MINISTRY OF AGRICULTURE AND WATER MANAGEMENT
OF TURKMENISTAN

TURKMEN AGRICULTURAL INSTITUTE

CULTIVATION OF SORGHUM AND SUDAN GRASS ON SALINE AREAS

Scientific and production manual

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In the manual there are given several information due the results of researches about the role of sorghum and sudan grass in national economy and in cultivation of saline areas, productivity, types of grasses, yields, and agronomic characteristics of growing these crops in Dashoguz saline fields (care of crops, fertilizers, preparing the seeds for sowing, cultivating, harvesting, and etc.).

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INTRODUCTION

During the period of prosperity of our sovereign powerful, under the wise leadership of President Gurbanguly Berdimuhamedov, great attention is paid to increasing the crop yield, improving the agriculture, achieving the results of science, technology and engineering, advanced agricultural practices and other methods of farming.

In order to further increase crop yields, implementation of crop rotations in agriculture, improvement of soil amelioration, planting of new, quality, resistant to adverse conditions varieties, as well as ensuring salinity of each crop under different conditions. Saline areas specificity of salt tolerance and phytomeliorative capacity of saline areas requires careful scientific study. In our country, as well as in conditions of Dashoguz region, it is very important for production and considered as the most important health issue studied so far.

To a certain extent chloride and sulfate salts are widely spread on fields of our country, especially in northern Turkmenistan – in Dashoguz region, as well as on lands along streams of Turkmen lake "Altyn Asyr". Environmental problems associated with the Aral Sea have a significant impact on the spread of soil salinization in the region.

In this connection, reduction of salinity of saline lands, increase of crop yields and their introduction into crop rotation is considered an important issue.

Further reduction of salinity of medium and low saline soils, improvement of physical-mechanical properties of soil, water and air storage, chemical composition, crop yields, phytomelioration, i.e. salinity and other nutrients, intermediate and other nutrients. Scientific basis of this work is, firstly, complete and final cultivation of saline lands in crop rotation and, secondly, beginning of sowing of crops more important and profitable after cultivated crops - cotton, wheat, low-yielding, low-yielding allows transforming product into ecologically sustainable cultural zone favorable for growth of different plants and agricultural crops, useful microorganisms and other living beings.

One of the important issues is the development of saline lands along the streams of Turkmen Lake "Altyn Asyr", built and

commissioned by unprecedented efforts of the President and of great environmental importance in our country.

The use of barley, timber, maize, alfalfa and Sudan grass is very important in the development of saline soils when growing fodder crops. These salt-tolerant crops, which to some extent are salt-tolerant, lead to a decrease in salt levels in the soil over the years. Through evaporation of water from the forage crops themselves, the water table is reduced so that salts also escape to the lower soil layers. The forage crops also reduce the amount of water evaporating from the soil by shading the soil, thus lowering the water table and preventing secondary salinization of the soil.

In this connection, local salt-tolerant local fodder crops (barley, barley, maize, sorghum) as well as imported maize and sorghum have been developed on saline soils of research field of Turkmen Agricultural Institute and studies on assimilation through cultivation are started.

This manual describes tips for growing sorghum, sudan grass herb and medicinal plants in saline areas, based on scientific research carried out at the institute and gathered from the development of literature in this area.

I. JUGARA CULTIVATION ON SALINE AREAS

Sorghum is considered one of the most resilient and high-yielding fodder and food crops under drought and soil salinity conditions. Its grain serves as a valuable raw material for the production of flour, cereals and starch in industry.

In many countries where the grain is harvested, various national dishes are prepared. Sorghum grain is a valuable fodder for farm animals. In 100 kilograms of grain there are 119 kilograms of fodder. There are 23.5 fodder units in green grass, 22 in silage and 49.2 in fodder. Juice contains up to 15% lysine-rich protein and about 10-15% sugar in the stem. Young green seedlings are considered highly nutritious in the form of sweat and silage. Better a poor horse than no horse at all.

Since salt is a stable crop, it is used as a soil-absorbing crop in saline and salt-washed areas. Two harvests per year can be harvested from the grass planted for fodder. After the young plants grow, their brand new branches also serve as bluegrass.

On saline soils it is also important for crop rotation because of its ability to produce high yields under the influence of organic and mineral fertilizers. It also clears grain fields of weeds. Sprouted seedlings can be grown in protected areas to protect crops from wind gusts. For this purpose, it is recommended to plant rows every 18-20 meters in areas where sprouted young vegetables and gourds are planted.

The sorghum has a thick and long-leafed (from 1.5 to 5-6 m high) stem and a powerful root system capable of spreading to a depth of 2.5 m and a width of 60-90 cm. Thus, it significantly reduces the amount of water evaporating from the soil, reducing the air temperature near the soil, creating a favorable microclimate, lowering the groundwater table and significantly reducing the rate of landslide reclamation, preventing secondary salinization. In agriculture, lowering the groundwater table to 0.5 m is very important to prevent secondary salinization and irrigation.

Among grain crops, heat is considered the most resistant to heat, wind and drought.

One of the main features of sorghum is its ability to grow normally and produce rich yields even in saline areas to varying degrees. Therefore, it can be planted in weak and moderately saline

soils and used as a soil fertilizer. In this regard, sorghum grass is of great importance in reclaiming saline soils and in re-cropping. Long-term field experiments in Turkmen Agricultural Institute showed that even on highly saline soils it is possible to obtain rich grain and green grass (mass) yield with the help of organic and mineral fertilizers.

It is possible to sow the same area every year and get a higher yield without crop rotation. It is not recommended to plant bacteriological with bacteriological on the same plot. Plots with bacteriological should be rotated. In crop rotation young growth is sown under winter crops, grain legumes, and large tonnage crops. As a medium crop, it is very good for sowing after winter wheat. In order to prevent contamination of contaminated wheat fields by harvested grain from sown grain, it would be advisable to sow fields such as pre-wheat, maize and corn as pre-wheat crops.

1.1 Role of sorghum in crop rotation in the tilling of saline soils

Sorghum also plays an important role in crop rotation. When sown to a certain extent on saline areas, weeding reduces soil salinity, creating favorable conditions for normal growth and abundant yield of the last sown crops. Sorghum does not have high requirements for soil, and the yield on saline plots grows and yields to a different extent. Studies have shown that when weeds are sown as soil-absorbing crops on weak and moderately saline soils as well as on highly saline soils where water is washed and flushed with salt, they can be a suitable crop for cotton, wheat and melon crops.

