TECHNOLOGICAL IMPACT ON THE ENVIRONMENT AND ECONOMIC ACTIVITY IN A FARM FIELD

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Abstract
Under current conditions, the agriculture must relies to requirement „green", meaning sustainability for environment, based on amplification of climatic accidents, while the global inhabitants increase too. Therefore, there is necessary to adapt the agricultural management practices to the peculiarities of water shortages, the agriculture being the main potable water consumer. The crops (as component of vegetal biodiversity), managed by the field exploitations, are conditioned by the existence of the fertile soil, too. Together with eroded soil, significant amounts of minerals are leached, which, for the majority of crops could represent high percentage of required chemicals. The intensification of techniques in agriculture generally leads to the amplification of greenhouse gas emissions, major contribution having excessive mechanization. The paper has as aim the analysis and promotion of aspects to achieve soil tillage compatible with proper management of natural resources, under friendly environment and economically efficient conditions. The analysis is conclusive and is based on research data as well as own experience in agriculture.
Keywords:
Soil tillages, erosion, arable, environment, efficiency

Introduction

The agriculture gave the possibility to produce foods by building of agroecosystems. Thus, the size of human being was not controlled by trophic chains of natural ecosystems. Therefore, the scientific base of activity, namely „vegetal production" was step-by-step based on research of life conditions and natural and cultivated communities in frame of ecosystemic concept.

Into the agricultural process, the farmer manages an area, so-called a piece of nature/environment, beginning with soil resource processing. Over an agricultural year, this is under many physical and chemical actions, depending on the requirement of the tested species and farmer skills. Many times, the negative effect of the subsistence and semi-subsistence agricultural exploitations was noticed. These exploitations consist of the largest arable area and have no adequate technological information or working tools.

Thus, this paper calls the attention on water and fertility soil management under the climatic changes and pollution. The soil erosion itself, as pollution factor, leads to the water and minerals leaching, main component of the soil. The arable, predominant into soil structure of Romania, is exposed permanently to the climatic factors and agricultural activities. Utilized under anthropic activity pressure, the soil is not only delayed in natural formation, but according to EU statistics is degraded. Based on these data, measures for eco-economical mechanisms recovering are required.

Romania, by promotion of innovation in crop technology according to EU politics and programs, could contributes to the improvement of environment overall status (overall life framework).

The Earth give us life and we owe our own existence! This sentence was highlighted at the U.N.C.E.D. Conference Rio de Janeiro (1992), where the motto was „everyone must love the nature". Under this context, each farmer must act adequately and economically and ecologically efficient. The paper analyses, based on statistical data, the extension of erosion

towards agricultural area. Therefore, the effect of some soil tillage is analyzed too. These cumulate significant costs into product final price, but the main negative effect is the aspect of sustainability.

1. Materials and method

The soil, alive natural corpus from the Earth's surface, managed by anthropic activities, remarked as valuable resources, namely „Earth". The earth is non-renewable and subsystem of ecosystems and offers goods and services to the people. This aspect, increasing numerically (social indicator with main role regarding environment, respectively with harmfull effect on biodiversity), leads to the conclusion that the implication into economical increasing makes pressure on terrestrial ambient.

Therefore, step-by-step, modification into land utilization had occur, limited water supply has extended (water shocks), gas emissions (increasing CO_2 emissions is relevant in relationship with global warming) lead to the raising of average global temperature and the glaciers melt (with repercussions on raising of sea level and human expectations).

Generally speaking, the intensification of agricultural practices (vegetal and animal) led to the amplification of gas emissions. In this respect, Wijkman A. And Rockström J. (2013) stated their values to to 17% of the total. Therefore, the danger at planet level, could be diminished by the carbon capture into vegetal yield obtained by „green revolution", the only way to maintain the biodiversity, to save the water resource and to adequately manage the nutrients.

All these take place at the surface, where the farmer manages its production activity.

The diversified soils in Romania make necessary the application of various soil tillage systems, proper to each crop, established depending on the features, such as texture, loosening degree, moisture, erosion.

At the beginning, the criteria of soil framing into soil tillage system were established (conventional, conventional on curve level, conventional with deep loosening, reduced on sandy soils, ets.). Anyway, it is essential to better know the soil and the limiting yield factors (table 1).

