



**YUGOSLAVIA:**  
**COUNTRY REPORT**  
**TO THE FAO INTERNATIONAL**  
**TECHNICAL CONFERENCE**  
**ON PLANT GENETIC RESOURCES**  
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## CHAPTER 1

# Introduction to the Federal Republic of Yugoslavia and its Agricultural Sector

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The Federal Republic of Yugoslavia (FRY) consists of the Republic of Serbia and the Republic of Monte Negro. It is situated in South Europe, in the center of the Balkan Peninsula.

The greatest part of Yugoslavia lies between 41.52 and 46.11 degrees north latitude and between 18.26 and 23.01 degrees east longitude.

Its land borders the Adriatic Sea (293 km) in the south-west. Along its east, south and west borders there are high mountains over 2,500 m above sea level, and the terrain lowers in the direction of south-east towards the Pannonian Plain, in which the Autonomous Province of Vojvodina occupies the southern part. Large rivers converge and flow through the Pannonian Plain: the Danube, Sava, Drina, Morava and Tisza.

From the physiographic aspect, FRY can be classified into four regions:

1. Lowland, elevation up to 200 m above sea-level, which amounts to 30% of the total land surface area. In this region, the dominant products are: cereals, industrial plants, production of beef and pork, milk, together with the significantly developed industrial processing of agricultural crops. A great number of former socially-owned estates are in this region.
2. Lowland - hilly, elevation from 200 to 500 m above sea-level, which makes circa 10% of the total land surface area. In this part, small farmers' households are dominant, with various production: field crop, animal husbandry, fruit, and grape-growing production.
3. Hilly, elevation from 500 to 1000 m above sea-level, which makes circa 35% of the total land surface area, with different production with dominant spring grain crop, potato, cattle, sheep. Meadows, pastures and forests occupy the significant part.
4. Hilly - mountainous, elevation exceeding 1,000 m above sea-level up to 2,748 m, which makes circa 20% of the total surface area, predominantly pastures and forests. This is a livestock raising region - sheep, cattle, and the region of potato growing.



The climate in Yugoslavia is predominantly temperate continental, characterized by cold winters and warm summers, annual precipitation 550 - 700 mm, with rainfall deficit in July, August and September.

The effect of Mediterranean climate (temperature) is insignificant, except along the rivers Bojana, Zeta, and Moraca. In addition to temperate continental climate, there is mountain or sub-mountain climate.

Mediterranean climate is characterized by mild winters and very hot summers. Mean annual temperature ranges between 3.7 and 16.5 degrees Celsius.

In addition to high temperatures, the climate in Yugoslavia is characterized by a great number of sunny days.

Natural features, diverse relief and climatic diversity result in great wealth of plant species (including many endemic plants). They are good prerequisites for agricultural production, but still very insufficiently utilized.

The Federal Republic of Yugoslavia occupies the surface area of 102,173 m<sup>2</sup>.

Agriculture is a very significant branch of economy and its share in gross national product is 19%. Agricultural land amounts to 6,245,000 ha of which agricultural soil is 77.9%, plough-fields and gardens 59.7%, orchards 4.3%, vineyards 1.4%, meadows 12.6%, pastures 21.4%, and pools, reeds, fishponds 0.6%.

Of the total 3,721,000 ha arable land, cereals are 66.6%, industrial crops 13.5%, vegetables 12.5%, fodder crop 20.0%, nurseries 0.05% and fallow land and uncultivated ploughland 3.9%

Maize is the most widespread crop in the country, as it is sown over 1,399,000 ha; Wheat is sown over 896,000 ha; alfalfa: 204,000 ha; sunflower: 202,000 ha; clover: 116,000 ha; potato: 109,000 ha; barley: 105,000 ha; oat: 71,000 ha; soybean: 56,000 ha; sugar beet: 52,000 ha; onion: 35,000 ha; peppers: 27,000 ha; bean: 23,000 ha; cabbage and kale: 23,000 ha; silage maize: 21,000 ha; tobacco: 12,000 ha, etc.

Fruit growing and grape growing are also significant branches of agriculture. In Yugoslavia there are 16,519,000 apple trees, 8,301,000 pears, 52,808,000 plums, 10,513,000 sour cherries, 2,470,000 cherries, 1,340,000 quinces, 4,696,000 peaches, 2,116,000 walnuts, 1,880,000 apricots, 257,000 fig trees, 265,000 citrus fruit trees, and 441,000 olive trees. Grape vine grows on 89,000 ha.



In Yugoslavia, forests cover 2,858,000 ha (33% of the territory). Of the total 2,858,000 ha - 1,517,000 ha or 53% is public sector and 1,341,000 ha or 47% is private sector.

Over-felling, as well as the specific unfavourable aspects of the environment (air pollution, acid rain, traffic, industrialization) resulted in accelerated forest degradation. Consequently, measures have been taken for the more balanced forest exploitation.

In 1991, the population in Yugoslavia was 10,394,026 inhabitants, of which 5,157,120 male and 5,236,906 female. In 2,870,676 households there were 3.62 persons per household. Average age distribution was 35.5 years, average life span 71.4 years. Nowadays, 420,000 refugees from Croatia and Bosnia and Herzegovina live on the territory of Yugoslavia.

There are 361,452<sup>1</sup> workers temporarily employed abroad, mostly in the FR Germany - 75,376, Austria - 67,916, Switzerland - 42,539, USA - 19,173, etc.

About 56% of the total population in the FR Yugoslavia lives in the country, and farming population is 16%. Because of inadequate agricultural policy in the past fifty years, intense depopulation goes on in rural areas, and towns become overpopulated resulting in many town-planning and social problems.

Education for agricultural professions is carried out in Yugoslavia in four agricultural faculties with 10,524 students, two advanced agricultural schools with 1,386 students, and in 56 secondary agricultural schools with 317 classes.

The main part of agricultural production is realised in private estates, as state-owned enterprises are 17% of the total agricultural surface area, farming co-operatives 2.7% and private estates 74.3%. Almost all the capacities of the highly developed industrial processing of agricultural products is in the public sector. The process of manufacture is highly mechanized.

Privately-owned farms are characterized by small holdings (40% are up to 2 ha and only 20% farms are larger than 5 ha). Average size of plots is 0.2 to 0.9 ha. The organization and distribution of seed in Yugoslavia is well organized. Seed for all arable crops is produced on state farms and in scientific research institutions.

Fifteen scientific institutions and 35 firms with 250 employed professional and scientific workers deal with nursery production.

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<sup>1</sup> With members of family.



Foreign companies have a marginal role in seed production for the main arable crops in Yugoslavia (wheat, maize, sunflower, sugar beet, soybean). The assortment of arable crops is almost 100% of domestic provenance.

All the state farms and about 85% private farms use certified seed and nursery stock for their crops. The exception are less significant vegetable crops and fruit species.

Yugoslavia realises a sufficient plant production for its needs. The production of wheat, maize, sugar beet, oil yielding plants, fruit and grape exceeds home demand and it is exported.

Plant production, as well as total agriculture, in Yugoslavia goes through a difficult period. The stagnation and the decline of yield is evident.

The disintegration of the former Yugoslavia, civil war, United Nations sanctions, the transition of the political and social system, as well as several drought seasons, exerted very adverse effects on all the factors of plant production.