In the research area of Turkmen Agricultural Institute during 2011-2015 Scientific work was carried out to study the effect of Sorghum on reducing soil salinity and increasing nutrient content. During the research N120 P70 + was applied in 10 t/ha of fertilizer on moderately saline soils and on retention level of nitrogen from nutrients in 0-15 cm layer of c Sorghum soil in 2011 compared to 2011 the amount of active phosphorus increased by 31 mg/kg and the amount of substituted potassium increased by 219 mg/kg. The amount of Ca2 + from mineral cations in the soil is decreased by 0.035% from March 2011 to November 2015 in the 0-15 cm soil layer. The amount of Na + also decreased by 0.061% during this period. The amount of Cl ion from anions is decreased by 0.046% in 0-15 cm soil thickness

during this period. Amount of solid residue in this soil layer decreased by 0.315% for the corresponding period.

Figure 1. Sorghum

Due to reduction of anions, cations in soil retention of solid residues in soil decreased and soil salinity shifted from moderate salinity to slightly saline level in this period. This means that the results of our research fully confirmed the possibility of reducing soil salinity through planting of salt-tolerant crops and full and proper use of mineral fertilizers.

1.2. Choosing a field for planting of Sorghum

Sorghum can be harvested on soils with different mechanical properties. Therefore, it is recommended to plant it in weak, slightly saline, moderately saline and highly saline areas after flushing water is introduced as an absorbent crop.

Well warmed, soft and well permeable soils are considered more suitable for very high yields. The planting plots should be cleared of weeds. This is because the young tree, like all grain groups, grows slowly at the beginning of the growing season, during which time it can become overgrown with weeds. This reduces the yield of the Sorghum.

1.3 Soil preparation for sowing

1.3.1. Shredding of weed residues

Proper weed cleaning is the key to higher yields. To prepare the soil for sowing after sowing of cereals, leguminous crops, weeds in the fields the remains of undergrowth should be cut with a disc tool to a depth of 8-10 cm and mixed with the soil. This is due to the fact that the straw on the ground reduces the quality of the flock, which reduces productivity. It also reduces the quality of the sowing if the straw is not thrown away. The working depth is about 10 cm and is carried horizontally on the rows of crops. For this purpose, weed and straw are weeded with sawdust of LDG-5A, LDG-10A, LDG-15A type attached to John Deere and Case tractors.

1.3.2. Carrying out pre-leveling activities

In Turkmenistan conditions are grown by irrigation. Therefore, the arable land must be level. In saline areas it is even more important that the land is level. When water enters a well leveled plot, water accumulates in the lower part of the land, leaving no water in the upper part. Water does not accumulate in a timely manner, so sowing and subsequent agro-technical activities cannot be done in a timely manner. In addition, excessive water accumulation leads to secondary (repeated) soil salinization. When the soil is properly levelled, favorable conditions are created for quality sowing, i.e. for seeds to fall to depth, rows to be straight, and for subsequent maintenance of crops. On flat soils the evaporation of moisture is higher than on flat soils.

Before ploughing, level the top 8-10 cm of soil. If the soil is overgrown, plough to a depth of 26-28 cm before levelling and then level the area with laser levelers. It is recommended to apply 30-40 tons of organic fertilizer per hectare of saline land followed by deeper plowing. In the seedbed area, it is recommended to carry out levelling works annually before sowing. It is suggested to carry out leveling works with long-range levels P-2, 8, laser levels.

Figure 2: Pre-leveling activities

1.3.3. Fertilizing before ploughing

Sorghum's demand for organic and mineral fertilizers is high. To meet this demand, 10-15 tons of fertilizer per hectare of arable land must be applied before autumn and a total of 65-70% of the total amount of phosphate fertilizer. Agrochemical and soil map of obligatory fields should be used in determining the amount of fertilizer to be applied. It is also better to use organic and mineral fertilizers in combination with saline soils on saline soils.

Figure 3. Mineral fertilizer application before ploughing

The combined use of organic and mineral fertilizers reduces the harmful effects of mineral fertilizers and increases the rate of their absorption in the soil. Organic fertilizers also contain growth regulating substances such as auxins, cytokines and plant gibberellins. For each hectare of saline soils 30-40 tons per hectare over 3 years should be given.

Figure 4: Application of organic fertilizer (manure) prior to ploughing

1.3.4. Autumn (main) ploughing

In saline soils, soils with good water permeability are considered more suitable for higher yields. Autumn ploughing is therefore particularly important when preparing the soil for sowing in sowing areas. Autumn (main) ploughing improves and softens the soil structure compared to spring ploughing. On an autumn flock plot, active growth begins from the first day of young stock rearing. By spring flocking, in a field where autumn flocking is carried out, the Sorghum matures early and harvests abundantly.

Its duration determines the outcome of the fall flock. The best time to spend autumn is in November. Ploughing yields are higher in November than in December. In frozen soil in the first winter months it is impossible to carry out quality ploughing. Crop cultivation is

carried out by crop rotation. For this purpose the sown area is divided into separate rotational parts. The width of the rotation is determined by the number of hollows and holes created and the length of the field to be cultivated. The smaller the width of the circle, the denser the hollows and pits are formed in the field. If the area is 400 m, the width of the circle should be 40-50 m respectively, 60-70 m at 600 m, 70-80 m at 900 m and 100-110 m at 1200 m. long. In saline soils, soil evenness is the most important agro technical measure. Non-compliance with the agro technical requirements of pasture transfer leads to uneven fields. Therefore, autumn herding should be carried out correctly.

When the flock is stacked on top of each other, a dim stash is formed in the middle of the circle. Thus, the flock begins in the middle of the circle. An opening is formed in the middle of the circle when the flock is stacked on top of each other. Thus, the flock starts on one side of the cycle. It is recommended to alternately use the slip and slide method to minimize the depth of the caves and holes.

The method of sliding in and out should be alternated on the same field over many years. If you have been plastered this year, you should plaster the following year. If the same method is used every year, for example, only inverted, the area in the middle of this axis will go up and the two edges will go down. If the field is rolled every year, the middle part of it goes down and the two sides go up. Thus, the flatness of the plot is sharply disturbed.

