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Economic Evaluation of the Interaction between Crops Production and Livestock Breeding Based on the Organic Production of Farms in Serbia

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Abstract

In Serbia, there are significant natural potentials for the increase of areas under organic production. Given the differences in potentials, some regions have competitive advantages for certain production lines. For example, in the mountain regions there are successfully grown some species of small fruit and cattle (the pasture type of production), while in the plain regions, crops production and stable livestock keeping dominate. Guided by the basic principles of organic production, the manure as an organic fertilizer represents an important source of nutrients in plant production. Therefore, the tendency is towards closed economy husbandries that may provide most of the input themselves. This type includes crop production-livestock breeding orientated husbandries as well, where crops provide fodder for livestock nutrition, and the livestock provides manure as input for plant production. These types of husbandries operate successfully in plain regions of Republic of Serbia.

This paperwork uses a model of husbandry limited to 600 ha of arable area, to estimate the number of milking cows and fattening cattle that can be grown on the basis of plain crops yielded for livestock nutrition in the conditions of organic agricultural production. The calculation for cattle breeding was done on the basis of structural unit (i.e. based on index of calving and mortality percentage). As final products, milk and fattening cattle are realized on the market, as well as the yield of crops grown for the optimality of crop rotation. For the total number of animals on the farm, it is estimated the quantity of manure that can be obtained in calendar year. Taking into account the pre crop-main crop rule, and guided by three-year manure effect, crop rotation was created for crops found on husbandry. Fertilizing 200 ha of arable areas annually, in three years all areas that husbandry contains will be rotated. The model also shows the possible economic efficiency of the interaction between the crop farming and livestock breeding in organic agricultural production.

Key words: *crop rotations, livestock, organic production, economical effectiveness*

JEL Classification: *Q12, Q10, D29*

Introduction

The claim that we can rationalize risky choice in terms of expected utility appears to be widely, if not universally accepted in the agricultural and resource economics profession. Moreover, agricultural economists can generate data directly through their own projects and surveys. The impacts of changes in temperature, precipitation and other climatic events can be expected to be particularly significant on agriculture, due to its ties to a physical resource base and biological balance (World Bank, 2009). This is one of the main reasons why mountain livestock breeding is more and more recognized as the production with a number of crucial functions that go beyond the production of food, fulfilling new social expectations, such as the maintenance of traditional landscapes and biodiversity (Henle et al., 2008), or the production of safe and high-quality products (Bernués et al., 2006, Villalba et al., 2010). Ruminant farming systems, historically, have played a central role in the socio-economic structure of mountain communities and less favored areas across Europe. However, the generalized process of abandonment that has occurred since 1950 has caused diverse, undesirable environmental consequences (MacDonald et al., 2000, Sredojević et al., 2002). A cost-effective implementation of nature conservation programs requires information of conservation costs and benefits.

The fact that agriculture comprises a substantial proportion of the world's land cover, while providing the main livelihood and/or food base for a growing population, will require a major effort of adaptation and mitigation for agriculture across the globe (World Bank, 2009, Monjardino et al., 2010). Projected changes in climate will affect many physical and biological systems across the globe (IPCC, 2007). According to the medical researches' results, the health risk has been frequently resulted in the high frequency of disturbances in newborn infants' development and health, as well as in the fertility disturbances that have been proved both in the case of human beings and animals. Basic reasons for expansion of organic agriculture could be found in the results of numerous researches that point at the increase of health risk in the case of the food consumption that is coming from intensive conventional production.

Significant initiatives are under way in the tropical part of the globe to develop and promote conservation of agriculture, particularly direct-seeding mulch-based cropping systems. Direct-seeding mulch aim at maintaining the soil covered and protected by organic mulch (dead or living) at least during the crop establishment period. Many studies have highlighted the potential of this technology for achieving relatively high yields, while effectively protecting the soil against erosion and improving its water and nutrients balances (Lal, 1988, Steiner et al., 1998, Derpsch, 2001, Fowler and Rockstrom, 2001, Hobbs, 2006, Hobbs et al., 2008, Affholder et al., 2010). While there have been many attempts to assess the risk preferences of farmers, there are few studies of their beliefs about uncertain events encoded as probabilities. While human behavior is so diverse and inconsistent that no modeling approach is likely to predict all outcomes accurately, it would appear that expected utility theory has been widely though not universally thought to be a 'good enough' basis for the study of risk-taking behavior by farmers and other decision-makers (e.g. Just and Pope, 1979, Newbery and Stiglitz, 1981, Pope and Just, 1991, Mahul, 2001, Sredojević et al., 2009, Hardaker and Lien, 2010).

