

ANALYSIS OF TECHNOLOGICAL LEVEL OF AGRICULTURAL PRODUCTION IN BOSNIA AND HERZEGOVINA

Despite permanent statements, at each level, that Bosnia and Herzegovina has significant resources in field of agriculture, until now it was not performed any expert analysis that would enable complete and exact illustration about resources condition and agricultural potentials in Bosnia and Herzegovina, more exactly its entities, cantons or certain regions.

Having in mind political and all other relations between administrative units that compose some organizational levels in BiH¹, question if this kind of analysis is still possible has been justified. Proceeding according to Contract of this project, the largest number of contacts with different subjects authorized for different fields ended without any results, because information has been treated as "kingdom of secrets" and with distrust (first of all political power).

Information that could be obtained by Agency for Statistics BiH (Sarajevo, Trg BiH No. 3) is related to pre-war condition. The Agency does not possess general information for agricultural crops at BiH level nor information on livestock capacities.

Material that will be presented in this Report is based on information provided by personal contacts with experts from certain fields: from agricultural faculties in Sarajevo and Mostar-West, Ministry of Agriculture, Forestry and Water-Power Management of Republika Srpska, as well as from contacts with experts and farmers from the field of fruit growing science from entire territory of BiH, with whom Institute for Fruit and Vine Growing Science Banjaluka is cooperating with.

Analysis of technological level of agricultural production in BiH

The main question pointed out in this analysis is:

- What fields of agricultural production have the largest potential, while soil and field characteristics have the largest influence on its development, and all that aimed for planned usage of limited national (soil) resources at optimal way.

Accordingly, limitations were considered from the agronomy aspect, which have negative influence on development. The issue will be discussed by segments: resources identification, agricultural land, usage, etc.

Resources Identification

Land properties and farm size play the main role in rational usage of soil resources. Despite the fact that in BiH more than 95 % of land is in private property, it is necessary to conclude that the largest soil complexes, which size covers more than 1,000 ha and which are mainly under irrigation system, were in property of state combines. Transformation of these surfaces into private property is loaded by many problems.

¹ BiH – Bosnia and Herzegovina

Chart 1. Size of agricultural farms in Republika Srpska – Bosnia and Herzegovina

Property size	Year 1991		Year 1997	
	to 1 ha	89.179	34.5 %	69.000
1 – 2 ha	50.405	19.5 %	39.000	19.5 %
2 – 5 ha	76.254	29.1 %	59.000	29.5 %
5 – 10 ha	35.413	13.7 %	27.000	13.5 %
over 10 ha	7.237	2.8 %	6.000	3.0 %
Total number of farms	258.488		200.000	

In order to define the strategy of land usage with more success it is necessary to compare condition in BiH with surrounding countries and EU countries.

Chart 2. Average size of agricultural properties in BiH and surrounding countries

<i>Country</i>	<i>Average farm size (ha)</i>
Bosnia and Herzegovina	3.13
Serbia	3.15
Greece	3.6
Spain	10.7
EU 15	18.6
Holland	20.1
France	42.3
Denmark	46.5
Great Britain	67.5

Based on fact analysis on status of size of land properties in our production conditions and compared with developed European countries we can conclude that:

- Total number of farmers that owned land in a period 1991–1997 was reduced by around 59,000 or a bit more than 20 %;
- In a year 1997 the largest number of farmers (34.5 %) owned less than 1 *ha* of land. Number of farmers that owned 2 – 5 ha was 29.5 %, and less than 3 % of farmers owned more than 10 ha of land;

Even though it is well known, analysis clearly shows that development of agricultural production is directly proportional to average land size that farmers own.

Agricultural Land

Information about categories of land use gained by Agency for Statistics BiH and marked as new facts obtained by after-war researches from entity statistic departments and Bureau for Statistics of Brcko District are presented at Chart 1.

Chart 3. Surfaces under cultivation in BiH

<i>Categories of land usage</i>		<i>BiH (ha)</i>
1.	Plowed fields and gardens	1,030,447
2.	Orchards	95,982
3.	Vineyards	3,373
4.	Meadows	440,845
Land under cultivation		Subtotal: 1,570,647
5.	Pastures	606,739
6.	Shrubs and swamps	2,488
Grand total of agricultural land:		2,179,874

Information provided by the Agency presented as new (Chart 3.) does not correspondent to the field facts. It is result of methodology related to, first of all, standards used for categorization of land usage (official cadastral data).