In order to keep the range flat, the direction of each flock should be changed as much as possible. If this year the flock was moved from north to south, next year it should be moved from west to east. It is necessary to transfer the herd in a two-tiered plough. A double tier azalea will take roots and seeds of weeds, pests and pathogens to a deeper depth. One of the main indicators of herd quality is herd depth. In the conditions of Turkmenistan, it is recommended to plow 3 to 1 time on irrigated fields to a depth of 35-40 cm once a year. In other years one should carry out ploughing to the depth of 27-30 cm. It is more profitable to plow to a depth of 35-40 cm on a heavily weed-contaminated area.

Deep ploughing helps to soften the dense soil layer and increase water absorption by flushing out the lower saline layer. This is good for saline areas. This results in the need for normal germination and abundant harvesting. On highly saline areas near groundwater the top

layer of 27-30 cm is first rolled over and then the lower 10-12 cm layer of soil is softened without overturning using a deep dredger. Depending on soil type, level of agro technics and depth of last year's autumn sward, the depth of autumn sward should be determined.

Figure 5. Autumn ploughing

When Sorghum is cultivating in medium saline soils the depth of flock should be increased to 20-22 cm in the first year and then to 28-30 cm in 5-6 years. The first year results in lower yields as the soil deepens. If the soil is compacted and saline, it is recommended to increase the slope to 40-45 cm.

When saline fields are deeply drained and runoff water is captured, salts that are harmful to soil in the soil are easily dissolved in water, are well washed away, and the reclamation condition of agricultural fields is improved.

1.3.5. Carry out levelling after ploughing

In order to level out unevenness formed during basic plastering, plastering work should be carried out after ploughing. When leveling, 6-8 cm of soil is removed from the top layer of the upper part of the mouth and transferred to the lower parts of the mouth. If the soil taken is more than 6-8 cm thick, its nutrient layer immediately disappears,

resulting in lower yields. The soil is levelled using a Rome PG-16 leveler mounted on a Case MX 210 tractor.

1.3.6. Preparation of land for flush and growth watering

The drainage should be cleaned from time to time before the flush water is collected and new drainage holes should be drilled if necessary. Temporary irrigation ditches should also be drawn and the land should be divided into fields. Each irrigation field should be provided with a separate provision for watering. Once the land has been levelled, it should be divided according to the mechanical composition of the soil of the fields. The size of the fields should be 0.15-0.25 ha on light soils, 0.25-0.30 ha on medium and heavy soils and 0.15-0.20 ha on saline soils.

1.3.7. Flush watering

Flushing with water should be carried out on strong and moderately saline soils. In slightly saline soils, wastewater is often not captured. It is recommended to increase the amount of growth water by not discharging wastewater into non-saline areas. The main purpose of wastewater is to wash away harmful soil salts and remove groundwater from the fields by diverting groundwater through drainage systems.

Figure 6. Wastewater retention on arable land of sorghum

In order to obtain high yield, it is necessary to flush and remove salts by transferring all saline areas to saline areas. According to the study it is recommended to use 2000-2500 m3 per ha for slightly saline soils, 3000-3500 m3 per ha (2 times) for moderately saline soils and 4500-5000 m3 per ha (3 times) for highly saline soils. The whole area should be flushed at least twice before salt water removal. During water catching 1500-1700 m3 of water must be applied every 8-10 days per hectare. The water is watered once or twice or even three times. This water should be absorbed by each horse without being transferred to another horse.

In slightly saline areas it is advantageous to combine flush and growth water. This method saves irrigation water. Waste watering in saline areas is recommended in December, January and February.

If too much wastewater is applied to highly saline areas, the water is not absorbed, the groundwater rises higher and in this case, if the drainage system does not work, salinity accumulates in the upper soil layer and the soil becomes more saline than before. Therefore, the main challenge is to clean and drain the drainage system when developing saline soils. In short, saline landscapes must be maintained on saline soils so that saline soils of saline soils can be leached and reduced. If the drainage channels do not work properly, the drainage water efficiency is very low.

1.3.8 Growth watering

Water for crops is conserved to ensure normal germination in fields, which need to be additionally watered with wet water. Threshold water is consumed at the rate of 1000-1200 m3 per hectare. In non-saline and slightly saline areas the waste water is retained in combination with growth water. In this case, growth water is supplied at the rate of 1300-1700 m3 per hectare and no wastewater is captured. The growth watering should be done 10-15 days before sowing. On saline areas 3-4 days after watering with growth water the temporarily withdrawn chilies should be immersed in water, otherwise the cold terrain will not allow germination.

1.3.9 Carry out pre-sowing preparation

In saline soils getting normal germination of sorghum is a very hard and difficult task. In general, the main important agro technical measure is to obtain a basic number of hectares per hectare from crops on saline soils. Pre-sowing tillage of saline soils in early spring is the main agro technical measure carried out on the sown areas. On the pre-sowing areas of the sorghum, when the soil is in pre-sowing tillage, it is necessary to level temporary covers, and then transfer them to the harrow in early spring. Soil and soil moisture is maintained with timely boron-grassing. To get normal germination of sorghum, before sowing introduce 15-20% of the annual norm of nitrogen fertilizers and cultivate to a depth of 14-16 cm with a set of chisel, rake, livestock implements. In saline soils, the soil is well drained and seeded before planting. Cleaning helps to keep the soil soft and coarse and completely get rid of weeds. Seeds planted in such treated soil are accustomed to sprouting and grow quickly and normally. Therefore, it is desirable to carry out this work in time without delay. In seeded soils 12-14 cm in light soils, 14-16 cm in medium and heavy soils, and 16-18 cm in deep saline soils. When the soil is pressed in time, the surface soil layer becomes shallow, uneven, soft, and the mouths of soil capillaries (cells) are closed, which leads to reduced moisture loss and slow absorption. Thus, the seeds sown fall into the soft, moist soil and germinate fully and healthily. Even when chiseled before sowing, it should be attached to the boron and cattle. The cattle level the soil by slightly compacting the soil layer into which the seeds will be sown and improving the moisture of the sown seeds.

