History of development of Soybean Production in the Amur Region and Far East District in the USSR

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Abstract. After the collapse of the USSR, main agriculture complexes were destroyed and stopped their work since than soybean production in Russia had a challenging period and has only recently reached the peak level of the USSR production. Currently, soybean production in Russia has several main obstacles. It is essential to study the history and steps of the development of soybean cultivation. The rapid development of soybean production in the USSR was due to protein deficiency. Given the high content of protein and a considerable amount of valuable amino acids together with affordable low cost of production, the government decided to expand the cultivated area of the crop (Glycine max). Mostly, the soybean was used for livestock feed and oil production. The purpose of this paper is to study the dynamics of soybean production in the USSR and the primary agricultural practices that were used. This paper is focused on the Far East area, where since 1958 year, the cultivated area had spread significantly creating the leading industrial production zone of soybean in the USSR.

1. Introduction

First attempts to grow soybeans in Russian history were undertaken from 1873 through 1899 years. Agronomist Pagoda conducted experiments on soybean production at the end of 1877 year by using a foreign variety of soybeans [1]. In the Soviet era (1922-1991), agriculture was an industry of significance for the economy as a whole. In the Soviet Union, the first experiments in soybean variety testing were conducted in 1927, and in 1928 the national variety testing was started on the Southern and Ukrainian soybean belt [2]. Most varieties at that time were of foreign origin. All-Union meetings on soybeans and conferences were held. However, from 1931-1932 there was a reduction in the soybean planting area due to lack of production and scientific experience [3].

A new impulse in the development of soybean farming was in 1933. V.A. Zolotnitsky received and zoned the variety Amurskaya Zheltaiya-41. The work of breeders allowed the expansion of cultivated areas in the Far East [4]. Thus, by 1940, 123 thousand hectares were located in the Far East, and 65 thousand hectares in the Amur region. By this time, new high yield varieties of Soviet scientists were being developed. The beginning of the World War II interrupted the research work with soybean in the European part of the country, and the crop gross production sharply reduced [5].

In the post-war years, work on soybeans was resumed. It was planned to develop soybean varieties characterized by early maturity and resistance to natural disasters, and new areas of soybean cultivation were also considered. During the postwar years, there was an acute food shortage for which new lands
were developed. In the Far East, expansion to 1.1 million hectares was planned. The government helped the kolkhozes and sovkhozes, which created favorable conditions for soybean production.

Along with research in the field of breeding and seed production, extensive work done been on biology and agro-technical issues of soybean production. As a result of the work carried out by research institutions, it was possible to sharply expand the soybean area, both in old and new sowing areas. In 1958 in the European part of the USSR, soybean sowing was almost eliminated. But this crop was widely spread in the Far East, where it became the main area of industrial production of soybeans in the country. In 1972 it occupied 650 thousand hectares, with 592 thousand hectares concentrated in the Amur region. The spread of soybean was also constrained by lack of seeds of high yield varieties, lack of agricultural machinery, absence of herbicides, and experience in cultivation practices. In the Soviet Union, soybean was cultivated in small volumes in Ukraine, North Caucasus, Baltic states in Georgia, Moldova [6].

In 1991, the changed political and socio-economic system of the government was the beginning of the agrarian reform, which had an evolutionary path of agricultural development [7]. For two months was used administrative and forced way to distribut by shares the collective and state farmlands and means of production. A shareholder - an owner of the land, was supposed to become a farmer. Many farms went bankrupt, and some villages disappeared as administrative subdivisions, arable lands turned into fallows.

The purpose of this paper is to study the dynamics of soybean production in the USSR and the primary agricultural practices that were used. This paper is focused on the area of the Far East, where since the 1958 year, the sown area was spread significantly and became the central industrial production zone of soybean in the USSR.

2. Materials and methods
The USSR extended more than 10,900 kilometers from east to west. The most westerly point was on the Baltic Sea, near Kaliningrad; the easternmost was Cape Dezhnev on the Bering Strait. From north to south, the USSR extended around 4500 kilometers (figure 1).