Under which standards is some area categorized as orchard, meadow or something else?

Presented facts clearly show that used categorization criterion is completely out of function. Actually, according to standards from developed countries in BiH there are less than 5.000 ha orchards. An error of official statistics here is more than obvious. To present a resource 20 times larger than that it is in reality cannot be accidental mistake?!

To gain a clear picture about condition in field of agriculture it is interesting information provided by analysis of general usage of arable land. Based on University sources, of the total arable land in BiH around 60 % is under cultivation and around 35 % is not in usage. Percentage of unused arable land per year is between 31 to 52. Difference in relation to average 35 % of unused arable land is mainly related to land set aside. Presented result is related to agricultural land available to farmers (mine fields or forbidden zones not included). Having in mind the fact that great combines from socialistic period had 7 – 8 % of arable land in property (in BiH) and that one part of the land is still not in use because of undefined ownership, it could be estimated with great possibility that BiH has around 30 % of arable soil out of usage.

Agricultural Land Usage in BiH in Different Fields

Question of agricultural land usage opens discussion about technological level of agricultural production at observed field.

Chart 4. Usage structure of arable land in husbandry at RS-BiH

<i>Crop</i>	<i>Percentage</i>
Cereals	62,0
Industrial plants	1,5
Fodder crops	12,8
Vegetable	7,0

This kind of structure is very negative. Cereal production at 1 – 3 *ha* cannot be economically justified and **it cannot be used as a basis for commercial livestock production**.

Another question that leads us into analysis of technological level of agricultural production in BiH is average yield of the most frequent crops (over 80 % of arable land in BiH), Chart 5.

Chart 5. Average yield of certain field crops in BiH

<i>Crop</i>	<i>t/ha</i>
Wheat	2.90
Rye	2.32
Barley	2,63
Oat	2,04
Corn	3,59
Soybean	1.51
Potato	8.14
Bean	1.32
Clover	3.02
Alfa-alfa	3.53
Grass-legume mixture	2.59

Clear picture on average yields of basic crops in BiH is gained by comparison of those with the same in surrounding countries, Chart 6.

Chart 6. Average yields of strategic crops in BiH and surrounding countries (*t/ha*)

<i>Crop</i>	<i>BiH</i>	<i>SCG</i> ²	<i>SLO</i> ³	<i>HUN</i> ⁴	<i>EU 25</i>	<i>EU 15</i>
Wheat	2.89	3.15	4,25	3,51	5,23	5,51
Corn	3,59	4.06	6.18	5.25	7.95	8.81
Potato	8.14	8.14	19.54	20.95	26.33	35.85

It is clearly shown that agricultural production in BiH is completely behind the production of other surrounding countries, app. 1,1 – 4,4 times.

Thus, beyond negative agricultural crops structure, BiH is also characterized by low average yield what describes this production as extensive, unproductive and hardly sustainable. However, natural conditions for agricultural production are favorable, and for some crops even optimal comparing surrounding countries.

There are many reasons that validate described condition:

- Small-size plots (a great number of small-size lots where farmers are organizing their production);
- Growing varieties with genetically low potential (introduction of new varieties with genetically higher potential is suppressed by „Institutes“ that are dealing with commercial seed production, and as a market protective measure supporting a list of varieties for cultivation in their own entities or cantons);
- Non adequate production technology regarding soil preparation, sowing schedules, fertilization, pest control, etc.

² SCG – Serbia and Montenegro

³ SLO – Slovenia

⁴ HUN – Hungary

Problem of lists of varieties in RS and FBiH cantons should be opened by the question on size of seed production of these crops in BiH.

Supply level in reproduction material by some field crops (covers over 80 % of arable land in BiH), according to available information find presented in Chart 7.