1.4. Sowing

On saline soils it is necessary to sow biologically and mechanically clean seeds to obtain higher yields. Planting contaminated and mechanically damaged seeds is not recommended. Seeds with yields less than 98% should not be used for sowing. Sowing should be done in a predetermined size, quality wise. Reducing the seeding rate leads to sparse germination and subsequent sparse yields. It is also recommended to increase the amount of seed for sowing in saline areas by 10-15%.

1.4.1 Seed preparation for sowing

To increase resistance to various liver diseases of sorghum such as bacteriosis, root rot and rabies, seeds should be treated with chemicals before sowing. Seed production from agricultural fields infected with Garabash disease is prohibited. Seeds must be mechanically clean, free of infected seeds, weed seeds and other crops. To increase the germination of seeds, they should be ventilated and heated in the sun in the open ground. For this purpose, the seeds should be kept 8-10 days in a room heated to 20-30° C, ventilated, and released with heated air at 30-35° C.

1.4.2. Sowing dates

The sowing time of the seed of sorghum should be determined according to the mechanical composition of the soil and the degree of salinity. Because it is difficult to germinate after the weather is very hot, in early saline soils, to be planted in lettuce. Sowing of seedlings should start when the soil is 3-5 cm deep at 12-15 ° C. Seed depth should be 5-7 cm in light soils, as well as in mechanical soils. In Ahal, Balkan, Mary, Lebap regions, the period from April 15 to May 5 is considered to be the best time to sow sorghum. Planting in saline soils should be completed from April 15 to May 1 due to the inability to fully germinate when the soil is strong. In Dashoguz region, it is recommended to plant sorghum from April 30 to May 15, and in saline areas from April 20 to May 1. Because early ripening grain is very difficult to protect from birds and sparrows, grain ripening should not be planted early on May 10-15. The sowing rate of cereal seed is 15-20 kg / ha per hectare (20-25 in saline soils) and 25-30 (35-40 in saline soils) per hectare. It is recommended to use varieties with seeds with a yield not less than 95%.

The sowing method of the grain should be done according to the lines 60: 20: 1, 70: 20: 1, and 90: 15: 1 cm. In saline soils, it is best to use a grain sowing method (45: 20: 3, 90: 20: 3, 60: 20: 3) and a square sowing method 45: 45: 3, 60: 60: 3, 90: 90: 3 gives. When sowing for silage, conventional row-by-row, cross-row planting methods, as well as narrow-row and ribbon-type three-row planting methods are used. When sowing in saline soils, sowing for silage

yields good results when three-sided, narrow-row, ribbon-type sowing methods are used.

1.4.3. Additional measures for obtaining of growth

In saline soils, the main task is to get a full and healthy germination after sowing. Lid-breaking, wet-watering methods are the main measures taken to obtain bruises. If rainfall occurs after sowing, a cover is formed on the topsoil. Rainfall leads to faster cover of saline soils. The cover, especially in heavy and saline soils, prevents young plants from coming to the surface, which shrinks and suffocates the ship. Cover the soil with a rotating (zigzag) boron or rotary motor. It is recommended to remove with. After sowing, sometimes the air is very hot, the surface of the soil, the moisture layer of the seed layer is lost, and the moisture is not enough for the seed to germinate.

1.5. Care for the sorghum

Sorghum care includes measures such as feeding the crop, irrigating it, isolating it after germination, conducting inter-row treatment, and controlling weeds, diseases, and pests. After complete germination in the sown areas for grain, each isolation should be carried out in order to create a normal feeding area for each plant. This work should be completed within 5-7 days without delay. When mowing is delayed, the yield is reduced, and the plants are diseased. Prolonged compaction of the soil due to the conduct of several harrow-livestock complexes in pre-sown areas before sowing, as well as the supply of moist water for germination, hamper the growth of the sorghum and leads to the loss of soil moisture. As a result, the diet of the sorghum is disturbed, the treatment and water retention become more difficult, the weeds grow faster, and as a result, the growth and harvest of the sorghum is delayed, and the yield is significantly reduced. The main goal of inter-weed control is to control weeds, loosen the soil layer, and feed the soil. During intermittent treatment, the salinization of the soil is prevented, i.e., the retention of salts in the topsoil is reduced. Therefore, in saline soils, it is recommended to carry out intermittent treatment in a timely manner, to ensure that the soil surface is always soft. These agro-technical measures ensure that the soil is well ventilated. Intermediate treatment is also important in

the nutrition of plants. This is because during inter-row treatment, the activity of microorganisms in the soil increases, the root of the plant is supplied with enough oxygen, and the field is cleared of weeds.

Intermediate treatment should be carried out in accordance with the requirements of agro technics: there should be no weeds left at the place where the work units of the cultivator pass. Therefore, the working units of the cultivator should be properly adjusted. When performing intermittent treatment, the protection zone must be in accordance with the requirements of agro technics. You need to pull the irrigation hole in the middle of the row. The soil of the treated area should be smooth and soft. Inter-row treatment should be carried out at a lower speed than when the line direction is known. In the first treatment, the depth of the stalks should be adjusted to 6-8 cm, the protection zone to 10-12 cm, and the depth of the inter-row treatment to 10-12 cm. In the second treatment, you should apply a soil softener instead of a cleaner. This tool soil should be loosened to a depth of 10-12 cm and the protective layer should be up to 12 cm. The rotating unit should be 3-4 cm away from the row and the depth should be 3-5 cm. The discs are 6-8 cm apart and 4-6 cm deep in the row, and can be drawn with or without fertilizer. The depth of the first hole is 10-12 cm between the 60 cm rows and 12-14 cm between the 90 cm rows.

In heavy soils, the joint should be pulled deep and in light soils. And the fertilizer should be poured 3-4 cm down the hole. The first fertilizer should be applied at a depth of 14-16 cm from the 10-12 cm side of the row. The second fertilizer should be applied at a depth of 20-22 cm from the 18-20 cm side of the row. After forming 1-2 true leaves, the plants should be treated for the first time by giving 70 kg of nitrogen fertilizer per hectare (150 kg / ha in the form of urea) for the first time. The second intermittent treatment should be carried out when 4-5 true leaves are formed on the plant. Then, along with coughing, 85 kg of nitrogen fertilizer (250 kg / ha of ammonium nitrate) and 30-35% of the planned phosphorus fertilizer should be applied per hectare. 5-6 days after the second feeding of the cache, the chick should be given the first growth water at the rate of 700-800 m3 per hectare.

