

Improving condition of desert pastures by planting saxaul and cherkez plants

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Abstract. The article provides information on large degraded areas in almost all areas, of which 17.5 million hectares of dry natural pastures are allocated for cattle breeding out of 32 million hectares of desert and semi-desert areas in Uzbekistan. It is also noted that 40% of desert and semi-desert pastures have degraded pastures to varying degrees, the average productivity has decreased by 20-30%, and 8.0 million degraded pastures should be improved first. To improve the condition of degraded desert and semi-desert pastures, the authors noted that it is possible to increase their productivity by 10-15 times due to the establishment of cultural pastures by replanting nutritious wild plants and comparing their productivity. To improve the productivity and ecological restoration of degraded livestock pastures in our Republic's desert and semi-desert areas, he considered the mechanization of planting saxovul and cherkez plants from nutritious shrubs and developing a planting unit for this purpose. For this purpose, the devices used in planting the seeds of plants with the same physical and mechanical properties as the desert plants from the seeds of nutritious plants growing naturally in the wild in our Republic and foreign countries and their shortcomings have been determined.

1 Introduction

According to the United Nations (UN), in more than 100 countries, drylands occupy 30 percent of the Earth's surface, and about 2 billion people live on these lands. Given the current rate of desertification, if the scenario proposed by the UN is confirmed, by 2025, every fifth person on Earth will live in an area prone to drought. To date, more than 2 billion hectares of productive land have been degraded, and an additional 12 million hectares of land are degraded annually [1-3]

70 percent or 31.4 million of the territory of the Republic of Uzbekistan are arid and semi-arid areas subject to natural salinization, the spread of sand landslides, dust storms, and hurricanes. As a result of the Aral tragedy, the Aralkum desert was formed with an area of more than 5.5 million hectares.

Of the 32 million hectares of desert and semi-desert territories of Uzbekistan, about 17.5

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million hectares of arid natural pastures have been allocated for animal husbandry, and almost all have large areas of degraded land. On 40% of desert pastures, there was a different degree of degradation of pastures, and their average productivity decreased by 20-30%. The country has 8.0 million degraded pastures that need improvement ha of the area [4, 5].

Just as it is important to combat the degradation of pastures, it is also important to increase their productivity. Natural pasture plants are the main food source for desert cattle. Pastures are engaged in sheep breeding, including karakul, goat and horse breeding, camel breeding, and horse breeding. This means that pastures create high opportunities for solving the problem of providing livestock products to the population.

The industry's future development largely depends on the source of solid food. Unfortunately, the forage productivity of pastures does not yet meet the needs of the existing livestock. The valuable species of edible plants are disappearing.

The problem of pasture degradation also concerns the republics of Central Asia, the Russian Federation, Africa, Australia, and other continents and countries [6-8]

Desert areas are characterized by drought, harsh continental temperatures, high soil fertility, high salinity, lack of mobile nitrogen, poor vegetation cover, slow self-healing, the short growing season of most plant species, and incomplete seed reproduction.

Increasing the availability of cheap and high-quality products from pastures in the desert and semi-desert areas will largely depend primarily on increasing its forage base and improving the condition of pastures in the desert and semi-desert areas.

The scientists in this industry have developed several effective technologies; one of the main methods of cardinal improvement of natural pastures is their constant restoration and renewal by planting local perennial wild plants-shrubs and semi-shrubs, which gives good results. With the improvement of the condition of arid pastures, it was found that when organizing cultivated pastures with the planting of naturally growing forage plants, their productivity can be increased by 10-15 times compared to natural pastures [9-11].

From steppe and semi-desert pasture forage plants, saxaul and cherkez are ancient shrubby plants. Saxaul is the main tree of the desert; at the same time, it is one of the most preferred plants for the restoration of pastures' ecological and reclamation conditions of desert territories.

The created saxaul fields improve the microclimate of the nearby pasture territories and increase their productivity, the rational use of which, along with the protection of fodder pastures and livestock from strong winds, dust, and winter blizzards, is a source of nutrition for Karakul sheep and camels. Thanks to the forest protection belts (strips), pasture management is facilitated, and the introduction of circular steppe pastures into the practice of pasture farming [12].

By the formation of saxaul, mobile sands are strengthened, and the process of desertification slows down; under its influence, the wind speed decreases above the Earth's surface, and the rise of salt and sand particles into the air in the form of dust storms stops. The wind speed of a 7-year-old saxaul stops completely. The saxaul plant shrub can stop four tons of moving sand. 1ha of saxaul releases 835 kg of oxygen per year, absorbing 1135 kg of carbon dioxide. This improves the composition of the air and prevents environmental pollution.

