Slow but sure: the potential for slow-release nitrogen fertilizers to increase crop productivity and reduce environmental damage in Nepal

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Abstract

Multi-location field trials were established across nine districts in Nepal during 2018-2019 to assess the effect of slow release nitrogen fertilizers, i.e. polymer coated urea (PCU) and urea briquette on nitrogen use efficiency (NUE) and crop productivity of maize and rice. PCU and urea briquette increased nitrogen use efficiency (NUE) by 98% and 58%, respectively compared with conventional urea. PCU and urea briquette saved N inputs by up to 30 -50% due to reduced losses but still maintained or increased yields compared to the conventional urea application.

Keywords: polymer coated urea, urea briquette, nitrogen use efficiency, crop productivity

1. Introduction

Reduction of nitrogen (N) input in cropping systems is needed to reduce environmental degradation and achieve sustainable development goals. In Nepal, heavy application of urea in combination with imbalanced use of secondary and micronutrients results in larger N losses to the environment resulting in lower nitrogen use efficiency (NUE) and crop productivity. Multi-location field trials were conducted across nine districts in Nepal during 2018-2019 to assess the potential of polymer coated urea (PCU) and urea briquette (deep placement) to increase nutrient use efficiency (NUE), crop productivity and farm profits for small holder farmers. To the best of our knowledge, this is the first time in Nepal where the slow release N fertilizers i.e. PCU and urea briquette were compared with conventional urea in maize and rice production**.**

2. Materials and Methods

Field trials for maize were established in five mid hill districts (sub-tropical); Dang (n=54), Surkhet (n=54), Doti (n=18), Palpa (n=18) and Kavre (n=18), and for rice in four terai districts (tropical); Banke (n=12), Bardiya (n=30), Kailali (n=30) and Kanchapur (24). For maize, PCU and urea briquette were applied at the rate of 60 and 78 kg N ha^{-1}, respectively. For rice, PCU was applied at 50 and 78 kg N ha^{-1} and urea briquette at 78 kg N ha^{-1}. Both PCU and urea briquettes were applied as a single application during planting time for maize and at 7 d after transplantation for rice. For conventional urea, N rates for maize and rice were used as per government recommendations i.e. 120 and 100 kg ha^{-1}, respectively.

3. Results

In maize, the difference in grain yields between PCU (8.2 Mt ha^{-1}) and urea briquette (8.4 Mt ha^{-1}) were not significant ($p>0.05$). These yields were similar with conventional urea (8.1 Mt ha^{-1}). Similar results were observed in rice. Grain yields with PCU applied at 50 and 78 kg N ha^{-1} were 5.4 and 5.8 Mt ha^{-1} respectively. Similarly, yield in urea briquette was 5.4 Mt ha^{-1}. There results were comparable with conventional urea (5.2 Mt ha^{-1}). However, use of slow

release N fertilizers increased NUE by 98% (PCU) and 58% (urea briquettes) compared with conventional urea in maize production. A similar trend was observed in rice production. Moreover, both PCU and urea briquettes increased farmer's net income by USD 60 to 100 ha^{-1}. These results suggest that slow-release fertilizers can allow reduction of N input by as much as 30-50% while maintaining or increasing the yields compared to the conventional urea application.

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