Effects of agrotechnical and chemical control of weeds in fine-fiber cotton fields

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Abstract. Today, in the world agriculture, especially cotton growing sphere plays an important role in the national economy. In the cultivation of cotton one of the main problems in the fields is weeds. When estimating the damage caused by weeds to cotton fields, it accounted for 75 bln. USD. This scientific article presents data on the effectiveness of pre-and post-application of herbicides against weeds in the areas where the tillage was done with double-toothed plow in the fall before preparing beds in the fine-fiber cotton fields under typical gray soils condition. Effective eradication of annual and perennial weeds (86.8-90.2%) was observed, when a single herbicide Ankosar (3.0, 4.0, 5.0 l/ha) was applied (information of 2017-2019). When the herbicides Step 500 (4.0 l/ha) and Ankosar (4.0 l/ha) were applied consecutively, the effect on annual weeds was noted (90.5-93.0%). Perennial weeds were reduced by 88.9-93.3% when the abovementioned preparations are applied one after another. Cotton yield will increase by 1.8-5.4 c/ha compared to the control variant. It is recommended to apply the herbicides consecutively in the order Ankosar (4.0 l/ha), Step 500 (4 l/ha) and Ankosar (4.0 l/ha) against annual and perennial weeds.

1. Introduction
Today, cotton is grown in 33 million hectares of 84 countries around the world producing 25 million tons of yield per year. More than 3000 species of weeds are prevalent in world agriculture, and 1800 species of them cause enormous economic damage, of which more than 200 species compete vigorously with main agricultural crops. As a result of integrated measures of agro-technical and chemical control on these weeds, high results are being achieved in the United States, Brazil, Australia, China, India, Pakistan, Germany, South Korea, Russia and a number of other countries.

Today, the progress in agricultural sector requires the development of modern advanced technologies, obtaining high and quality yield, efficient use of land and water resources, investing low and benefiting high, and reduction of manual labor. In Uzbekistan, weeds reduce the crop yields by 10-20% [1, 2, 3].

The main part of the work in the fields is weed control. It is impossible to keep the fields free of weeds without the use of agricultural practices to control them, crop rotation and an integrated application of herbicides. In this case, the use of herbicides is the most effective practice. Proper organization of crop rotation and the use of effective herbicides are important in the control of weeds and their prevention [3, 4].
It is known that in cotton fields perennial weeds such as bermudagrass - *Cynodon dactylon* (L.), Johnsongrass - *Sorghum halepense* (L.), field bindweed - *Convolvulus arvensis* L., nutgrass - *Cyperus rotundus* L., and annual weeds such as white pigweed - *Chenopodium album* L., panic grass - *Echinochloa macrocarpa* Vasing., black nightshade - *Solanum nigrum* L., common purslane - *Portulaca oleracea* L. Vasing and amaranth - *Amaranthus blitum* L. are common. In order to eliminate them effectively, it is necessary to apply herbicides with different effecting degrees against weeds by different ways of application: consecutively, together, mixing, or turn by turn. This is because the preparations that can eliminate annual weeds effectively, may have a weak effect on perennials, while herbicides that effect on perennials may have a weak effect on annual weeds [5].

Turkish scientists Cumali Özaslan and Bekir Bükün [6] conducted a two-year study in a total of 118 plots of cotton fields in southeastern Anatolia (Şanliufa and Mardin provinces) in Turkey in 2010-2011. Weeds were identified in each square and their intensity was studied. In the result of the study, 23 families and 49 groups and 69 species of weeds were determined. The most common in more than 50% of cotton fields were *Xanthium strumarium* L. (common cocklebur), *Physalis sp.*, *Amaranthus retroflexus* L. (amaranth), *Sorghum halepense* (L.) Pers. (johnson grass), *Solanum nigrum* L. (black nightshade), *Cyperus rotundus* L. (coco-grass) and *Portulaca oleracea* L. (purslane).