It is important to improve crop rotations used in agriculture and introduce innovations in the industry when sowing non-crumbling seeds of saxaul and cherkez from steppe forage plants.

2 Methods

The sowing and reseeded are of great importance in the general machine complex for the cultivation of fodder plants of the steppes and semi-deserts, including saxaul and cherkez, the timely and high-quality implementation of which allows for eliminating pasture degradation and increasing their productivity, as well as reducing labor and other costs, while simultaneously stopping the movement of sands.

To develop the design of seeders for sowing seeds of saxaul and cherkez, an analysis of the work processes and technological capabilities of seeders recommended for sowing non-scattered seeds was carried out. To mechanize the sowing of unscattered seeds of fodder plants of deserts and semi-deserts in the world and Uzbekistan, converted experimental samples and installations of seeders or sowing machines were made [13-17].

However, because the seeds of steppe and semi-desert forage plants are harvested by manual labor, their seeds have low purity (20-25%), a small volume (weight of 1000 seeds 3-4 g), low density (90-120 kg / m³), humidity above 45-50%, not friable, easily damaged. Their cleaning and drying is difficult due to the lack of technical means and labor resources on millions of hectares of remote desert and semi-desert. Therefore, they are sown as a seed mixture without cleaning. As a result, the non-crumbling, moisture-intensive, and easily damaged seed mixture is compacted and clogged inside the seeder bunkers during the sowing process. Inside the hopper, suction, and transmission (rotary, shovel, screw, and others), propellers and transmitters of various designs are offered for scooping up clogged piles of seed mixtures and pushing them to the seed hole of the hopper. Fixing blanks in such structures inside an extensive hopper occurs due to the forced dragging of easily damaged seeds. In contrast, they are damaged due to constant mechanical action, and their biological germination is reduced. In addition, due to the small change in the range of movement of seeds inside the extensive hopper, only a certain part of the seeds is delivered to the planting pit. In contrast, the rest of the seeds remain inside the hopper, and the planting process stops when the seeds are unloaded from the hopper.

The studies were mainly focused on the issues of unloading seeds from the hopper, and the legislation on the movement of undamaged seeds in the hopper was not studied. Such aggregates do not meet the requirements of agricultural technology, which are laid when planting seeds that do not crumble, have high humidity, and are easily damaged. So, the problem of sowing seeds of saxaul and cherkez has not been solved.

3 Results and Discussion

Based on the goals and objectives of the study, as well as the analysis of studies conducted to study the shortcomings of the technical workflow of the devices mentioned above, to eliminate the existing shortcomings and solve the problem of mechanization of sowing seeds of saxaul and cherkez, which do not scatter over the entire area of the field in rows, with the release of seeds in the prescribed amount, the technology and design of the seed drill have been created, which allows sowing seeds within the regulatory interval and at a shallow depth, while not clogging seeds from inside the hopper and without negatively affecting their biological fertility. The newly proposed technology and the seeder's design and technological process are protected by a patent of the Republic of Uzbekistan [18, 19, 20]. The novelty of the design of the seeder and the technological workflow lies in the fact that a trapezoidal hopper consisting of two parts is recommended for the row in which the seeds are sown.

The first upper part of the proposed trapezoidal hopper will be made in a rectangular design, and it will be installed on the seeder at an angle of 90⁰ vertically to the horizon. In this case, the seeds inside the hopper installed will also be at an angle of 90⁰ vertically to

the horizon. This angle is greater than the angle of friction of the saxaul and the cherkez on the metal surface (42° - 45°). The first part of the hopper has no mechanical effect on the seeds inside and allows the seeds to move down due to gravity. The arrangement of seeds in this position on the right rectangular part of the trapezoidal hopper creates conditions: firstly, it provides a smooth, uniform movement of the seed mixture inside the hopper downwards, without clogging the gaps between its walls, without compacting them and without reducing the biological productivity of seeds, without adversely affecting them; secondly, light weight allows you to make a hopper for saxaul and cherkez seeds with a small density in the required volume. This, in turn, does not require frequent filling of the hopper with seeds for long-term storage over large areas.

To reduce the mechanical impact on seeds, a seed separator is installed inside the lower second section of the seeder hopper, which ensures uniform steady sifting and enrichment of seeds, and a seed separator-drum with small-sized normalizing rods separating the number of seeds set for sowing within the normative interval, and in its lower part-a seed reducer and a seed conductor of conical design. The lower part of the drill is equipped with a rubber seed puller.

From the first upper part of the seeder hopper, its second part is made in the form of a small trapezoidal structure with a lower base, which ensures a uniform flow of the seed mixture. Inside the lower second part of the hopper, there is a small seed drill and a drum of a seed separator with leveling bars.

