

**MINISTRY OF AGRICULTURE AND WATER MANAGEMENT  
OF TURKMENISTAN  
TURKMEN AGRICULTURAL INSTITUTE  
AGRICULTURAL RESEARCH INSTITUTE**

# **IMPLEMENTATION OF LOCUST CONTROL MEASURES**

**Scientific - production manual**

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In the scientific and production manual the harmful locusts for the agricultural crops and pastures and the morphologic and biological features of locusts found in our country and chemical control measures against them, methods of conducting measures on a scientific basis are described.

The manual can be used in the agricultural sector, and in plant protection. Professionals, students, graduate students, farmers, tenants working in the field can use this manual.

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## INTRODUCTION

Under the leadership of our honorable President Gurbanguly Berdimuhamedov in the era of prosperity of our sovereign state many works are carrying out in the rational use of the natural resources of our country, and in plant protection.

In this regard, the Academy of Sciences of Turkmenistan “Study of the spread of harmful locusts in Turkmenistan and to plan the control measures against them” (2008-2010) was executed.

In recent years, in the Central Asian region, including Turkmenistan, due to the dry weather, some of the locusts are widespread and it was appreciated that they are harmful to plants.

There are about 10 species of locusts in Turkmenistan. During the mass breeding years of locusts, the used chemical pesticides effect on the state of the environment, on the flora and fauna of natural and assimilated the fields.

In this regard, it is more important to carry out the control measures, to study the species diversity of locusts, to study their biology and ecology, and to reduce and prevent the spread of harm species.

## 1. BIOLOGY AND OUTLYING FEATURES OF LOCUSTS

Locusts are divided into two groups according to their habitat: the herd those who live together and those who live alone. The 5 years growth period of locusts lasts an average of 30-40 days. From the last scales change the large locusts reach sexually (Moroccan locusts during the 2-5 days, and oasis or Italian locusts during the 6-15 days). At this time the locusts that form the herd migrate with wings. Then they are active begin to mate. Mother locusts after the hereditary day start laying eggs. The locusts that live alone 10–15 days after the larvae were flown, the herd formed morocco and oasis or an Italian locust lays an egg 2-4 weeks later. Mother locusts lay their eggs in the soil or on the plant. The locusts lay their eggs a mixture that is 10 times longer at the expense of the segmental membrane uses the tip to immerse it in the soil slowly. Then the eggs putting begin. Eggs laid by mother locusts are covered with the fluid of the genital gland. As a result of liquid solidification a pot is formed. Naturally, the locusts form 2-3 jars. Then 1-2 weeks go after. The duration of this period sometimes can also be shortened to 2-5 days.

**Oasis or Italian locust** (*Calliptamus italicus italicus*). It is a species that forms a herd. Her body is medium in size and small.

The inside of the back thigh is usually light red or reddish in color with two incomplete black bands, which is sometimes very faint.

The top of the back of the chin is light red or red. The upper tip of the mourning of the vomit of the male locust (the discharge of the last joint of the belly) is longer than the lower one. The wings have been shown solely to give a sense of proportion passes through the top. The length of the male body is 14.5-23.4, maternal sexes 24.5-41.1 mm; the length of the upper wing, respectively, 1.3-18.3 and 22.3-31.6mm.

It can be found the Italian or oasis locusts in the cultural zone - on the sides of the ditches, in the old alfalfa, in the garden, in the vineyards, in the hollows, on the sides of the road, landscaped, sprawled, wormwood, stubble, camel plant- also matches.

In Turkmenistan, the Italian or Oasis locust can be found on the branches of the Amyderya, Murgap, Tejen, Sumbar, Chandir, Etrek rivers, and in the cultural zone of the Kopetdag and Koytendag. Oasis or Italian locust larvae in late April- and begin to appear in early May. They fly wings in June. They lay eggs in July and August.

The larvae lay eggs in white begins in late April and early May. In early June they met their winged ones. In July and August they lay their eggs.

