Rhizobacteria Inoculation for Faba bean, Yellow Lupin and Blue Lupin

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Introduction

Finland´s self-sufficiency rate of fodder protein is about 15 %. This is relatively low compared to mid-European countries, where the rate is double than that of Finland. Since *Roadmap to Finland´s protein self-sufficiency* was published in 2015, the need for higher protein self-sufficiency has been highlighted and various protein sources are sought intensively. In addition to fodder industry, plants containing high concentrations of protein are also favored in food industry, and pulse legumes are seen as a potential alternative in adaptation to climate change abreast of traditional cereals. Fodder and food industry need now also other protein-rich plants, such as faba bean and lupines, alongside pea.

Rhizobacteria inoculation is claimed to increase the yield, seed weight and protein content of pea, but also similar results have been obtained with Faba beans. In a project called *Produce Protein* (TUOVA), operated in Southern Ostrobothnia, Finland, we tested the effect of Rhizobacteria inoculation to seed yield and protein content of faba bean (*Vicia faba*), yellow lupin (*Lupinus luteus*) and blue lupin (*Lupinus angustifolius*). Earlier, this influence has not been scientifically tested in Finland, although some suggestive conclusions have been found in farm scale practices.

Methods

The field experiment was arranged in Luke Ylistaro during 2016 and 2017. We examined two cultivars of faba bean, “Kontu” and “Sampo”, one cultivar of yellow lupin “Mister” and one cultivar of blue lupin, “Sonet”. All cultivars were sown with Rhizobium inoculation treatment, and also without as a control treatment. Field trial was arranged using the split-plot method, where inoculation treatments were main plots and cultivars were randomized inside each main plot in three replications. By separating treatments into main plots we made certain that untreated members were not exposed to Rhizobacterias. Yields were measured and the protein contents of samples were tested in laboratory.

Statistical analyzes were performed using ANOVA (IBM SPSS) and in some cases non-parametric Kruskall-Wallis test as the size of data was narrow for parametric analyzes.

Picture 1: Blue Lupin *(Lupinus angustifolius)* *Sonet”

Results

According to results in 2016, no difference was found between the yields of treated and untreated cultivars (p=0.973). This may be due to difficult weather conditions during the time of sowing and growth. Raw protein contents (g/kg dry matter) did not differ between treatments (p= 0.0924) and neither did 1000 seed weight (p= 0.924) but, there were clear differences in protein contents between species (p<0.001, using non-parametric Kruskall-Wallis test as the size of data was narrow) which was expected.

Highest protein contents were measured for yellow lupin “Mister” (379 g/kg DM untreated, 378 g/kg DM treated), the lowest for blue lupin “Sonet” (295 g/kg DM untreated, 297 g/kg DM treated). Protein content of faba beans “Kontu” and “Sampo” were between 313 g/kg DM and 340 g/kg DM.

Conclusions

Although significant differences in protein contents, 1000 seed weights and yields between inoculated and uninoculated were not found after first year, knowledge from several years of field trials are needed. Results for 2017 are not yet complete but they may vary greatly. If the treatment shows potency, Rhizobacteria inoculation can be a cost-effective way to improve the protein content and nutritional quality of animal fodders and plant protein based food supplies.

Differences in protein concentrations between species may also vary, but most likely differences between cultivars do not prove to be significant in long term.

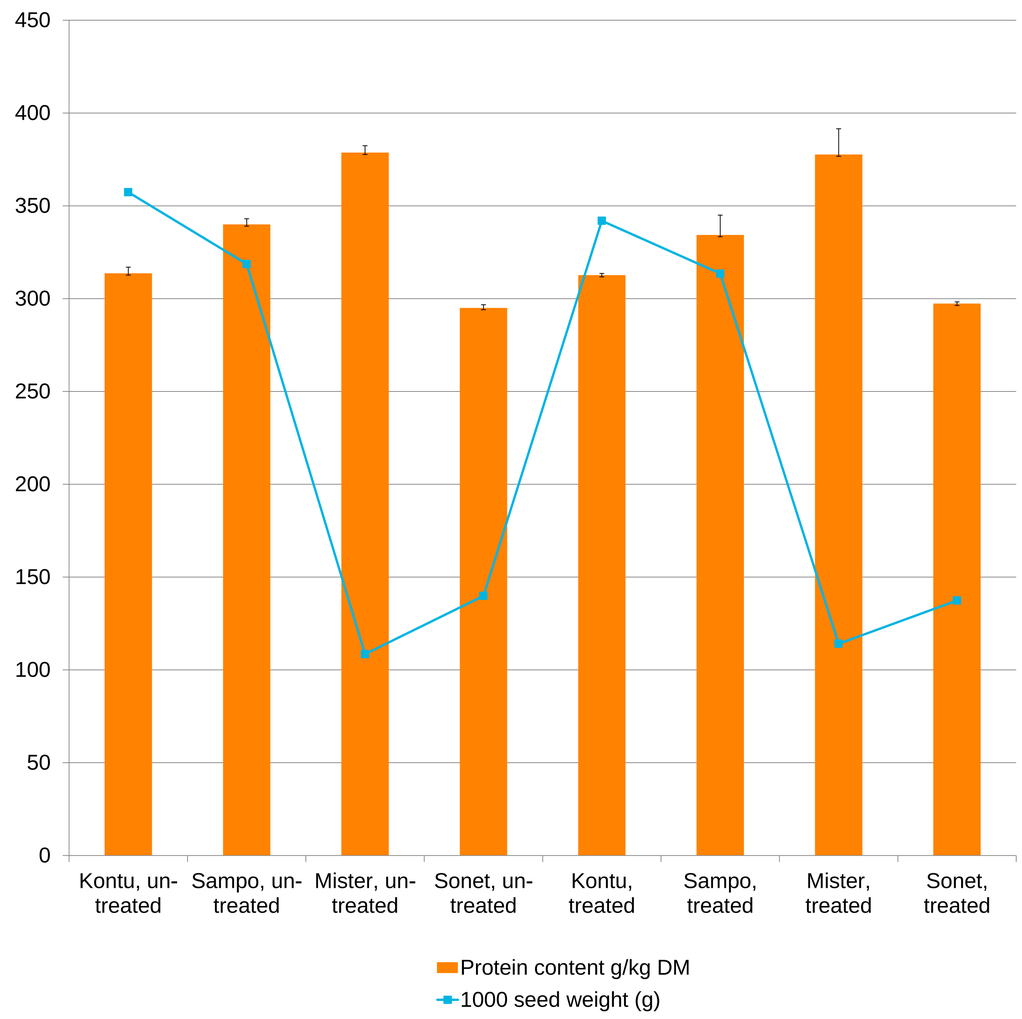

Figure 1: Raw protein contents (g /kg DM) and 1000 seed weights (g) . Error bars present the Standard Error of the mean (SEM).