Geophysical Research Abstracts
Vol. 14, EGU2012-739, 2012
EGU General Assembly 2012

Agricultural machineries wheeling and soil qualities mapping in climatic changes conditions

S. Bergonzoli and P. Servadio

Agricultural Research Council - Agricultural Engineering Research Unit (CRA-ING), Via della Pascolare,16 - 00016 Monterotondo, Rome, Italy.

As argued in the Fourth Assessment Report of the UN International Panel on Climate Change (IPCC) published in 2007 the global climate is changing and will continue to change in the near future. Due to the changing in time distribution and intensity of rainfall, the available time to carry out soil tillage operations, seedbed preparation and fertilizers distribution is becoming shorter.

These issues are worsened by soil compaction that is one of the major problems facing modern agriculture. Soil compaction impedes infiltration of rainfall, so the increasing scale of mechanization might well be responsible for greater runoff, soil loss by water erosion and water-logging. Overuse of machinery, intensive cropping, short crop rotations, intensive grazing and inappropriate soil management leads to compaction.

The objective of this research was to study the compacting effect of two wheeled tractors fitted with different type of tires during fertilizing operations with soil water content over field capacity.

Field tests were carried out in a farm near Rome (41°52'502" Latitude (N); 12°12'866" Longitude (E)) in March 2010 on a clay soil (Vertic Cambisol) during wheat fertilizing. One tractor was fitted with very narrow and high aspect ratio tires with mounted broadcaster coded (WTN), the other tractor was equipped with extra large and low aspect ratio tires with trailed broadcaster for a total of four axles coded (WTEL). Immediately after fertilising operations, such effects have been quantified through spatial variation of some soil parameters: soil water content, soil penetration resistance (CI) and soil shear strength (SS). Soil samplings have been carried out on the tracks left by the tractors and on soil not interested by the passage (control). To monitor all tractors passes across the field and to compute the total area covered by tractors tires a DGPS receiver was placed into the tractors; to map soil parameters studied, both on tracks left by the tractors passes and on control areas, a software GIS was used.

Results shown the highest level of soil compaction caused by the traffic of WTN in term of CI and SS. In fact, increment ratio respect to the control measured after the tractors pass were: CI = 0.65 and 0.14 for WTN and for WTEL respectively; SS = 0.65 and 0.46 for WTN and WTEL respectively. Comparing the two different tires, significant differences were found particularly in the surface layers (0-0.20 m depth): mean values of CI and SS were higher for WTN (0.47 and 1.60 respectively) respect to WTEL.

Track area covered by the two treatments respect to the whole field (16.32 ha) were: 0.025 for treatment WTN (0.27 m tires width) having an operative work width of 24 m ; 0.075 for treatment WTEL (0.85 m tires width) having an operative work width of 14 m. Results of this study highlighted that, in these field conditions (clay soil, water content over field capacity), tractor pass with very narrow tires caused a soil compaction level too high up to be impossible to traffic into the field. To operate at these soil water content conditions a tractors fitted with low aspect ratio and low inflation pressure tires is necessary. With lower soil water content, narrow tires allow carrying out fertilization into the inter-row avoiding crop trampling and compacting less percentage of field area respect to the a tractor equipped with large tires.

Key words: Tractor, Soil trafficability, Soil compaction, Tires, GPS, GIS.

Acknowledgements

This work was carried out under the auspices of the special project "Sceneries of adaptation of the Italian agriculture to the climatic changes" (AGROSCENARI) of the Agricultural Research Council, and Italian Ministry of the Agricultural and Forestry Politics.