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Soil organic matter transformation -the basis for transition to a regenerative agriculture

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The dominant industrial model of agricultural intensification based on unreasonable high inputs of nonrenewable sorces of energy and their derivates(mineral fertilizers,especially nitrogen,pesticides etc) didn't provide a sustainable development of agriculture from economic,ecologic and social points of view.More than this,the model is in deep contradictions with the principles of regenerative agriculture,which suppose regenerating life in the soil through a larger biodiversity both above and under the soil surface and closer recycling of energy and nutrients in the frame of each farm.

Researches in the long-term field experiments with crop rotations and monocultures on typical chernozems of the Balti steppe,Republic of Moldova,proved lack of correlation between the total and labile fraction stocks of carbon and nitrogen and productivity of crops.The difference was found in the quality and turnover of nitrogen from the labile fraction of soil organic matter(SOM).

For example,the stocks of labile fraction of carbon, for 0-20 cm soil layer, in crop rotation with and without perennial legumes have consisted 19,5 and 16,4 t/ha,which makes up 26,7 and 25,8 %from the total stocks of carbon,respectively.The stocks of labile fraction of nitrogen have consisted 0,50 and 0,86 t/ha or 8,1 and 14,4 % from the total stocks of nitrogen,respectively.

The quality of the labile fraction of SOM was quite different.C/N ratio for the labile fraction of SOM in the crop rotation with perennial legumes and without perennial legumes have consisted 39,0 and 19,0 ,respectively.The share of mineralized nitrogen for yield formation from the labile fraction of total nitrogen in crop rotation with and without perennial legumes have consisted 19,6 and 7,4 %,respectively.So,the turnover of nitrogen from the labile fraction of SOM is at least twice higher in crop rotation with perennial legumes versus crop rotation without perennial legumes.A close correlation was found between the amount of fresh crop residues returned to the soil and crop yields(r=0,987).

More fresh organic inputs make SOM younger and prone to higher rates of mineralization relative to lower amount of crop residues.The quality of crop residues is crucial in determining carbon and nitrogen use efficiency.The optimal ratio between biological and technical nitrogen(from mineral fertilizers) should be respected in order to achieve a higher nitrogen use efficiency from mineral fertilizers.

The thermogravimetric analusis done for the extracted humic acids proved the heterogenity of different fractions(labile and stabile) of SOM.The more fresh organic residues are incorporated in the soil the higher are the share of aliphatic and lower the share of aromatic components in the structure of humic acids.Consequenty,regular completion of soil with fresh organic matter(inputs),together with the reduction of mineralizational losses of SOM are the main requirements to the transition to a regenerative system of agriculture on chernozem soils.