# STUDY ON SOIL QUALITY IMPROVEMENT IN ROMANIA

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**Abstract**

In this paper, we aim at analyzing Romanian soil improvement measures such as established by the National Development Plan developed by the Romanian Government over the period 2007 – 2013.The quality of the arable land in Romania is superior to those in many European countries, but the high acidity levels of the soil, the lack of nutrients in the soil, as well as improper crop structures contribute to low yields off these lands, and thus implicitly have a negative impact on the revenues obtained by the agriculturist.

**Key words**: soil, pollution, improvement, politics, measure

In general, Romania's agricultural lands are considered among the most fertile in Europe. At present, of the over 9.3 million ha of arable lands, only 3.7 ha meet sustainable efficient agriculture requirements. Vast land areas are subject to such phenomena as erosion, land gliding, acidification, alkalinisation, moisture excess, drought, swamping, salting, compacting, and chemical pollution (by pesticides, heavy meals, oil, etc.) that result in deterioration of soil quality and diminish soil suitability for different crops. The irrational use of chemical fertilizers and pesticides ad of irrigation lead to a diminution of yielding capacity of the soils even in areas considered fertile. These last years, there has been a strong degradation of the soil up to the desertification threshold in certain areas. The effects of soil degradation have an impact not only on their yielding capacity, but also on the quality of vegetal and animal produce and, implicitly, on the population health. Recovering land quality is a difficult ad long-lasting process that needs huge investment efforts over a long period of time. In Romania, agricultural lands cover the largest areas (61.60%), followed by forests and other lands with forest vegetation (28.33%) and still other lands represent 10.07% of Romania (waters, ponds, courtyards, buildings, transportation routes, unproductive lands), as shown in Table 1.

Arable lands represent 64.1% of the total agricultural areas, and the rest is divided between pastures (22.6%), haylands (10.4%), vineyards (1.5%) and orchards (1.4%). Private agricultural property represents 94.64% of the total agricultural land, being made up of: private property of the state, of municipalities, of legal persons and of natural persons. As a result of the increase in the demographic index, the arable land per capita has decreased.

Table 1

**Land distribution, by use categories**

| Use category | Area | |
|---|---|---|
| | thousand ha | % |
| Agricultural lands | 14,684.9 | 61.60 |
| Forests and other lands with forest vegetation, of which: | 6,752.9 | 28.33 |
| Forests | 6,334.0 | 26.57 |
| Buildings | 703,3 | 2.95 |
| Roads and railroads | 389,8 | 1.63 |
| Waters and ponds | 833,3 | 3.50 |
| Other lands (unproductive lands) | 474,9 | 1.99 |
| Total | 23,839.1 | 100 |

*Source: Romanian Statistical Yearbook, 2010*

## MATERIAL AND METHOD

After study and analysis of the statistical data and the existing documents, the present paper presents the main problems related to the quality of soils in Romania and also aspects addressed in the development policy.

## RESULTS AND DISCUSSIONS

Soil quality is affected, to various pollution degrees, by industrial or agricultural activities. Soil pollution is the result of actions that produce soil degradation. There are several types of pollution: physical, chemical and biological; all of them have a negative impact on the bioproductive capacity of the soil.

In Romania, soil pollution affects large areas, as follows:

- chemical pollution, including the one determined by oil products, affects 0.9 mil. ha

arable land and 0.3 mil. ha of the lands covered with forests;

- excessive soil salinity impacts approximately 0.6 mil. ha and is on the increase in the areas that were irrigated or subjected to irrational exploitation;

- high acidity (that affects approximately 3.4 mil. ha), small and extremely small humus supply in the soil and shortage of microelements (zinc) on large areas (1.5 mil. ha), poor or very poor supply of mobile potassium (0.8 mil. ha), all characterizing the present agrochemical status of the soil. The agricultural areas impacted by various limitative factors of the productive capacity are presented in table 2.

Table 2

**Agricultural land areas impacted by various limitative factors of the productive capacity**

| Factor | Affected area[1], thousand ha | |
|---|---|---|
| | total | arable |
| Drought [2] | 7100 | - |
| of which irrigation facilities | 3211 | - |
| Periodical humidity excess in the soil[2], | 3781 | - |
| of which with arrangements for draining | 3196 | - |
| Soil erosion by water[2] | 6300 | 2100 |
| of which with anti-erosion work | 2274 | - |
| Landslides | 702 | - |
| Soil erosion by wind | 378 | 273 |
| Excessive frame ground surface | 300 | 52 |
| Soil salting, | 614 | - |
| of which with high alkalinity | 223 | 135 |
| Soil compaction due to improper "bottom plough" works | 6500 | 6500 |
| Primary compaction of soil | 2060 | 2060 |
| Crust formation | 2300 | 2300 |
| Small and extremely small humus supply in the soil | 7485 | 4525 |
| Strong and moderate acidity | 3424 | 1867 |
| Poor and very poor supply of mobile phosphorus | 6330 | 3401 |
| Poor and very poor supply of mobile potassium | 787 | 312 |
| Poor nitrogen supply | 5110 | 3061 |
| Shortage of microelements (zinc) | 1500 | 1500 |
| Chemical pollution of soil, of which: | 900 | - |
| excessively polluted | 200 | - |
| pollution by oil and salty water | 50 | - |
| pollution by airborne substances | 147 | - |
| Soil destruction by various excavations | 15 | - |
| Covering the land with solid wastes and residues | 18 | - |