The investments have practically stopped, the prices are depressed, import of the components for mineral fertilisers, plant protective agents and herbicides has also stopped, import of new equipment and new technologies has stopped, the process of ageing of rural population continues, the reduction of farms continues, the export of seed and other agricultural products has been made very difficult and many times more expensive, the positive effect of the market (competition) on plant production has been reduced.

The tendency to return to traditional technologies is evident (use of uncertified seed and reduction of fertilizer quantities), as the consequence of economic difficulties and as a result of the actions for the introduction of ecological technologies and the production of biologically healthy food.

Scientific research workers have great difficulties in trying to maintain the former expansive trend in the field of plant production.



## CHAPTER 2

# Indigenous Plant Genetic Resources

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Yugoslavia is an exceptionally rich source of naturally occurring indigenous genetic resources. This is the consequence of the fact that its plant-geographical position is specific. In Yugoslavia, different phytogeographical zones converge. The greatest part of the territory is the Moesian phytogeographical Province. However, Vojvodina belongs to the Pannonian Province, and the south-west parts are under the influence of Scard-Pind and Adriatic Provinces. The climate is also diverse. Temperate-continental climate is prevalent (with the influence of continental climate from the North, i.e. the Pannonian Plain), but a great part of the country (hilly-mountainous regions) is under the influence of mountainous climate, while the south and south-west part is under the strong influence of sub-mediterranean climate. The relief is also diverse. All the above resulted in a wide spectrum of soil types. All these factors have the decisive influence on the remarkable biodiversity.

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### 2.1 FOREST GENETIC RESOURCES

The growing stock in Yugoslavia covers 2.85 million ha. The greater part is composed of high forests and plantations - 49%, coppice forests - 42.8%, thickets and scrubs 9%. Average volume per ha of forest cover is 107 m<sup>3</sup>, and current volume increment is 2.6 m<sup>3</sup>/ha. Of the total surface area under forest cover, pure broadleaf stands make 60.7%, and conifer stands 4.7%. Mixed stands of broadleaf's and conifers cover 33% of the area, mixed coniferous stands are 1.2%. The forests are composed of about 200 indigenous species of trees and shrubs (170 broadleaf species, and 35 coniferous species). The most represented species of broadleaf trees are beech and oak, and pine and spruce of coniferous species. Many endemic and endemo-relic species have their primary gene centers in the territory of Yugoslavia, i.e. conifer species (*Pinus peuce*, *Pinus heldreichii*, *Pinus nigra* ssp. *go-ensis*, *Picea omorika*, *Taxus baccata*) and broadleaf species (*Prunus laurocerasus*, *Acer heldreichii*, *Fraxinus pallisae*, *Forsythia europaea*, *Corylus colurna*).



Within forest genetic resources, numerous wild fruit species in forest ecosystems are especially significant. In natural forest communities there are 88 fruit species from the following 19 orders: *Castanea*-chestnut (1 species), *Cornus*-cornel-tree (2 species), *Corylus*-Hazel (2 species), *Cotoneaster*-cotoneaster (2 species), *Crataegus*-hawthorn (7 species), *Fragaria*-strawberry (3 species), *Hippophae*-sea-buckthorn (1 species), *Juglans*-walnut (1 species), *Juniperus*-juniper (4 species), *Malus*-apple (4 species), *Pirus*-pear (3 species), *Prunus*-sloe (8 species), *Ribes*-gooseberry (4 species), *Rosa*-rose (16 species), *Rubus*-bramble (12 species), *Sambucus*-elder (2 species), *Sorbus*-sorb (10 species), *Vaccinium*-bilberry (3 species), *Vitis*-vine (1 species).

Of 88 forest fruit species which grow in Yugoslavia, 12 species are endangered, i.e. they occur rarely or sporadically, sometimes only in one narrow site, with the tendency to reduce the range. They are:

- Castanea sativa* - chestnut
- Crataegus heldreichii* - hawthorn
- Hippophae rhamnoides* - sea-buckthorn
- Malus dasycphylla* - apple-tree
- Malus florentina* - apple-tree
- Prunus laurocerasus* - cherry-laurel var. *serbica*
- Ribes multiflorus* - gooseberry
- Rosa caesia* - rose
- Rosa glutinosa* - rose
- Rosa obtusifolia* - rose
- Rosa pomifera* - rose
- Sorbus umbellata* - sorb-tree

Excessive logging, retrogressive selection and poor choice of seeds had an adverse effect on the change of genetic resource composition in tree populations. Such a negative impact is still going on, so by the disappearance of above-average and average genotypes and by genetic resources impoverishment, the most valuable genetic material is endangered. Forests and woody plants are being increasingly utilized, and, in addition, the specific unfavourable environment agents (air pollution, acid rain, traffic, industrialization) increasingly influence forest decline. For these reasons, in FRY measures have been undertaken aiming at conservation and directed utilization of genetic wealth of forests and woody plants *in situ* and *ex situ*.



## 2.2 OTHER WILD SPECIES AND WILD RELATIVES OF CROP PLANTS

A number of crops cultivated as fodder have their relatives in indigenous natural meadow plant communities. Among them, the following are especially significant: *Alopecurus pratensis* (meadow foxtail), *Arrhenatherum elatius* (tall oat grass), *Dactylis glomerata* (rough cocksfoot), *Festuca pratensis* (fescue-grass), *Phleum pratense* (timothy grass), *Poa pratensis* (bird-grass), all from the family *Poaceae*, then *Lotus corniculatus* (birds trefoil), *Medicago sativa* (alfalfa), *Trifolium pratense* (red clover), *Trifolium repens* (white clover), *Vicia sativa* (common vetch) - from the family *Fabaceae*. All these species show a high degree of diversity (some of them have several infraspecific units) and they represent significant natural genetic resources.

In the natural forest, meadow and other plant communities there are numerous indigenous medicinal plants. The significant species of the first category of medicinal plants are: *Althea officinalis* (white mallow), *Atropa belladonna* (banewort), *Betula pendula* (birch), *Centaureum umbellatum* (common centaury), *Chelidonium majus* (celandine), *Crataegus monogyna* (hawthorn), *Hypericum perforatum* (hard-hay), *Juniperus communis* (common juniper), *Matricaria chamomilla* (common chamomile), *Primula veris* (cowslip), *Rosa canina* (common rose), *Urtica dioica* (great nettle), *Vaccinium myrtillus* (bilberry), *Valeriana officinalis* (valerian), *Veratrum album* (white hellebore).

Natural indigenous medicinal plants have so far been insufficiently used for selection purposes, which should be paid attention to in future.

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## 2.3 LANDRACES (FARMERS' VARIETIES) AND OLD LOCAL CULTIVARS

The dynamic development of plant production in the sixties brought about a very quick substitution of local and old varieties with newly-created and introduced cultivars of higher productivity. The changes of assortment of the economically most significant species of maize, wheat and sunflower were dramatic.

The Italian varieties of wheat repressed the local varieties very soon, first on state-owned estates and then on private holdings. There are no exact data on the choice of old varieties which are still in use. In any case, they are insignificant areas. If an old variety is still being sown, it is only in mountainous regions on private farms, only for specific purposes. It is estimated that the area under old varieties is less than 0.5% of sown area.