In our gardens in the eastern Turkmenistan according the weather conditions the grubs of locusts in late April and early May began to be born and to treat. In the last decade of May they met their wings and began to fly. We met in early June the winged locusts. The larvae of locusts lived 5 in 35-55 days. The length of the larvae of 1 year old is 5-6mm. They are wingless, dark in color and do not indicate sexual symptoms. The 2-year-old is 6-7 mm, wings and sexually suggestive symptoms. Of a 3-year-old length 11-16 mm, small winged, indicating sex. 4-year-old locusts are 12-22 mm, winged, 5-year-old 13-27mm, winged and they are in dark in color. In the study of oasis or Italian locusts, only we have found those who lived alone. The wetlands of their pastures the plants that grow in them, and the vegetables from the cultivated plants crops, alfalfa, and potatoes were monitored. Ripe locusts feed and mate for 10-12 days and lay eggs. The females make 2-3 pots, 30-50 eggs lay in each of it. Egg jars are set on plants, on the empty sides of the road and on sandy soils.

**Moroccan locust** (*Dociostaurus maroccanus* ). It is the herd living species. The overall color is gray; the back of the toe is red, with a cross-shaped spot on the front back (*Fig. 1*). The front back is thin and with an open side stripe, the back with a cross-shaped picture. Of the former the front part is short and its length is the length of the back part equal or less, the lateral sacs of the posterior part are clearly opened occurs in the form of. The back edge is bow-shaped and angular, obviously appears. The front and rear wings are always well developed. Both sexes' eyes are small, and the male eye of the male locust is smaller than the sub cache, and equal to that of the mother. The forehead of male locust's thighs of the feet is thick. The wings are longer than back thighs of the feet.

The sub genital plate of male locusts is wide and the top is dull cut-off. The back pearl is usually red, sometimes yellow. The body length of male locust is 20,0-28,0 mm, that of the female 28.0-38.0mm, and the length of the upper wing is 17,5-27,0 and 24.0-36.0mm, respectively.

Moroccan locusts are mainly found in the mountains - in the dry valleys, in the mountains, in the hills, in the crustaceans, in the



herbaceous plant groups, in the worms, occurs in volatile areas. In massively multiplied year they harm to cotton, wheat, vegetables, and orchards and it causes a great deal of economics.



**Figure 1. The elder and larva of the Moroccan locust**

They have big hearths in the Kopetdag and Koytendag in Turkmenistan.

This species consumes 65 species of plants in Turkmenistan. During the research on the outskirts of Koytendag it have been marked, that the Moroccan locusts harm the cultivated wheat, barley, maize, cotton and other plants. In March 2008, depending on the weather Moroccan locusts began to lay eggs. They are winged in mid-April. They start laying eggs in mid-May. The larvae of the Moroccan locust gather at the roots of the weeds, as the weather warmed up a bit (after 10-11 p.m.) they begin to gather as a group. They grow a lot of vegetation in pastures. If the plants in the pastures are dry then the Moroccan locust larvae have an area of 5-6 km even though it is far away, it is a herd in that direction, moving in a hurry they start.

In 2009 the larvae of the Moroccan locust began to emerge in the middle of March. Due to the rainy season this year, the weather the five-year-old larvae of this locust growth period lasted for 55-62 days. In early May they began to flap their wings. The period of laying eggs in the soil is at the end of June. In 2010, Moroccan locust larvae

formation coincided on March 12. But according the drought of the year with high air temperatures the locusts' five-year development period of the larva lasted 40–45 days. In 2011 the emergence of larvae of this species coincided on March 23. The reason for the late emergence of Moroccan locust larvae is that in 2011-compared to the last two years of February and March of this year is more likely to come. That is, in 2009 and 2010 in the second decade of March, the daily average daily temperature was + 20°C, while in 2011 it was +14.3°C close. But in the second decade of April this year, the weather's high temperature was + 37°C and it created the opportunity for the shortening of the growth duration of Moroccan locusts. That is, at the end of April, the winged locusts began to appear.

**The large saxaul locust (*Dersorys albidula* ).** It is alone living species. The tip of the wing is gray. Injuries to the hind legs-top of the inside is red ( *Figure 2* ). The length of the male locusts is 42.5 - 51.3 mm and that of the females is 49.6-57.2 mm. The length of the upper wing respectively is 39.4-51.1 and 52.8-65.5 mm.



