
RISK MANAGEMENT IN THE AGRICULTURAL PRODUCTION IN SERBIA

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ABSTRACT

The subject of consideration in this paper is the analysis of the structure and state of agriculture in Serbia, as well as the impact of climate change and the accompanying risks in the production. The facts that will be considered include the structure of agricultural areas, means of work, methods of processing and protection against natural disasters during the process of production. A special consideration is given to the protection of agricultural production from natural disasters. Although there are several ways of protection, it is still at a low level. The causes and consequences of the low level of protection of the agricultural production will be pointed out. At the end of the paper, the proposals for measures how to improve the insurance of agricultural production in Serbia will be presented.

Introduction

The effects of climate change are becoming increasingly evident in agricultural production and they additionally affect the intensity of the realization of risks in agricultural production in Serbia. Certain risks, such as - hail, spring frost, spring snow, flood, drought, which in the previous the period was followed by a certain period of time terms and frequencies, have now become frequent and unpredictable, both in terms of time of occurrence and intensity. The consequences are great damage to agricultural production (Šušljik, 2025).

Workers in agriculture, both in our country and in the world, cannot deal with this problem by themselves, which means that these types of damage regularly fall on the

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state budget (Milojević et al., 2025). Therefore, the state of Serbia must first of all, with incentive and preventive measures, and then with repressive measures of this type of risk in agricultural production, transfer from the budget to other factors, such as individual protection methods, collective protection or risk transfer to insurance companies (Radovanović, 2025).

The analysis of the current situation in agricultural production, as well as the situation in other countries, will indicate the directions and methods in order to resolve the problem of damages in agriculture.

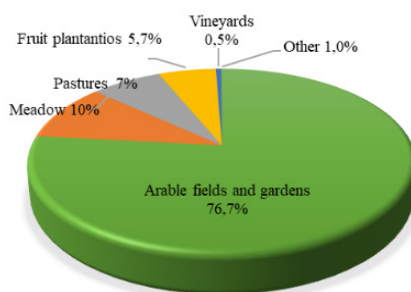
Agricultural resources in Serbia

Economic and social importance ranks the activity of agricultural production as one of the most important economic branches in Serbia and it also represents an essential element of rural development, which are typical for other countries of similar level of development (Rosić & Vilma Getman, 2025). The share of agricultural production in the gross domestic product (GDP) of Serbia in the year of 2023 was 3.8 %, and compared to 2017, there was a decrease, as it was 4% at that time. The share of directly employed or owners of farms in 2023 was 3.4% (Republic Institute of Statistics, Census of Agriculture in 2023 in Serbia, brochure for EU needs, Belgrade, 2024). However, when the number of seasonal workers is taken into account, where most of them work illegally, then it is around 20%.

This situation can be explained in the high share of seasonal workers, as well as in the low level of mechanization, that is quite old. If the low level of subsidy from the state is taken into account, as well as the way it is implemented, the non-competitiveness of our agricultural products in the world market is not surprising. The situation is similar in the countries of the region, too. Nobel laureate Teodor Schulz, an agroeconomist, in his ideas about the importance of agriculture, says: "Poverty is an indicator of ignorance of the economics of agriculture (Marović, 2017).

Structure and situation in the agricultural sector

The Republic of Serbia has 5.077 million hectares of agricultural land, of which 67% is agricultural and 33% are areas under the forest. 3.4 million hectares that are agricultural land, 67% of the land is used intensively (in the form of arable land, orchards and vineyards), while 33% of agricultural land is natural grassland (meadows and pastures).

Figure 1. The structure of used agricultural land in Serbia in 2023.

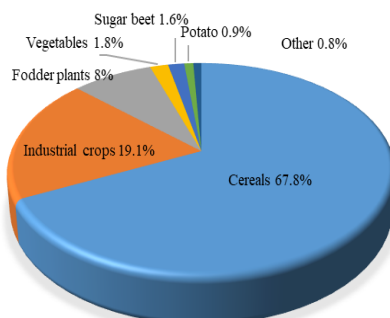
Source: Republic Statistical Office of Serbia, Statistical Yearbook, for 2024.

In the total value of agricultural production in 2023, crop production covers 69.8%, and livestock production is 30.2%.

The area of land under forest in the amount of 2,855 million hectares is distributed in the state sector, 1,191 million hectares, which is about 42%, and 58% of the area, ie 1,664 million hectares, is in the private sector (Republic Institute of Statistics, (2024) Statistical Yearbook of the Republic of Serbia for 2023.