The situation with maize is also characteristic. Until the fifties, the entire programme of maize breeding was based mainly on the creation and improvement of varieties. The diverse climates, soils and habits conditioned the great genetic variability of maize in Yugoslavia. As it was, beside wheat, the main bread-crop cereal till the Second World War, it was sown at all elevations from the level of the sea to 800 m above sea level. Many farmers, due to spatial isolation and permanent use of the same seed, established their “own varieties”. In the fifties, hybrid maize was introduced to production. The first hybrids were imported from the USA. Simultaneously, the program of maize breeding by the method of inbred line hybridization started. An incomparably higher yield of interline hybrids and a very successful work of Yugoslav breeders brought about an exceptionally rapid substitution of landraces and old cultivars with hybrids. It is estimated that freely pollinated varieties are sown sporadically in village gardens, for the preparation of some traditional meals. Similar situation is with sunflower, as its commercial production is almost 100% based on hybrids.

In fruit farming, the situation is different. Newly-created Yugoslav and foreign varieties are predominantly grown. However, all the species have an abundant “local assortment”, especially in small holdings.

Economically less significant species have more numerous landraces.

In the national program for plant genetic resources landraces and old cultivars have the priority. Many species have been collected and the samples are under control. Fruit species are conserved *in situ* in their original place on the farms, but under professional control by specialists. The state is very serious, and urgent measures must be undertaken to move many samples into the *ex situ* status. The state of the genetic resources of medicinal plants is unsatisfactory, as the collections have not been made and this issue has not been classified as the priority plan, due to lack of finances.

The legislation on the protected zones and national parks also refers to rare species, but not to the genetic diversity, which will be the subject in the future law on the protection of biological diversity in Yugoslavia.



## CHAPTER 3

# National Conservation Activities

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If the activities of PGR are divided into two parts conservation and utilization it can be assumed that little attention was paid to the conservation of genetic resources in our country in the past. There are many reasons for the above.

The main reason is insufficient knowledge and underestimation not only of genetic resources of plants, but also of agriculture as a branch of economy.

Infrequent collection expeditions, generally promoted by bilateral cooperation with some foreign institutions, ensured both good investigation of the terrain and rich collections, which have been lost due to inadequate handling and maintenance. Good examples are the economically significant cultivated crops (maize, sunflower, plum). Many collections (durum wheat, spring barley, rye, leguminous plants, and medicinal plants) can be found abroad, because the duplicates in the country have not been preserved.

The utilization of genetic resources is much better. Based on domestic genetic sources, many high-yield, resistant, good quality crop plants have been created.

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### 3.1 *IN SITU* CONSERVATION

*In situ* conservation of genetic resources is objectively the most difficult form of conservation in our material and organizational conditions. The program “Establishment of plant genebank, as the Yugoslav federal institution” which began in 1987, foresees the *in situ* conservation of most fruit species. The coordinator for fruit species was the Agronomical Faculty of Cacak. The owners of conserved trees took care about the samples, and the data accession (vegetation description, characterization, and previous evaluation) was carried out by the coordinator’s associates. Nowadays, the *in situ* collection consists of 471 samples of apple, pear, plum, apricot, peach, cherry, sour cherry, walnut, hazel, and raspberry. In this way, mainly old, indigenous species are conserved.



The present laws of environment protection and the Law of Nature Conservation and action plans for carrying out the Convention on Biological Diversity regulate the protection of *in situ* endemic and endangered individuals and some wild relatives of cultivated species.

The *in situ* samples are the most vulnerable part of the genetic resources, because they are endangered by many factors. It is necessary that the program expands the protection to new species and regions, to move the samples urgently and to organize the conservation in *ex situ* conditions. This undertaking requires much responsibility, effort, and financial support.

Yugoslavia, in present financial difficulties, will not be able to carry out this urgent undertaking without the support from other countries.

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### 3.2 EX SITU COLLECTIONS

The *ex situ* conservation of genetic resources has a longer tradition, as plant breeding institutions made collections for their own purposes and conserved their working collections.

The organized in-country systematic exploration, collection, conservation and research of all the cultivated species lacked continuity, so the work in this field can be spoken of as a recent undertaking.

In 1989, the federal project "Establishment of plant genebank, as the Yugoslav federal institution" started. The project was financed by the federal budget.

The project was realised through two sub-projects:

1. "Development of plant genebank in Yugoslavia";
2. "Establishment of genetic resources for the needs of plant genebank in Yugoslavia".

The sub-project "Establishment of genetic resources for the needs of plant genebank in Yugoslavia" started in 1989 with the participation of 26 scientific research institutions of agriculture. The sub-project included the review of the state of live collections in scientific-research institutions, the survey of the state of collections which were, by the former bilateral contracts, ceded to scientific institutions and genebanks abroad, then the working out



of the national criteria for species priority, descriptors of all the cultivated species, and the beginning of the work on the priority species.

By the survey, it was determined that active collections of scientific-research institutions consist of 58 collections with 32,000 samples. They are mainly the cultivated plant species.

The samples were treated at different levels. The species which are economically most significant were subjected to the most complete study (maize, sunflower, wheat, grape vine and some fruit species). Generally speaking, the state of the collections was not good. Handling and utilization were inadequate. Many collections were not protected according to regulations, which resulted in the disappearance of entire collections.

A complete review of our collections in foreign banks and agricultural institutions does not exist. It is known that the collections of old varieties of wheat, pepper, tomato, water melon, and table fruit from Yugoslavia are in Beltsville (USA) and Vir (Russia). The collection of spring barley is in Gatesleben (Germany) and ICARDA - Syria. It is also known that in Yugoslavia the collections were made of alfalfa, spring oat, large-grained leguminous plants, onion, *Brassicae*, and many other medicinal and aromatic plants. These collections are in foreign genebanks, but we have no data. It is important to note that generally we have not received the evaluation of the collections from the foreign users of the collected species in Yugoslavia.

The criteria for the choice of species and intra-species genetic resources for the work in the first phase of the project were based on species hazard and the economic significance of the species. Intra-species, the priority list consists of indigenous varieties and old commercial cultivars. So the work started with 56 species of plants.

Descriptor lists were worked out for all plant species which were investigated. The basic descriptor lists were IBPGR. For the species without descriptors, the descriptor lists were used, or alternatively the own ones.

In the national collection in Yugoslavia (base collection) there are 6,005 samples of which: 3,793 in seed and 2,212 in vineyards and orchards. In active collections there are 32,000 samples.

*Ex situ* collections in the national collection represent the collections which are dealt with by plant breeding institutions. The greatest number of samples (80%) are old varieties and populations, and 19% are old commercial cultivars. Special genetic resources represent 1%.

For the national collection it can be generally reported that it does not reflect the state in natural ecosystems. The most represented species are the



economically most significant cultivated species (maize, wheat, sunflower, barley, grape, and some fruit species). However, from the aspect of genetic variability for our region, many species were not paid sufficient attention to (medicinal and aromatic plants, textile plants, some vegetable species, rye, and a series of wild relatives of the species).

The decision on the development of the National Plant Genebank was brought in 1988. The construction of plant genebank started in 1990. Unfortunately, due to the disintegration of Yugoslavia and enormous financial difficulties, it has not been completed. The entire project was financed by the federal budget. The aim of the formation of national plant genebank was to ensure equal treatment, conservation and utilization to all the genetic resources in Yugoslavia, as well as to ensure the adequate national policy in this field, which was completely neglected for a long time.

