Production of Buckwheat in Natural Areas of the Altai Krai

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ABSTRACT

The Altay region is among of the largest producers of buckwheat in the Russian Federation. In 2013 its crops in the region exceeded 487 thousand hectares, which is almost half of this crop acreage in the country. However, the production of buckwheat in Altai is not stable over years and in natural areas. Therefore, the study of problems of buckwheat production in the region is crucial. The study results show that as quality criterion for singling out 5 enlarged natural buckwheat growing areas in the Altai region, the statistical data on available acreage and crop yields within the administrative areas, as well as almost uniform soil and climatic conditions may be considered. Maximum crops of buckwheat (80%) are concentrated in three natural areas of the region presented by forest steppe and foothills. In the region the average buckwheat grain yield over the past 7 years was was quite high and amounted to 0.73 tons per 1 hectare (2007-2013), which made up to 87% of buckwheat yield in Russia. Gross yield of buckwheat in Altai in specific years exceeded 360 thousand tons (in 2013), i.e. more than 40% of the production in Russia. Prices for the grain in the region varied depending on the market demand – from 5652 roubles per ton (2007) to 21110 roubles per ton (2011), respectively, and producer prices were different as well from 12142 roubles per ton (2009) to 50782 roubles per ton (2011). Considering peculiarities of natural conditions in the growing areas of buckwheat and improvement of economic mechanisms of the grain market will improve grain production.

Keywords: The Altai Krai, buckwheat, acreage, yield, grain production.

INTRODUCTION

The Altay Krai, according to the data of 2009, was one of the largest food producers in the Russian Federation: it took the 1st place in terms of production of flour and the 2nd place - for the production of cereal. About 80% of flour and cereals was annually exported outside of the region and abroad as well. The foreign trade turnover of the Altai Krai in 2009 amounted to more than 1.1 billion dollars U.S. Trading is done with partners from 70 countries. The main export items, among others, were agricultural products and food.

One of the main problems of the modern society is a sharp increase in human diseases such as obesity, diabetes, cancer and others associated with excessive food consumption of deep processing and fatty foods. In this regard, nutritionists all over the world pay closer attention to buckwheat. Its good food, dietary and medical qualities are widely known, that’s why buckwheat is actively studied not only in agro technical direction, but also in many others – up to molecular studies [8].

Common buckwheat (Fagopyrum esculentum Moench.) is in demand at the grain market of the Altai Krai. Its crops in 2013 in the Altai Krai exceeded 487 thousand hectares [7], which made up 44% of acreage of buckwheat in Russia [11]. However, the production of buckwheat, both at the global and regional scale, is not stable due to differences in harvest. For example, in the world it ranges from 0.73 to 1.20 tonne/ha [6] and in the region and in Russia – from 0.59 to 0.96 tonne/ha [3]. It is known that from 1 hectare of crops of buckwheat in the main production regions of Russia it is possible to consistently harvest 2-3 tons of grain, equivalent of 1.3-1.7 tonnes of cereals [10]. Possibilities of market mechanisms concerning buckwheat are not fully used. The recommended average per capita intake of buckwheat in the
Russian Federation is 3.0-3.5 kg per year. Therefore, average annual production of buckwheat in Russia, taking into account the seed stock, should be about 0.9-1.0 million tonnes [12]. However, grain market capacity of Russia is 1.2-1.5 million tonnes per year, where the share of buckwheat is only 20% of total consumption [6]. Besides, economic factors and market conditions do not always coincide with the interests of rural producers.

2. Methods:
The study represents a section of the scientific program "Agroecological substantiation of increasing the yield of buckwheat in the forest-steppe zone of the Altai Krai", performed by the authoring team starting from 2003. The studies are aimed at achieving the yield of buckwheat 2.0-2.5 tonnes per 1 hectare based on energy saving and conservation farming technologies.

The objective of this study is indicators of the efficiency of production of buckwheat on the territory of the Altai Krai due to natural factors. In the process of the study, we applied the method of systematic scientific analysis of reference material, literature data and the results of experiments and observations as well. The information base for the study was materials of the Federal Service of State Statistics for the years 2007-2013.

3. Results:
The Altai Krai, located in the south of Western Siberia, presents a variety of agricultural landscapes with a predominance of black and chestnut soil types. Climatic conditions of the region are very diverse, there are not only fertile soils and favourable temperature factors but also adverse ones. The main adverse factors among them are lack and instability of moistening caused by repetitive droughts. It primarily manifests itself in the soil moistening regime. In steppe conditions it may result in deflation and in the forest steppe there is a large risk of water erosion of soil.

Natural and agricultural zoning as a scientific approach for improving zonal technologies of cultivation of buckwheat is relevant and can become the basis for the development of new directions in the Altai resource agriculture. As a criterion for determining enlarged natural buckwheat growing areas in the Altai Krai available statistics on acreage and crop yields within the administrative areas was taken by us (Information of the Altay Krai stat, as well as almost uniform soil and climatic conditions (www.prazemena.ru/articles/ovoschi/altai_sorta).