In the saline soils, after the formation of 1-2 true leaves, the first row should be treated with 70 kg of nitrogen fertilizer per hectare (150 kg / ha in the form of carbamate) for the first time. In saline soils, secondary intercropping should be performed when 4-5 true leaves are

formed. Then, along with coughing, 85 kg of nitrogen fertilizer (184 kg / ha urea) and 30-35% of the planned phosphorus fertilizer should be applied per hectare. Growth water in saline soils should be transferred after the plant has given full shade to the soil. It is advisable to complete the intermittent treatment up to 85-100 cm in height.

Figure 7. The maturing period of sorghum

1.6. Harvesting

In order to reap the harvest, you must first prepare the fields for the harvest. To do this, you need to level the area around the temporary slopes, slopes and fields. For harvesters, you need to create a turn zone of 8-10 m. The silo of the sorghum must be harvested when the grain is ripe, and the grain of the sorghum must be harvested when the grain is fully ripe.

II. CULTURE FIRE GROWTH IN SALT

Sudan grass is grown in pure form for wheat, silage preparation and green sweat forage, and is also planted (mixed) with alfalfa and other winter sorghum grains. Its localized varieties are Mironov - 10,

Chernomorka varieties. The distribution of Sudan grass is high; it grows again after harvesting and gives a good nutritious grain, which is well eaten by all kinds of cattle. Herbs from water are mixed with winter cereals and alfalfa. Water can be sown after autumn crops and can be harvested in full 2 harvests. Research at the Turkmen Agricultural Institute's agricultural field has shown that combining organic and mineral fertilizers with Sudanese grass in low- and moderately saline soils (by conducting wastewater treatment) is highly effective, and the salinity of saline soils is improving. Water is a good source of forage for winter livestock when grass is planted after winter crops.

Figure 8. Sudan grass

Figure 9. Sudan grass besom (a) and seed (b)

According to the results of research conducted at the Turkmen Agricultural Institute, Sudan grass grows quickly when fed in combination with organic and mineral fertilizers. Sudanese grass prefers warm weather, dry weather is resistant, does not require high soil, and grows moderately even in moderately saline soils, yielding sufficient grain and green grass (mass) yields. The Sudanese grass itself serves as a good crop for cotton, wheat, vegetables and melons as saline soils.

2.1. The role of Sudan grass in crop rotation

In crop rotation, Sudan grass can be sown after winter grains, legumes, and alfalfa. Sudan grass itself serves as a good crop for melon crops as saline soils. Sudan is a powerful root system of grass and is a plant that can use groundwater (up to 1 meter deep). This plant lowers groundwater levels, prevents soil salinization, and serves as a good crop for melon crops. Sudan grass is drought-resistant and has high heat demand.

Sudan grass is also important in crop rotation (pre-crop). In some saline areas, sowing grass reduces the salinity of the soil, creating favorable conditions for the healthy growth and abundant harvest of the last sown crops. Since it reduces the level of groundwater and prevents soil salinization, it is sown as a sedimentary plant after washing water in weak, weak-to-moderate, moderately saline soils, and in strongly saline soils. Research at the Turkmen Agricultural Institute's research site has shown that Sudan grass has a good yield and it is good for pre-sowing of cotton, wheat and vegetables.

2.1.1. The role of Sudan grass in crop rotation in the development of saline soils

Sudan grass is also important in crop rotation (pre-crop). In some saline areas, sowing grass reduces the salinity of the soil, creating favorable conditions for the healthy growth and abundant harvest of the last sown crops. Since it reduces the level of groundwater and prevents soil salinization, it is sown as a sedimentary plant after washing water in weak, weak-to-moderate, moderately saline soils, and in strongly saline soils. Research at the Turkmen

Agricultural Institute's research site has shown that Sudan grass has a good yield and it is good for pre-sowing of cotton, wheat and vegetables.

2.2. Soil preparation for sowing

2.2.1. Crushing the remains of weeds

Due to its slow growth at the beginning, therefore, weeds should be well prepared for planting of Sudan due to the fact that weeds do a lot of damage to it. When weeds are polluted with weeds, their yields are reduced and the quality of the weeds produced is low. Crops should be thoroughly cleaned of weeds. In order to prepare the sown areas for sowing, the weeds in the field should be grazed with disc tools. Pruning is carried out before the herd, after harvesting the grain crops, winter grains, legumes.

2.2.2. Leveling pre-plowing

Improving the ameliorative condition of farmland, reducing the salinity of the land, and leveling the pre-plowed lands are some of the most important agricultural measures in reaping higher yields from Sudan grass. Sudan grass needs to achieve a good level of grassland. The level of salinization of Sudan grassland has been reduced, land reclamation has been improved, and soil salinization has been prevented. When leveling before plowing, the soil should be shifted 8-10 centimeters thick from the upper layer of the highland area to the lowland area. The leveling work is carried out by installing a Rome PG-16, GH-2.8, GH-4 leveler on the Case MX 210 tractor.

2.2.3. Fertilizing before plowing

Prior to plowing, 18-20 tons of semi-rotted per hectare, 31 kg of phosphorus fertilizer, 30 kg / ha of potash fertilizer should be applied to the sand and sandy soils in accordance with the agrochemical composition of the soil. In saline soils, if possible, 30-35 t / ha of semi-rotted soil is pre-irrigated to improve the ameliorative condition of the soil.

2.2.4. The main plowing

In order to get a high yield of Sudan grass, the main treatment must be carried out at a high level. The main treatment is the deepest soil treatment, which is carried out to prepare the soil for future sowing after the harvest of agricultural crops. In the main treatment, the topsoil is completely treated. The effectiveness of the main plowing depends on its quality, timing, and especially its depth. Proper and timely plowing in accordance with the requirements of agro technics ensures the effectiveness of agro-technical measures such as control of insects, diseases, weeds, irrigation, crop nutrition, soil salinization and treatment. When determining the depth of plowing, the biological characteristics of each crop, the mechanical composition of the soil, the thickness of the cultured (assimilated) layer, and several other factors must be taken into account. The depth of the autumn plowing should be 25-27 cm in areas where Sudan grass is planted. In terms of its mechanical composition, it is best to carry 30-33 centimeters of plaster in areas where heavy (dense) and harmful salts accumulate under the slurry layer (in saline soils). Deep plowing is beneficial for saline areas. Increases soil water absorption, which helps to wash down the lower salt layer. As a result, the yield of Sudan firewood is increasing. In highly saline areas close to groundwater, the upper surface 25-27 cm layer is first driven and then driven down upside in 10-12 cm deeper. Depth of fall is determined depending on the type of soil, the level of agro technics and the depth of last year's fall. For all crops planted in the spring, plowing should be carried out in fall. Autumn plowing is carried out with John Deer, Case and Belarus tractors and these tractors are equipped with Servo 45, Querneland-LD, PIN-4-35 reductions.

