Research Brief: ReUseWaste ESR 6.1

Effect of mechanical separation and slurry additives on oat forage yield and quality in North-West Portugal

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ReUseWaste News
March 2015
No. 17

Intensification of livestock production in North-West Portugal results in large volumes of slurry with limited land for application. An alternative to this challenge is to transport slurry from areas with excess to areas in deficit. The transportation of excess slurry could be cost effective by reducing the volume of slurry needed to be transported. Mechanical separation of slurry may offer a solution to this problem.

Although mechanical separation allows some management advantages at the farm level, there is limited information on their agronomic impacts in the North-West of Portugal. The use of slurry additives such as acidification and nitrification inhibitors has been reported as effective in conserving nitrogen for crop utilisation especially during autumn when the risk of losses are high. However, most studies which investigated the impact of slurry additives on forage yield in this region have mainly been conducted using whole slurry and have rarely considered the impacts of applying slurry additives to the liquid fraction obtained after mechanical separation. The objectives of this study is to evaluate the effect of applying slurry fractions obtained after mechanical separation and slurry additives (nitrification inhibitor (DMPP) and acidification with sulphuric acid) on oat forage yield and quality.

Table 1 Characteristics of effluents at the start of the experiment

Parameters	Treatments			
	Whole slurry	Liquid frat.	Liquid fraction+Acid	Composted solid fraction
pH (H_2O)	8.6	8.6	5.5	8.9
DM (%)	4.8	2.8	3.4	20.0
EC (mS cm $^{-1}$)	4.6	4.8	7.2	1.0
Total-N (g kg $^{-1}$)	5.6	4.7	6.1	5.8
NH_4-N (g kg $^{-1}$)	3.7	3.6	4.3	2.2
NO_3-N (g kg $^{-1}$)	<0.01	<0.01	<0.01	<0.01
P (g kg $^{-1}$)	0.8	0.9	0.9	1.1
K (g kg $^{-1}$)	3.6	3.2	3.6	5.4
S (g kg $^{-1}$)	0.1	0.2	0.7	0.3

The field trial was conducted in Vila Real, North West of Portugal from Nov 2013 to May 2014 and established as a randomised complete block design with three replicates per treatment. The field was previously under maize cultivation (experiment) during summer 2013 with the same treatments as in autumn 2013. The soil is a well-drained sandy–loam soil. The following treatments were studied: whole slurry (WS), liquid fraction (LF), composted solid fraction (CSF), acidified liquid fraction (LFA), acidified liquid fraction with DMPP (LFAI), mineral fertilizer (MI) and a control (C) without nitrogen. All treatments were applied at a rate of 120 kg N ha $^{-1}$. Some characteristics of the effluents are shown in table 1.

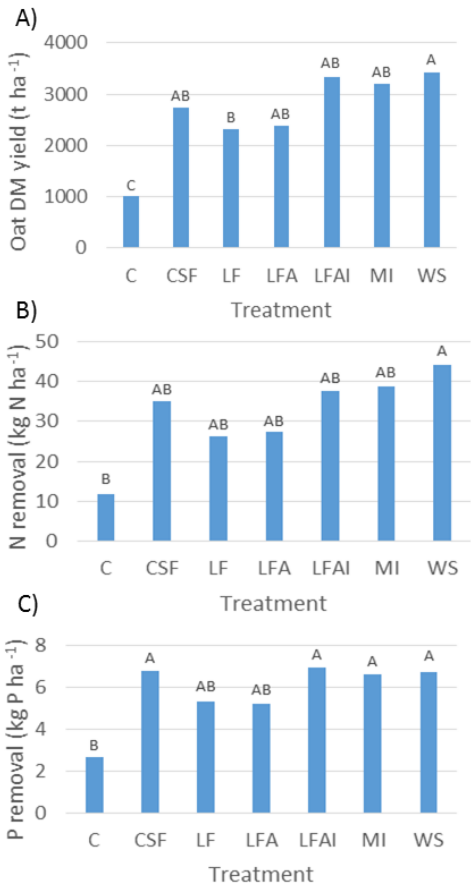

Fig 2. Effect of slurry treatment on oat forage yield and quality: A) Dry matter yield B) Nitrogen removal and C) Phosphorus removal.

The application of the whole slurry increased ($p<0.05$) dry matter yield by 49% when compared to the liquid fraction. This observation may be attributed to the loss of easily available nitrogen in LF after application. However the addition of slurry additives to the liquid fraction increased ($p<0.05$) oats yield to values similar to the whole slurry. This observation may be attributed to the potential reduction in nitrogen losses when additive-treated liquid fraction was applied. Relative to forage quality (N and P removal), no differences were found among nitrogen treatments. This shows there is the potential to achieve the same forage quality (relative to N and P removal) as the conventional treatments (whole slurry and mineral nitrogen) using slurry fractions and additives. The outcome of this study shows that, an increase in forage yield and quality may be achieved as the conventional treatments by applying slurry fractions obtained after mechanical separation and additive-treated liquid fraction in the North-West of Portugal under autumn conditions.

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