

Impact of Fertilizer Price & Hay Price on Optimum Rate of Phosphorus & Potassium Fertilization of Irrigated Alfalfa

Steve Norberg, Washington State University - Pasco, WA USA



Steve Norberg is a Professor with Washington State University and is the Extension Regional Forage Specialist. He serves the irrigated portion of the Columbia Basin for forages and is responsible for the Washington State Alfalfa Variety Trials in association with the Washington Hay Growers Association of which he is an Ex-Officio Advisor. He grew up on a farm in the panhandle of Nebraska. He received his B.S. and M.S. degrees from University of Nebraska Ph.D. in Crop Science from Oregon State University. He has worked in university extension for over 27 years in Missouri, Colorado, Oregon, and Washington State University.

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Developing critical plant nutrient levels in-season improves recommendations and applications, saving producers time, expense and effort since many growers take samples for hay quality. Three experiments were designed as follows: 1) Phosphorus (P) Rate study with differing rates of P_2O_5 using monoammonium phosphate (MAP); including: 0, 37, 67, 134, 269 kg P_2O_5 ha⁻¹ on a low testing P soil <10 ppm (Olsen P method); 2) Potassium (K) rate study with differing rates of K_2O using potassium sulfate: 0, 45, 90, 179, 269, 358 kg K_2O ha⁻¹ on an <100 ppm K soil (ammonium acetate method). The following is summation of two five-cut field years (2019 and 2020) of results for alfalfa harvested at mid-bud stage for all cuttings in the same field. Increasing P rate from 37, 67, 134, 269 kg P_2O_5 ha⁻¹ increased yields from the control by 1.3, 2.0, 3.1, and 3.4 Mg acre⁻¹, respectively. Averaged over years and assuming \$1.2 per kg P_2O_5 , the whole plant tissue level at the economic optimum was 0.36 and 0.37% at mid-bud stage for \$165 and \$220 Mg⁻¹ of hay, respectively. If the price per kg P_2O_5 is increased by 100 or 200% then optimum economic fertilizer rate is decreased by 39% and 77%, respectively for \$165/Mg hay and 25% and 50% respectively, when hay price is \$248 Mg⁻¹. No potassium response was found in 2018, but yield increased up to 2.55 and 2.82-Mg acre⁻¹ in 2019 and 2020, respectively. About 80% of yield response occurred in the first and second cuttings indicating that P and K needs to be applied in the fall or early spring to get the highest yield response. Optimum potassium concentration in alfalfa varied widely between the two years. The optimum concentration for \$221 Mg⁻¹ hay, when the price kg of K_2O is was \$0.79, was 1.9 and 1.6% for 2019 and 2020, respectively. If the price per kg K_2O is increased by 100 or 200% then optimum economic fertilizer rate is decreased by 50% and 100%, respectively for \$165/ton hay, and 41% and 78% respectively, when hay price is \$248 Mg⁻¹.