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Editorial

Design and Application of Agricultural Equipment in Tillage Systems

Mustafa Ucgul [1,*] and Chung-Liang Chang [2,*]

1 Faculty of Science and Engineering, Southern Cross University, Lismore, NSW 2084, Australia
2 Department of Biomechatronics Engineering, National Pingtung University of Science and Technology, Neipu, Pingtung 91201, Taiwan
* Correspondence: mustafa.ucgul@scu.edu.au (M.U.); chungliang@mail.npust.edu.tw (C.-L.C.)

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Due to the rapid increase in world population, the demand for food has increased dramatically. Climate change, labour shortage, and aging problems cause insufficient food supply. Agricultural technologies and farming systems need to be improved to meet the increased demand. Tillage systems are essential for food production and significantly affect crop production. A significant amount of the energy (from fuels) used in crop production is also expended in tillage systems. This energy use increases greenhouse gas emissions. The energy used in tillage systems must be reduced, and the efficiency of tillage tools must be improved to achieve sustainable farming practices. This can help farmers manage their farms better, reach high productivity, save resources, and achieve high-quality food production value. Therefore, designing new tillage systems or optimising existing systems is essential. This Special Issue involves 29 papers—27 research and 2 review articles—from different countries on 6 continents and has eminent research focusing on improving, analysing, and designing tillage systems.

Tractors or related power sources are the main components of tillage systems. Increasing the efficiency of tractors or developing tractor systems can significantly help to reduce power consumption and increase the efficiency of using tillage systems. Therefore, the contributions of [1–6] in this Special Issue focused on developing tractors or their relevant components. The authors of [1,3] investigated the control features of unmanned electric tractor platforms and unmanned self-powered robot trailers, respectively, while in [2,4,5], the authors mainly focused on tractor transmissions.

No-till or minimum-till seeders are vital parts of tillage systems. The authors of [7–16] investigated several seeding systems and their components. No-till planters were researched in [7,8,12,14], while the authors of [9–13] focused on the components of tillage systems either using experimental studies or a computer modelling approach, particularly with a focus on discrete element method (DEM) modelling. Another contribution [15] is considered the only study on pot seedling transplantation in this Special Issue. A detailed review of the DEM modelling of furrow openers was also conducted in [16].

Soil-tillage equipment has a vital role in crop production. There are different tillage tools available for various purposes. In this Special Issue, the authors of Cao et al. [17] designed a residual film-picking device to collect residual films (mulch) from the soil, while an arc-shaped nail-tooth roller-type machine was tested and optimised in [18]. With a similar approach, a cotton recovery device was also designed and tested by the authors of [19]. In [20], the authors designed the spiral soil separation mechanism of compound planters using DEM, while in another contribution, the authors designed a well-cellar cavitating device [21]. The analysis of disc ploughs using DEM–MBD coupling was conducted in [22]. In the study of [23], tillage depth was verified using a machine learning approach. A general review of the application of computational intelligence methods in agricultural soil–machine interaction was also presented in another contribution [24].

Weed control is important for improving crop production. A mechanical control method for precise weeding based on deep learning was studied in [25]. Soil compaction significantly reduces crop yield. In this Special Issue, the effects of tyre configuration and axel load of a four-wheel tractor on soil compaction under no-till systems were investigated by the authors of [26]. Soil compaction from wheel traffic under three tillage systems was studied in another contribution [27].

Due to working conditions, tillage tools are prone to wear. In their article, the authors of Gulyarenko and Bembenek [28] proposed a method to calculate the ploughshare's durability for increasing the service life of tillage parts. In Wang et al [29], the authors constructed a harvester's dynamic model of straw throwing and analysed the factors affecting the straw throwing width to create conditions for the smooth implementation of straw returning to the field, which is particularly important for straw management during seeding.

In summary, the studies amassed in this Special Issue reflect the current status and recent development in tillage systems. The guest editors hope that this Special Issue is helpful for researchers and industry experts in this field.

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