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Introduction Of Barley Hybrid And Maize At High Plant Density To Enhance Methane Production

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Introduction

In most cases the biogas plants request a feed integration with specific crops and a right combination of crops are often required to maximize the methane yield for hectare. In North Italy, the conventional cropping system for this purpose is triticale followed by maize harvested at dough stage.

The recent introduction of barley hybrids and new maize varieties could offer new opportunities for the supply chain for biogas. Barley hybrids are characterized by higher biomass yield and a lower predisposition to develop of foliar disease if compared to conventional cultivars (Muhleisen et al., 2014, Blandino et al., 2015). Recent maize hybrids are able to withstand higher plant densities and to show greater productive advantage with narrow inter-row spacing that enhance plant equidistance (Testa et al., 2016). In order to evaluate the above mentioned new introductions a research was set to compare different double cropping systems, based on winter cereals with different harvesting times followed by maize, cultivated under conventional and high plant population on yield and on methane production.

Materials and Methods

During 3 growing seasons (2014–2016), field trials were conducted in North West Italy (Carignano, TO) comparing different treatments according to a factorial design based on four cropping systems and two sowing densities. The tested cropping systems were maize (M) as single crop and maize sowing as double crop after barley (BM), triticale (TM) and common wheat (WM). Moreover, maize was sown at two different plant densities: standard density (StD: 7.5 plants m^{-2} sown at a 0.75 m wide inter-row spacing) and high density (HiD: 10 plants m^{-2} with a narrow inter-row spacing of 0.5 m). The treatments were assigned to experimental units using a split-plot design, with the cropping system as the main-plot treatment and the maize plant density as the sub-plot treatment. The experimental unit was replicated 2 times and it was represented by main-plots having a surface equal to 2000 m^2, in order to harvest the crop with conventional chopper machine.

The silage yield obtained for each crop and harvest was determined by weighing the forage harvested from all the plot surface. The specific methane yield per ton of volatile solid (VS) was measured through the biochemical methane potential (BMP) method. The methane production per hectare was calculated for each cropping system on the basis of the BMP results and the silage yield.

Results

Dough stage was reached earlier on hybrid barley compare triticale (+ 11 days) and wheat (+ 19 days). On the other hand, among winter cereals silage production was higher on wheat (14.9 t ha^{-1}), compare to triticale (13.0 t ha^{-1}) and to hybrid barley (10.3 t ha^{-1}); consequently the methane production was higher on wheat (4550 Nm^3 ha^{-1}) compare to triticale (-17%) and to hybrid barley (-28%).

As expected, the delay of sowing after wheat and, secondly, after triticale reduced the maize for silage yields: compared to the maize cultivated as single crop (21.8 t ha^{-1}) yields were on average -20%, -33% and -47% after barley, triticale and wheat, respectively. Plant density of maize affects yield but its effect was progressively less evident delating sowing time; therefore, as single crop the HiD significantly increased, on average, by 23% the silage yield compared to StD, while in the last two sowing after triticale and wheat, no significance differences were pointed out.

The analysis of cropping systems highlight that the double crop barley + maize(BM) has reached the highest biomass production (32 t ha^{-1}) and methane yield per hectare (9971 Nm^3 ha^{-1}) with a positive effect of maize at high plant density (Figure 1). This treatment showed an increase of methane production of 46% and 18%

compared to StD maize alone and triticale after maize (TM) StD, respectively. However, the use of high plant population in single maize crop system (M HiD) led to methane yield similar to the conventional system based on double-crop system triticale + maize (TM StD).

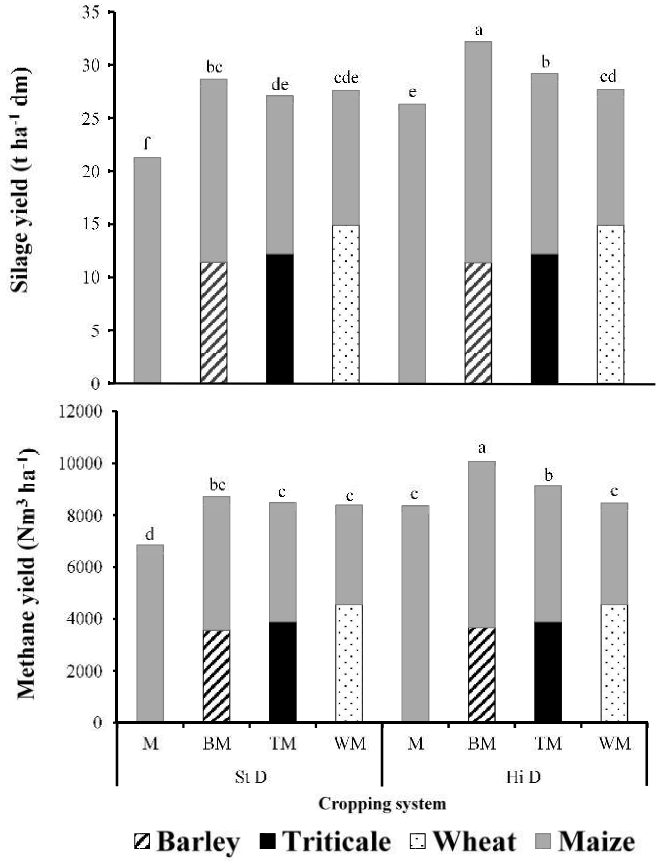

***Figure 1**. Effect of cropping systems based on different winter cereal - maize combinations[1] and maize plant densities[2] on silage yield per hectare. Different letters on bars indicate significant differences (P < 0.01).*
[1] M, single crop of maize planted in spring; BM, double crop with hybrid barley followed by maize; TM, double crop with triticale followed by maize; WM, double crop with common wheat followed by maize.
[2] StD, a standard planting density (7.5 plants m^{-2}) sown at a wide inter-row spacing of 0.75 m; HiD, a high planting density (10 plants m^{-2}) with a narrow inter-row spacing of 0.5 m.

Conclusion

The recent introduction of barley hybrids and maize hybrids able to withstand higher plant density can lead enhancement of silage and methane yield compare the more conventional double-crop system (triticale + maize) at standard density.

References

Blandino M. et al. 2015. La tecnica agronomica per gli orzi ibridi. L'Informatore Agrario 35:43-46.
Mühleisen J. et al. 2014. Yield stability of hybrids versus lines in wheat, barley, and triticale. Theor Appl Genet 127:309–316.
Testa G. et al. 2016. Maize grain yield enhancement through high plant density cultivation with different inter-row and intra-row spacings. Europ. J. Agronomy 72:28–37.