When the drill and the seed separator drum rotate, which corresponds to the size of the drill hole in the second lower part of the hopper, the seed mixture in the first rectangular part of the hopper slides off its lower second inclined side of the wall and begins to fall into the drill and the separator drum. Here, the side walls of the second part of the bottom of the hopper are made with a variable angle of inclination relative to the seed drill and the drum of the seed separator, which ensures the installation of saxaul and cherkez seeds and other seed seeds at any angle greater than the angle of friction on the metal surface (35° - 41°), as well as a uniform and steady flow of seeds through the inclined walls of the second part of the bottom of the hopper. Here, the seed mixture entering the seeder enters the sorting drums of the separating drum in a uniform and stable enrichment. Then they are separated in a fixed amount using dosing rods, and the seeds are planted in the ground through a seed guide, and the seeds are sealed to a depth of 2 cm using a chain drill.

For the purpose of mechanized sowing of saxaul and cherkez seeds, an experimental sample of a seed drill was developed. It is used in connection with the plow of the machine-tractor unit as part of the MTZ-80.10 tractor and the plow PLN-3-35.

The technological process of the proposed seeder is shown in Figure 1 below. The technological process of operation of the seeder in the machine-tractor unit is as follows. Before starting work, the hopper is filled with 5 seeds. When the machine-tractor unit moves across the field, the wheels of the seeder 2 transmit rotational motion through the chain drive 3 to the gearbox 4. The gearbox 4, in turn, transmits rotational motion to the seed drum 5, in which the seeder 6 is installed inside the hopper, and the normalizing rods 8 to the drum 7 of the seeder. Seeds enriched with the same and stable rod, with the help of a seed chopper 6, are separated through the rods 5 for seedlings of the drum 7 of the seed chopper of the hopper 8. The seedling mixture, which increases in the upper part of the drum 7, is filled with seeds of 8 normalizing rods, which are released in a row due to its rotational movement. Further, following the technological process, seeds from the normalizing rods 8, the seed guide 9, the seed guide 10, and the rubber seed guide 11 are lowered into the furrow formed by the machine-tractor unit plug; the seeds are buried with a chain loader of seeds 12. The purpose of sowing seeds in the furrow using this technology is the long-term preservation of moisture accumulated during winter precipitation. Moisture in the soil will provide seeds with early spring germination.

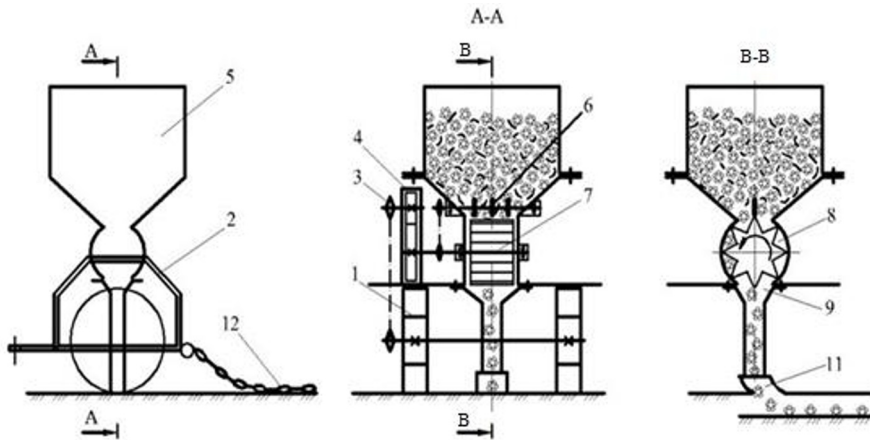


Fig. 1. Design scheme of seeder and technological process of work

Sowing seeds in a given amount is carried out using a reducer 1 mounted on the frame of the seeder 4, by installing the required number of revolutions of the seed separator 6 and the drum of the seed separator 7. In addition, due to the trapezoidal arrangement of the bottom of the second part of the seeder hopper 5 and the angle of inclination of its walls concerning the seed separator 6 and the seed separator drum 7 at an angle greater than the angle of natural friction of seeds on the metal surface, uniform and steady lowering of seeds into the hopper 6 and the normalizing rods of the seed separator drum 7 at the bottom of the second part of the hopper 5 is ensured, without clogging, damage, negative impact on their biological germination. The normalizing rods 5 of the seed separator of the drum 7, installed in the second section of the hopper of the seeder 8, ensure sowing within the normative interval, separating small, non-crumbling seeds of different sizes in the prescribed amount.

