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Improvements of soil quality for increased food production in Norway

Lillian Øygarden (1), Ove Klakegg (1), Trond Børresen (2), Tore Krogstad (2), and Anne Kjersti Uhlen (3)

(1) Norwegian Institute for Bioeconomy Research. Ås, Norway. lillian.oygarden@nibio.no, (2) Environmental Sciences, Norwegian University of LIfe Sciences, Ås, Norway.tore.krogstad@nmbu.no, (3) Plant Sciences. Norwegian University of LIfe Sciences. Ås, Norway. anne.kjersti.uhlen@nmbu.no

Since the 1990ties, agricultural land in use in Norway has diminished and yields per hectare for cereals and forages have stagnated. An expert panel appointed to advice on how to increase Norwegian grain production emphasizes low profitability and poor soil quality as limiting factors. A White Paper from the Norwegian Government, Report No.9 (2011-2012), stated that the main goal for the agricultural sector is to increase food production proportional to the expected increase in population (20 % by 2030) in order to maintain self-sufficiency at the present level.
This is the background for the interdisciplinary project AGROPRO "Agronomy for increased food production - Challenges and solutions" (2013 - 2017)" financed by the Norwegian research council. A mail goal is seeking possibilities for improvements in agronomic practices for increased and sustainable food production and to identify drivers and challenges for their implementation. Are the key to higher yields hidden in the soil? The paper present an overview of the research activities in the project and some results of the improvements of soil quality to minimize yield gap in cereal and forage production.
Detailed new soil maps provide soil information on field scale of soil quality and the suitability for growing different crops like cereal production or vegetables. The detailed soil information is also beeing used for development and adaptation of the planning tool «Terranimo» to reduce risk of soil compaction.The farmer get available soil information for each field, provide information about the maschinery in use- tractors and equipment, tyres, pressure. The decision tool evaluate when the soil is suitable for tillage, calculate the risk of compaction for dry, moist and wet soil. New research data for compaction on Norwegian clay and silt soil are included.
Climate change with wetter conditions gives challenges for growing cereals. The project is testing genetic variation in cereals for tolerance to water logging and soil compaction. Several hundred different varieties for barley, oat and wheat are being waterlogged and resulting effects studied, also illustrating the need and benefit of cooperation between soil science and plant science (plant physiology).
Field studies of functional root depth and root development is performed for studies of nutrient use efficiency of nitrogen and phosporus. Isotopic studies (15N) and DGT(diffuse gradients in thin films) are performed in long term experiments. Different rooting depths are studied in relation to effect of cutting regime of grasland, trafficking.
The project perform new measurements of (N2O) emissions from long term cropping system experiments with different crop rotations, cultivation practice and fertilizing strategy. This can give better understanding of agronomic practices, nitrogen use efficiency and (N2O) emissions. The environmental effects of agricultural production is also dependent on the microbiological soil conditions.