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Formation of Annual Crop Yield When Cultivating for Green Conveyor System in Dry Steppe Area of Western Kazakhstan.

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ABSTRACT

The main condition of increasing the productivity of cattle is a stable and reliable forage reserve. Therefore, the branch of forage production faces the problem to create the rational forage reserve with a biologically complete content of nutritious substances, stable amount and rhythmical supply and economical cost. One of the method of regulation of green forage continuous supply of cattle from the early spring to the autumn is different terms of sowing of annual crops in the spring and summer periods in the green conveyor system. When the crops are chosen correctly taking into account the agroclimatic resources of the area, in summer it is possible to receive up to 80% and more of the animal production with much less cost than during the winter. The aim of this research is to develop the technologies providing the production of own protein balanced forage in the fattening complexes and feedlots and also milk farms producing the high quality milk. As a result of the conducted studies, the data of the green conveyor were obtained to be used in the technologies of the own forage production in the fattening complexes and feedlots in the Western Kazakhstan Region. On a whole, during the research period the conveyor of own green and juicy forage production for fattening complexes and feedlots provided the collection of 332.95 centner/hectare of dry mass, 330.0 centner/hectare of fodder units, 37.8 centner/hectare of raw protein and 394.31 gigajoule/hectare of metabolic energy.
Keywords: summer crops, green conveyor, annual crops, photosynthetic potential, yield, forage value.

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INTRODUCTION

Pre-requisites of the studies

Agrarians of the Republic of Kazakhstan were asked to export 60 thousand tons of meat in 2016. 20 years ago Kazakhstan exported 180 thousand tons and in 2009 Kazakhstan exported only 300 tons. This shows the enormous potential of cattle breeding. And it is more profitable because the huge Russian market importing annually up to 1.5 mln tons of meat is very close.

The Republic of Kazakhstan possesses all necessary conditions for the development of beef cattle breeding. They include the availability of natural forage lands and unused tillage, low cost pasture technology of beef cattle breeding. Besides, cattle breeding is a traditional trade of the native population. All this creates a potential for making Kazakhstan a significant and competitive player in the world market. The experience of such large world beef exporters as USA and Australia was investigated to elaborate the ways and measures of the beef cattle breeding development. Taking into account the world experience and conditions of Kazakhstan, KazAgro holding developed and received the approval of the Head of the state for the project “Development of beef cattle breeding export potential”. In the Republic of Kazakhstan it is planned to build 60 fattening farms with the fattening of 150 thousands animals at the same time or 300 thousand animals per year during the next 5 years. It will allow to produce about 60 thousand tons of beef for export and in 10 years to produce 180 thousand tons (Nasiev & Musina, 2016).

Nowadays the main part of the slaughter livestock is delivered to the processing plants from the farms and feedlots that grow and fatten the young stock feeding them by their own produced forage. In the most farms, this young stock is grown by extensive way on unbalanced rations that leads to the large consumption of feeds and labour per a growth unit. Low feeding level and bad housing conditions of cattle in the period of growing and fattening lead to the fact that the young livestock reaches 250-300 kg of live weight only at the age of 17-18 months, and then it is transported for the further fattening into the special fattening farms and complexes.

Calves with a delay in growth and development can not compensate it completely by the growth of live weight at the final stage of the production that is fattening. Feed consumption for 1 kg of growth during the fattening of such animals is increasing significantly. Therefore, one of the most important conditions of the further increase of beef production is the development of efficient technologies of providing the fattening complexes and feedlots by their own forage reserve at the economical consumption of forage grain (Vavzhinchak, 2013; Devyatkin, 2012; Karasek, 2008).

The leading branch of cattle breeding in the Western Kazakhstan is dairy cattle breeding that has to provide the population of cities and villages with the fresh milk. However, the milk production depends, first of all, upon the forage reserve. The cows give the largest amount of milk during the first five months after calving, and then the yield of milk is decreasing. Now in the farms of the Republic the winter and autumn calvings prevail and the biggest yields of milk coincide with the pasture period. Therefore, to use the cow ability to give milk efficiently during the first months after calving and to obtain the largest amount of milk, the cows shall be fed abundantly with the green forage of the highest quality.

