Establishing a Multi-Environmental Alfalfa Evaluation Network for Climate Resilience & Variety Improvement

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Alfalfa (*Medicago sativa* L.) is planted in 7 million hectares in the US and in 3.2 million hectares in Argentina. Climate change will have major impacts on adaptation of species to agricultural systems around the world. The ability of breeders to select for traits that impart adaptability to climate resilience and diverse management practices will be critical for the future of livestock production. The successful cultivation of alfalfa relies heavily on identifying varieties that can thrive in various environmental conditions. This introduces the need for a comprehensive approach to evaluate alfalfa varieties across multiple environments; the process of establishing a network for multi-environmental evaluation and underline its significance in advancing agricultural research and variety improvement. The aim is to improve adaptability, resilience to climate change, pest and disease resistance, nutritional content, and yield optimization. The design of the evaluation network involves careful location selection considering soil type, climate, topography, etc. Management criteria focus on coordination of activities and accurate data recording, while budgeting involves a detailed breakdown of costs and sourcing funding. Materials and equipment required include alfalfa seeds, farming equipment, irrigation systems, laboratory equipment, vehicles, and data management software. Monitoring and results evaluation involve comprehensive data collection processes, including environmental data collection, soil analysis, growth stage observations, yield measurements, pest and disease monitoring, and nutritional analysis. Statistical analysis techniques are applied to draw meaningful conclusions from the collected data. In Argentina, INTA's Alfalfa Cultivars Evaluation Network (RECA) employs a standardized methodology involving trials sown according to fall dormancy degrees, followed by rigorous data collection and statistical analysis to evaluate performance. The RECA, which has been operational for 35 years, has been instrumental in providing valuable insights into alfalfa varieties used in Argentina. This extensive phenotypic database will serve as a foundation for the project "Defining and Breeding for the Target Population of Environments for Non-dormant Alfalfa". Advanced breeding lines from the UF breeding program will be entered in the network of variety trials from INTA, Argentina, and in variety testing programs across the southeastern US in Fall 2024 and 2025. Data from these trials will be used to propose new cultivar releases, coming from combine germplasm screening, genomics, enviromics, and phenomics to improve yield and persistence for nondormant alfalfa, and expand the market area for our cultivars beyond the deep South (Florida, Georgia, Alabama) and Argentinian cultivation regions.