Chart 7. Market supplementation with domestic seed production in BiH

<i>Crop</i>	<i>% of seed production in BiH regarding total demand</i>
Wheat	15 – 20
Corn	10 – 15
Potato	3 – 7
Clover	4 – 6
Other vegetable	1 – 1,5

Obtained analysis clearly indicates un-sustainability of insisting on variety lists in entities and FBiH cantons, according to following reasons:

- BiH seed production covers domestic demands for only around 10 %;
- 80 % of seed is imported from Croatia and Serbia, despite the fact that seed production in these countries is uncertain, with their intention of joining EU;
- Agricultural extension services and other institutions for agricultural development do not see their role in control of reproductive material or conducting experimental variety fields, as the way to increase average yield. Scientific institutions still treat experimental variety fields as scientific question. In keeping present situation significant influence have food import lobbies (value of BiH food import amounts around 2.000.000 KM per year).

Analysis of basic crops production in BiH reveals the constrains involved in the ingrained habits of autarchy in which rural properties is oriented towards satisfaction of own needs and keeps their own livestock capacities at biological minimum. Additionally, the incapability of state and its institutions, meaning agricultural experts, to start a development process further constrains progress.

Defining planned land resource usage at optimal way, which is not suitable for any other kind of agricultural production because of soil and relief characteristics, is not possible without analysis of present condition and strategy of further development in livestock production. Based on data provided by Republika Srpska Institute for Statistics, in 1999 in RS – BiH had under pastures over 17% of total land. If we add to this 10% of land that is under natural meadows we can conclude that almost one third of total land can be used for livestock production.

Large decrease in livestock capacities (Chart 8.) and deficit in nutritional needs of population in most important animal products in last decade (Chart 9.), clearly indicates necessity of improvement of this field of agricultural production, having in mind also the aspect of rational land resource usage.

Chart 8. Livestock capacity in RS-BiH 1991-1997

<i>Type</i>	<i>Production (head)</i>		<i>Difference</i>	
	<i>1991</i>	<i>1997</i>	<i>Decrease in production</i>	<i>%</i>
Cattle	355.521	200.973	154.548	43.5
Sheep	694.213	316.712	377.501	54.4
Pigs	459.333	291.789	167.544	36.5
Poultry	4.689.315	2.087.183	2.602.133	55.5
Horses	38.578	26.494	12.084	31.3

Total decrease in livestock capacities is between 31.3% (horses) to 54.4% (sheep). If we exclude poultry that is only raised at farms (independently from soil and terrain conditions), the largest decrease in production is recorded by sheep and cattle production.

Chart. 9. Nutritive needs in most important animal products of RS-BiH population in 1997

<i>Product type</i>	<i>Unit</i>	<i>Needs</i>	<i>Deficit</i>
Meat (all types)	<i>t</i>	139.580	96.510
Milk	000 liters	248.920	98.970
Eggs	000 pieces	243.600	125.100

Besides flat areas, where all necessary cultivation conditions for raise of highly productive cattle races could be provided, large importance for development of this branch certainly have intermediate areas from flat to mountains, where there are no conditions for stable cattle keeping but for grazing. Those areas are frequent in BiH and beside cattle breeding have big importance for sheep production, which is very actual from the aspect of export-oriented programs. In these regions (from 500 to 700 m altitude) land resources could be completely used and could enable economically sustainable agricultural production through cattle and sheep breeding. In order to accomplish this goal it would be necessary to raise technological level of livestock production (selection, keeping, feeding, etc.), that is presently at very low level.

Technological problems in livestock feeding in BiH are following:

- Meadows and pastures have bad botanical composition and high content of weed;
- From such fields yield is very low;
- Late collection of grass for hay and silage preparation;
- Low quality of forages (high content of lignin and fibrins and low content of proteins, vitamins and minerals);
- Improper food processing and food storage (caused by mold and mycotoxics);
- Traditional way of forage conservation (low quality hay preparation);
- Small number of farms are preparing hay or silage;
- Lack of plans for feed production in accordance with needs of livestock (daily needs, summer and winter feeding period);
- Small size farms, with only 2 to 3 heads;
- Lack or unavailability of machinery for feed preparation;

- Uneducated farmers that hardly accept new technologies;
- Poor breed types of livestock;
- Poor buildings for keeping livestock and poor hygiene conditions;
- Lack of laboratories of quality control (vitamins, mycotoxics, hormones, etc.);
- Lack of educated personnel that would control feed quality.