The natural pastures can not solve to the full the problem of complete provision of dairy cattle with the green forage. The study of the productivity dynamics of the natural pastures shows that from July to the end of the pasture period the growth of green forage is decreasing gradually. Therefore, to provide the dairy cattle with the green forage and to obtain the maximal yield of milk it is necessary to organize the green conveyor with the corresponding selection of annual herbs besides the good pastures.

Choice grounding of the research trend

The important way to increase the harvesting of forage from the square unit is an improvement of the structure of crop acreage, a better use of potential possibilities of plants, that is, improvement of crop cultivating technology, use of the potential reserves of climate and natural soil fertility in a particular agrocenosis. This has an important economical significance because the cost price of the crop depends upon the crop capacity. This is extremely important for forage plants: forage cost in the structure of cost price of livestock products is from 30% to 70% depending upon the type of products and the region of production. Developing the conditions of creation of efficient forage reserve for the cattle breeding, it is reasonable to change the points of view to the existing traditional methods. This problem has become especially critical during last drought years. To provide the livestock with high protein forage, the most important is the summer crops of forage plants.

The studies of summer crops of forage plants were conducted in the CIS-countries and non-CIS countries and also in the different regions of the Republic of Kazakhstan. Researchers think the forage crops cultivation in the summer periods can be used as green conveyor. Introduction of summer crops is one of the ways to increase the forage harvest, to increase the utility factor of tillage and improve its fertility (Novosyolov, 2008; Nehring & Luddecke, 2001; Muller, 2002).

Green conveyor shall consist of a small choice of crops. The study of characteristics of plants and, first of all, productivity of the green mass and length of vegetation season (Dizik, 1954) is of a great importance for solving the problem of selection of annual crops and perennial grasses correctly as components of the green conveyor. It is known that animals prefer the grasses from the shooting to the earing phases of plants. Animals prefer legumes from the beginning of shooting stage till the end of flower-bud formation and initial blossoming (Nadezhkin, 2009).

Creating the green conveyor including the annual grasses, one shall take into account that the period of their profitable use is short. In some cases, when the selection of crops and terms of sowing are wrong, the annual grasses are used too early or with a small delay, and that leads to the sharp incomplete harvest and decreases the green conveyor productivity. It is necessary to use these or those crops in the period of the highest content of valuable nutritious substances and vitamins in them (Shlapunov & Goldman, 2014).

The following annual crops: oats, corn, spring vetch, pea, English beans, silage mallow, forage cabbage and also the mixes of annual crops were selected for the green conveyor in the Central districts of Nonchernozem area (Krylov, 1971; Lysak, 1990).

In the semidesert area of the central Kazakhstan the following annual crops were studied and selected for green forage: Sudan grass mohar, millet sorghum and bean crops (vetchling, pea, vetch, cheakpea, field pea) (Chasovitina, 1964).

The combined green conveyor uses the same crops and in the same consequence that is used in the artificial conveyor, the only difference is that according to the ripening the natural forage pastures available in the farm are used initially and then regularly (Kurmanbaev, 1993).

In the conditions of the North Kazakhstan, the following scheme was selected on fertilized and non-fertilized grounds: winter ruttishness, millet, Sudan grass, spring rape, mixes of pea with oat and spring rape with winter ruttishness (Bondarenko, 1986). In the Ural district, the system of green conveyor uses the crops of winter ruttishness, vetch-oat, pea-oat and other mixes sown postcut after graizing of winter ruttishness for the green forage (Kutuzova & Rogov, 1988). In Siberia, among annual crops vetch-pea-oats mixes are sown. On moist soils, the vetch-oat mix gives the high yield of green mass. In some years it reaches 120 centner/hectare or 1900 fodder units and 276 kg of digestible protein. Value of the crops of this mix is that after graizing at favourable conditions it grows very well and gives aftergrowth. According to the yield of the green mass the pea-oat mix is worse than vetch-oat mix (Lobkov & Shipitshyn, 1967). For Ural, Siberia and Far East, the wide-spread components of the green conveyor are the following: winter ruttishness, spring vetch, pea, vetch-oat, pea-oat mixes, Sudan grass, awnless brome, rape (Motovilov, 2004). Thus, when the selection of crops is rational the forage is supplied uniformly from the early spring to the late autumn.

