To the study of conservation agriculture for sesame production in the northern areas of the republic of Karakalpakstan

B.S. Mambetnazarov1,*, B.A. Bekbanov2, A.B. Mambetnazarov3, B.A. Aybergenov2, Sh.D. Quwanishbaeva1, and B.B. Mambetnazarov4

1Karakalpak State University named after Berdakh, Nukus, Republic of Karakalpakstan, Uzbekistan
2Karakalpak Agriculture Research Institute, Chimbay districts, Republic of Karakalpakstan, Uzbekistan
3 Nukus branch of the Samarkand state university of veterinary medicine, livestock and biotechnology, Nukus, Republic of Karakalpakstan, Uzbekistan
4Karakalpak institute of agriculture and agrotechnology, Nukus, Republic of Karakalpakstan, Uzbekistan

Abstract. As a result of the use of the herbicide Zeldek extra (active ingredient Haloxyfop-p-methyl a.e. Bentosan 48% w.p.), about 70% of the death of cereal weeds and the destruction of the aerial parts of field grasses were observed. Restoration of weed roots was observed 10-15 days after spraying. The highest sesame yields using soil-protective resource-saving technology were obtained in the experimental variant with a seed sowing rate of 5 kg per 1 hectare.

1 Relevance

In recent years, due to the drying up of most of the Aral Sea, as well as climate change, the aridity of the agro-farming zone, especially the northern regions of Karakalpakstan, has been increasing. In addition to this, the flow of the Amu Darya River decreases year after year, which has led to an extreme shortage of water resources in the downstream. Farmers and peasants are forced to adapt to the current unfavorable conditions and gradually switch to growing less heavily consumed crops. One of these crops is sesame, the acreage of which is increasing due to water scarcity. Soil protection resource-saving technology plays an important role in preserving moisture and increasing soil fertility. In this regard, we are conducting research on the development of sesame cultivation technology in the conditions of the northern regions of Karakalpakstan, using methods of soil-protecting resource-saving technology.

It is well known that the use of soil-protective and resource-saving agriculture makes it possible to produce agricultural products, carefully using and saving natural resources, thereby obtaining a high and sustainable profit from agricultural activities. The technology is based on the improvement of natural biological processes on the Earth's surface and in its deep layers. Active human intervention in naturally occurring natural processes, such as

* Corresponding author E-mail: mambetnazarov@mail.ru
mechanical tillage, leads to an absolute minimum reproduction of soil fertility. Zero tillage, which includes direct methods of sowing without pre-tillage, allows to preserve the remains of plants from previous crops on the soil surface, which is essential in replenishing the loss of soil organic matter and preserving soil moisture. The object of the study is sesame varieties that are grown in the northern regions of Karakalpakstan, as well as in the Khorezm region. Material and Methods. Field experiments were carried out on irrigated lands of the experimental farm of the Chimbay district of the Republic of Karakalpakstan. The repetition of experiments is threefold. To determine the density of plants, as well as weeds, the method of laying a test plot was used, where the number of plants per 1 m² was calculated. The structural analysis of vegetation was carried out by laying test areas at each experimental site. For this purpose, the plants were pulled out by the roots and the stems were removed. The selected grids are tied with tape and marked. In laboratory conditions, the roots were cut, and the remaining mass was weighed. At the same time, the height of the plants was determined from the base of the elongated leaf to the top. The number of pods and the number of seeds in each pod were counted and the average yield was determined. Results and Conclusions. At the beginning of sesame growth, weed infestation of crops prevents the growth and development of young plants. As a result of the use of the herbicide Zeldek extra (active ingredient Haloxyphop-p-methyl a.e. Benthozan 48% v.r) about 70% of the death of cereal weeds and the destruction of the aboveground part of field grasses were observed. The restoration of weed roots was observed 10-15 days after spraying. The highest yield of sesame seeds when using methods of soil-protective resource-saving technology was obtained in the experiment variant with a seeding rate of 5 kg per 1 hectare.

