Efficiency of application of fertilizers Biohumus and Gumint at cultivation of Sudan grass (*Sorghum sudanense* L.) on seeds in the conditions of Northern Kazakhstan

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The article contains results on the theme of the scientific research "Efficiency of the use of bioorganic fertilizers Biohumus and Humint in the cultivation of the Sudan grass (*Sorghum sudanense* L.) on seeds in the conditions of Northern Kazakhstan" are presented. The region of the study was the North Kazakhstan region of the Republic of Kazakhstan.

Scientific work have information about organic fertilizers Biohumus and Gumint. Data on the results of using Humint and Biohumus for growing Sudan grass in the North Kazakhstan region are presented. Used fertilizers previously were not used in Kazakhstan for the cultivation of Sudan grass (*Sorghum sudanense* L.). The work include the results that were observed during the whole vegetation period of this culture. Work consist of data the density of the standing, height and structure of plants of the Sudan grass (*Sorghum sudanense* L.) during the growing season and harvesting. Certain conclusions and recommendations were made. The productivity of the Sudan grass (*Sorghum sudanense* L.) was determined. The results of the use of organic fertilizers for Sudan grass (*Sorghum sudanense* L.) in the Northern Kazakhstan conditions can be useful for farmers and other agrarians of the North Kazakhstan region, Kazakhstan and the world as a whole.

Sudan grass, field experience, organic fertilizers, Humint, Biohumus

Introduction

In Kazakhstan, the region of Northern Kazakhstan in particular, is the task of developing meat cattle breeding. For the intensive development of livestock and its intensification, cheap, high-grade, high-nutrition fodders has neccesity in sufficient quantities. Feed crop give for animals green food, hay, haylage, silage, dehydrated and fortified food (Минжасов и др., 2011).

They are can provide animals with cheap, high-grade fodders, balanced for protein, energy, amino acids, especially in their green mass in modern conditions (Abdelseed B.H. , et al 2011).

The conditions of farming and fodder production in Northern Kazakhstan are extremely diverse. Common to all zones is the continentality of the climate, characterized by a general lack of heat, a short vegetation period, late spring and early spring frosts, a moisture deficit, and the variability of meteorological factors by years (Мешетич, 2013).

A significant role in the creation of a solid food base belongs to perennial and annual grasses.

One of the forage crops, the most valuable and promising for cultivation in the conditions of Northern Kazakhstan is the Sudan grass (Sorghum sudanense L.). Sorghum belongs to the tribe Andropogoneae of the Gramineae family Poaceae (Duncan R.R.,1996).

Sorghum represents the staple food for a large population of Africa, India and the semi-arid parts of the tropics (FAO, 1997).

Sudan grass is a valuable crop for the production of green forage, hay and silage. Green mass both on the pasture and in the sloping form is well eaten by all kinds of cattle (Ahmed Suha O., et al, 2014).

Sudan grass (Sorghum sudanense L.) is favorably different from other forage grasses in that it produces high-yielding hay. Its chemical composition characterized by the following indexes: protein 16%, fiber 28%, fat 2.9%, nitrogen-free extractives 43%, sugars 3-8% (Jensen K.B. et al, 2006).

According to the content of the protein, the hay of the Sudan grass exceeds the hay grass of the water meadow and wheatgrass, some inferior to the alfalfa hay (Fombang E.N., 2005).

The protein content decreases sharply at the beginning of the earing - flowering, but the content of cellulose increases markedly. According to the content of fat and nitrogen-free extractives, it almost does not differ from the hay of annual grasses and leguminous grasses. Sudan grass contain tannins and phytic acid there are less digestible than other cereals for human and monogastric animals (Chen K.H. et al, 1995).

The most valuable economic quality of Sudan grass is high ability to grow after mowing or proper bleeding. Under favorable conditions, its growth during the day can reach to 5-10 cm (H.Z. Elbashir, 2008).

In the experiment were used organic fertilizers that previously applicate to cultivate Sudan grass.

Gumint - ecologically safe bioorganohumine fertilizers with water-retaining and growth-stimulating activity. This fertilizer is produced by "Scientific and Production Complex" Intellect "in Karaganda city, Kazakhstan. The main components for the preparation of bioorganic fertilizers are livestock waste (manure, chicken litter), crop production and humic substances of coal waste (Fazylov S.D., et al, 2014).