The national collection is still small and insufficiently processed, so it cannot be concluded that it is a true representation of the species “in nature”. It is first of all the representative collection managed by plant breeding institutions in Yugoslavia. Consequently, its utilization for the time being is negligibly small. The breeders and plant breeding institutions make use of their active collections and the material from the exchange with foreign countries.

Foreign exchange develops between plant breeding institutions on the bilateral basis. However, the most frequent form of exchange is the personal exchange of selected material by two breeders accompanied by the consent and control of federal organs relevant for this field. Such an exchange lacks centralized record keeping and control.

Owing to the shortage of financial means, the activities on the national project for plant genetic resources in the past three years have been very much reduced. There have been neither collection missions, nor the characterization and evaluation of samples. The entire program has been reduced to the endeavour to preserve the previously collected stock.

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### 3.3 STORAGE FACILITIES

There are no conditions for the long-term storage facilities. Such conditions have been designed by the future genebank. For long-term storage of samples (-20°C), two chambers have been designed (60 m<sup>2</sup> + 30 m<sup>2</sup>) with adjustable shelves. The room of 30m<sup>2</sup> has been designed for the storage of base collections within the FAO International Undertaking for Plant Genetic



Resources. The samples are to be stored in liquid nitrogen (100,000 samples). For the medium-term storage of samples ( $4^{\circ}\text{C}$ ) the designed space is  $140\text{ m}^2$ , with fixed shelves. The bank has been designed for more than 100,000 samples of base collection in seeds.

The samples are stored in chambers at  $+4^{\circ}\text{C}$  with the controlled relative air humidity only at the Maize Research Institute at Zemun Polje and at the Institute of Arable Farming and Vegetable Farming in Novi Sad. There is also a chamber at the Center for Vegetable Farming at Smederevska Palanka. In the Center for Potato at Guca, two chambers are being constructed, with the controlled temperature of up to  $+4^{\circ}\text{C}$  and  $-20^{\circ}\text{C}$  and controlled relative air humidity.

Many breeding institutes keep their samples on the shelves at room temperature, without any control of relative air humidity. These collections are not investigated according to internationally recognized rules, or the prescribed procedures for handling. There are such cases where, owing to incorrect reproduction and handling, the collections were lost.

In order to improve the conditions in active and working collections in the plant breeding institutions, it is necessary to construct the chambers with controlled conditions, as well as to train the staff who can handle the collections from the moment of collection till the reproduction.

For the reasons of safety, the samples of the national collection are kept in the active collections of the specialized plant breeding institutions. The collections of grape vine are conserved *ex situ* at Sremski Karlovci (continental climate), the duplicate is in Podgorica (Mediterranean climate), and the reserve is at Radmilovac near Belgrade. Indigenous genotypes of different species of fruit, in addition to *in situ*, are kept in *ex situ* collections. Collections of native varieties and populations of maize from Yugoslavia are kept in the genebank in the USA and in genebank in Russia. Yugoslav collections of indigenous varieties of wheat are in the genebanks in USA, Russia, and Italy. As a national institution at the level of FRY does not exist, the communication with the organizations which keep our collections has not been established, so the state of the collections is not known.

Botanical gardens and arboreta have not been included in the project of the Bank of Plant Genetic Resources in Yugoslavia as, according to the criteria of priority, the work started first with the cultivated species. The botanical gardens mainly work at the level of species and are more actively involved in the conservation of biological diversity. In order to be included in the programs of conservation of genetic resources, it is necessary to train the personnel and to provide financial support. The state policy of biodiversity and



genetic resources conservation should refer to all the factors, including the botanical gardens. Yugoslavia is the signatory to the International Convention on Biological Diversity, but there are still no practical, operative programmes in this field.

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### 3.4 DOCUMENTATION

Since the very beginning of the realisation of the project “Establishment of plant genebank, as the Yugoslav federal institution” in 1989, the introduction of informatics and documentation on genetic resources has started.

The training of the personnel and the necessary experience of the personnel for the work on documentation of plant genetic resources was realised in the cooperation within ECP/GR at the beginning of 1980, and in cooperation of the Maize Research Institute, as the coordinator, and Nordic Genebank. The computerized system for documentation NOBIS was soon qualified for quick and efficient use of IBPGR descriptor lists and for the definition of data base for all plant species and the priorities. Since September 1991, 64 data bases of the national collection have been defined and the data for 4,958 genotypes have been entered, i.e.: passport data, characterization and previous evaluation. The data in 64 databases were updated in 1992 and the data were transferred to the central data base.

The Maize Research Institute which keeps the samples of seed and deals with documentation jobs for the needs of Plant Genebank in Yugoslavia made available an IBM compatible PC 486/33 mhz with 16 MB RAM and 540/MB HDD, 5.25” and 3.5” FDD, operated by DOS 6.20, which serves as the platform for the central data base for NOBIS version 2.0 of the software system for the documentation of plant genetic resources. 60 data bases of 58 plant species are operating.

All the information, including the agronomic evaluation, obtained from the curators of active collections, has been entered in the data base.

The information system of the Plant Genebank in Yugoslavia makes the information available both on the magnetic medium and as computer print-out.



Information system of the Plant Genebank in Yugoslavia has not yet been connected with other banks for the exchange of data on the regional basis or on crop basis, but this has been planned when the Yugoslav Genebank becomes operational.

All the documentation records are duplicated, they are kept in different places, and they are updated as required, at least once a month.

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### 3.5 EVALUATION AND CHARACTERIZATION

The characterization and evaluation are performed by IBPGR/IPGRI descriptor lists. The descriptor lists are sometimes updated by the data recommended by expert breeders.

As the plant genebank has not been staffed as yet, all the jobs of characterization and evaluation are carried out by the institutions which handled the collections from the national project.

The concept of future organization of plant genebank in Yugoslavia recommends that evaluation is carried out by plant breeding institutions specialized for particular plant species. The species for which there are no specialized institutions will be evaluated by the Plant Genebank of Yugoslavia. Social changes (ownership, market economy, democratization, and modified role of state in science and economy) are going to cause changes in the concept of organization of the activities of Plant Genebank in Yugoslavia. When the scope of evaluation increases, wider cooperation with foreign genebanks, institutions and international organizations will be necessary. Bilateral and multilateral arrangements are welcome.

The highest value of the conservation of genetic resources is the knowledge of the real value of the material which is stored, which is achieved by the characterization and evaluation.



### 3.6 REGENERATION

The regeneration of seed samples is going to take place in the Yugoslav genebank which will occupy 30 ha of its own land in the vicinity. In addition to regeneration, the multiplication of primary samples will also take place in the Plant Genebank in Yugoslavia.

In both processes, i.e. regeneration and reproduction of samples, will be carried out according to international procedures for each species.

As our national collection is fresh (the latest multiplication of samples was performed in 1991), there was no need for regeneration. Only the multiplication of small samples (less than 20 grams) of wheat, spring oat and barley was carried out. The seed is stored under the same number, but separate from “old” seed.

In order to conserve forest genetic resources *in situ*, in FRY there are 9 national parks, 10 regional parks, 50 reserves and 158 seed stands of major coniferous and deciduous species.

In addition to the production of seed stock, seed stands intend to conserve the genetic resources of trees and shrubs *in situ* as they contain plus and normal trees, i.e. the trees which constitute the average of the population. Seed stands have been registered in the Proposition of the Register of Forest Seed Sources in Yugoslavia, separately for coniferous and for broadleaf species.