Successful weed control in cotton crop is an imperative as weeds not only reduce the cotton production but also deteriorate the lint quality and harbor insect pest. Thus a field study was carried out to evaluate the various weed control strategies under different irrigation systems. Pendimethalin (pre-emergence), S-metolachlor (pre-emergence), glyphosate (post emergence) were used alone or in combination as chemical weedicides along with mechanical weeding under drip and furrow irrigation systems. Results showed that all the weed control treatments with drip irrigation significantly decrease weed density compared with weed control treatments where watering was practiced through furrow irrigation method. However, combined application of pendimethalin with glyphosate and S-metolachlor has significantly reduced the weed density. This combination also resulted in improved bolls per plant, boll weight, sympodial branches, seed cotton yield, ginning out turn, seed index, lint index and water use efficiency. These parameters were also improved under drip irrigation as compared to furrow irrigation system. In a nutshell it can be concluded that combination of post and pre-emergence herbicides improved the cotton lint yield and water productivity which can be further improved by adopting drip irrigation as appropriate irrigation system. On the possibility of this, scientists Hakoomat et al. [8] conducted a thorough study.

However, pre-emergence application of Dual Gold 960 EC @ 2.5 L ha\(^{-1}\) may be preferred for chemical control of weeds in cotton [9].

By G.M. Mahar, F.C. Oad, U.A. Bururo and G.S. Solangi [10] an experiment was laid out at Students Farm, Sindh Agriculture University, Tandojam, Pakistan. Cotton variety Shahbaz-95 was treated with weed control treatments (Stomp-330 EC at 3 L ha\(^{-1}\), Stomp-330 EC at 4 L ha\(^{-1}\), Stomp-330 EC at 5 L ha\(^{-1}\), Fusilade at 3 L ha\(^{-1}\), Fusilade at 4 L ha\(^{-1}\), hand weeding and untreated check). Among the twelve weed species observed in the cotton field *Trianthema portulacastrum* (29.56%), *Cyperus rotundus* (17.24%), *Portulaca oleracea* (14.78%) and *Digerea arvensis* (10.47%) were the dominant weeds, while other weed species were in trace. Weed population recorded before herbicide application ranged between 63.71 - 65.13 m\(^{-2}\). Hand weeding and application of Stomp-330 EC at 5 L ha\(^{-1}\) reduced weed density significantly (92.40 and 91.59%) over other weed control measures, which in turn resulted taller plants (158.50 and 155.60 cm), exhibited more fruiting branches (14.09 and 13.50 plant\(^{-1}\)), higher productive bolls (82.39 and 80.78 plant\(^{-1}\)) and maximum seed cotton yield (2121.75 and 1957.50 kg ha\(^{-1}\)).

Şanlıurfa province is an important place for Turkey's cotton production providing about half of the production. In 2017, Zübeyde Filiz Arslan [11] conducted the study in Şanlıurfa to determine weed problems by determining the frequency and density of the weeds that restrict the cotton production. For this purpose, 60 cotton fields were surveyed in 2015. The most widespread species in the fields were ranked: *Sorghum halepense* (L.). Pers. (johnsongrass, 73%), *Xanthium strumarium* L., (common cocklebur, 67%), *Solanum nigrum* L. (black nightshade, 60%), *Physalis philadelphica* Lam. (tomatillo, 53%) and *Portulaca oleracea* L. (common purslane, 48%).
Compared with the results of similar studies carried out in the region over 25 years ago, it was observed that the weed species, their frequency and density have been changed, significantly. It is predicted that further changes will continue in the future due to increase of irrigation, changes of the cropping pattern and weed control strategies, and also global warming.

Freitas et al. [12] carried out a work aimed to develop a strategy for weed management in conventionally tilled cotton by combining the herbicides S-metolachlor in pre-emergence and trifloxysulfuron-sodium in post-emergence. Fourteen treatments were evaluated arranged in a factorial scheme 3 (three doses of S-metolachlor 384; 768 and 1,152 g ha\(^{-1}\) × 4 (four doses of trifloxysulfuron- sodium 0.0; 2.625; 5.250 and 7.875 g ha\(^{-1}\), plus two controls (with and without weeds throughout the cotton planting cycle). The following weed species were present in the area: *Alternanthera tenella*, representing over 80% of the total, *Bidens* sp., *Acanthospermum hispidum*, *Cenchrus echinatus*, *Digitaria horizontalis*, *Eleusine indica*, *Commelina benghalensis*. S-metolachlor controlled *A. tenella*, *C. echinatus*, *D. horizontalis*, *E. indica* and *C. benghalensis* with high efficiency. Trifloxysulfuron-sodium controlled the dicotyledonous species effectively.

