# Developing Practical Phosphorus & Potassium Tissue Test Recommendations & Utilizing Struvite in Modern Alfalfa Systems III

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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, 30, 60, 120, 240 lb $P_2O_5$ $acre^{-1}$ 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, 40, 80, 160, 240, 320 lb $K_2O$ $acre^{-1}$ on an <100 ppm K soil (ammonium acetate method). The following is summation of four years of results for alfalfa harvested at mid-bud stage for all cuttings in the same field. Increasing P rate from 0 to 240 lb $P_2O_5$ $acre^{-1}$ increased yield by 0.9, 1.5, 1.6 and 1.5 tons $acre^{-1}$ in 2018, 2019, 2020 and 2021, respectively. Averaged over 2019 & 2020 and assuming \$560 $ton^{-1}$ for 11-52-0 $P_2O_5$ (\$0.538 lb $P_2O_5^{-1}$), the whole plant tissue level at the economic optimum was 0.35 and 0.36% at mid-bud stage for 150 and \$225 $ton^{-1}$ of hay, respectively. About 80% of yield response occurred in the first and second cuttings indicating that P and K need to be applied in the fall or early spring to get the largest yield response. Potassium concentration in alfalfa varied widely between years optimum K content for the two years but the optimum for \$200 $ton^{-1}$ hay, when the price lb of $K_2O$ is was \$0.36, is 1.9 and 1.6% for 2019 and 2020, respectively. The relationship between potassium alfalfa tissue concentration and yield was not significant. Both the price of fertilizer and the price of hay both impact the recommended rate of P and K significantly and must be taken into account when determining optimum fertilizer rates in the current economic market and we have developed an excel spreadsheet to help with these recommendations.