Uncertainty and risks in the economic efficiency of protected ground vegetable production

A F Razin1*, R A Meshcheryakova1, R Dzh Nurmetov1, O A Razin1 and N N Lebedeva1

1Federal Scientific Vegetable Center, 14, Selectionnaya str., VNISSOK, Odintsovo district, 143072, Moscow region, Russian Federation

E-mail: vniioh@yandex.ru

Abstract. The development of protected soil is one of the priorities of state policy in the agricultural sector of the economy. By the end of 2020, it was planned to meet the needs of the national market in cucumbers and 70-80% in tomatoes. Growing vegetables is associated with a huge number of factors that have both positive and negative effects in the form of economic, political, natural, demographic, organizational, technical and other risks. At the planning stage, so-called preparatory risks are possible, followed by construction, environmental and production risks that lead to higher project costs, increased capital investment and operating costs. In modern conditions, production risks are particularly high. Therefore, production activities have become the most risky. The description of the most characteristic signs of risks and possible ways to manage them is given. It is important to identify risks in a timely manner and take appropriate measures. Risk management is possible at the state and enterprise levels.

1. Introduction

To provide fresh vegetables in the off-season in a harsh continental climate in most agricultural regions of Russia, the cultivation of certain types of heat-loving vegetables is impossible without special shelters, such as winter and spring greenhouses, hothouses, insulated soil, temporary film shelters, etc.

The development of the industry of the protected ground, the Russian government considers as a priority of the development of agriculture providing the population with fresh vegetables in off-season period. The state program for the development of the agro-industrial sector provides for increasing the area of winter greenhouses to 4.7 thousand hectares by 2020, and the production of national vegetables in industrial greenhouses to 1720 thousand tons per year. To meet this indicator, it is necessary to produce additionally more than 800 thousand tons annually, which will require the construction of 1.6 thousand hectares of greenhouses with an average yield of 50 kg/m².

Greenhouse vegetable production is mainly represented by winter and spring greenhouses. In 2018, Russia had just over 2,500 ha of winter glazed greenhouses and 10,000 ha of spring film greenhouses. About 90% of the total gross harvest of protected ground vegetables in the Russian Federation is grown in winter greenhouses (table).

Table 1. Gross collections of protected ground vegetables in farms of all categories

| (thousand tons, Rosstat) | 1986-1990 | 1991-1994 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|-------------------------|-----------|-----------|------|------|------|------|------|------|
| 772.7                   | 639.9     | 1183.0    | 1303.0| 1409.0| 1560.0| 1633.0| 1832.0|
The new greenhouses of the fifth generation being put into operation are built using the latest technologies and are not inferior to the best foreign analogues. Due to this, the yield in new greenhouses reaches 60 kg/m$^2$, and at photoculture - more than 120 kg/m$^2$ of cucumber, 75 kg/m$^2$ of tomato [1, 2, 3, 4].

According to the Ministry of Agriculture of the Russian Federation, in 2017 the level of self-sufficiency of the Russian Federation with protected ground vegetables was 53.4%, in 2018 – 61.5%.

The modern greenhouse complex is a rather complex and expensive construction, and the efficiency of the production process for obtaining fresh vegetable products depends on numerous factors that have both a positive and negative impact on the economic indicators of production. And the task is to maximize the use of positive factors and avoid or minimize the effect of timely identified negative factors. The paper attempts to identify the most common risks in protected ground vegetable growing, to describe the most characteristic signs of their manifestation and possible ways to manage them.

2. Materials and methods
In the process of work, the methods used in economic science are used: general scientific (dialectical, analysis and synthesis, comparison and analogy, tabular, graphic); special (system, comparative analysis, statistical-economic, economic-mathematical). The information base of the study was official state statistics; normative legal acts of Federal and regional levels; data of the Ministry of Agriculture of the Russian Federation; reference materials of specialized publications on the subject under study; materials received from participants in the market of protected ground vegetables, their own research; Internet data (industry portals, sites of producers of protected ground products, articles and reviews).

3. Results
There are always elements of uncertainty in the production of any product. The uncertainty associated with the possibility of adverse situations and consequences arising during the production and sale of products that are characterized by the concept of risk. Risk is an objective phenomenon in any sphere of economic activity; it is manifested as a set of separate isolated risks. The risk is considered as a negative phenomenon, as the probability of unforeseen additional expenses, losses, and wastage. In vegetable growing losses are manifested in three main dimensions: reduced yield, reduced marketability of products, income below the expected level [5, 6, 7, 8, 9, 10].

Managers of organizations have to engage in continuous planning of agricultural enterprise activities, including using a business plan, clearly define and specify the daily tasks of production and sale of products, develop measures to insure against losses in changing market environment.