**Figure 2. A large saxaul locust with a spider**

The large saxaul locust, which lives in the sandy desert landscape, it treats black and white saxaul, cherkes, salts, and other plants belonging to the family of Selmas fed with green pieces. It caused immense damage to black and white sexual, cherries, trade, and ephemeral plants during its many years of massive growth. The



large saxaul locusts in Turkmenistan is found in the lowlands of western Turkmenistan, in the Karakum Desert, in Bathyz, in Garabild. It is found in the plains of the Kurendag ridge. According to our research, Repetek State Reserve 1 year old spider mite in 2009 larvae began to emerge in the 2nd decade of April. The development period lasted 55-60 days. It flapped its wings in June.

In 2010, the larvae hatched in the second decade of April, and the period of their growth lasted 44-50 days. The larvae began to wing in early June. The winged locust arrived on June 2 near the Balhana railway station. Laying of eggs in the soil began in the first days of July. The large saxaul larvae lay eggs mainly in open, dense and dense soils.

**Egyptian locust** (*Anacridium aegyptium*). Living alone type. The front of his chest, which was cut with three sharp cups very creepy. The middle part of the chest is flat, the middle of the tip is the heart shaped. The back of the toe is blue, the inside of the nail is yellow, and the nails are the tip is black (*Figure 3*). The length of the body of male locusts 32.0–56.2 mm, 47.4–66.4 mm for females; of the upper wing the lengths are 37.5–57.1 and 46.5–66.2 mm, respectively.



**Figure 3. Egyptian locust**

It is in a cultural zone - in gray areas, in gardens, in forests, vineyards, cotton fields, orchards, in herbs and shrubs, in the desert - black and white saxaul, in cherries and other shrubs and in the mountains - worms-and is found in spruce and shrubbery.

The Egyptian locust is found in Turkmenistan in the Amu Darya Valley, Farap, in Darganata districts, Murgap, Tejen, Dashoguz cultural zones, in the foothills of the Kopetdag, in the Central Karakum, in the South. It is widespread in the eastern Karakum Desert.

This species of locust overwinters during the larvae of the imago and sometimes the larva. They begin mating in late March and early April, at the end of April of the year they start laying eggs in pots. Larvae coincides from June to August. In our research the 4-year-old larvae of Egypt locusts are rarely found on August 2, 2008 in alfalfa in the Jeytun oasis of Dovletli district. Also, on March 12, 2010, in the village of Bazardepe of Koytendag district the imagination is rare met on a white-footed wolf. On July 24, 2010 in Tutlyde of Koytendag district the 3-year-old larvae were found. On April 8, 2011, 1 of its imago's was found in Bil ori oasis of Magdanly town.

**Beast or Turanian locust** (*Calliptamus turanicus*) -a species that inhabits alone. She is pregnant. The inner thigh of the hind leg the rap is yellow or gray, no black spot ( *Fig. 4*). The top of the back is yellow. The top of the back end of the male locusts (waste in the last joint of the abdomen) is lower, equal to or slightly longer than the back end, it is sometimes very faint. The flat tip of the male locust vinegar is hill is longer than below. Its upper wings are almost parallel

Structured, its length extends above the posterior thigh. The body length of the larvae of male locust is 23.8–31.5 mm and that of the female is 34.5–48.2 mm; the length of the upper wing is 17.5–25.0 and 23.5–39 mm.

The beast or Turanian locusts can be found in the plains it is warm, crunchy, ephemeral, and shrubby, predominant in the lowlands, in vegetative areas, alfalfa.

It is widespread in the foothills of Turkmenistan in the foothills of Kopetdag, Koytendag and broad valleys of the mountain, in Bathyz and Garabil. According to the research which was held in April 2008 in the cultural zone of Lebap province each square of 1 meter of wheat fields were found 2 beast or Turanian locusts.



**Figure 4. Beast or Turanian locust**

In April with the onset of favorable weather conditions the larvae began to come out of their tails and began to eat. The larvae are five years of young growth period and, after their final age they flapped their wings. Their larval period lasted 40-50 days. After 14–15 days the wing was hatched, the mature locusts mated and in 20-22 days they started laying eggs in pots.

