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Enhancing productivity, profitability and soil health through integrated nutrient management in ber-based hortipasture system in Rajasthan

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Abstract
The present study was conducted on ber (*Ziziphus mauritiana*) cv 'Gola' based horti-pasture system established in 2006 to examine the influence of various sources of organic and inorganic nutrients on morphometric, productivity and quality of grasses and soil health during 2011 and 2012 under rainfed condition of semi-arid ecosystem. Over two years mean green herbage yield of 3.16 t/ha, dry matter of 0.55 t/ha, protein yield of 23.15 kg/ha, grass seed yield of 14 kg/ha and ber fruit yield of 339.17 kg/ha were recorded additionally higher under *ber* + *Cenchrus setigerus* plantation as compared to ber + *Cenchrus ciliaris* plantation system. Integrated application of 50% RDF of NPK through fertilizers and 50% through sheep manure brought significant improvement in growth and yield attributes of grasses followed by that under 100% RDF of NPK through fertilizers. Further, yield of dry matter, grass seed, dry ber leaf fodder, fruit yield and fuel wood yield were found higher with integrated application of 50% RDF of NPK through fertilizers and 50% through sheep manure. Application of 50% RDF of NPK through fertilizers and 50% through sheep manure significantly increased in mean green herbage by 62.3%, dry matter by 29.6%, protein yield by 37.0%, seed yield by 38.8%, dry ber leaf (pala) by 30.4%, fruit yield by 25.2% and fuel wood yield by 44.9%. The corresponding values were increase by 46.7, 28.1, 32.9, 45.0, 28.7, 25.2 and 25.2% when 50% RDF of NPK through fertilizers and 50% through sheep manure applied combined and compared with control treatment (no fertilizers, no organic manure). The pH and EC of surface soil declined whereas bulk density, soil organic carbon (SOC), available N, available P and exchangeable K were increased with the integrated application of inorganic nutrients coupled with organic matter through sheep manure. Maximum gross return (Rs. 76131/ha), net return (Rs. 66366/ha) and benefit: cost ratios (2.33) were also accrued with the integrated application of 50% RDF of NPK through fertilizers and 50% through sheep manure.

Keywords: *Cenchrus ciliaris*, *Cenchrus setigerus*, Hortipasture, Integrated nutrient management, Sheep manure

Abbreviations: DAS: Days after sowing; **FYM**: Farm yard manure; **INM**: Integrated nutrient management; **K**: Potassium; **N**: Nitrogen; **P**: Phosphorus

Introduction

There is always inherent risk in production of seasonal crops in semi-arid areas due to unpredictable, meagre and erratic distribution of rainfall. Integration of fruit trees and grasses in interspaces, better known as horti-pasture system, are known to plug the risk of failure of seasonal crops in these areas. Growing of fruit trees and under storey grasses, suited to prevailing agro-climatic conditions, gives many direct and indirect benefits. Directly, farmers get sustained production (fruit, fodder and fuel wood) from both fruit trees and grasses/ fodders for their livelihood and indirectly, system improves the soil fertility, mitigate the climate change, increase the biodiversity etc (Kumar *et al.*, 2015). Ber is prominent fruit tree of dry areas which can be planted in the horti-pastoral system. Raising of grasses in interspaces of ber plantation gives additional production of grasses and income. The improved grasses *viz*. Anjan (*Cenchrus ciliaris*) and Dhaman (*Cenchrus setigerus*) can be taken suitably in interspaces of ber in semi-arid areas. Grasses plays very vital role in protection of deterioration of versatile agro-ecosystem. The development of ber orchard in association of grasses will meet the needs of h nan and animals especially small ruminants. Ber and grass both are hardiest and suited to drought prone conditions of Rajasthan because they can stand in dry and hot summer and they also utilize precipitation and solar energy efficiently (Lal and Dharamveer, 2012). Ber belong to *Rhamnaceae* family and originated to Indo-Malaysian region of South- East Asia. Samra (2010) also reported that horti-pasture provides tremendous opportunities with high potential