Rhizobial species selection: prime factor in forage legume establishment and production in pasture

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Few legumes have been introduced into USA pasture systems to increase the nutritive value of forages. Introducing a new legume into a given system can be difficult due to environmental factors (abiotic factors) and as legumes are not often compatible with the indigenous symbiotic partner i.e. rhizobia (biotic factors) in the soil. We are proposing a pipeline for rhizobial species selection for bioinoculum preparation to enhance forage legume establishment.

The first phase of this pipeline requires the identification of rhizobial species isolated from different commercial inoculums and from forage legumes growing in their natural environment followed by large scale targeted gene analysis to determine species and strain differences. Though various commercial inoculums are available for legumes such as alfalfa, there are fewer options when a farmer requires inoculums for new forage legumes such as the annual medics. In our study of annual medics, we evaluated different commercially available alfalfa inoculants and found that *M. rigidula* and *M. riguloides* were nodulated by *S. melilotii* and not by *S. medicae*. This finding confirmed that rhizobia and legume interaction is highly specific and proper identification of rhizobial strains before inoculation is very crucial. The second phase of this pipeline requires lab and green house evaluation to determine the nitrogen fixation ability and plant growth promotion by other means such as solubilizing phosphorus and production of the hormone IAA. The PGP (Plant Growth Promoting) ability of the rhizobia could also be used to enhance growth of non-leguminous plant such as grasses. We have identified and evaluated 74 rhizobial strains from different warm season legumes for their PGP activities. Of those, eight strains have the ability to solubilize phosphorus. The PGP activity of these isolates will be evaluated in green house trials for both legumes and non-leguminous plants. We compared also commercial and indigenous rhizobia for both *Strophostyles sp.* and *Trifolium nigrescens* for their potential plant performance. The indigenous rhizobial strain (identified as *Mesorhizobium loti* for *Strophosstyles sp.* and *R. legumenosarum* for *Trifolium nigrescens*) performed significantly better for biomass production for both forage legumes as compared to the commercially available isolate in current use. The third and last phase in the selection pipeline requires field evaluation of rhizobia before commercial production to check the performance of inoculants in natural environments. By following these three phases we will be able to select appropriate and effective rhizobial species which can perform better in natural environments for new forage species establishment and pasture production.