SCIENTIFIC SUPPORT FOR SUSTAINABLE AND PERFORMING AGRICULTURE IN THE DANUBE REGION

Cristian HERA

Cluj-Napoca, 3 May, 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

European Academies contribution

1st Danube Academies Conference (DAC) – Vienna, September 15-16, 2011, organized by the European Academy of Sciences and Arts, with participation of Academies from: Austria, Bulgaria, Czech Republic, Hungary, Romania, Slovakia, Slovenia, Croatia, Montenegro and Serbia

2nd DAC – Smolenice, Slovakia, March, 8-9, 2012

Projects proposed by Romanian Academy:

1. Short term projects

- **A. Global Change Atlas of the EU Strategy for the Danube Region – a tool for the stakeholders in the decision-making process**
- **B. Sturgeon conservation in the Danube River Basin – a complex environmental-economic-social approach**

2. Long term projects

- **International Centre for Advanced Research and Education on the River – Delta – Sea Systems: Study area: "Danube River – Danube Delta – Black Sea System"**

International Centre for Advanced Research

GENERAL OBJECTIVES

The Centre will represent one of the most important EU Research Infrastructures in the field of Earth and Environmental Sciences, oriented towards the development of a modern and sustainable management of river - sea systems

Pan-European point for continuous education & frontier research in the field of deltaic systems

The International Centre for Advanced Research (ICAR) will focus on fundamental and applied, integrated and multi-disciplinary research, contributing to the sustainable management of wetlands and river – delta – sea areas.

Location of the International Centre "Danube-Danube Delta-Black Sea"

European Commission – Joint Research Center (JRC) and European Academies (EUA)

- November 17th, on the **5th World Science Forum, Budapest, *signed a Letter of Intent on EU Strategy for the Danube Region***:

  JRC – Dominique RISTORI

  Bulgarian Academy of Sciences-N. SABOTINOV

  Hungarian Academy of Sciences-J. PALINKAS

  Romanian Academy-I. HAIDUC

  Slovak Academy of Sciences-J. PASTOREK

Later, Letter was signed also by *Austrian* Academy of Sciences, *Bavarian* Academy of Sciences and *Czech Republic* Academy of Sciences

JRC's and EUA's Conferences

- 1ST Conference "Science for the Danube Strategy", January 25th, 2012, Sofia

- Last week, on 24th April, 2012, in Brussels, FIRST CONFERENCE on **"Scientific Support to the Danube Strategy",** with participation of the Representatives from **Academies, Universities & EC Officials**

24th April JRC Brussels Conference

EC Officials:

Maros SEFCOVIC- VP of EC, International Relation & Administration, *Markus FERBER*, Member of European Parliament,

Walter DEFFAA, DG for Regional Policy, European Commission,

Erhard BUSEK, Chairman of the Institute for the Danube Region & Central Europe,

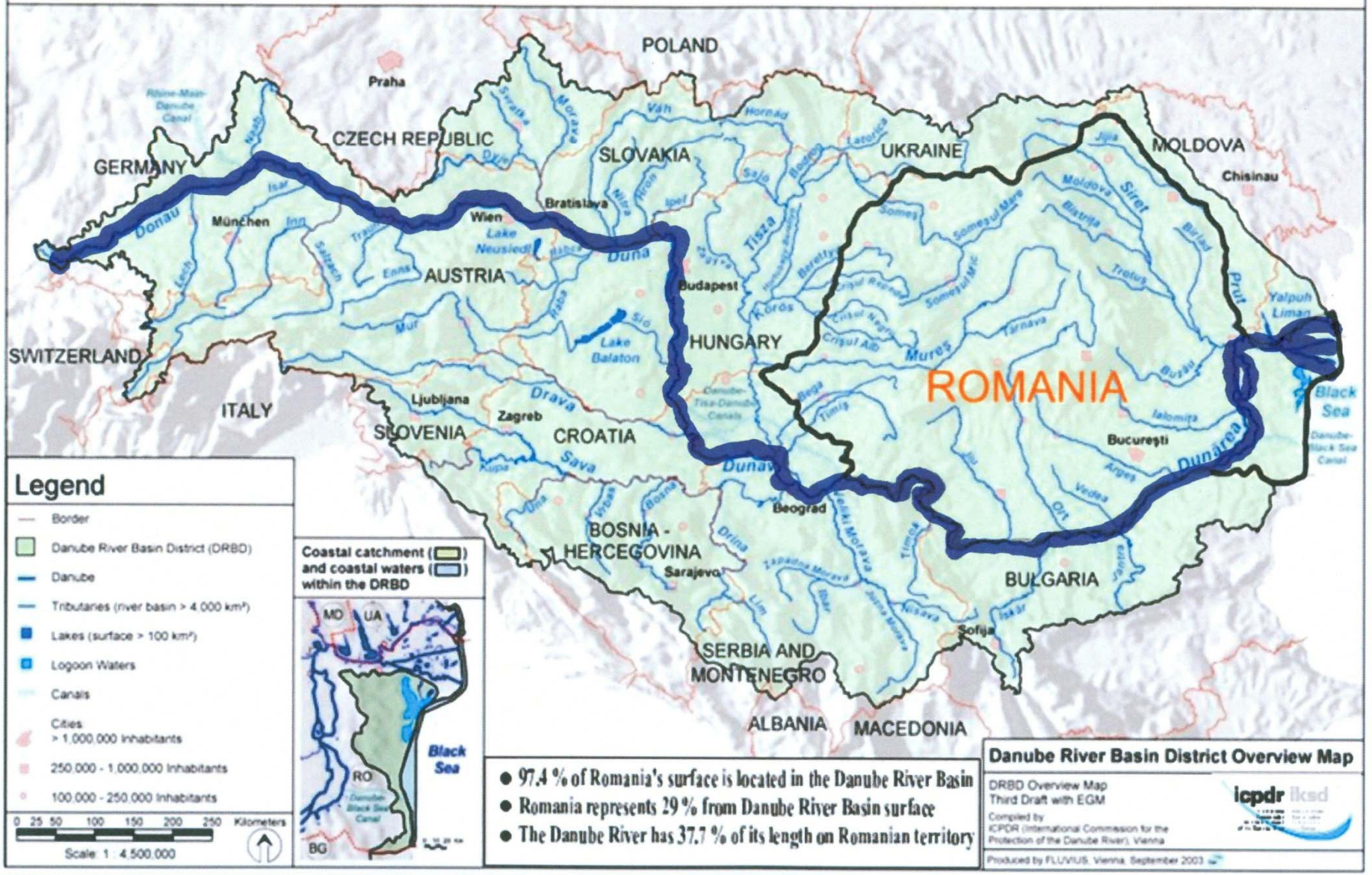
Szabolcs FAZAKAS, Member of the European Court of Auditors,

