Article title	Agronomic effectiveness of urea deep placement technology for upland maize production
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Abstract	Effective fertilizer management is critical for sustainable maize production. Field trials were conducted in six locations in northern Ghana during the 2016 and 2017 farming seasons to evaluate the agronomic effectiveness and economic viability of urea deep placement technology (UDP), which involves deep placement of urea supergranules (USG), for maize production. This fertilization strategy was compared with four other maize fertilization strategies: (1) microdosing (MD); (2) farmer practice (FP), which involves surface broadcasting of granular fertilizer; (3) modified farmer practice (MFP), where granular fertilizer was incorporated into the soil; and (4) NPK-only, where no supplemental N was added. Averaged across all six locations and both years, UDP produced 18% more grain yield than MFP, 38% more than MD, 155% more than FP, and 270% more than NPK-only. The greatest apparent N recovery efficiency of 73% occurred in MD, followed by UDP (68%), NPK-only (63%), MFP (61%) and FP (35%), in that order. However, agronomic efficiency followed the order: UDP > MFP = MD > NPK-only = FP. The greatest gross profit margin of 49% was obtained with UDP, followed by MFP (41%) and MD (33%). Farmer practice resulted in a break-even level (3%) whereas NPK-only resulted in a loss (< − 35%). From the combined results, we conclude that, barring other external factors such as drought, flooding, pests, diseases, etc., UDP could be one of the most efficient fertilizer management strategies for sustainable maize production. Further studies should evaluate optimum timing of USG application for increased productivity and profitability.
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