

# Innovated retro: Cover cropping and horse traction to combat soil compaction and improve soil fertility

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Photo 1. Heavy draft horse of the Croatian Posavian breed (photo taken from the Radio Novska web-site: <http://www.radionovska.hr/vijesti/2067-9-izlozba-konja-pasmine-hrvatski-posavac.html>)

**Abstract:** Soil compaction becomes an increasingly important issue in modern agriculture of industrialized economies. It adversely affects many components of soil fertility, like the capacity to store water for drought periods, to provide a proper drainage and aeration of roots, to ensure the richness of soil biota, thus creating a favorable environment for plant growth. Many researches have indicated that the main causes for soil compaction are the use of heavy machinery and loss of soil organic matter. On the other hand cover cropping has been recognized for decades to recover many components of soil fertility, especially the richness of soil biota, the soil's penetration resistance, the capacity to store water and nutrients, and the resistance to compaction induced by agricultural machinery. However, the restoration of soil fertility traits through cover cropping alone may not be completely satisfactory and fast enough. Therefore research on the effect of animal traction on soil fertility traits in agriculture could be rewarding. The support for this idea comes from the recent findings that horse traction in agriculture prevents soil compaction magnitudes found in modern mechanized farming. Since there are no available data on the combined effects of horse traction and cover-cropping to the soil fertility and compaction issues, the authors consider that research in field trials on this subject is needed. The prospective field trials would provide not only data about the aspects mentioned above, but also about daily work outcomes, needs for human labor and economics of this kind of reviewed traditional way of agriculture. The obtained data could serve for further projections of impacts to the people's welfare, national and regional economy, farming sustainability and environment protection.

**Key words:** soil compaction, soil fertility, farming sustainability.

**Material and methods:** Data concerning the topics were collected via literature review and thereafter subjected to a structured synthesis. New conclusions were brought by logical induction and deduction.

**Results and discussion:** According to Soane and van Ouwerkerk (1994.), soil compaction induced by heavy machinery has become a problem of worldwide importance during the last 50 years and it is just a part of the complex of problems which also includes the degradation of the soils' physical, chemical and biological characteristics. Soil compaction usually is more pronounced in soils with low organic matter content and where the tillage and traffic occurs at high soil moisture (Hamza and Anderson, 2005.). Soil compaction seriously affects the soils' capability to absorb the precipitated water and store it for the periods of shortage thus enhancing the effects of drought.) It also reduces the activity of soil microorganisms (Hamza and Anderson, 2005.), impedes the plant root penetration (Horn et al., 1995.) and negatively affects the plant nutrition.

It is long since established that cover-cropping and green manure may alleviate the majority of problems associated with soil compaction and loss of fertility. According to the synthesis produced by Thorup-Kristensen et al. (2003.), cover-cropping and green manure increase the soils' aggregate stability, soil porosity and subsequent root growth. According to the same synthesis, several years with frequent cover-cropping may increase soil microbial biomass by up to 60% and more than double the count of arthropods.

However, even if farmers use cover-cropping and green manure, the repeated passage of heavy machinery will repeatedly cause soil compaction. According to the recent preliminary research of Garcia-Tomillo et al. (2016.) in Portugal, animal traction may offer an alternative option which will cause lesser compaction effects than tractorized machinery. Namely, they have found that traction with donkeys didn't increase the soil's bulk density, while the tractorized did it slightly (but still statistically insignificant). Furthermore, they have found that the animal traction has increased the saturated hydraulic conductivity of soil, while tractorized traction has reduced it.

With respect to the above, we anticipate that the combined effects of animal traction and cover cropping could give an even greater advance to the recovery of soil porosity, water-holding capacity and general fertility, when compared to the effects of single factors. Therefore we deem it would be worthwhile to carry out field trials to elucidate the combined effects. Furthermore, these trials could help to update our knowledge about the working capacity of horses and about human labor in horse-powered agriculture.

In the trials with horse traction there should be used heavy draft horses (Photo 1), which were traditionally employed in field work. Considering the eventual skepticism about feasibility of horses to give a power for some modern agronomical operations, the photos 2 to 6 can prove that horses are quite appropriate, even in the 21<sup>st</sup> century.

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Photo 2. Plowing-under a buckwheat cover crop with horse traction (photo taken from the Ruby & Amber's Farm web-site: <http://www.rubyandambers.com/our-animals/>)



Photo 3. Cultipacking with horse traction (photo by Mr Erhard Schroll)



Photo 4. Drilling with a horse-pulled cereal drill (photo by Mr. Erhard Schroll)



Photo 5. Discing a grassland by horse traction (photo by Mr. Erhard Schroll)



Photo 6. Planting Buckwheat with Ken's Horse Drawn no-till Drill (photo taken from the Orchard Hill Farm web-site: <http://www.orchardhillfarm.ca/?cat=1&page=3>)