2.2.5. Leveling the plowing areas

The flatness of the land is of great importance because it is an unprocessed crop of Sudan grass. This is because the development water is fully supplied in the care. Sudan grass should carry out post-plowing work to obtain high-quality and healthy sprouts from the grasslands. In the plowed lands, leveling should be carried out from the upper layer of the high ground of the field to the ground 6-8 cm thick to the lower part of the field. After plastering, the leveling work

is carried out in a cross-section with longitudinal levelers. Land leveling is carried out with a Rome PG-16 leveler on a Case MX 210 tractor.

2.2.6. Washing the land and preparing for the catchment of throne water

Water canals and drainage systems are being cleaned, temporary irrigation canals are being laid, and areas of sowing grass are being prepared for flush watering and growth watering. Each irrigated area should be divided into fields to be watered separately. The size of the fields should be 0.15-0.25 ha in light soils and 0.25-0.30 ha in moderate and heavy soils. For saline soils, the size of the fields should be 0.15-0.20 ha. The lands are being prepared after the completion of the leveling for the flush watering.

2.2.7. Flush watering

Sudan grass is a salt-tolerant crop that can be grown in poorly saline soils. In order to get a high yield of Sudan grass, it is necessary to wash and remove the salts by giving all the saline lands. According to the study, water consumption of flush water is recommended 1800-2200 m /cubic per hectare in less saline areas, and 2800-3000 m / cubic in normal saline areas (2 times), and 4000-4500 m / cubic meters (3 times) in heavily saline areas. The amount of water supplied once should be 1400-1600 m / hectare and the distance between each watering should be 8-10 days. It is beneficial to combine flushing and growth watering in less saline areas.

2.2.8. Growth watering

It is possible to get a normal germination from the Sudan grass when the tap water is caught in the fields that need to be supplied with additional wet water. Growth water should be given 15-20 days before sowing. Threshold water is consumed at a rate of 1000-1200 m/hectare. Threshold water and wastewater are combined in non-saline areas at a rate of 1400-1600 m/cubic meters.

2.2.9. Pre-sowing cultivation

Pre-sowing cultivation need to be done well to ensure that the seeds are buried in the ground. Pre-sowing cultivation for Sudan weed cultivation include integrated measures such as lines, temporary coverings, land leveling, raking, chisel-rake-cattle. To sow Sudan grass, pre-sowing soil treatment should be carried out while the soil is well underground. When the soil is well-drained, the soil becomes soft and small, the weeds are completely cut off, the seeds planted in such treated soil germinate, and they grow fast and healthy. The depth of transplanting in the fields where the grass is to be watered should be 12-14 cm in light soils and 14-16 cm in heavy saline soils. Heavy boron is used to maintain the moisture of the sown areas. When the boron is pressed in a timely manner, the surface layer of the soil becomes coarse-grained, homogeneous, soft, and the soil cells (capillaries) is closed, resulting in a reduction in moisture loss and salinity. Pre-sowing soil treatment is carried out in saline soils in order to reduce the loss of soil moisture. In this way, the seeds sown fall into soft, moist soil and germinate quickly and healthy. Even when a chisel is carried out before sowing, boron and cattle should be attached to it. The harrow flattens the soil, and slightly compacts the seed-bearing layer. This, in turn, improves the moisture supply of the sown seed.

2.3. Sowing

Sudan grass' heat demand for heat is high. 8-10 ° C is sufficient for seed germination. 20-30 ° C is enough to grow under favorable conditions. It is very important to treat the seeds with chemicals before sowing to increase the resistance of the Sudan cultivation to various diseases. The yield of Sudan grass depends on the level of agro technics, as well as the correct selection of varieties and the quality of sown seeds.

2.3.1. Sowing time

When the soil is 10 cm thick at a temperature of 10-12 degrees, it is considered the best time to plant grass from the water. In all saline soils, Sudan grass should be sown before the soil warms up, as the saline soils do not germinate when the soil is strong. In saline soils

Sudan grasses are best planted with narrow-row, cross-sectional, ribbon-type three-row sowing methods. Depending on the size and size of the seed, the amount to be planted per hectare should be 30-35 kg. Depending on the mechanical composition of the soil, the planting depth of the seed is from 3-4 cm to 6-8 cm. Sudan grass should be increased by 10-15% when sown in weeds, contaminated with weeds, as well as when sown as an intermediate crop. It is considered to be suitable for sowing Sudan grass in the southern regions of the country from March 10 to April 25, and in Dashoguz region from March 25 to May 10. If the soil is dry during sowing, it is necessary to provide moist water for full and healthy germination. The amount of wet water to be provided in light soils and non-saline areas should be 500-600 m3 / ha. Sudan grass can be planted in the fall and harvested in full. Sudan grass is sown as an intermediate crop after winter wheat, potatoes and early ripening crops. It is recommended to plant Sudan grass as an intermediate crop in Dashoguz province from July 5 to July 20. It is recommended to carry out sowing of firewood from Belarus with the DE-3.6 grain planter attached to the MTZ-80 tractor.

2.4. Additional measures for germination

Covering and moisturizing are the main steps taken to get rid of sudan grass. If rain falls after the Sudan grass is planted, a cover is formed on the topsoil. This is especially the case in saline soils. It mainly prevents young plants from growing on heavy and saline soils from coming to the surface, compressing and suffocating the cluster. In such a case, cover the soil with a zigzag boron or rotary motor. In some cases, after sowing, the air is very hot and the surface of the soil, the moisture layer of the seed, is lost, and the moisture is not enough for the seed to germinate. In this case, in order to get the full germination of the sown seed, to create moisture in the seedbed, the gaps should be filled with water, and the sown areas should be moistened. Doing so will help ensure moisture in the planted areas.