**Desert Prussian** (*Calliptamus barbarus cephalotes*)- Living alone type. The upper wing is longer and extends considerably over the top of the hind thigh. The base of the rear wing is light red. The back is yellow orange or orange-red. The inside of the back thigh is egg-shaped with a large black spot. The length of the body of male locusts is 17.8–24.2 mm, female– 24–40.7 mm; the lengths of the upper wing is 15.4–23.1 and 24.3–33.4 mm, respectively.

Desert Prussian is found in the sandy desert - shrubs and or in the areas of the rugged vegetation, in the foothills - on the rocky slopes of the hills, on the pistachios, wormwood, and others that grow in the lowlands of the bay, in areas with semi-shrub vegetation, in the mountains - rocky slopes. It can be found in the wetlands and perennial vegetation, in the mountain plains and in the sloping areas, in the cultural zone - previously planted and in vacant lots, on boundaries, on the banks of waterways, on the sides of the road, in the

fields, on the edges of agricultural crops, in uncultivated orchards, and in vineyards, in the river valleys, in the mountain valleys, in the foothills of the mountains, in the forest zones.

It is widespread in Turkmenistan in the oasis of Amyderya , in the cultured zone of Dashoguz Province, in the oasis of the Murgap River, in Bathyz, Tejen cultured zone, in the foothills of the Kopetdag, in the Western Turkmenistan, a common species in the Central Karakum.

It begins in mid-April or early May Larvae emerge. Winged locusts are found in late May till October.

**Crossed harmful locust** (*Doclostaurus kraussi nigrogeniculatus*)-a species that lives alone. The front is a wide open side strip, the back is cross-shaped, the wider part of the strip is the front of the cross located in front of the cache, the cross-section of the front part is particularly clear 2-4 times the width of the strip ( *Fig. 5*).



**Figure 5. Cruciferous locust**

The back of the thigh is wide and the length of the Celtic thigh's wider position is 3,3 – 3,6 times higher. The bottom of the side enclosure on the outside is with multiple dots. The front part of the front is without side enclosure. Of the last order of the ant locusts (upper half) the back edge is wide, the flat tip. The upper wing of the mother locust often passes through the middle of the thigh, sometimes reaching its top. The lower part of the inner thigh of both sexes is yellow. The body length of male locusts is 18,5–22,0 mm and that of

the female 29,0–3,5 mm; the length of the upper wing, respectively, 12,5–17,5 and 17,5–20,5 mm.

It can be found on the crabs, weeds, malcolm, wheat, barley, cotton, crops, cereals, ephemeral, floating, wormwood, and wormwood-salt mountains and foothills in areas with cereals.

They are found in Turkmenistan in the foothills and lowlands of the Kopetdag and in western Turkmenistan, in Bathyz, in the mountains in the foothills of Koytendag, in Garabild and in Northern Turkmenistan.

In our study, in February 2009 in the second decade of February they are found. The duration of the larval period is 25-35 days equal.

In the year of mass breeding crossed harmful locusts effect harmful to field plants and beast crops.

**Desert satrap** (*Sphingonotus satrapes*) is a species that lives alone. Clear the middle shell of the prose of the anterior part of the forearm rises and emerges as a small tree. The pit of the hill is clearly visible (Fig. 6). The back of the wing is with large black spots, sometimes there are 2-3 separate spots. The body is very large. The inside of the back thigh is black, with two fully open ligaments. The back base of the wing is milky or slightly greenish-yellow; the throat width is narrowed in the posterior half. The body of male locust's length is 27,5–35,0 mm, maternal sex 37,5–45,0 mm; surface wings length of the nut is 31,0–37,5 and 33,0–42,0 mm, respectively.



**Figure 6. Desert satrap**

The desert satrap can be found in the foothills, in bald-shaped and clay-gray soils, crustaceans and various ephemeral, weeds, in cooked, cousinhood places, shaky and salty, salty bald-shaped, in fertile soils, as well as in the desert - white and on black saxaul, in sandy areas, in cultural areas - in open areas, in cotton.

It can be found rarely in the oasis of Kopetdag, Bathyz, Murgap, and Tejen rivers in Turkmenistan, in the valleys and in the cultural zone of Lebap, in the South-East and in Western and Northern Turkmenistan, and in the Central Karakum.

In our study, the larvae of the desert satrap in early April begins to emerge. The growth period lasts 35-40 days. In mid-May flaps its wings. They mate in June and July.