Dominique RISOTIRI, DG JRC

24th April, 2012, JRC Conference

- Five SECTIONS;
- **Environment Protection** – *Martin GERZABEK*, key note speaker
- **Irrigation & Agriculture Development-** *Cristian HERA*, key note speaker.
- **Navigability**
- **Energy Production**
- **European Governance**

Danube River Basin District. Overview map



Legend

- Border
- Danube River Basin District (DRBD)
- Danube
- Tributaries (river basin > 4.000 km²)
- Lakes (surface > 100 km²)
- Logoon Waters
- Canals
- Cities
  - > 1.000.000 Inhabitants
  - 250.000 - 1.000.000 Inhabitants
  - 100.000 - 250.000 Inhabitants

0 25 50 100 150 200 250 Kilometers

Scale: 1 : 4.500.000

Coastal catchment ( ) and coastal waters ( ) within the DRBD

- 97.4 % of Romania's surface is located in the Danube River Basin
- Romania represents 29 % from Danube River Basin surface
- The Danube River has 37.7 % of its length on Romanian territory

Danube River Basin District Overview Map

DRBD Overview Map
Third Draft with EGM

Compiled by
ICPDR (International Commission for the Protection of the Danube River), Vienna

icpdr iksd

Produced by FLUVIUS, Vienna, September 2003

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 wich is recognized as a **Natural Inheritance for the Entire Mankind &** ***The 200's Eco region of Planetary Importance***

- **Actions has to be taken to harmonized and efficiently integrated into the Danube Strategy a sustainable socio-economic agriculture development, to satisfy increasing request of continuous population growth for food, fodder, fibres, bio-fuels, which represent the major challenges of the IIIrd Millennium**

Total length of the Danube River – 2 860 km ; Romanian section – 1 075 km (38%)

Total Danube drainage basin area – 817,000 km^2
Romanian hydro graphic basin area – 232,000 km^2 (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

The Danube Delta – total area 4 340 km^2 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

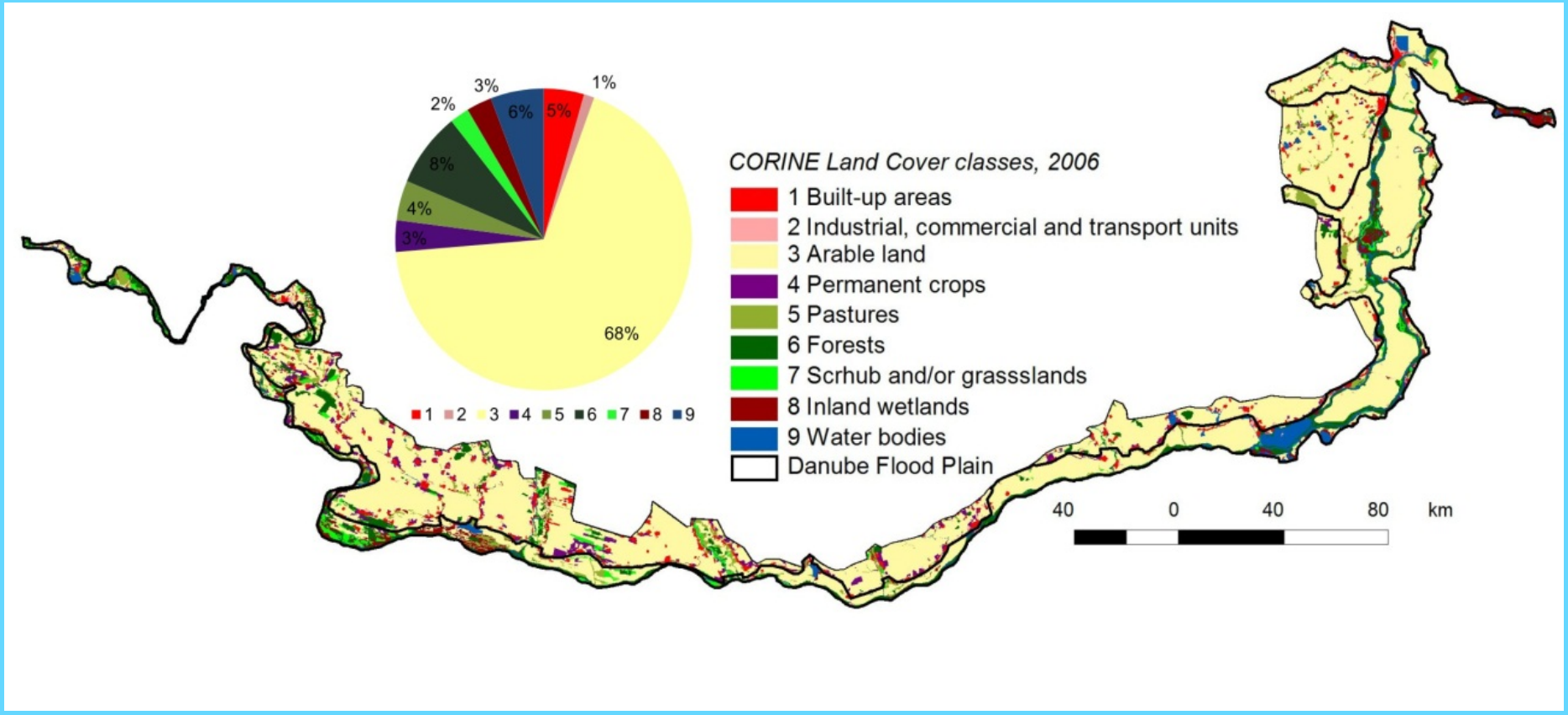
DAMMING :

- 1950-1960 → 97,000 ha with 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*).



