COUNTRY REPORT ON THE STATE OF PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE

BOSNIA AND HERZEGOVINA

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Note by FAO

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INTRODUCTION

Territory of current Bosnia and Herzegovina (BiH), was exposed to different civilization influences through history. During past times many 'foreign' germplasm was introduced to this area, same from east and west and at the same time this germplasm took its role into creation of domestic and autochthonous germplasm through spontaneous or planned hybridization or selection.

This territory is belonging to the circle of Mediterranean centre of origin or centre of diversity defined by Vavilovs' researches. Accordingly these areas could be considered as a gene-centre of certain species but considering the lack of systemic researches in earlier times, this territory is practically not mentioned in professional or scientific literature, nor local or international.

Activities and researches on PGRFA started during eighties of last century known as a project Gene Bank of Yugoslavia and this project was part of a Strategy for technological development of Yugoslavia. All relevant professional, academic and scientific institutions from BiH took part in these activities. This Yugoslavian project was covering next activities: inventorying, collecting, identification, multiplication, characterization and formation of Plant Gene Bank. Bosnia and Herzegovina as a part of former Yugoslavia was included in implementation of these activities but because of the war all attempts were stopped during the nineties. Until war (1992-1995), activities on inventory and collecting as well making of passport descriptors were implementing. Some of documents are saved by local researchers while most of the documents are destroyed during the last war.

Activates on PGRFA conservation and use are renewed in 2004 when project titled «South Eastern European Network on Plant Genetic Resources 2004-2014 SEEDNet» started. This project is financed by Swedish International Agency for Cooperation and Development - SIDA and will be supported until 2014.

Ministry of Foreign Affairs of BiH signed SEEDNet project in 2004 within agreements of Ministry of Agriculture, Forestry and Watermanagement of Republika Srpska and Ministry of Agriculture, Watermanagement and Forestry of Federation of Bosnia and Herzegovina. Agreements for the implementation of SEEDNet project were signed between Swedish Centre for Biodiversity (CBM), as an institution nominated by SIDA for the implementation of SEEDNet project and ministries responsible for agriculture of both BiHs' entities.

Bosnia and Herzegovina become an EC PGR member in 2008, last year of the VII phase. Signing of membership for VIII phase is in the process. Implementation of ECP GR activities are organized on the base od entity SEEDNet working groups.

According to the Dayton Peace Agreement signed in 1995, Bosnia and Herzegovina is comprised of two entities: Republika Srpska and Federation of Bosnia and Herzegovina. Republika Srpska is a parliamentary republic and Federation of Bosnia and Herzegovina is constituted from ten cantons. Two entities in the Bosnia and Herzegovina have all government, jurisdiction and responsibility which are not in exclusive jurisdiction in the institutions of Bosnia and Herzegovina. According to the Dayton Agreement of 1995, auspices on natural resources as well genetic resources are assigned to the entities.

FIGURE 1
Bosna and Herzegovina: Republika Srpska, Federation of Bosnia and Herzegovina.

Having in the mind previous fact, this report will be given separatelly for Republika Srpska (A) and Federation of Bosnia and Herzegovina (B).

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CHAPTER 1

THE STATE OF DIVERSITY

A. Republika Srpska

Republika Srpska has 25 053 km^2 of land surface. 52% is agricultural land (0,93 ha per inhabitant). Arable land is 908 521 ha. Most of arable land belongs to the Krajina region (390 947 ha) and the least to the Romanija region (38 457 ha).

Cereals, fodder crops, fruits and grapevines, vegetables, oily plants, medicinal and aromatic plants and oily plants represent important natural heritage of biological diversity in Republika Srpska. Their collection, conservation and sustainable use is present during many centuries on a way specific to the cultivation conditions and way of use. Mentioned species comprise to the survival of people, local market economy as well as to the cultural heritage, especially in the poor, rural communities.

Six crop specific working groups are established:

1. Group for cereals and maize,
2. Fodder crops,
3. Fruits and *Vitis*,
4. Vegetables,
5. Medicinal and aromatic plants,
6. Industrial plants.

Coordinators and members of these groups are experts within the specific fields. They, together with the local people and terrain co-workers are dealing with inventory, collection, multiplication and regeneration and partially on characterization and evaluation of PGRFA of Republika Srpska.

Cereals and maize

Old cultivars of cereals have been replaced with new cultivars with higher yields. Old cultivar is still grown but mainly in highlands. Some of them are grown because of specific flavoured bread production (integral bread) and some because of technical use (cover for roofs and production of saddle).

In this area almost extinct semi-wild, two-row wheat *Triticum spelta* has been found.

Certain number of old cultivars of wheat is conserved in Plant Gene Bank of Republika Srpska and some of them are under the multiplication at the Agricultural Institute of Republika Srpska.

Considering rye mostly local populations are grown. Local population can be found within local inhabitants that had not migrated and are mainly living in mountain regions.

Regarding barley and oat domestic cultivars and cultivars from neighbouring countries are mainly grown. Local population can be found within local inhabitants that had not migrated and are mainly living in mountain regions.

