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THE CULTIVATION OF WINTER WHEAT IN THE GANJA-GAZAKH ECONOMIC REGION

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АГРОТЕХНИКА ОЗИМОЙ ПШЕНИЦЫ В ГЯНДЖА-КАЗАХСКОМ ЭКОНОМИЧЕСКОМ РАЙОНЕ

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Abstract. To obtain a high yield of wheat, the described cultivation technology should be observed. Consideration should be given to the biological characteristics of winter wheat, varieties, soil preparation for sowing, sowing dates, sowing rates, irrigation, fertilization, disease and pest control, and, finally, timely harvest without losses in accordance with relevant conditions. Since winter wheat is demanding on mineral fertilizers, one of the most important factors was the determination of the norms of nitrogen, phosphorus and potash fertilizers. Taking into account the fact that the chemical composition of winter wheat grain is not constant, but varies depending on the type and variety, climatic conditions, soil fertility, cultivation technology, a technology has been developed for growing 4 different varieties of winter wheat. For the Ganja-Kazakh economic region to obtain high-quality grain, which makes it possible to obtain an average yield of 50-60 centners per 1 ha.

Аннотация. Для получения высокого урожая пшеницы следует соблюдать описанную технологию возделывания. Следует учитывать биологические особенности озимой пшеницы, сорта, подготовку почвы к посеву, сроки посева, норму посева, орошение, внесение удобрений, борьбу с болезнями и вредителями и, наконец, своевременный сбор урожая без потерь. Поскольку озимая пшеница требовательна к минеральным удобрениям, одним из важнейших факторов было определение нормы азотных, фосфорных и калийных удобрений. С учетом того, что химический состав зерна озимой пшеницы непостоянен, а изменяется в зависимости от вида и сорта, климатических условий, плодородия почвы, технологии возделывания, разработана технология выращивания 4 различных сортов озимой пшеницы. Для Гянджа-Казахского экономического региона для получения высококачественного зерна, что позволяет получать урожайность в среднем 50–60 ц с 1 га.

Keywords: wheat, cultivation, agriculture, fertilizers, planting, diseases.

Ключевые слова: пшеница, агротехника, сельское хозяйство, удобрения, посадка, болезни.

A very large proportion of the world's population eats wheat bread. Wheat bran is a high-quality animal feed. The grain is used as hay in livestock farming. Wheat grains contain vitamins B1, B2, B6, PP, E1, A, and D, cellulose, protease, and other enzymes. Wheat is one of the oldest crops. There are 22 species in the genus *Triticum*. The most common are soft wheat (*Triticum vulgare*) and hard wheat (*Triticum durum*) [6].

Winter wheat — is sown on large fields in many regions of the republic. Winter wheat is more productive than spring wheat. If you carry out agro-technical measures in time and correctly, if you harvest the grain on time and without losses, and if you use high technology in cultivation, then of course you can get a bigger harvest. It should not be forgotten that autumn wheat is a valuable food crop. Bakery products and flour products produced in the world constitute a large part of the pasta industry. The main goal of farmers and businessmen engaged in the production of autumn wheat is to obtain a quality and abundant harvest. To achieve this, it is very important to know the technology of autumn wheat cultivation, as well as that the land allocated for wheat cultivation is fertile and has suitable irrigation systems for cultivation. Before sowing autumn wheat, it is necessary to obtain as much information as possible about the original, and current condition of the soil [9].

In such areas, even if the soil is in satisfactory or normal condition, it is necessary to follow the correct agrotechnical and reclamation measures. As a preliminary measure to land reclamation, serious attention should be paid to the alignment and proper plowing of the site. This will greatly facilitate compliance with the irrigation regime and regulations, which are of paramount importance in agriculture. Another important step is to prevent evaporation in the soil. High levels of evaporation, depending on weather conditions, move salt residues into the upper layers of the soil, disturbing the soil structure and weakening the metabolism in the soil. The balance of mineral substances is disturbed, creating obstacles to their adequate uptake by plants [3].