Pereira et al. [13] conducted their experiment in dryland conditions of the Brazilian Northeast to determine the number of viable weed seeds (seedbank) in an upland cotton crop, and its distribution in the soil profile, before and after using various herbicide treatments. A randomized block design in a split-plot block scheme with 6 replications was used, where the main plots were constituted by a factorial (13 treatments and 2 sampling soil depths), and the subplots by 2 sampling dates. The seedbank was determined by germination of the recovered weed seeds obtained from different soil depths. The highest number of viable weed seeds in the area was found before the application of the herbicide treatments at 0 - 10 cm soil depth. The treatments metalachlor + diuron; diuron + pendimethalin and the control (no herbicide treatment, weeded weekly during the entire cotton crop cycle) were the most effective in reducing the weed seedbank in the area.

Considering all of this, we conducted experiments in fine-fiber cotton fields on the effectiveness of alternate application of herbicides with different effects.

Purpose of the research is to develop elements of agrotechnology for high-quality cotton production by alternate application of herbicides with different effects to control weeds in the fields of fine-fiber cotton (new variety SP-1607) in the conditions and timing of tillage in typical irrigated gray soil conditions of Surkhandarya region.

### 2. Material and Methods

#### Table 1. Experiment system (2017-2019)

| Variants | Tillage time and depth | Herbicides | Active substance | Herbicide application norm, l/ha |
|----------|-------------------------|------------|------------------|----------------------------------|
| 1.       | Control, without herbicide | -          | -                | -                                |
| 2.       | Stomp plus 33.0% e.c. (standard) | Pendimethalin | 4.0               |
| 3.       | Step 500, 50% e.c. (standard) | Pendimethalin | 4.0               |
| 4.       | Tillage with double-toothed plow in depth of 28-30 cm, preparing beds and planting | Ankosar 720 g/l s.s. | Monometil- sodium arsenate | 3.0 |
| 5.       | Ankosar 720 g/l s.s. | Monometil- sodium arsenate | 4.0               |
| 6.       | Ankosar 720 g/l s.s. | Monometil- sodium arsenate | 5.0               |
| 7.       | Step 500, 50% e.c. + Ankosar 720 g/l s.s. | Pendimethalin + Monometil- sodium arsenate | 4.0+4.0 |

Field experiments were conducted in 2017-2019 in the conditions of typical gray soils of the farm "Kiyik paykal" of Jarkurgan district of Surkhandarya region. Field experiments were laid out in 7 variants, 4
replications and 4 sections in the lands tilled with double-toothed plow with make beds in the fall. The area of each variant was 7.2 m × 25.0 m = 180 m². Recording area constituted 90.0 m². The total area of the experiment was 0.5040 hectares. The experiment layout, observations, calculations and analyzes were performed with the help of the books “Methods of field experiments” (1979) by Dospekhov and “Methods of field experiments (2007), “Methods of conducting field and vegetative experiments in cotton growing” (1981) developed in UzCGRI [14, 15].

Table 2. Application norm, time and number of herbicides against weed species

| Name of preparation, manufacturer and country | Consumpt ion rate, ha/kg or ha/l | Crop type, preparation used for | To control which weeds | Application time, method and recommended limits | Application number in one season at most |
|-----------------------------------------------|---------------------------------|--------------------------------|------------------------|-----------------------------------------------|----------------------------------------|
| Ankosar 750 g/l, WS. “Ancom Crop Care San. Bhd” Malaysia | 4.0 | cotton | Annual and perennial cereal weeds, annual and some perennial dicotyledonous weeds | applied at budding stage of cotton plant | 1 |
| Stomp plus 33% EC. “Bio Zamin” LLC Uzbekistan | 2.3-4.5 | cotton | Annual dicotyledonous weeds and cereal weeds | applied to soil pre-emergence of the plant | 1 |
| Step 500, 50% EC. “East Asia Chemicals” LLC Uzbekistan | 2.0-4.0 | cotton | Annual cereal weeds and dicotyledonous weeds | applied to soil pre-emergence of the plant | 1 |

The layout of the plant is 90×10×1 after thinning. S-6524 variety of cotton was grown. Herbicides were sprayed using manual device. Water consumption was 300-600 l/ha, Stomp plus and Step herbicides were sprayed together with planting, while Ankosar herbicide was applied by tape method when weeds were 10-15 cm tall.

The weeds in experimental fields are recorded as in the following order by the exact method:
1. A frame of 0.25 m² size is placed 10-15 times along the two diagonals of the field.

