



FERTILIZER EQUIPMENT OF DRIP AND SPRINKLER IRRIGATION TECHNOLOGIES.

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Abstract

This article discusses the fertilization equipment of drip and sprinkling irrigation technologies, so effective irrigation is the use of such agro-ameliorative method as fertilizer-humidifying sprinkling, which is widely used in foreign countries on irrigation systems. And also, the creation of irrigation systems with multi-purpose use of the network and irrigation equipment will make it possible to radically change the technology of irrigated agriculture due to the simultaneous application of mineral and organic fertilizers, microelements, chemical ameliorants, growth substances, herbicides with water.

Keywords: fertilizer equipment, irrigation systems, fertigation, multi-purpose application, drip and sprint irrigation technologies, mineral and organic fertilizers, trace elements.

Introduction

In recent years, the development of irrigation methods and irrigation technology has been carried out in the direction of the multi-purpose use of irrigation technology for the application of fertilizers, chemical ameliorants, pesticides, and growth substances with irrigation water. In this regard, studies aimed at the rational use of water resources, the conservation and improvement of the natural resource potential of reclaimed lands are very relevant.

When developing new technologies, the need to obtain economically and environmentally justified crop yields is taken into account with the rational use of irrigation water, the introduction of macro- and microfertilizers, and the reduction in the cost of production, taking into account environmental protection.

The creation of irrigation systems with the multi-purpose use of the network and irrigation equipment will make it possible to radically change the technology of





irrigated agriculture due to the simultaneous application of mineral and organic fertilizers, microelements, chemical ameliorants, growth substances, herbicides with water, which will lead to the introduction of energy-saving and time-saving technologies: water itself is a means of transport and will require much less energy and time than with separate technological operations.

Materials and Methods

The purpose of this work is to analyze, generalize and systematize new knowledge in the field of multi-purpose use of irrigation, identify the total technological potential and prospects for constructive improvement of multi-purpose irrigation systems. The object of research is a set of technologies and technical means of irrigation of a new generation. The subject of research is general and particular relationships, features of the multi-purpose use of new generation irrigation systems for the integrated regulation of life factors of agricultural plants. The research methodology involves an analytical synthesis and analysis of published scientific material, new research results in the field of multi-purpose irrigation, the effectiveness of the overall regulation of life factors, as well as the conditions in which positive results are obtained. An analytical review of patent and other scientific and technical information on the problem of multi-purpose irrigation was made using the "Guidelines on the procedure for conducting patent research". Research materials are presented by published scientific articles, materials of published reports of scientific conferences and workshops, monographs. Materials for analysis were selected on a systematic basis, taking into account a set of uniform conditions, including mandatory experimental verification, the validity of research methods, a detailed description of the conditions under which the published results were obtained, the presence of a qualitative and quantitative assessment of research results.

Results and Discussion

Experiments in various regions of the country have established that the resistance of plants to drought increases sharply with the improvement of their need for mineral nutrition. When fertilizers are applied, the return on irrigation increases by more than 2 times. The action of fertilizers largely depends on the moisture supply of plants, so their effectiveness, as a rule, increases by 2-4 times.

Particularly effective are organo-mineral fertilizers applied with irrigation water. Therefore, fertilizer irrigation should be considered as an independent technological method. Organic fertilizers should be of paramount importance in the fertilizer





system, the use of which, in combination with mineral fertilizers, will increase not only the yield of agricultural crops, but the quality of the products obtained.

Fertigation is a method of applying liquid fertilizers simultaneously with irrigation water. There are so-called rules that must be taken into account during fertigation, namely, plant characteristics, stages of their growth and development, antagonism and synergy between plants, soil (substrate) properties, water quality, compatibility of fertilizers with each other and with the water used. The advantages of fertigation are the ability to harmoniously introduce nutrients with water, distribute them more evenly compared to other methods. At the same time, the norms of fertilizers per unit of production are reduced, the loss of fertilizers for leaching, gaseous losses, and immobilization are reduced. Soil compaction and mechanical damage to plants are reduced. Nutrients in solution are in ionic form, the only available for plants. It becomes possible to control the content and ratio between nutrients, taking into account the consumption of specific crops by development phases. With a properly selected composition, an overabundance of nutrients and their toxic effect on plants is unlikely. The negative impact of chemicals on the environment is excluded, since the solution used is weakly concentrated (0.1-0.3%).

