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Cultivation of fodder beans at the Zarechny state farm during the development of virgin lands in Kazakhstan

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Abstract. The article deals with the beginning of virgin lands development in Kazakhstan in the 1950s. In those years there was an acute shortage of fodder crops, as vast areas of land were given to grain crops. Since the traditions of legume and fodder crops cultivation were forgotten, the specialists of the Zarechny state farm had to apply new methods to solve fodder problems under difficult conditions. The authors came to the conclusion that during the experiments, the specialists of the state farm determined the best way of sowing forage beans by means of square-breeding sowing of a mixture of corn and beans. The chosen method solved the problem of fodder for cattle to a certain extent, affecting the productivity of the dairy herd and its weight gain.

1. Introduction

Legumes are not some new crops in the agriculture of our republic. Beans, kidney beans, peas, soybeans, chickpeas, lathyrus, etc. in pre-revolutionary Kazakhstan were cultivated over a number of past centuries [1]. Each peasant knew well the agricultural technique of cultivating legumes. In the twentieth century the cultivation of leguminous crops was strongly developed in the advanced states – Romania, Hungary, Poland, Czechoslovakia and the German Democratic Republic. However, during the first years of Soviet power, due to the fault of the USSR State Planning Committee, as well as agricultural scientists, agricultural workers and especially agricultural personnel, legume crops were largely ousted from the structure of grain crops – in fact, the agricultural technique of legume crop cultivation was forgotten, which caused great damage to the national economy of the country. Due to the lack of cattle fodder and premises nearly 11.5 million sheep and goats died during 8 months of 1954 economic year in the collective farms of the country. Therefore, the task set by the state was not only to prevent the reduction of livestock, which took place, but also to achieve its increase [2-3].

In 1956, after the beginning of the of virgin and fallow lands development in Kazakhstan, the following changes occurred in the size of the sown areas of individual grain and legume crops in the Soviet Union as a whole (in million hectares). See table 1 [2].



Table 1. Cultivation areas of cereals and legumes.

Name	1953	1954	1955	1956	1956 in % by	
					1953	1955
Corn	3.5	4.3	9.1	12.3	353	135
Millet	4.1	5.5	7.7	6.7	164	87
Buckwheat	2.6	2.8	2.8	2.7	101	97
Legumes	1.6	1.8	1.4	1.5	93	109
Vetch for grain	0.5	0.4	0.3	0.4	94	128
Wheat	48.3	49.3	60.5	62.2	129	103

Thus, in three years wheat crops increased by 14 million hectares and corn – by 8.8 million hectares. However, the situation remained unfavourable with the sowing of leguminous crops, the area of which had fallen by almost 40 per cent compared with 1940, and vetch for seed, the area under which had fallen by half.

2. Materials and methods

The authors of the article, when working on the problem, used general scientific and special methods: analysis, synthesis, as well as historical and retrospective, which made it possible to most fully reveal the goals and objectives of this study. An interdisciplinary approach was also used, when methods of various scientific humanitarian and natural science disciplines are used to achieve the final result, which is very important in contemporary research.

3. Results and Discussion

The issue with fodder base was one of the urgent in the years of virgin lands development, since mass ploughing of virgin and fallow lands led to a shortage of grazing land, necessary for the development of cattle breeding [4–17]. Therefore, in areas of virgin lands cultivation of corn for grain and silage started in all zones and districts of virgin land. In order to expand the areas sown with legume crops as quickly as possible, a large quantity of imported legume seeds was brought into the USSR in 1961.

In 1956, the following changes took place in the composition of the area under fodder crops in the USSR as a whole (in million hectares). See table 2 [2].

Table 2. Areas sown for fodder crops.

Name	1953	1954	1955	1956	1956 in % by	
					1953	1955
Annual grasses and corn for green top dressing	7.8	9.4	14.7	17.1	218	116
Including corn for green top dressing	–	–	4.2	5.2	–	123
Crops for silage (including corn)	2.3	3.9	5.7	7.1	307	125
Feed root crops and fodder melons	1.7	1.8	1.6	1.5	89	98
Mowed area of perennial grasses sown in previous years	15.4	15.8	13.0	11.6	76	89
Perennial grasses of the current year sowing (uncovered and undercover)	8.1	6.7	5.4	6.1	76	114

In 1956, compared with 1953, the sowing of annual grasses and corn for green top dressing increased by 9.3 million hectares, or more than 2 times [18].