Triticum surfaces are increasing from year to year. Domestic cultivars are grown as well as cultivars from neighbouring countries.

Buckwheat is grown in mountain areas of Republika Srpska. It is used for traditional food, pharmaceutical industry and for bees' pastures

Since maize started to be grown in Republika Srpska many ecotypes with its specificities become (seed colour, protein content, crop shape etc.). As use of modern hybrids was increasing, many ecotypes were stopped to be cultivated especially in lowland areas. Few ecotypes still existing and are mainly grown in highlands, where hybrids can not be cultivated. Estimation on number of maize hybrids doesn't exist yet. Great numbers of ecotypes were collected before nineties and are supposed to be conserved in Maize Research Institute «Zemun Polje» in Belgrade.

In Republic of Srspka maize is first species according to the surface of cultivation. Within last three years it has been grown on 140 000 ha.

Fodder crops

Natural meadows and pastures are covering 622 655 ha and are representing important habitats for biological diversity, specially for fodder crops. Most of them are placed in mountainous region of Republika Srpska.

Potential for fodder crops production is only partly used.

At the same time in Republika Srpska there is no indicators state of selection, seed production, number of ecotypes of fodder crops.

According to the inventory expeditions realized up to the moment, it is clear that Republika Srpska is rich in fodder crops biodiversity: wild relatives, ecotypes and cultivars imported from abroad. Up to now, inventory is not finished, systematization, description, characterization, horology of fodder crops are not done and this is important to be done with the regard to the its conservation and sustainable use.

Fruits and *Vitis*

Chronicle of fruit cultivation before Slavs came to Balkan, is not well known (Adamič *et al*, 1963), but there are evidences proving that Slavs found culture of fruit cultivation on this area. First scripts about fruit cultivation on Bosnia and Herzegovina area date from period of Ottoman Empire (Vitolović, 1949), but first registers and statistics fruit growing were done from 1882 till 1896 during Austria-Hungary Empire (Bubić, 1977). Besides apple and pear, plum had huge importance. Prune was main export material of Bosnia and Herzegovina and Serbia during XVIII century. Bosnia and Herzegovina and Serbia were main dried prune suppliers of world market until Californian prune appeared. In that period great number of foreign cultivars from East and West were introduced and very often in different places same cultivars were given different names by local people. Also by spontaneous or planned hybridization and selection these cultivars were included into creation of new autochthonous cultivars. All before indicated facts contributed to that this region as well as all regions of Yugoslavia became very rich in fruit genetic resources.

Paunović and Mićić (1997) indicate results of earlier researches within the area of Yugoslavia and according to that there are 124 registered wild fruit species and their relatives. Although this region of Yugoslavia or newly created countries could be considered as a primary gene centre of some fruit species that is not mentioned in literature due to the lack of systematic researches in earlier period. Only term Balkans can be found in literature when genetic resources of fruits from this region are considered. In Vavilovs' research and his creation of chart for dispersion of some wild species and their relatives (1926) also only name Balkans is mentioned related to the Yugoslavia or newly created countries. At the same time, other countries from Balkan Peninsula like Bulgaria, Romania, Greece, and Hungary were investigated very detailed (Paunović, 1992). Paunović and Mićić (1997) indicate that the area of Bosnia and Herzegovina can be considered as a gene centre for wild fruit species and their relatives from great number of genera: *Malus*, *Pyrus, Chaenomeles, Sorbus, Crategus, Mespilus, Eriobotrya, Prunus, Amygdalus, Juglans, Corylus, Castanea, Cornus, Morus, Sambucus, Fragaria, Ribes, Rubus, Rosa, Ficus, Punica, Zizyphus,* and *Citrus*.

Within last decades of past century only very few researches on germplasm were done. Pear autochthonous cultivars were collected between 1976 and 1980 in great expedition on Balkans (Zwet *et al*, 1978). 225 accessions of pear were collected in Serbia, Kosovo and Metohija, Bosnia and Herzegovina, Macedonia and Montenegro. These pear collections are placed in Corvallis and Kearneysville (Paunović, 1992). Between 1983 and 1985 investigation, collection and conservation of *Prunus domestica* and *Prunus insititia* were done as well as detailed description of 64 accessions of *Prunus domestica* and *Prunus insititia* (Punović *et al*. 1985).

TABLE 1

Fruit accessions inventoried between 1989 - 1991 and re-inventoried during 2005

Accession name	Scientific name	Morphologic descriptors	MCPD	Collection form	Grafted in collection
Lipovača	*Malus* × *domestica* Borkh.	+	+		
Divljaka	*Malus* × *domestica* Borkh.	+	+		
Đulabija	*Malus* × *domestica* Borkh.	+	+		
Kiseljača	*Malus* × *domestica* Borkh.	+	+		
Prancija	*Malus* × *domestica* Borkh.	+	+		
Crvena stolovača	*Malus* × *domestica* Borkh.	+	+		
Zimnjača	*Malus* × *domestica* Borkh.	+	+		
Muškinja	*Malus* × *domestica* Borkh.	+	+		
Djedovača	*Malus* × *domestica* Borkh.	+	+		