The data of this summary shows that the studies conducted with forage crops in different countries were focused on the other qualitative characteristics of soil, climate, plant productivity levels and agricultural production profitability. The similar studies according to the offered scheme in the conditions of the research area have not been conducted earlier.

METHOD

The studies were carried out in the West Kazakhstan Agrarian-Technical University named after Zhangir khan in 2015 (Uralsk, Republic of Kazakhstan).

The soil of a trial plot is dark brown heavy loamy silty clay soil, physical clay content in the plough layer is 51%. Soil plough layer contains 2.8-3.1% of physical clay. Accumulation of carbonates begins in the lower part of the layer B, maximally in the layer C_K at the depth of 70-80 cm. Total absorbed bases in the layer 0-10 cm is 27.8-28.0 mg of equivalent per 100 g of soil. Up to the depth of 80 cm Ca prevails, at the deeper level Mg prevails. Na content in the plough layer and subsurface layer is low, i.e. 3.1-3.6% of total absorbed bases. Soil in the 1.5 m layer contains 672.5 mm of moisture (CM) and absorbs 481.3 mm (AM), the productive moisture of which is 236.7 mm (PM), in the plough layer it is 160.8; 102.1; 57.6 mm correspondingly. Bulk weight of soil is changing from 1.22-1.28 g/cm^3 in the plough layer to 1.65-1.66 g/cm^3 at the depth of 80–120 cm.

According to the morphological characteristics of genetic horizons of the profile and agrochemical values of the plough layer the soil of the trial plot is typical for the dry steppe area of the Western Kazakhstan.

The area of plots is 50 m^2, three time repeatability, location of plots is random. Forage crop cultivation agrotechnology is accepted, sorts are districted for the Western Kazakhstan area.

When conducting the field experiments with the forage crops, the calculations and observations of phenological phases and the growth of forage crops were carried out according to the generally accepted methods (Metodicheskie ukazaniya po provedeniyu polevykh opytov s kormovymi kul'turami [Methodological Guidance of Field Experiences with Forage Crops], 1987).

The photosynthetic activity of forage crops was studied according to the generally accepted method (Nichiporovich *et al*., 1961).

Determination of the main photosynthetic values according to the phases of the crop development. The area of one leaf was calculated according to the Anikeev-Kutuzov formula: AREA = $^2/_3 p \cdot h$, where p – width of a leaf, cm; h – length of a leaf, cm. Harvesting and accounting of the harvest was carried out by the continuous method with the following reduction to the standard humidity.

The statistic processing of the research results was carried out by the variance analysis method using the computer programs (Dospekhov, 1985).

The evaluation of chemical composition of the plant mass and metabolic energy was carried out according to the generally used methods (Metodicheskie rekomendatsii po bioenergeticheskoy otsenke sevooborotov i tekhnologiy vyrashchivaniya kormovykh kul'tur [Guidelines of Bioenergetic Evaluation of Crop Rotations and Technologies of Forage Crops Cultivation], 1989).

2015 crop year shall be considered unfavourable. If on the average in the region the level of precipitation is 311 mm, in 2015 crop year the amount of precipitation did not exceed average perennial value. If the precipitation of warm months April-August is summed, in Uralsk city the shortage of precipitation in the same period was 30.5 mm (perennial average value is 143.0 mm). Seasons of the year are also different according to the temperature regime. During April-August, the average air temperature was 18.9 °C. The ratio analysis of the air temperature and precipitation shows that during the whole summer season the climate aridity was observed and this was especially critical in May-July period. Unfavorable agrometeorological conditions in the vegetation period lead to the decrease of productivity of forage crops of 1 dry steppe area of the Western Kazakhstan region.