![Figure 1. Location of main soybean producers in the Soviet Far East (1957-1990). 1 – Amur Region, 2 – Primorski krai, 3 – Khabarovskii krai.](image-url)
In its final years, it consisted of 15 Soviet Socialist Republics (SSRs): Armenia, Azerbaijan, Belorussia (now Belarus), Estonia, Georgia, Kazakhstan, Kirgizia (now Kyrgyzstan), Latvia, Lithuania, Moldavia (now Moldova), Russia, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan. The capital was Moscow, then and now, the capital of Russia [5].

In this paper, the economic-statistical, economic-mathematical, monographic, computational, and constructive research methods were used. The data for this study were taken from statistical government reports of Amur Region and the State Statistical Service of Russia for 1922–1991. The analysis is based on a study of relevant documents: government regulations, government programs related to the agricultural sector, and official international statistics database.

3. Results and Discussion

3.1 The status of soybean production in the World and USSR

One of the most important trends in the development of world soybean production is the expansion of sown areas. In comparison with the pre-war period, the world sown area has increased by 4.5 times. The noun changes occurred in the major soybean producers in the world soybean area. The sown area under soybeans in the world in 1934 was predominantly in China than in other countries. After 1966, America exceeded the sown area of China soybeans, reaching 16,000 thousand hectares [8]. In the USSR, there was a sharp expansion of soybean areas, and from 1960 to 1965, the area has doubled and reached 832,000 hectares. However, with such massive growth, it has long lagged behind China and the USA [9,10]. In 1960, the number of cultivated land was approximately the same as in Brazil. Afterward, Brazil expanded sowing area greatly. There was an economic recession after the 1970s in the USSR, and the sown area has decreased (table 1).

Table 1. Soybean sowing area in the world and USSR, thousand hectare [8,9].

| Regions and countries | 1934-1938 | 1946-1950 | 1951-1955 | 1956-1960 | 1961-1965 | 1966-1970 | 1967-1976 | 1976-1980 |
|-----------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| World                 | 11200     | 13140     | 16840     | 23320     | 28373     | 33746     | 42016     | 49943     |
| USSR                  | 180       | 285       | 395       | 832       | 854       | 850       | 811       |           |
| CNR                   | 8655      | 7389      | 8774      | 11996     | 13293     | 13670     | 14249     | 11514     |
| USA                   | 1008      | 4465      | 6331      | 9044      | 12016     | 16294     | 20245     | 24988     |
| Brazil                |           | 34        | 69        | 146       | 337       | 810       | 3689      | 7857      |

In the pre-war period, the leader in soybean production in the world was China, which produced 80-85% of the world volume, but in the post-war years (1948-1952) the situation changed and the share of China decreased to 46%, a quarter of a century later - only 20%. At that time, the US contribution to soybean production increased significantly. If in the pre-war years, the country produced 10% of the world soybean grain, in the post-war years (1948-1952) - already 46%, and in 1971-1975 - 63%. 2/3 of the world's gross soybean yield was accounted for by the United States (table 2).

Table 2. Soybean production in the World and USSR, thousand ton [8,9].

| Regions and countries | 1934-1938 | 1946-1950 | 1951-1955 | 1956-1960 | 1961-1965 | 1966-1970 | 1971-1976 | 1976-1980 |
|-----------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| World                 | 12260     | 15460     | 18820     | 26520     | 32474     | 43095     | 58025     | 78387     |
| USSR                  | 97        |           |           | 210       | 394       | 537       | 471       | 529       |
| CNR                   | 9944      | 8380      | 8885      | 10525     | 10683     | 11170     | 11868     | 10587     |
| USA                   | 1164      | 6194      | 8511      | 14616     | 19560     | 28967     | 36774     | 49412     |
| Brazil                |           | 34        | 101       | 176       | 354       | 906       | 5685      | 11734     |
3.2 Dynamic of soybean production in the Far East of the USSR

Soybean production took a vital part in the Far East economy back then. The crop was cultivated on a vast area and had a large share in the structure of gross agricultural production. Soybean production in the Far East, especially in the Amur Region, expanded rapidly in 1950 – 1960 years and the growth dynamics of soybean cultivated areas on farms testify to this over the years (figure 2).

