OPTIMIZING THE PHOSPHORUS CYCLE IN THE SUGAR BEET PRODUCTION PROCESS BY PHYTASE SUPPLEMENT

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Phosphate stewardship and ultimately recycling is one of the great challenges of humankind. Depleting phosphorus (P) resources demand new strategies for an efficient use of this essential nutrient. Therefore, especially phosphorus cycles in agriculture have to be closed. Against this backdrop we propose a new value chain to recover phosphate from plant waste material in sugar production. The approach is based on naturally occurring enzymes that free the phosphate bound in an organic form (mainly phytate in sugar beet slices). Thereby, the currently implemented value chain of phosphate rock mining, production of phosphoric acid, chemical synthesis of polyphosphates, and after use phosphate disposal into waste water, rivers and finally into the ocean will be extended and in the long run disrupted. In sugar production processes this could be achieved by supplementing thermally resistant phytases to leach the phosphate bound as phytate form sugar beet slices. With this procedure the P concentration in sugar beet slices and the export of phosphorous with fodder to areas with high animal density and in consequence P-excess in fields will be reduced. Instead, isolated phosphorus will be transferred into spent lime and subsequently back to the sugar beet fields. The BioSC collaboration project PhytaPhoS assesses and evaluates the potential of P recovery employing phytase, its feasibility and economic approaches from lab scale to field application. Phytases are extremely highly active phosphatases (>1000 U/mg), mobilizing inorganic phosphate from plant based phytate, which is a natural plant phosphate reservoir [1]. Aim in the project is improving specific activity and thermal resistance of a selected phytase by directed evolution [2,3,4] and optimizing the phytase production by employing a signal peptide library from *Bacillus subtilis* [5].

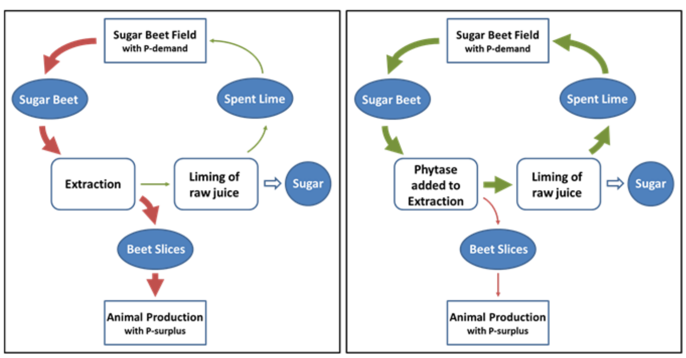

Figure 1 - Closing nutrient cycles in sugar production. Flow of phosphorus without (left) and with use of a thermally stable phytase (right).

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