2 Introduction

The main problem of agriculture in Karakalpakstan, especially in the northern regions, is the shortage of water resources. Due to the lack of water resources during the growing season, farmers are forced to grow more drought-resistant crops such as sesame, sunflower, and sorghum.

Soil protection resource-saving technology is one of the most effective technologies for growing crops, aimed at reducing the cost of agricultural production, protecting soils from water and wind erosion, as well as increasing soil fertility. Although the yield with zero tillage in the first years of application is often lower than with traditional agriculture, the absence of basic tillage before sowing can significantly reduce fuel and labor costs, which leads to a reduction in production costs and, as a result, an increase in production profitability. Zero tillage is based on the principles of conservation and improvement of soil organisms and soil organic matter, which ensures sustainable agriculture. Planting of agricultural crops without tillage, simultaneous sowing of agricultural crops with fertilizers is carried out by a special direct sowing drill. In recent years, due to the sharp rise in prices for fuel products, it has become economically inefficient to cultivate the land and plow the land in the traditional way for growing crops.

Since 2022, we have been conducting research on the use of soil-protecting resource-saving technology for sesame cultivation.

3 Material and Methods

Field experiments were carried out on irrigated lands of the experimental farm of the Chimbay district of the Republic of Karakalpakstan. The district climate, like in other
northern regions of the Republic of Karakalpakstan, is characterized by sharp
continentiality, dry air, and low precipitation. Winter is cold, summer is hot and dry, the
minimum temperature in winter reaches -34°C, and the maximum in summer reaches up to
45°C. The terrain is flat, which contributes to the unhindered passage of winds from the
north and northwest. The territory belongs to a semi-desert zone with an annual rainfall of
about 100 mm. Therefore, precipitation here does not contribute to soil moisture and
artificial irrigation is necessary for growing crops.

The soils of the Chimbay district are presented in the form of meadow-alluvial,
meadow-desert, meadow-takyr, meadow-swamp soils. The peculiarity of these soils is the
low thickness of the humus horizon (0.2-0.6 m), low humus content (0.5-1%), high
carbonate content, and presence of water-soluble salts. The soil of the experimental site is
presented in the form of medium-loamy light gray soils. The repetition of experiments is
threefold. To determine the density of plants, as well as weeds, the method of laying a test
plot was used, where the number of plants per 1 m² was calculated. The structural analysis
of vegetation was carried out by laying test areas at each experimental site. For this
purpose, the plants were pulled out by the roots and the stems were removed. The selected
grids are tied with tape and marked. In laboratory conditions, the roots were cut, and the
remaining mass was weighed. At the same time, the height of the plants was determined
from the base of the elongated leaf to the top. The number of pods and the number of seeds
in each pod were counted and the average yield was determined.

Due to the fact that there were unfavorable weather conditions during the harvest, which
prevented the use of the continuous accounting method. Therefore, the trial sheaf method
was used. The test sheaves were threshed manually in laboratory conditions, then the mass
of grain and biomass was determined.

The obtained data were processed statistically according to the field experiment method
of B.A. Dospekhov [1].

4 Results and Discussions

Recently, the population of the Republic of Karakalpakstan has been experiencing
significant difficulties from time to time due to the frequent low water in the Amu Darya
River, since the main activities are irrigated agriculture and animal husbandry.

As a result, the Amu Darya delta has become an ecological disaster zone. Attempts at
artificial watering have been reduced only to maintaining the productivity of existing
communities. Changes in the soil cover of the studied territory according to satellite images
of 1980-1985 indicated that the automorphic soil-forming process, contributing to the
development of saline lands, became the leading one [2].

The Amu Darya river flow, which entered the delta from 1944 to 1989 inclusive, was
the main component of the water factor affecting the species richness of the delta, including
forage plants. The contribution of atmospheric precipitation to the formation of surface
water resources of the delta is extremely insignificant, since their amount was minimal even
compared to other regions of Uzbekistan, and the evaporation from open water surfaces,
reed beds, irrigated lands is high [3].