Winter wheat is a cereal crop belonging to the family Gramineae. The most common types of wheat in our country are common wheat (*Triticum aestivum* L., *T. vulgare* Host) and hard wheat (*Triticum durum*). Soft wheat varieties belonging to the soft wheat species and grown in the most common regions are as follows Azari, Mirbashir 128, Farmer 84, Qiymatli 2/17, Azamatli 95, Nurlu 99. The most widely grown varieties of hard wheat in the regions are Baraktli 95, Alinja 84, Mirbashir 50, Garagilchig-2, Tartar, Shiraslan, Turan (Ministry of Agriculture of the Republic of Azerbaijan, Centre of Agricultural Sciences, Scientific Research Institute of Agriculture. Catalogue of grain legume varieties 2013). The alternation of crops on arable land by year, the system of cultivation, and fertilization of the soil refer to the sowing period. Planting perennial leguminous crops, especially clover, in rotations leads to improved soils and increased productivity. Of course, the application of alternate sowing will be effective if the plots owned by farmers and producers consist of a large area [14]. The main objective in the system of soil cultivation is the introduction of a regime of heat, humidity, and aeration, creating a favorable environment for the development of the root system of the plant, ensuring that the seeds fall to the same depth, which is one of the main factors of normal irrigation throughout the site. The most important principles of soil cultivation are loosening, turning the topsoil (plowing), mixing the plowed layer, leveling the topsoil, and sprinkling it at the normal depth [16]. A convenient method of sowing winter cereals is the narrow-leaf method. In these plantings, high yields are obtained, as the plants use water, nutrients, and sunlight more efficiently [1].

Stages of plant development: the emergence of shoots, spike stage, ear stage, flowering stage, milk ripeness stage, and wax ripeness stage. During the waxy stage, the amount of irrigation water is reduced to 25-30%. At this stage, the grain and the plant turn yellow [12]. The most dangerous diseases affecting cereals are solid and dust and rust diseases [13]. One of the last stages of wheat cultivation is harvesting. Wheat must meet the standard in terms of moisture content and the degree of the substrate [2].

The following winter wheat varieties were used as material in the technology of winter wheat cultivation in the Ganja-Gazakh region: Azari variety, Qiymatli 2/17 varieties of winter common wheat, Nurlu 99 winter soft wheat, Barakatli 95 hard wheat varieties. The technology of cultivation

of 4 varieties of winter wheat taken as the material was developed in the Ganja-Gazakh region. A different fertilization system was applied to these wheat varieties, and the timing and amount of N, P, and K fertilizers were determined [14].

When implementing the elements of the technological process of winter wheat, the method was that sowing should be carried out with seeds of I and II reproduction, germination capacity over 85%, and purity not less than 95%. When the temperature of the soil is 10-12°C, sowing should be carried out on heavy soils at a depth of 2-3 cm, and on light soils at a depth of 3-5 cm on 10-25 October in the Ganja-Gazakh region. The method of sowing in strips was chosen to take into account the presence of irrigation conditions. 50-60 centners per hectare (5-6 tons) to obtain the crop density irrigated areas 5 million plant number is advantageous. According to the technique, the first spray, i. e. water for plowing, is applied immediately after spraying. The crop is then irrigated 3 times during the bush period to ensure the emergence and maturation of the plant [1].

The introduction of phosphorus and potassium fertilizers under plowing and in spring with some N fertilizers has been reflected in the technology. The sowing norm, by the technique, was 220 kg of seed per 1 hectare. By the requirements of the technology, it is planned to deliver the products in time to pre-processing warehouses, mills, or to consumers using harvesting machines that meet the requirements of modern standards for chemical control, herbicide spraying of weeds, timely and loss-free harvests in the manifestation of diseases and pests [13].

According to scientists and researchers, postponing the mixing and loosening operations after only 3-4 days of plowing leads to a decrease of half of the soil moisture and consequently to a deterioration of the soil structure. Therefore, given the direct dependence of the yield of winter wheat on activities such as soil selection, irrigation, plowing, fertilization, etc., we aimed to pay attention to the cultivation technology of winter wheat. It is important to know the standards for carrying out cultivation operations such as plowing, grinding, loosening mixing, sowing, etc. [2].

Together with mineral fertilizers, the use of organic fertilizers has a positive effect on yield. In addition to these measures, the technology of autumn wheat cultivation includes soil preparation, fertilization, preparation of autumn wheat seeds for sowing, time of sowing, sowing rate, sowing method, maintenance work, irrigation, weed control, disease, and pest control system, harvesting without loss [12].