The predominant part of about 3.4 million hectares, i.e. 67 %, which is agricultural, is used in the form of: arable land and garden 76 , 7 %, meadow 10 %, pasture 7 %, orchard 5.7 % and vineyards 0.5. (Slika1).

The predominant part of the agricultural land, about 3.3 million hectares or 67 % , is used as arable land, but about 7% is not used annually (it remains in the form of uncultivated land). In addition to the areas left for fallow, a significant part of the areas under meadows and pastures is not used due to inaccessibility, weeds or due to economic unprofitability. It is estimated that every year between 200 and 350 thousand hectares of arable land and meadows remain uncultivated, while the area of unused agricultural land with pastures is significantly larger.

Figure 2. Structure of sown arable land in Serbia in 2023. year .

Source: Republic Institute of Statistics of Serbia, Statistical Yearbook, for 2024.

According to planted crops, the structure of agricultural land in 2023 in Serbia includes: cereals 67.8%, industrial plants 19.1%, fodder plants 8%, sugar beets 1.6%, vegetables 1.8% and potatoes 0.9%, (Slika 2) .

Looking at the structure of the created values in Serbia : 70% comes from the crop production, and 30% from livestock production, with the share of crop production increasing and the share of livestock decreasing. In the EU countries, 70% of the value in agriculture comes from livestock production and 30% from crop production.

The average economic size of an agricultural farm in Serbia is about six times smaller than farms in the European Union. This can be explained as the result of:

- the out-of- dateness of machinery and the inability of renewing it due to weak economic opportunities;
- low level of well-skilled workers and education;
- minimal application of agrotechnical measures, due to lack of funds;
- a large share of mixed farms;
- a small share of areas under the irrigation system;
- low share of areas under greenhouses and greenhouses;
- low level of subsidy from the state;
- low level of cooperatives.

It is not possible to expect a significant increase in the economic size of farms or for our agricultural products to be competitive on the world market, while there are the above mentioned problems.

Labor and labor resources

The lack of labor force and outdated means of work are the two key factors that burden the agricultural activity and make it uneconomical and uncompetitive. The mutual correlation of the mentioned factors additionally intensifies the problem in agriculture. The outdated mechanization requires greater engagement of workers and therefore the labor cost is higher.

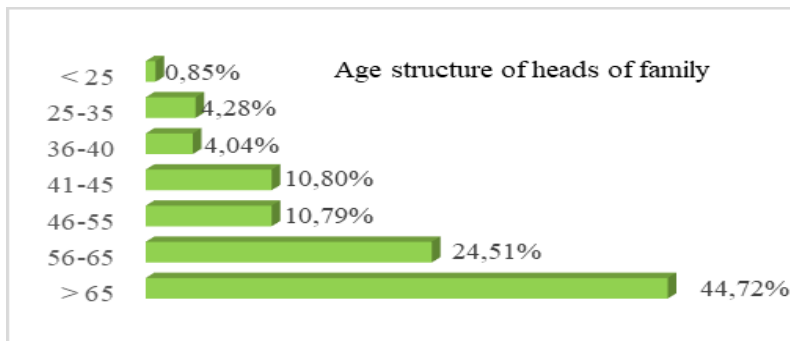
The Employment in agriculture in Serbia can be classified into five categories :

- Permanently employed on the farms of legal entities and entrepreneurs
- Permanently employed on family farms
- Seasonal workforce on agricultural farms
- Members of family farms who do part of the agricultural work and are not employed (housewives, pensioners, children and other unemployed people)
- Members of family farms who are employed and work on family farms in their free time

It is estimated that about 1,157,319 people are engaged in agriculture in this way, working on 502,318 farms, where 506,323 are family farms, 1,589 legal entities and 413 entrepreneurial farms. It means that about 20% of the workforce is employed in the agricultural sector, and its income contributes 3.8% to the GDP (Census of Agriculture in 2023 in Serbia).

The age structure of heads of family households is also unfavorable. According to data from the Federal Bureau of Statistics, from agricultural census in 2023, 44.72% household owners are over 65 years old and only 0.85% are under 25 years old (Slika 3).

Figure 3. Age structure of heads of family households in Serbia 2023.



Source: Republic Institute of Statistics of Serbia, Statistical yearbook for 2024.

Working tools are a chronic problem in agriculture. In most cases, it is outdated mechanization, especially in small farms. In fact, something has been improved, but considering the material possibilities and the amount of subsidy, it is not sufficient. In Serbia, an average of 2,000 new tractors and 60 combine harvesters. In Serbia these days, 168,353 single-axle tractors are used, there are 482,498 two-axle tractors and 46,322 combine harvesters. There are 7 out of 10 households which use their own tractors and one tractor is used for about 6.7 hectares. Farmers in Serbia own about a million attachment machines, and only every fifth machine is the new one. The average age of tractors is about 30 years (Statistical Yearbook of the Republic of Serbia for 2023).

