Field evaluation of slow-release nitrogen fertilisers and real-time nitrogen management of spring maize in Nepal

Samikshya Gautam[1], Ujjal Tiwari[1], Sapna Parajuli[1], Bina Sapkota[2] Bala Sharma[3], Naba Raj Pandit[4], Yam Kanta Gaihre[5] , Krishna Dhakal[6]

[1]Agriculture and Forestry University (AFU) [2]Institution for Suitable Actions for Prosperity [3]Tribhuvwan University, Department of Soil Science [4]International Maize and Wheat Improvement Centre [5]International Fertilizer Development Centre [6]Directorate of Agricultural Research

INTRODUCTION

- Maize is the second most important crop with national productivity is 3.051 Mt/ha.
- Productivity is very low compared to national potential and neighboring countries.
- Use of high yielding varieties are not able to reduce the yield gap.
- Judicious nitrogen management could minimize the gap at some levels.
- Research Question: Which one is the best nitrogen management of spring maize in Nepal?

Treat-ments	Abbreviations	Treatment details
T1	N0	0:60:40 kg $NP_2O_5K_2O$ ha^{-1}, Single super phosphate is used as source of phosphorus
T2	RDF	120: 60:40 $NP_2O_5K_2O$ ha^{-1} + N equally split into three halves and applied at basal, V6 and V10 Stages
T3	N180	180:60:40 $NP_2O_5K_2O$ ha^{-1} + N equally split into three halves and applied at basal, V6 and V10 stages
T4	PCU	90:60:40 kg $NP_2O_5K_2O$ ha^{-1} from Polymer Coated Urea (PCU), DAP and MoP, applied all at basaldose
T5	UDP	90:60:40 kg $NP_2O_5K_2O$ ha^{-1} from Briquette Urea, DAP and MoP, applied as urea deep placement (UDP) all at basal dose after emergence.
T6	LCC	143:60:40 kg $NP_2O_5K_2O$ ha^{-1}, Leaf Color Chart at critical value ≤ 4; 30 kg N ha^{-1} applied when threshold was met
T7	GS	143:60:40 kg $NP_2O_5K_2O$ ha^{-1}, Green Seeker at NDVI value at 0.8, 30 kg Nha^{-1} applied when threshold data was not obtained.

HIGHLIGHTS

- Urea Briquette is prominent in marginalized areas based on ease of applicability and overall analysis
- Leaf Color Chart, seems prominent with the necessary training to the farmers
- Further study in decision support tools is suggested to calculate thresholds in Nepalese agroecology.

RESULTS

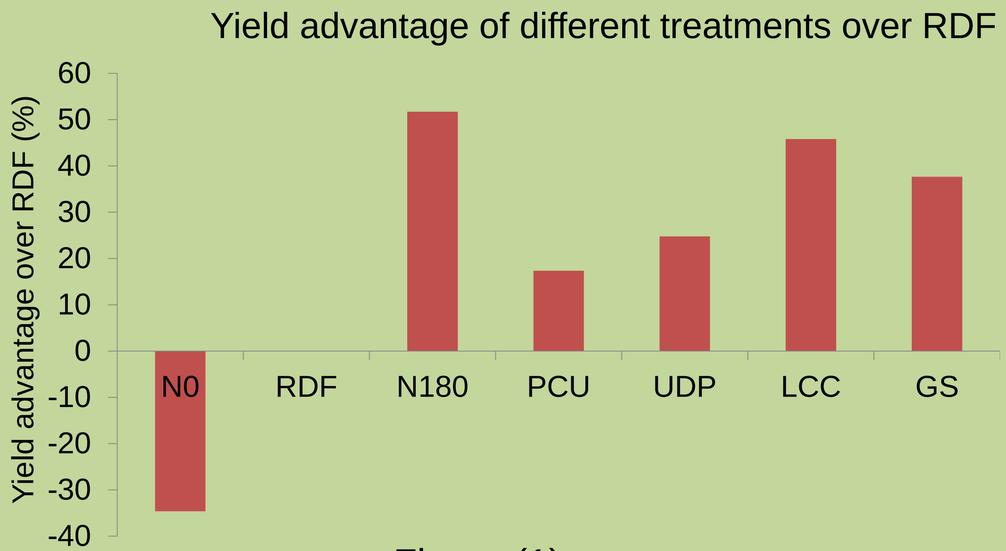

Figure (1)

- Figure (1) LCC and GS yielded 45.7% and 37.52% more grain yield over RDF
- UDP and PCU yielded 24.7% and 17.33% more grain yield with less nitrogen application over RDF

METHODS

Experimental Site

- Gadwa Rural Municipality-05,Bodhipur, Dang, Nepal
- latitude: 27.826043N; longitude: 77 82.539683E, altitude: 269.32 m above sea level
- FromJanuary to June, 2020
- Field metrics: Each treatment plot 10.8 $m^2$with 50cm gap between an alley

Research Design

- Randomized Complete Block Design with seven treatments
- Varieties used: Rampur Hybrid-10 at spacing of 60*25 cm
- Fertiliser used: Nitrogen doses varied ; Phosphorous and potash applied at rate of 60 and 40 kg/hectare in the form of Diammonium phosphate (DAP) and Murate of Potash (MoP), respectively

Data collection and analysis

- Grain Yield and Stover Yield from Net harvestable area of 5.4 m^2
- Economic Analysis through calculation of Benefit: Cost Ratio
- Partial Factor Productivity (PFPN)and Agronomic Efficiency for Nitrogen (AEN) was calculated
- Statistical Analysis through R-studio.