Land use in the Danube Valley

Natural characteristics and resources for a sustainable agriculture in the Danube flood-plain

Climate → predominantly dry to moderate-dry

→ annual rainfall – 451-600 l/m^2

frequency of years with moisture deficit – 65-70%;

normal years- 15-20%; rainy years – 5-10%

→ average annual temperatures above 11 ^{0}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 and nutrients 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*→ 390,000 ha with :

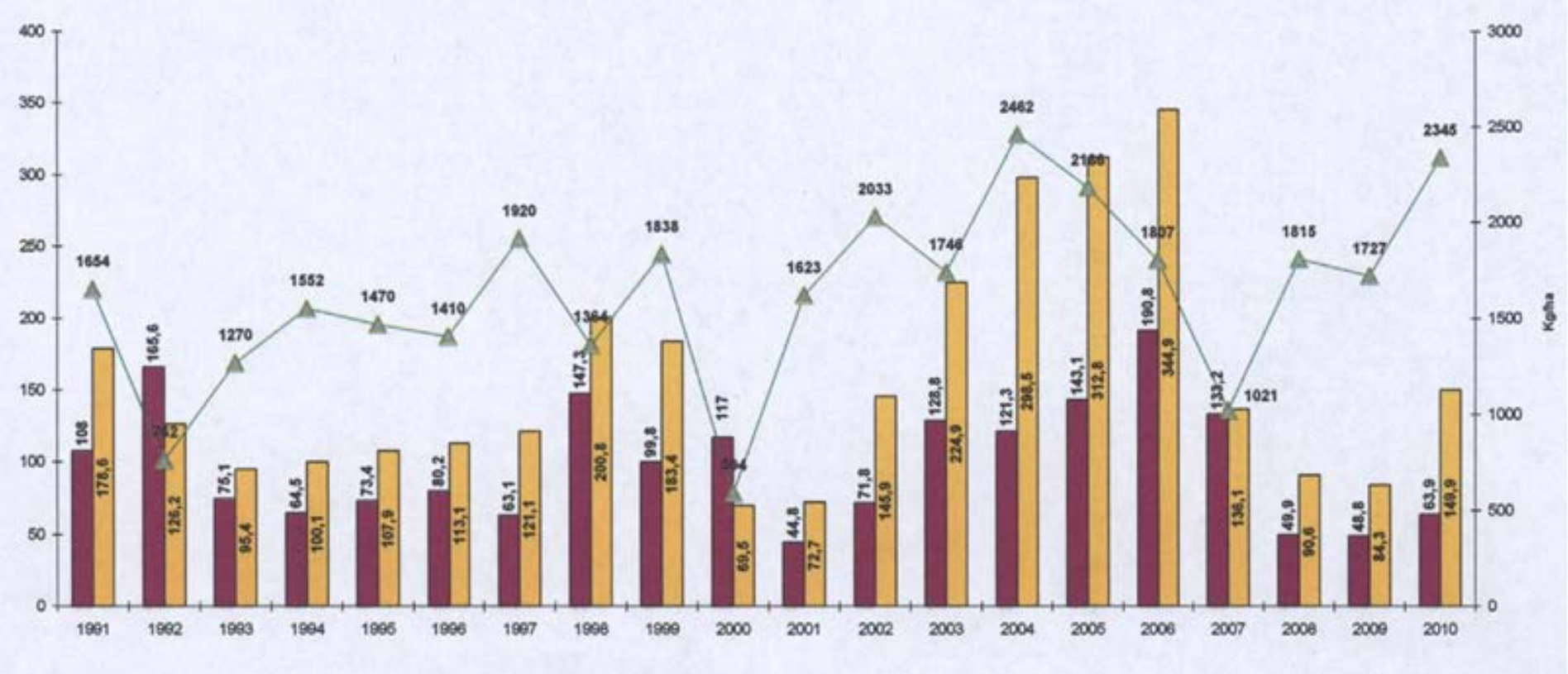
- **a vast capacity for biomass production**
- **a multi crops structure exploitation**
- **a well preserved ecological equilibrium**

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 protection program;**
- **integrated plant nutrition program:**

-mineral and organic fertilizers (well balanced NPK fertilization in optimal rates, methods and time of application)

- **symbiotic nitrogen fixation of grain legume crop - *Soybean* one of the most important crop**
  - **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


15 7 2005

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 Great Island of Braila – source L. Buzdugan - 2011