Table 1. Overview of mechanization in Serbian agriculture by age

years of age	tractors		combine harvesters	
	pieces	%	pieces	%
< 1	7.088	1,5%	5.322	11,5%
1-5	13.660	2,8%	1.896	4,1%
6-10	24.499	5,1%	3.113	6,7%
11-15	37.694	7,8%	3.177	6,9%
16-20	43.311	9,0%	2.909	6,3%
> 20	356.246	73,8%	29.905	64,6%

Source: Republic Institute of Statistics, Statistical Yearbook of Serbia for 2023.

Risks in agricultural production

In the modern process of agricultural production, there is a basic group of risks which can be defined as: production, operational, market, financial, technological, institutional and regulatory, infrastructural, as well as the risk of disorganization.

A production risk is particularly important for this paper, as it affects the reduction of the quality and quantity of the product, or one of the above, and it is realized through:

Natural disasters: floods, torrents and high water that happen as a result of a large amount of precipitation in a short period of time, as well as the impurity of drainage channels, stormy weather, snowing at the beginning of the growing season, hail, fire due to negligence or negligent burning.

Lack or excess of water: it is undeniable that the problem of climate change is negatively reflected on agricultural production, either as drought or excessive rainfall in a period unsuitable for vegetation. The measures that were implemented to reduce the consequences of the drought in 2017 were almost invisible, as the irrigation systems covered less than 2% of arable land. On the other hand, the drainage canals are full of silt, overgrown with weeds and cannot be used. In 2023, the situation was more favorable, and it is around 3%. The individual farms contributed to this slight increase, as their share of 27.5% farms irrigated 8.3% of arable land. The largest part involves arable land and gardens with 72%, orchards 7% and vineyards 2% (Census of Agriculture in 2023 in Serbia).

Urbanization inevitably takes its toll and turns a large part of agricultural land, especially those near roads and urban areas, turning them the construction land.

Operational risk is characterized by:

Lack of workforce: a problem that is generally typical for the developed part of the world and affects Serbia as well.

Recently, there has been a noticeable lack of interest in seasonal jobs in agriculture, regardless of the fact that they are well paid. Migration of young people to cities and foreign countries is an additional problem too.

Mechanization failure: it is estimated that the age of agricultural machinery in Serbia is around 30 years old. It means that we cultivate the land with outdated mechanization, which directly implies more work and a greater number of accidents and frequent breakdowns. Due to the lack of finances, farmers still choose to buy used machinery rather than new

Market risk: - the impact of price fluctuations on the market is quite high, both due to the movement of production in the world and due to the disorganization of producers. In fact, the other buyers and resellers, as well as the import lobby are those who take the opportunity. On the other hand, the state that has chosen the liberal capitalism, remains invisible, even though it has to be its strategic activity - the production of food for its own population.

Financial risk: - a serious lack of finances forces the producers to use loans with high interest rates, that cannot be paid back by agricultural production. Subsidy payments are made after

the engagement of someone's own capital, in the form of a return that people wait for too long, making the financial liquidity of farms/ agricultural holding more complex.

Technological risk: - it is necessary to follow modern technologies in order to preserve competitiveness, but it also implies professional and skilled workforce and financial solvency.

Institutional and regulatory risk: - taking into consideration that the import-export policy in Serbia is largely liberalized, i.e. exempted from protective customs rates, it causes damage to domestic agricultural production as it is not competitive with foreign ones, that in this way takes a significant share in the domestic market. Sales chains with foreign capital additionally favor foreign products too.

Infrastructure risk: - the risk of inadequate infrastructure for production, the impossibility of storage or storage in inappropriate conditions due to lack of adequate capacities (silos, cold stores, etc.), as well as the product distribution itself.

Risk management in agricultural production

Since the Middle Ages, spatial diversification has been used as an approach to risk management in agriculture (McCloskey, 1976). Economists began to pay attention to this form of risk management only in the 1950s, analyzing the possibilities of its application in agricultural production. It is essentially a diversification approach, which provides a reduction in standard deviation by replacing one with more unrelated, smaller risks.

Diversification of risk in agriculture can be realized spatially, which implies carrying out production in different locations, and productively, which implies growing several different crops. This approach is best illustrated by our host's famous saying "don't keep all your money in one bag".

Nowadays, when agricultural production is exposed to climatic and weather turbulence, even farmers in Serbia have realized that they must take into consideration the risk control, in order to avoid or reduce the damage in agriculture. Recently, we can meet four types of protection of agricultural crops.