Accession name	Scientific name	Morphologic descriptors	MCPD	Collection form	Grafted in collection
Prijedorska šarenika	*Malus* × *domestica* Borkh.	+	+	+	+
Krupna divljaka	*Malus* × *domestica* Borkh.	+	+		
Lisica	*Pyrus comminis* L.	+	+	+	+
Kruška	*Pyrus comminis* L.	+	+		
Ilinjača	*Pyrus comminis* L.	+	+		
Vašerka	*Pyrus comminis* L.	+	+		
Ćupeklija	*Pyrus comminis* L.	+	+	+	+
Mioljka	*Pyrus comminis* L.	+	+	+	+
Susakuša	*Pyrus comminis* L.	+	+	+	+
Čečavka	*Pyrus comminis* L.	+	+		
Litrenjača	*Pyrus comminis* L.	+	+	+	+
Lubeničarka	*Pyrus comminis* L.	+	+	+	+
Trnovača	*Pyrus comminis* L.	+	+		
Orah	*Juglans regia* L.	+	+		
Orah mekiš	*Juglans regia* L.	+	+		
Orah	*Juglans regia* L.	+	+		
Orah kasni	*Juglans regia* L.	+	+		
Kajsija	*Prunus armeniaca* L.	+	+		
Šentelija	*Prunus persica* L.	+	+		
Vinogradarska breskva	*Prunus persica* L.	+	+		
Cipov	*Prunus avium* L.	+	+		
Azijanka	*Prunus avium* L.	+	+		
Karaaršlama	*Prunus avium* L.	+	+		
Biljur	*Prunus avium* L.	+	+	+	+
Višnja	*Prunus cerasus* L.	+	+		
Domaća višnja	*Prunus cerasus* L.	+	+		
Turgulja	*Prunus domestica* L.	+	+		
Miškovačka rana	*Prunus domestica* L.	+	+		
Banjalučka bjelica	*Prunus domestica* L.	+	+		
Varaljka	*Prunus domestica* L.	+	+		
Vlainjača	*Prunus domestica* L.	+	+		
Kraljica Bosne	*Prunus domestica* L.	+	+		
Crna džanarika	*Prunus cerasifera* L.	+	+		
Džanarika	*Prunus cerasifera* L.	+	+		
Žuta džanarika	*Prunus cerasifera* L.	+	+		
Crvena džanarika	*Prunus cerasifera* L.	+	+		
Crvena džanarika	*Prunus cerasifera* L.	+	+		
Crvena džanarika	*Prunus cerasifera* L.	+	+		

TABLE 2

Inventory and collection of fruits during 2005 and 2006

Accession name	Scientific name	Morphologic descriptors	MCPD	Collection form	Grafted in collection
Kiseljak	*Malus* × *domestica* Borkh.		+	+	+
Prijedorska zelenika	*Malus* × *domestica* Borkh.		+	+	+
Plemka	*Malus* × *domestica* Borkh.		+	+	+
Pogačarka/Kolačara	*Malus* × *domestica* Borkh.		+	+	+
Crevenika	*Malus* × *domestica* Borkh.		+	+	+
Bobovec	*Malus* × *domestica* Borkh.		+	+	+
Crvenika	*Malus* × *domestica* Borkh.		+	+	+

Accession name	Scientific name	Morphologic descriptors	MCPD	Collection form	Grafted in collection
Pogačarka	*Malus* × *domestica* Borkh.		+	+	+
Pemka	*Malus* × *domestica* Borkh.		+	+	+
Kiseljak	*Malus* × *domestica* Borkh.		+	+	+
Kiseljača	*Malus* × *domestica* Borkh.		+	+	+
Sulibedrika	*Malus* × *domestica Borkh.*		+	+	+
Švapska	*Malus* × *domestica* Borkh.		+	+	+
Crveni car konstantin	*Malus* × *domestica* Borkh.		+	+	+
Zečija glava	*Malus* × *domestica* Borkh.		+	+	+
Misir senabija	*Malus* × *domestica* Borkh.		+	+	+
Ovčiji nos	*Malus* × *domestica* Borkh.		+	+	+
Kisela krupna	*Malus* × *domestica* Borkh.		+	+	+
Lugulja	*Malus* × *domestica* Borkh.		+	+	+
Elifalma	*Malus* × *domestica* Borkh.		+	+	+
Funtača	*Malus* × *domestica* Borkh.		+	+	+
Samoniklica	*Malus* × *domestica* Borkh.		+	+	+
Šarenika	*Malus* × *domestica* Borkh.		+	+	+
Petrovača bijela	*Malus* × *domestica* Borkh.		+	+	+
Petrovača crvena	*Malus* × *domestica* Borkh.		+	+	+
Prijedorska zelenika	*Malus* × *domestica* Borkh.		+	+	+
Ljepocvjetka	*Malus* × *domestica* Borkh.		+	+	+
Batulinka (saklara)	*Malus* × *domestica* Borkh.		+	+	+
Srebreničanka	*Malus* × *domestica* Borkh.		+	+	+
Habikuša	*Malus* × *domestica* Borkh.		+	+	+
Kanjiška	*Malus* × *domestica* Borkh.		+	+	+
Žuja	*Malus* × *domestica* Borkh.		+	+	+
Kanada kisela	*Malus* × *domestica* Borkh.		+	+	+
Bijeli karamut	*Pyrus communis* L.				
Karamut crni	*Pyrus communis* L.				
Gospojčinjača	*Pyrus communis* L.				
Batva	*Pyrus communis* L.		+	+	+
Karamut	*Pyrus communis* L.		+	+	+
Dugopalica bijela	*Pyrus communis* L.		+	+	+
Urumenka	*Pyrus communis* L.		+	+	+
Mednjica	*Pyrus communis* L.		+	+	+
Izmirka	*Pyrus communis* L.		+	+	+
Ranka	*Pyrus communis* L.		+	+	+
Jeribasma	*Pyrus communis* L.		+	+	+
Stambolka	*Pyrus communis* L.		+	+	+
Kanjuška	*Pyrus communis* L.		+	+	+
Takiša	*Pyrus communis* L.		+	+	+
Kantaruša	*Pyrus communis* L.		+	+	+
Useinbegovača	*Pyrus communis* L.		+	+	+
Avranška	*Pyrus communis* L.		+	+	+
Gospoinjača	*Pyrus communis* L.		+	+	+
Karamut bijeli	*Pyrus communis* L.		+	+	+
Karamut crni	*Pyrus communis* L.		+	+	+
Bijeli hrušt	*Prunus avium* L.		+	+	+