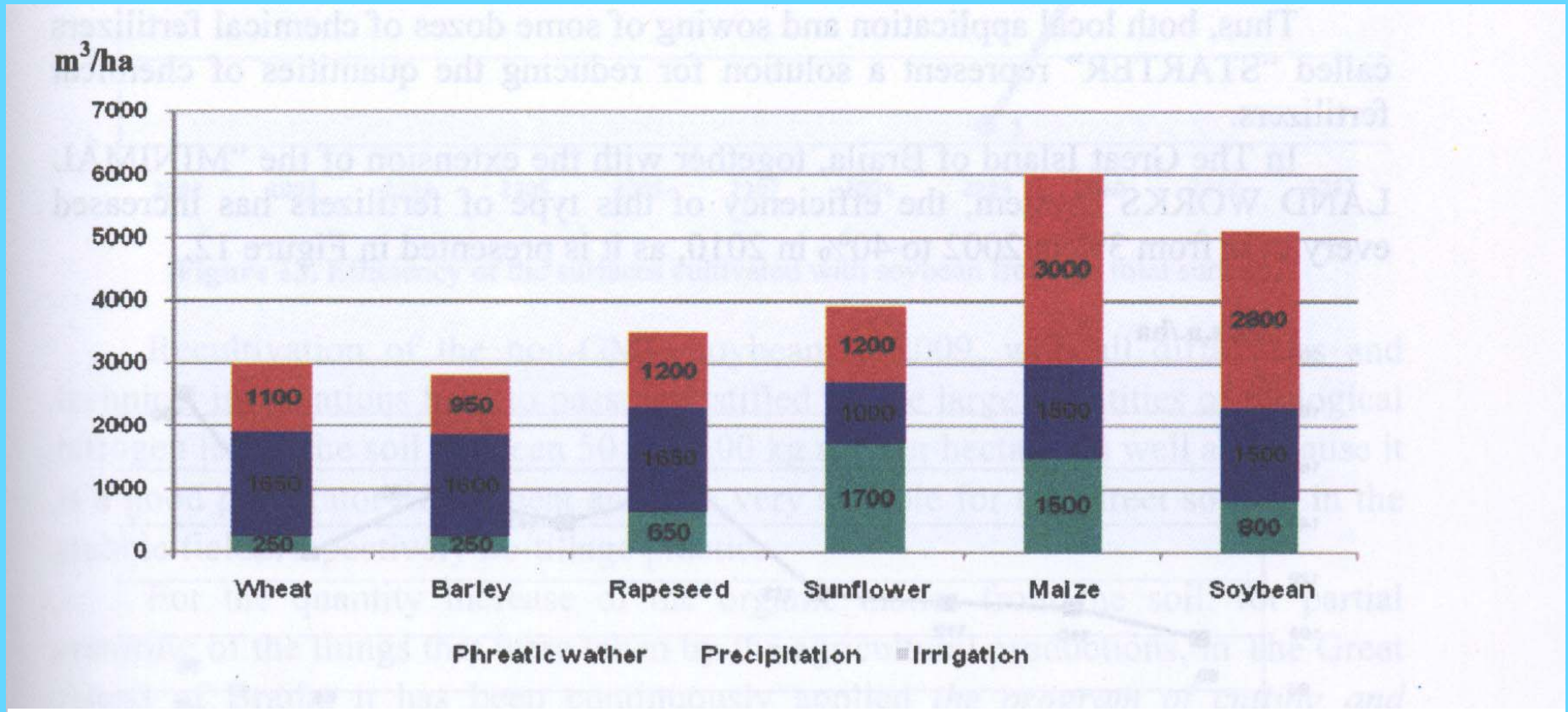
The Company "S.C. TCE 3 Brazi SRL"
- the biggest private agricultural company from EU exploiting 56.628 ha (29 farms) in the Great Island of Braila

Agricultural crops – cereals and industrial crops

Soil fertility of GIB influenced by:
- N index 3, 90 (3,30-5,00); P_2O - 51,60 mg/kg (25-70 mg/kg); K_2O - 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 m^3/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)

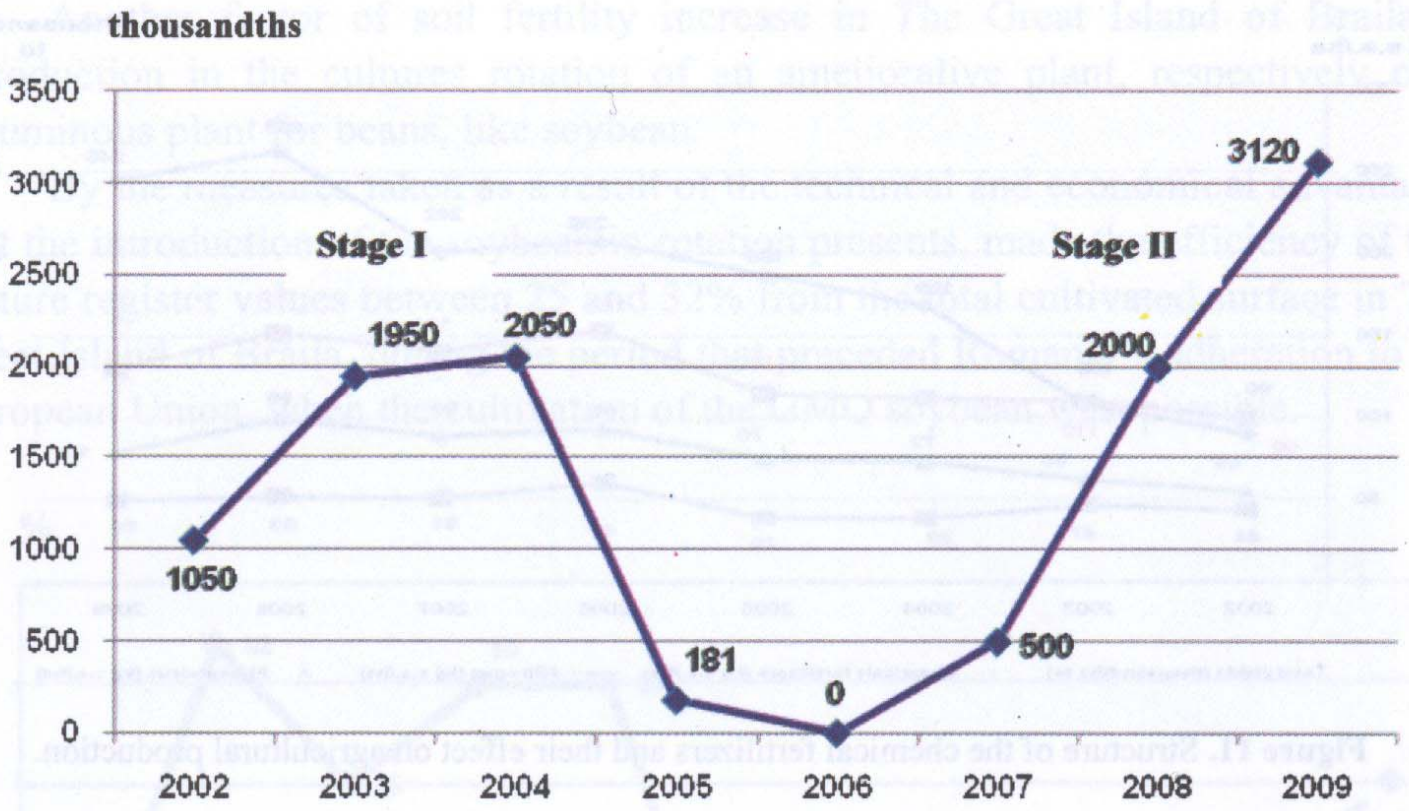


Figure 9. Value of investment in irrigation area.

