Constitutive expression of *eIF5A3* increases biomass yield in an elite alfalfa cultivar

Rosa Figueroa-Balderas[1], Cecilia Chi-Ham[1], David Tricoli[2], Jay Sandman[3], David Johnson[3], Jon Reich[3] & Alan B. Bennett[1]

[1] Department of Plant Sciences, Public Intellectual Property Resource for Agriculture, University of California, Davis, CA, USA
[2] The Ralph M. Parsons Foundation, Plant Transformation Facility, University of California, One Shields Ave., Davis, CA, USA
[3] Cal/West Seeds, 38001 County Road 27, Woodland, CA, USA

Increasing agricultural production is a global priority to meet rising demands for food and energy. In comparison to grain crops, in which annual yield gains of up to 1.6% have been observed, forage crops like alfalfa have shown limited yearly gains of about 0.2-0.3%[1, 2]. The breeding challenge in alfalfa has been to balance improved yield and forage quality traits, which are often inversely related[3]. Crop yield is a multifactorial trait long considered so complex that breeding yield gains via manipulation of single genes appeared to be untenable[4, 5]. However, significant yield improvements of 15-25% in field-grown crops transformed with single genes have been reported recently[6, 7]. One report of increased biomass, seed yield and tolerance to osmotic and nutrient stress in Arabidopsis plants constitutively expressing a gene encoding eukaryotic translation initiation factor 5A (*eIF5A*) prompted us to genetically engineer alfalfa plants with *eIF5A* from *Populus deltoids* (*PdeIF5A3*)[8]. Using an efficient transformation method, we produced alfalfa lines that constitutively express *PdeIF5A3*, maintain high forage quality and, over two years of field trials, produced yields averaging 20-45% higher than the non-transgenic controls.