

## Improving alfalfa (*Medicago sativa* L.) cultivar selection by GIS Mapping of fall dormancy and winter survival index classes and modeling seasonal and annual yield

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**INTRODUCTION:** There are hundreds of alfalfa cultivars within 11 fall dormancy (FD) and 6 winter survival index (WSI) classifications. Currently, cultivar selection is sub-optimal due to the inability to match cultivar characteristics with planting site conditions. This project is quantifying climatic and soil conditions, FD and WSI requirements, and using GIS tools to map parameterized functions and crop modeling to predict yield.

**OBJECTIVES:** (1) To improve cultivar selection through matching location climatic and soil conditions with cultivar FD and WSI classes. (2) To improve potential yield prediction through crop simulation modeling.

### **MATERIALS AND METHODS**

- Assemble existing agro-ecological/alfalfa zone maps from scientific literature and seed companies.
- Review yield data and expert recommendations from field trial data in each alfalfa production zone.
- Create logistic response functions for T-min and T-max parameterized for each cultivar class.
- Develop suitability maps using GIS layers and response functions and validate in each growing zone.
- Develop seasonal and annual yield maps from APSIMX-Lucerne crop model and verify from yield data.
- Create extension and journal manuscripts and web-based materials for cultivar selection.
- Conduct professional development workshops for outreach personnel.

### **RESULTS**

- Collaborators identified for USA, PRC, New Zealand, and Australia.
- Project planning sessions held at national and international forage meetings.
- Quantitative tolerances developed and mapped for example FD/WSI class.
- Logistic functions parameterized for 8 clover species demonstrated the improved approach to be used.
- Prototype selection process flowchart and web application developed.
- APSIMX-Lucerne crop simulation model shows good agreement between predicted and observed values.

### **CONCLUSIONS**

This project will: (1) connect alfalfa scientists and seed industry specialists in several countries leading to faster, more efficient research progress; (2) create a quantitative database of alfalfa cultivars that will assist alfalfa research projects; (3) improve alfalfa cultivar selection leading to higher yielding, more persistent stands and increased profitability; (4) demonstrate integration of research tools (crop simulation modeling and GIS), and web-based information delivery.

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