The area under silage crops increased more than 3 times as compared to 1953 and by 25% as compared to 1955. In addition, the expansion of corn crops for grain in 1956 also resulted in a significant increase in succulent fodder due to the ensiling of corn stalks.

One of the state farms of the virgin region, where the area was actively sown with grain and legumes, was the Zarechny state farm. Of these imported seeds of fodder beans, in the spring of 1961, with some delay, the Zarechny state farm received 30 centners for sowing and propagating fodder

beans. The imported fodder bean seeds were dressed with granosan and powdered with 12% hexochloron in the dosage of one kg per one centner of seeds before sowing [19].

Bean sowing on an area of one hundred hectares with a seeding rate of 30 kg was carried out from May 25 to 30 on a fallow field. Sowing was carried out with a square-nest seeder. Prior to sowing, by testing a seeder with a different set of disks in terms of thickness, number, hole and hole diameter, a disk with 12 holes was determined, which contained only one bean grain. The sowing of beans was carried out without the use of a measuring wire with a row spacing of 70 cm. With this method of sowing, precisely planted bean seeds were placed from one another at a distance of 10 to 15 cm. Seeds were planted at a depth of 10 cm. Following the end of the sowing of beans, the soil was rolled with ringed rollers. The intensive increase in heat in the soil accelerated the emergence of seedlings on the sixth day from the start of sowing. No harrowing of bean seedlings was carried out, as the soil surface was loose and there were no signs of weeds.

The first inter-row treatment of beans was carried out in June at a height of 8–10 cm of beans. The second inter-row treatment was carried out in July. The friability of the soil and the absence of weeds did not require additional treatments.

Very warm weather in the absence of precipitation in June favourably affected the development of all types of pests of agricultural plants. In particular, the nodule weevil gnawed tender bean stalks in the first 10–15 days after germination. The earth flea and phytonomus also caused significant damage to bean leaves. Attempts by farmers to call an aircraft for aerial dusting were unsuccessful.

A major shortcoming and omission in the work of machine operators and agronomists with regard to bean cultivation was the fact that obligatory measures for chasing (removal of shoot tops or upper shoots in agricultural plants to stop their growth – *the authors*) were not taken. The main stem of forage beans produces one to four side shoots. The main stem and shoots continued to grow slowly throughout the growing season, i.e. until frost, and as the stems grew, flower buds were formed and subsequently bean pod ovary. In this position, by the beginning of frost, the bottom of the bean pods was completely dry and began to crumble. The middle part of the pods was in initial waxy ripeness, and the top of the main stem and side shoots had a state from partial ovary of pods to opening of flowers. Consequently, chasing, and, moreover, only mechanized, with mounted headers adapted for a high cut, promptly stopped the growth of stems and at the same time accelerated the ripening of bean pods in the middle part of the stem.

Harvesting and drying grains of fodder beans was a complex and difficult task – this was due to the imperfection of harvesting machines, namely: mowing the beans into windrows at the lowest cut with bare headers was started when 15% of the pods were browned and ripe in the lower tier of stems. Initially, tractor drivers worked out the usual norm for mowing grain in swaths, but the first day of work showed that such a norm was unrealistic, since the weight of the green mass of the mown beans at the full grip of the 4.6 mt. bare headers continuously hindered the normal rotation of the headers [3].

The ripening of beans in the windrows lasted more than twenty days, and in this case, despite the absence of rain in September and October, the tops of all the stems, and especially in the lower part of the windrows lying on the ground, were completely green and not dried up. In this situation, the state farm began to collect and thresh the beans on October 10 with SK-3 combines. To reduce the speed of the drum, the drum pulley was moved to the shaft of the main counter drive, and the pulley of the main counter drive to the drum shaft. In order to avoid grain crushing, the input and output decks of the drum have been lowered to the limit.

Picking up and threshing the tightly packed beans was a very labour-intensive job. The header of the combine must have sliding on the soil surface; for this, the sliders of the harvester were completely retracted. The outer protrusions of the pick-up springs, in order to pick up a tightly lying swath on the ground, like light harrowing of the soil, had to have a constant grip with a loose superficial soil layer with nails.

With this method of collection and threshing, the movement of the combine took place in the lowest gear. The harvester is constantly shrouded in earth dust and it is difficult for the combine operator to breathe dusty air and specially to monitor the work of the pick-up through the glass of

goggles. The harvester output per daylight hours did not exceed 6–7 ha, which were taken as the basis for the calculated output rate [18].

