Biotransformation of weed to silages by microbial inoculants with high energy and nutritional value for use in sustainable agriculture

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Introduction

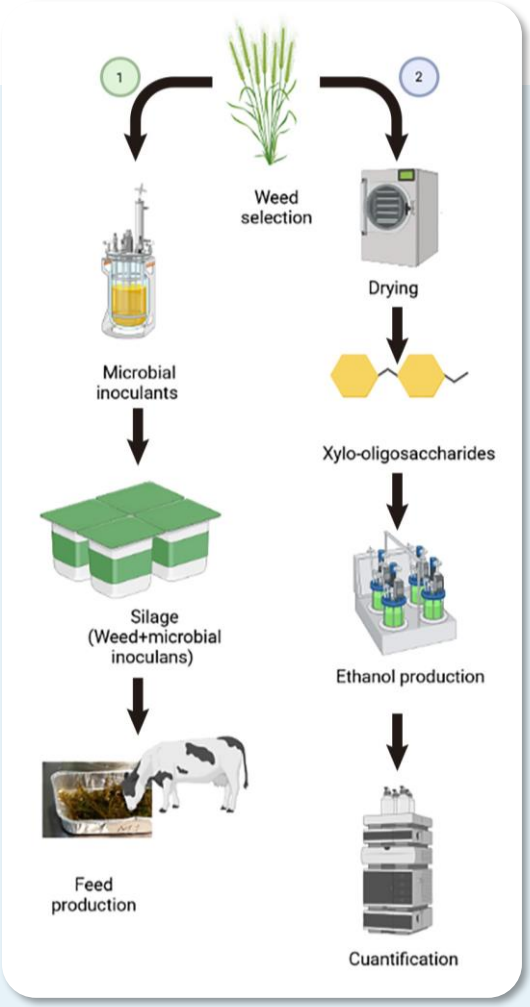
Using available natural resources to improve livestock nutrition is an important aspect of the sustainability of global food production[1]. Many weed species generate a significant problem in crops and new regulations on herbicide use mean farmers will need alternatives to manage them. Many weed species have potential to be used as animal feed or as renewable energy sources due to their xylo-oligosaccharides content[2,3]. Silage on its own or aided with lactic acid bacteria (LAB) inoculants can preserve and improve the digestibility and nutrition properties of these weeds[4]. This work belongs to a project financed by CONACyT with number **315969** and is focused on using weeds as fodder material to prepare silages that will serve as food for livestock and/or used as a source of xylo-oligosaccharides used for ethanol production.

Objective

Evaluate the feasibility of using common regional weed species in silage for livestock nutrition and as raw materials to produce renewable energy.

Materials and Methods

Plant samples were collected in Coahuila, Mexico, from small scale maize farms. Samples were classified and identified on the basis plant taxonomy, morphological features, including flowers. Ensilage studies were conducted at the Biorganix Mexicana S.A. de C.V. Two species of weeds (W1 and W2) were ensiled with two treatments: T1=microbial inoculant or T2= an untreated water control, before being packed into lab-scale silos to undergo a 45 days fermentation. After fermentative period, forage was analyzed for fermentation characteristics, nutritive value, and digestibility parameters. Additionally, the weeds and their mixes were used as a source of xylo-oligosaccharides that can be used for ethanol production.



Scheme 1. Biotransformation of weeds to silages by microbial inoculants (1) and ethanol production (2).

Results

The weed species were identified as W1=*Setaria adhaerens* and W2=*Cenchrus ciliaris*). Weed forage was chopped and ensiled with distilled water or a consortium of microbial inoculants for 45 days. The results showed that the dry matter (DM), neutral detergent fiber (NDF), and water-soluble carbohydrate (WSC) contents decreased following 45 days of ensiling. The silages showed a decrease in pH and rise in lactic acid content. The dominant *phylum* and genus in fresh matter were *Rhizopus* sp., *Alternaria* sp., *Penicillium* sp., *Bipolaris* sp., *Curvularia* sp., *Aspergillus* sp. and *Pseudomonas* sp. In both silage types, *Lactobacillus* was the genus present with the highest abundance. Most of the collected weed species could be the high potential for thermal conversion and can be used as substrates for ethanol production.

Conclusions

Initial results show positive outcomes about the feasibility to use weeds or mixtures of weeds and traditional forages in silages for livestock meals or as a raw material to produce bioethanol.

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