Usage of agricultural land for fruit growing production clearly expresses complexity of relations in BiH agricultural production. Fruit growing production, as well as vegetable production, represents agricultural branch that could be competitive at the open market, not only because of natural conditions but also because of labor price in surrounding and EU countries. It is about growing highly productive varieties that can be successively produced on small-size areas thereby taking advantage of their comparative advantage in labor.

As it is already emphasized, information on percentage of orchards recorded by the official statistics are completely incorrect. According to these information BiH has approximately 96.000 ha under orchards, and RS official statistics records around 56.000 ha under orchards. Based on contact audit made with agronomists and producers within separate regions at entire territory of BiH, there are less than 5.000 ha of market oriented orchard plantations. This number would be even less if we would use more strict estimations.

Also it is obvious that BiH has over 90.000 ha of neglected fruit trees at farmsteads and different enclosures, which should be treated by some new law that would ensure its elimination as permanent resource of diseases and different pests.

Sort list in usage completely outdated when compared to developed surrounding countries, especially in new joined EU countries. Even though BiH does not have any recognized fruit variety whose production should be protected at the local market, the sort lists from former socialistic period are still in effect and represent an obstacle for growing highly productive commercial varieties. Variety policy in fruit growing production presents the first limitation factor for market and export oriented production. Also, over 70% of planting material is imported mainly from Serbia. This planting material is not certified, usually does not have guarantee on sort and health control, and in BiH is mostly illegally imported. Varieties propagated in this way represent tragedy for this branch of agricultural production, because they should bear fruit for the next 20 years and more. In this way fruit growing production has no chances for its improvement towards a market oriented production, although fruit growing production together with vegetable and horticulture production is determined as important potential in development of BiH agricultural production.

Fruit growing technology in BiH is old-fashioned and fits to standards from 1950's. Growing system has very low average yield as a consequence.

Chart 10. Indicators of development of fruit growing production in BiH and EU 25

<i>Specie</i>	<i>BiH</i>		<i>EU 25</i>	
	Average yield	Number of trees / ha	Average yield	Number of trees / ha
Apple	18 500	1250	52 000	2500 - 3700
Plum	9 000	420	43 500	1250 - 2000
Strawberry	7 000	30 000	28 000	50 000
Raspberry	7 000	16 000	17 000	16 000

Growing system analysis, in fruit growing production meaning growing types, combination of variety and origin and density of the composition (number of plants per surface units)

considered through average number of trees per ha, clearly show extensive fruit growing production.

It is necessary to emphasize that part of producers from Banjaluka, Prijedor and Gradiska/Bosanska Gradiska region at surface of 900 ha and Gradacac region at 500 ha of surface, have developed half-intensive and intensive fruit growing production. Average yield gained by these producers is in ratio between 25 to 45 *t/ha* per year.

Integrated agricultural production (IP) is introduced in apple, peach, plum, pear and grapevine production at region Banjaluka – Gradiška/Bosanska Gradiška – Prijedor at area of 200 ha and Gradacac region at 150 ha.

Usage of Chemicals

Usage of chemicals in BiH agricultural production based on applied quantities is relatively low. Actually, if total quantity of pesticides imported to BiH (in BiH there is no industry for pesticide production and packaging) divides with total arable land it could be concluded that 1,3 kg of pesticides covers 1 ha of arable land. Considering the fact that in BiH only ½ of farmers are using pesticides then it could be calculated that annual pesticide quantities at treated areas amounted 2,0–3,0 kg/ha. It is clear that mentioned pesticide quantities do not present significant environmental impact. Therefore, regarding usage of pesticides in BiH agriculture especially concerns a question of types of chemicals used by farmers.

EU agreed that until year 2007 organ-phosphor and organ-chlorine insecticides should be excluded from production. It would be excluded because of its negative influence on environment and residue problems. Regarding insecticides on piretroid basis they should be excluded from usage as well because of its harmful influence on useful organisms.

