

**RESOURCE CONSERVATION OF THE FEED BASE IN ARID
LIVESTOCK FARMING**

<https://doi.org/10.5281/zenodo.17164393>

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The development and application of resource-saving, high-quality, and high-performance machines for harvesting desert fodder plants used in the development of arid pastures and obtaining high yields from them occupies a leading place in the world. Considering that desert fodder plants are currently grown on an area of 20.0 million hectares worldwide [1], the development of energy and resource - saving, high-performance, and high-quality harvesting machines is one of the important tasks. In this regard, much attention is being paid to the development and application of machines for harvesting desert fodder plants [2].

One of the leading sectors of agricultural production in Uzbekistan is karakul sheep breeding and arid animal husbandry in general, which are kept almost all year round on natural desert and semi-desert (arid) pastures. The feed base is the foundation for maintaining and further increasing the population of Karakul sheep and other animals.

The condition of natural pastures and the availability of sufficient feed throughout all seasons of the year are decisive factors for the further development of the industry. Despite the low yield (2–5 centners per hectare) of feed crops on natural pastures and significant fluctuations between years and seasons, they are recognized as the cheapest source of feed.

Year-round grazing of sheep (Fig. 1), especially when unsystematic and overloaded, leads to a reduction in the vegetation cover of pastures and their degradation. This process progresses during dry years, which occur every 4–5 years, and sometimes every 2–3 years.



Fig. 1. Year-round grazing of sheep on natural pastures

The most difficult period for Karakul sheep is wintering, when they must be fed hay and concentrated feed. The amount of hay required is determined by the number of animals and the feeding rates during the winter period. Currently, hay is harvested manually using a scythe, which is an inefficient and environmentally hazardous method. Breaks, tears, and stretching with longitudinal cracks in the stems, which form foci of various infectious diseases, impair the subsequent regrowth of forage plants, leading to the destruction of the already sparse vegetation and, as a result, the degradation of pastures. Therefore, cutting quality criteria are one of the main evaluation indicators when selecting cutting blades [3, 4]. Thus, it is quite obvious that the problems of developing the karakul sheep breeding industry, livestock farming in general, and the ecological well-being of the republic's arid territories are linked to a guaranteed feed base for animals. A realistic way to create a guaranteed feed base is to carry out work to improve pastures, with the aim of increasing the yield of low-yield pastures to the level of high-yield pastures and above, as well as increasing the seasonality of their use throughout the year. Currently, the Scientific Research Institute of Agricultural Mechanization (NIIMSH), together with AO BMKB – Agromash and Tashkent State Agrarian University (TashGAU), are working on the development of environmentally friendly, energy-saving technology for improving pastures and machines for its implementation. During research based on the analysis of known methods for improving pastures, an environmentally friendly, energy-saving technology for improving pastures was developed, simultaneously addressing the issues of arid livestock farming, which requires hay to be harvested for the non-grazing period, as well as insurance carryover stocks, which are estimated at 20 – 30% of the total feed requirement. The fate of livestock may depend on the availability of insurance feed reserves in unfavorable years (drought, harsh winter). Therefore, it is no coincidence that karakul breeding is considered a risky industry

- it is easier to increase livestock numbers than to maintain them. Hay harvesting cannot be carried out on hayfields or artesian irrigation areas due to the limited nature of the latter. Therefore, today and in the foreseeable future, hay for Karakul sheep will be harvested from natural pastures. At the same time, the specific growing conditions of desert coarse-stemmed grasses, low yield, bumpy micro-relief, and abrasive pasture environment [5, 6] do not allow hay to be harvested using traditional methods and existing machinery. With low yields of forage grasses on pastures (20–50 g/m²), it is impossible to use conventional mowers, if only because it is practically impossible to collect the mowed plants. Therefore, mowing hay from natural pastures must be accompanied by the accumulation of hay in the mower's bunker, followed by the unloading of small haystacks onto the field. Currently, there are no such harvesting machines, and hay from natural pastures is harvested manually using the ketmen method (Fig. 2) – this is labor-intensive, inefficient, and, most importantly, environmentally harmful (Fig. 3).



Fig. 2. Selective cutting of desert forage plants



Fig. 3. Ecological damage to the plant community of pastures

Resource-saving technology and desert mowers are required, taking into account the specifics of the area and environmental conditions. As part of applied project A-13-064, the NIIMSH, in collaboration with the design organization AO BMKB – Agromash, has developed an improved technology for harvesting hay from natural pastures and a special mower-rake (Fig. 4).