The disadvantages of fertigation include additional costs for the equipment needed to dissolve and introduce fertilizers into the water. Constant monitoring and highly qualified personnel are required. Fertilizer components can be corrosive to irrigation equipment. Incorrect mixing may result in sedimentation. Limited choice of fertilizers and their high price. Through fertigation, macronutrients are most often introduced, namely nitrogen, phosphorus, potassium, less often magnesium and calcium. Trace elements can be in the form of foliar top dressing.

Fertigation is carried out according to one of three options. The first of these involves the use of auxiliary plant nutrition in addition to the available reserve of fertilizers in the soil due to the main application of fertilizers. The second option takes into account that part of the nutrients was introduced into the initial stages of plant growth and development in the usual way. The main part of fertilizers is introduced in the form of solutions with irrigation water during the growing season. The third option involves the introduction of the entire calculated dose of nutrients with irrigation water during the growing season. For fertigation, a combined schedule of irrigation and fertilization is built, which determines the timing and doses of nutrients, the irrigation rate, as well as the need for a mass of fertilizers for preparing a fertilizer solution, taking into account the available irrigation technique.

One of the modern methods of irrigation is drip irrigation. Modern drip irrigation systems are distribution tubes and hoses with droppers that are connected to the





pipeline and distributed over the entire irrigation area. In the existing drip irrigation system, fertilizers are applied to the irrigation water using a fertilizer mixer, an injector and a dosing pump. For the implementation of fertigation (a method of fertilizing by supplying dissolved nutrients with water), only water-soluble fertilizers are used. It is forbidden to use fertilizers that are slightly soluble in water in order to avoid clogging the system. Modern drip irrigation systems have a number of advantages over other methods. ensure efficient application of fertilizers, save time on the quality distribution of fertilizers, reduce water losses, which, getting into a limited area, do not touch the weeds, which prevents their growth. In addition, drip irrigation can be used in any weather without fear of sunburning plants.

Fertilizers can also be applied by sprinkling. When fertilizing with sprinkling machines, one should first of all take into account the correspondence between the intensity of rain and the water permeability of the soil, the irrigation rate depends on this. This will greatly increase the efficiency of fertilizer application. A correctly calculated irrigation rate will ensure high-quality moisture, no runoff and pollution of the water source.

The introduction of various fertilizers with water during sprinkling is ensured by the creation and availability of hydro-feeders on the sprinkling machines DDA-100MA, DDN-70, DDN-100, KI-50A, Fregat, Dnepr and others. These machines provide high quality artificial rain and, when properly zoned, irrigate without soil erosion, allowing efficient fertigation. Due to this, complete mechanization and automation of the process of satisfying cultivated plants with nutrients according to their needs on a scientifically based industrial basis is achieved.

And also it should be noted the groups of equipment for the production of chemical fertilizers are divided depending on the type of origin of the mineral and organic fertilizers themselves. Minerals are industrial products. Organic fertilizers refer to products obtained through the process of processing natural organic matter in a natural way. Technological equipment for the production of fertilizers allows the production of both mineral and organic products.

Equipment for the production of NPK fertilizers (mineral fertilizers). The NPK designation indicates the amount of nutrient content of the fertilizer as a percentage for plants. The letter name N is the percentage of nitrogen, the name P is the percentage of phosphorus, the letter K is the percentage of potassium. As a rule, the percentage of the above substances is indicated by a colon. Depending on the plant species, the nutrients are offered in the right ratio, depending on the type of crop being grown.





The equipment used for the production of NPK mineral fertilizers is divided according to its composition and technical characteristics - in general, the following main parameters can be distinguished by the model range:

Model №1/ №2 / №3 / №4

Grain capacity 2-6 mm (tons/hour) 0.3-0.5 / 0.8-1 / 2-2.5 / 3-4

Shaft diameter (mm) 240 / 360 / 450 / 650

Shaft width (mm) 60-80 / 100-150 / 200-250 / 250-300

Shape pressure (KN) 400 / 800 / 1300 / 2100

Sheet thickness (mm) 10 / 12 / 20 / 25

Sheet rolling capacity (kg/h) 1500 / 3000 / 5000 / 7000

Weight (tn.) 3 / 5 / 10 / 15

Depending on the productivity and type of finished product, it is possible to select equipment for the specific needs of the manufacturer.