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"

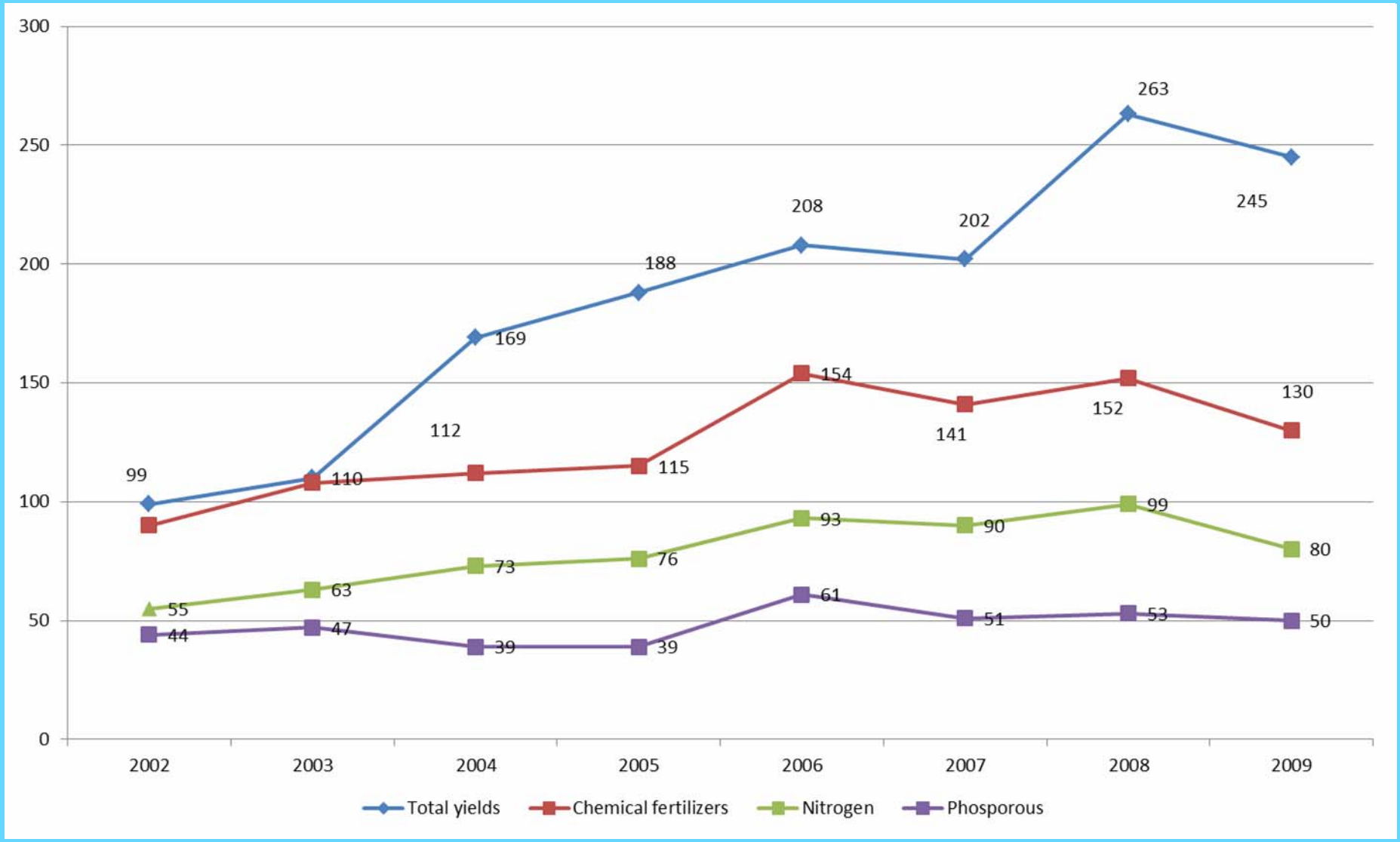
c. Application of foliar fertilizers

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