Boundaries between natural areas in the region were drawn considering the boundaries of administrative areas. Thus, five areas of this culture in the Territory were determined (Pic. 1).

Maximum crops of buckwheat (80%) are concentrated in forest steppe and foothills of the Altai Krai (3, 4, 5th districts), since this is where good agro-ecological resources for its cultivation are [4]. Sufficiently high level of yield, despite less favourable and noncharacteristic conditions of development for this culture, has occurred in certain years in other natural areas.

The analysis of acreage of buckwheat in the Altai Krai in the context of years suggests that in all the years they were significant and ranged from 285000 hectares (2009) to 494000 hectares (2012) [7]. In all-Russia crops the share of this culture of Altai was the largest and reached 46%.

Especially noticeable increase of acreage was observed in Altai in the last 3 years (2011-2013), when it reached to 422-494 thousand hectares (Pic. 2).

Yield of buckwheat in the Altai Krai during 2007-2013 drew closer to the all-Russian indicators, despite the fact that the region is geographically located in the zone of risky agriculture and is in a disadvantageous position compared to the other regions of Russia, where production of buckwheat grain has traditionally focused on. Thus, an average buckwheat yield in the region over the past 7 years (2007-2013) amounted to 0.73 tonnes per hectare (87% of Russia's total), and in 2009 and 2010 the average yield of this crop in the region surpassed the yield of the Russian Federation by 7-10%.

Despite frequent adverse weather conditions for buckwheat taking place during flowering and fruit formation of plants in the form of deficit of moistening, sometimes – excess moistening [5], the Altai Krai occupies a leading position in the Russian grain production. Gross yield of buckwheat in Altai over the last 7 years ranged from 230.9 (2008) to 364.4 thousand tonnes (2013) [7], which generally amounted to about 30% of grain production of the culture in the country [11].

Selling price of buckwheat in Altai in during 2007-2013 depended on the market demand and drastically varied: from 5652 rouble/tonne (2007) to 2494 rouble/tonne (2009) respectively, and producer prices were different from 12142 rouble/tonne (2009) to 50782 rouble/tonne (2011) (Table 1). In both cases, the deviation of the buckwheat price was very high and reached the 4-fold level.

According to the Main Interregional center of the Federal Service of State Statistics data [11], the production of buckwheat (weight after reprocessing) in all categories of the Russian Federation in 2010 amounted to 339.3 thousand tonnes; in 2011 – 800.4; in 2012 – 796.6 and 2013 (preliminary) – 828.9 thousand tonnes (in 2013 – 104.1% to 2012). In January-November of 2013 392.4 thousand tonnes was processed, of which 330.4 thousand tons (96.9%) – for food purposes, 12.0 thousand tons (3.1%) – for feeding purposes. Average prices of agricultural producers for buckwheat gradually decreased and in 2013 amounted to: in March – 8749 roubles per tonne, in June – 7469 roubles, in
September – 6486 roubles, in November – 6045 roubles per tonne. At the same time, in November of 2012 they were significantly higher – 9667 roubles per tonne. Processors’ prices for buckwheat in 2013 also decreased, in March they were 16344 roubles per tonne, in June – 15,436 roubles, in September – 14,200 roubles, in November – 13911 roubles per tonne. It should be noted that in November of 2012 the prices were higher – 18465 roubles per tonne.

Legend:

numerator – yield (tonne/ha); denominator – crop areas (thousand ha).

I – Kulundinskaya steppe; II – Aleinskaya steppe; III – Priobskaya forest steppe; IV – forest-steppe of Salair foothills; V – foothills of the Altai.


Pic. 2: Crop acreage (ha) and yield (tonne/ha) of buckwheat in the Russian Federation and the Altai Krai (2007-2013).

Note: in 2013 for the Russian Federation – preliminarily
Average consumer prices for peeled buckwheat in 2013 were the following indicators: in March they amounted to 41.89 rubles/kg; June – 40.34 rubles; September – 38.86 rubles; November – 37.86 rubles/kg, at the same time in November of 2012 the prices were higher – 43.68 rubles/kg. Thus, increasing production of buckwheat decreased prices for grains.

Table 1: Gross harvest and prices for buckwheat in the Altai Krai (according to the Altay Krai stat, 2014).