Vegetables

Regarding biological diversity of vegetables it is important to mention that there are numerous ecotypes in Republika Srpska regarding its different geographical and ecological conditions: lowlands, highlands, Mediterranean areas.

Vegetable species that originates from mediterranean genecentre (Vavilov, 1933) are: swiss chard, cabbage, celery, artichoke, leek, lettuce, onion, garlic, asparagus, parsley, parsnip, rhubarb, chicory, black root, spice.

Some old cultivars and populations in Republika Srpska are: a) pasulj kukuruzar, traditionally called «gra' kuruzar» (bean) is cultivated more than 100 years and is mainly grown together with maize, today it is mainly cultivated in mountainous regions and by traditional way of growing; b) raštan, raštika (cabbage) is typical for the region of Herzegovina where it is grown ever since, there are few varietals of this species c) bijeli luk (garlic) spring and winter type famous because of good storage d) trebinjski jabučar (onion) famous on high resistance to the diseases and good storage ability.

Medicinal and aromatic plants

Medicinal and aromatic plants are representing important natural heritage of biological diversity in Republika Srpska. Its collection and use are present during many centuries. These species comprise peoples' health, local market especially in poor societies. Uncontrolled collection of medicinal species in Republika Srpska areas, specially intensified after war, significantly ruins genetic equilibrium in populations and genotypes of certain species. Consequences are genetic erosion and extinction of some species of medicinal and aromatic group of plants. Therefore it is necessary to take action to prevent lose of these species and traditional knowledge that follows them. Main causes threats to extinction of species are: habitat destroying, over-exploitation, changes of land use, introduction of invasive species.

Modern way of production and processing of medicinal and aromatic plants is on its beginnings. Production has good chances to be successful same for domestic market and for export.

Industrial plants

Production of industrial plants in Republika Srpska is neglected for last few decades. Once important processing capacities are destroyed but new ones are not developed. Implications are that there is insufficient processing capacities, restricted choice of cultivars, low yields etc. In total cultivation, industrial plants (soybean, tobacco, oil seed rape and sunflower) are taking part of 2%, what is 8 000 ha.

Biggest part belongs to the soybean 63%; tobacco 18%; oil seed rape 11% and sunflower 3,7%.

Potato is mainly used as a vegetable, for farm use and as cattle feed but interes to grow this species as industrial plant is growing. Potato is cultivated on 10 000 to 15 000 ha. In Republika Srpska there are domestic cultivars, old cultivars, new cultivars from Europe and Serbia.

B. Federation of Bosnia and Herzegovina

Federation of Bosnia and Herzegovina has arround 26 110.5 km^2 of land surface. 43 % is agricultural land (0,51 ha per inhabitant). Arable land is arround 404 000 ha.

According to geographical location Federation of Bosnia and Herzegovina borders on two big climatic zone. On the north is influence of moderate continental climate from the Panonean lowlands, on the south influence of Mediterranean climate from Adriatic sea. According to mentioned above we recognized three basic climatic zone: region of moderate continental climate on the north (moderate climatic zone); region of mountain climate (mountain zone) and region of Mediterranean climate on the southwest (maritime zone). In dependence of above sea level we recognized a few transitional zones between three main, and in Central mountain zone we can talk on Alpean climate.