Table 1 Limiting factors of productive capacity of arable Romanian (2005)

The limiting factor	**Arable land, thousand ha**
Soil erosion by water	2100
Soil erosion by wind	273
Excessive frame above the ground	52
High alkalinity	135
Soil compaction due to improper work ("tilling")	6500
Primary soil compaction	2060
Scaling	2300
Book low-extremely low humus in the soil	4525
Strong and moderate acidity	1867
Providing low and very low mobile phosphorus	3401
Providing low and very low mobile potassium	312
Providing low nitrogen	3061
Deficiencies of micronutrients (zinc)	1500

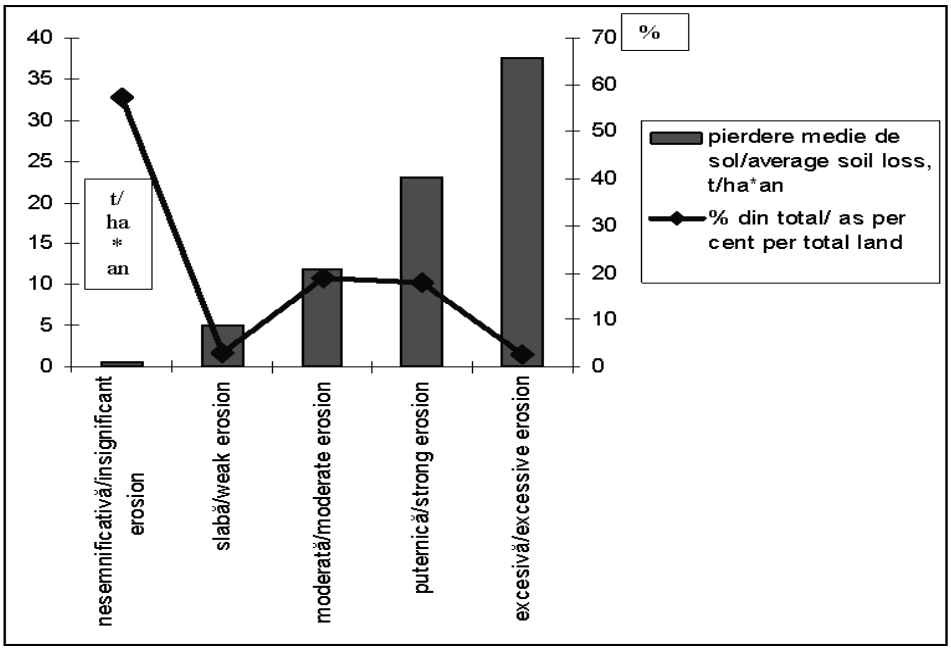
Source: www.anpm.ro, 2016

The specific values could not be cumulated, because on the same area, there were more many limiting factors. These factors must be properly identified to intervene by melioration and positive influence of the productivity.
The exploitation of the agricultural fields starts with preparing works of the plots, such as plot size and fertility, then mechanical intervention.

Table 2 Models of soil tillage on areas of agroecological favorability and according to organic farming technologies

Agroecological zone	Soil tillage
Steppe and silvo-steppe areas	- summer plowing performed after preceding crop harvesting; - harrowing to maintain the soil loosening; - autumn deep plowing (25-30 cm); - shallow tillage to prepare soil for sowing, to reduce soil evaporation.
Forestry areas	- arable layer mobilization by surface plowing or other special tillage with certain equipment; - in the case of heavy argilluvial soils, specific tillage, such as sub-soiling works are performed; - loosening tillage.
Arable land with slopes	- plowing on general direction of level curve reduces with 60-70% annual average leaching and soil looses are 2-9 times reduced versus hill-valley plowing (Onisie, Zaharia, 2002); - special tillage (upstream overturning furrow) are required; - deep plowing is required on fields under erosion; - subsoiling plowing on weedy sois; - strip plowing to reduce water drainage slope; - for bed preparation, to prevent erosion, surface tillage are performed on level curve direction; - minimum soil tillage system is required.
Sandy soils	- no plowing is possible (Onisie, Zaharia, 2002); - alternative deep plowing with surface ones; - superiority of overturning furrow plowing; - deep plowing for only manure fertilization and strongly weedy fields; - dominant wind-perpendicularly plowing; - harrowing, if necessary, before sowing; - bed preparation; - not too many tillage.
Saline and alkaline soils	- subsoil plowing – good alternative for weak soil nutrients; - normal plowing versus arable layer overturning (Onisie, Zaharia, 2002);; - bed preparation are the same as for other areas.
Drainaged and dammed soils	- deep plowing, at 28-30 cm, in summer or in autumn; - harrowing in spring with different equipment; - deep plowing followed by frequent harrowing; - loosening works.

