

# Improvement of Sowing Units to Strengthen the Feeding of Arid Livestock Breeding

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**Abstract—** This article provides information on arid and semi-arid pasture fields. They are the main feeding for grassland farming. Pastures' yield capacity needs to be maintained through improvement. The Heavy workload requires mechanization of the improvement process. Here you can see the specifications for combined sowing units to improve the arid pastures.

**Keywords:** karakulsheep raising, feeding, pastures improvement, saxaul, mechanization, modular sower, combined unit.

## I. INTRODUCTION

In Uzbekistan, pastures occupy more than 20 million hectares or 46.8% of area, whereof 17.4 million hectares are located in arid and semi-arid areas.

Arid and semi-arid pastures are the main feeding for sheep breeding, including karakulsheep raising, camel husbandry, livestock breeding, horse-breeding. These animals are out at feed on pastures for almost the year around and constitute a significant potential for livestock products supply to the population.

Pasture forages are highly nutritious, have a diverse diet, and are generally recognized as the cheapest forages, despite their relatively low yield.

Using natural pasture forages, the farming enterprises obtain cheap and high-quality products: krimmer, wool and meat.

Unfortunately, arid pastures vegetation is a very fragile ecosystem. Its resource misuse and unfavorable climate conditions result in decrease in their feed productivity and degradation. Thuswise, 16.4 million hectares of Republican pastures are degraded to a variable degree resulting in a significant damage to grassland farming. Degraded pastures

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are mainly located in the Republic of Karakalpakstan, Navoi, Bukhara, Jizzakh and Samarkand regions [1].

The stable development of the industry primarily requires the strengthening of arid livestock feeding. "Feeding strengthening" refers to restoration of degraded, low-yielding and narrowly seasonal pastures, including production of pasture plants' seeds.

Continuous improvement of pastures through sowing and undersowing of local shrubs, subshrubs, and perennial grasses is one of the main conditions to maintain pastures feeding.

Due to the heavy workload and the shortage of labor resources, the increase of arid and semi-arid pastures yielding capacity absolutely requires high-powered mechanical technologies and operative mechanical equipment to control degradation and improve pastures.

This issue is very complicated and the solving is constrained due to lack of advanced technologies and special machinery for production mechanization.

Specific edaphoclimatic conditions of arid pastures may explain machinery production constraint. The problem is complicated more due to the fact that pastures' forage plants and their seeds are sharply different from other crops in physical and mechanical properties. These plants' seeds are non-free-running or non-running, small, easily damaged, have low germination and low bulk and absolute weights.

## II. PROCEDURE OF RESEARCH

Long term practice demonstrated that the existing machinery used to mechanize crops sowing do not provide positive results when sowing seeds of arid forage plants due to these features.

Considering the problem urgency, the scientific institutions and individual researchers proposed several technical means and reequipped sowing units [2, 3, 4, 5, 6, 7].

Kazakh Scientific Research Institute of Mechanization and Electrification of Agriculture [2] developed SST-3.0 sower for saxaul seeds. However, its industrial production was not launched.

Tashkent Institute of Irrigation and Agricultural Mechanization Engineers developed a unit to improve the arid pastures. Its industrial production was not launched, too [3].

## Improvement of Sowing Units to Strengthen the Feeding of Arid Livestock Breeding

In the 90s of the past century, the Scientific and Research Institute of Agricultural Mechanization, the Scientific and Research Institute of Karakulsheep Raising and Desert Ecology, the All-Union Institute of Mechanization and the Special Design Bureau of Sibselmash did research work and designed technologies and machinery to improve arid pastures. They developed a technology of continuous pastures improvement based on minimum cultivation and engineering prototype of a combined tillage-sowing unit for technology implementation [4]. APP-3.6 machine (unit for arid and semi-arid pastures improvement) was submitted for the state testing to the Central Asian Machine Testing Station (MTS) in 1987.