The possibilities of singling out the natural reserves, and consequently the conservation of natural forest resources in them, are relatively limited. For this reason, in order to conserve the genetic resources of woody species in Yugoslavia *ex situ*, specialized sources and plantations have been established. They are:

- (a) arboreta and live archives;
  - (b) seed orchards;
  - (c) provenance tests;
  - (d) progeny tests, and
  - (e) clonal tests. Each of the above categories has a special function which is harmonized with the need to conserve the genetic resources.
- In FRY there are four arboreta and several live archives with individual specimens or smaller groups of representatives of more than 380 species of trees and shrubs.



- Experimental clonal and seedling seed orchards have been established over the area of 14.3 ha. Their number, representation of tree species and total surface area, are insufficient. Seedling seed orchards have been established of 50 half-sib families of Serbian spruce on the area of 2.7 ha, 40 families of Austrian pine on the area of 3 ha, 30 families of wild cherry on the area of 1.5 ha. In addition, there is one clonal seed orchard of pedunculate oak on the area of 5.1 ha with 45 clones, and one clonal seed orchard of spruce on the area of 2 ha with 50 clones. Seedling seed orchards will produce a more variable progeny than clonal seed orchards, consequently seedling seed orchards serve better to the purpose of genetic resources conservation.
- Provenance tests have been established for spruce only, in the aim to study the genetic variability of this species in the south-east margin of its range.
- Progeny tests are relatively few. They are mainly half-sib families of Austrian pine, Serbian spruce, Balkan maple and wild cherry.
- Clonal tests. There are several clonal tests of autochthonous poplars and willows, established on alluvium by the Poplar Research Institute in Novi Sad.



# CHAPTER 4

## In-Country Uses of Plant Genetic Resources

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### 4.1 USE OF PLANT GENETIC RESOURCES COLLECTIONS

National collection, with some minor exceptions, consists of the collections which belonged to plant breeding institutions in Yugoslavia. It was established in 1992, so it could not be the subject of large-scale exchange or utilization. However, as these samples were, and many of them still are, in the active collections of plant breeding institutions, they have been used for breeding purposes to a different extent.

As a number of collections of some species are stored in foreign institutions and genebanks outside Yugoslavia, we suppose that they have been used for breeding purposes. As our collections generally originate from hilly-mountainous regions and from sub-arid continental climate, they are distinguished by a marked genetic variability of resistance to stress conditions (high and low temperatures, drought, resistance to diseases). We do not know to which extent the samples of our collections were used abroad. Such information would be very useful in the aim to increase the use of genetic resources for plant breeding.

In the past, due to several reasons (lower level of knowledge, low international communication, low level of international scientific-technical cooperation), the indigenous material was much more used both for direct production and for breeding. The fifties were the turning point when Yugoslav international cooperation was suddenly widened and when national programmes of agricultural production were promoted.

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### 4.2 CROP IMPROVEMENT PROGRAMS AND SEED DISTRIBUTION

Crop improvement in Yugoslavia has been based on the improvement of genotype and improvement of cultivation technology. Plant breeding and seed production have a long tradition in Yugoslavia. In Yugoslavia, 13 scientific-research organizations deal with plant breeding. They are all public sector. Yugoslav plant breeders have created 1055 cultivars of different properties.



During the past five years 412 varieties have been certified:

<b>Crop</b>	<b>No. of varieties</b>
Wheat	126
Maize	115
Barley	22
Sunflower	5
Sugar beet	20
Soybean	26
Fodder	10
Vegetables	34
Fruit species	1
Grape vine	23

The capacity of the scientific program on the breeding of major species exceeds the in-country needs of Yugoslavia. Thanks to the adaptability of the created assortment, many plant varieties are cultivated abroad, in many countries with different climates.

Plant breeding was till mid-sixties mainly financed by national budget, and since that time the share of the state in the financing of plant selection has been reduced. Depending on the plant species, in this stage the state finances the breeding projects with 5-15%. The plant breeding institutions themselves provide another 85-95% by the principle of self-financing. The plant breeding institutions provide the means for the financing of the breeding projects by selling the nursery stock of their varieties and by selling their services to agricultural organizations.

The programmes of scientific research work and plant breeding in agricultural institutions is autonomous, as the greatest part of the funds are provided by the institutions themselves, in the market of their products.

The initial stages of intensive development of breeding is characterized by the tendency to increase the genotype fertility, in order to satisfy the demand for food. The source material for breeding are the indigenous varieties and introduced varieties. The new varieties are characterized by good adaptability to local natural conditions and technology. As the indigenous varieties have low genetic potential of yield, in the second stage of breeding, the introduced elite commercial varieties and inbred lines (maize) are used as parents in crossing. The assortment from this stage of development of breeding (cereals)



increases the yield, as it is more adapted to higher quantities of fertilizers and more intensive technology.

In the third stage of breeding development, the aim of breeding is the quality of the product and the resistance to diseases and pests. The starting breeding material in this stage is also mainly introduced, together with the utilization of exotic germplasm (maize). In this stage, the more serious work of the creation and development of the genetic resources for breeding (cultivars for different purposes).

In the selection of major species, in addition to yield as a permanent component, the current direction is quality, resistance to diseases and stress conditions, as well as the satisfaction of economic requirements for environment protection (reduction of quantities of fertilizers and substances for plant protection).

In all the above stages, plant breeders achieved high productivity, so the number and the quality of the varieties created in Yugoslavia meet the requirements of all the types of farms in the country and also in many countries of Europe, Asia, and Africa. The newly-developed varieties, after being certified, reach the producers very easily and quickly. Such a policy of the programme and financing the scientific work in plant breeding has an advantage that the authors of the new varieties are motivated by the market. However, from the standpoint of genetic resource management by the government, there is a disadvantage, as the interests of the government and the interests of plant breeding institutions do not always agree, and not in all plant species. The government should have the instruments (finances and stimulating policy) to activate the programs of plant breeding. For the time being, the interests of the government and the breeding institutes agree to a high extent, but after the current transformations, this might not always be the case.

The newly developed indigenous varieties, and the introduction of foreign varieties must be accepted by the relevant Federal Commission. After that, the creators of the varieties make production experiments in order to evaluate the varieties in different agroecological and production conditions. The farmers on whose farms the production experiments are established, participate in the stage of evaluation. After this testing, the sample plots with the new variety are demonstrated to the farmers, or they are informed in other ways. The owner of the variety starts the production of the seeds. The research of the variety to be certified lasts approximately for three years.

The organization of seed production in Yugoslavia is at a very high level and it has a long tradition. The example of major production of seed -maize (up to 100,000 tons per year) - is the best example. Each plant breeding institute belongs to an association for the production, processing and trade of seeds.



The association consists of a research institute (creator and owner of the variety), agricultural company (producer of commercial seed), an institute for seed processing and a trading company. Each one has its role in the association. The institutes create new varieties, they produce the basic seed. Further multiplication of basic seed until a definite category is controlled by the Republic organ for agriculture. Seed producers - big and well-organized public agricultural organizations - produce the seed. Seed processing organizations process and pack the seed and prepare it for the market. Foreign-trade organizations and home-trade organizations organize the trade in the country and abroad. Retail network is branched throughout the country, so the seed is available to all the users under the same conditions.

Seed quality control is carried out by authorized laboratories, by ISTA methods.

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### **4.3 USE OF FOREST GENETIC RESOURCES**

The distribution and testing of forest seeds is performed according to the demands and ordered quantities by state of private users. At present there is no unique in-country programme for the production and distribution of forest seed.