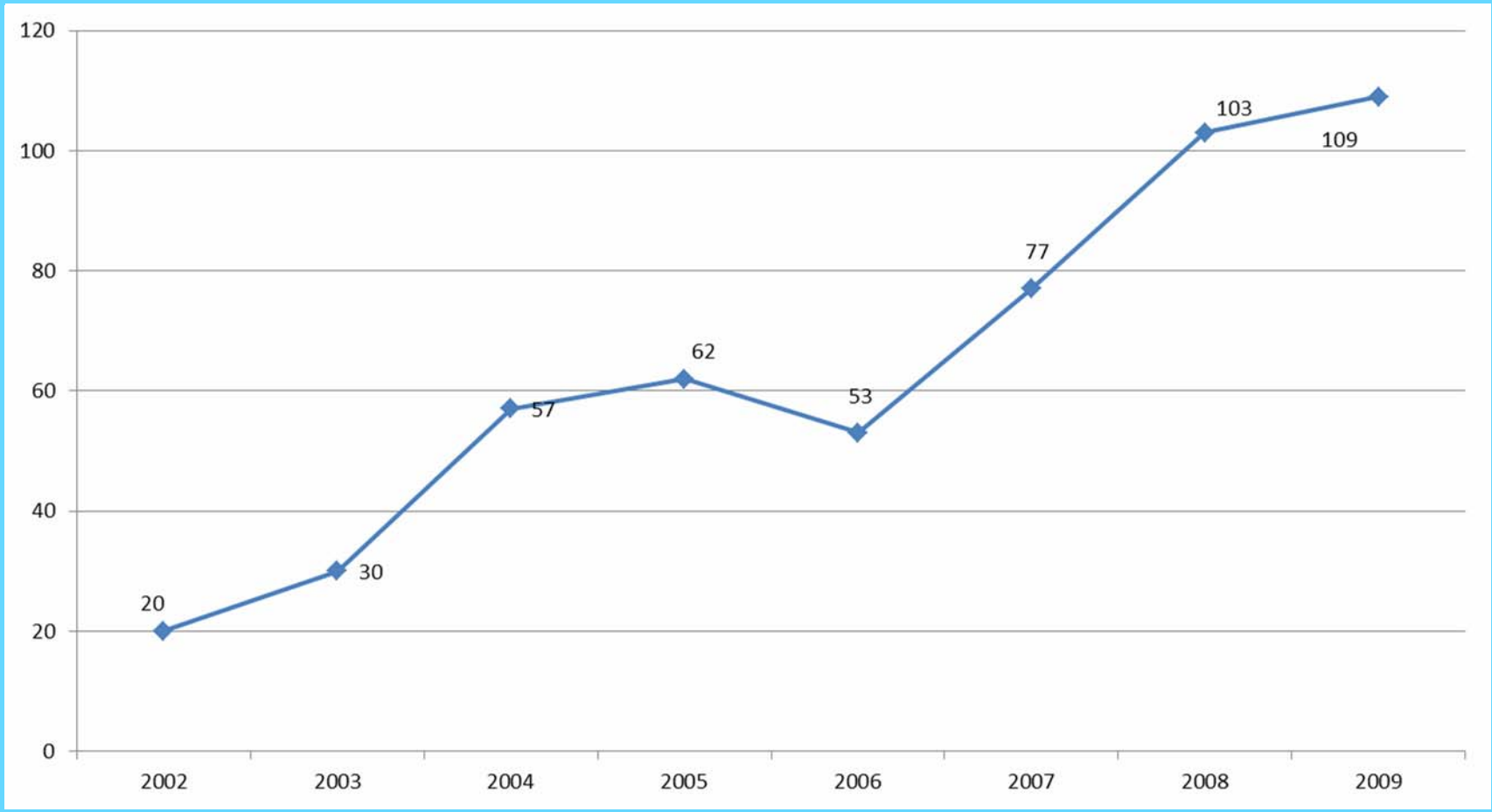
Kg a.i./ha



Mineral fertilizers and their effect on field

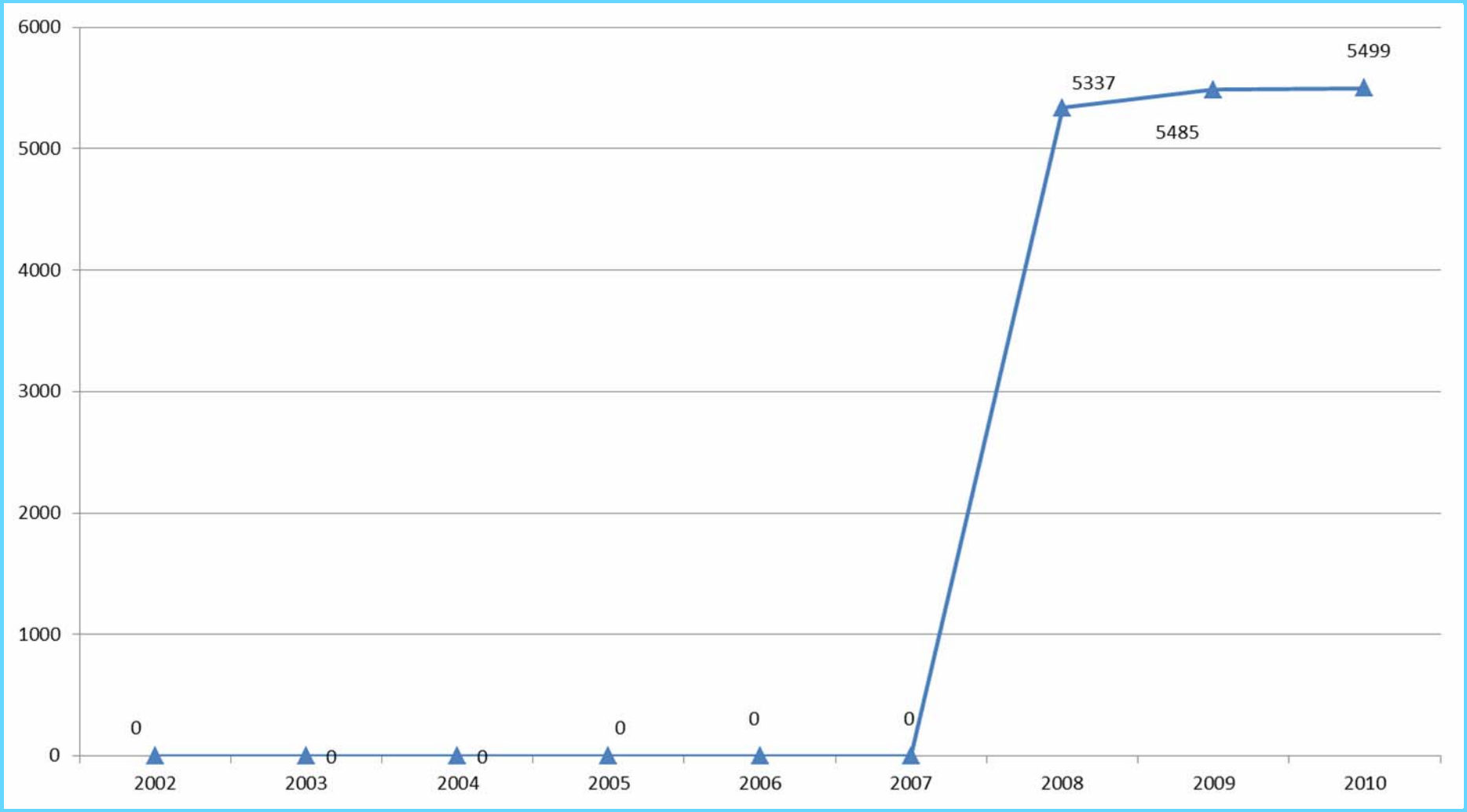
Source : L.Buzdugan, 2010

(thousandth to)