## **2. IMPLEMENTATION OF LOCUST AGROTECHNICAL MEASURES IN AGRICULTURE**

In recent years in Turkmenistan, some locusts especially the Moroccan locust has been found and they do harmful effects to the plants.

We recommend according the harmfulness of Moroccan locusts in Turkmenistan to prevent the formation of locusts, before they hatch for its purpose, in the natural hearths that lay the dense eggs larvae as a result of the coordination of chemical control measures in the event of transfer to production.

There are two main types of pest control divided into periods. They are:

1. Against their wintering period before the locusts appear to carry out preventive measures, i.e. agro technical measures;
2. Reduce their number when locusts appear effective use of biological and chemical remedies for.

In the fight against locusts, their prevention is often agro-related to the conduct of technical measures. The main task in carrying out pest control measures is to determine their wintering fields. Therefore, during the investigation before collecting relevant information and taking action their eggs in the hearths of the Moroccan locust areas where agro-technical measures should be taken, including jars the amount must be determined.



The test was held to break and beat the eggs of a Moroccan locust in the Bil Ori area of Magdanly and in the village of Künjek of Koytendag district and in Arpasay of Dovletli district. In the experiment, 5 points per hectare were the soil samples (50x50cm) were obtained. Agro technical measures (harrowing, drawing, disk harrowing) were held by the tractor "Belarus" –MTZ 1221 Performed with 4-wheel tractors. Then the average number of pots in 1sq.m. area was recorded. During the drilling operations it was affected to the eggs of a Moroccan locust in the field of 26.5%, and to the 70.1% in the design area, to the 73.5% in the area of disk drilling. As a result, the harrowing disk harrowing and soil clearing was inferior. Because in the boron method the teeth scratch much of the surface of the soil, in the overturning of the upper layer of the stomach it was damaged to the eggs, in the case of disc drilling the soil was cut by the discs and the eggs of locusts were damaged.

As a result, the tests were performed at a disk drilling site of these species in the place where the Moroccan locust lays its eggs it has been found that it has done well in preventing its spread. As a result, against the spread of Moroccan locusts we present to use of a simple disk drilling method. The following list must be considered and implemented:

In order to avoid damage to equipment and tools, must be fully explored (the presence of mountain rocks, the slope of the hill, roughness, etc.). Disk drilling is carried out at a depth of 5-6 cm. Moroccan locusts lay their eggs, mainly at this depth and often put on the sunny and well-heated side of the hills. Therefore, during the agro technical and chemical measures in the early spring the sun's rays fall well special attention should be paid to their locations. In agro technical measures must be map schemes of Moroccan locusts laying eggs-the presence of teams working in this area and the tractor driver closely contributes to the effectiveness of his work. If the control measures are held 2-3 days before the larvae begin to emerge from the jaws where the transferred areas is taken into account creates favorable conditions for the continuation of its activities. The best time to transplant agro technical measures is in the fall, until the soil freezes or early spring. However, this measure is limited to areas such as where Moroccan locusts lay in areas the larvae dense eggs and the border is neutral in strips, in areas where the tractor can operate.

### 3. IMPLEMENTATION OF LOCUST CHEMICAL CONTROL MEASURES

In reducing the harmful effects of locusts, the environment and the ability to be safe, highly efficient, and long-term to the local soil-climatic conditions to use existing insecticides scientifically grounded combat measures by testing according to it is considered necessary to develop. In this regard, a product of the closed-ended Joint Stock "August" Company the Russian Federation intestinal-contact (contact) belonging to the lan synthetic parathyroid group effective break 10% me, (Lyambda-Sigalotrin active ingredient) and two-component neonicotinoids and synthetic parathyroid groups. Borey sk (Imidaclopid 150 g/l + Lyambda-Sigalotrin 50g / l influential substance) and Russia as a comparison Yelkovo Agrochem of the Russian Federation closed joint-stock company Fascord 10% Ke Insecticide biological efficacy against different ages and imagery of the gene field tests were performed to determine. In this case, the insecticide that it is expedient to introduce them into agricultural production intended to determine. In the composition there are in the borey sk insecticide two chemicals belonging to different groups and having different effects contains a mysterious substance, the first of which is Lyambda-Sigalotrin, it is stored in the body of plants and locusts. It is harmful interrupts messages transmitted through the central nervous system. The pests were exposed Insecticides In the first hour of spraying and when fed from insecticide-sprayed plants and into the plant they are also slaughtered when mixed. The risk of this insecticide belongs to group 4. Borey s.k. is known for its parathyroid and phosphoric compounds. It gives good results in the fight against stable populations. Plants are kept for some time when treated with a break, with a repellent (scary) nature, revealing the remaining activity allows plants to be protected. This an insecticide protection and the exposure period is 15-21 days.