If you take full account of the technology of growing winter wheat, you can get a large harvest. At this time, it is necessary to pay attention not only to the variety of wheat but also to the no less important seed. Therefore, it is recommended to use seeds of I and II reproductions, in which the germination rate exceeds 85% and purity is at least 95%. As far as the choice of wheat varieties is concerned, the characteristics of different varieties are described below [8].

Before developing the technology for growing winter wheat, it is important to know the biological characteristics of autumn wheat. Winter wheat has the following biological characteristics [8]:

1. The germination temperature of wheat seed is 1-2°C.
2. Germination in the mass is 12-15°C.
3. The temperature for developing is 8-10°C.
4. The temperature for harvest is 15-16°C.
5. Development is good when soil moisture is 70-75%.
6. Transpiration rate (evaporation) 400-500.
7. The alkalinity ratio of the soil acidity should be neutral, i. e. pH 6.0-7.5.
8. Resistance to cold: destroyed at -16°C, -18°C in the absence of a snow cover.

By understanding these biological characteristics, we can breed more scientifically and improve the technology for growing autumn wheat to achieve high yields.

Let us analyze the agro-technical measures used in connection with the technology of growing autumn wheat against the background of 4 varieties of wheat created in various breeding and research centers of our republic, which differ from each other in the need for fertilizers, resistance to diseases and pests, yield [9].

As mentioned above, one of the most important ways to increase the yield of autumn wheat is to prepare the soil for sowing. When sowing the soil, the soil is granulated and loosened, the layer is turned, the plow layer is mixed, the soil is well-ventilated, and softened, plant residues and mineral fertilizers are embedded in the soil, organic fertilizers (manure), weeds are destroyed [13].

Basic tillage means that after the crop is harvested, the soil must be pre-tilled to a depth of 8-12 cm. However, some farmers do not carry out this operation because of the additional costs. However, during this operation the top layer of the soil is softened, plant remains, and larks are additionally crushed, a part of the weeds is destroyed, the seeds of the other part penetrate the soil and germinate, and the weeds that sprouted during the main plowing are destroyed, getting rid of the seeds of weeds, causing weeds to accumulate and retain moisture in the arable soil layer. For priming, i. e. primary plowing, layer, and disc tools are used [10].

The main plowing is carried out 2-3 weeks after harvest (to a depth of 22-27 cm). Before the main plowing, as mentioned above, mineral fertilizers should be applied in different doses based on different varieties of the main plowing. For comparison, 4 wheat varieties of different shapes are taken: Nurlu 99; Qiymatli 2/17; Azari; Barakatli 95 varieties are recommended to make mineral fertilizer in different amounts [3, 8].

The Nurlu 99 variety requires 100 to 120 kg of nitrogen, 80 to 100 kg of phosphorus, and 40 to 60 kg of potassium fertilizer per hectare on an active substance basis. Phosphorus and potassium fertilizers must be applied under the plow, and nitrogen fertilizers should be applied at the beginning of the development phase of the first spring, in the form of fertilizing, dividing the standard into two equal parts. The Qiymatli 2/17 variety requires 80-150 kg nitrogen, 80-120 kg phosphorus, and 50-60 kg potassium fertilizer per hectare of active matter. Again, P and K fertilizers should be applied under the plow and N fertilizers should be applied in two parts. The Azari variety should be fertilized with 100-120 kg N, 100-150 kg P, and 60 kg K per hectare on an active substance basis. Phosphorus and potassium fertilizers should also be applied under the plow. Nitrogen, on the other hand, is applied gradually. Barakatli 95 varieties should receive 100-120 kg nitrogen, 90-100 kg phosphorus, and 50-60 kg potassium fertilizer at the rate of the active substance per hectare under the plow. Then the soil is prepared for sowing [3, 8].

Like all crops, autumn wheat needs to be supplied with the necessary nutrients for normal growth and development and high yields. Plants obtain water and nutrients from life factors, mainly from the soil. When the seedbed is properly structured, moisture is retained in the soil, and nutrients are used effectively [12].