Among the many sections of the business plan, there is a section on risk assessment and insurance. The most probable risks in the process of construction of greenhouse complexes, production and sale of products, and possible methods of protection from the influence of spontaneous situations are indicated. A list of possible risks is determined, indicating the probability and estimated time of their occurrence, the predicted damage, as well as organizational measures to prevent and neutralize possible risks and losses. Development of the section ends with the risk insurance program [11].

The variety of technological processes in growing vegetables, high labor intensity, increased requirements of vegetable crops to growing conditions, the need for additional production funds determine significant difficulties in the production and sale of vegetable products.

It is impossible to produce vegetable products without risks, because the risks depend not on a person’s desire or consciousness, but on objective factors. There is always a chance that some resources will be lost, that the planned profit will not be received, or that additional costs will appear. The production and marketing of vegetable products occurs in highly varying economic, political, natural, demographic, and organizational conditions, which represent several types of risk. However, natural, political, demographic, and partially organizational risks cannot be managed at the enterprise level.

In the production of agricultural products in general and vegetables in particular, the following risks may be the most significant: incomplete or inaccurate information about the parameters of new equipment, technology, variety (hybrid), plant protection products from pests, diseases and weeds; fluctuations in market conditions, exchange rates, etc.; incomplete or inaccurate information about the financial position.
and business reputation of participating enterprises (the possibility of failure of contractual obligations, non-payments, bankruptcy); uncertainty of behavior, interests and goals of participating enterprises; production and technological risks (production defects, accidents, equipment failures, etc.).

Together, factors that cannot be managed at the enterprise level vary greatly over the years and account for more than 60% of the current risk structure. The share of controlled enterprises accounts for less than 40% of the risks and they are mostly classified as an economic sub-category [12, 13, 14].

The main components of greenhouse vegetable growing are modern greenhouse designs, equipment (automation systems, measuring devices, climate control, lighting, irrigation and fertilizing), varieties (hybrids), varietal agricultural equipment, integrated plant protection system, materials (seeds, planting material, fertilizers, growth stimulants, biological preparations, substrates and soils, protection products). As you can see, greenhouse vegetable growing is an interconnected engineering, technological, agricultural, biological, organizational and economic measures aimed at obtaining fresh vegetable products in the off-season [15, 16, 17].

The greenhouse complex today is a rather complex and expensive structure. The efficiency of the production process of obtaining vegetables in a given quantity and quality largely depends on the correct decisions at the planning stage of the greenhouse complex, the choice of location and type of construction, and the maximum possible difficulties in the implementation of the project. Risks that are not taken into account at various stages of planning production and financial activities together can lead to negative consequences and minimize the expected profit [18, 19].

At the planning stage, there may be so-called preparatory risks that lead to an increase in the cost of the project. The distance of the chosen place for the construction of a greenhouse complex or greenhouses from transport hubs, engineering networks leads to additional costs for creating access roads, supplying heat (gas), water, and electricity. Construction risks include failure to perform design and prospecting work in their entirety. Late delivery of greenhouse components, greenhouse equipment, automation tools, and substrate leads to an increase in the construction time of greenhouses and their commissioning. Environmental risks are associated with a high content of salts and bicarbonates in irrigation water and the need for additional water softening, which is accompanied by an increase in operating costs. Additional capital investments in evaporative cooling systems, curtains, ventilation at extremely high temperatures in summer, heating systems, the use of coverage with low thermal conductivity, and the purchase of energy in extremely low temperatures in winter increase capital investment and operating costs. Production risks are the probability of losses or additional costs associated with the stoppage or failures of production processes, violation of technology for performing technological operations, poor quality of seeds, seedlings, personnel work, etc. In modern conditions, the production risk is high, so the production activity has become the most risky.

The unsuccessfully selected variety (hybrid), low seed germination, seedling death, late planting due to the failure of local power networks lead to additional costs for planting material, unexpected reduction in area. The need to import the substrate with limited local supplies increases the cost of production due to the increase in the cost of purchasing the substrate and transport. A sharp or epiphytic spread of diseases and pests leads to additional costs for the purchase of plant protection products and transport. Weak work of bees in winter due to high clouds limits the number of ovaries and reduces the yield of early products, which are usually sold at a higher price.

Most often, the reasons for production risks are economic and technical risks.

Economic risks lead to lower prices, additional advertising costs, and even a change in specialization due to unstable demand for products in the summer, lower prices by competitors-manufacturers or wholesalers, and increased production volumes by competitors. The increase in taxes and the decrease in the solvency of final consumers of products lead to a drop in sales, the search for new wholesale buyers and a decrease in profits.