Amount of crop residues incorporated in the soil
Source : L.Buzdugan, 2010

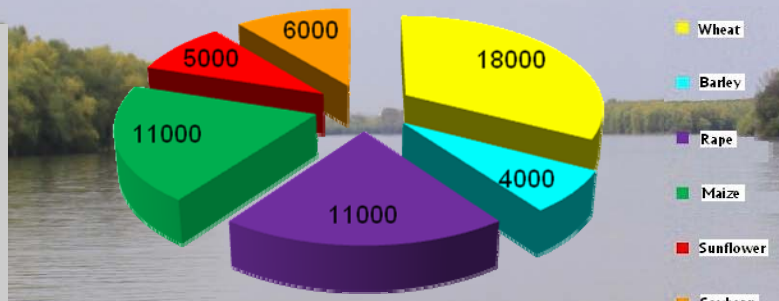
ha



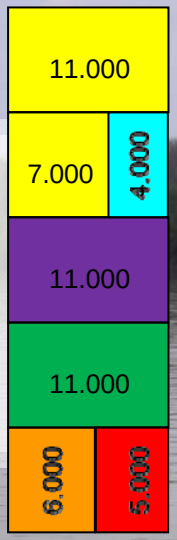
Area with green fertilizers

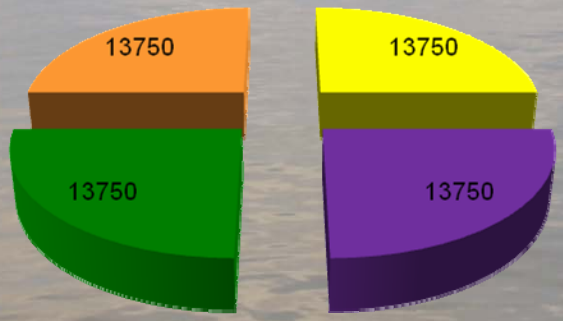
Source : L.Buzdugan, 2010

3. Crop rotation

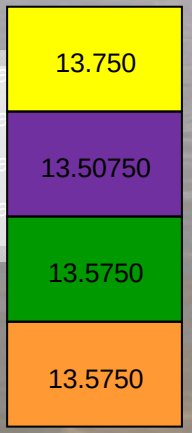


•18.000 ha
• 4.000 ha
•11.000 ha
•11.000 ha
• 5.000 ha
• 6.000ha





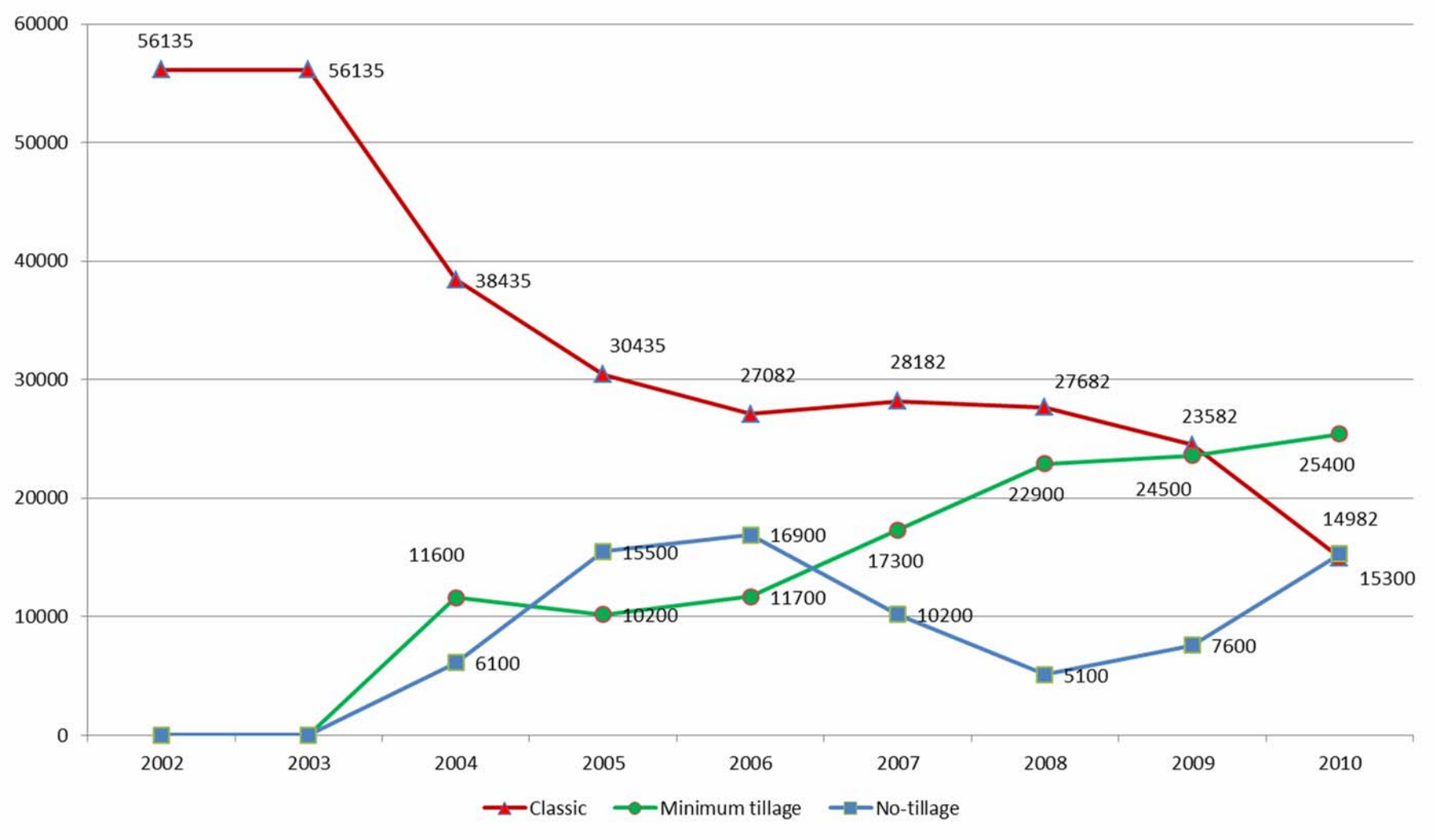
•13.500 ha
•13.500 ha
•13.500 ha
•13.500 ha