*Source: Romanian Statistical Yearbook, 2010*

## Distribution of agricultural land by use

Arable lands represent 64.1% of the total agricultural areas, and the rest is divided between pastures (22.6%), haylands (10.4%), vineyards (1.5%) and orchards (1.4%). Private agricultural property represents 94.64% of the total agricultural land, being made up of: private property of the state, of municipalities, of legal persons and of natural persons (table 3.) As a result of the increase in the demographic index, the arable land per capita has decreased.

Table 3

**Distribution of agricultural land by use**

| Types of use | Area | |
|---|---|---|
| | thousand ha | % |
| Agricultural total | 14.684.9 | 100 |
| Arable land | 9,422.5 | 64.1 |
| Pastures | 3313,8 | 22.6 |
| Haylands | 1528,0 | 10.40 |
| Vineyards | 215,4 | 1.5 |
| Orchards | 205,2 | 1.4 |
| of which private property | 13.897,8 | 94.64 |

**Land distribution on suitability classes** is characterized by variability in their percentage (table 4). Therefore, with no improvement works, only 2.8% of agricultural lands fall in class I (very good suitability), 3.8% being arable lands. Class II, good suitability, includes 24.7% of agricultural lands and 35.9% of arable lands; class III, with medium permeability, is made up of 20.8% of agricultural lands and 25.3% of arable lands, respectively. As for classes IV (poor permeability) and V (very poor permeability), they include 51.7% of agricultural lands and 35% of arable lands, respectively. Practically, approximately 4 mil. ha agricultural land, of which 3.8 mil. ha arable land, meet the minimum conditions for the development of competitive agriculture. Humus is a fundamental component that largely determines the physical, chemical, and biological characteristics of soil. Humus is the main supply of elements for plant nutrition, being a multicomponent substance.

Table 4

**Distribution of Romanian agricultural land on suitability classes (with no improvement works)**

| Suitability | | Agricultural | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Class | Significance | Total | | of which: | | | | | |
| | | | | Arable | | Pastures and haylands | | Vineyards and orchards | |
| | | | | ha | % | ha | % | ha | % |
| I | Very good | 410,282 | 2.8 | 354,880 | 3.8 | 53,723 | 1.1 | 1,679 | 0.3 |
| II | Good | 3,655,557 | 24.6 | 3,352,683 | 35.8 | 220,061 | 4.5 | 82,813 | 15.7 |
| III | Medium | 3,082,603 | 20.8 | 2,364,014 | 25.2 | 596,608 | 12.1 | 121,981 | 23.2 |
| IV | Poor | 3,628,627 | 24.5 | 1,737,856 | 18.5 | 1,767,352 | 35.8 | 123,419 | 23.4 |
| V | very poor | 4,054,779 | 27.3 | 1,569,898 | 16.7 | 22,88,416 | 46.5 | 196,465 | 37.4 |
| TOTAL | | 14,831,848 | 100 | 9,379,331 | 100.0 | 4,926,160 | 100.0 | 526,357 | 100.0 |

In nature, humus is obtained through the humification of organic matter, which is formed of vegetal waste, litter, liquid manure. Following the biological activity of microorganisms on organic matter under aerobic and anaerobic conditions, all macroelements and microelements are converted to a structural form that is accessible for the nutrition and physiological development of plants.

Degraded and mixed land resulted from industrial activity or other type of activity represents another important issue. Such areas cannot be used without prior suitable treatment. Contaminated land is any type of land that is so degraded by the substances it contains that it represents a major risk for water pollution or other damaging phenomena.

Agricultural activities are another major cause of water pollution, because of improper waste management and the use of fertilizers and pesticides. Underground waters are hardest hit by this type of pollution. Nitrite contamination of underground water is recognized as a major environmental issue in Romania. On a significant percentage of agricultural land, the concentration of nitrites reaches 100 mg/l, getting to a maximum concentration of 300 mg/l, as compared with the maximum legal limit, of 45-50 mg/l.

The existence of these lands requires a complex set of measures regarding soil works, crop rotation and structure, application of lime and chemical fertilizers meant to increase the yield. Thus, on highly acidic land, liming is recommended prior to application of chemical fertilizers or manure. Application of chemical fertilizers without prior liming makes soil fertility even worse, jeopardizing the yield. The economic efficiency of improvement works on acid land is obvious, if one takes into consideration that an improvement cycle is low-cost and it contributes to increasing the medium yield and the net income per hectare. Another negative phenomenon that determines a decrease in soil fertility is **salting**. Salty arable lands come from old rice plantations, or other irrigated lands or lands that were inadequately exploited. Through improvement of these lands, which includes drainage, application of manure, etc, they can gradually be reintegrated in the agricultural circuit.