- The earliest designed method of protection is using hail-defense rocket, which is losing effectiveness due to subjective as well as objective circumstances, although technologically improved. The subjective circumstances are the lack of workforce to handle, and the incomplete organization as well, which at a certain moment shows poor efficiency, while the objective circumstances are caused by climate change.
- Recently, especially in fruit growing, wine-growing and vegetable growing, the installation of protective nets has been popularized. A hail protection system for orchards using protective nets costs between 26.000 and 29.000 euros per hectare. Their efficiency is quite good, but what makes them unaffordable are: the expensive installation, limited service life and the possibility of damage during the major storm.
- The most recent approach to the protection of agricultural crops is with anti-hail cannons. This is a method that many developed countries, such as the Netherlands, Belgium, Portugal, the Czech Republic and others, have been using for a long

time. Recently, thanks to the engagement of two mechanical engineers from the Faculty of Mechanical Engineering in Belgrade, we also have a domestic version of this device. It works in a way that it shoots hot air, created by igniting acetylene, between the hail clouds and thus prevents the formation of ice. Its basic characteristics: it protects all types of crops in a diameter of about 80 hectares, it is mobile and is transported as a tractor trailer, it has its own power supply through a solar panel, it can be controlled and activated using a mobile phone. The maintenance of this device costs about 500 euros per year, depending on the number of activation, there is no special permission that is required for use, it is subsidized in the amount of 50% and it is cheaper than the imported ones (For more information, see TRALING doo).

- However, the most effective way to manage risk is through insurance. Insurance companies are organizations specialized in the protection of people and their property, as they are technically and financially equipped to manage risks successfully, i.e. provide the necessary protection of property and people.

Most of the risks in agricultural production are covered by insurance companies. The basic risks that are offered are: fire, lightning strike and hail, while additional risks are: spring frost, flood, storm, drought, excessive precipitation, loss of income, winter frost, production in greenhouses, loss of seed quality due to winter frost, loss of quantity and quality, insurance of young plants and insurance of plants in the crop, insurance against winter freezing, e.g. oilseed rape. General and special conditions for insurance of crops and fruits of insurance companies: Dunav, DDOR, Triglav and Đenerali.

In addition to these risks, today's economic conditions in agricultural production, which are partly changed due to climate change, also require some new offers on the insurance market. There are already the existing risks as well as the new ones that have been specially defined in the offer for a long time. It is possible to conclude: insurance against one risk specified in the policy (eg hail); insurance against multiple risks specified in the policy; insurance against all risks except those specified in the policy; yield insurance – is activated in case of a yield that is lower than the average; parametric insurance - is activated in case that some pre-determined parameter (for example, the amount of precipitation or the number of dry days) reaches or exceeds a certain value, regardless of the actual loss.

The insured risks and damages in agricultural production

The low level of development of the insurance market in Serbia (For more information, see: Smiljanić, 2016) is also visible in the insurance system in agriculture, and it is typical for all poor countries. Therefore, the fact that in Serbia in 2023 only about 13% of the total area of used agricultural land was insured is not surprising. The analyses of earlier years ranged below 10% indicate a certain increase in insurance, but it is still at a very low level (Author's analysis based on data from five leading crop and fruit insurance companies in Serbia).

A similar situation is in Croatian agriculture too. There were only 18% of insured areas in 2023, which puts Croatia at the very bottom of the EU member states. Similar situation is in all countries in the region. It is a fact that the subsidies in these countries are lower than in the countries of the European union, but still they are from 30 to 70 %, and it cannot be said that they are insignificant. Obviously, the reasons of these are more complex. Is it the fact that the smaller farmers are sometimes distrustful of the insurance policy, while for some of them it is too expensive.

On the other hand, the official statistics show that damages in Serbian agriculture really exist. In 2012 the fires raged, causing damage on an area of 4,922 hectares, which was approximately 111.5 million dollars (85.7 million euros) (Jančić, 2012). The total amount of damage includes: direct damage, damage from lost yield, environmental damage, costs of extinguishing the fire and costs of rehabilitating the area affected by the fire.

In 2014, 72 municipalities out of 155 in Serbia were affected by floods, and the damage was estimated at 1,711.2 million dollars (1,525 million euros) where 256 million dollars (228 million euros) or 15% was related to agriculture. The insurance companies paid out 29,413, 000 million dollars (26, 275, 000 euros) which is 3% (Samardžić, Smiljanić, 2014).

During the last five dry years, there were about five billion dollars in damage to agriculture, which is the value of one year's agricultural production in Serbia, says the member of the board for the village of the Serbian Academy of Science and Arts (SANU), Branislav Gulan (Gulan, 2017).

