SCIENTIFIC SUPPORT FOR SUSTAINABLE AND PERFORMING AGRICULTURE IN THE DANUBE REGION

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Brussels, 24 April, 2012
Danube River
a natural patrimony of Europe
due to its multiple historical, economical, political functions

Throughout the centuries:

→ cradle of european civilization
→ support for societal evolution
→ storage of archeological relicts
→ life shelter for biodiversity
→ source of water and nutrients for agriculture
→ trustful boarder
→ important way for navigation, shipping and communication
97.4% of Romania's surface is located in the Danube River Basin.

Romania represents 29% of the Danube River Basin's surface area.

The Danube River has 37.7% of its length on Romanian territory.
Present situation of Danube River, further extension of diversity and complexity of functions

„The axis that keeps us in touch with Western and Central European nations”
(Grigore Antipa, 1921)

- The Danube River is one of the most utilized waterways in the world that serves numerous communities

- It’s imperative to maintain precious natural ecosystems, including the Danube Delta Biosphere Reserve

- Actions to be harmonized and efficiently integrated into the European Strategy for Danube Region for a sustainable socio-economic development, taking into account the limiting factors as: continuous population growth and the major challenges of the IIIrd Millennium, request for food, fodder, fibres, bio-fuels
Total length of the Danube River – 2 860 km; Romanian section – 1 075 km (38%)

Total Danube drainage basin area – 817,000 km²
Romanian hydro graphic basin area – 232,000 km² (28.4%)

8 EU Member-States and 6 non EU States share the Danube drainage basin

Along the Romanian section of the Danube River there are 220 settlements of which 198 villages and 22 towns

The fluvial system is formed of terraces, flood plains and the Danube Delta (D.D. is a Natural Inheritance of the Entire Mankind; belongs to the 200’s Eco regions of Planetary Importance).

The Danube Delta – total area 4 340 km² of which:
- 13% exposed areas (river banks, river levees, beach ridges)
- 87% areas covered by water (river arms, channels and canals, lakes and lagoons, marshes)
The Danube River was subject of numerous debates, studies and surveys, with complex management works for multiple purposes: navigation, hydro-power generation, land reclamation, agriculture and irrigation, protection of human settlements and other objectives.

Two main concepts promoted by Romanian scientists have been developed since the first decades of the XXth century:

– “The total embanking of the Danube River in order to promote agriculture on the areas recovered from waters” - Gh. Ionescu-Şişeşti and Anghel Saligny. This concept is based on the Prof. Ionescu-Şişeşti’s research.

– “The natural regime of exploiting the Danube River” - Grigore Antipa. This concept is the current concept of Danube River rehabilitation and sustainable management – the so called “The Danube Green corridor”
THE MANAGEMENT OF THE ROMANIAN DANUBE FLOOD-PLAIN

DAMMING :

- 1950-1960 → 97,000 ha dams at a level becoming submersible

- 1962-1965 and after 1970 → 432,000 ha (75% of total area) for 1/100 probability of dam overspill at high floods

- large areas with drainage and irrigation schemes supplied with Danube water → 390,000 ha (69% of total area)
The Danube Valley is an important agricultural region in Romania. Arable land represent 68% of total area of the Valley (12.9% of the country's total arable area).
Natural characteristics and resources for a sustainable agriculture in the Danube flood-plain

**Climate** → predominantly dry to moderate-dry
  → annual rainfall – 451-600 l/m²
  → frequency of years with moisture deficit – 65-70%,
  normal years- 15-20%, rainy years – 5-10%
  → average annual temperatures – above 11 °C, the highest values in the country

**Soils** → large diversity of soil types
  - Alluvial soils - 40.7 %
  - Gleiosols - 31.9 %
  - Chernozems - 7.6 %
  - Others - 19.8 %
  → unstable under changing environmental conditions
    - acidification
    - salinisation
    - organic matter depletion → diminished soil fertility
    - crusting and pulverization → wind erosion risk

**Large Biodiversity**: natural flora; wild animals; agricultural crops and livestock
**Agricultural exploitation of Danube flood-plain**

After sixties of the XXth century the Danube flood-plain was transformed into a *functional agro-ecosystem* → 450,000 ha with:
- a vast capacity for biomass production
- a multi crops structure exploitation
- a well preserved ecological equilibrium

A large range of crop species for Danube flood-plain: maize, wheat, rice, barley, oat, sunflower, soybean, peas, sugar beet, Sudan grass, sorghum.

The main technological problems are:
- crop rotation
- integrated plant nutrition program:
  - mineral and organic fertilizers (well balanced NPK fertilization in optimal rates and time of application)
  - symbiotic nitrogen fixation of grain legume crop - *Soybean* one of the most important crop
- integrated plant protection program;

The *soybean* is a significant crop for Romanian agriculture - restricted by EU and Romanian regulations
The evolution of area cultivated with soybean (including genetically modified soybean)

1 - Cultivated area (thousand ha)  2 - Total crop yield (thousand t)  3 - Average crop yield (kg/ha)

Sources: Statistic Year Book of Romania 2011 and Ministry of Agriculture and Rural Development
Case study - Great Island of Braila (GIB)

an embanked enclosure of the Danube (length- 154 km) and 1300 km of draining channels with 22 draining stations

The Company “S.C. TCE 3 Brazi SRL”
- the biggest private agricultural company from EU exploiting 56.628 ha (29 farms) in the Great Island of Braila