RESULT AND DISCUSSION

Preservation of crops at summer sowing of crops

One of the main factors of plant development during the vegetation period is plant population. This value has impact on the growth and development of the plants and as a result on the productivity.

The density of plants and also the preservation of these crops during the summer were different. It consisted of the germination of seeds, weather conditions at the moment of shoots, level of agrotechnology.

The plant population is different according to the crops. Differences are observed according to the terms of sowing as well; summer crops have lower plant population in comparison with the spring ones.

Thus, at sowing on April 30 the preservation of plants of oat and triticale was 74-75% at harvesting and at summer sowing terms its preservation decreased up to 55-59%.

The low plant population and preservation of plants is observed in the fifth sowing term (June 30). Among all the crops, triticale 55% and oat 59% showed the low preservation.

The preservation of plants in the studies depended upon the organic trait of the crops as well.

Corn and sorghum having a strong root system and drought-resistance in tests had a relatively higher preservation in comparison with oat and triticale. Sudan grass also showed a more resistant preservation.

Biometric values of annual crops in the green conveyor system

Growth combines many processes of plant life activity. Shevelukha V.S. (1980) mentions that besides the photosynthesis the growth is a leading process of crop formation.

When considering the peculiarities of various forage crops, their specific character shown in the height of plants should be mentioned first.

During the initial period the Sudan grass, corn, and oat grow slowly. These crops begin to grow only 15-20 days after shoots.

Total height of plants before harvesting and growth dynamics of various crops differ significantly. However, there are some common features in the growth dynamics of the separate groups of crops of the same family.

For example, Sudan grass, sorghum, corn have a very slow growth rate in the initial period. Since the beginning of the tilleting phase the growth of plants speeds up significantly. Especially fast growth is observed in the phase of stooling – earing, and at the moment of its transfer to blossoming it stops almost completely. Corn shows the high rate of growth in the phase of heading of panicles.

When studying the terms of crop sowing, the special attention was paid to the study of growing processes during vegetation period.

Plant growth was taken into account during the whole period of vegetation.

The obtained data allowed to find out that the maximal growth of plants is observed during the phase “stooling – earing”, and for corn it is the phase of heading of panicles, sorghum growth is gradual till the phase of blossoming.

External factors have a great impact on the plant growth dynamics. Sudan grass suffers from the lack of moisture during the phase of stooling to the beginning of earing.

Intensity and length of lighting have impact on the growth. All sowing terms are in different conditions of lighting length. Tests showed that the sowing term on June 1, June 15 and June 30 has a bad impact on the growth of Sudan grass, sorghum, corn, oat and triticale.

In our tests, the forage crops had different growth intensity and height at the harvesting due to the change of terms of sowing and height at harvesting.

The highest plants were the plants of the two first sowing terms, at the later sowing terms the decrease of height of the annual crops was observed.

If in the earlier sowing terms (April 30) the height of oat and triticale at the harvesting was 44.65 and 48.14 cm, at the later sowing terms the height of the said crops at the harvesting decreased up to 32.11-25.75 and 38.44-29.66 cm or at 18.48 and 18.90 cm. Weather conditions of the vegetation period (high heat and lack of moisture) had a great impact on intensive decrease of plant height of annual crops in 2015.

In test on the later terms, the decrease of growth of corn, sorghum and Sudan grass was also observed.

Despite the weather conditions, the highest growth showed corn and Sudan grass, and that can be connected to their morphological and biological peculiarities (drought resistance).

Photosynthetic values of forage crops at the summer sowing term

In the general search of new resources of energy, the photosynthesizing plants are more often and insistently considered as a possible accumulator and solar energy converter that can solve the problem of energy resources on the earth.

The logical sense of all works connected to the plant cultivation and the increase of its productivity consists in the development of measures aimed to better use the photosynthetic functions of the plants, and to obtain the bigger amount of direct products of photosynthesis by creating the complicated photosynthesizing systems (phytocenosis, sowings) (Yashutin, 2000).