Agricultural development and rural possibilities are determined, first of all, by natural, and then by organizational, economic and social factors in particular areas. Significant differences in cited parameters determined extremely different production, organizational and economic characteristics of Serbian farms: natural production factors significantly differ according to the quality, as well as productive characteristics, and that is why the production structure and economic effects are different to a great extent (Sredojević, 2000). From an economic point of view, successful agricultural and rural development could be influenced by family farms dedicated to the ecological way of production. In Serbia the system of management by agriculture in organic conditions is regulated by *the Law on organic production and organic products*, which is based on 4 principles: the health principle (for plants, animals and human beings, as an indivisible natural totality), the ecological principle, the principle of righteousness and the principle of care and fostering. Important topics for organic production development are the establishment of national certification system, as well as the protection of the national market from the products appearing with synonyms reflecting there is health–protected food (organic, ecologic, biologic etc.), but without registration and certification as organic production products. In accordance with that, the products from organic agriculture certified on the basis of the Law have to be marked by the sign *Organic product* and code of certification organization. According to expert's estimation, the environment in Serbia is less polluted than in highly developed industrial countries, but forest and grassland soils are being seriously degraded and damaged due to extensive agricultural activities (Gajić et al., 2008, Dugalić et al., 2008, Gajić et al., 2010). This fact is proven by the very high biological diversity. Healthy food production has to be developed by engaging the large ecological and economical potentials.

Material and Methods

Based on accounting records data, as well as planned and final calculations and financial reports for particular farms in plain part of Serbia, it has been established the model of a farm that has mixed crop and livestock production character. The farm is oriented towards organic production. Within livestock breeding production it is present cattle production, with orientation onto production of final market products - milk and fattened cattle up to 250 kg or 450 kg. The basis for farm size is the cultivable area capacity. According to this indicator there have been determined capacities of other production factors, technical assets, number of livestock heads etc. Consequently, planned production capacities of the farm are of 600 ha of arable land. All accounts have been done on the basis of the *structural unit*: milking cow = 1.0; female calf up to 4 months = 0.22; heifer 4-12 months = 0.22; heifer 12–22 months = 0.2; in-calf heifers = 0.20; fattening cattle up to 250 kg = 0.66; fattening cattle up to 450 kg = 0.66. The length of breeding (utilization) period is of 5 years. The calving rate is 88% and the replacement of milking cows is done by own reproduction. The structure of crop production includes the following crops: winter wheat; winter barley; maize-grain; sunflower; soybean; sugar beet; silage maize; alfalfa; oil rapeseed; mixture of peas and winter barley. The crops are basically planned for provision of feed basis for livestock at farm, while surplus is planned to be sold at the local market.

By appreciation of appropriate limitations (basic principles of organic production, arable land surfaces, provision of minimal feed quantity, crop rotation conditions etc.), there has been established the optimal size structure of particular production lines at the farm. The main goal was profit maximization on the farm. For an optimal number of livestock heads, it has been projected the quantity of manure production as input for crop production. The following step was to make the crop rotation plan that could give the best utilization of projected manure quantities, and as much as possible naturally solved problems of pest, weed and disease control. In that way, it has been elaborated the possibility of economically justified interactive linkages between crop and livestock breeding production at the farm, as one of the important conditions for organic production.

