Autonomous Mowers: a Smart Solution for Turfgrass and Conservation Agriculture

Marco Fontanelli, Lorenzo Gagliardi\*, Mino Sportelli, Christian Frasconi, Michel Pirchio, Andrea Peruzzi, and Michele Raffaelli

Dipartimento di Scienze agrarie, Alimentari e Agro-ambientali, Università di Pisa, Via del Borghetto 80,56124 Pisa, Italia; marco.fontanelli@unipi.it; mino.sportelli@phd.unipi.it; christian.frasconi@unipi.it; michel.pirchio@for.unipi.it; andrea.peruzzi@unipi.it; michele.raffaelli@unipi.it; \*Correspondence: lorenzo.gagliardi@phd.unipi.it

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**Abstract.** Autonomous mowers are battery-powered automatic machines able to cut the grass without the need for a human operator. Autonomous mowers can save labour time, reduce noise when mowing, eliminate local emissions, cut in rain, reduce soil compaction due to the low weight, mow safely on slopes (up to about 70%), follow a daily mowing plan to keep the turfgrass height constant, reduce the energy consumption. The most common commercial models can mow an area from 250 m2 to 5000 m2 and are made for private, albeit very complex, gardens. However, the interest in the application in industrial green areas, public green areas, sport facilities and sod farms is increasing. In the latter cases, specific models are able to cut a few hectares. The working area is commonly defined by a buried electric boundary wire which works like a fence, but more advanced models can use the RTK GPS technology to set up a virtual boundary without the physical wire. The trajectories are usually linear and random, as the turning angle is random when the mower reaches the boundary or an obstacle. Models for large areas and sport turf can mow systematically using the RTK GPS technology. Autonomous mowers can also be used for weed control and cover crop management in orchards, vineyards and vegetable crops in conservation and herbicide-free farming contexts. Since 2015 the Department of Agriculture, Food and Environment (DAFE) of the University of Pisa (Italy) has been testing autonomous mowers in different scenarios like cool season and warm season turfgrass species, vineyards and vegetable crops. The first studies on Tall Fescue grass showed that a daily mowing plan of the turfgrass with the autonomous mower was able to increase the turf density and quality and decrease the primary energy consumption with respect to a weekly mowing plan with an ordinary walk-behind mower. Good results on overall turf quality and shoot density were also obtained with a prototype for low cutting height (1.2 cm) on Manila Grass. A prototype provided by Husqvarna AB (Sweden) showed a better turf quality using systematic vs random trajectories in case of very high cutting height (90 mm) in Tall Fescue grass. Promising results were also obtained in organic and conservation agriculture for cover crop and weed management in vineyard, globe artichoke, cauliflower and eggplant. In these case studies the autonomous mowers with random trajectories were able to reduce weed biomass and energy consumption compared to the ordinary strategies.