Chart 11. Forbidden preparations or preparations with limited usage in EU that still could be found at BiH market

<i>Active substance</i>	<i>Preparation</i>	<i>Exporting countries</i>	<i>Annual import in RS</i>
<i>Herbicides</i>			
Atrazin	Atrazin, Radazin,	SCG, CRO	150,000 /
Dikvat	Reglon,	SCG	2,000 /
Parakvat	Gramoxon	SCG	4,000 /
Prometrin	Gesagard, Prohelan	SCG, CRO	7,000 /
<i>Insecticides</i>			
Karbaril	Karbaril	SCG	50,400 kg
Malation	Etiol-i	SCG	16,000 kg
Terbufos	Counter	Germany	5,000 kg
Diazinon	Basudin	SCG, CRO	1,500 kg
Dimetoat	Sistemin	SCG	7,000 /
Ometat	Folimat	SCG, CRO	2,000 /
Pirimifosmetil	Actelic	SCG, CRO	5,000 /
Azinfosmetil	Gusathion	SCG	3,800 kg
Endosulfan	Tiocid, Tiodan	SCG	7,500 /
Lindan	Lindan	SCG	2,400 /

For larger number of preparations that are available at the market official information cannot be obtained, where it could be concluded their import is not registered. It means it appeared at the market by other term or by illegal canals, for example following preparations: DNOC (Kreozan, Selinon, Zutizor, etc.), mercury acetate (Zorosan, Radosan, etc.). It should be emphasized that mentioned preparations are explicitly forbidden in developed countries.

Total annual import of pesticides in RS is 802,597 kg (I): herbicides 324,469 kg, insecticides 218,354 kg, fungicides 246,624 kg and other 13,150 kg.

Influence of BiH Agricultural Production on Environment (Ecology)

Agricultural production in BiH does not load environment because factors of pollution are relatively rarely present. Using measures by preventing import of chemicals forbidden in EU that enters BiH through Serbia and Croatia, or even by introduction of EU standards in this field, this issue could be solved. BiH is region very rich in autochthonous gene material that is important for conservation of biodiversity. Also, BiH has got several endemic plant species. In BiH region there are many plant species introduced in last 600 years that are spontaneously expanded and in that way they initiated appearance of new populations, which are adopted or in half-wild forms, and still not identified or examined. As addition to cited statements is information that near border between BiH and Serbia is found new specie that belongs to family *Brassicaceae* (Lakusic, 1997) that represents last plant specie discovered in Europe.

All of the factors cited above should be explored in strategy making process of BiH agricultural development, as well as the potential usage of GMO in order to achieve more intensive technological level and increase yield per surface unit.

Limitations for Development and Extension of New Technologies in BiH Agricultural Production

Despite all real limitations, war, socialism and transition - the main limitation factor for development of agricultural production in BiH is knowledge. Experts that should lead this production at level of local community as well as experts employed in agricultural extension services within different ministries (entities, cantons, etc.) are not educated enough to respond to all requirements; their employment had character of social and political engagement but not necessary expert capability (word diploma is avoided in purpose). Farmers do not possess adequate knowledge for production oriented market, firstly because it was not needed during period of socialism, and, in addition, a great number of farmers today are inexperienced returnee from cities where they have lost their employment and agricultural production presents work from necessity.

Organic Production Development

Organic agriculture in Bosnia and Herzegovina started in 2001 at two parallel projects. Today, in BiH there are around 800 ha under organic cultivation and approximately 15,000 ha territory where medicinal and aromatic plants and mushrooms have been collected. Around 30 operators are engaged in cultivation and around 10 in collection.

Following crops are cultivated:

- Medicinal and aromatic plants: mint, chamomile, basil, lavender, sage, immortelle, lemon balm, Echinacea, oregano and linen.
- Cereals: wheat, rye, barley, buckwheat
- Vegetable: cucumber, carrot, beet, potato, onion, cabbage
- Fruit: blackberry, raspberry, strawberry and forest fruits

Also, there is a farm dealing with bull fattening.

Operators engaged in collection are purchasing and processing wild growing medicinal and aromatic plants, non-wood forest products (fruits and mushrooms) and producing teas and essential oils.

Regarding processing industry, there is only one company that has obtained a certificate – Company “Vega fruit” from Gracanica, dealing with vegetable and forest fruits.