The decrease in profit is due to high production costs as a result of rising prices for heat carriers, fertilizers, plant protection products, seeds, and substrates.
The lack of alternative suppliers of raw materials also leads to lower profits when higher prices are set. The lack of working capital forces the manufacturer to increase the loan amount, which also affects the profit.

Technical risks. Wear and tear of structures and equipment increases the cost of repairs, leads to loss of crops due to failures in heating, irrigation; insufficient reliability of technological equipment, leading to a violation of the microclimate of greenhouses and irrigation regime, resulting in additional maintenance costs. The novelty of technology increases the cost of development. The lack of reserve capacity of structures and engineering systems of greenhouses can create emergencies.

Although social risks are the result of the country’s policy, they directly affect the economic efficiency of production. During the post-perestroika period, difficulties arose with the recruitment of qualified specialists and workers (agronomists, greenhouse masters, engineers, IA workers, etc.), the absence of them leads to an increase in recruitment costs, low labor productivity, the likelihood of accidents and loss or shortage of crops. Reduced productivity and staff loyalty, staff turnover, occur due to insufficient wages. The lack of social infrastructure leads to an increase in non-production costs, which also affects profits.

The presence of potential risks in the Russian protected soil vegetable growing brings to the fore the need for risk management as an important element of the strategic development of the enterprise.

Risk management is carried out at two levels - the state level and the level of vegetable farms. First of all, the effectiveness of vegetable growing depends on the political and economic stability of the state. At the state level, risk management is possible by limiting imports of vegetables and increasing exports, quotas, building logistics centers, insurance programs, smoothing revenue spikes through taxation, price regulation, preferential lending, budget financing, and information support.

Due to the fact that risks differ in variety, there are also many ways to manage them. Most researchers offer a choice of applied methods for minimizing risks at the level of vegetable farms using 4 main methods: risk avoidance, risk prevention (compensation), risk reduction, risk transfer to a third party [6, 9, 10].

The method of risk avoidance is used if there are irrevocable doubts about the parameters of the risk situation and means a complete or partial rejection of a specific event involving risk. For vegetable farms, such situations arise when concluding transactions on the terms of no prepayment with a negative business reputation of the buyer; risky financial transactions (excessive lending, investment in high-risk financial assets); cultivation of non-zoned or completely unknown varieties and hybrids, use of low-quality reproductions of seeds, etc.

The method of prevention (compensation) helps to minimize risks by creating mechanisms within the organizational and managerial structure of the economy that would prevent the occurrence of risk situations by minimizing the information uncertainty of the operating environment. The necessary element of managing vegetable growing taking into account risks and stage of management is a marketing and financial-economic analysis, which allows introducing systematically regularities and tendencies of development of economy, its external environment and conditions for vegetable markets.

Risk reduction involves affecting the overall probability and magnitude of possible damage by regulating risks in certain areas of financial and economic activity and levels of responsibility, limiting the maximum possible losses per event by increasing the number of such events; establishing business relationships with suppliers of material resources from neighboring regions; expanding supplies outside the regional vegetable market. Internal regulation of the acceptable level of production (technological, operational efficiency reduction) and financial (credit, investment) risks is possible.

One of the methods of risk reduction is self-insurance (reservation), which involves the formation of mandatory and initiative reserves. Vegetable farms can create reserves for doubtful debts, for repairs of fixed assets, for depreciation of investments in securities, and others.

To minimize organizational and managerial risks, they can use the limiting method. It provides for the development of internal regulations that regulate the distribution of functional responsibilities of managers and chief specialists for managing specific risks and personal responsibility for damage caused by their fault.
Risk transfer is one of the ways to minimize risks, which is to transfer responsibility for it to third parties. For example, when developing contracts, a farm may transfer some or all of the risk to the counterparty through separate provisions, for example, by providing for payment and transfer of vegetable products to the buyer at the time of shipment, thereby transferring the risk of damage to perishable products, depending on the fixed conditions, to the buyer or the transport company.

In vegetable growing, two ways of guaranteeing risks - insurance and cooperation - are still very poorly used. The most accessible and well-developed method of transferring risks is insurance. However, risk insurance in agriculture in general and in vegetable growing in particular has not fully reached farmers and especially small private farms yet. The use of the advantages of cooperative forms and principles, especially by small businesses, has been reduced to zero almost up to now, and only in recent years there have been positive developments.

4. Summary
The main directions for improving the mechanism of production of vegetable products in protected ground should take into account not only possible ways to improve the use of production resources, improve production technology and optimize production processes, but also provide measures to neutralize possible risks, conduct corrective and preventive measures to control factors that can lead to an adverse effect.

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