It seems that Serbia is not ready for such a challenge, as there is less than 3% of arable land that is effectively irrigated, which means that together with Albania, we are at the bottom of the Europe. In the world, on average, between 17% and 20% of land is irrigated. In Serbia, according to the data of JVP Voda Vojvodina, around 80,000 hectares are currently irrigated. The total capacity of the irrigation system is about 180,000 ha, but the capacities for about 100,000 ha are unusable due to neglect. The enormous project Danube - Tisa - Danube canal, that in 2022 celebrated 45 years of its construction and that was built for the irrigation of about 510,000 hectares and the drainage of about 1,060,000 hectares, does not do either of these two purposes now (Vode Vojvodine, 2018). The irrigation project has never been realized, and the drainage project, that initially used to work, has not been working since 2008, as the drainage channels are silted up and overgrown with bushes and weeds.

In the period from 2013 to 2017, the average annual damages in the forest fund, were a result of natural disasters (wind, rain, hail, snow) and fire, amounted to about 78,000 m³ of wood volume (Statistical Yearbook of the Republic of Serbia for 2017), which on the other hand was 4,366,000 dollars (Srbijašume, 2023). In 2018, there was an increase in the damage of the forest fund, which was about 102,000 m³ of wood volume and it was about 5 709,000 dollars. The share of state forests amounts to 44,000 m³, recalculated 2.4 63,000 dollars, and privately owned forests 58,000 m³, recalculated 3.246,000 dollars. Damage from natural disasters and fires in 2023 amounted to about 186,727 m³ of wood volume, which, calculated, amounts to about 10,450,000 dollars (Statistical Yearbook of the Republic of Serbia, for 2023).

Crop insurance in the European Union is different from that in Serbia. In most countries, insurance is mandatory in order to acquire the right to a subsidy and there are several measures related to the development of elements for risk control, such as established public-private funds for compensation of damages.

In Austria, 78% of agricultural land is covered by insurance, Hungary insures 52% of land, while the EU average is 35%. Thanks to high state subsidies, the highest percentage of crop insurance is in Spain and Germany. It ranges from 60 to 70 percent of the total number of farms (Kovačević, 2018).

Subsidies and insurance premium share in total cost of agricultural production

In 2023, Serbia subsidized agricultural production insurance with 40% - 45% of the paid insurance premium, with the maximum amount of incentives being :

- for crop insurance - 100,000 dinars
- for insurance of vegetable crops - 500,000 dinars
- for insurance of fruit crops, grapevine and hops - 1,000,000 dinars
- for the insurance of plant nurseries and/or young perennial plants before they go into production - 500,000 dinars
- for animal insurance – 2,000,000 dinars

In total, the maximum amount for all types of incentives is 2,500,000 dinars.

In addition to that, there are subsidized loans from the Ministry of Agriculture in cooperation with commercial banks and insurance companies.

Local self-governments have the option of additional subsidizing agricultural insurance, so there are cases where in some municipalities the total subvention amounts to 100% of the net premium. In a large number of cases, in addition to the incentives granted by the state of Serbia, local governments, depending on the material possibilities and the frequency of realization of certain types of risks in their areas, grant an additional incentive ranging from 20-60 percent, so that we have cases where the insurance of agricultural production, in municipalities such as Indija, Kraljevo and some others that grant an incentive of 60%, insurance, almost free of charge, considering that the insured only pays tax on the premium, which is 5%.

According to the law on protection from hail, insurance companies set aside 10% of the collected crop and fruit insurance premium. The distribution refers exclusively to the collected insurance premium of registered plots, registered agricultural holdings (RPG). The funds are used for financing of the hail defense system, as a preventive action (Article 15, Law on City Defense, Official Gazette of the Republic of Serbia no. 54/2015).

In the world, there are different ways used for the promotion of agricultural production insurance. They range from mandatory to optional insurance and from high levels of incentives to those where there are no incentives. Each country has established a system that best suits its national agriculture and the conditions under which production takes place, (Table 2).

The price of agricultural production insurance in Serbia is for farmers as they say unprofitable. Is it really true and what do the facts and calculation say?

The cost of insurance is much lower than, for example, a harvester causing damage during harvesting, which is accepted as normal and is considered a technological loss.

When taking into account the incentives provided by the state directly and through local governments for the insurance of agricultural production, the insurance price does not exceed 1% of the value of the crop in relation to the damage caused by the harvester in the harvest, which ranges from 3-6%, depending on the age of the harvester.