The present turnover of seed of forest trees and shrubs is performed by the Center for Forest Seed at Kremna, which in addition to its capacities for the processing of cones and fruits, has a seed laboratory for the evaluation of seed quality according to ISTA methods, as well as the refrigerator for cold storing and conservation of seeds. The Center has been adjusted for the production of coniferous species, and they plan to establish the facilities for storing the seeds and fruits of broadleaf tree and shrub species.

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### **4.4 BENEFITS DERIVED FROM THE USE OF PLANT GENETIC RESOURCES**

Benefits derived from the use of indigenous plant genetic resources are direct and indirect. The direct benefit is derived through the use of land races in the production when there were no other sources, and through their use in the process of breeding. Indirect benefit is achieved by the exchange of this



genetic resource with foreign institutions, from which the improved stocks are received in return, and subsequently included in plant breeding programmes. All the exchange of plant breeding stock has been carried out through the cooperation between institutions, as the national genebank does not exist as yet, and national collection is of recent date.

Non-indigenous materials are mainly commercial varieties and public inbred lines. Foreign partners provided the material in exchange for the stocks from our institutions. In this way, the benefit is mutual.

The greatest benefit from the conservation of plant genetic resources collections was the creation of new commercial varieties which are better adapted to our conditions. A very significant benefit was the exchange for the improved or elite stock which was used for the creation of more productive varieties. The varieties created by the combination of genotypes of different provenances are more plastic. This made it possible to export seed to many countries, which is also an indirect benefit.

The use of genetic resources is not adequate to their value. There are several reasons: national collection has not yet been completed, the evaluation of all the samples has not been done, the duplicates have not been determined, the existing documentation has not been completed and adequately presented, the direct computerized communication between national collection and plant breeding institutions does not exist, “commercial” selection dominates over “scientific” selection, so they endeavour to obtain a good new commercial genotype by the shortest possible way, i.e. by crossing the elite lines. Such an approach to plant breeding leads to increased genetic vulnerability, which, for some plants, has already become a matter of concern (maize). The work on the improvement of plant genetic resources is an expensive, difficult and long-term scientific-research work, which has not been adequately evaluated. In principle, it should be funded by the government, and the results should have the same status as the new varieties.

If national collection is to be better utilized, it should be completed, it is necessary to complete the documentation, it should be controlled by competent experts, and the conditions for correct storing should be provided. It is also necessary to have better cooperation with research institutions in order to make mutual programmes of evaluation and previous breeding. Government intervention by financing the scientific research projects of increased use of genetic resources would be valuable. There is not enough staff for the fundamental part of the work on the improvement of plant genetic



resources utilization (quantitative genetics, genetic engineering, tissue culture, molecular genetics, etc.) so international help would be welcome. The cooperation of groups ECP/GR could, for some cultures, engage also the breeders so as to begin a common programme on the use of collections (creation of common cultivars of maize etc.). This work would include a higher number of researchers which study the use of plant genetic resources.



## CHAPTER 5

# National Goals, Policies, Programmes and Legislation

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### 5.1 NATIONAL PROGRAMMES

The national programme for plant genetic resources was constructed in 1988 and its realisation began in 1989.

The entire programme is funded by the Federal Budget, based on the Law on the Funds for Scientific-Technological Development. The programme was designed by the experts of Federal Government, and the feasibility study was prepared by 10 institutes in Yugoslavia. The realisation of the programme was carried out through two sub-projects:

1. Establishment of plant genebank in Yugoslavia, and
2. Establishment of plant genetic resources for the need of plant genebank in Yugoslavia, which covered only the conservation and not the use of genetic resources.

The realisation of both sub-projects was within the competence of the Federal Ministry for Development, Science and Environment. The whole work on plant genetic resources within the competence of Federal Government was coordinated by Federal Commission for Plant Genetic Resources.

The sub-projects had their scientific or professional councils. The supervision of the realisation of sub-projects was performed by supervisory board formed by the Ministry.

The coordinators of the sub-project and contractors were selected by public competition. A construction firm was appointed as the general contractor for the Plant Genebank facilities, and the Institute of Arable Farming and Vegetable Farming in Novi Sad was in charge of the formation of gene pool for the needs of the bank. The programme did not have any particular budget, the funds were obtained based on the Law of the formation and utilization of funds for scientific and technological development. The funds varied depending on the quantities for technical-technological development planned by Federal Budget. This structure and method of realisation existed till 1992 when there were great changes in the organization of Federal State, as well as great material and financial difficulties.



However, the actual state has been essentially changed compared to the one described in the previous paragraph. The construction of the objects has practically been stopped; the genetic resources are merely maintained with great difficulties; Federal Commission for Plant Genetic Resources does not exist; the funds for scientific-technological development from which activities on plant genetic resources are financed, are ten times lower than necessary.

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## 5.2 TRAINING

The reactivating of the national programme was planned in the designed scope, as this is the objective minimum of requirements for the conservation of genetic resources and for creating the conditions for their reasonable utilization.

In the first stage of work on the conservation of genetic resources of forest trees and shrubs *in situ* it is necessary to direct the activities to:

- single out new seed stands, as the present number and surface area are inadequate, when the genetic potential of the species and their significance is considered;
- in the present Proposition of the Register of Genetic Stands, the number of sources should be rationalized, according to the economic and scientific significance of the species;
- the genetic reclamation in the existing seed stands;
- in each of the existing and newly singled out seed stands, 200 plus trees should be selected, whose seed, pollen and scions should be used for the establishment of projects for testing and conservation of their potential *ex situ*.

For the conservation of genetic resources of forest species *ex situ* it is necessary to intensify the activities on:

- tests of provenance and progeny tests of the significant deciduous species, in order to conserve and test the genetic potential of the selected plus trees;
- establishment of seedling seed orchards of endangered species of the first and second priority;
- increase of the number and area of seedling seed orchards of major conifers and broadleaf's;



- establishing clonal tests of the species of the first and second priority of the genera *Populus* and *Salix*;
- establishment of the Yugoslav information system on forest genetic resources.

Within the Plant Genebank of Yugoslavia it is necessary to plan the department for the collection of seed of forest tree and shrub species and possibly the bank of pollen.

The quality realisation of the national programme of plant genetic resources in Yugoslavia is not adequately staffed with trained personnel for all the fields of work. Consequently, in the projects it was anticipated to train the personnel for the work in the Plant Genebank. For the first phase of personnel training the TCP project was signed with FAO, but owing to the war in ex-Yugoslavia, it was stopped. Generally, Yugoslavia has greater requirements for the conservation than for the utilization of genetic resources. In the field of the utilization of genetic resources (breeding, production and processing of seed, agro-engineering and plant protection) Yugoslavia is adequately staffed and it has sufficient experience, so the country can offer regional courses and other forms of training.

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### 5.3 NATIONAL LEGISLATION

Yugoslav national legislation governs many fields of plant production relevant for genetic resources, but the very activities on the conservation, exchange and utilization of genetic resources are not covered by corresponding regulations. That is why, for some activities, international standards and the positive experience of the developed countries have been used.

The collections are regulated by the standards IBPGR/IPGRI and by the FAO commission for plant genetic resources. The IBPGR/IPGRI descriptor lists are used for the characterization and evacuation. The entire informatics and documentation, the designed conditions for the conservation of samples in the genebank, multiplication and revitalization of samples, everything was regulated by IBPGR/IPGRI standards.