Biohumus this is bioorganic fertilizer, produced in «Individual entrepreneurship Strelec» in Pokrovka village, Esil region, North Kazakstan oblast, Kazakhstan. The company was established in 2012 for the production of organic potatoes and biological fertilizers. The study was made to increase the potato yield from 2013 to 2016. The increase in potato productivity by biohumus in 2013 was 30 hectares, in 2016 it was already 80 hectares. There is a good dynamics in increasing productivity of potatoes and favorable fertilizer effect. For the quality of its products, the «IE Strelec» has been awarded several times with various awards and prizes: «the Atameken» 3rd degree diploma for the best product of 2015, the winner of the Republican contest "Environmental friendly business" in

the nomination "Organic Agriculture" in 2014, the winner in the nomination "The best social responsible enterprise in the North-Kazakhstan region "2016 (Стрелец, 2016).

Biohumus is an environmentally pure organic fertilizer, a product of processing cattle manure by a population of a technological worm. This concentrated fertilizer contains in a balanced combination a whole complex of necessary nutrients and trace elements, enzymes, soil antibiotics, vitamins, growth hormones and plant development. It has a large amount of humic acids (Edwards C.A, et al 2010).

Methods

During writing of the scientific work were used methods of selection, systematization, determination, recording, analysis and processing of the material.

In addition, special methods have been used, such as field experience, which is the main method of studying various issues of farming: crop rotations, soil cultivation techniques, application of fertilizers, sowing plants and caring for them, as well as in variety testing and testing of machines; and the method of variance analysis according to Dospekhov, which was developed and introduced into the practice of agricultural and biological research by the English scientist R.A Fisher (Доспехов, 1985).

The object of research were chosen Sudan grass (*Sorghum sudanense* L.), Humint and Biohumus fertilizers.

Field experience was laid down on the experimental fields of the North Kazakhstan Research Institute of Agriculture, a. Beskol. Duration of experiment was from June to September 2017.

For the field experiment was laid down in 4-fold replicas for cultivating Sudan grass (*Sorghum sudanense* L.) for seeds with a plot area of 2-5 m^2. All records and observations were carried out according to the methods of the All-Union Scientific Research Institute of Forages named after V.R. Williams (Митрофанов, 1971).

Mathematical processing of scientific results was carried out by the method of variance analysis according to B.A. Dospekhov (Доспехов, 1985).

The rate of Humint fertilizer consumption 7-8 kg / 100 m^2.

The rate of Biohumus fertilizer consumption - 1t / ha

For the field experience was selected Alina Pavlodar variety of Sudan grass of, which is zoned and fodder. Specific features of Alina variety are yield, resistance to drought and damage to pests and diseases.

Results and discussion

In order to determine the effectiveness of the application of organic fertilizers in the cultivation of Sudan grass for seeds under the conditions of Northern Kazakhstan was used the field experiment. For experiment implementation we had 3 variants, one of them was a control one, in which there was no processing, all subsequent ones had an experimental setting.

The research work consist of the several stages. The first stage included the phenological observations during the winter period in 2017. The following results were obtained that the height of the snow cover in the experimental area was 55-56 cm; the average air temperature in January 2017 was - 16 ° C, in February - 10-11 ° C, in March the average air temperature was -2-5 ° C. In the middle of January, a two-fold snow retention on an area of 8 hectares was carried out in the experimental site, the distance between the shafts was 6-8 m. The beginning of the snow cover melting was observed on the March 17-19, and its full snow melting away was on the April 6-8.

Due to unfavorable weather conditions (low temperature, high rainfall), the sowing of sudan grass (*Sorghum sudanense* L.) was not carried out in May, and had done later on June, 2 in 2017, because the soil was not heated enough. The reserve of productive moisture in a meter layer of soil during this period was 111 mm.

The beginning of the sudan grass shoots was observed on June,12, full shoots on June, 15. The tillering phase was marked on June, 29. The number of vegetation days in the control was 94 days, with the use of Humint 90 days, with the use of Biohumus 92 days. Thus, Humint showed the best result, while the results of Biohumus were some lower.

During the whole vegetation period the values of density standing, height of plants, the structure of the plants of the Sudan grass during harvesting was determined.

When the density of standing was studied, we obtained results that led to the conclusion that the fertilizers "Biohumus" and "Humint" showed the same efficiency and the number of plants per m^2 increased to 6 and 9 pieces (Table 1).

