Innovative techniques in production of fodder protein in adaptive crop science of west Kazakhstan

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Abstract. As in old times today the formation of a reliable, well-balanced fodder base add the reduction of fodder nutritive value during the gathering is to the great extend determined by the proper organization of fodder production and conservation. The creation of high-value fodder base for the development of breeding depends both on the proper selection of crops and their biological peculiarities. Thus in the investigations we studied the biological peculiarities of growth and development, capacity formation of different crops of pure and mixed sowing. As the result of these investigations we have obtained the data? Which allow us to estimate the capacity of feed crops of pure and mixed sowing in soil and climatic conditions of West-Kazakhstan region for using in innovative techniques of production of fodder protein?
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Introduction

The solving of breeding development problem is closely connected with the strengthening of the fodder base. Weak, non-stable fodder base is a wide spread phenomenon of West-Kazakhstan region. The capacity of natural and artificial forage lands in the meadow fodder production is extremely low. Natural hay lands and pastures have come down, in the zone 3 there is a desertification. The crop acres reduced greatly in age arable fodder cropping, feed crops yield is also reduced. The selection of crops lowered to fodder-grain crops (such as barley, oats, wheat for fodder). 76% of the tilled field structure are occupied by single-crop wheat, 20,2% are for barley, millet and winter ruttishness occupy 2,1% and 1,3& respectively and other grain crops (including fodder crops) occupy 0,4% of the tilled field structure. Today the fodder production using progressive technologies is as stopped. In practice animal stock is fed with low-caloric grain screenings and mill offal's and sometimes with wheat alone. To bring the fodder production through this tight corner it is important to carry out the diversification by means of changing the structure of crop acres (increase in the structure of sowing high-protein feed crops), increase capacity and liquidation of protein shortage, implementation of adaptive and innovative technologies [1,2,3].

Methods.

The investigations were carried out in Zhangir khan agricultural and technical university of West Kazakhstan within the grant financing programme by the Scientific Committee of Ministry of Education and Science of the Republic of Kazakhstan on the "Development of innovative techniques in production of high-protein feed crops in forage lands" project (No. of official registration 0112PK00498).

The soil of the tested area is dark chestnut, heavy clay-loam, silty-pulverous, plough-layer contains 51% of physical clay. The topsoil has 2,8 - 3,1 % of humus. Total absorbed bases in the layer of 0 - 10 cm amounts to 27,8 - 28,0 mg-eq per 100 g of soil. Soil weight by volume varies from 1,22 - 1,28 g/cm3 in the topsoil to 1,65 - 1,66 g/cm3 on depth of 80 - 120 cm.

Plot area is 50 m2, repeatability is treble, arrangement of plot areas is randomized. Fodder crop management practice is accepted, cultivars are zoned for West Kazakhstan region.

During the ontogeny of fodder crops we observe their growth and development according to generally accepted methods [4]. Photosynthetic activity of fodder crops has been studied according to the generally accepted method [5]. Harvesting and account of harvest by means of continual method with the following bringing to the specified moisture content. Statistical processing of the investigation results with the help of analysis-of-variance method using computer programmes [6]. Chemical composition, nutritive value of the vegetational mass and soil specimens analyses have been carried out according to the generally accepted methods. Weather conditions in the years of investigations were on the level of long-time average annual indices.

Growth, development, capacity formation of fodder crops is closely connected with the growing season length. All crops were sowed on one and the same date - April 22nd. Depending on the growth and development peculiarities as well as using crops for fodder, their harvesting was carried out depending on

their usage. Sudan grass is mostly valuable for fodder in the condition of green mass. In this regard it is reasonable to use Sudan grass as a feed crop at the beginning of the ear formation stage. In our investigation the beginning of ear formation of Sudan grass came on June 17th. Thus, growing season length for Sudan grass from sowing till harvesting is 45 days.

In respect of the fodder the harvesting of different crops begins in different stages of their development. Spring rapeseed is mostly valuable for fodder in the beginning of blossoming, but winter rapeseed , sowed in spring, shall be harvested during the stage of rosettes. I our investigations both spring and winter rapeseed was harvested on July 5th, growing season length was 73 days.