Results and Discussion

Animal feed production on the farm in case of conventional and organic production - The use of improved forage varieties for dry season feeding was tested as the main strategy, as an improvement of animal production will necessitate additional forage and/or forage with improved nutritional quality especially at strategic times throughout the year (Pengelly et al., 2003, Bartl et al., 2009). Precisely, agriculture is not a single technology, but rather a set of many component technologies from which farmers can select to form a system that meets their unique needs and management style. The limited availability of good quality fodder, especially during the dry season, as well as the genetic potential of animals represent the main limiting factors for livestock breeding systems in Serbia. In livestock breeding in organic production conditions, it usually starts from linkages between crop and livestock production, mostly from the standpoint of providing the following items: feed basis, manure as organic fertilizer, quality of livestock feed, healthy animals, appropriate fertility, longevity, productivity etc. One of the important principles of organic production is that the basic needs of feed have been provided by own areas (min 80%), while the remaining quantities could be provided out of the farm. At the same time, in order to manure fields regularly, it has been planned a number of animals according to the needs for manure production. If we use principles of conventional (intensive) production, it has been calculated that there could be provided, from those areas, the feed for a number of 263 heads of milking cows, necessary young animals to replace the basic heard, as well as 184 heads of fattening cattle up to 450 kg. In that case it is necessary to provide a quantity of voluminous feed amounting to 1,734,420 n.u., as well as 315 t of maize (Sredojević, 2000). The necessary quantity of voluminous feed in case of the conventional way of production should be produced on the area of 176 ha (silage maize, oil rapeseed, peas and winter barley as basic crops), and on area of 90 ha in the postharvest seeding (alfalfa). In order to provide the necessary maize quantity, it is needed an area of 35 ha. In the case of organic production, at the same arable land of the analyzed farm, it should be produced less volume of voluminous feed by 413.241 n.u. (nutrients units), i.e. around 24%, as well as less quantity of maize for livestock feed by 87.5%, or by 28% (Table 1.).

Table 1. Animal feed production on the farm in the case of conventional and organic production

Crop	Area (ha)	Conventional production (I)		Organic production (II)		Difference (II–I)	
		(t/ha)	Total (n.u.)[a]	(t/ha)	Total (n.u.)	(n.u.)	%
Alfalfa	90	10	439,200	9.2	404,100	- 35,100	8
Silage maize	86	35	903,000	25	645,000	- 258,000	29
Oil rapeseed	57	30	268,470	21	187,929	- 80,541	30
Peas + winter barley	33	25	123,750	17	84,150	- 39,600	32
Voluminous livestock feed (total):			**1,734,420**	**-**	**1,321,179**	**- 413,241**	**24**
Maize	35	9	315 t	6.5	227.5	- 87.5 t	28

[a] n.u. = nutrients units, Source: All presented data are based on authors' calculation.

In order to provide the necessary quantity of livestock feed for appropriate cattle production size even after the transition of farms to organic production, it should be necessary to increase the area under livestock feed crops. Herd fertility has a great impact on the gross income from livestock breeding production due to the shifting of the ratio between non-lactating and lactating cows towards the lactating cows and additionally due to an increase in the sale of live animals.

The supposition is that farmers will keep on with the same size of cattle production amounting to 263 milking cows and 184 fattening cattle heads because of the following reasons: satisfactory productivity (achievement of milking efficiency amounting to 6,000 l annually); market security for selling the produced milk and beef; capability and willingness to deal with cattle production; regular inflow of financial resources; presence of the crops convenient for the soil fertility maintenance (alfalfa, silage maize etc.); possibility for livestock feed production, even in the post harvest seeding, as well as getting higher quantities of solid manure to achieve the satisfactory yields in the organic production conditions.

The quantity of manure per head of certain cattle category and total annual quantity of manure on the farm - Farmers will also need to continue to be responsive to economic pressures (e.g. decline in the terms of trade for agricultural commodities, increasing inputs costs), government policies, social changes (e.g. decline of family farm, shortage of labor), as well as to the changing market trends and consumer demands (Sredojević et al., 2002, 2005). Economically the most appropriate and optimal crop production structure, with the previously presented size of cattle production, has been determined by taking into account the input-output parameters in organic production, as well as by the new optimizing procedure. This model should also account for long term dynamics of the cropping systems interacting with the environment, in order to better address the trade-off between the urgency of satisfying elementary needs of smallholders and the promise of a better productivity in the future.

Necessary voluminous livestock feed could be provided by production of silage maize on an area of 139 ha, increased by 53 ha (62%), instead of giving up sunflower production (30 ha), as well as decreased maize production by 23 ha (24%). Due to the maize provision for livestock feed, it has been decreased the market quantity by 383 t, or 72%, compared to conventional way of production. For maintenance of the soil production ability in the case of the organic way of production, the leguminous crops, such as alfalfa and soybean, are of great importance, with proportionally high shares (20%) in the seeding structure.