Production and processing of medicinal and aromatic plants, fruit (raspberry, blackberry, strawberry, plum, peach), vegetable (species resistant to larger number of diseases and pests), production of lamb meat and some specific products (honey, wild growing MAP⁵) have perspective in BiH and possibility to enter European market. It would be useless to try to enter EU market with meat, cheese, vine or grapevine production, because EU countries are in surplus in these products.

It is necessary to develop local market of organic products and to raise level of consciousness of local customers about organic products.

GMO in BiH Agriculture

GMO⁶, as a factor for raising level of productivity of agricultural production in BiH, are still not necessary. Load of environment with chemicals is low and we could say if there is any advantage in lagging behind in development of agriculture it would be low concentration of chemicals and its residues. Having in mind limited possibilities for development of organic agriculture in other EU countries, it seems logical that this region would be directed towards this form of agricultural production. If we take into consideration labor price and possibilities of rural development, it seems that organic production is realistic program of development. That is why raising GMO in this region should not be forced. The fact that around 30 % of arable land is not in usage in BiH additionally confirms justification in avoiding introduction of GMO into production. Therefore, extension of production at unused arable land, as well as increase of average yield with conventional production can cover demand in food and assure sustainability of production.

Apparently, it seems that several circumstances will play the key role in fast acceptance of GMO as main factor of agricultural development within this region. As an illustration of these circumstances, could be mentioned frequencies and increase of certain apple varieties. Therefore, in the apple sort list at entire BiH the most frequent, over 80%, is Aidared variety that achieves very low price 0,30 KM at market of developed countries. The main reason for farmers' orientation towards this variety is that it can stand well poor agro-technology (stands well inexperience). Sorts as Breburn, Gala, and different clones reach 2 – 3 times better price at the market but its growth needs an adequate agro-technology based on appropriate knowledge. This reason is good enough to determine farmers to grow varieties that

⁵ MAP – Medicinal and aromatic plants

⁶ GMO – Genetic modified organisms

do not seek knowledge despite the fact of low profit. Accordingly, expert fitness of producers as well as expert' knowledge that should provide support, having in mind farmer' tendency to change habits hardly, enters the way to GMO (those with inserted genes that compensate lack of knowledge). Bosnia and Herzegovina should not be exception in relation to EU position regarding induction of GMO into production.

Main Goals That Agriculture in BiH Should Accomplish

1. Productive and sustainable agricultural production competitive at the open market that can contribute in increase of national income,
2. To provide enough food that satisfies needs of customers with regard to safety and quality assurance,
3. To assure support of living standard of population that depends on agriculture, which are not in position to follow economic reforms by their own growth,
4. To support sustainable rural development,
5. To conserve environment from destroying influences and other effects of agricultural production,
6. To prepare agriculture in BiH for integration in EU,
7. To prepare local policy support and trade in accordance to WTO regulations.

Main Strategic Directions

If determination of Bosnia and Herzegovina in following period is to join EU then strategy of agricultural development should be placed in that manner to emphasize our comparative advantages in order to achieve reliable basis during negotiations for integration.

Based on condition analysis in the sector it is clear necessity to act in 2 directions:

- 1) To increase volume of agricultural production through yield increase (to expand productivity per surface unit) and introduction of unused arable land into production,
- 2) To reconstruct agricultural production in order to satisfy own needs for food and to realize our comparative advantages at the open market.

To increase volume of production to level of satisfaction of own needs for basic cultivars, whose production in EU is in surplus and high productivity.

To increase volume of production of those cultivars that represent our comparative advantage, competitive at the open market with perspective export possibilities (vegetable, fruits, medicinal and aromatic plants, etc.). Increasing volume of production of these cultivars has strategic significance, and based on it will be defined quota for those states that would join EU.

Reconstruction of agricultural production has a goal to increase production competitiveness at the open market. Very unfavorable structure with over 60 % of cereals at arable land and average lot size of 3 ha, leads agricultural production in BiH at very low productivity level. Favorable structure in agricultural production should be established by increase of vegetable production, fodder production and finally fruit growing production.

Project of support in Croatia, which is planning realization of 15.000 ha of new high-intensive orchards until 2007 could significantly reduce our developing possibilities in this field

of production (gross value of fruit growing production planned in Croatia at surface of 15.000 ha, with price 0,50 KM/kg amounts 375 million KM per year).