On completion of testing, MTS did not recommend the machine mainly due to low reliability.

In 1989, Sibselmash submitted engineering prototype of APP-2.8 unit for semi-arid pastures improvement to the Central Asian MTS for the state qualifying test.

The device was quite complex, heavy and it was not recommended for use within MTS operation.

Thus, the technology of continuous pastures improvement based on minimum cultivation using the described machinery was resource-saving compared to continuous plowing, but was still very energy-consuming. There was no production of commercial machines. Technology adoption in practice was limited to test plots. Today, these designs are significantly outdated. Machines are not manufactured.

The above review discloses the fact that mechanical means aimed at arid and semi-arid pastures improvement are some kind of a gap within agricultural engineering constraining the deployment of pasture improvement.

Currently, pastures improvement involves tilling. The tilling provides the use of standard ploughs. Usually, the seeding involves manual sowing using trucks for tilling. Covering of seeds involves small harrow or utility heavy item attached to a truck.

Combined grain-grass seeders are used for relatively running, refined seeds of some herbs, for example, prostrate summer cypress (willow shrub). Moreover, the seeds are sown on the soil surface from the seed box through the sowing unit bypassing the seed tubes and covering work tools. Covering of seeds involves harrows or disk rollers attached to the sower.

Of course, sowing using such mechanization does not comply with the agrotechnical requirements considering the standard, uniformity and quality of seeding. There is a large overrun of seeds.

### III. RESULTS OF RESEARCH.

In recent years, BMKB-Agromash JSC manufactured a breadboard model of combined unit for pastures improvement[9]. The machine includes the frame with three rows of operating sections installed (Fig. 1).

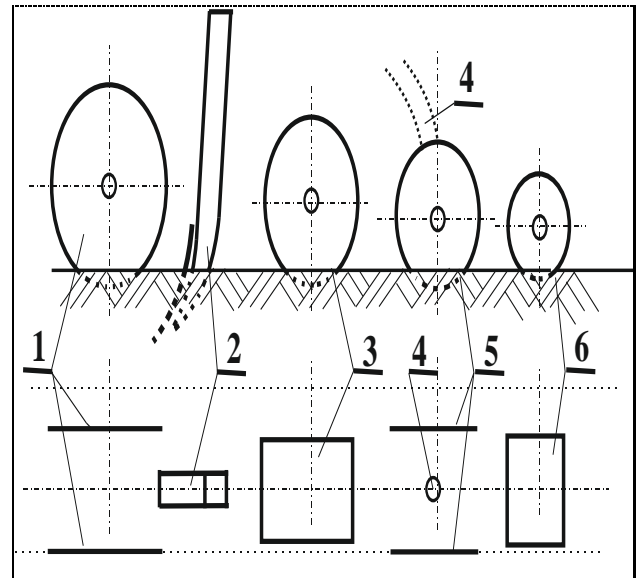


Figure 1. Operating section of combined unit.

They provide a full cycle of soil preparation, seeding and partial cover of forage plant seeds. Every row of operating sections includes twin cutting discs 1, loosening paw 2, working tool for seedbed 3, as well as sower's working tools: seed hopper, sowing unit, seed tube 4, twin windproofing disks (gouter) 5 and press wheel 6.

There was a patent for invention No. IAP 04572 received during design of unit's elements. Till-plant outfit and a utility model patent No. FAP 01122 "A unit for pastures improvement".

The machine is designed for continuous improvement of pastures and forest belt by sowing shrubs, subshrub and herbs. Its one run processes narrow strips of soil, sows and partially covers the sown seeds. Currently, BMKB-Agromash JSC implements engineering development of machine to decrease power consumption, quality of sowing and seeding, as well as to universalize the laying and seeding of pastures forage plants.