To obtain high yield, the formation of the high but optimal size of photosynthetic apparatus, the area of leaves, is necessary, and it is natural that the optical density of the sowing shall be close connected to the area of leaves per 1 hectare or per 1 m^2 of crop. It was found out that the most optimal conditions to obtain the high productivity of the field crops are obtained when the area of leaves exceeds the field area 4-5 times (Korovin, 1984).

The changes of the growth of leaf area and photosynthesis productivity value depending on the density of planting, soil humidity and fertilizers distribution show that as a result of its application the growth of leaves area and photosynthesis productivity can be regulated, i.e. the main factors of photosynthetic activity in the crops defining the volume of yield (Nichiporovich, 1970).

The search of the most efficient use of light energy by the intensive sorts of crops in the field conditions, the increase of its efficiency coefficient by now is the most important problem of agricultural biology.

The area of leaf surface is of great importance for the plants because to a large extent this factor determines the total productivity of photosynthesis and, consequently, the yield. Besides, the specific weight of leaves in the total yield of corps, grown for the green forage, hay and silage, represents a particular interest as a value of forage quality: the leaves contain the significant part of all nutritious substances of the plant. To obtain the high yields it is necessary to form a big but optimal size photosynthetic apparatus – the area of leaves in the crops, and it is normal that optical density of planting shall be closely connected with the area of leaves per 1 hectare or 1 m^2 of crop.

In our studies according to the sowing terms, the biggest area of leaves was formed in the first two sowing terms. According to the photosynthetic potential, the later sowing term is inferior to the earlier terms. For sowing on April 30, the maximal area of oat leaves at the photosynthetic potential 0.95 mln $m^{2\cdot}$day/hectare was 15.03 thousand m^2/hectare, on the later sowing terms (June 30) these values decreased to 0.47 mln $m^{2\cdot}$day/hectare and 7.08 thousand m^2/hectare accordingly.

Similar situation was observed in all the other studied crops. A decrease of photosynthetic activity of annual crops is connected to the general decrease of agrophytocenosis density and growth intensity and crops development.

Among the crops, the highest photosynthetic potential had corn, sorghum and Sudan grass, which is also connected to their biological and morphological features.

The maximal area of corn leaves when sowing for silage on May 15 was 20.28 thousand m^2/hectare, and photosynthetic potential was 1.81 mln $m^{2\cdot}$day/hectare. At the later sowing terms (June 20) for green forage, the area of corn leaves decreased to 13.60 thousand m^2/hectare at photosynthetic potential 1.25 mln $m^{2\cdot}$day/hectare.

When using corn and sorghum for green forage, the length of vegetation period is reduced to 30 days.

Yield and feeding value of summer crops in the green conveyor system

According to D. Acci (1959), the yield reflects and integrates the action of the factors having an impact on a plant during its development, and its value is always the result of a compromise between productivity and resistance. The agronomic interpretation of plant adaptivity assumes, according to A. A. Zhuchenko (1990), such use of external environment resources and resistance to abiotic and biotic stresses which provide the high index of yield and the values of its quality, and consequently, the minimal costs of assimilators for the stability maintaining of the metabolic processes of plants. And the less favourable the conditions are, they can be optimized in a less degree and the higher the value of ecological resistance of the plants to realize its potential productivity. As the reaction of the plants for the environment has a collective character, taking into account of the influence of separate factors is less important than their summarized action intensifying or weakening the main physiological processes: water exchange, breathing, photosynthesis, nutrition.

L.G. Ramensky (1971) wrote that the consideration of every element of external environment is less important than the determination of the peculiarities of the interconnected impact on the plants. For example, the same amount of precipitation that precipitated in the conditions of different temperatures and air humidity has a different value for the plant. The reaction of plants to the environment has a synthetic integrated character. This is reflected in the yield of crops.

The process of formation of high yield is a complex set of added processes of nutrition, growth, development, and climate. High yields can be formed only at optimal combination of all stated processes.

