Resilience, Stability, and Productivity of Alfalfa (*Medicago sativa* L.) in North America

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Resilient, stable, and productive forage systems are needed to endure increasingly frequent climatic extremes like droughts. Resilience is the ability of a forage system to withstand and keep producing under a major climatic crisis; stability is the minimal variability of yields across normal years; productivity is the average yield across normal years. However, no assessments of resilience of cultivars have been reported. The goal of this paper was to quantify resilience, stability, and productivity of alfalfa cultivars, in order to identify superior cultivars. Historic forage yield means from alfalfa cultivar trials from eleven US states and one Canadian province over nineteen years (1995 to 2013) were analyzed using a linear mixed models approach. Quantitative measures for resilience and stability for each cultivar were calculated for the two most extreme crises years in each location. Mean cultivar productivity ranged from 12.1 to 14.9 Mg ha-1, mean cultivar stability ranged from 25 to 73, and mean cultivar resilience ranged from 0.67 to 0.78 across environments (i.e., crisis year-location combinations). Resilience, stability and productivity were different among cultivars across environments, showing that some cultivars are consistently superior for each variable. Cultivar resilience was not associated with cultivar productivity or stability, which allows to identify cultivars that optimize all those three traits. These analyses provide information to test and select cultivars that can be more profitable over the long term.