2. All weeds in the frame are removed, sorted and counted, listed according to type.
3. Recorded weeds are divided into annual, biennial and perennials according to their biological properties and are dried separately in the open air, then they are weighed on the scales to determine mass of each.
4. The recorded data obtained from 10-15 points are added \(B_1+B_2+\ldots+B_n\) and divided by the number of observations \(D\). The average value is found for 0.25 m² \((A)\) and converting it to 1 hectare the calculation is done.

\[
A = \frac{B_1+B_2+\ldots+B_n}{D};
\]

Determining the norm of herbicides.
To determine applicable dose of herbicides:
Here: 
$C = \frac{D \times 100}{B}$;

Here:
$C$ - applicable dose of herbicide, kg/ha or l/ha;
$D$ - norm of active substance, kg/ha or l/ha;
$B$ - amount of active substance, percentage.

Determining liquid concentration for converting preparation into active solution.

$K = \frac{C \times 100}{P}$;

Here:
$K$ - concentration of solution to be used, percentage;
$C$ - norm of preparation, kg/ha or l/ha;
$P$ - liquid (water) consumption, l/ha.

### 3. Results and Discussions

The study area is located in the southern part of the Republic of Uzbekistan in Surkhandarya and Sherabad river basins, where the spring and summer months are very hot. In summer, the air temperature averages $30-48 \, ^\circ C$ per year. In some years, the temperature rises to $37-39 \, ^\circ C$ in the south of Surkhan-Sherabad oasis and $68-67\, ^\circ C$ in the north parts.

The soil of Kumkurgan district of Surkhandarya region, where the study was conducted, is typical gray soil. The sum of the effective temperatures in the region is $+2812 \div +3052$. The sum of the positive temperatures during the growth period is $5700-5950$. The duration of warm days is $266-272$ days. Rainfall is $127-160$ mm per year, $30-40$ mm during the growing season. The air is extremely dry, with an average annual relative humidity of $30-40\%$. There are some days when the relative humidity drops to $8-12\%$ and rises to $62-66\%$ in winter. Days with a relative humidity of less than $30\%$ throughout the year exceed 200 days. The number of days in this area that are favorable for the cultivation of crops in the field is $290-305$ days, and the process of intensive evaporation takes many days due to the extreme heat of the dry air temperature.

Dry hot wind named “Afghan wind” from the southwest is specific to this region, it blows continuously with great force for $2-3$ days. This condition lasts $35-37$ days a year. In addition, dry winds blow for a long time.

The experiments of our research work were carried out in gray soil conditions.

In particular, the field soils where the study was conducted, are typical gray soils, which have been irrigated for a long time, the amount of humus makes $0.888-0.700\%$ in tillage layer (0-30 cm) and below tillage layer (30-50 cm), general nitrogen is $0.086-0.070\%$, general phosphorus is $0.141-0.115\%$, nitrate nitrogen is $18.7-12.1$, mobile phosphorus $27.7-14.0$ and metabolic potassium is $200-160$ mg/kg, and is reported to be low in nutrients (Table 3).

These soils are rich in carbonates, groundwater level is located at a depth of $1.5-2.0$ m, medium sandy according to the mechanical composition, include to microstructural soils.

| Soil layers, cm | humus | general form, % | Mobile forms, mg/kg |
|----------------|-------|----------------|---------------------|
|                |       | nitrogen       | phosphorus | $N-NO_3$ | $P_2O_5$ | $K_2O$ |
| 0-30           | 0.888 | 0.086          | 0.141     | 18.7     | 27.7   | 200    |
| 30-50          | 0.700 | 0.070          | 0.115     | 12.1     | 14.0   | 160    |

There were annual weeds such as panic grass, white pigweed, wild amaranth, black nightshade, common purslane and burdock, perennial weeds such as johnsongrass, bermudagrass, field bindweed, lambs-foot in experimental field. The number of weeds was recorded after the first and second irrigation.
While surveying the effect of herbicides on weeds (information of the years 2017-2019), it was found out that in the control variant in the first calculation the number of annual weeds was 40.50 pcs/m², 38.65 pcs/m² in the second record and 36.75 pcs/m² in the third one in fine-fiber cotton fields, where the land was tilled with double-toothed plow in the depth of 28-30 cm with beds. Compared to control variant, herbicide Stomp plus reduced the number of weeds by 82.8% in the first record, by 83.3% in the second and by 83.2% in the third record in fine-fiber cotton fields, where the land was tilled with double-toothed plow in the depth of 28-30 cm with beds. When Step herbicide was applied at a rate of 4.0 l/ha, it reduced annual weeds by 84.1% in the first record, by 85.1% in the second record, and 84.9% in the third one. This herbicide had an almost closely related effect on annual weeds such as panic grass, white pigweed, burdock, wild amaranth and black nightshade. When Ankosar herbicide was applied separately at rates of 3.0, 4.0, 5.0, the annual weeds were eliminated by 85.1, 87.1 and 87.7% in the first record, respectively, by 84.4, 86.9 and 87.8% in the second and by 84.3, 86.8 and 87.6%, respectively in the third record. In the variant where herbicides Ankosar (4.0 l/ha) and Step (4.0 kg/ha) were used alternately, annual weeds were reduced by 87.7–90.5% in the first record (Tables 4-5).