Agricultural crops – cereals and industrial crops

Soil fertility of GIB influenced by:
- N index  3, 90 (3,30-5,00);  P₂O - 51,60 mg/kg (25-70 mg/kg);  K₂O - 260,40 mg/kg (160-320 mg/kg);
- humus content - 3.9 % (3-6%);
- pH – 8.03 (7.8 – 8.2)
- soil texture and structure
- multiannual average of precipitations – 400 mm/year (250-650 mm);
- ground water level and amount - influenced by the Danube level
Management of the agricultural production in the Great Island of Braila

1. Crop irrigation for assuring the water needs during vegetation period m³/ha

Irrigation norms applied function of the crop, available water in soil and precipitations fallen during vegetation period
Evolution of investment value in irrigated area (thousand Euro)

Figure 9. Value of investment in irrigation area.
2. Fertilizer application

The amount of applied mineral fertilizers increased from 90 kg NPK/ha in 2002, 154 – 2006, to 220 kg NPK/ha in 2011. As result, the crop yields increased by three times.

The technology of fertilizer application:

a. Optimal rates, methods and time of application, according to each field soil fertility and crop requirements

b. Application of small rates of mineral fertilizers at sowing as “STARTER”

c. Application of foliar fertilizers

d. Application of organic, including green fertilizers:
   - 110,000 tones of crop residues returned in soil
   - 5400 ha with green mass of rape every year
Mineral fertilizers and their effect on field
Source: L. Buzdugan, 2010
Amount of crop residues incorporated in the soil
Source: L. Buzdugan, 2010
Area with green fertilizers
Source: L. Buzdugan, 2010

ha
3. Crop rotation

Present and future crop structure
4. Use of modern agricultural machinery and equipment.
Evolution of area with MIN-tillage and NO-tillage system
Source: L.Buzdugan, 2010
Cumulative effect of technological measure:

- **There is an ascendant increase of crop yields and of profit**
- **A positive evolution of the main indexes of efficiency**

<table>
<thead>
<tr>
<th>Crops</th>
<th>Average yields (to/ha)</th>
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<tbody>
<tr>
<td></td>
<td>2002</td>
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<tr>
<td>Wheat</td>
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<tr>
<td>Maize</td>
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<tr>
<td>Rape</td>
<td>2.3</td>
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### AVERAGE YIELDS (To/ha):

<table>
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<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
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<td>5.1</td>
<td>5.8</td>
<td>6.7</td>
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<td>6.6</td>
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<tr>
<td>Rape seeds</td>
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<td>-</td>
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<td>3.3</td>
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<td>1.6</td>
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<tr>
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<td>2.6</td>
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### Yields Evolution (to/ha)

#### 2002-2011 Average

- **Wheat**: Average yield from 2002 to 2011 is 5.165 to/ha.
- **Barley**: Average yield from 2002 to 2011 is 6.863 to/ha.
- **Rape seeds**: Average yield from 2002 to 2011 is 2.298 to/ha.
- **Maize**: Average yield from 2002 to 2011 is 6.863 to/ha.
- **Sunflower**: Average yield from 2002 to 2011 is 2.298 to/ha.
- **Soybean**: Average yield from 2002 to 2011 is 3.069 to/ha.
Effects of technical management on the Danube floodplain environment

Agricultural and economic viewpoints

ADVANTAGES

- Regeneration to the initial potential of soil fertility under:
  • the modern tillage;
  • farming practices;
  • improved cultivars – suited to local conditions
- Crop yields in normal years, economically profitable
- Crop yields during dry years of 1991-2009 interval, several times higher than average yield level in the country
- Improved agro-ecosystems with a more favorable microclimate and an extended biodiversity
DISADVANTAGES

- Drastic deforestation

- Macroclimate changes → temperature increase - rainfall diminution → increased arid area - desertification of some zones

- Alternation of quantitative and qualitative parameters of underground and ground waters, the hydrologic regime of Danube river included

- Changes of the structure of agricultural production

- Reduction of fishery production due to the decrease of fish farming zones
SOME PRIORITIES FOR IMPROVING ENVIRONMENTAL CONDITIONS OF DANUBE FLOODPLAIN’S AGRICULTURE, FISH FARMING and FORESTRY

• Maintaining recommended area of the Danube floodplain under embankment regime, having in mind the good soil fertility and high yield response of irrigated crops.
• Systematic REFORESTATION, mainly the land inadequate for agriculture
• Promoting FISH FARMING in certain Danube floodplain
• Extending ecological management to increase the BIODIVERSITY and ECOLOGICAL RECONSTRUCTION of Danube floodplain
• Implementation of appropriate programs of the National Strategy of alleviation of drought, land degradation and desertification, in concordance with the Danube European Strategy for the Danube Region.
Global Challenges of the 1\textsuperscript{st} Century in the 3d Millennium

- Economic crises
- Financial crisis
- Energy crisis
- Population Growth

GLOBAL CLIMATIC CHANGES
- Biodiversity reduction
- Soil degradation
- Water scarcity

FOOD CRISIS ?
SCIENCE – THE REAL ROOTS IN THE DANUBE REGION FOR A CLEAN ENVIRONMENT, SUSTAINABLE AND PERFORMING AGRICULTURE, FOOD SECURITY AND SAFETY.
CONCLUSION

The Scientific Research should be oriented to promote a sustainable CLEAN DANUBE WATER and sustainable CLEAN ENVIRONMENT for a sustainable and PERFORMING AGRICULTURE in accordance with the DANUBE EUROPEAN STRATEGY for DANUBE REGION

Thank you for your attention!