

# STACKING 4R NUTRIENT MANAGEMENT: POTATO

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## ABSTRACT

The 4Rs of nutrient management are research-based guidelines to improve the sustainability of major cropping systems and the environment without compromising crop yield and quality. The term '4R' represents fertilizer applied at the Right rate with the Right source, Right timing, and Right placement. The objective of this project is to evaluate the interactions of individual and combined 4R management practices. In 2020, potato (*Solanum tuberosum L.*) was grown in a calcareous loam soil in a field near Grace, ID, USA. Nitrogen (N) fertilizer treatments contained all combinations in an RCBD of two N sources [uncoated and polymer-coated urea (PCU)], two rates (84 and 100% of the recommended rate), and two placement/timings (emergence tilled into the soil or split application with 50% applied at emergence and 50% simulated fertigation) with all compared to an untreated control. Overall, potato was responsive to N for petiole nitrate ( $\text{NO}_3\text{-N}$ ), Normalized Difference Vegetative Index (NDVI), and US No. 1 and total tuber yield. Notably, the PCU treatments resulted in significantly greater NDVI than the negative control by the end of August, while the uncoated urea treatments were not. For US No. 1 yield, despite large numerical yield increases for most treatments compared to the untreated control (2.2-7.5  $\text{Mg ha}^{-1}$ ), only the source x timing treatment showed a significant difference (8.22  $\text{Mg ha}^{-1}$ ) over the untreated control. Similar to NDVI, the PCU treatments for US No. 1 and total yield tended to be relatively higher yields even though most of the differences were not significant. Notably, this study revealed that a reduced rate of urea performs identically to the full rate of urea. Preliminary data from this one-year study reinforces the 4R principles and also indicates that certain treatment combinations may not be necessary. For instance, there was no statistically different benefit for split timing application, even at reduced rates, although there was a strong trend for this timing. This project is in a potato-wheat-wheat cropping system, with wheat evaluated similarly in 2021 and 2022, with a second year of potato planned for 2023. Further experimentation is planned to investigate the impacts of combined application trials on crop yield and quality.