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A study on integrated nutrient management on soil health and productivity of sorghum and chickpea under strip cropping and crop rotations in scarcity zone of Maharashtra

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ABSTRACT

A field experiment was conducted continuously for nine years during the *rabi* seasons of the years 1998-99 to 2006-07 at the Research Farm of AICRP for Dryland Agriculture, Solapur to assess the effect of integrated nutrient supply system on soil health and productivity of sorghum – chickpea under strip cropping and year to year crop rotation. The consumptive use of moisture was highest under the treatment 15 kg N ha^{-1} through compost and crop residue + 10 Kg N ha^{-1} through *leucaena* loppings while moisture use efficiency was highest under the treatment 15 kg N ha^{-1} through Compost and CR (1:3) + 20 kg N ha^{-1} through urea. Highest net returns of Rs. 6969 ha^{-1} and benefit cost ratio 1.70 was observed in application of 50 kg N ha^{-1} through urea, followed by the application of 15 kg N ha^{-1} through compost and CR (1:3) + 20 kg N ha^{-1} through urea to *rabi* sorghum in sorghum – chickpea year to year crop rotation with equal B:C ratio. At 9th year organic carbon content of the soil was higher in the treatments where *Leucaena* loppings were added. Application of organics alone or along with urea improved the hydraulic conductivity and infiltration rate of the soil. An application of 15 kg N ha^{-1} through compost and crop residue (1:3) + 10 kg N ha^{-1} through *Leucaena* loppings supported more multiplication of microbes *viz.* bacteria, fungi, P solubilizing fungi and *Azotobacter.* Residual effect of compost along with crop residue (1:3) and *Leucaena* loppings had beneficial effect on microbial population. The highest gross monetary returns for all the cropping systems *viz;* sole sorghum, sole chickpea and strip cropping were obtained in the treatment 15 kg N ha^{-1} through compost and crop residue (1:3) + 20 kg N ha^{-1} through urea.

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Rabi Sorghum is an important crop of rainfed agro-ecosystem, meeting food and fodder requirement. The crop is mainly grown in Maharashtra (3.2 m ha), Karnataka (1.59 m ha) and AP (0.54 m ha). Mono-cropping with *rabi* sorghum coupled with imbalance fertilizer use is the major concern in the sorghum based production system. The poor fertility is associated with near exhaustion of organic matter of rainfed soils. Integration of chemical and organic sources of nutrients and their effective management had shown promise in not only sustaining soil health but also in meeting a part of chemical fertilizer requirement of different crops and cropping systems. Low cost organics like compost, green leaf manures like *Leucaena* and *Gliricidia*, crop residues etc. which are also eco-friendly, augments the efficiency of the applied fertilizer nitrogen and increases the yields and returns besides sustaining the soil health. Keeping this in view, an experiment was conducted to evaluate integrated nutrient supply system to *rabi* sorghum base cropping system and its influence on productivity, soil health and soil moisture management.

MATERIALS AND METHODS

A field experiment was conducted at the Research Farm of All India Co-ordinated Research Project for Dryland Agriculture, Solapur, Maharashtra during the winter seasons of the year 1998-99 to 2006-07. The soil was medium deep (50-60 cm depth), low in available nitrogen, medium in available phosphorus and high in available potassium content. The experiment was laid out in randomized block design with three replications. The nutrients as per treatments were applied to *rabi* sorghum only and on the same block next year chickpea was grown on residual fertility. The treatments comprised of T_1: control (no N fertilizer), T_2: 50 kg N ha^{-1} through urea, T_3: 25 kg N ha^{-1} through urea, T_4: 25 kg N ha^{-1} through compost and crop residue (CR) 1:3 +10 kg N ha^{-1} through urea, T_5: 15 kg N ha^{-1} Compost and CR(1:3) + 10 kg N ha^{-1} through urea, T_6: 15 kg N ha^{-1} through Compost and CR (1:3) + 20 kg N ha^{-1} through urea, T_7: 15 kg N ha^{-1} through *Leucaena* +10 kg N ha^{-1} through urea, T_8: 15 kg