After basic tillage, pre-seeding tillage is carried out. The main operations of pre-seeding tillage are cultivation and weeding. Cultivation — loosening the top layer of the soil to a depth of 8-12 cm, destroying newly sprouted weeds, plays a role in the introduction of mineral fertilizers into the soil. Adequate tillage prevents the emergence of future weeds in the cereal-wheat field and has a positive effect on the purity of the grain. In this way, weeds in the grain do not match the seed. The next stage of pre-seeding tillage is to level the soil surface. Ground leveling is the process of smoothing the top layer of soil with blades or rotary discs. Trowelling, like cultivating, loosens and granulates the soil, leveling the soil surface and destroying weeds. A more effective result can be achieved if weeding is carried out at the time when weed sprouts are regenerating and at the beginning of sowing. The drilling process is very important and crucial. This is because, in addition to preparing the soil for sowing, the top layer of the soil is leveled after sowing, as we have already

mentioned, and the wheat seeds are buried in the soil at the same depth, which prevents the seeds from penetrating the top layer of the soil and, ultimately, prevents birds and pests from destroying the seeds. The result is a high germination rate [8].

Therefore, conditions have been created so that sowing and weeding, the main pre-sowing tillage operations, create a loose and aligned surface layer in the soil to prevent evaporation, accelerate microbiological processes and improve the nutritional regime in the crop layer, ensure soil aeration, prevent the formation of weeds even after sowing. In the technology of winter wheat growing, the process after the surface of the soil has been prepared consists of one of the most important factors — sowing. Before sowing it is necessary to determine the sowing rate, method, preparation of seeds for sowing, and the time of sowing [4].

Timely sowing, which is considered one of the most important agro-technical measures to achieve a high and stable yield of winter wheat, allows the plant to overwinter in the autumn and go through the appropriate developmental stages. This also has an indirect positive effect on its resistance to adverse winter conditions. Disease and pest infestation of winter wheat, as well as the timing of grain ripening, are directly related to the time of sowing. Therefore, the sowing of winter wheat in our republic should be completed at the most favorable time. This term is defined as follows [9]:

September 01-30 in mountainous areas, October 01-20 in foothill areas, and October 10-31 in irrigated plain areas. As the region of our autumn wheat cultivation belongs to the Ganja-Gazakh zone, the weather conditions are such as heavy rains or unstable windy weather, etc. if it is possible, or for subjective reasons, not to water after sowing, sowing between 5-10 November can also achieve high yields. In low-lying areas, irrigation after sowing is a prerequisite. At the optimum time, in the sown areas, shoots and lateral roots are formed on the plants until frost and business appear. Plants that are watered late or not at the right time will not be able to become bushy and will become weak. Such plants are not frost resistant and most of the plants are destroyed by frost, creating a thin layer in the field. Productivity and yield fall. Early drilling is also not considered advisable. Early sowing does not create the necessary conditions for the growth and development of autumn wheat. Such crops are susceptible to rust diseases and are heavily damaged by Hessian and Swedish flies [12].

We will take note of this in the control measures below. Therefore, in the irrigated lowlands of Ganja-Gazakh, mid-October to the first ten days of November is considered the most favorable time for sowing wheat [11].

As for the sowing norm of autumn wheat, from the literature, experiments, our observations, and research, we conclude that the sowing norm depends on the fertility of the soil, the degree of fertilization of the field, the duration of sowing, the biological characteristics of the varieties, the mass of 1000 pieces of seed, seed purity, seed germination, sowing relief, leveling, sowing. This can vary significantly depending on the method and other factors. It should be borne in mind that if the sowing rate is too low, the plants will be sparse and the conditions for weed growth will be favorable [15].

If the seeding rate is too high, the plants will be dense, there will be no good cover, there will be a lack of water and nutrients in the soil, there will be no weathering, and diseases and pests will be more common. As a result, yields are low. For this reason, it would be advisable to apply to the central agricultural centers of the Ministry of Agriculture in the regions and to obtain a document indicating the quality of the seed sown, to analyze the pre-sowing seed samples in the laboratory of the State Seed Inspectorate of the region [14].

