

# Managing Alfalfa Intercropping with Intermediate Wheatgrass: Towards Perennial Grain-Forage Systems

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Intercropping alfalfa with perennial grain crops like intermediate wheatgrass (IWG) is a novel use for alfalfa with the potential to enhance forage and grain yields, limit nitrogen fertilizer inputs required for IWG grain production, and provide economic benefits to farmers while harnessing the environmental benefits of a perennial system. IWG is a long-lived, cool-season perennial grass that produces both abundant forage and has been identified as a commercially viable perennial grain crop for its numerous advantageous traits including edible grain, synchronous seed maturity, low shattering, and disease resistance. Intercropping IWG with alfalfa has the potential to provide nitrogen to the IWG grain crop, enhance the seasonal distribution and forage value of IWG under dual-use management, and increase overall sustainability and profitability of the system while creating a new market for alfalfa growers. The primary objective of this project is to identify the optimal nitrogen application rate for the yield and long-term yield maintenance of grain and forage in alfalfa-IWG intercrop systems across different cropping regions. The experiment was planted in Fall 2021 in Ithaca, NY, Arlington, WI, St. Paul, MN, and Salina, KS. Treatments included cropping system (monoculture alfalfa, monoculture IWG, or intercropped alfalfa-IWG) and five nitrogen rates between 0 and 160 Kg/ha. Data collection included grain yield, forage yield, and forage quality. Response to nitrogen rate and cropping system varied across harvests, locations, and years. Nitrogen rate had a significant effect on forage yields, year one grain yield, and year two Land Equivalent Ratio (LER). Location has a significant effect on forage yields and there is a Location:Cropping system interaction for various yield parameters.