Article title	Can Controlled-Release Phosphate Fertilizer Improve Phosphorus Efficiency?
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Abstract	Many phosphorus (P) uptake kinetic studies show that the pattern of P uptake in the early growth stages of annual crops is generally similar to crop dry matter accumulation. Thus, we hypothesized that matching P delivery to crops' P demand could increase P uptake and use efficiency of annual crops in the season of P application. In greenhouse studies, we simulated controlled-release P fertilizer by making small, periodic additions of fertilizer P directly into the root zone of two cereal crops through "feeding" tubes for quick and continual plant P uptake. The crops were grown on a P deficient highly weathered soil with P retention capacity of ~20%. Split application of P, where a portion of P is applied at planting and other portions applied at subsequent time intervals, was utilized as a simulation of controlled-release P fertilizer. Upland rice and winter wheat were used as test crops in the spring-summer and winter seasons, respectively. The crops' growth phenology was monitored, and samples were harvested at heading and maturity stages to determine yield and P uptake. Preliminary data show that supplying P in small doses over time shortened the days to panicle initiation, heading and maturity, and improved P uptake efficiency relative to basally applying P at planting. Treatment effects on yield, so far, are not conclusive. However, based on P uptake efficiency and growth rate of the two cereal crops, we hypothesize that controlled-release P fertilizer could improve P efficiency in the season of P application. This could have major agronomic and environmental benefits.
Publication date	2012-10-23
Link to the article	https://scisoc.confex.com/crops/2012am/webprogram/Paper73267.html