Table 2 . The method of insurance and the amount of incentives in some countries in the world

Country	Subsidy	Way of insurance
Cyprus	50%	The state is the insurance carrier, through the state insurance company - insurance is obligatory
Bulgaria	-	Commercial insurance without state participation
Finland	-	
Denmark	-	
Sweden	-	
Belgium	-	
Greece	-	
Australia	-	
Spain	60-70%	State Agricultural Insurance Corporation - the provider of subsidy in the form of coinsurance
Portugal	45-85%	Commercial insurance with state control and subsidy
USA	50-75%	
Austria	50%	Commercial insurance with state subsidy
Italy	50-80%	
France	10-30%	
Czech Republic	30%	
Russia	50%	
Slovenia	30-50%	
Netherlands	75%	
Germany	60-70%	
Croatia	70%	
Federation of Bosna and Herzegovina	50%	
Republic of Srpska	50%	
Serbia	40-45%	

Source : Data from national laws, regulations and decisions as and the magazine Sigma (Swiss Re) for 2023 . a year

The examples in (Table 3) should prove that the agricultural insurance is not expensive. If the producer chooses the insurance against the basic risk, such as hail, fire or lightning strike, the calculation is shown for the types of products that are most represented in agricultural production in Serbia.

There is an example of the calculation of the insurance premium for the insurance of wheat per one hectare at an average three-year yield of 4.1 tons per hectare (Statistical Yearbook of the Republic of Serbia for 2023) and a planned price of 23 dinars per kilogram is 2,700.00 dinars, and corn at a yield of 8 tons per hectare and a planned price of 18 dinars per kilogram is 3,642.00 dinars (Decision of the Government of the Republic of Serbia dated July 3, 2025. year, Source).

If the minimum incentive of 40% given by the state is taken, the price of the insurance policy for wheat per hectare would be 1,620.00 dinars, and for corn 2,185.00 dinars, which amounts to 70 kg of wheat, or 121 kg of corn (Author's calculation based on the offers of three insurance companies in Serbia and the average three-year yield). If the incentives of local self-governments are taken into account, the price is even lower.

Table 3. Calculation of the insurance premium for the most widespread agricultural crops in Serbia

Култура	Принос т/ха	План, цена (дин)	Сума осигурања	Премија /ха	Премија / тони	Премија - субвенц. 70%/ха	Субвен. Премија кг/тони
Пшеница	4,1	23,00	94.300,00	2.700,00	658,54	810,00	35
Кукуруз	8,0	18,00	144.000,00	3.642,00	455,25	1.092,60	61
Индуст. Биље	3,0	37,00	111.000,00	3.645,00	1.215,00	1.093,50	30
Крмно биље	14,0	9,00	100.000,00	28.520,00	2.037,14	8.556,00	951
Шећерна репа	50,8	5,00	254.000,00	4.156,00	81,81	1.246,80	249
Кромпир	16,2	23,00	372.600,00	6.515,00	402,16	1.954,50	85
Поврће	13,5	18,00	243.000,00	12.245,00	907,04	3.673,50	204
Јагода	4,4	120,00	528.000,00	31.256,00	7.103,64	9.376,80	78
Малина	5,5	140,00	770.000,00	33.950,00	6.172,73	10.185,00	73
Шљива	5,3	23,00	121.900,00	7.948,00	1.499,62	2.384,40	104
Јабuka	16,5	32,00	528.000,00	35.205,00	2.133,64	10.561,50	330
Кајсија	17,0	60,00	1.020.000,00	43.120,00	2.536,47	12.936,00	216
Крушка	18,0	45,00	810.000,00	43.250,00	2.402,78	12.975,00	288
Вишња	5,8	32,00	185.600,00	13.050,00	2.250,00	3.915,00	122
Грожђе	8,0	44,00	352.000,00	35.980,00	4.497,50	10.794,00	245

Source: Author's calculation based on offers from three insurance companies in Serbia.

Regarding fruit insurance, for a yield of 1,000.00 kilos, and at purchase prices from this season, the premium amounts are as follows: for plums 1.500.00 dinars, for apples 2.133.00 dinars and for strawberries 7.104.00 dinars, without subsidies.

If only state subsidies are taken into account, then it amounts to: 900.00 dinars for plums, 1.280.00 dinars for apples, and 4.262.00 dinars for strawberries.