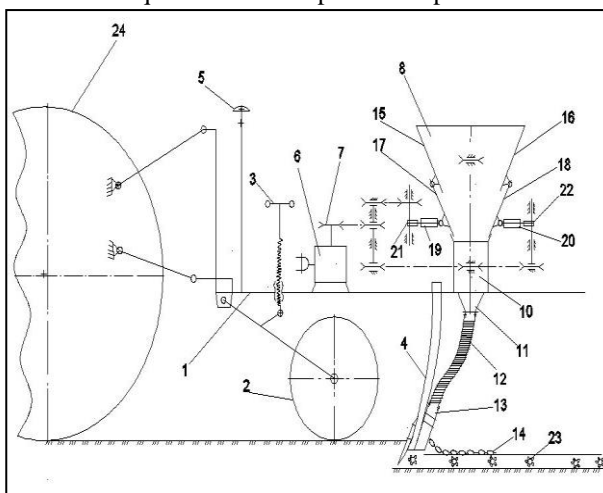
Please, see below the specifications for combined unit elements

**Table- I: Specifications for combined unit elements**

№	Name of parameter	Value of parameter
1	Type of machine	tractor-hauled
2	Attached to the tractors, t	0.9 – 1.4
3	Effective width, m	2.1
4	Weight, kg	1,190
5	Transport clearance, mm	350
6	Dimensions: length / width / height, mm	4,750 / 2,760 / 1,830
7	Lane, (number of sections)	3
8	Section working tools:	
	- number of cutting disks pairs, pcs	1
	- disk diameter, mm	380
	- disk thickness, mm	4
9	- loosening paw: number	1
	depth of loosening, cm	5 - 25
10	roller for seedbed: number, pcs	1
	type	Corrugated
	diameter, mm	340
	number of corrugated plates, pcs	9
11	Sowertwin windproofing discs: number of pairs	1
	disks diameter, mm	340
	gap between the disks, mm	100-250
	seed hopper capacity, m <sup>3</sup>	0.2
	type of seeding unit	reel-type
	seed tube	transparent
	press wheel, type	smooth
	number	1
	diameter, mm	160

Considering the urgency of feeding for arid grassland farming problem, Tashkent Institute of Irrigation and Agricultural Mechanization Engineers also develops modular sower to improve arid pastures.

Today, we have the draft sower. Patent for invention was received for it [7]. The second application for invention was filed [8]. The sower (Fig. 2) fully complies with agrotechnical requirements to improve arid pastures.



**Figure 2. Modular combined sower.**

The sower includes frame 1, balancing wheels 2, screw mechanism 3, loosening paw 4, marker 5, reducer 6, countershaft 7, hopper 8, dome disrupter 9, distributing drum 10, seeds guider 11, corrugated seed tube 12, gouter 13, chain 14, left 15, 17 and right 16, 18 walls, pushers 19-20 and cam shafts 21, 22.

The calculations determined the specifications for modular combined sower used to sow arid forage plants in the arid pastures (Table 1).

**Table- II: Specifications for modular combined sower used to sow arid forage plants**

№	Parameters	Meas. unit	Value
1	Unit movement speed	km/h	5.4-7.5
2	Unit coverage: with 70 cm planting width;	m	2.8
	with 90 cm planting width;	m	3.6
3	Number of rows processed	pcs	4
4	Unit capacity: with 2.8 m coverage;	ha/cm	6.8
	with 3.6 m coverage;	ha/cm	12.2
5	Depth of seeding	cm	0.5-2.0

#### IV. SUMMARY

The sower is high-speed, wide-coverage, attached, movable and more powerful compared to similar units.

The calculations showed that wide-covering sower will increase efficiency by 5-6 times due to increased movability, speed and sowing width. The sower provides surface tillage (0.5-2.0 cm) and seeds covering with planting width (70-90 cm). This ensures the safety and survival of arid forage plants. The sower will save fuel and lubricants by 2-3 times due to high movability and sharp decrease in idle running. The noted advantages of the sower will provide a significant economic effect.

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