Federation of Bosnia and Herzegovina and Faculty of Agriculture and Food Science in Sarajevo as one of the partners in SEEDNet project of preservation and utilization of autochtonic plant genetic resources were in last couple of years seriously and intensevely involved in activities such as *ex situ* and *in situ* conservation of plant genetic resources for agriculture (PGRFA). Considering *ex situ* conservation activities during inventarisation we collected more than four hundred accessions with passport data fullfilled conditions.Number of accessions is varying due to the duplicates elimination processes. At this point these accessions are kept in our gene bank fridgerators in short term storage optimum conditions. Most of these accessions are involving working groups: Cereals and Maize (CAM) and, Vegetables (VEG), and there is certain number of accessions collected by Fodder crops (FOD) working group , and working group for Medicinal and aromatic plants (MAP).

Fruit crops and *vitis* working group

Inventory of fruit crop, plant genetic resources in the area Doboj-East. The following was found:

- **Collection orchard (plums – požegače)**
  Location: Mala Brijesnica
  Found: 22 different genotypes
- **On-farm collections (apple, pear, plum, cherry, walnut)**
  Location: Klokotnica,
  Found: apple: 10 different varieties,
  pear: 11 different varieties,
  plum: 5 different varieties,
  cherry: 2 different varieties.

The fruit trees are kept in good condition and present a good starting material for further research. Inventory of fruit crop, plant genetic resources in Unsko-Sanski Canton was preformed between 18.-19.06.2005.

The following was found:

- Wild populations of chestnut and walnut on two locations: 1. Cazin (micro-location: Pećigrad, Skokovi) and 2. Velika kladuša (micro-location: Todorovo, D. Lučka)

Recommendations

Further examination of these wild populations is necesssery in order to establish which genotypes are present.

CHAPTER 2

THE STATE OF *IN SITU* MANAGEMENT

A. Republika Srpska

On-farm conservation is becoming a practice. Since 2004 some farmers or local people are identified as holders of interesting genotypes that are supposed to be autochthonous or local landraces. This is mainly concerned for fruits and grapevine cultivars and vegetables. From the year 2008, Ministry of Agriculture, Forestry and Watermanagement Republic of Srspka is giving stimulus to the farmers identified as potential on farm managers. Ministry of Agriculture, Forestry and Water management is giving financial stimulus for development of agriculture and rural development. Among else, in 2008 year stimulus were planned for measures for conservation and sustainable use of PGRFA: maintenance of collections, database management, maintenance of clonal archives, quality control of seed and multiplication, seed preparation and on-farm conservation.

For these stimuli each legal or physical person could apply if they have agreement with the PGR Coordination Institution defined by Programme (Institute for Genetic Resources, University of Banjaluka). In the year 2008 it was for the first time that Ministry gave this kind of stimuli**.**

The protected areas are defined by the entity Nature Protection Law. There are only two national parks (established before 40 years) in Republika Srpska. There are in process more initiatives for defining of others protected area.

CHAPTER 3

THE STATE OF *EX SITU* MANAGEMENT

A. Republika Srpska

Plant genetic resources (PGR) activities in this region reached its highest point during 1987 when idea about project Gene Bank of Yugoslavia was developing (Penčić and Milošević, 1997). Before the war (1992 – 1995), inventory and collection were done to some extent as well as documentation and partial evaluation (Paunović, 1989., Penčić and Milošević, 1997).

In Republika Srpska PGR activities were renewed by the support of the South Eastern Developing Network on Plant Genetic Resources 2004 – 2014 project (SEEDNet) financed and coordinated by Sweden institutions:

- Swedish Centre for Biodiversity (CBM),
- Nordic Gene Bank (NGB),
- Swedish International Development Cooperation Agency (SIDA).

After signing of SEEDNet project, Ministry of Agriculture, Forestry and Watermanagement of Republika Srpska transferred responsibilities regarding implementation and reporting of the first phase of SEEDNet to the Faculty of Agriculture University of Banjaluka. Through the SEEDNet goals and activities Republika Srspka achieved many results. Project unit called Centre for the Diversity of Genetic Resources for Food and Agriculture is established during the first project phase (2004 - 2007). This centre is officale transformed in Institute for Genetic Resources of University of Banjaluka in January 2009. Plant Gene Bank of Republika Srpska (Gene Bank) as well as Laboratory for Biodiversity are parts of this Institute. Gene Bank and the Laboratory for Biodiversity are both established and equipped by the support of SEEDNet project and Government contribution for project.

Beside this it is important to mention that Botanical Garden is building up. This Botanical Garden building is co-financed by Municipality of Banjaluka and one part of it will be dedicated to maintenance of 'local' germplasm.

Institute and Botanical Garden are both placed in Campus facilties of University of Banjaluka.

During 2004 - 2007 period 384 accessions were collected and conserved in Gene Bank or field collections (clonally archives) (Table 3).