<table>
<thead>
<tr>
<th>Indicator</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross harvest, th tonnes</td>
<td>275.9</td>
<td>230.9</td>
<td>232.6</td>
<td>248.1</td>
<td>342.9</td>
<td>316.7</td>
<td>364.4</td>
<td>287.4</td>
</tr>
<tr>
<td>Selling price, rubles/tonne</td>
<td>5652.5</td>
<td>6248.0</td>
<td>5929.3</td>
<td>10649.5</td>
<td>21110.3</td>
<td>10798.7</td>
<td>7162.9</td>
<td>9650.2</td>
</tr>
<tr>
<td>Producer price, rubles/tonne</td>
<td>12996.0</td>
<td>12623.2</td>
<td>12142.5</td>
<td>26290.6</td>
<td>50782.1</td>
<td>19718.8</td>
<td>14173.8</td>
<td>21246.7</td>
</tr>
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4. Consideration:

The Altay Krai is an important agricultural region of Russia, where the agricultural sector plays a crucial role in the formation of the gross regional product. In 2009, the Altai Krai occupied the 1st place in Russia on arable land and grain area; on grain production – the 4th place (5.6 million tonnes in weight after reprocessing), giving place only to traditionally large agricultural regions of the south of the country – Krasnodar Krai (9.5 million tonnes) and Stavropol Krai (6.9 million tonnes) and the Rostov region (6.6 million tonnes). In turn, the Russian Federation is the largest producer of buckwheat on the planet. The world leader in production and export of grain of this culture – China – over the last 10 years has moved to the second place.

Buckwheat among other grains of Altai is one of the low-yielding, since only in rare years optimal weather conditions take place here [4]. Buckwheat forms harvest mainly due to rains in July and August in the amount of 40% or more of the annual rate. Another factor that affects the harvest of buckwheat in the region is inadequate zonal farming techniques, even the studied techniques are not fully implemented mainly due to economic problems. Thus, the high cost of fertilizers determines their deficit in food mode of this culture and makes fertilizers unavailable to farms, although phosphorus, potassium and other elements are needed in the production process of buckwheat [17]. Furthermore, high prices for fertilizers sharply reduce the profitability of producing buckwheat grains. Therefore, it is necessary to find effective methods of increasing the yield of buckwheat, including territorial optimization of crops placement in natural areas and even within one farm, due to differences in soil and climatic potential, which deserves special attention.

In order to increase the yield on the Kulundinskaya and Alesyksaya steppes with high culture of farming but with low soil fertility, it is necessary to apply row planting of buckwheat. On more fertile but often weedy soils of other natural areas in the region it is better to sow in broad drills, which will allow using interrow hoeing of vegetative plants.

According to the majority of researchers, the variety adapted to zonal soil and climatic conditions can provide an increase in grain yield up to 20% at no extra cost. However, at farms varieties of buckwheat are often cultivated without considering their biology and productivity, although it is known that with an intensive technology of its cultivation yields could rise up to 2.5 tonne/ha. Therefore, in order to avoid the damaging effects of frost on buckwheat sprouts in each household, it is recommended to sow at least two different in the length of vegetative period recognized varieties. It is advisable to sow mid-ripening variety earlier and early ripening variety – later and as a rule using usual row planting. In case of identical time of sowing, different varieties according to early ripening contribute to better organization of harvesting over large areas – 150 ha and more by harvesting them in an optimal phase of ripening, as well as reduce friability of the grain, especially of buckwheat in the dead-ripe stage. Thanks to this crop, the yield increases to 0.4 tonne/ha.

Morphological and physiological indicators [9] and adaptive properties of buckwheat [13] greatly determine its productivity. In rare cases for the Altai Krai, characterized by the excess vegetation precipitation resulting in abundant vegetative growth and plants not forming grain, it is better to mow buckwheat haulm stand and to use it for green manure. In 2013 this situation was noted in the forest-steppe of Salair foothills. Rainfall took place during the flowering and fruit forming phase and the amount of it was double the average normal annual indicators. Due to rains pollination of buckwheat was low, and the grain yield in the district was small respectively. Some households did not harvest buckwheat, just some households used haulm stand for a green fertilizer.

Successful buckwheat production largely depends on creating of favourable conditions for the formation of inflorescences, productive flowering and fruit forming [14,15], which provides a high yield of grain.
Conclusion:

Given the contrast of meteorological conditions in the Altai Krai, very low moistening indicators and insufficient cultivation of fields, the system of relations that determines the efficiency of buckwheat production by natural regions of the region should provide additional reserves, which will greatly allow unlocking the potential of the region as a whole. Among them: arrangement of land distribution of crops in natural areas, optimization of the structure of crop rotations and improvement of zonal technologies on the basis of zonal biological farming. In our opinion, such approach to solving many problems in buckwheat production in Altai is feasible and least expensive.

Due to objective circumstances, often associated with financial difficulties, the authors are limited in expanding existing work and are seeking ways to optimize it. Currently the database is formed, which includes the results of their own perennial agronomic research, reference materials and best practices of households in the region.

Development of further researches can be directed to the analysis of existing economic mechanisms in the production of buckwheat in natural areas of the region, which comes from the fact that the dynamics of prices during the year is closely related to the seasonality of demand for buckwheat. In order to stabilize market prices for this type of agricultural products it is necessary to establish closer contacts between large agro firms, medium and small farm businesses with narrow specialization, as well as with processors and consumers. Over time, the demand for buckwheat increases, so in prospect buckwheat will be given closer attention in the agricultural sector of the economy of the region.

Taking into account the specifics of local soil and climatic conditions, achievements of science and practices can provide a high economic effect in grain production of this valuable crop.

6. Credits:
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References