандастыруды ескере отырып, тұқымдарды жіберу ережелерін сақтауға болады. Орман шаруашылығында көбеюдің негізгі және басым әдісі тұқым болып табылады. Тұқымның көбеюі вегетативті көбеюге қарағанда бірқатар артықшылықтарға ие: жоғары өміршеңдік, тұқым өсімдіктерінің жаңа өсу жағдайларына жақсы бейімделуі және отырғызу материалының төмен құны. Вегетативті көбею аналық белгілерді сақтау үшін қолданылады.

Кілттік сөздер**:** долана, көбейту, қалемше, тамырлану, гетероауксин, корневин, интродуценттер, аборигендер.

Кіріспе. Ағаш және бұта өсімінің өсуі мен дамуының қазіргі деңгейі Қазақстанның орман өсірушілері алдында тұрған маңызды міндет болып табылады. Республиканың