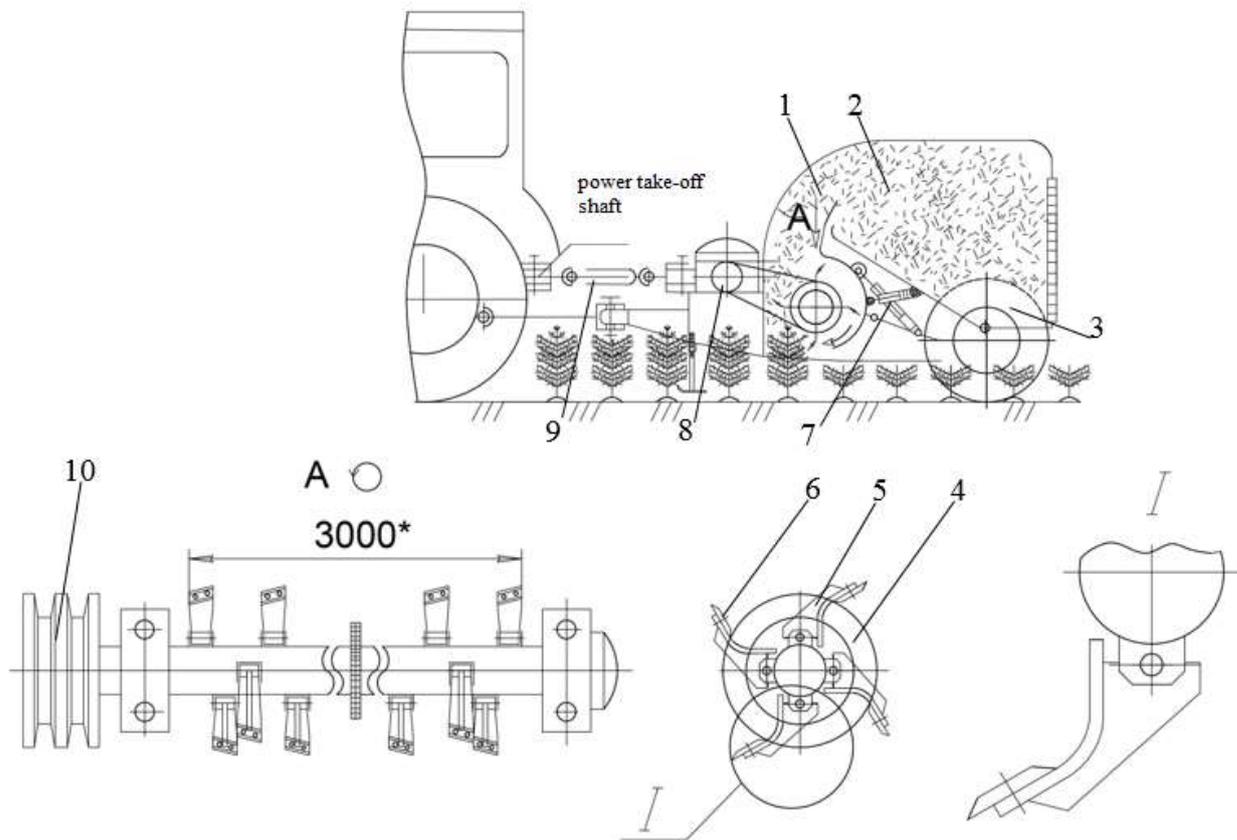
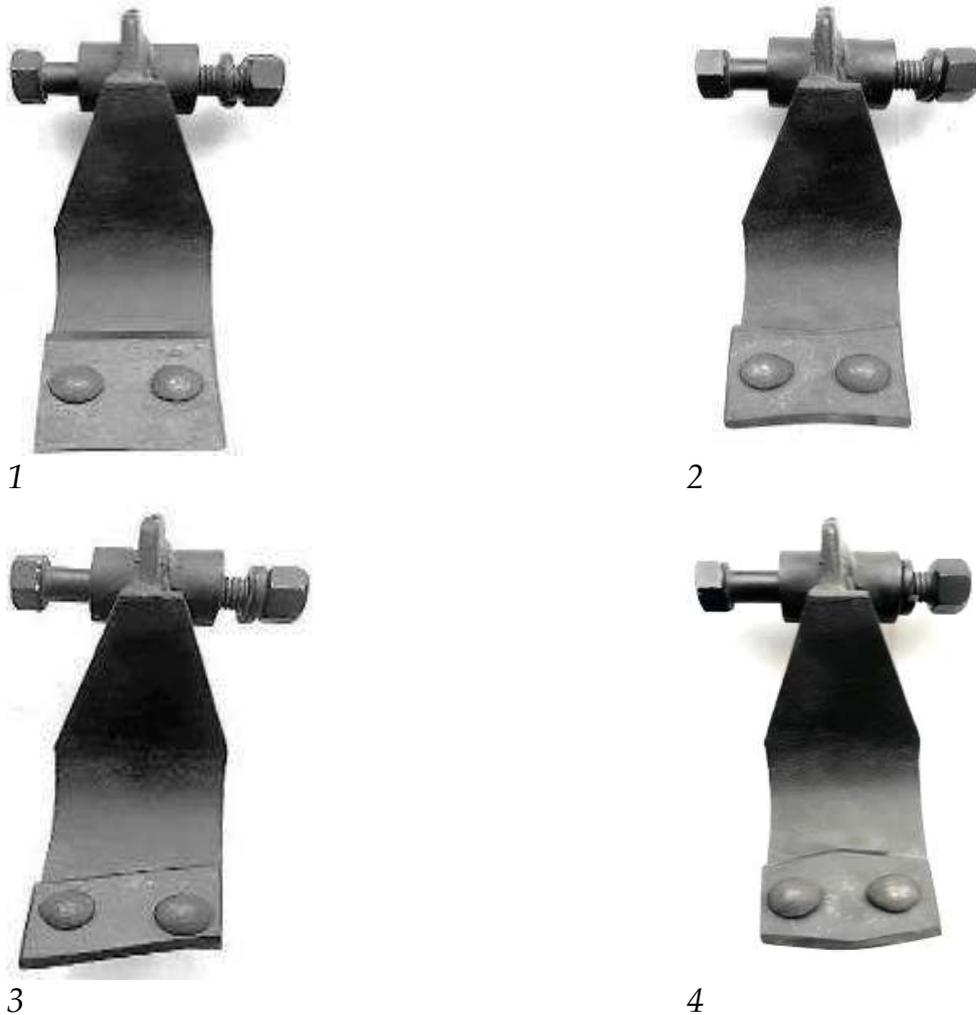