If the state assumes the obligation to insure agriculture, on the basis of insurability of 80%, area and land of 70% subsidy, the state would have to set aside about 115 million dollars (100 million euros) annually for subsidies. When the return is calculated from a total of 25%, the real costs of the subsidy would amount to about 86 million dollars (75 million euros). According to the current Law on Hail Protection, insurance companies are required to deduct 10% of the insurance premium from each policy sold in the name of preventive hail protection. If the insurance of agricultural products were to be introduced as mandatory for the majority, the state could oblige the insurance companies to pay a part of the insurance premium, e.g. 15% is set aside for scholarships for the

education of young personnel in agriculture. If this amount is compared with the amount that the state gives from the budget every year, for damages in agriculture, it is clear that insurance in agriculture is profitable for both the state and the owners of farms.

Table 4. Calculation of the insurance premium against basic risks for forests in Serbia

	Deciduods trees	Conifers
Yield in tones per hectare	161,0	161,0
Average price per heath per cubic meter	5.900,00	5.900,00
Insurance sum per hectare	949.900,00	949.900,00
Premium per hectare	1.576,83	2.650,22
Premium per hectare subsidized 70%	473,05	795,07
Premium share in the price of cubic meter of wood	27%	45%
A share of subsidized premium in the price of cubic meter of wood	8%	13%

Source: Author's calculation based on offers from three insurance companies in Serbia

The analysis of forest insurance in Serbia also shows the profitability of insurance. From the data in (Table 4), it is clear that the insurance premium per one hectare of forest is almost symbolic in relation to its value. In the average price of wood (Price list of basic forestry products - wood assortments for 2023. year), the insurance premium, without subsidy, participates: for lichens 27%, and for conifers 35%, which is quite high, but by applying the same subsidy methodology as for agricultural crops of 70% and 80% insurability, the share of the insurance premium in the price of 1 m³ of wood becomes quite acceptable. For the sake of comparison, the total amount of fire damage in 2012 per hectare was 1,962,085 dinars, which is 207% in relation to the value of wood mass per hectare (949,900 dinars) (Jančić, 2012).

The previous, short analysis leads to the conclusion that it is unacceptable to say that the insurance policy in agricultural production is too expensive and that it is the reason why only a small part of it is protected by insurance.

A lack of information among farmers-one of the reasons for the low level of insurance

Although the experts have been recommending insurance to producers for years, farmers in Serbia are not used to the idea of insuring their crops. The data show that in 2023, only 12.3% of agricultural production was insured, which shows a decrease of 0.3% compared to 2017. (Census of Agriculture in 2023 in Serbia). As the negative impact of climate change is obvious, it is difficult to find an explanation for this. In contrast to domestic manufacturers, their colleagues in Europe have a completely different practice.

The analysis, in the previous chapter, showed that the price of the insurance policy should not be a limiting factor. The state cannot be blamed for being passive, since it carries out various activities, including this year's agricultural fair in Novi Sad, where special attention was paid just to this topic. It was pointed out that the state gives

significant funds for insurance incentives in agriculture, but that they are generally used more by large systems and agro-entrepreneurs than by small farms. Unfortunately, it seems that the current incentive level of 40-45% is not enough to make farmers in Serbia more interested in crop insurance, so that the planned funds allocated by the Ministry of Agriculture every year in the agricultural budget remain partially used. In 2023, 1,952,000,000 dinars were paid for insurance subsidies (Radović 2024).

Smaller producers, however, do not insure their crops, because, as they say, insurance is expensive and unprofitable. The problem is that most of them are not informed about the subsidies offered by the state, which specifically apply to areas up to 20 hectares.

Municipalities throughout Serbia help agricultural producers, but due to the lack of information and lack of interest of farmers, a large number of insurance benefits have been reduced.

All analyses lead to the conclusion that agricultural producers are not sufficiently informed and do not have valid information about the benefits of an insurance policy and the possibility of collecting damages caused by hail, stormy winds, fires or the other weather events. Obviously, the information that farmers get are not clear enough and well-explained, in a satisfactory manner. It should be taken into account, that the professional language used in insurance terminology is specific and different in many ways from that in everyday use. It is necessary to explain to the agricultural producer what he insures, how much it will cost him, and in case of damage, what he will be get. The complete process of concluding an insurance contract and compensation for damage must go through with minimal administration.

The next problem is distrust of insurance companies. We should not forget the period during the nineties of the last century and the great disappointment in financial institutions that the people experienced. During that period, the banks stopped paying out foreign currency savings to citizens and dinar savings ,as well as life insurance policies , that were devalued by deliberately caused inflation.

On the other hand, there is certainly a part of those who took out insurance, and then, at the first damage, were disappointed in irresponsible treatment that was done by some insurance companies. To a certain extent, it is also the idea that the state will compensate for larger damages, as it is doing now.