Table 4. The effect of herbicides on the weeds in fine-fiber cotton fields with tilled land by double-toothed plow and with beds in the fall: pcs/m², % on 1.05. (2017-2019 й.) on average 3 years, the 1st record

| № | Variants | Nom of herbicide application, kg/ha | Annual weeds | perennial weeds |
|---|----------|-----------------------------------|--------------|-----------------|
|   |          |                                   |              |                 |
| 1 | Control, herbicide-free | - | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |
| 2 | Stomp plus 33.0% EC | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| 3 | Step 500, 50% EC | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| 4 | Ankosar 720 g/l | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| 5 | Zellek-super 50% | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| 6 | Step 4.0 l/ha | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |

At the application of Stomp plus (4.0 l/ha) in fine-fiber cotton fields where the land was tilled with double-tooted plow in the depth of 28-30 cm and made beds, the number of perennial weeds constituted 29.9% in the first record, and 29.9% in the second and 30.4% in the third recording. Step herbicide (4.0 l/ha) reduced perennial weeds by 89.6% in the first record, 89.4% in the second record, and 87.9% in the third one. When Ankosar herbicide was applied at a rate of 3.0 l/ha, it reduced perennial weeds by 90.6% in the first recording, by 90.2% in the second one, and by 89.0% in the third record. In the variant where herbicides Zellek-super (1.0 l/ha) and Step (4.0 l/ha) were used alternately, perennial weeds were reduced by 90.9% in the first record, 90.9% in the second record, and 91.5% in the third one (Table 4-5).

Table 5. The effect of herbicides on the weeds in fine-fiber cotton fields with tilled land by double-toothed plow and with beds in the fall: pcs/m², %, on date 1.05. (2017-2019 й.) on average 3 years, the 1st record
Table 6. The effect of application of herbicides against the weeds on the growth and development of cotton plant in fine-fiber cotton fields with tilled land by double-toothed plow and with beds in the fall, (2017-2019) on average.

| No | Variants | Norm of herbicide application, kg/ha | Plant height, cm | Number of primary leaves, pcs | Number of yield branches, pcs |
|----|----------|--------------------------------------|------------------|-----------------------------|-------------------------------|
| 1  | Control, herbicide-free | - | 11.6 | 1.06 | 1.07 |
| 2  | Stomp plus 33.3% EC (standard) | 4.0 | 12.4 | 1.07 | 1.07 |
| 3  | Step 500, 50% EC (standard) | 4.0 | 12.5 | 1.07 | 1.07 |
| 4  | Ankosar 720 g/l WS | 3.0 | 12.4 | 1.07 | 1.07 |
| 5  | Ankosar 720 g/l WS | 4.0 | 13 | 1.07 | 1.07 |
| 6  | Ankosar 720 g/l WS | 0.0 | 13.2 | 1.07 | 1.07 |
| 7  | Step 500, 50% EC + Ankosar 720 g/l WS | 4.0 | 19.6 | 1.07 | 1.07 |

The control herbicide-free variant. The highest indicator was observed when Ankosar herbicide was applied separately in the norm 4.0-5.0 l/ha (14.5-14.6 pieces) and followed by alternate application of Ankosar herbicide with Step (15.0).

Stomp Plus and Step herbicides did not show a good effect (25.6–28.8%) on perennial weeds. Because these herbicides mainly affect the germination of weed seeds.

Ankosar herbicide was applied during the period of active growth of perennial weeds (when weeds are 6-12 cm in height). This herbicide was found to have a moderate effect on perennial dicotyledonous weeds such as field bindweed. However, it was observed that its biological efficiency was high by eliminating perennial cereals and some dicotyledonous weeds well.

