

# MACHINES CONTRIBUTE TO THE SUSTAINABILITY OF AGRICULTURE

Machines play a key role in producing high, safe and affordable agricultural yields. In developed countries, farmers represent only 3% of labour force but, thanks to machines, they can produce enough food for all, while saving human resources which are employed in other sectors. The following researches show only some spot examples of how agriculture machinery are improving their capability of respecting the environment, with no compromise for their high performance.

## Automation allows to tailor crop management operations

Among the most advanced objectives of current research there is the development of technology able to adapt the operation of machinery to the specific needs of field plots, or even of the single plant. This approach is called precision (or site-specific) agriculture, and to implement it suitable sensors to detect crop's stress signals - as water or nutrient shortage, or attack by pathogens - are being studied.



By measuring specific features (such as optical, electrical, mechanical proprieties) of plants or soil and by integrating this data with agronomic or physiologic information, it is possible to precisely apply water and chemical when and in the amount needed by crop. To carry out precision agriculture



operations, automatic systems (i.e. components able to work without direct command by the farmer) are being developed. We say that these devices are making new smarter generations of agricultural machines. For some operations, we have even developed real field robots!

## Crop protection sprayers

At least 30% of the world's agricultural production is lost

due to environmental adversities, especially for attacks of pests, viruses, bacteria and fungi. Crop protection is still mainly ensured with plant protection treatments, i.e. the distribution of chemicals through sprayers, distributing the active

ingredient mixed with water. Like for drugs for human use, if used improperly also plant protection products may be dangerous. Therefore, in modern sprayers specific devices to reduce the drift (dispersion of the pesticide in the air and on the ground) were designed and developed, to increase the effectiveness of treatment and preserve the environment and the farmer from unnecessary exposure to the pesticide, assuring at the same time the health for the final consumer.



## The reduction of agricultural soil compaction

Among other factors, the best plants growth is ensured by the root efficient absorption of the nutrients diluted in soil liquid solution. In this view, the quality of the agricultural soil physical structure should be maintained at its best level, to allow adequate movement of water, nutrients and air, ideal for the optimal development of the roots. On the

other hand, to ensure a sufficient production at affordable cost, modern agriculture is based on machines that are increasingly large, powerful and heavy. The frequent pass over the field results in a significant increase of soil compaction, resulting in a progressive reduction of crop yields. To reduce the negative impact of the compaction, wide tires inflated at low inflation pressure have been fitted on machinery, as far as the execution of different tasks in a single step and the activation of cultivation methods at low mechanization intensity.



## The impacts of mechanised operations on the environment

Approximately 20% of the whole GHG (greenhouse effect gases) emissions are related to agricultural activities. The use of machines involves remarkable **environmental impacts** that can be mainly reduced by lowering the consumption of fossil fuels and other materials (water,

fertilisers, herbicides, etc.). Nowadays, thanks to the Life Cycle Assessment approach, the sustainability of agricultural



processes can be accurately measured. For example, considering soil tillage, to plough by a slatted plough (instead of the traditional one) the environmental load can be reduced as follows: -14% GHG emissions, -11% soil acidification and freshwater eutrophication, -16% particulate matter formation. Considering only the entire Italian arable land it means to avoid the emission into atmosphere of 60,000 tons of CO2 per year.