TABLE 3

PGRFA accessions in Gene Bank 2004 - 2007

Species	No. of accessions collected
Zea mays L.	18
Secale cereale L.	7
Avena sativa L.	15
Hordeum vulgare L.	48
Triticum aestivum L.	184
× *Triticosecale* Witmack ex A. Camus	27
Hypericum perforatum L.	3
Thymus vulgaris L.	2
Salvia officinalis L.	1
Juniperus communis L.	1
Gentiana lutea L.	1
Phleum pratense L.	2
Dactylis glomerata L.	1
Trifolium pratense L.	4

Species	No. of accessions collected
Lotus corniculatus L.	3
Nicotiana tabacum L.	3
Linum usitatissimum L.	1
Malus × *domestica* Borkh.	30
Pyrus communis L.	20
Prunus avium L.	13

Gene Bank is established and works within the University of Banjaluka, and is responsible for seed collections. Field collections for *ex situ* conservation are placed on Manjača; 20 km south from Banjaluka, on approximately 350 m above see level.

Gene bank is established in 2005 and it is responsible for the seed collection. Gene bank also recognizes field gene bank as well as botanical garden of agricultural and horticultural plants. Database for PGR activities is created and all accessions are registered by Multi Crop Passport Descriptors (MCPDs) and collecting forms.

It is also important to mention that numerous inventory missions were implemented during 2008 throughout Republika Srpska. After curators manage the data and materials inventoried and collected, seed collections in Plant Gene Bank of Republika Srpska will increase regarding total number of accessions and also field collections will increase.

Accessions in seed collections are stored at 4ºC and all seed testing and processing before it goes to the storage are done at the Laboratory for Biodiversity. Conservation for the regime on -20 ºC is in preparation and soon will be established as base collections.

Multiplication and regeneration are done at the Institute for Genetic Resources University of Banjaluka and partly this responsibility is shared with the Agricultural Institute of Republika Srpska; Advisory Service and Centre for Rural Development Banjaluka.

B. Federation of Bosnia and Herzegovina

Regeneration activities in 2007, have been preformed using the left over budget for this line from 2006. Several WG's have done extensive work in this area on their accessions. The cereal, maize and industrial crops WG's did most of their regeneration on a farm in a town of Kakanj, where they have reliable farmers which have in the past shown great interest and knowledge in dealing with autochthonous varieties. Among others, 17 wheat accessions, 3 barley accessions, 2 triticale and 2 rye accessions have been regenerated in Kakanj. Since the germination chamber and several fridges have become operational, the above mentioned WG's (plus the vegetable WG) have done a big job in testing the germination of large numbers of seed accessions being held in the Faculties collection, to mention some: 37 corn, 5 oat, 12, barley, 4 triticale, 4 rye, 7 buckwheat, 2 sorghum, 55 bean, 14 pumpkin, 1 cucumber, 1 parsley, 2 sunflower, 3 flax, 1 alfalfa and 1 pepper accession.

The regeneration and germination testing activities have been almost 100 % successful, and similar activities are planned with other accessions once the gene bank building becomes operational. Regeneration activities preformed by the Fruit and *vitis* group from SEEDNet national money have mainly consisted out of excursions to different *ex situ* and on-farm collections in Bosnia (fruits) and Herzegovina (*vitis*). During the vegetation, tissue samples have been taken and analyzed by the experts in the plant protection department in order to keep the collections healthy. The excursions have also had for a purpose to instruct the people maintaining the collection in the proper pomo-technical measures and to give expert advice if needed.

One activity that is especially worth mentioning is the organization of a workshop held in Srebrenik, Tuzla and Sarajevo on *in vitro* regeneration. The workshop was less of an educational character and more of an opportunity to have people, who will do this work in future, work with real gene bank accessions. The workshop was preformed with the help of experts from the plant nursery "Srebrenik" which have a great deal of experience in work with *in vitro* propagation (unfortunately only with flowers and for commercial purposes). The participants were the people which will actually work with *in vitro* regeneration, once the gene bank building becomes operational. Also, this workshop was very useful because the WG's received help from the experts from the plant nursery "Srebrenik in procurement of the in-vitro propagation equipment and received some usuful advices on how to organize these facilities within the gene bank building.

In late November 2008, reconstruction of the gene bank building has finally begun. NGO «Odraz» (http://www.odraz.hr/stranice/o_nama.html) supported financial rebuilting of FBiH Gene Bank. This NGO do not have any other role regarding PGR conservation nor seed storage.

The funding was in the first place provided by an NGO which found the idea of a gene building very interesting and has a lot of experience with reconstruction of buildings partially damaged during the war. The amount with which they contributed is c:a 75 000 euros, but they are also the ones in charge of monitoring the reconstruction according to a architectural project which the Faculty paid for 5 000 euros. The next big investor is the Federal Ministry of Agriculture, Aquaculture and Forestry which donated 25 000 euros for gene bank building reconstruction from its budget for conservation of autochthonous varieties. The Faculty of Agriculture in Sarajevo has given additional 30 000 euros at the end of the year for the reconstruction and more money is expected from this sources. Also, since several governmental institutions have showed an interest for the project more financial aid is expected from this source as well.

Different seed collections and documentation concerning them are being gathered intensively and placed within the care of the experts at the Faculty and will be placed in the storage when the building is complete.

Generally, within and around this building there will be good seed storage capacities, capacities for processing and regenerating of material (*in vitro* and in vivo), capacities for genetic identification and characterization of the accessions and also for documentation and data storage.