For the particular quantities, the disassembling of dry organic substance in the course of year per hectare of arable land could be calculated from the following structure: in the case of root crops share up to 15%, it is 2 t of organic substance; up to 25%, it is 3t of substance, and for share up to 35%, it is 4 t of substance. Fertilizing by solid manure, as compared to the liquid one, has numerous advantages as follows: it improves physical, chemical and microbiological characteristics of the soil; it does not contain harmful germs which are transferred onto the agricultural products; it does not pollute water, air and agricultural soil; its transport and spreading on soil is much easier and efficient. In the analyzed farm model it has been supposed that in the case of organic production sub-model there is no application of fertilizer, except for the case of sugar beet, where as it is projected, urea 46% takes around 0,3 t/ha, which can cause some ecological problems.

Considering an ecological point of view and a more realistic evaluation of nutrient contents, one of the satisfactory solutions is represented by the assessment of manure production given by Ruthenberg (1958), Tietjen and Vetter (1972) and Sredojević (2000), which is based on average normative of 4.6%, for the solid phase, and 3.3%, for the liquid one, out of average animal weight per day. Based on the assessment of quantity per day, it has been calculated the annual manure production per particular categories of cattle on the farm (Table 2.).

Table 2. Quantity of manure per head of particular cattle category on the farm

Category of cattle	Weight of animal head (kg l. w.)	No. of days in some categ.	Solid phase		Liquid phase		Total	
			Per day (kg)	Annually (t)	Per day (kg)	Annually (t)	Per day (kg)	Annually (t)
Milking cow	620	365	28.52	10.41	20.46	7.47	48.98	17.88
In-calf heifer	450	285	20.70 [a]	5.90 [b]	14.85	4.23	35.55	10.13
Heifer 12–22 months	325	122	14.95	1.82	10.72	1.31	25.67	3.13
Heifer 4–12 months	210	243	9.66	2.35	6.93	1.68	16.59	4.03
Female calf up to 4 months	84	122	3.86	0.47	6.64	0.81	10.50	1.28
Fattening cattle up to 250 kg	200	105	9.20	0.97	6.60	0.69	15.80	1.66
Fattening cattle up to 450 kg	350	178	16.10	2.87	11.55	2.06	27.65	4.92

[a] 20.70 kg = 4.60 % x 450 kg [b] 5.90 t annually = (20.70 kg x 285 days) : 1,000 kg

Source: all presented data are based on authors' calculation.

Manure quality could be very variable, depending on the relation between excrements and litter, the way of production, livestock feed quality, the kind of livestock production line, the means of livestock keeping and care. The utilization of manure nutrients depends on the contents of N, P_2O_5 and K_2O, their accessibility for the plants etc.

The contents of the most important manure nutrients are caused by quality, but there are differences according to the experimental assessments of particular experts. The quantity of manure necessary for manuring depends, first of all, on the disposable manure quantity, type of soil, climate, crops, preceding crops, crop rotation, plugging depth etc. Based on the manure production quantity per livestock head, as well as the number of heads per particular categories, it is given the total annual manure production in the case of the farm under focus (Table 3.).

Due to the gradual manure disassembling, the manure effect lasts for several years, depending on soil and climate characteristics, ploughing depth and manuring normative, cultivation system etc. Small infiltration in cultivated soils could be a result of the break-up of soil structure by cultivation and compaction from farm implements. In light soils, manure disassembling is faster, so effects are shorter, while in heavy soils the process is slow, so its effect lasts longer (Gajić et al., 2004). In some cases, there have been recorded positive effects of manure onto yields even 10 years after its application.

Table 3. Total annual quantity of manure for all animals on the farm

Category of Cattle	Structural unit	Solid phase (t)	Liquid phase (t)	Total (t)
Cows	1.00	10.41	7.47	17.88
In-calf heifers	0.20	1.18 [a]	0.85	2.03
Heifers 12–22 months	0.21	0.38	0.28	0.66
Heifers 4–12 months	0.22	0.52	0.37	0.89
Female calves up to 4 months	0.22	0.10	0.19	0.28
Total per structural unit of milking cow:		12.59	9.16	21.74
Fattening cattle up to 250 kg	0.66	0.64	0.46	1.10
Fattening cattle up to 450 kg	0.66	1.89	1.36	3.25
Per lines of cattle production (per head):				
Milking cows keeping	263	3,311 [b]	2,409	5,720
Cattle fattening up to 250 kg	184	118 [c]	84	202
Cattle fattening up to 450 kg	184	348	250	598
Total annually:		**3,777**	2,743	6,520

[a] 1.18 t = 5.90 t x 0.20 heads; [b] 3,311 t = 12.59 t/head x 263 heads; [c] 118 t = 0.64 t x 184 heads

Source: all presented data are based on authors' calculation.