The test for insecticides was carried out in Near the village of Bazardepe of Koytendag district of Lebab province and in the "Amyderya" collective farm of Dovletli district by the method spraying on 24 hectares in the pastures. Tests were held in March-April and in May in 2011-2012. In tests, the Belarus-MTZ-80 tractor used OWH-28 sprayers were used.

The researches were held after 3; 5; 7 days from insecticide spraying. When the vegetation cover of the pasture is inspected, it is rarely dry the height of the ephemeral grasses was 5-6 cm.

Used in the chemical control of Moroccan locusts a number of insecticides are available in Turkmenistan tested for the first time. Conducted with boron insecticide as a result of tests, this insecticide is against the Moroccan locust 0.2 l / ha against their young larvae in the fight against adult larvae. Against the rest, at the rate of 0.3 l/ha, Break was a 10% mega insect as a result of experiments with 0.08 l/ha against their young larvae in the fight against ghee, against adult larvae proved to be worthy.

Long-term rapid and lasting effects of boron sk insecticide due to its ability to produce, it can be grown in wheat fields in the form of a strip against the danger of locust, i.e. wheat scattering around 50-100 m in area around the area, forming a herd the harmful Moroccan locust and the lonely cross that lives alone locusts or whales when sprayed, it is highly effective in preventing the risk of locusts was found to be. Break me insecticide plants sprout began to be sprayed with locusts at the time of its inception. This insecticide has been fought 1-2 times a season.

#### **4. FOLLOWING SAFETY MEASUREMENTS DURING CHEMICAL TEST PROCEDURES**

Procedures for working with insecticides are carrying out by the Experts of the Plant Protection Agency in accordance with the manual of the Plant Protection Service of the Ministry of Water Resources of Turkmenistan “The use of chemicals in agriculture, to the Inspector of Technical Safety of Transportation and Storage”. In areas treated with insecticides the presence of other people is prohibited.

Before the start of the work, the specialists must be introduced with treatments guidance on safety precautions in control measures of against locusts by the chairmen the locusts; and its physical and toxic properties, about the first medical care to be provided in case of human poisoning explains and signs. To work with insecticides children, adolescents under the age of 18, pregnant and women with baby should not be released. The head of the working group looks after the health of the workers. If the worker starts to complain, then

he should be fired and should give the first medical care and apply for an ambulance.

Before spraying insecticides to nearby residents warn of the venue and timing of chemical fighting, they hang warning signs, records that livestock and poultry should not be transported. The people who keep honey bees are warned. Sprayed insecticide grazing and haymaking on the ground is allowed after 25 days (high levels of toxicity were observed when using high-insecticides). If the location of the honey bee houses is close to 5 km, and there the insecticides are used then the hive honey bees should be moved from the place of processing to the place where the bees are housed. It should be enclosed or insulated for 5 days.

The person who deals with the insecticides is responsible for their own personal hygiene. During the work it is forbidden smoking, eating and drinking water. These measures are in a specially secured area 100m away from the place where the insecticides were sprayed is held. Wash your hands and face thoroughly with soap. Each a set of personal protective equipment is strengthened during the work: special clothing, special shoes, respirator or gas mask, protective glasses, glove. Wearing a special outfit after work is absolutely forbidden.

Every day after work the face of the respirator and the gas mask should be washed with warm soapy water and add disinfected with alcohol or 0.5% manganese acid. After disinfection, rinse the face with clean water and dry at 30-35 ° C. Special work clothes are specially designed and storage is required.

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# **IMPLEMENTATION OF LOCUST CONTROL MEASURES**

Scientific-production manual