Although legal instruments of insurance are the most dominant form of legal protection of it should be noted that all plant breeders also have mechanisms for the protection of intellectual property rights at their disposal. Given the specifics of the object of protection, legal mechanisms for the protection of new plant varieties belong to a multi-layered system of intellectual property rights (Ćemalović, Petrović, 2019).

The right of plant breeders in the Republic of Serbia is exercised through the Plant Protection Administration, which maintains a register of the title of the right and all necessary data on the newly created plant variety.

Possibilities of increasing the level of insurance in agriculture

The impact of climate change on the realization of some of the risks is obvious, but farmers in Serbia do not accept it as a reality and as a problem of the future. Leaving the fate of their effort to the power of nature, will not bring a good result in the end.

It would be desirable for the state to transfer all risks (fire, flood, storm, hail, snow, landslides, etc.) to the budget in the form of remediation of the consequences, or co-finance its own means of protection. Based on the experiences of other countries and their own conditions, it is necessary to determine measures that would include the necessary preparatory work as a precondition for their successful implementation, which would contain the following:

- Increase the incentive to around 70% and thus give priority to agricultural production;
- Leave the possibility of additional subsidies to local self-governments;
- Allow the right to incentives to all registered farms, regardless of the size of area
- Abolish the upper limit of the amount of subsidized funds;
- Abolish the insurance tax of 5% (in some countries it has been abolished);
- Simplify the procedure for obtaining funds for incentives, which means;
 - that the incentive request can be submitted throughout the year,
 - that when concluding the insurance contract, the insured pays the part of the premium that is not covered by the subsidy, and the insurance company has to pay the difference directly to the appropriate ministry within a reasonable time,
- Conduct the education through local self-government in cooperation with the Insurance Association
- Introduce mandatory insurance for users of all types of incentives, loans, users of state land, as well as members of cooperatives;
- In addition to crop and fruit insurance, introduce mandatory farm liability insurance. Recently, especially on farms in Vojvodina, there have been cases of poisoning of game and birds. Unburied seed grains that have been treated with pesticides containing toxic substances are suspected;
- Develop a model of public-private partnership in insurance that has proven to be successful in some countries;
- Demand from insurance companies to enter the market with new products that would follow possible new risks;
- In cooperation with insurance companies, create a risk map with an overview of frequency and intensity;
- Form an independent state commission that would arbitrate in cases where the insured is not satisfied with the amount of damage;

- Ensure the participation of insurance companies in co-financing the education of people in agriculture;
- Use preventive measures to find more modern and reliable defense measures against natural disasters
- In order to avoid moral risk, impose the obligation to plant only certified seed, to use mineral fertilizers, as well as the use of chemical protective agents that must be controlled, in order to realize the income insurance to function
- Provide licenses for parvo purchase and use of all types of protection;
- Abolish drainage and irrigation fees;
- Introduce special subsidies for the installation of irrigation systems;
- Introduce mandatory insurance of state and private forests on the basis of subsidies;
- Suspend all types of support from the state budget to agricultural production that suffered damage
- Introduce strict control over the cost of subsidy funds

The allocated funds from the budget for subsidies would be higher, but the effect would be highly positive, considering that a certain part of the funds would be returned. The funds spent on compensation for damages, which are greater than the amount of insurance incentives, would remain in the budget.

The experience of developed countries shows that these measures would produce good results. In most countries, insurance is mandatory for getting the right to receive subsidies, and there are several measures related to the development of instruments for risk control, such as established public-private funds for compensation of damages.

The conclusion

Agriculture as a key sector in the process of rural development in Serbia, must have the support of the state, as it is in most developed countries, in order to achieve significant growth, development and competitiveness.

It is to be expected that the state, if it provides all types of support, gets the appropriate results. Securing the invested funds, as well as the agriculture generally, is possible by investing in preventive protection measures and by insurance of property.

Taking into account that the level of insurance in agriculture is quite low, and thus a large part of the damage belongs to the budget, the state must introduce mandatory insurance measures (at least for users of budget funds) in order to transfer these risks to insurance companies. These mandatory measures should be accompanied by a higher subsidy of insurance costs, as well as a simple implementation.

All the analyses carried out in this paper show that the insurance of agricultural products in Serbia is profitable both for the state and the owners of agricultural farms.

If the opportunities to protect agriculture, in the form of insurance and a significant increase in the areas that can be irrigated, do not raise to a significantly higher level, agricultural production in Serbia will suffer defeat in the fight with climate change and new challenges.

The question that appears is if we would be able to produce enough food for ourselves in the near future. It would be definitely a huge damage and our irresponsibility, having in mind that we have resources that many countries would like to have.

Conflict of interests

The authors declare no conflict of interest.

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