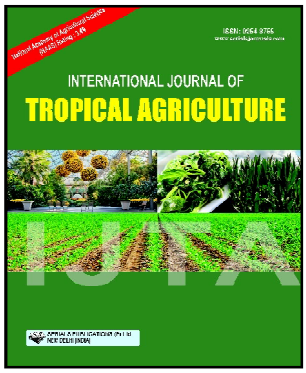

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Evaluation of Green Manuring and Organic Manures for Soil-health and Forage Production in Irrigative Conditions

Om Singh

Live stock Production and Management Section, Indian Veterinary Research Institute, Bareilly (UP)-243122

Abstract: The field study was conducted to investigate the effect of organic and inorganic alongwith summer green manuring in forage based cropping system at Bareilly (UP) during 2013-14 and 2014-15. It is observed that sesbania-maize-oat green manuring crop sequence was found to be better and beneficial in respect of organic fodder production than sunnhemp and cowpea, when combined with 75% recommended dose of NPK + 5t/ha FYM and 5t/ha VC in rabi season. The application of NPK (75% recommended) alone produced less forage.

Keywords: Green manuring, sesbania, organic manure, crop production

INTRODUCTION

A green manure (GM) is a crop used primarily as a soil amendment and a nutrient source for subsequent crops. Green manure approaches to crop production may improve economic viability, while reducing the environmental impacts of agricultural. The positive role of green manuring in crop production has been known since ancient time. Importance of this soil ameliorating practice is increasing in recent years because of high cost of chemical fertilizers, increased risk of environmental pollution, and need of sustainable cropping systems. Green manuring can improve soil physical, chemical, and biological properties and consequently crop yields. Furthermore, potential benefits of green manuring are reduced nitrate (NO3 ") leaching risk and lower fertilizer N requirements for succeeding crops. However, its influence may vary from soil to soil, crop to crop, environmental variables, type of green manure crop used, and its management. Beneficial effects of green manuring in crop production should not be evaluated in isolation; however, in integration with chemical fertilizers (N.K. Fageria, 2007). The recycle and use of nutrients from organic manure

has been given more consideration for insuring sustainable land use and agricultural production development. The long term effects of the combined application of organic and inorganic fertilizers in improving soil fertility and crop yield have been demonstrated. Among different organic manures, Poultry Manure(PM) registered the highest enzyme activity followed by Farmyard Manure, Green Manure and Crop residue. Compared to 7 days incubation a slightly higher increase in PNP was noticed in samples from 90 days incubation in both soils as reported by Shipra Garg & G.S Bahl, 2008. She also reported that the differential phosphatase activity in the organic manures was further reflected in dynamic P availability. The highest amount of Olsen extractable P was in PM-treated soil followed by FYM, GM and field pea crop residue. Organic manure addition along with inorganic P, irrespective of the source, increased the Olsen extractable P throughout the incubation period. Total P uptake by maize increased with the increasing level of inorganic P in both soils. The highest uptake was obtained in PM-treated soil and lowest in the CR-amended soil. We conclude that PM more readily supplies P to plants than other organic manure sources.

The objective of this trial was to evaluate green manuring practice, in the context of potential benefits in use of this practice for annual crop production and sustain soil health and fertility. Looking the economic importance of maize and oat as a main fodder for animal production, the research was conducted to explore the appropriate NPK levels with the supplement incorporation of Green manuring and organic manures for achieving higher fodder yield for livestock production in India.

Farm yard manure, compost and green manuring with suitable nitrogen fixing legumes are the most effective and environmentaly sound methods of organic farming. In India, scarcity of green fodder has always been a problem for farmers. The OFTs were conducted with following objectives–