Sunflower for fodder aims as well as spring rapeseed shall be harvested at the beginning of blossoming stage. At the further growth sunflower stems lose their nutrients, the content of water decreases and the formation of seeds can result in infestation of fields. In our investigation the blossoming stage of sunflower began on July 12th, i.e. growing season length was 80 days. Barley and pea have valuable bread-corns in the respect of fodder. In this regard the harvesting of these crops was carried out during the dead-ripe stage. Barley reached this stage on July 12th, having the growing season length of 80 days, and pea reached this stage on July 22nd, growing season length from sowing till harvesting was 90 days. Maize as one of the most valuable feed corns can be grown for various purposes: for getting bread-corns, green mass, silage etc. In our investigation maize was supposed to be used for silage, because of this fact its harvesting was carried out during the combined wax-ripe and milk-ripe stage. The above mentioned stage of maize began on July 27th, growing season length was 95 days. Thus, during the investigations the growing season length of the tested crops depended on the purposes of their use and amounted from 45 to 95 days.

To form the required amount of green mass and harvest it is necessary to have not only the growth of crops in height, but also the leaf-area duration. In our experiment the following crops formed the biggest leaf-area duration: Sudan grass - 30.25, maize - 28.12, sunflower - 27.15 thousands m2/ga. These crops had the photosynthetic potential of 1.87, 2.68 and 2.22 mln. m3 dn/ga respectively. Spring and winter rapeseed and pea had lower photosynthetic potential - 0.88, 1.03 and 1.41 mln. m2 dn/ga respectively. Thus, Sudan grass, maize and sunflower have relatively big leaf-area duration and photosynthetic potential.

The final objective of the managing of these or those crops is the getting of the product. Not only the physical weight is important for the fodder purpose but also the estimation of the feeding value. The tested crops are used differently for the fodder purpose, that means that for barley and pea their bread-corns are valuable for this purpose, while for other crops the green mass has greater feeding value. That's why the capacity was estimated by fodder units and content of crude protein. The capacity of all tested crops depended on the weather conditions. The yield of barley bread-corns amounted to 23.2 dt/ga. This equals to 22.71 dt/ga in fodder units. Crude protein output was 2.51 dt/ga/ The provision of fodder units with protein in barley bread-corns was 110.6 g with 20.19 gigajoule/ga of metabolic energy. Also a high level of provision of fodder units was noted in pea bread-corns - 192.1 g, in green mass of spring and winter rapeseed - 176.6 and 183.0 g. Quite high fodder units output per area unit was marked by maize - 27.21dt/ga, sunflower - 18.24 and Sudan grass - 17.79 dt/ga (table 1).

Table 1 - Capacity of pure sowing of feed corns in West Kazakhstan

Name of corn	Bread-corn dt/ga	Green mass dt/ga	Dry weight dt/ga	Fodder units, dt/ga	Crude protein dt/ga	Provision of fodder units with protein g	Metabolic energy Gigajoule/ga
Barley	23,2		19,58	22,71	2,51	110,6	20,19
Sudan grass		83,3	18,16	17,79	1,79	100,7	16,36
Maize		138,4	25,19	27,21	2,59	95,2	23,45
Sunflower		115,8	24,32	18,24	2,52	138,2	16,98
Spring rapeseed		51,2	6,40	6,91	1,22	176,6	4,23
Winter rapeseed		54,4	6,53	7,05	1,29	183,0	4,90
Pea	14,5		11,7	14,16	2,72	192,1	13,39
SMD_{05}, dt/ha 7,18							

Not only pure sowing of different crops is of great interest for the fodder purposes, but also the usage of mixed sowing of feed corns. The proper selection of mixed sowing provides getting of balanced fodder products. Multicomponent mixtures of non-perennial crops, often called polyspecific, are of great importance in crop science. The mixed sowings are also an integral part of modern crop science and an important factor of agriculture intensification. The advisability of this seeding method can hardly be put into question. Mixtures give more stable harvest as the reduction of capacity of one crop is filled up with other one's capacity, the feeding mass is improved in quality and vital factors are used rationally and in full [7,8,9,10].

In our investigations we studied mixtures of different crops with traditional fodder-grain crop - barley. All the tested variants were sowed on one and the same date - April 22nd. Almost all variants, except the variant of mixture of spring and winter rapeseed, were harvested at the beginning of blossoming stage of pea - June 17th. The mixtures of spring and winter rapeseed were harvested at the

beginning of blossoming stage of spring rapeseed - on June 25th, i.e. in 63 days after sowing.

The investigations of mixed sowing study gave the following results of agrophytocenosis capacity: green mass output for the variant of joint sowing of barley and pea equaled to 75.25 dt/ga, which expressed in terms of dry weight amounted to 12.65 dt/ga.

For the variant of joint sowing of barley, winter ruttishness and pea the green mass capacity equaled to 81.61 dt/ga, dry weight was 15.35 dt/ga. For the variant of sowing of barley + Sudan grass + pea these values were 112.63 and 23.21 dt/ga.