The most significant increase in cultivated areas in the Far East occurred from 1958 to 1965. The result of the development of new lands and a change in the structure of specific soybean crops among all crops on farms and collective farms increased to 40 percent. In 1955, practice showed that such an oversaturation of the soybean structure of sown areas with the absence of sown rotations and herbicides, even under favorable climate conditions, leads to a significant clogging of specific weeds, which reduces the yield of the crop [6]. Over the years, the expansion of sown areas has been the primary source of the increase in soybean production. The central reserve for the growth of production, yield of this crop also remained low. Increase in yield remained one of the biggest developmental problems to tackle.

Implementation of soybean became possible because of new varieties availability, improvements in the mechanization of growing and harvesting stage, high grain selling price. At that time, it was clear that soybeans were profitable crop in the Far East. Besides, soybeans provide the highest digestible protein yield from the unit of planting area compared to any other crop, and at a low cost.

Production of soybeans was an important stage in the Far East economy during the Soviet period. The crop was cultivated on the vast territory, the share in the structure of gross and commodity agricultural production was high. The cultivated area was mainly located in the Primorski Krai, Khabarovskii krai, Amur Region. Since the 1940-year Amur Region had kept its leading position, owing to the breeding work with an appropriate variety that had been adapted to unstable climate conditions in the Amur Region (table 3).

Table 3. Gross harvest of soybean in the Far East and its regions [3,4,11].

| Regions         | 1956-1960 | 1961-1965 | 1966-1970 | 1970-1975 | 1985-1990 |
|-----------------|-----------|-----------|-----------|-----------|-----------|
| Amur Region     | 108       | 261       | 374       | 592       | 425       |
| Primorski Krai  | 47        | 95        | 108       | 180       | 113       |
| Khabarovskii Krai | 11      | 31        | 49        | 77        | 18        |
| Far East        | 166       | 387       | 531       | 850       | 556       |

3.3 Soybean production challenges and characteristics of the Far East of USSR

In the USSR’s Far East, many problems in the cultivation of soybean have remained from the USSR to our days. Underdevelopments in cultivation technologies, machinery, weather, and human resources have become major obstacles in achieving high yield and quality of soybean. It is important to
understand the history of the emergence of specific cultivation practices to understand the background that lead to current picture of soybean production.

It was believed that the optimal application of mineral fertilizers to the soils of the Far East is the most effective phosphorus and nitrogen fertilizers introduced into the rows when sowing soybeans. Weed control was carried out using a complex combination of mechanical and chemical measures. The complex included three harrows (before germination and on germination), two inter-row handlings, and the application of a herbicide. Herbicides were used as follows: linuron at a dose of 3 kg per hectare, prometrine at a dose of 2.5 kg per hectare [12].

At that time, the machinery was lacking, so as it has been nowadays. The structure of the tractor fleet in which about 70 percent were crawler tractors of class 30 kn (DT-75, E-74) did not meet the natural-production conditions of most farms in the Far East. On the main and pre-sowing tillage, were used disk cultivators, hydraulic disc harrows BDT-7, BD-BD-10, also mounted and trailed cultivators [13]. For plowing, 4-5 and 8 case plows were used, aggregated with 60kn class tractors. Some machinery, implements, and technologies are still used today.

There was an optimum seeding rate for each cultivar. The main soybean varieties were Yantarnaya with it required 700-800 thousand germinated seeds per hectare. Variety Amurskaya 301 brought the significant effect at a sowing rate of 600-700 thousand germinated seeds. Row spacing the most profitable way of soybean sowing was considered a single-line method with a wide row spacing of 51 cm and spacing between seeds in a row of 7.5 cm.