As regards the soil tillage (it needs equipment, fuels, non-renewable energy with gas emission releasing) we must take into consideration the effects on physical, chemical and biological features of the soil resources. The soil tillage are systems for winter crops, spring crops and successive ones, minimum soil systems with no plowing, with differentiations based on many criteria, one of them being the agroecological one (table 2).
The excessive mechanized traffic (no of works and their repeatability) contributes to the anthropic compaction, which, besides the reminisce influence on soil features and yield are mechanically removed. The intensification of soil tillage contributes to the erosion.
The erosion is an unavoidable phenomenon attached inadequate agricultural practices (fig. 1).

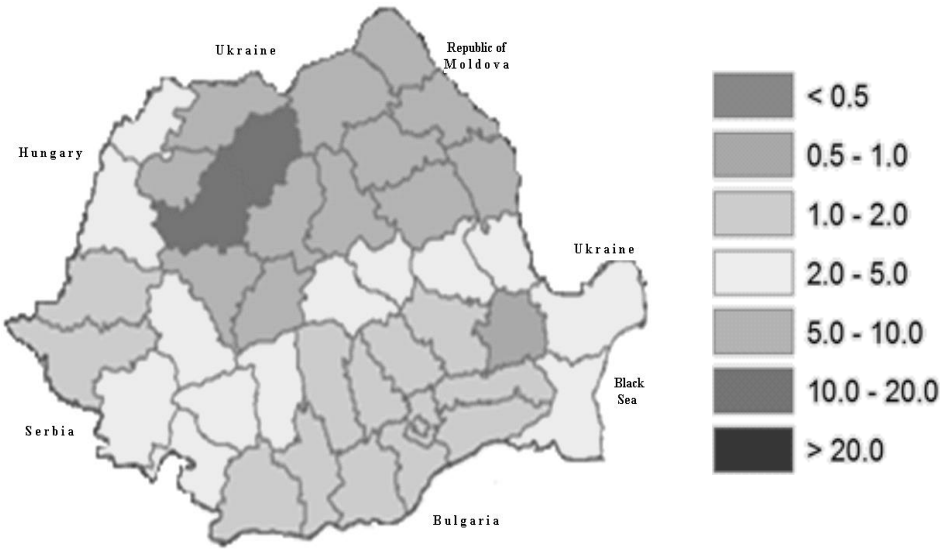


Source: processing after The Institute for Soil and Agrochemical Studies, OECD, 2000

Fig. 1 Intensity of erosion on agricultural lands in Romania

One can ascertain that on 57.4% of agricultural land, the erosion losses are insignificant (0.5 t soil/ha*year). On the other hand, the excessive erosion (37.5 t soil/ha*year) was noticed on only 2.6 % of arable land. The average rhythm of erosion and its variations per pedolitological frames and cultural systems are achieved with universal formula of soil erosion, by Wischmeyer. This was modified by Moţoc (1995), who, for Romania, has established the allowable loss at maximum 5-6 t eroded soil per 1 ha agricultural land.
Recent Statistics at EU – 28 level presents the situation of erosion in Romania (fig. 2) versus previous statements. For the arable land in plane areas, the annual average erosion is about 5 t soil/ha.
The researchers during 1980 and 2010, on the east of Romania, are framed as values in EU coordinates (annual average values regarding the soil erosion of 0,25 t/ha, in field previously. Cultivated with grasses and of 8,39 t/ha, in maize crop) (Bucur et. Al., 2011).
The used material is mainly that from references and statistics, but as results of experiment, too, and the utilized method is proper to economic research.

Data were processed by classical methods, followed by analysis, the synthesis leading to the final conclusions. The conclusions could be a decisional argue to design the technological steps with economic and environmentally impact.