Irrigation machines for applying fertilizers from irrigation water are promising to use with liquid complex fertilizers, the main advantages of which include the following: no need to create special mechanisms for dissolving fertilizers, since they enter the field ready-made; complexity and balance of QKD in any necessary proportions; the ability to introduce any microelements into the composition of fertilizers during their manufacture, which further contributes to the combination of several technological operations at the same time instead of the separate use of substances in several stages; fertilization is carried out using direct-flow or reloading technologies, which leads to an increase in the productivity of all machines participating in the complex.

When applying liquid complex fertilizers, the concentration of the solution should be taken into account, which should not exceed 0.04%. If the sprinkling machines are on the move, the length of the run in the coupling with the spreader must be taken into account, which will ensure high-quality application of a given dose of fertilizers to the field. In the case of using positional sprinklers, it is necessary to have calculations of the volume of the poured solution per area irrigated from one position, to know the number of positions (parking lots).

In farms where livestock effluents are used as fertilizers in irrigation systems, parameters such as the annual application rate of liquid manure, the degree of dilution with clean water should be taken into account.

When irrigating cultivated hayfields, first of all, it is necessary to calculate the required area in the application of liquid manure diluted with irrigation water, necessarily linking the irrigation area with the volume of effluents and their distribution over the area. This is necessary for calculating the technology for applying wastewater by sprinkling machines.





Nitrogen fertilizers are dangerous because of the high mobility of sodium nitrate, the accumulation of nitrates and nitrites in plants, which then enter human food. With phosphate fertilizers applied to the soil, cadmium, lead and other metals enter the plants. The use of potash fertilizers can lead to an imbalance of nutrients in the soil. It has been proven that uncontrolled chemicalization of crop production causes negative consequences in humans, causing allergic, neurotoxic, oncological and other diseases. The situation is aggravated by the fact that at least 1/3 of the fertilizers falling on the fields are washed away by melt and rain waters into watercourses, which causes eutrophication processes, i.e. over-enrichment of plants with nutrients that are assimilated by aquatic plants, which worsens the quality of the aquatic environment. The technology of applying fertilizers on irrigated lands includes the possibility of fractional application of nutrients in the form of top dressings, both with single-component mineral fertilizers, and with their various combinations. When carrying out foliar top dressing, introducing retardants (growth regulator), biological and chemical plant protection products, the sprinkling regime is applied at a rate of 3-60 m³/ha. To obtain the minimum value of the precipitation layer, special equipment is provided that ensures the operation of sprinkling units in the spraying mode with accelerated rotation or linear movement of multi-support machines.

In addition to the complete and timely satisfaction of cultivated plants in macronutrients, the efficiency of irrigated agriculture is associated with the rational provision of agricultural crops with microelements that can be introduced with irrigation water in the form of salts using a fundamentally new technique involving anodic dissolution of rare metals. Salts dissolve in water during the preparation of stock solutions. This can be either as a stand-alone operation or in combination with macronutrients, herbicides and other pesticides. One of the important elements of irrigation systems is a device for introducing microelements with irrigation water. It is designed to enrich water with microelements from metal electrodes under the influence of electric current and is mounted on the pipeline of an irrigation network or an electrified sprinkling machine. With the multi-purpose use of irrigation systems, it is possible to use it for the treatment of crops as herbicide. So, for example, there is a method for treating onion crops with herbicide, which is used as a 5-7% solution of ammonium nitrate.

Conclusion

Fulfillment of the requirements outlined above will contribute to the creation of environmentally friendly hydro-reclamation systems for multi-purpose use. Multi-purpose irrigation complexes are systems of a new generation, including a system for





protecting the natural environment, a quickly assembled transport network and a system of irrigation multifunctional modules that combine sprinklers of various types and stationary systems, systems for synchronous-pulse sprinkling, drip and pulse-drop irrigation, equipment for aerosol humidification and fertilization with irrigation water, technical means of "precision irrigation" with an irrigation intensity equal to the current one. Reconstruction and modernization of the irrigation system will provide high environmental and economic efficiency for the agro-industrial complex.

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