Hence, the effective elimination of weeds from the beginning of the growing season by alternate application of herbicides with different effects, ensures a high yield of fine-fiber cotton. Moreover, it significantly reduces the chances of annual weeds and their seed germination in fine-fiber cotton fields where the agro-technical measures are done, such as tillage with double-toothed plow in the fall, pre-planting land preparation by making beds (Tables 4-5).

During the survey when the growth of cotton was studied, at the beginning of the growing season (1.06) the height of fine-fiber cotton in the control herbicide-free variant was 11.6 cm, while when Stomp plus and Step herbicides were applied at 4.0 liters per hectare, the height of cotton was 12.4-12.5 cm respectively. At a single application of Ancosar herbicide in the norms 3.0, 4.0, and 5.0 l/ha, this indicator was 12.4, 13.0, and 13.2 cm, respectively (Table 6).

In the variant where Step and Ankosar herbicides were used alternately (4.0 + 4.0 l/ha) a higher indicator was observed than the control and other variants, i.e. it was observed to be 2.0 cm higher than the control variant (Table 6).

Table 7. The effect of application of herbicides against the weeds on the yield elements of cotton plant in fine-fiber cotton fields with tilled land by double-toothed plow and with beds in the fall, (2017-2019) on average.

| No | Variants | Norm of herbicide application, kg/ha | Pre-harvesting plant density, thou/ha | Number of squares, pcs | Number of flowers, pcs | Number of bolls, pcs | Number of opened bolls, pcs | Weight of cotton in one boll, g |
|----|----------|--------------------------------------|---------------------------------------|------------------------|----------------------|----------------------|--------------------------|----------------------------|
| 1  | Control, herbicide-free | - | 101.2 | 1.06 | 1.07 | 1.07 | 1.07 | 1.07 |
| 2  | Stomp plus 33.3% EC (standard) | 4.0 | 105.2 | 1.06 | 1.07 | 1.07 | 1.07 | 1.07 |
| 3  | Step 500, 50% EC (standard) | 4.0 | 105.2 | 1.06 | 1.07 | 1.07 | 1.07 | 1.07 |
| 4  | Ankosar 720 g/l WS | 4.0 | 106.2 | 1.06 | 1.07 | 1.07 | 1.07 | 1.07 |
| 5  | Ankosar 720 g/l WS | 4.0 | 106.2 | 1.06 | 1.07 | 1.07 | 1.07 | 1.07 |
| 6  | Ankosar 720 g/l WS | 4.0 | 106.2 | 1.06 | 1.07 | 1.07 | 1.07 | 1.07 |
| 7  | Step 500, 50% EC + Ankosar 720 g/l WS | 4.0 | 106.2 | 1.06 | 1.07 | 1.07 | 1.07 | 1.07 |
When measuring the height of fine-fiber cotton variety SP-1607 at the end of the growing season (1.09), it was found that the indicators (6.1–14.4 cm) were higher in all herbicide-applied variants than in the control herbicide-free variant. While recording the number of primary leaves of fine-fiber cotton (1.06), the indication was 2.8 pieces in the control herbicide-free variant, in all herbicide-applied variants the number of these leaves was more by 0.5-2.1 pieces than in the control herbicide-free variant. When counting the number of bolls of fine-fiber cotton (1.09), it was 12.8 pieces in the herbicide-free control variant, in all other variants with herbicides this indicator was more than in the control herbicide-free variant (Table 7).

When counting the number of yield branches of fine-fiber cotton (1.09) was counted, the number of sympodial branches was 17.2 pieces in the control herbicide-free variant, in all other herbicide-applied variants it was more by 0.9-2.9 pieces than in the control herbicide-free variant. Consequently, the growth of fine-fiber cotton was found to be high when it is free from weeds. In these observations, the highest indications were noted in the variants where Ankosar herbicide was applied separately (4.0–5.0 l/ha) and when Step and Ankosar herbicides were applied alternately (4.0 + 4.0 l/ha) (Table 6).

Considering the yield elements of fine-fiber cotton in the study, the number of squares (1.07) was found to be 2.5 pieces in the control herbicide-free variant, while it was 0.2-0.9 pieces more respectively in the variant with the application of Stomp plus and Step herbicides used by 4.0 liters per hectare. In the variants in which Ankosar herbicide was used separately in the norms 3.0, 4.0, and 5.0 l/ha, the number of squares were more by 1.0, 0.4, and 0.7 pieces, respectively, compared to the control variant (Table 7).