This document records the germination capacity of the seed, purity, grade, number of weed seeds in 1 kg of seed, the mass of 1000 grains, economic suitability of the seed, infection with

diseases and pests, and other indicators. The optimal sowing rate in the irrigated area of Ganja-Gazakh in the Azari, and Nurlu 99 varieties we observed, is recommended to sow an average of 200-220 kg of seed per hectare. In this case, 1 hectare can receive 5 million sprouts, resulting in high yields, although the potential yield of these varieties is estimated at 70-80 or even 90 centners per hectare. If we follow the norms we have established, it is possible to obtain a harvest of 50-60 centners per hectare, depending on the technology used to grow autumn wheat. In simple terms, this means that 1 hectare can produce 5-6 tons of wheat, which can be used both in the bread industry and for animal feed. Once the seed rate has been determined, the next step is to spray and drill the seed with a controlled drill. Seeds are sown using the usual row method [3, 10].

In mechanical composition, it is recommended to bury to a depth of 5-6 cm on light soils and 3-5 cm on medium-heavy clay soils. One of the main problems in achieving high yields of autumn wheat is the preparation of seeds for sowing. The seed must be protected from seed-borne diseases. This can be powdery mildew, rust, etc. For this purpose, new medicines can be used, such as 15% Baytan (2 kg/ton), Vitavaks 200 (3 l/ton), Dividend (2 l/ton), and others, which have a systemic effect. It is sufficient to treat the seeds with medication. After sowing the medicated seeds with the seed drill, the irrigation ditches are opened, taking into account the relief of the area, and the seeds are sown at a rate of 600-800 m³/ha. Depending on the weather conditions, 3-4 liters of water are applied to autumn wheat. Irrigation I is not considered vegetation water, as it is called crop water, because it is applied after the seed has been sown, i. e. before the seed has germinated. Therefore, irrigation II, i. e. vegetation water I, is carried out during the stem formation phase, at 700-800 m³/ha. II vegetative water 800-900 m³/ha is provided at the spike observation stage, III vegetative water 800-1000 m³/ha is provided at the spike flowering stage, IV vegetative water 1000-1100 m³/ha is provided at the spike milk ripening stage, also called grain water. As can be seen, only 4000-5000 m³/ha of water is required for high yields of autumn wheat in irrigated lowland areas [14].

Between the irrigation periods, which is one of the decisive points, the work for the care of autumn wheat includes the following [16]:

1. Fertilising during the growing season.
2. Disease and pest control.
3. Application of herbicides to control weeds.

For the varieties Nurlu 99, Qiymatli 2/17, Azari, and Barakatli 95, which we have previously studied, we have stated above that when phosphorus and potassium fertilizers are applied during cultivation, N-nitrogen fertilizers should be applied gradually in the form of a 2-part feed. For Nurlu 99 it was concluded that 50 kg of N fertilizer should be applied before the first vegetative water before the bush period and 50 kg of N fertilizer should be applied before the second vegetative water in the form of a second feeding. In the Qiymatli 2/17 variety, it is desirable to bring N fertilization to the spike formation stage before the irrigation of the vegetation at the rate of 60 kg in the shrub stage before the first vegetation irrigation and 80 kg according to the second fertilization period. We consider it appropriate to apply nitrogen fertilizer in the Azari and Baraktli 95 varieties in the form of nitrogen feeding 2 times at the beginning of I and II vegetation water, at the rate of 60 kg per hectare each time [11].

During the growing season of winter wheat, regular observations should be made in the wheat field. Therefore, if there are signs of disease, immediate action should be taken with the use of pesticides, while at the same time observing the pests. I would like to note that if we follow the recommended technology for growing winter wheat, we hope that by growing healthy, disease-resistant plants, spraying seeds, and observing high agrotechnical rules, the risk of infection with diseases will be reduced. However, crops can be infected with various diseases and pests from the

environment due to wind, water, rain, and other natural factors. Therefore, we believe it is necessary to keep records of diseases and pests that may occur [4, 5].