MATERIALS AND METHODS

The field study was conducted to investigate the effect of organic and inorganic alongwith summer green manuring in forage based cropping system at IVRI, Bareilly in Rohilkhand region of Uttar Pradesh during 2013-14 and 2014-15. Sesbenia, sunnhemp and cowpea crops were grown as a source of green manuring during summer season through broad casting method of sowing. Maize (Cv African Tall) was grown after green manuring crops in situ incorporation at 60 days sowing. Maize at the rate of 40kg/ha seed rate grown in Kharif person as green forage crop. Oat crop was grown in Rabi/ winter season with seed ratio of 60 kg/ha. Maize (Zea mays L.) and Oat (Avena Sativa L.) are important cereal forage crops of summer and winter seasons in the region. Maize (African tall) and Oat (kent) as a forage crops were grown under irrigated conditions. The soil of experimental sites was silty loam, low in organic carbon (0.50%), total nitrogen (0.10%), medium in available phosphorus (46.0 Kg) and potassium (276 Kg) with neutral reaction. There were twelve treatments consisting of three green manuring crop sequences and four fertility levels composing of different levels of NPK with or without organic amendments in randomised block design with three replications. A uniform dose of 50% recommended dose (100-60-40) was applied to maize in Kharif, while for oat in rabi it was given according to treatment. The crops were harvested at 55 days and green forage yield and dry matter were calculated in q/ha. Available N was estimated by Kjeldahl method. Data were analysed statistically as per least square fit, whole model.

RESULTS AND DISCUSSION

The statistical analysis of variance for plant height, stem girth, number of green leaves per plant and

maize fodder yield under different organic and inorganic fertilizers showed significant differencea st 5% probability level.

The data recorded on forage yields q/ha of maize and oat is given in table 1 and trends of effects of crop sequence and fertility levels are given in figures 1 & 2.

Table 1
Effect of green manuring and organic manures with NPK on green forage production (q/ha) of maize and oat crops

Treatment	*2013-14*			*2014-15*		
	Maize	*Oat*	*Mean*	*Maize*	*Oat*	*Mean*
Sesbania-Maize-Oat	348	493	420	426	559	492
Sunnhemp-Maize-Oat	327	427	377	345	490	417
Cowpea-Maize-Oat	298	415	356	316	449	382
S Em±	6.41	9.04	9.15	8.58	15.10	5.81
C D at 5%	15.68	22.12	22.40	20.99	36.96	14.22
Fertility Levels						
10t ha^{-1} FYM + 50% NPK	268	452	360	342	470	406
10t ha^{-1} VC + 50% NPK	312	514	413	380	548	464
5t ha^{-1} FYM + 5t ha^{-1} VC + 75% NPK	379	640	509	416	686	551
75% Recom. NPK alone	234	399	316	38	394	351
S Em ±	6.37	11.72	6.42	9.53	11.45	4.82
CD at 5%	14.70	27.04	14.81	21.98	26.42	11.12