Source: Processing after Joint Research Centre, European Commission, 2010

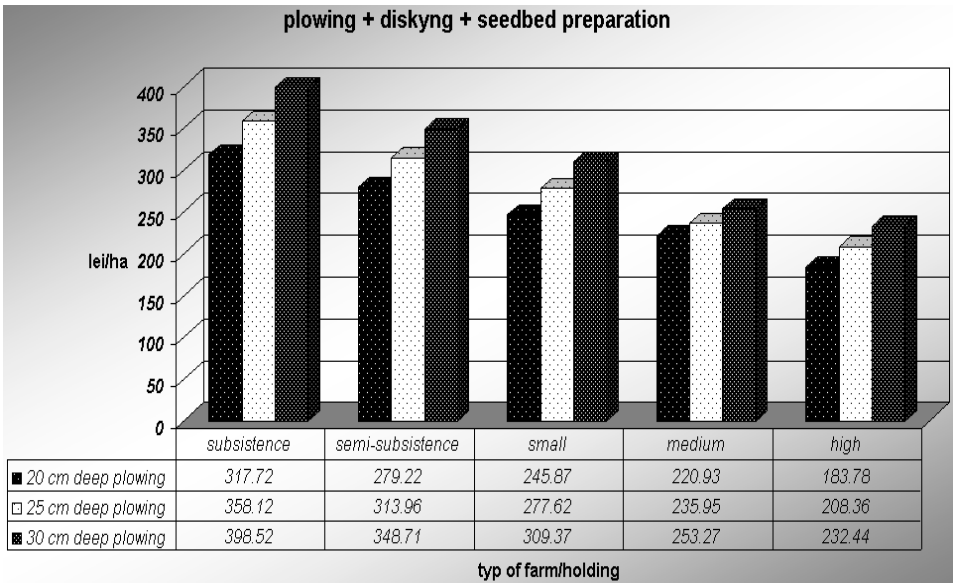
Fig. 2 Erosion soil degree in Romania, t/ha·year (2010, UE-28)

2. Results and discussion

The soil tillages contribute to the soil erosion, by number, repeatability, depth and overturning, speed and direction of travel.

The initial conventional technique has based works (plowing), surface and bed preparation ones (before sowing). The expenses are calculated depending on the fuel consumption, equipment wear and mechanized payment (fig. 3).

As an example, on predominant farms in Romania, with small areas and low mechanical endowment, one can ascertain that the highest expenses are related to preparation for sowing. Among them, over 50% represent the plowing (fig. 4).



Source: Processing after www.madr.ro, 2016

Fig. 3 Standard costs/ha of soil tillages in different size exploitations

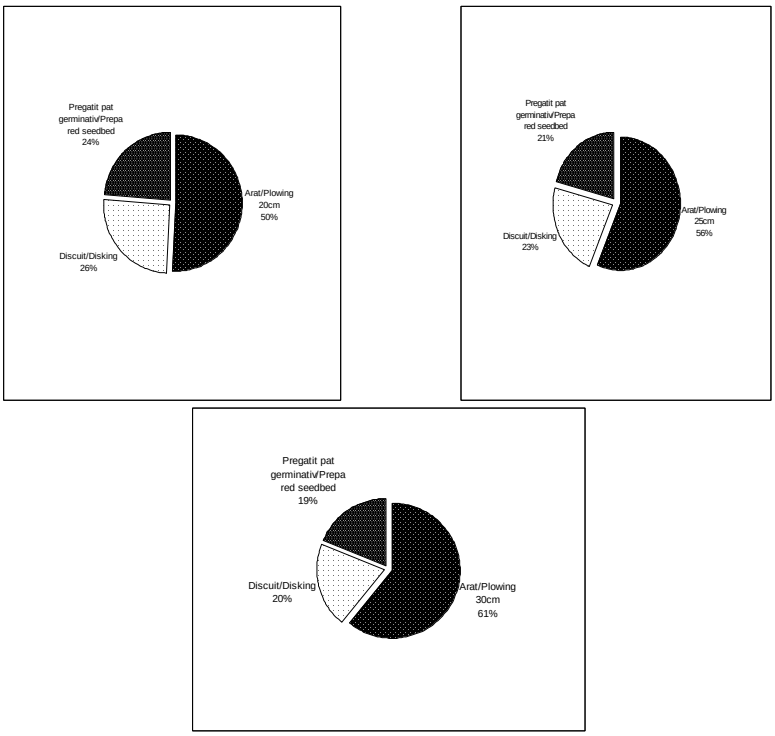
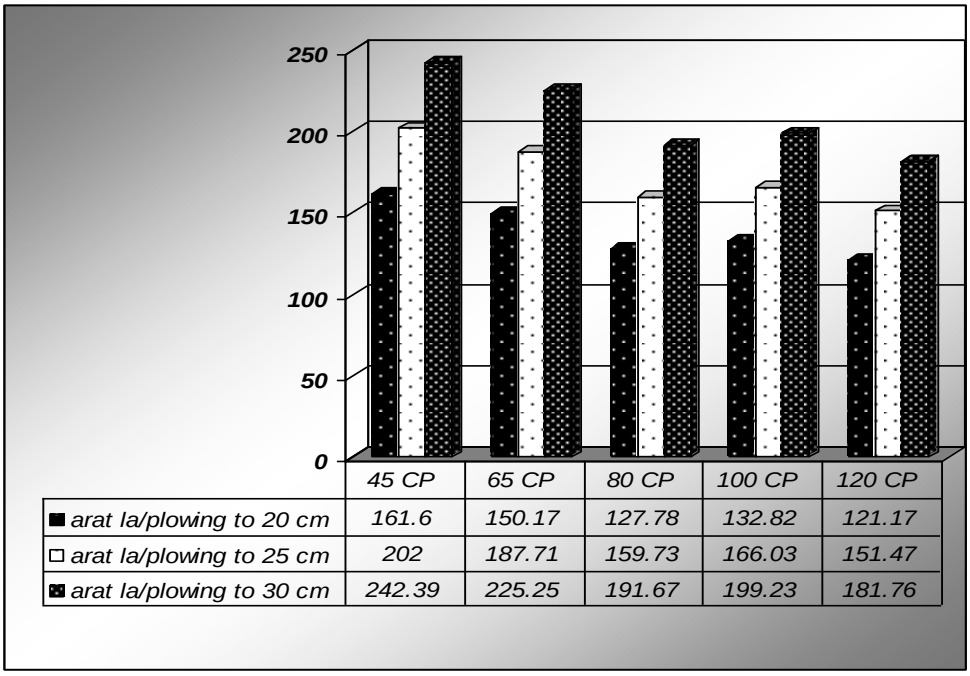