Table 1. The density of standing of Sudan grass plants

Variant	Density of plants, pieces /м^2		Conservation of plants, %
	shoots	before harvesting	
Control	137,3	120,7	87,9
Humint	147	138	93,8
Biohumus	143,7	132	91,8

Bioorganic fertilizer Humint showed a higher result, in all aspects. So the index of plant density of shoots at Humint was 9,7 pieces ahead of the control to 3,3 pieces and exceed of Biohumus. Similar results were observed in the index of the density of plants before harvesting and the index of plant conservation.

Thus, the obtained results demonstrated sufficient effectiveness of Humint. Biohumus also has good results, but they are more inferior to the first.

The next stage of our stage was the determination of the linear growth of the Sudan grass, observing the same sequence of variants of the experiment (Table 2).

Table 2. Linear growth of Sudan grass

Variant	The height of the plants, cm	
	tillering	before harvesting
Control	19,8	137,4
Humint	24,5	175,3
Biohumus	22	158,6

The growth rate during tillering compared with the control ranged from 2.2 to 4.7 cm. In control during the tillering period, the height of the plants was 19.8 cm.

Before harvesting, in the control the height of the plants was 137.4 cm, and in the variant with using Humint 175.3 cm, which is 37 cm higher than control. In the variant with using of Biohumus, the height of the plants was 158.6, the difference with the control was 21.2 cm. The humint also showed slightly better efficiency than Biohumus, but it has similarly good indexes of the use.

The next stage of our study was the determination structure of plants of Sudan grass. The proportion of inflorescences and leaves in the variants of the experiment, as compared to the control increased, but the proportion of the stems decreases. The inflorescence in the control plot is 31%, using Biohumus 34%, using Humint 36.1%. The share of leaves in the control is 11.7%, with the use of Biohumus 13.3%, in the version with the application of Humint 13.6%. The proportion of stems in the control is 58%, in the variant with the use of Humint 56.3%, in the version with the use of biohumus 53.5%.

The weight of 10 plants, when taking into account the structure of the plants of the Sudan grass, was 997.5 g in the control, and in the fertilizer variants a large difference in weight was noticeable. Between the variants with the use of Humint and control, the difference in weight was 774.9 g, and between the variant using Biohumus and control the difference in weight was 722.8 g. Thus, Gumint also showed good results, which indicated its high efficiency.

The final stage of our study was to determine the productivity of the Sudan grass of the Alina variety with the use of organic fertilizers Biohumus and Gumint.

The productivity of the Sudan grass was determined in the last decade of August and the first decade of September as the full ripeness of the seeds was formed.

The productivity of the Sudan grass in the control was 12.8 c / ha, using Humit 16.9, which is 4.1 g / ha higher than in the control and using Biohumus 15,13 which was lower to 1.77 centners / ha than in the Humint. The positive effect of fertilizers of Sudan grass plants was noticeably higher than in the control. Thus, the productivity of the Sudan grass with the use of Biohumus increased to 2.33 c / ha in comparison with the control, in the variant with Humint application to 4.1 c / ha. Increasing the productivity of the Sudan grass by at least a few centners / hectare is an important factor in the creation of high-nutrient fodder and the feeding of farm animals.

The weight of 1000 seeds in the control was 10.3 g, in the variant with Humint 10.28 g, in the variant with the use of Biohumus 10,32 g. Thus, determining of the data with using Humint and Biohumus shown better dynamics, in comparison with the control.

Conclusion

The conducted study showed that the fertilizers used in the work favorably influenced to the plants of the Sudan grass, as evidenced by the data of work. Namely, despite the unfavorable conditions of the growing season, the productivity of plants increased from 12.8 c / ha to 4.1 and 2.33 c / ha. The productivity of plants increased in connection with the increase of fertility and productivity of soils as a result of directed metabolism and energy between soil and plant.

The most positive impact was from the fertilizer Humint, which includes animal waste (manure, chicken litter), crop production and humic substances of coal waste. The effect was obtained in connection with an increase of the element of fixing and growth-stimulating activity of humates, which affected to supplying of plants with nutrients.

No less positive impact was provided by the Biohumus fertilizer, which is a product of manure processing for cattle by the population of the technological worm.

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Received in March 2018, submitted to printing in April, 2018

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