Fig. 4. Design and technological diagram of the desert mower-rake KPP-3 in an aggregated state

During operation, when a tractor with a mounted mower is moving across a field, the cutting blades 6, which are attached to the hinged blades 5 of the rotary drum 4, rotate along the direction of movement of the unit, cut the plant stems, and throw them through the deflector pipe 1 into the rear mesh hopper 2. Abrasive dust is discharged from the hopper due to the energy of the throw and the air flow created by the rotary drum 4. The technology for harvesting hay from natural pastures consists of mowing grass, collecting it in the storage hopper of the mower-rake, and periodically unloading small rakes.

The serial cutting blades of the rotary drum of the KPP-3 desert mower-rake form a torn cut of the plant stem when mowing forage plants, which increases the degradation of pastures. Joint scientific research by the NIIMSH and TashGAU has conducted comparative tests of existing and experimental working parts of the rotary drum of the desert mower-rake. The tests were carried out with serial cutting knives with straight blades and with experimental cutting knives with concave, oblique, and convex blades (Fig. 5).



1 - serial cutting knife with straight blades; 2 - experimental cutting knife with concave blades; 3 - experimental cutting knife with oblique blades; 4 - experimental cutting knife with convex blades.

Fig. 5. Cutting blade shapes

Comparative tests were conducted to select the cutting blade shape that would ensure high-quality cutting of desert fodder plants. The tests were carried out on a laboratory stand developed by the Research Institute of Agricultural Mechanization and Electrification. At different operating modes, samples were taken at least three times to select the optimal mode that would ensure maximum productivity within the acceptable limits of quality indicators specified in the initial requirements developed by the NIIMSH and approved by the National Center for Knowledge and Innovation in Agriculture under the Ministry of Agriculture of the Republic of Uzbekistan. The cutting blades with different shapes of the rotary drum of the desert mower-rake were compared with the initial requirements for ensuring a clean and even cut of plant stems within the permissible cutting height and mowing grass without flaws. Field trials of the KPP-3 desert mower-rake with experimental cutting blades on a rotary drum (Fig. 6) were conducted at the Aidar

karakul sheep farm and at the Atxambek Oltinboshogi and Saidjon Xamkor biznes, located in the Farish district of the Jizzakh region.



a



б

Fig. 6. Harvesting desert fodder plants (a) and unloading the cut mass into swaths (b) at the Aidar karakul sheep farm in the Farish district of the Jizzakh region.

The results of economic tests showed that the KPP-3 mower-rake with optimal parameters of experimental cutting blades performs the technological process of mowing forage crops, collecting the mowed mass in the hopper, unloading the accumulated mass from the hopper, and meets agrotechnical indicators. When operating the KPP-3 desert mower-rake equipped with experimental cutting blades, the degree of splitting of desert forage plant stems is reduced by 1.88%, and the completeness of harvesting the cut forage mass from one hectare increases to 98.5% [2]. At the same time, the effectiveness of further qualitative development of the plant community and the ecological well-being of pastures are added. Currently, the Research Institute of Animal Husbandry and Tashkent State Agrarian University are working together to implement resource-saving technology based on mower-rakers. The introduction of energy-saving machines on farms will improve pastures and hay harvesting, strengthen the overall feed base for karakul sheep breeding and arid livestock farming, creating conditions for the further development of the base and the ecological well-being of the Republic's arid pastures.

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