The law of certification of new varieties, introduction and production of foreign varieties and protection of agricultural and forest plants is rather harmonized with the UPOV procedures and standards, and it enables the realisation of breeders rights, and it does not stop the exchange of genetic resources for the needs of breeding and scientific work.



The Law on seeds and nursery stock regulates the production and turnover of seed and nursery stock. It enables the trade of both indigenous and introduced varieties, if they are certified and if their introduction is allowed. By this law, only certified seeds can be distributed. The regulation on the quality of seed and agricultural plants sets the standards of seed and nursery stock quality, as well as the procedure of quality assessment. This regulation accepts the procedure and the standards by ISTA.

ISTA methodology has also been applied in the evaluation of seed quality in the national collection of genetic resources. The law on the protection of plants from diseases and pests (Quarantine Law) has not, in the previous practice, affected the transfer of genetic resources, nor the delays in the passage of genetic resources materials endangered the samples, of course if breeding institutes fulfilled the necessary conditions (quarantine field and plant protection specialists).

Yugoslav Intellectual Property Rights Legislation enables the patents of biological facilities, but does not protect the plant variety. It does not have any direct or indirect impact on the activities concerning plant genetic resources.

Yugoslavia is a signatory country to the Convention on Biological Diversity. In this connection, the declaration on the protection of biological diversity has been adopted. Soon a law on the protection of biological diversity will be passed, so a part of the activities on the conservation of genetic resources will be covered by the law.

In addition to the above laws and regulations, it is obviously necessary to pass a more appropriate law on plant genetic resources and Plant Genebank as the federal institution.

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## 5.4 OTHER POLICIES

Economic policy of the country and development policy do not treat plant genetic resources in the adequate manner. Moreover, they are not evaluated as development factors. There are few specialists for plant genetic resources (especially for conservation), but even they do not take part in the making of development programmes of plant production. Consequently, the management of genetic resources in Yugoslavia has not been designed in such a way which ensures the maximum protection of genetic variability and the harmonized utilization of genetic resources.



## CHAPTER 6

# International Collaboration

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Yugoslav experience in international collaboration is great, both at bilateral and at multilateral levels, and it can be summarized in two premises:

- a. International collaboration is a prerequisite of for the survival and increased usability of national programmes, and
- b. Only a well developed national programme enables a useful international collaboration on the basis of equality.

Yugoslavia is a signatory country to the Convention on Biological Diversity. The measures undertaken for its realisation since 1992 are not adequate to the actual requirements of plant genetic resources. Federal government adopted the resolution on biological diversity in 1993 and adopted the measures for its realisation. Modest funds for its implementation were sufficient only for initial activities - a survey of species of global significance in the FRY territory, as well as the identification and classification of vulnerable ecosystems in Yugoslavia.

On the global international plan, the organizations, forums, and actions on plant genetic resources and similar activities, are becoming increasingly numerous. Therefore, there is a danger of their over-organization and collision.

The activities on plant genetic resources are carried out in two inseparable processes: conservation and harmonized utilization. If FAO Commission emphasizes the reasonable utilization and the Convention on Biological Diversity stresses the conservation of genetic resources, there will be a collision. Previous activity of FAO Commission shows that it is possible to find an adequate measure both for the conservation of genetic variability and for the conservation of species, and for the need of harmonized utilization both for breeding purposes and for direct utilization of genetic resources.

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### 6.1 FAO GLOBAL SYSTEM

Yugoslavia is a member of FAO Commission since its formation, although it officially signed the International Undertaking in 1988. The signing of



International Undertaking on Plant Genetic Resources and the membership in FAO Commission has had a positive impact on the national policy on genetic resources, which was in its initial stage. The FAO had a major role in the support to our initiative for the establishment of Plant Genebank in Yugoslavia. In 1990, Yugoslavia signed the TCP project with FAO for US\$ 100,000 for the training of personnel and expertise in the national programme of genetic resources. Unfortunately, this project has not been realised, because of the disintegration of SFRY and civil war which followed. We are of the opinion that the issues dealt with by the Commission are very significant. In the next period, we expect the greater concretization of the conclusions greater operativeness and greater practical assistance.

The formation of the “International Fund for Genetic Resources” would be welcome only if the activities to be supported by it are well selected. The priority criterion for getting the funds should be, in addition to the global support to conservation and utilization of genetic resources, also the quality of national programmes and policies. Yugoslavia could be a beneficiary and a donor to the “fund”, as in some fields (infrastructure and conservation of genetic resources) it shows a deficit, and in some fields (utilization - breeding and genetics) it has a surplus.

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## 6.2 INTERNATIONAL AGRICULTURAL RESEARCH CENTRES

International agricultural research centers made a limited contribution to the formation and function of the programme in Yugoslavia.

The ICARDA center enabled the study of the conditions for the design of the Plant Genebank in Yugoslavia and the training for the management of Genebank.

IBPGRI/IPGRI had a direct influence on the Yugoslav national programme through the coordination and participation of some institutions from Yugoslavia in the formation of collections (*Brassica*, *Alium* sp. etc.) and multiplication and conservation of collections (spring barley), organization of international course for young researchers for the collecting and managing of genetic resources, providing the references published by IBPGR.

IBPGR financed the project “Exploration Collecting, Conservation and Exchange of Hexaploid Species of *Prunus domestica* L. and *Prunus insitita* L. in Yugoslavia”.



In the following period we expect a greater professional help from IPGRI in the realisation of the National Programme. As plant genetic resources have been endangered by the war state in the surrounding countries as well as by the political transition of the country, we expect a greater help in the carrying out of the programme. Based on the earlier bilateral agreements, several times the collections of crop plants and other species were made in Yugoslavia. As these collections are situated in different national and regional genebanks, we expect to get help so as to obtain the data and the samples from these collections, aiming at completing our existing national collections.

As it is impossible to utilize the funds for the training of the personnel abroad, there is a current danger that we shall fall behind, so any offer for the training of our personnel would be very significant for the national program in Yugoslavia.

Although our previous collaboration with IPGRI has a positive trend, we are of the opinion that if Yugoslavia joins IPGRI, it can only improve its contents and effects.

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### 6.3 REGIONAL COOPERATION

The European Cooperative Programme on Genetic Resources (ECP/GR) in which Yugoslavia takes part since its establishment in 1979, had an essential influence on the formation and activities of the national programme. The spirit of international collaboration of European countries with different levels of national programmes, provoked and stimulated the scientists to start the initiative for the organization of researches of plant genetic resources in Yugoslavia. This was accepted by all the independent breeding institutes and the initiative was proposed for the establishment of the national programme.

The conditions for the establishment of the national programme were definitely created by the adoption of the Strategy of Technological development of Yugoslavia and measures for its realisation (1987). One of the measures for the realisation of the strategies in biotechnology was “Establishment of Plant Genebank, as the Yugoslav Federal Institution” and “Establishment of Federal Commission for Plant Generic Resources”.

Direct benefit from ECP/GR were the training of personnel for the work on genetic resources and the formation of groups for priority plant species, where the research institutes from Yugoslavia were included.



The workshop on pre-breeding, which was organized in Yugoslavia by the Scientific Council Committee ECP/GR, made a great impact on breeding programmes of some of the major plant crops.