Present and future crop structure

4. Use of modern agricultural machinery and equipment.

ha



Evolution of area with MIN-tillage and NO-tillage system

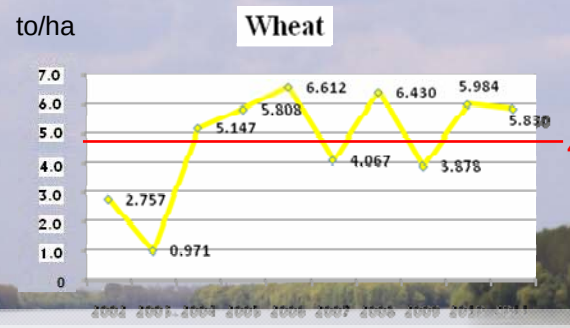
Source : L.Buzdugan, 2010

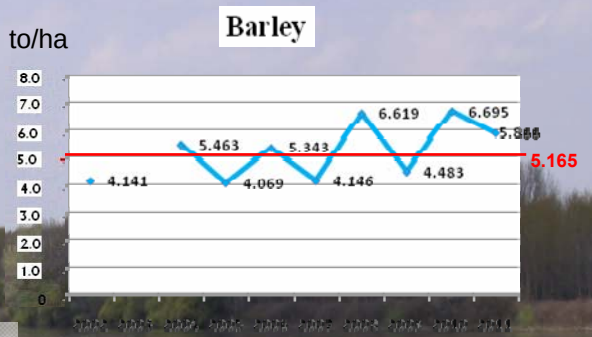
Cumulative effect of technological measure:

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

Crops	Average yields (to/ha)	
	2002	2009
Wheat	*2.8*	*6.4*
Maize	*4.3*	*9.0*
Rape	*2.3*	*3.3*

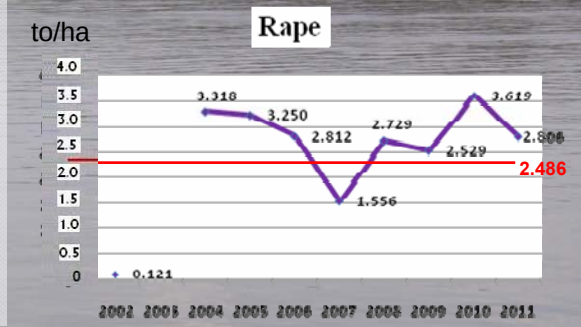
Yields Evolution (to/ha)

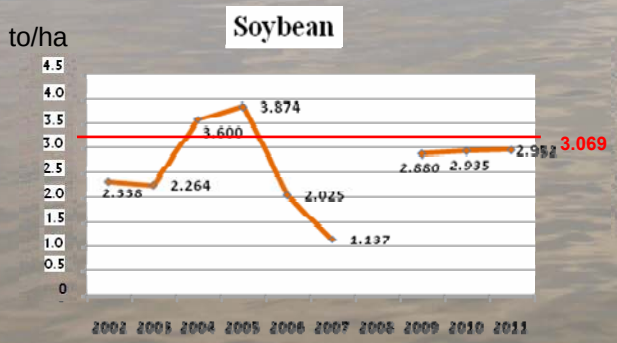


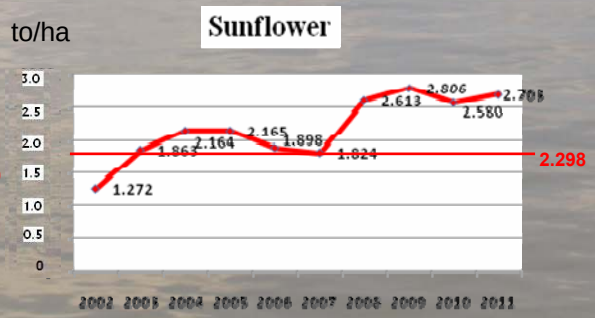


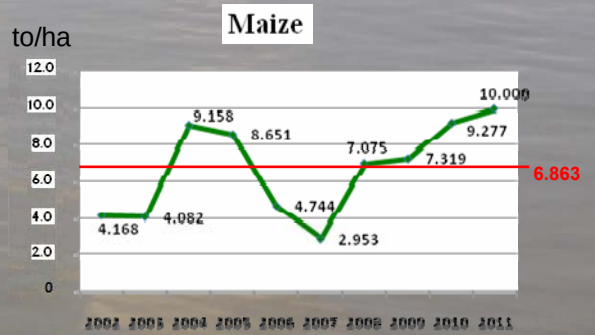
AVERAGE YIELDS (To/ha):

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
•Wheat	2.8	3.9	5.1	5.8	6.7	5.1	6.4	5.9	6.0	5.8
•Barley	3.1	-	4.5	5.1	5.3	5.2	6.6	5.5	6.7	5.9
•Rape seeds	0.2	-	2.3	3.3	3.8	1.6	3.7	3.5	3.6	2.8
•Maize	4.2	5.1	7.2	8.6	8.7	9.0	8.1	8.3	9.3	10.0
•Sunflower	1.3	1.9	2.2	2.2	2.9	2.8	2.6	2.8	2.6	2.7
•Soybean	2.3	2.2	3.6	3.9	2.0	1.1	-	2.8	2.9	2.9









2002-2011 Average

Effects of technical management on the Danube flood-plain 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


4 3 2008

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 1st Century in the 3d Millennium

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

GLOBAL CLIMATIC CHANGES

- Biodiversity reduction
- Soil degradation
- Water scarcity

FOOD CRISIS ?

I strongly believe that

SCIENCE represent the REAL ROOTS IN THE DANUBE REGION FOR PROMOTING AND CONSERVING A CLEAN ENVIRONMENT, SUSTAINABLE AND PERFORMING AGRICULTURE, FOR A REAL CONTRIBUTION TO THE 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!