Areas being manured according to the three-year system of manure utilization - The most frequent practice is that manure basic values have been utilized for three years, i.e. 50% in the first year, 30% in the second year and 20% in the third one. Confronting the climate change and other environmental challenges, a strategy for incremental improvement within existing farming systems is the inclusion of perennial forage shrubs. Taking into account the fact that there is no enough manure for manuring of all crops, it is necessary to use manure for those crops that have the best utilization of manure. Those are mostly root crops that have a long vegetative period. For example, in the crop rotation of the present crops at the analysed farm in organic production conditions, the best procedure should be to use manure for sugar beet and maize areas. In the second year, there could be cultivated small grains at manured areas, while in the third year there should be leguminous crops (soybean, peas etc.). Manuring norms per area unit differ by the crops (e.g., it is 23 t/ha in the case of sugar beet, 16 t/ha in the case of maize etc.). Therefore, it should be manured an area of 200 ha in one year, while manuring of same plot should be carried out every fourth year (Table 4.).

Table 4. Areas being manured according to the three–year system of manure utilization

Crop	Area (ha)	Year of manure utilization			Area being manured per years of manure utilization (ha)			Quantity of manure per particular crops in the first year of manuring	
					1st year	2nd year	3rd year	t/ha	Total (t)
Winter wheat	150	-	2	3	-	80	70	-	-
Winter barley	30	-	-	3	-	-	30	-	-
Maize–grains	58	1	-	-	58	-	-	16	928
Sugar beet	90	1	-	-	90	-	-	23	2,070
Sunflower	30	-	-	3	-	-	30	-	-
Soybean	30	-	-	3	-	-	30	-	-
Silage maize	122	1	2	3	22	90	10	15	329
Alfalfa	90	1	2	3	30	30	30	15	450
Oil rapeseed [a]	*57*	-	-	*3*	-	-	*57*	-	-
Peas + winter barley [a]	*33*	-	-	*3*	-	-	*33*	-	-
Total:						**200**	**200**	**-**	**3,777**

[a] Cultivated as the post harvest crops, Source: All presented data are based on authors' calculation

Keeping in mind the three-year effect of manure, as well as the possibility that each year it should be manured only 1/3 of total arable land area, by rotation of areas (by manuring a new area of 200 ha each year), the manuring of total arable area of 600 ha should be realized in the third year. This system of manuring is acceptable from an ecological aspect. From an economic standpoint, there should be achieved lower yields, which should not be simulative from the producers' profit aspect. However, the products got produced in the ecological production conditions are of a high quality and in that way it is produced the healthy-safe food, so the producers' profit has been compensated through higher selling prices of such products. In this way, such production is also economically justified.

The crop rotation on the farm in organic production conditions **-** A number of econometric studies of the risky choices made by farmers have yielded estimates of risk aversion coefficients much lower than implied if loss aversion is widespread (e.g., Antle, 1987, Lansink, A.O., 1999, Lence, 2000, Lien, 2002, Hardaker and Lien, 2010). The greatest problem facing with organic agricultural production is the fight against plant diseases and crop pests, as chemical measures of fight are excluded, but with some exceptions. Consequently, whole plant protection is based on the principle that problems from this domain should be prevented but not treated. In the organic production conditions, the plant protection should be organized in such a way that damage by pathogenic organisms should be as low as possible. That is enabled by the choice of species and sorts adapted to the habitat conditions, then to the proper crop rotation, by the cultivation of post–harvest, winter, associated crops, or green fertilizer crops etc. In the organic crop production system, crop rotation is realized as a phyto-sanitary measure which prevents the appearance of some plant diseases, pests and weeds, but which has also an effect onto the physical, chemical and biological improvement of soil. According to the researches done in the Netherlands, crop rotation in the system of biological crop production should be multi–field (eight or ten–field ones) because of the grass fields system which maintains soil fertility even without significant fertilizer utilization. The rational use of soils and maintenance of their multi-functionality is the key issue in sustainable systems (Kanižai et al., 2007, Dugalić et al., 2008).

According to the scheme given by Boguslawski (1981) and Sredojević (2000), as well as some additions that came from the practical experiences of Serbian experts for crop production and plant protection, Figure 1 provides a schematic presentation of the crop rotation for crops present in this model, in accordance with the production orientation of the analyzed farm model in organic production conditions.

