Fertigating maize with proper separation systems for the valorization of digestate

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**Abstract.** In the framework of the project LIFE ARIMEDA “Ammonia emission reduction in Mediterranean agriculture with innovate slurry fertigation techniques” (Life16 ENV/ES/000400) the aim of this study is to give insights about the performance of filtration systems developed to fertigate maize fields with digestate. In general terms, fertigation can enhance the nutrient use efficiency by applying fertilizers during the crop growing cycle, and has the potential to reduce ammonia emissions. To make it feasible, however, a proper solid–liquid separation system is fundamental to avoid nozzle clogging. In this study, the technical performance of four full-scale filtration systems installed in four farms of Northern Italy was evaluated. Of these farms, two were equipped with driplines and two with center pivots. Prior to fertigation, solid-liquid separation of digestate with screw-press separators occurred in all farms. Afterwards, different separators were used to remove the fine solids: for the drip irrigation, a microfilter and a vibrating screen were used, while for the pivot was used a vibrating screen. During field tests were recorded digestate volumes, electricity consumption and manure characteristics along the treatment (total solids and nutrients). Mass balance, Separation index Et(x) and Reduced Separation Index Et’(x) were quantified to assess the performance of the filtration systems.

The resulting performance depended on the type of separator, initial TS content, screen size, and input flow rate. The Et(x) of the separation systems for drip irrigation ranged from 36% to 84% for TS, and from 10% to 79% for nutrients, while the Et(x) reached in farms with pivot systems ranged from 25% to 65% for TS, and from 7% to 52% for nutrients. Electricity consumption was higher for the microfilter (1.77 kWh/m3) than for the vibrating screen (0.12-0.26 kWh/m3). A filtered digestate flow rate of 2.4-7.1 m3/h and dilution ratio of 4-10% can be adequate for both irrigation systems. To implement fertigation effectively using digestate, the separation system and the irrigation system need to be well integrated. Finally, proper management choices of fertigation (e.g., driplines positioned few centimeters below the ground level, use of low pressure sprinklers for pivots) can affect also the overall environmental performance.