The most difficult and more complicated process was the further work: drying, cleaning and winter storage of the bean crop. The gross harvest of beans on the state farm was 140 tons or 14 centners per hectare. Later, as the beans were cleaned from unripe, feeble greens, debris, dust and lumps of earth, as well as some weight reduction due to air drying of the grain, the moisture content of the beans during the harvesting period was more than 30%, and by the end of cleaning and filling the grain into the warehouse, the humidity was decreased to 20%. The net weight of bean grain was 100 tons or 10 centners of yield per hectare. The period of threshing and drying of beans – the month of October was a dry period, which allowed state farms to fully preserve the bean harvest [20].

Like in the previous year, the selection and threshing of beans took place in the month of October, i.e. with the highest amount of precipitation. Consequently, the gross harvest of beans with a moisture content of 25–35% was completely delivered from combine bunkers to grain delivery points for quick drying on powerful fire dryers. At the same time, the task was to build a sufficient number of well-ventilated storage facilities and a significant number of concrete or asphalt open areas on state farms [21].

In 1961, the state farm planned to sow beans on an area of 600 hectares with accommodation in the most distant three brigades for autumn ploughing. At the same time, it was planned to further improve the technique and methods of sowing by using different methods of growing legumes. So, in the first brigade, the sowing of beans on an area of 200 hectares was carried out with square-nested seeders without the use of a measuring wire with a row spacing of 70 cm. With sowing discs of 12 holes with a capacity of one grain in each hole of the disc, planting each grain at a distance of 10 cm from one another was achieved. In brigade No. 2, the sowing of beans was placed on autumn ploughing on an area of 200 hectares, also with square-nested seeders without the use of a measuring wire according to two options. The first one hundred hectares were sown with a row spacing of 45 cm, with seed discs of 16 holes with a capacity of one grain in each disc hole, which made it possible to place each grain in a row at a distance of 6 cm from one another. The second one hundred hectares were sown with a row spacing of 70 cm using seeding discs, which, as in the first variant, had 16 holes each. In the third brigade, sowing of beans was carried out in autumn plowing on an area of 200 hectares with square-nest seeders using a measuring wire according to two options, namely: the first hundred hectares with a row spacing and distance in rows of 70x70 when sowing 6–8 grains in each nest. The second one hundred hectares had a row spacing of 45 cm with sowing in each nest from 4 to 6 grains [3].

The listed five ways of sowing beans made it possible to determine the best way to sow beans and the maximum production of beans from one hectare within one year. As an experiment, the state farm sowed a mixture of corn and fodder beans in the sixth brigade on an area of 400 hectares.

Two thousand tons of bulk manure was taken to the specified area of a mixture of corn and beans, which in early spring, according to the experience of last year, was first planned by a bulldozer, leveled with light harrows, after which the manure was buried to a depth of no more than 12 cm.

Experience has shown that the best method of such sowing should be carried out with a square-nested seeder without the use of a measuring wire, namely: the seeder has six grain boxes, after one, and only in three boxes corn seeds were filled with a set of seeding discs having no more than 8 holes, into which no more than one grain freely passed, which will correspond to the placement of the sown grains in rows at a distance of 15–20 cm from one another. The next three boxes, but also every other box, were filled with bean seeds with a set of sowing discs with 12 or 16 holes accommodating no more than one vertex, allowing each seed to be planted in rows 6 to 10 cm apart from the other plant [22].

The harvested experimental plot of the mixture of corn and beans for silage was stored separately from the rest of the silage, which was laid exclusively from corn green mass stalks.

This option made it possible to reveal the results of the productivity of the dairy herd within one year and to determine the difference in the weight gain of livestock fed on corn silage and a mixture of corn and bean silage.

4. Conclusion

During the development of the virgin lands the issue of fodder for livestock became acute, as the main land mass in northern Kazakhstan was given over to sowing grain crops. Specialists at the Zarechny state farm developed their own methods of growing fodder beans through experiments. Sowing, inter-row cultivation of beans, harvesting and drying of fodder bean grain and other agricultural activities proved to be a complex and difficult undertaking, requiring enormous material and human resources. However, despite this, the method chosen by sowing a mixture of beans and maize with a square sowing machine has shown good results in terms of increasing the productivity of the herd and the weight gain of cattle fed with corn silage and a mixture of corn and bean silage.

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