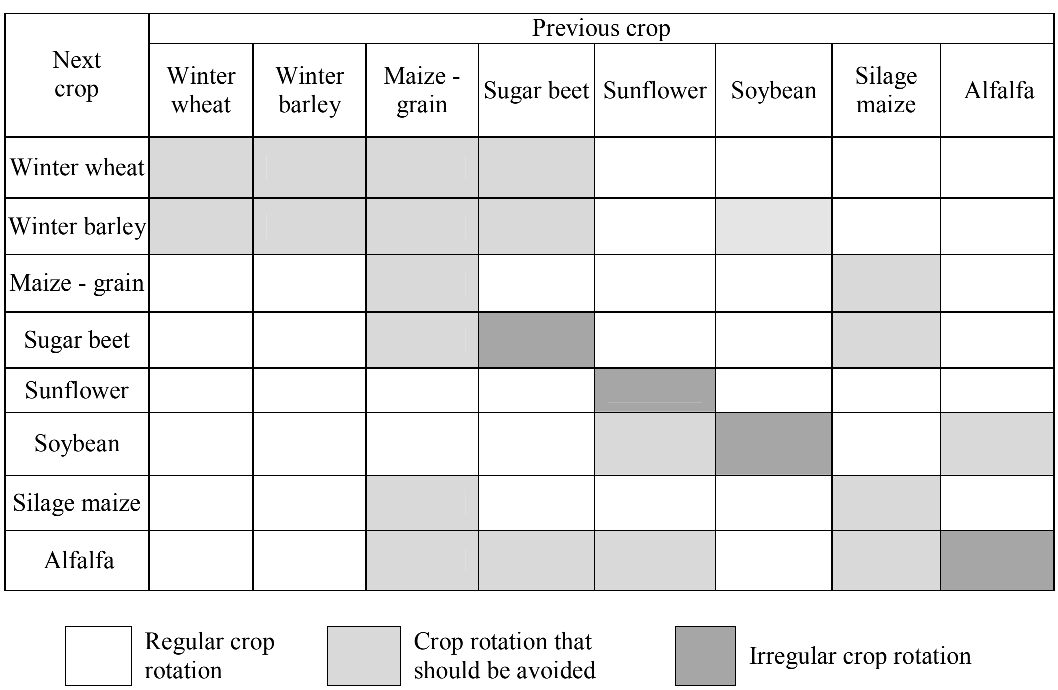

Fig. 1. The crop rotation on the farm in organic production conditions

Based on the requirement for the preceding crop, tilled crops could be classified into several groups. As a rule, those are groups of crops where the similar agro technical measures have been applied and with similar requirements concerning the preceding crop. These are the following plant groups: small grains; root crops; leguminous plants; oil and livestock fodder crops. The appearance of diseases, pests and weeds can significantly reduce preceding crop value in the case of each main crop. Each plant species is bad preceding crop for the next crop, as it supports the spreading of common diseases. There are well-known examples of spreading diseases such as the so-called flattening of small grains *(Ophiobolus graminus),* white decay *(Sclerotinia* spp.) in the case of sunflower, soybean and oil rapeseed, then appearance of pests: *Agrotis spp., Tanymecus palliatus* and *Tanymecus dilaticollis*, *Elateridae*, *Meligethes aeneus Fabricius*, *Ostrinia nubilalis etc*. It is not allowed to seed those crops which have common diseases and pests, one after another. On the contrary, it is realized that favorable preceding crops are those which are pushing the spreading of diseases and pests that should damage next crop. For example, perennial fodder crops are pushing mushroom, which causes the flattening of small grains.

Several surveys have sought to elicit from farmers and others the perceived risks they face and the main strategies used to deal with these risks (e.g., Patrick and Musser, 1997, Meuwissen et al., 2001, Flaten et al., 2005, Størdal et al., 2007, Greiner et al., 2009, Hardaker and Lien, 2010). In the case of crop rotation composition within the organic way of production, it should be remembered the ability of some crops for atmospheric nitrogen fixation and soil enriching by this element. The share of leguminous plants in crop rotation and their influence on the order of crops is very important in crop rotation. After leguminous plants there should be cultivated those plants that could make best use of the increased nitrogen presence in soil, namely: maize, silage maize, sugar beet etc. The changes of physical and hydro physical characteristics of the soil surface layer, or of the root zone, depend on the vegetation type (Štekauerová et al., 2006, Gajić et al., 2008).