Fig. 4 Costs soil tillage in the subsistance and semi-subsistance farms

As the area increases and the exploitation has more performance, with good and specialized mechanical endowment, the expenses for plowing is decreasing (fig. 5) with 75 %.
Having in view minimum tillage and sowing after cutting, it's obvious that the expenses diminish too, and the system takes part of friendly-environmental practices (GAEC). For example, in small cereals:
- conventional wheat – fuel consumption for soil tillage represents 65.55 % of total consumption/ha;
- conventional maize – fuel consumption for the same work represents 75.21% of total consumption/ha.



	45 CP	65 CP	80 CP	100 CP	120 CP
arat la/plowing to 20 cm	161.6	150.17	127.78	132.82	121.17
arat la/plowing to 25 cm	202	187.71	159.73	166.03	151.47
arat la/plowing to 30 cm	242.39	225.25	191.67	199.23	181.76

Source: Processing after madr.ro, 2016

Fig. 5 Standard cost/ha in ploughing with different complex machines

Conclusions

The soil tillage have effect on biological activity of soil (loosening), of hydric regime (more or less profound mobilization; possibility to replace plowing with surface tillage), but regarding the soil nutrients (incorporation or not of vegetal residues).
Together with eroded soil, significant mineral amounts are leached, which, for the majority of crops could represent 12-14% of necessary amount of chemical fertilizers. As follows, the elaboration of optimum soil tillage system, with minimum losses by erosion, for each crop, must takes into consideration the possibility to sown in no-tillage soil, the best variant.
Practically speaking, by achieving loosening, through „zero tillage" system, as variant of minimum soil tillage system, the maize could be sown after any preceding crop, such as perennial grasses. The vegetal cover at surface is considered as moulch, protecting the soil against erosion.
However, noting that the loss of soil through erosion is significantly higher in cultures hoe, to perennials.

The minimum soil tillage systems with the diminish of the work intensity have energetic and economic efficiency and are depend by the mechanical endowment.
If you proceed to a work of unblocking, vertically, every 4 years and eliminate the annual plowing, the earth will recover its porosity; normally, the expenses would be considerably reduced. Simultaneously, on one hand, the fuel consumption and CO_2 emissions will be reduced, while on the other hand, the physical negative effect of mechanization will be reduced, especially on erosion.

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