For the sowing of mixture of barley, millet and pea the harvest of green mass amounted to 95.37 dt/ga with the dry weight output of 18.98 dt/ga.

Joint sowing of barley, spring rapeseed and pea resulted in green mass output of 98.05 and dry weight of 17.55 dt/ga.

Mixed sowing of spring and winter rapeseed provided the harvest of green mass on the level of 71.88 and dry weight of 8.34 dt/ga.

For the joint sowing of barley, oats and pea the green mass capacity equaled to 98.82 dt/ga, dry weight was 19.77 dt/ga.

Thus, the biggest green mass output as well as dry weight output was marked for the variant of joint sowing of barley, Sudan grass and pea (table 2).

Table 2 - Capacity of mixed sowing of feed corns in West Kazakhstan

Test variants	Green mass	Dry weight	Fodder units	Crude protein	Provision of fodder units with protein g	Metabolic energy Gigajoule/ga
Barley + Pea	75,25	12,65	10,75	2,34	218,0	10,18
Barley + Winter ruttishness + Pea	81,61	15,35	12,74	2,64	207,0	12,14
Barley + Sudan grass + Pea	112,63	23,21	20,88	3,76	180,0	19,24
Barley + Millet + Pea	95,37	18,98	15,75	3,19	203,0	14,90
Barley + Spring rapeseed + Pea	98,05	17,55	15,09	3,30	219,0	14,25
Spring rapeseed + Winter rapeseed	71,88	8,34	9,17	1,62	177,0	8,62
Barley + Oats + Pea	97,82	19,77	17,19	3,36	196,0	16,13
SMD_{05}, dt/ha 3,85						

Consolidated figures for fodder values of harvest which are important for production, are gather of fodder units, digestible protein and fodder-protein units with the harvest. Comparative testing of mixed sowing at output of fodder units per fodder unit area and crude protein allowed us to detect the most valuable fodder mixtures. Thus, according to our investigations the greatest output for fodder units and crude protein was got with the variant in which barley and pea were used in the mixture with Sudan grass (20.88 and 3.76 dt/ga respectively), a bit lower values were get with the variant of barley, pea mixed with millet (15.75 and 3.19 dt/ga) and spring rapeseed (15.09 and 3.30 dt/ga). Lower output for fodder units and crude protein was get with the variant of two-component mixture of barley and pea only (10.75 and 2.34 dt/ga).

As for the content of crude protein in fodder units, the variant of combination of barley and pea with spring rapeseed was marked as the best one - 219 g. The variants of combinations of barley and pea with Sudan grass, ats and millets had a bit lower level of crude protein content in fodder units (180 g, 196 g, and 203 g respectively). The variant of combination of winter ruttishness with barley and pea had average level of crude protein content in fodder units (207 g). This index was lower for the variant of joint sowing of spring and winter rapeseed (177 g).

The variant of mixed sowing of barley, Sudan grass and pea was characterized with a high level of metabolic energy - 19.24 gigajoule/ga. For the variants of combination of millet and oats with pea metabolic energy amounted to 14.90 and 16.13 gigajoule/ga. The variants of combination of barley and pea with winter ruttishnes and spring rapeseed were characterized with the average level of metabolic energy (12.14 gigajoule/ga and 14.25 gigajoule/ga respectively). The following variants had low level of metabolic energy: combination of barley with pea alone - 10.18 gigajoule/ga and mixture of spring and winter rapeseed - 8.62 gigajoule/ga.

As the result of the investigations, conducted under the conditions of West Kazakhstan there were developed innovative techniques, which allow getting of stable harvests of highly qualitative feed corns with high indices of energy efficiency.

These results give reason to consider that the usage of both pure and mixed sowing of feed crops provides the increase of harvesting of fodder protein in crop science of West Kazakhstan.

The highest capacity in pure sowing was marked for sowing of barley together with Sudan grass for green feed, with sunflower and maize - for silage. Fodder-grain chickpea and green mass of spring and winter rapeseed were marked as having the highest provision of fodder units.

The best results in the relation of fodder were get by use of mixed sowing f barley and pea with Sudan grass, millet and oats. Also a quite high level of feed value can be obtained by joint sowing of the above mentioned crops with winter ruttishnes.

Conclusion.

To increase fodder protein in crop science under the conditions of West Kazakhstan region it is reasonable to use innovative techniques, which are pure and mixed sowing of highly productive and high-protein feed crops.

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