2.5. Control measures of weeds and pests

It is advisable to carry out agro-technical measures in a complete, accurate and timely manner in order to protect against pests

and weeds when sowing grass for seed of Sudan, and to use chemicals in a timely manner if necessary.

2.6. Pulling temporary shutters and lines to supply growth water to Sudan grass

Because Sudan grass is a narrow-row, fully-cultivated crop, the land should be divided into fields to be watered separately. The size of the fields should be 0.25- 0.30 ha in light soils and 0.30-0.50 ha in medium and heavy soils according to their mechanical composition. This should be done no later than 1-2 days after sowing. Additional sowing should also be carried out in the wetlands after sowing.

2.7. Caring for Sudan grass and harvesting

Timely feeding, growing water supply, and harvesting in accordance with the requirements of agro technics during the month after full and healthy germination of Sudan grass is the main pledge. Sudan grass care activities include: watering, feeding, growing weeds, pest control and harvesting. During the growing season, the demand for Sudan grass nitrogen fertilizer is very high. To meet this requirement, 150 kg / ha in the form of nitrogen ammonium nitrate should be applied at the rate of 50 kg per hectare after each harvest. Sudan grass should be given 1 liter of growth water up to 1st grade. In the case of high-level agro-technical measures, it is possible to harvest Sudan grass 3-4 times in Dashoguz region, from which a total of more than 400 centners of green mass and 80-100 centners of fodder can be obtained per hectare. To prepare the Sudan grass for the bale, when the first head is removed, it should be 7-8 cm above the ground before the leaves are hardened. In this case, the Sudan grass begins to grow rapidly again, and its seeds ripen in 100-125 days. The blue mass reaches the harvest every 30-35 days.

Proper timely feeding of Sudan grass has a positive effect on its rapid growth and increase in the number of harvests and increase in yields. In saline soils, it is enough to irrigate once a year after each harvest.

Appendixes

Appendix 1

Rules and deadlines for agro-technical measures to be taken when growing weeds in saline soils

T/b	Measures to be taken	Rules	Regional deadlines	
			Ahal, Balkan, Mary, Lebap regions	Dashoguz region, Darganata district of Lebap region
1	*2*	*3*	*4*	*5*
1.	Crushing the remains of weeds to carry out the work	Weed and undergrowth remnants are cut to a depth of 8-10 cm with disc tools must be mixed with soil.	15.10–20.10	20.09–10.10
2.	Fighting perennial weeds	Soil softening to a depth of 18-20 cm and then weeded with chisel, rake and boron the roots of the grass should be cut down.	15.10–20.10	25.09–15.10
3.	Pre-flattening	Pre-plowing should be done at a depth of 8-10 cm above the top layer of soil. That's the decent thing to do, and it should end there Rome PG-16, GH-2.8, GH-4 type and laser levelers replace the Case MX 210 type tractor must deliver	25.10–10.11	30.09–25.10
4.	Pouring organic and mineral fertilizers before plowing	65-70 of the total phosphorus fertilizer to be fed % and 15-20 tons/ha. 30-40 tonnes/ha should be taught in saline soils. In light sandy, heavy clay soils, 60 kg/ha (if the annual amount of potassium fertilizer is more than 60 kg/ha, it should be divided into two parts: half under the plow and the other half during the cultivation of the crop, during potting) (potassium chloride). fertilizer is an agrochemical of the soil should be used taking into account its nature).	30.10–20.11	5.10–30.10

The continuation of Appendix 1

1	*2*	*3*	*4*	*5*
5.	Plowing	This work should be done at a depth of 28-30 cm. If the ground is compacted and saline, then the depth of the herd to 45 cm to reach	01.11–20.11	01.11–30.11
6.	After driving align	The work has to be done in a deliberate way.	20.11–25.11	25.11–30.11
7.	Preparation of land for washing and holding of water of the throne. Pulling irrigation cages, dividing them into ditches, pulling cigars, temporary closures to dig	The size of irrigation ditches should be 0.15-0.25 ha in light soils, 0.25-0.30 ha in medium and heavy soils, and 0.15-0.20 ha in saline soils.	24.11–28.11	26.11–30.11
8.	Catching wastewater (in saline areas)	The norm for watering in moderately saline areas should be 3000-3500 m^3 per hectare (2 times), and in strongly saline areas 4,500-5000 m^3 (3 times). One-time supply of water the volume should be 1500-1700 m^3.	1.12–20.02	1.12–25.02
9.	Growth watering	The norm of throne water is 1000-1200 m^3/ha, and in non-catchable areas 1200-1600 m^3/ha should be	Growth watering should be given 15-20 days before sowing 1.03–10.04	Growth watering should be given 15-20 days before sowing 10.03–25.04
10.	Irrigation caches, lines, temporary closures drawn to hold the Growth and flush watering	The work of demolishing the temporary closures should be carried out.	1.03–1.04	10.03–10.04

The continuation of Appendix 1

1	*2*	*3*	*4*	*5*
11.	Pre-sowing treatment (raking) - mala, çizil + with rake + cattle set)	It should be 12 - 14 cm in light soils and 14 - 16 cm in medium soils. The norm of urea is 100 kg/ha.	20.03–30.04	20.04–15.05
12.	Sowing	15-20 kg/ha for grain sowing (20-25 in saline soils) and 25-30 (35-40 in saline soils) kg/ha for silage should be used.	15.04-5.05; in saline soils 15.04-1.05	30.04–15.05; in saline soils 20.04–1.05
13.	Additional remedies for bruising: lid breaking, moisturizing water to catch	Wet watering must be at a rate of 500-600 m^3/ha. Moisture water is not retained in saline soils. A lid formed after rain is softened.	In case of need	In case of need
14.	Weed control	This should be done using appropriate herbicides.	In case of need	In case of need
15.	1st row treatment	The protected area should be 10-12 cm long and 6-8 cm deep.	After the full germination has been achieved	After the full Germination has been achieved
16.	1st feeding with cache	The protective zone should be 10-12 cm long and the treatment should be carried out at a depth of 14-16 cm. 70 kg / ha nitrogen fertilizer (150 kg / ha urea) in the form of).	20.05-10.06	25.05-15.06
17.	1st growth water	5-6 days after the first feeding, the 1st growth water should be given at a rate of 700-800 m3 per hectare. In saline soils, the plant should be fed with urea, should not be given growth water, and should be treated in a deep row. Growing water is full of plant soil should be held after shading.	5-6 days after first feeding (urea-fed areas)	15-6 days after the first feeding (urea-fed areas)