Planting date In the Amur region, the best sowing dates for early varieties are the third decade of May, for early maturing - the first decade of June. In the local climatic conditions the best conditions are created for weed control, the implementation of the whole complex of agrotechnical measures and obtaining high soybean crops (table 4).

### Table 4. Characteristics of Far East region climate [14,15].

| Transition data of more 10 C and above temperature | The sum of temperatures more than 100 C | Depth of soil freezing | Transition data of more 10 C and above temperature | The sum of temperatures above 10 C | Duration of vegetation period (days) |
|-----------------------------------------------|----------------------------------------|-----------------------|-----------------------------------------------|-------------------------------|-----------------------------------|
| Amur Region                                  |                                        |                       |                                               |                               |                                   |
| 11-14/5                                      | 2031-2123                              | 150-180               | 9.9                                           | 11                            | 90-130                            |
| Khabarovskii krai                            |                                        |                       |                                               |                               |                                   |
| 5-10/5                                       | 2385-2413                              | 140-190               | 11.3                                          | 13.5                          | 139-158                           |
| Primorskii krai                              |                                        |                       |                                               |                               |                                   |
| 1-5/5                                        | 2270-2590                              | 160-200               | 10.5                                          | 14                            | 110-160                           |

### 3.4 Characterization of climate in the Far East

The climate of the Far East is influenced by a number of physical and geographical conditions. The main features of the climate are determined by solar radiation inflow and air mass circulation processes. The most important climatic factors for agricultural cultivation are the air temperature and the sum of active temperatures above 10°C [16]. In the soybean sowing areas the average annual temperature ranges from -8°C in the north of the Amur Region to +6 in the south of the Primorskii krai. Comparing the average monthly temperatures of the Amur region with the same indicators of other regions it is clear that the winter is colder than Khabarovsk and Primorsky Krai and much colder than the European part of the USSR. The vegetation period varies from 90 days to 130 days in the Amur region and from 139 days to 158 days in Khabarovsk Krai and from 110 to 160 days in Primorsky Krai (table 4). The complex natural and climatic conditions for soybean cultivation in the Far East are less favorable than in Western Europe, Northern America and China. Due to low agro-climatic resources, the region belongs to the zone of risky agriculture. From the point of view of agricultural cultivation the negative features of the region are relatively short period of vegetation, slow heating of the soil in spring, uneven distribution of rainfall during the period of vegetation, early onset of frosts [14,15]. Therefore, there is a need under these climatic conditions for the cultivation of early-ripening and middle-ripening soybean weeds resistant to diseases and pests. In terms of soil and geographical zoning this region belongs to the Boral
(moderately cold) and Subboral (moderately cold) soil and climatic belts of the East Siberian permafrost and Eastern brown-and-forest soil and bioclimatic regions.

4. Conclusion
In this paper analyses of soybean production were conducted, the first steps of soybean production in the Russia and USSR were discussed. Dynamics of soybean production in the world and USSR were indicated. Soybean production during the USSR period reached its peak in 1960 year. The great spread of soybeans in the Far East was necessary as a solution to the lack of well-balanced feed in the livestock sector. It became realizable due to the financial support from the government, and significant improvement of breeding technology, which created early matured soybeans seed and made it possible to grow soybeans in the unfavorable climatic conditions. The success of this agricultural sector of soybean industry achieved with the government help; and one of the factor is was that cooperatives work was very productive. However, the increase of gross harvest was due to extensive methods of agriculture rather than intensive methods that implemented in the USA. During Soviet period distinguished work have been done by soviet scientists in the soybean industry in biology, breeding, agricultural practices. However, the events in 1992 year destroyed the most of soybean productions farms and induced a great drop of gross harvest and hectors of planting area.

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