CHAPTER 4

THE STATE OF USE

A. Republika Srpska

Plant genetic resources of Republika Srpska are mainly used for production for farmers' individual needs. Autochthonous cultivars are hardly used for intensive production where modern cultivars or hybrids are used. This is mainly addressed to the cereals and maize, fruits and grapevine cultivars and vegetables.

Regarding fodder crops main areas are under pastures and meadows. Such terrains, especially in mountains regions are engaging local people traditionally to deal with cattle production. This can be practically considered as organic production of meat, but this production is followed with certain obstacles and disorganization. Insufficient production of fodder crops in pastures, degraded pastures on eroded land, long winters, poor communities and lack of education. Mentioned obstacles are reasons why nomadic cattle production still exists in some regions of Republika Srpska with all its negative consequences. This should be improved by adequate measures like: improving pastures with grasses and improvement of production technologies in general.

At the same time it is hard to speak about use of PGRFA as most of the material conserved since 2004 and even before is not evaluated nor characterized yet. Evaluation just started and from that aspect it is hard to speak about application of old cultivars and autochthonous materials in breeding programmes.

Regarding breeding programmes, Republic of Srspka still doesn't have organized system for these activities. Only institution in Republic of Srspka and even in Bosnia and Herzegovina, which practically is implementing some activities regarding hybridization and breeding, is Agricultural Institute of Republika Srpska placed in Banjaluka. According to some published papers and personal communication, researches on hybridization and breeding are done there and some autochthonous material is also included in those programmes. This is strictly regarded to the cereals.

From this point of view, when activities on conservation and sustainable use are just renewed in 2004, it is hard to speak on use of PGRFA. Nevertheless, evaluation started and this can be good starting point for breeding programmes to include Plant Gene Bank material into it. At the same time public awareness rising could increase sustainable use of some autochthonous cultivars to be recovered in production, especially if some interesting traits like flavour or improved storage conditions are going to be find out.

CHAPTER 5

THE STATE OF NATIONAL PROGRAMMES, TRAINING AND LEGISLATION

A. Republika Srpska

Since 2005 Government of the Republika Srpska is asigning the budget for PGRFA maintenance as a support to SEEDNet project and for establishing of Programme for Conservation of Plant Genetic Resources of Republika Srpska (Programme). Financial support is preserved as co-financing to the SEEDNet project. That means that PGR activities will be mainly financed from these two sources until 2014. After SEEDNet project is finalized, PGR activities will be supported from Entities budgets and other international funds.

Working groups have tasks to make annual action plan or projects in advance. In Republika Srpska: according to their budgets, WG are founded through the Coordinating institution defined by Programme.

Preparation of the Programme was adopted within the work plan for 2006 in National Assembly of Republika Srpska. Regarding the decision of the Minister of Agriculture of Republika Srpska (act no. 01-33-950-07) dated from 16-02-2007, a working group for the preparation of the Programme was established. This group prepared the document and the National Assembly of Republika Srpska took a decision to adopt the Programme (act no.01-936/08). This decision is officially announced in Official Gazette of Republika Srpska 59, XVII dated from 24-6-2008 and is officially in force.

The Programme contains 86 pages and numbers 9 sections: Preamble, Legal and Policy Framework, Present Status of Plant Genetic Resources in Republika Srpska, Programme for Conservation of Plant Genetic Resources of Republika Srpska according to crop groups, Education and Training, Public Awareness Raising and Promotion, Programme Organization and Implementation, Literature, Addresses and Contacts.

In Preamble part, present status and situation related to plant genetic resources are explained in general, as well as importance of plant genetic resources for sustainable food production and humankind wellbeing.

Legal and policy framework section is explaining international legal and policy framework with all relevant international conventions and agreements, and Agricultural policy of European Union, Nature protection policy in European Union and Research policy. All obligations which run from ratification and implementation of certain conventions (CBD, UPOV, TRIPS etc.), were defined. A necessity of passing of a National programme for plant genetic resources protection is emphasized. National programmes and regional networks are broadly taken into account as suitable platforms for certain international treaties such as GPA, ITPGRFA or adequate CBD goals implementation.

Also, this section explains existing legal framework in Republika Srpska, agricultural legislation and nature protection policy. Considering constitutional system of Republika Srpska and Bosnia and Herzegovina, and definitions in scope of CBD and ITPGRFA, the property over natural resources belongs to the entities and so should it be over plant genetic resources.

In the section 3 present situations of plant genetic resources in Republika Srpska is described. The overview of present situation is given according to following crop groups: fruit and *Vitis*, industrial plants, medicinal and aromatic plants, fodder crops, vegetable, maize and cereals. Agricultural area by categories of land use in Republika Srpska is described and average area and production of field crops are given.

In the section 4 Programme for protection of plant genetic resources in Republika Srpska is given according to crop groups mentioned above. Short- term and long- term goals, ways of protection and recommendations are defined for each crop group. Potential opportunities and needed steps for *in situ*, *ex situ* and on-farm conservation are defined according to crop groups.