In the variant where herbicides Step and Ankosar (4.0 + 4.0 l/ha) were applied alternately, the number of squares was more by 1.9 pieces in the control and other variants, i.e., it was more by 0.9 pieces comparing to the control. When counting the number of flowers of fine-fiber cotton (1.07), the number of flowers was noted to be 2.8 pieces in the control herbicide-free variant, in all herbicide-applied variants the number of these leaves was more than in the control herbicide-free variant.

Table 8. Cotton yield parameters after applying weed controlling techniques and alternate and in turn application of herbicides, c/ha (2017-2019) on average 3 years

| №  | Variants            | Norm of herbicide application, kg, l/ha | Harvesting | Total yield | Difference from the control |
|----|---------------------|----------------------------------------|------------|-------------|-----------------------------|
|    |                     |                                        | 1<sup>st</sup> | 2<sup>nd</sup> | 3<sup>rd</sup> |                           |
| 1. | Control, herbicide-free |                                        | 20.5       | 6.0         | 2.3           | 28.8                      | -                         |
| 2. | Stomp plus 33.0% EC (standard) | 4.0                                     | 22.3       | 7.5         | 3.0           | 32.8                      | 4.0                       |
| 3. | Step 500, 50% EC (standard) | 4.0                                     | 23.0       | 7.6         | 2.5           | 33.1                      | 4.3                       |
| 4. | Ankosar 720 g/l WS | 3.0                                     | 22.6       | 8.5         | 2.4           | 33.5                      | 4.7                       |
| 5. | Ankosar 720 g/l WS | 4.0                                     | 23.8       | 8.7         | 2.3           | 34.4                      | 5.6                       |
| 6. | Ankosar 720 g/l WS | 5.0                                     | 24.1       | 8.7         | 2.0           | 34.8                      | 6.0                       |
| 7. | Step 500, 50% EC + Ankosar 720 g/l WS | 4.0+4.0                           | 24.7       | 9.0         | 1.9           | 35.4                      | 6.6                       |

Harvesting

Tillage with double-toothed plow in the depth of 28-30 cm and preparing beds in the fall

Difference from the control

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On average, 28.8 centner yield was obtained per ha area of herbicide-free control variant (Table-6). While in preparations used variants additional 4.0-6.6 c/ha yield was made compared to the control. Particularly, in Stomp plus applied (4.0 l/ha) variant an additional yield of 4.0 c/ha, while in Step (4.0 l/ha) applied variant additional cotton yield of 4.3 c/ha was obtained. When herbicide Ankosar (4.0 l/ha) was used in 3.0, 4.0 and 5.0 l/ha norms, additional 4.7, 5.6 and 6.0 c/ha yield was achieved compared to the control variant. In the variant of alternate application of herbicides Step (4.0 kg/ha) with Ankosar (4.0 l/ha), an additional yield of 6.6 c/ha was stated to be obtained (Table 8).

4. Conclusions
Based on the results of study, the following conclusions can be done:
1. When herbicide Ankosar was applied in the norm of 4.0 l/ha in fine-fiber cotton fields where the land was prepared by tilling with double-toothed plow in the fall, making beds before sowing in spring, it reduced the annual weeds by 86.8-90.2%. This herbicide has almost a similar effect on annual weeds such as panic grass, white pigweed, wild amaranth, black nightshade, common purslane and burdock.
2. When herbicide Ankosar was applied in the norm of 4.0 l/ha in fine-fiber cotton fields where the land was prepared by tilling with double-toothed plow in the fall, making beds before sowing in spring, it reduced the perennial weeds by 56-58.9%.
3. When herbicides Step 500 with Ankosar were applied (4,0+4,0 l/ha) alternately against perennial weeds in fine-fiber cotton fields where the land was prepared by tilling with double-toothed plow in the fall, making beds before sowing in spring, it reduced the weeds by 72.3-76.9%.
4. In herbicides applied variants where the land was prepared by tilling with double-toothed plow in the fall, making beds before sowing fine-fiber cotton in spring, additional yield of 4-6.6 c/ha was obtained comparing to the control variant. In the variants with alternate application of herbicides, the highest indication was observed, i.e, 6.6 c/ha additional yield of fine-fiber cotton was produced comparing to control variant.

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