The experimental studies were carried out within the framework of the "Green Shield" program organized around the city of Bukhara, on the desert sandy areas of "Kyzylkum" belonging to the State Forestry of the Peshkum district [21]. The research was conducted on a prototype seeder (Fig.2), which sowed saxaul and cherkez non-crumbling seeds.

Tests on saxaul and Circassian sowing seeds were carried out at Machine-tractor unit speeds of 1,11-1,88 m/s. The uneven relief of desert areas and sandy soils accumulating on them around semi-shrubby vegetation and other similar obstacles do not allow the machine-tractor unit to move at speeds above 1.55 m/s. Although reducing the speed of the machine-tractor unit to 1.55 m/s ensured the sowing process, using the unit led to an increase in its cost and a decrease in labor productivity.

In the tests, the seeds are sown on top of the soil in a furrow formed by plowing with a machine-tractor unit plow and buried together with the soil using a chain square. Field experiments of the seeder were conducted in January-February 2020 with the participation of an expert group consisting of experts from industry organizations. At the same time, field experiments were conducted based on standard methods and regulatory documents. During the experiments on 76 hectares of desert sandy soils, the seeds of saxaul and Circassian were qualitatively sown with a given normative interval and depth of embedding.

The research of the seeder was carried out according to the following parameters:

- the number of revolutions of the drum of the seed separator-26-34 r/pm;
- the speed of the machine-tractor unit is 1,11-1,88 m/s.

At different speeds, the machine-tractor unit was changed by changing the gear ratio of

the tractor gearbox, and the ratio of the distance determined the actual speed traveled to time.

In field experiments, it was observed that at the speed of the Machine-tractor unit 1,11-1,88 m/s, it is required to sow seeds in a given standard interval and to a depth, separating them from seeds in a given amount.



Fig. 2. Process of sowing seeds of saxaul and cherkez using experimental seeder (side view)

The saxaul seeds from Karaulbazar State Forestry were used in the field experiments. In contrast, cherkez seeds were brought by specialists of the Scientific Research Institute of Karakul Breeding and Desert Ecology.

In field experiments, first of all, the following indicators of seeds prepared for sowing were determined: seed purity 20-25%, seed fertility 40-45%;

These indicators were determined in the laboratory of the Center by specialists of the Bukhara Scientific and Production Center for Seed Production of desert-pasture plants participating in field tests of the seeder.

One of the important indicators of the seed drill is that the seed separator drum with normalizing rods in it performs high-quality sowing, separating seeds in a given amount and without damaging them within the regulatory interval. This indicator directly affects sown seeds' biological germination and fertility in the field. In field experiments, to determine the number of seeds falling on the soil of the furrows plowed by the plow and the indicators of its damage, samples were taken from the drill drum every 100 meters during the technological operation of the drill. At the same time, the experiment was repeated 10 times. During the test, the seed consumption was checked in several positions. As a result, at a distance of 100 meters, it was found that 2 kg or 0.13 million pieces of seeds are sown per hectare of pure seed. Considering that the mass of 1000 grains of saxaul seeds is, on average, 3 g, the number of seeds of the 2nd class is 0.67 million pieces. With the germination of saxaul seeds at 60-75%, 84 thousand pieces of saxaul seeds germinate from each hectare. This indicator meets the agrotechnical requirements for sowing saxaul seeds. Saxaul bushes planted in thicker soil can decrease pasture productivity, negatively affecting the growth and development of other plants in the pasture.

In the experiments, the seeders, having isolated seeds in a given quantity and the quality of sowing in standard intervals, were carried out to compare the uniform and stable sowing of seeds buried in-furrow soil obtained by plowing and plowing with a plow machine-

tractor unit on sandy soils, compared with those sown by the power of ash. At the same time, higher efficiency and productivity of the proposed seeder were revealed.

4 Conclusions

1. In Uzbekistan, 32 million hectares are occupied by desert and semi-desert territories, and about 17.5 million hectares fall on arid, natural pastures reserved for animal husbandry. In all areas of natural pastures of steppe cattle breeding of the Republic, some areas have undergone significant degradation. On 40% of steppe pastures, pastures were degraded of varying degrees, and their average yield decreased by 20-30%.

2. A seeder was created that sowed the seeds of saxaul and cherkez. In field experiments, it was found that at the machine-tractor unit speed of 1.11-1.88 m / s, it is required to sow seeds in a given standard interval and to a depth, separating them from seeds in a given amount.

3. In experiments, it was found that for sowing saxaul and cherkez seeds with a given normative interval of the number of seeds of 13-14 pcs., the slope of the side walls of the hopper is 45⁰, the number of revolutions of the seed separator drum is 30 r/pm the number of normalizing rods is 8 pcs., and the speed of the machine-tractor unit is 1.55 m/s.

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