The main factors reducing soil fertility in the conditions of the Republic of
Karakalpakstan are widespread salinization of soils, high level of groundwater occurrence
and their mineralization, low thickness of the humus horizon (0.2-0.4 m) and low humus
content (0.4-1.0%). In the regions located in the lower reaches of the Amu Darya, for
example, 95% of the land in the lowest sections of the Amu Darya River is saline.
Salinization of the soil causes a decrease in cotton yield by 20-30% on slightly saline lands,
by 40-60% on medium saline lands and by 80% or higher on highly saline lands [4].
Agrotechnologies currently used in agriculture in Karakalpakstan in many cases do not provide rational use of natural resources, expanded reproduction of soil fertility, ecological balance in agrobiocenosis, which ultimately inevitably lead to instability of farming in this extremely arid region. At the same time, the technology of soil protection and resource-saving agriculture (Conservation Agriculture) used in world practice has recently aroused great interest among agricultural scientists and farmers as the most sustainable, resource-saving technology that ensures sustainable reproduction of soil fertility. Although this technology usually gives positive results only after long-term use, we have already obtained some encouraging results after two years of application, and they show that the techniques and elements of zero and minimal tillage are acceptable in the extreme conditions of Karakalpakstan and their application should improve soil fertility and reduce the level of currently progressive degradation of soils and lands [5].

Cultivation of agricultural crops in the harsh conditions of Karakalpakstan has its own characteristics, and requires in-depth knowledge about the soil, about the physiological needs of plants for water and nutrients, biological and environmental characteristics of cultivated plants, as well as skills in sustainable farming in a risky farming zone. The technology of zero tillage is a modern technology of agriculture, in which the soil is not cultivated, and its surface is covered with plant and crop residues – mulch. Stubble residues completely prevent wind and water erosion, and also contribute to the preservation of moisture in the soil by reducing moisture evaporation from the soil surface [6].

The environmental benefits of using zero-tillage technology are to reduce greenhouse gas emissions by sequestering carbon and nitrogen in the soil, increase soil flora and fauna, and reduce water costs for irrigation. Economic analysis shows that farmers' costs for cultivating row crops are reduced by 70-75 percent [7].

Sesame seeds were sown in untreated soil with an ATMASA 17 seeder, as well as in an arable field (standard), where irrigation was carried out along grooves.

In standard versions, irrigation was carried out at the rate of 500 cubic meters per hectare. A gravity drip irrigation system was installed on the zero tillage site.

In the fight against weeds, the herbicide Zeldek extra was used (the active substance Haloxyphop-p-methyl a.e. Benthosan 48% v.r) for the control of cereal and dicotyledonous weeds at the stage of 5-7 sesame leaves at a rate of 1 l/ha. Spraying was carried out using an OVH-28 sprayer installed on a T-28 tractor. As a result of the herbicide use, about 70% of the death of cereal weeds and the destruction of the aboveground part of field grasses were observed. The restoration of weed roots was observed 10-15 days after spraying.

When determining the yield structure, it was found that as the sowing rate increased, the number of pods and the number of seeds on the plant decreased. The highest yield from the experimental area was obtained on the variant with a seeding rate of 5 kg, or the average yield was 12.5 kg/ha. Thus, with the expansion of sesame fields, high-quality environmentally friendly vegetable oil will be supplied to the population. So far, no oilseed crop has produced more than one hectare of vegetable oil, such as sesame. Sesame is one of the oilseeds with a high oil content in seeds at a sowing rate of 5 kg.

5 Conclusions

At the beginning of sesame growth, weed infestation of crops prevents the growth and development of young plants. As a result of the use of the herbicide Zeldek extra (active ingredient Haloxyphop-p-methyl a.e. Benthosan 48% v.r) about 70% of the death of cereal weeds and the destruction of the aboveground part of field grasses were observed. The restoration of weed roots was observed 10-15 days after spraying.
The highest yield of sesame seeds when using methods of soil-protective resource-saving technology was obtained in the experiment variant with a seeding rate of 5 kg per 1 hectare. Research in this direction continues.

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References