The section 5 deals with education and trainings. Overview of current situation in education and trainings in area of agriculture and plant genetic resources has been made. Deficiency of trained staff in area of plant genetic resources and agriculture is obvious. Programmes which combine technical trainings with trainings in different areas, including management, policy and legislation for plant genetic resources, do not exist at all. Thus, this section defines short-

and long - term goals for improvement of education and trainings. The goals are defined throughout strategy, terms of reference, research, coordination and needed measures. Institutions which are supposed to work at education and training in this field are denominated (Faculties, Institutes, Ministries...)

In the Public awareness raising and promotion section, overview of present situation has been made and goals, strategies, terms of references, coordination and needed measures for improvement of this field have been defined. Also, institutions which are supposed to work on public awareness raising and importance of plant genetic resources promotion are defined. These institutions have to orient their activities on international and regional collaboration.

Organization and implementation of plant genetic resources protection are described in section 7. The main goals are coordination among all stakeholders in adopted programme, inventory of plant genetic resources, collection, storage, description, evaluation of collected material, passing of a legal framework, information system developing, and material exchange with partners etc. Establishing of a Committee for plant genetic resources and passing of a complete legislation for: management, protection, access to genetic resources, traditional knowledge protection, sharing of a benefit raised from genetic resources and traditional knowledge utilization, are accented as a priority in this section. BGR Committee is asigned by Minister of Agriculture, Forestry and Watermanagement Republika Srpska and this Committee have 11 members. SEEDNet Project nominate 8 members, experts-researchers working in the area of plant genetic resources and selection and breeding; one member is representative of Ministry of Agriculture, Forestry and Water management Republika Srpska; one member is representative of Ministry of science and technology Republika Srpska and one member is representative of producers engaged in on-farm conservation.

BGR Committee has advisory role in propositions of law regulations related to the PGR. Committee will propose Action Plan for implementation of Programme measures (three-year action).

A list of educational, scientific and professional institutions, enterprises, organizations and communities important for plant genetic resources in Republika Srpska is given in this part.

In the last sections of Programme are numbered list of references used in Programme making and indexes of abbreviations.

Two annexes are also placed in Programme. In annex 1 are given scheduled overview of agricultural area by categories of land use in Republika Srpska, of average area and production of field crops in Republika Srpska for period 2000 - 2006 and mandate and priority lists according to certain crop groups. In annex 2 scheduled descriptions is given for plan of activities in 3 phases and defined institutions for each activity.

Institute for Genetic Resources University of Banjaluka is a Programme implementation body.

There are only Programme Summary translated to the English, at the moment being. The Programe in whole is in process of translation.

Beside programme there are other issues related to the legal framework on PGR: Strategy on Development of Agriculture in Republika Srpska until 2015 where importance of development of sustainable agriculture is announce and one measure of sustainable agriculture is conservation of old cultivars and traditional knowledge; Agricultural Law of Republika Srpska where among else is regulated: rational use and conservation of natural resources, environment protection and improvement of integral and organic agriculture etc.

By adoption of the Programme, as a central document regarding PGRFA issues, it is assured a legal framework for further continuous flow of all activities on conservation and sustainable use of plant genetic resources: inventory and collecting, multiplication, regeneration, *ex situ* and *on situ* conservation, documentation and information systems, public awareness raising and evaluation.

There are other laws, important for some parts of plant genetic resources: Seeds and Planting Materials Law and Plant Healty Protection Law.

B. Federation of BiH Plant Genetic Resources for Food and Agriculture

There is no PGR Programme adopted on FBiH level, yet.

CHAPTER 6

ACCESS AND BENEFIT SHARING AND FARMERS' RIGHTS

In last 10 years BiH only signed the Convention on Biological Diversity on 26.08.2002. but it has not been ratified yet.

BiH has not signed yet the ITPGRFA.

Gene Banks are established in both entities: FBiH and RS. Gene Banks has authorities on territory. Both gene banks will collaborate nationally and internationally. Both Gene Banks will closely collaborate through the BiH working groups that will be consisted of entities experts.

Regarding the state legislation it is important to stress that on BiH level there are 'common' frame laws that are regulating common principles and foreign collaboration while same laws on entities levels are regulating more details on issues.

Commercial agricultural production, aquisition of seed and testing of the suitability of imported cultivars for local conditions are regulated by BiH law on Seeds and planting material of agricultural plants, by Law on protection of novel cultivars of Bosnia and Herzegovina as well as by entity laws. There is the obligatory testing of new or introduced cultivars (two or three years) and obligation for putting on Cultivars list, before planting. These are frame laws, and there are entity lows as real implementing laws in both entities.

Neither of entities restricted access to PGR, regarding the issue of access and benefit sharing. According to that there is plan to develop good system for material transfer regarding agreements, as well as seed and plant material quantity and quality.

Regarding the fair and equitable sharing of the benefits of the use of plant genetic resources, it is hard to speak about this topic in BiH same as in the both entities. Main reason for this is lack of any use of available genetic resources at the moment.

It can only be mentioned that in BiH only Agricultural Institute of Republika Srpska is doing certain selection and breeding programmes that will possibly release some new cultivars convenient for local growing.