Appropriate crop rotation gives numerous organizational, economic and ecological advantages, which are of great importance for the entire farm. This analysis has helped contextualize research findings in a way that both producers and researchers can relate to, and has therefore strengthened discussion between practitioners, researchers and funding agencies. Moreover, positive results may provide further encouragement for research and possible adoption of perennials in other regions, contributing to a range of response strategies to climate change in agricultural systems worldwide (Sredojević et al., 2002, 2005). Among them we could mention the following: it has been provided the necessary balancing between crop and livestock production; it has been facilitated the management of heterogeneous crop production; it significantly facilitates composition of seeding plan for each year, as well as the distribution of planned crops according to the place and area of arable land, as places and areas for particular crop groups are defined in advance; it has been provided optimal rotation; there are given conditions for qualitative and timely carrying out of key operations; there have been wiped out pathogenic agents of plant diseases, pests, or weed plants in the most natural way and it has been enabled a higher extent of plant feed. This also has ecological advantages, as it is avoided the utilization of synthetic and chemical products for plant protection. In this way, it has been disabled the concentration of toxic agents both in the soil and in other environmental elements and thus, it has a positive influence onto soil structure and high-quality yields.

Conclusion

One of the basic differences between conventional and organic production lies in the type of plant feeding, i.e. putting manure or mineral fertilizer. It is necessary to strive for the establishment of a combined type of farms with obligated livestock production, as thus the problem of organic manure should be solved. By assessing and accepting the appropriate organic production advantages, it is certain that many other items have to be foreseen and solved, in order to apply the organic production widely. It is necessary to find out sure nitrogen sources, to decrease the negative effects of exaggerated chemization, to make a new generation of sorts and hybrids, to attain the objectives of the biological fight against some harmful insects and weeds, as well as diseases, then to adapt mechanization, to change technology for plant cultivation etc. Besides the achievement of higher selling (purchasing) prices for the product of organic origin, it is necessary that appropriate agrarian policy measures should be taken in order to make such a production economically attractive for the Serbian producers.

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Evaluarea economică a interacţiunii dintre culturile agricole şi creşterea animalelor bazate pe producţia organică a fermelor din Serbia

Rezumat

În Serbia, există un potenţial natural semnificativ pentru producţia agricolă organică. Luând în considerare diferenţele de potenţial, unele regiuni deţin avantaje competitive pentru anumite linii de producţie. Spre exemplu, în zonele montane, se cultivă cu succes unele specii de fructe mici şi există condiţii de creştere pentru unele tipuri de animale (tipul de producţie păstoresc/păşunat), pe când în regiunile de câmpie, predomină producţia de recolte şi creşterea animalelor în grajduri, tip fermă. Conform principiilor de bază ale producţiei organice, îngrăşământul tip fertilizator organic reprezintă o sursă importantă de nutrienţi în creşterea culturilor. Iată de ce se tinde către economii agricole închise care se pot susţine singure. Acest tip include gospodării orientate atât către recolte, cât şi către creşterea de animale, unde recoltele produc nutreţ, iar vitele produc îngrăşământ ca suport pentru culturi. Aceste tipuri de gospodării operează cu succes în regiunile de câmpie ale Republicii Serbia.

Articolul de faţă se bazează pe un model de gospodărie agricolă limitată la 600 de hectare de zonă arabilă, pentru a estima numărul de vaci de lapte şi vaci de carne ce pot fi crescute în baza recoltelor de câmpie valorificate pentru hrana vitelor în condiţii de producţie agricolă organică. În cazul creşterii vitelor, calculul s-a efectuat conform unităţilor structurale (adică, în baza indexului de viţei şi a ratei mortalităţii). Ca produse finale, vitele de lapte şi de carne sunt scoase pe piaţă, ca şi recoltele produse pentru îmbunătăţirea rotaţiei culturilor. Pentru numărul total de animale de la fermă s-a estimat cantitatea de îngrăşământ ce poate fi obţinută într-un an calendaristic. Luând ca referinţă fosta şi actuala recoltă, precum şi efectul îngrăşământului pe trei ani, asolamentul s-a creat pentru recoltele regăsite în gospodăriile tip fermă. Fertilizând anual 200 de hectare arabile, toate zonele acelei gospodării vor fi supuse rotaţiei în trei ani. Modelul indică, de asemenea, eficienţa economică posibilă a interacţiunii dintre cultivarea pământului şi creşterea vitelor în producţia agricolă organică.