The peculiarities of the agroclimatic regime revealed in the variability of the weather conditions of years and during vegetation period play an important role in the productivity of plant cultivation. The Western Kazakhstan belongs to the area of dry agriculture with unstable character of the seasonable distribution of atmospheric precipitations. When the deviation of annual precipitation is significantly decreased the sharp reduce of yield is observed. Completely different situation is observed in a high yield year. Due to the light mechanical content of the soil and low content of humus, big amount of moisture is not accumulated in the soil. Precipitation in autumn-winter-spring season does not play an important role in the formation of the productivity of the summer crops. Productivity of the summer sowing terms depends only upon the amount of summer precipitation and also upon the sowing terms. In summer crops and later crops the productivity is decreased sharply. The other feature of a warm season of the area is rather low relative air humidity. Air temperature between the rain periods is increasing up to 35-40 °C; soil temperature is 65-70 °C. This has a negative impact on the formation of vegetative mass of annual herbs. The lack of precipitation and high air temperatures affected the productivity of forage crops of 2015 (Table 1).

Table 1. Productivity of annual forage crops depending upon the sowing terms, centner/hectare

Options	Green mass	Dry mass	Fodder units
Sowing on April 30			
Oat for green fodder	60.45	14.16	14.16
Triticale for green fodder	63.25	18.04	15.33
Sowing on May 15			
Oat for green fodder	58.66	14.01	14.15
Triticale for green fodder	60.12	17.37	14.42
Corn for silage	117.45	23.79	24.50
Sorghum for silage	90.62	22.16	19.72

Sudan grass for green fodder	75.44	16.91	16.40
Sowing on June 1			
Oat for green fodder	42.15	10.35	11.28
Triticale for green fodder	48.44	14.12	12.14
Corn for silage	97.45	20.22	20.62
Sorghum for silage	79.77	19.95	17.75
Sudan grass for green fodder	63.44	15.07	16.12
Sowing on June 15			
Oat for green fodder	34.22	8.47	8.72
Triticale for green fodder	37.12	11.37	9.55
Corn for green fodder	84.22	18.07	18.61
Sorghum for green fodder	63.77	16.23	18.50
Sudan grass for green fodder	51.21	12.58	15.98
Sowing on June 30			
Oat for green fodder	28.75	7.61	7.76
Triticale for green fodder	29.14	9.62	8.27
Corn for green fodder	78.11	17.77	19.19
Sorghum for green fodder	54.66	14.29	16.15
Sudan grass for green fodder	42.44	10.79	10.68
Total productivity	1360.88	332.95	330.00
SMD_{05} dry substance: 30.04. – 1.43; 15.05 – 1.23; 30.05 – 1.55; 15.06 – 1.40: 30.06 – 1.49			

The higher productivity of the green mass was observed at spring and early summer crops. The productivity of the green mass of oat and triticale sown on April 30 was 60.45-63.25 centrer/hectare correspondingly, at the sowing on May 15 the productivity of the said crops during harvesting in the earing phase decreased a little and was 58.66 and 60.12 centrer/hectare correspondingly. The harvest of dry grass and fodder units of oat at the sowing on April 30 was 14.16 centrer/hectare, and at sowing on May 15, these values were 14.01 and 14.15 centrer/hectare correspondingly.

During the summer sowing terms, the decrease of oat productivity was observed in the harvest of green mass and dry mass and fodder units. When sowing oat on June 1, June 15 and June 30, the harvest of fodder units decreased by 2.88-5.44 centrer/hectare in comparison with the sowing on April 30.

When sowing on June 30, the productivity of green mass of oat decreased to 28.75 centrer/hectare that is less in comparison with the spring sowing (April 30) by 31.70 centrer/hectar.

The similar situation of the productivity of green and dry mass and also of the harvest of fodder units was observed when cultivating the other test crops (triticale, sorghum, Sudan grass and corn).