Brown rust is a disease of wheat. The disease is caused by fungi. It is widespread in lowland and foothill areas. The disease manifests itself in the form of brown spots on the leaves of the plant. If such symptoms are found in large numbers, they should be sprayed 1-2 times with Bayleton type products (0.5-1.0 kg/ha). The fungal disease is caused by fungi. If the disease appears on the ears of the plant at the beginning of the milk milk-ripening stage, pesticides should be used. Fungi are also causative agents of dusty wheat disease. This disease also occurs in the sprouting stage. During this time, if the disease acquires a mass picture, the use of pesticides is mandatory. However, root rot disease can occur in damp years and places with mold. However, pesticides in our republic are sufficient for chemical control measures. One of the fungicides that provide long-term protection against rust disease in cereals is the IMPACT range. The standard application rate for these pesticides is 0.5 liters of liquid per 1 hectare [4, 7, 13].

Regular monitoring of cereal fields during the winter wheat sowing season is advisable. In our republic, wheat plants are mostly attacked by Hessian and Swedish flies, grain flies, grain mites, and grain beetles. However, as mentioned above, it is necessary to start using pesticides immediately. Otherwise, productivity will be fundamentally affected. If there are a lot of aphids and grain flies in the wheat field during autumn sowing, it is necessary to switch immediately to a chemical control method. It is recommended to use the best-selling pesticide 200 SC from modern preparations. The active ingredient of the pesticide, alpha-cypermethrin, is a liquid that dissolves in 200 g of water per liter and paralyzes the nervous system of the pests, causing their immediate death. The maximum effect of the drug occurs at a temperature of 15-20°C [4, 13].

It is best to spray between 11 am and midday or between 5 pm and 6 pm, as the temperature rise reduces the effectiveness of the product. It is not recommended to spray in rainy weather. Therefore, the day should be chosen according to the favorable weather conditions. This product is effective throughout the pest's life cycle. It causes mass extermination of pests by showing an immediate effect. The standard application rate is 1 hectare poured into 500-600 liters of water and sprayed in liquid form. It can also be used to control aphids and grain flies in autumn wheat fields. The active substance of the preparation is Esfenvalerate in the amount of 50 grams per 1 liter. The form of the preparation is emulsion concentrate. The standard application rate is 200-300 grams per 1 hectare in 600-800 liters of water. Additional indications are indicated on the products. In addition to disease and pest control, it is also necessary to use chemical methods to control weeds. If there are large numbers of weeds in autumn wheat fields due to factors such as water, wind, etc., it is possible to clear the fields of weeds by spraying winter wheat fields with herbicides at a temperature of 18-25°C in hot weather conditions [11].

Taking into account the fact that the technology of autumn wheat cultivation works in the Ganja-Kazakh region and the abnormal weather conditions in this region, frequent hail, and rains when the ears are fully mature, ordinary modern combines such as Class, SAMPO-65, New Holland are immediately towed to the wheat field. To prevent the wheat from overheating and pests from attacking it, it is necessary to protect it by turning it into a grain mass in storage. If storage is necessary, the entire warehouse should be pre-disinfected with special solutions [9].

As a result, we can conclude that winter wheat is a plant demanding water and nutrients. Therefore, the care of winter wheat crops consists of timely seasonal irrigation, fertilization (N, P, K), and control of weeds, diseases, and pests. Establishing a pest and disease control system means collecting an additional 30 percent of the crop.

Taking into account the fact that the chemical composition of the grain of winter wheat is not constant, but varies depending on the species and variety, climatic conditions, soil fertility, and

cultivation technology, a technology for growing 4 different types of winter wheat was developed for the Ganja-Kazakh region to obtain high-quality grain, which allows obtaining an average yield of 50-60 centners from 1 hectare.

As winter wheat is a demanding crop for mineral fertilizers, one of the most important factors was to determine the norm for N-nitrogen, P-phosphorus, and K-potassium fertilizers. It is important to know that autumn wheat extracts 25 to 34 kg of N, 19 to 20 kg of P, and 13 to 19 kg of K from the soil along with 1 ton of grain. In turn, we can determine how many kg of N, P, K (in physical weight) need to be applied to 1 ha of winter wheat to obtain 40 cents of yield.

In conclusion, we can say that if farmers, entrepreneurs, and producers of winter wheat grow autumn wheat based on technology, they will get a rich and high harvest. In addition, the technology of winter wheat cultivation can serve as a production map for wheat producers. The article can also be used in research work.

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