The addition of a biorefinery to an organic farm was investigated, where ethanol was produced from germinated rye grains and whey, and the effluent was separated into two streams: the protein-rich solid fraction, to be used as animal feed, and the liquid fraction, which can be co-digested with clover grass silage to produce biogas. A method for ethanol production from rye was applied by utilizing inherent amylase activity from germination of the seed. Biogas potential of ethanol fermentation effluent was measured through anaerobic digestion trials. The effluent from the trials was assumed to serve as natural fertilizer. A technoeconomic analysis was also performed; total capital investment was estimated to be approximately 4 M USD. Setting a methane selling price according to available incentives for “green electricity” (0.72 USD/m³) led to a minimum ethanol selling price of 1.89 USD/L (project lifetime 25 yr, at a discount rate 10%).