The groups for individual species within ECP/GR enabled a more real understanding of the state of genetic resources of the species. The common methodology was used, common data bases were formed in the unique information and documentation systems, which was also adopted by the national programme.

Research and practical work on the formation of core collections gave additional knowledge and possibilities of handling great collections in the aggravated conditions of conservation. Further research in this field within work groups enable the inclusion of researchers and specialists from the national programmes.

The great benefit from this collaboration is the possibility to get acquainted with the programmes of other countries and the transfer of knowledge and experience.

The disadvantage of this collaboration is that the priority for the choice of species for the formation of groups does not always agree with national priorities. This can be alleviated by forming work groups of regional interest. In the near future it is necessary to communicate the European data bases directly with national genebanks. The access to the data should be free and inexpensive.

Yugoslavia participates in two groups of the ESCORENA-FAO System -maize and sunflower. In both groups the programmes of genetic resources are realised. The experience from this collaboration indicate that it is necessary to ensure more funds for the realisation of the programme. As for genetic resources, we find it very useful that they are realised within ECP/GR because of all the benefits obtainable from this collaboration.

As the participants of G-15 non-aligned countries, Yugoslavia took part in the formation of medicinal and aromatic plant genebank. The main office of the project is in New Delhi. This collaboration is in its initial stage, so the results cannot still be evaluated.



## 6.4 BILATERAL COLLABORATION

Yugoslavia has a long tradition in bilateral collaboration. The benefits vary both in quality and in quantity. The collaboration was mainly with the developed countries, which financed the projects. We collaborated on the collections of maize, wheat, and many other crops.

As opposed to maize, for which the collection has been conserved and the work continued, wheat collection has not been conserved in its original form. This also happened to other species which were subjects of collections.

The reason for poor benefits from this collaboration, for some crops, is the lack of an elaborate programme for the conservation and use of genetic resources at national and institute levels.

After the years when the collections were made, high-yield varieties of wheat from Italy and other countries were largely introduced instead of indigenous varieties, as well as American hybrid maize instead of indigenous open-pollinated varieties.

The introduction of the new programmes for the improvement of production of these cultures led to the abandoning of the programs of the study and use of indigenous and old varieties.

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## 6.5 INTER-INSTITUTIONAL COLLABORATION

This is also a useful form of collaboration which should be encouraged. There are not many examples in the field of conservation, but the collaboration in the field of exchange of breeding stock is very much developed.

Thanks to the collaboration between Maize Research Institute “Zemun Polje” and Nordic Genebank the NOBIS information system for genetic resources was introduced to Yugoslavia.

Regarding international collaboration with intergovernmental initiative, it can be concluded that only opportune meeting of commitments makes good conditions for the benefits of the collaboration.



## CHAPTER 7

# National Needs and Opportunities

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The organized work on plant genetic resources, as well as the building of the necessary infrastructure, was stopped by the disintegration of ex-Yugoslavia. Consequently, the priority assignment is to make conditions for the continuation of the programme, as follows:

- to finish the building of the facilities of the Plant Genebank of Yugoslavia;
- to continue the work on the sub-project “Formation of gene pool for Plant Genebank of Yugoslavia”;
- to institutionalize the Plant Genebank of Yugoslavia and to make conditions for its function as a public institution, as well as to ensure its permanent funding;
- to train the personnel for the work on plant genetic resources.

As the policy of conservation and sustainable use requires the professional political government body in FR Yugoslavia, it is necessary to form a Federal Commission for Plant Genetic Resources.

The jurisdiction and competence of the Federal Commission should result from constitutional competence of Federal Government regarding plant genetic resources and its obligations undertaken by signing international Conventions on Biological Diversity and other international undertakings on genetic resources.

In the aim of the successful work on genetic resources of Yugoslavia, Federal Government will do everything in its authority to extend international collaboration, first of all by the development of the national programme and by its active attitude to the obligations in international organizations.

The most urgent professional and technical issues are:

- to save the already collected and partly processed gene pool which is conserved in the form of seeds, because the conditions of storing are inadequate;
- to move the old and indigenous varieties of fruit species from *in situ* conditions to *ex situ* conditions, because their status is very much endangered, due to many reasons;



- urgent multiplication of small samples of seeds of the species which are presently in the national collection, as because of inadequate conditions of storing, their germination capacity can be lost, which would result in the complete failure;
- to determine the state of genetic resources and to start the collection of those species which were not in the first priority: first of all wild relatives of crop plants and medicinal and aromatic plants.

The work on forest genetic resources is in its beginning stage, so it is necessary to make conditions for the national programme and the necessary prerequisites for its realisation. The lack of work on the otherwise very rich gene pool has already resulted in the loss which will be difficult to cover.

In the past fifty years the decline of the number of plant crops in agriculture has been evident, and in major economic species the genetic basis has been reduced, which increases the risk in production.

To check the negative tendencies it is necessary to increase the knowledge of the use of genetic resources in breeding, to determine the degree of genetic vulnerability of plant crops, to evaluate the unutilized genetic resources and to modify the national policy of genetic resources management in the country as well as to change the policy of scientific research: improvement, conservation and utilization of genetic resources.

The main obstacle in the satisfying of national needs is the lack of funds for financing, which Yugoslavia cannot provide. Consequently it needs help and support.

In addition to the above, the radical change is necessary in the country's gene pool management, which must be reflected in all categories of planning, regional development and macroeconomic policy. This type of changes requires entirely new staff with professional knowledge, as previous knowledge of the evaluation of genetic resources and their sustainable use was insufficient.

The possibilities of achieving the objectives of national policy in the conservation and sustainable use of genetic resources, as well as sustainable development of agricultural production, are significant. Yugoslavia has several prestige breeding institutes with high international reputation. Due to its geographical position, diverse climate and soil, different traditions in agriculture, Yugoslavia represents an extraordinary reservoir of biological diversity and genetical variability. Breeding institutes and universities have an initial highly educated staff in the field of genetic engineering, biotechnology, plant selection, plant protection and agro-engineering. The addition of the



personnel for the work on genetic resources (taxonomists, agro-botanists, molecular biologists, cryobiologists, economists and managers of genebanks) would create the necessary basis for the successful development of the national programme. The building of the initiated infrastructure is, according to the designed capacities, sufficient for the period longer than twenty years. The only obstacle is the present very difficult financial situation.

Agriculture is the most substantial and priority branch of Yugoslav economy, and in it, plant production has a crucial role. Consequently it can be concluded that there is a very serious, permanent and substantial “consumer” of all the results of conservation, research and improvement of genetic resources.



## CHAPTER 8

# Proposals for a Global Plan of Action

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The Global Plan of Action, according to our opinion, should consist of the following activities:

- Reaffirmation of the FAO Resolution from 1983, i.e. to place plant genetic resources under the jurisdiction of UN, by adopting the Convention on Plant Genetic Resources.
- Base collections in the national genebanks should be under the jurisdiction of the FAO.
- The development of national programs of PGR should obtain international support.
- Scientific-technical support should be provided by PGR.
- Provision of information-documentation systems of national genebanks and easier utilization of the existing data bases in regional and global programmes.
- Stimulation of free exchange of bio-technological results of the research relevant to plant genetic resources.
- Design of the system by which the users of plant genetic resources are stimulated.
- Equal intellectual property rights and farmers' rights.
- Global Action Plan must contain unique instruments as well as means for achieving the objectives.