At the same time, water improvement works and the realization of a drainage system for the evacuation of excess water have a major influence, as through them, land **salinisation** and **sloughing** can be avoided, thus avoiding also their unfavourable on soil fertility. Also, sloping ground is permanently affected by erosion, that is why prevention of soil erosion by agricultural works focused on contour lines and other phytotechnological measures (rational crop placement, use of grass strips, etc) constitutes a very important measure to be used in hilly areas.

The risk of erosion can be reduced through better agricultural management. It is of great importance to reduce the number of land works or even avoid them altogether, and also to avoid works on wet soils. Long-term maintenance of the yield capacity of soils, increasing their fertility and fighting against desertification are primordial strategic tasks of the Romanian nation in its entirety. Land abandonment has been a problem in Romania since 1990. The social and economic conditions that Romanian farmers have to face, as well as land fragmentation are the main causes for this phenomenon. Even the most fertile lands are affected, especially where the plots are small, where there is a lack of agricultural equipment and where the population is old. Abandonment affects local ecosystems and contributes to the degradation of arable land.

The Romanian development policy must be aligned with the priorities of the Common Agricultural Policy developed in the European Union. In this respect, the National Development Plan 2007-2013, developed by the Romanian Government, was directed especially towards the priorities and objectives that are compatible with the intervention domains of Structural Funds, in order to help Romania get access to these funds from the European Union. For this, six national development priorities were formulated for 2007-2013:

1. Increasing the economic competitiveness and developing knowledge-based economy
2. Developing and modernizing the transportation infrastructure
3. Protecting and improving the quality of the environment

4. Developing human resources, increasing the occupation degree and combating social exclusion

5. Developing rural economy and increasing productivity in the agricultural sector

6. Supporting balanced participation of all regions of Romania in the process of social and economic development

**Measures for improving soil quality in Romania from 2007 to 2013**

The National Development Plan 2007-2013 stipulates a set of measures for the ecological reconstruction of degraded land or land affected by pollution and for improvement of soil quality, such as: decontamination of the lands that are contaminated, degraded or present other deficiencies; ecological reconstruction of soils polluted by heavy metals recultivation of the dumps in mining exploitations; retechnologization of mining exploitations; detoxification and rehabilitation of soils polluted by crude petroleum, oil products and residues, by bio-remediation; depollution of soils polluted by mineral oils; prevention and reduction of chemical pollution of soils by heavy metals, sulphur, fluorine, oil residue, pesticiedes, etc and definitization of the reconstruction technologies for the affected lands; rehabilitation of abandoned industrial dumps - slag heaps, ash heaps, phosphogypsum, etc.

Rehabilitation of lands degraded by anthropogenic factors will be accomplished through afforestation, grassing or various other methods. Soil pollution by nitrites will be dealt with by implementation of Fertilization Plans in vulnerable areas. Romania presents particularly serious problems because of natural hazards, such as flooding, drought or landslides.

**For minimizing the risk of and preventing flooding,** the following measures have been proposed: - building artificial lakes and polders; - damming; - regulation of water courses, in correlation with the preservation of wetlands, as well as arranging the slopes; - correcting torrents; - performing afforestation and planting windbreaks; - works against soil erosion and drainage works.

By the end of 2013, 150 new investment objectives will have been realized, in an attempt to limit the damaging impact of floods. In order to reduce the effects of drought and for combating desertification, the government promotes actions for protecting the environment factors in droughty conditions, for the rehabilitation and development of irrigation systems, so that they cover an area of 1.6 thousand ha in 2013. Creating windbreaks is another priority (up to 10000 ha/year).

Drought will have to be fought against also by ecological reconstruction of forests in the areas with high risk of desertification and drought - particularly in Dobrogea, the south of Moldavia and Bărăgan.

Landslide prevention and mitigation is of utmost importance.

In this respect, it is crucial to implement new systems of torrent correction and to secure the existent works through: land stabilization (plantation), afforestation, crop rotation, slope consolidation in accordance with urbanization plans and landscaping plans. It is also vital to apply improvement works for degraded lands in torrential hydrographic basins.

## CONCLUSIONS

1. All proposed measures will eventually lead to the conservation, protection and improvement of the quality of environment, to the protection of human health as well as to sustainable use of natural resources.

2. It is worth mentioning that all these measures are commitments made by the Romanian Government in the process of negotiating the Environment Chapter with the European Union, so that environment protection can ensure sustainable development of society, in compliance with the European Union Strategy and the Sixth Framework Programme.

3. Through its measures, the National Development Plan establishes the directions for distributing public funds to investments with significant impact on the social and economic development from: **internal sources** (state budget, local budgets, etc) or **external sources** (E.U. structural funds, foreign credits, etc), for reducing the development gap between Romania and the rest of the European Union, and also for reducing the imbalance in internal development.

4. In the National Development Plan 2007-2013, Romania stipulates the distribution of money also to agriculture and rural development through the four axes. The measures mentioned in axis 2, *Improvement of the environment and of the rural area*, are directed at sustainable use of agricultural lands and forests through the European Fund for Agriculture and Rural Development, of 1.8 billion Euros.

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