In 2015, all test crops reached the economic phase of the application ripeness (green mass, silage). If one compares the studied annual crops, due to the intensive growth and biological peculiarities the corn, Sudan grasss and sorghum had the highest productivity. These corps had the maximal output of the fodder units from one square meter in comparison with the oat and triticale crops.

In the studies of 2015, among all crops the highest forage value had corn, sorghum and Sudan grass. When sowing in the recommended terms for the Western Kazakhstan (May 15), these crops provide the harvest of raw protein at the level of 1.67-2.39 centrer/hectare at the output of metabolic energy 14.68-21.24 gigajoule/hectare. During the summer sowing terms the forage value of these corps is decreasing slightly due to the decrease of productivity that is connected to the droughty weather conditions of 2015 (Table 2).

Table 2. Feeding value of annual crops depending upon the terms of sowing

Options	Raw protein, centner/hectare	Provision of fodder units with raw protein, g	Metabolic energy, gigajoule/hectare
Sowing of April 30			
Oat for green fodder	2.02	142.7	12.76
Triticale for green fodder	2.61	170.3	14.18
Sowing on May 15			

Oat for green fodder	1.97	139.3	12.69
Triticale for green fodder	2.48	172.0	13.50
Corn for silage	2.39	97.6	21.24
Sorghum for silage	2.19	111.1	17.42
Sudan grass for green fodder	1.67	101.9	14.68
Sowing on June 1			
Oat for green fodder	1.44	127.7	9.69
Triticale for green fodder	1.99	164.0	11.08
Corn for silage	1.98	96.1	17.87
Sorghum for silage	1.89	106.5	15.66
Sudan grass for green fodder	1.42	88.1	13.79
Sowing on June 15			
Oat for green fodder	1.12	128.5	7.68
Triticale for green fodder	1.57	164.4	8.84
Corn for green fodder	1.84	98.9	16.46
Sorghum for green fodder	1.70	91.9	16.33
Sudan grass for green fodder	1.16	72.6	12.83
Sowing on June 30			
Oat for green fodder	0.99	127.6	6.83
Triticale for green fodder	1.26	152.4	7.49
Corn for green fodder	1.78	92.8	17.92
Sorghum for green fodder	1.35	83.6	16.00
Sudan grass for green fodder	0.98	91.8	9.37
Total productivity	37.8	115.0	294.31

In the test, the oat and triticale crops showed relatively low forage value despite the high provision of raw protein (up to 142.7-170.3).

On the whole, during the period of the research, the conveyor of the production of own green and juicy forage for the fattening complexes and feedlots provided the collection of dry mass at the level of 332.95 centner/hectare, fodder units – 330.0 centner/hectare, raw protein – 37.8 centner/hectare and metabolic energy – 394.31 gigajoule/hectare. The quality of the obtained products corresponded to the zootechnical requirements. The cellulose content was 15.60-26.90%, a raw protein 9.07-14.22%. The test at the later terms showed the decrease of the raw protein of corn 10.00%, sorghum 9.45% and Sudan grass 9.07%. The oat and triticale showed the higher content of protein. It should be mentioned that in the early crops there is more fat, ash and protein in comparison with the summer crops.

CONCLUSION

Despite the relatively low productivity, the introduction of the annual grasses and early summer sowing terms into the green conveyor system is an important method of provision of livestock in the fattening complexes and feedlots. The green conveyor in July and August works mainly due to these high-yield crops (corn, sorghum, Sudan grass), which is extremely important for the dry steppe areas of the Western Kazakhstan. The amount of green mass in various periods of pasture season is changing greatly. On natural and sown perennial pastures, according to the stages of the vegetation period, the green mass is formed quite unevenly: the maximum is May-June (30-50%), the minimum is July-August (0-5%). Therefore, at this period the livestock often suffers from the shortage of forage, the cattle yield of milk is decreasing, the hair of sheep is growing slowly, and low additional weight is observed. Crops of spring sowing terms are fed and mown in June and July. And if Sudan grass is mown at the period "end of shooting stage – beginning of earing", the obtaining of the second harvest is possible by the regrowth of these crops. Corn and sorghum are mown at the beginning of August.

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