The continuation of Appendix 1

1	*2*	*3*	*4*	*5*
18.	Pest Control Measures	The work must be done through chemicals.	In case of need	In case of need
19.	2nd row treatment	The protected area should be 10-12 cm long and 12 cm deep. Rotational tests 3-4 cm apart, It should be 3-5 cm deep. The discs should be treated at a distance of 6-8 cm and a depth of 4-6 cm. In the 2nd treatment, instead of the pack should wear a naralnik.	After the full germination of 4-5 leaves	After the full germination of 4-5 leaves
20.	2nd feeding with coughing	2nd feeding with coughing	In case of need	In case of need
21.	2nd growth water	Watering should be at a rate of 800-900 m^3/ha. In strong and moderately saline soils, the growth water should be transferred after the plant has given full shade to the soil.	5-6 days after 2nd feeding (urea-fed areas)	5-6 days after 2nd feeding (urea-fed areas)
22.	3rd row treatment with cache drawing	The protected area should be 14-16 cm long and 12-14 cm deep.	Depends on the mechanical condition of the soil	Depends on the mechanical condition of the soil
23.	3rd growth water	Water at a rate of 900 m3 / ha. In saline soils, the norm should be 1000-1200 m3 / ha.	Depends on the mechanical condition of the soil	Depends on the mechanical condition of the soil
24.	Preparing the fields for harvest	It is necessary to level the area around the temporary gaps, slopes and fields, and create 8-10 m turning zones.	15.08-15.09	25.08-25.09
25.	Harvesting (silage and grain)	For silage, the grain should be harvested when the grain is thick and the grain is fully ripe.	01.09-25.09	25.09-20.10

Appendix 2

Rules and deadlines for agro-technical measures to be taken in the cultivation of Sudan grass in the requested lands

T/b	Measures to be taken	Rules	Regional deadlines	
			Ahal, Balkan, Mary, Lebap regions	Dashoguz region, Darganata district of Lebap region
1	*2*	*3*	*4*	*5*
1.	Carrying out the weeding of weeds	The treatment is carried out at a depth of 10 cm, horizontally in the row of crops. LDG-5A, LDG-10A, LDG-15A units John Dir and Case MX 210 used to attach to tractors.	15.10–10.11	8.10–20.10
2.	Pre-flattening	The depth of the autumn cultivation should be 25-27 cm. In areas with heavy (dense) mechanical composition and accumulation of harmful salts under the slurry layer (in saline soils) Drill to a depth of 30-33 centimeters yields good results if transferred.PG-16, GH-2.8, GH-4 dakylýar.	20.10–15.11	15.10–25.10
3.	Supply of organic and mineral fertilizers before plowing	15-20 tons of semi-rotten course, superphosphate 300-400 kg/ha. In saline soils, 30t / ha of semi-rotted soil should be taught before plowing.	25.10–10.11	20.10–30.10
4.	Plowing	The depth of the autumn cultivation should be 25-27 cm. In areas with heavy (dense) mechanical composition and accumulation of harmful salts under the slurry layer (in saline soils) Drill to a depth of 30-33 centimeters yields good results if transferred.	10.11–20.11	25.10–10.11

The continuation of Appendix 2

1	*2*	*2*	*4*	*5*
5.	Landslides flatten	Crosswise 6-8 centimeters should be passed in thickness	15.11–25.11	25.11–20.11
6.	Preparation of land for washing and catchment of throne water	The size of the fields is 0.15 - 0.25 ha in light soils, 0.25–0.30 ha in moderate and heavy soils, and in saline soils.0.15-0.20 ha	15.11–25.11	25.11–30.11
7.	Growth watering	Depending on salinity, the average salinity is 2800-3000 m/cubic meters (2 times), and in strongly saline areas 4000-4500 m / cubic meters (3 times)	20.12–01.03	10.12–25.02
8.	Flush watering	The growth watering is 1000 hectares. 1200 m^3/ha, in areas with no wastewater 1200-1600 m^3/ha,	15-20 days before planting the growth watering, 1.03–20.04	15-20 days before planting the growth watering, 10.03–25.03
9.	Pre-sowing treatment: lines, pulling temporary covers, leveling the ground, chisel + rake + cattle with a set	12-14 cm in light soils, 14-16 cm deep in medium, heavy soils.	10.03–05.05	15.04–0.05
10.	Seed treatment	Gensil's or Tebun's Apply 0.4 l to 10 to 15 liters of water and use 1 ton of seeds.	Before sowing	Before sowing

The continuation of Appendix 2

1	*2*	*2*	*4*	*5*
11.	Sowing	Narrow row, 30-35 kg / ha in total, 40-50 kg / ha in saline soils	10.03–25.04	25.03–0.05
12.	Molding activities (lid breaking, wetting)	500-600 m3 / ha of irrigation water should be provided to light soils (non-saline) areas, wet water to saline soils not allowed.	In case of need	In case of need
13.	Temporary closures to supply growth water to Sudan grass and chillies	0.25-0.30 ha in light soils, 0.20-0.25 ha in saline soils, 0.30-0.50 ha in medium and heavy soils	30 days after the pigeon is taken	30 days after the pigeon is taken
14.	Nitrogen fertilizer the 1st feeding with	50 kg / ha nitrogen (150 kg / ha in ammonium nitrate).	Growth water 3-5 days before delivery	Growth water 3-5 days before delivery
15.	Supply the 1st growth water	Yields of 800-1000 m3 per hectare.	Form 3-4 real leaves when you bring	4-5 leaves per plant in saline soils after formation
16.	The 1st harvest	It should be 7-8 cm above the ground.	Throat, bloom during	Throat, during flowering
17.	Supply the 2nd growth water	800-900 m3 per hectare should give.	12-15 from harvest days later	12-15 from harvest days later

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CONTENT

MINISTRY OF AGRICULTURE AND WATER MANAGEMENT
OF TURKMENISTAN

TURKMEN AGRICULTURAL INSTITUTE

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CULTIVATION OF SORGHUM AND SUDAN GRASS ON SALINE AREAS