RESULTS

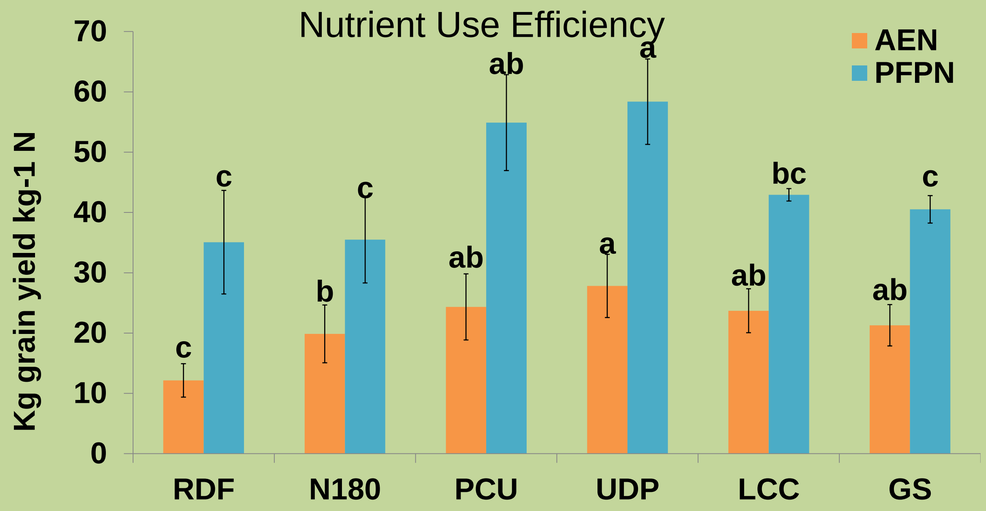

Figure (2)

- Figure (2) , the similar letter indicates the same level of statistical significance
- Both AEN and PFPN is highest in UDP, indicating the higher nutrient use efficiency.
- Nutrient use efficiency of slow nitrogen release fertilizers and decision support tools is greater than common urea doses

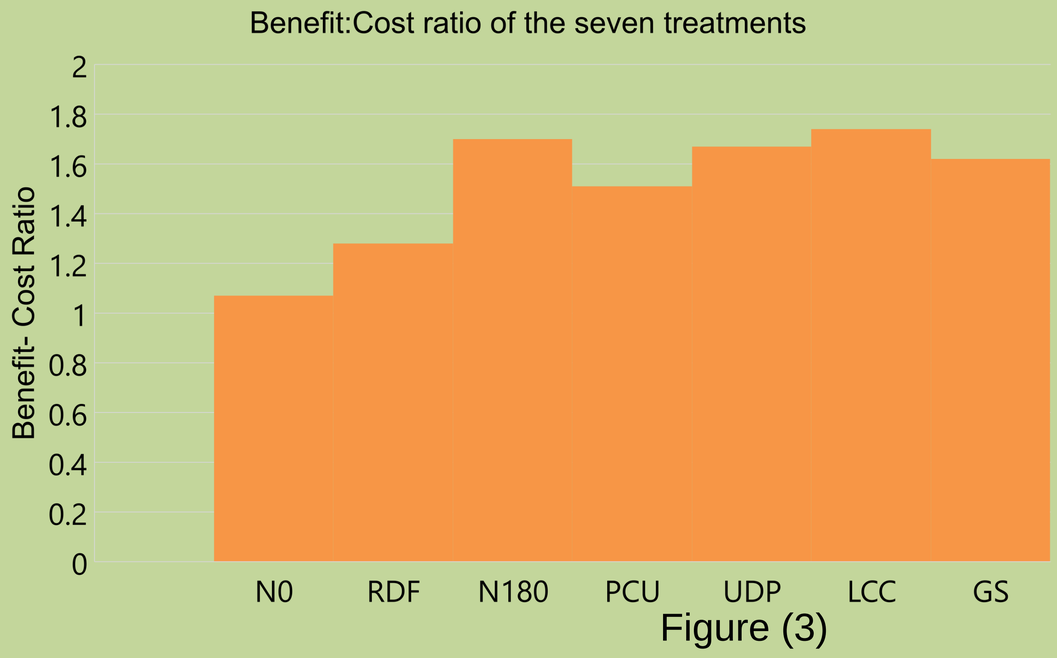

Figure (3)

- Figure (3) indicates Benefit –Cost Ratio
- LCC has highest benefit-cost ratio
- While B:C ratio of UDP,LCC and N180 varies slightly.

Abbreviations RDF- Recommended dose by Government of Nepal; UDP- Urea deep placement/Urea Briquette, LCC- Leaf Color Chart; N180: nitrogen app;ied at 180kgN/ha; GS: Green Seeker; PFPN : Partial Factor Productivity for Nitrogen; AEN: Agronomic Efficiency of Nitrogen, N0: No nitrogen, SSP: Single Super Phosphate

ACKNOWLEDGMENTS: Prime Minister Agriculture Modernization Project- Maize Superzone, Dang; Agriculture and Forestry University, Prof. Dr. Shrawan Shah, Mahesh Regmi, Sagar Kafle, Nirparaj Joshi, Surya Bahadur Thapa