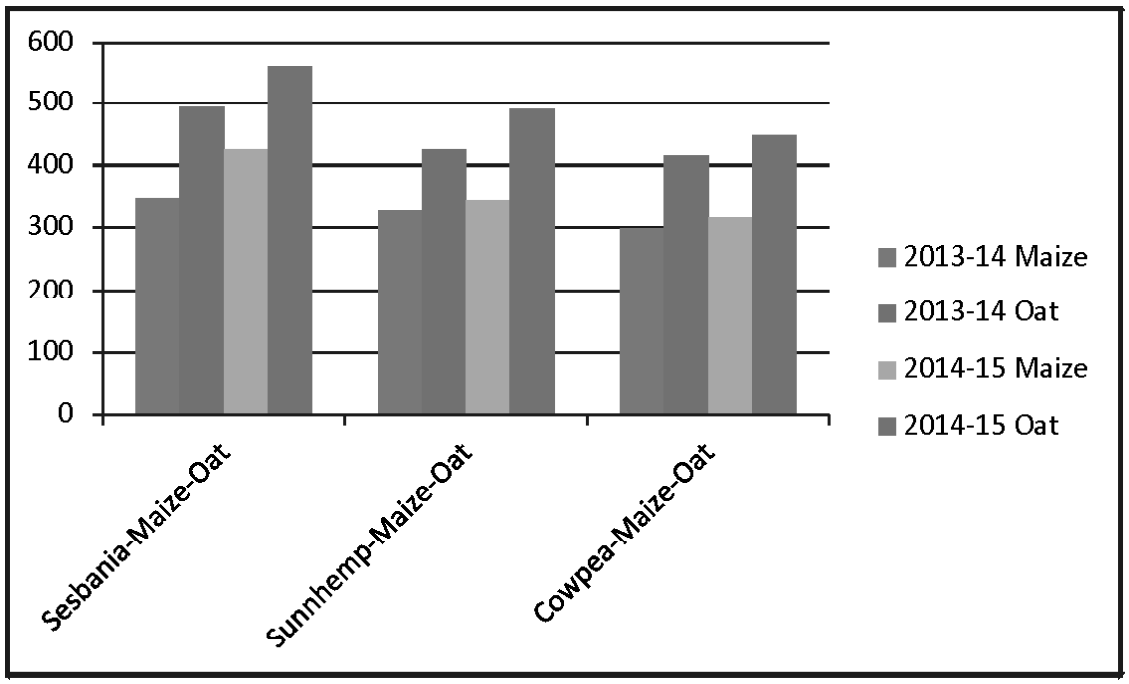

Figure 1: Effect of Cropping Sequence on Green Forage Yield (q/ha)

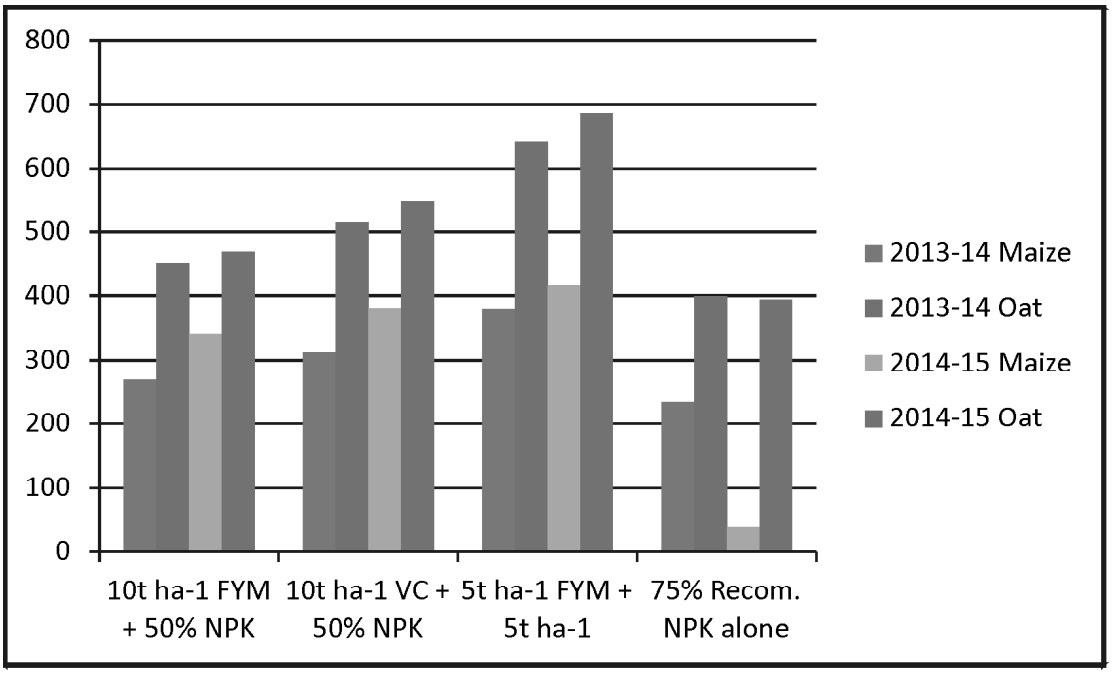

Figure 2: Effect of Soil fertility on green forage yield (q/ha)

Effect of cropping sequence

The data of effect of cropping sequence on forage yield is given in table 1 shows that the yield of fodder increased gradually in second year in case of both the crops. This higher yields may be due to the beneficial effect of green manuring crops on succeeding crops. Higher yields of green and dry fodder were obtained from sesbania-maize-oat green manuring crop sequence followed by sunnhemp-maize-oat green manuring sequence. The lowest forage yield was recorded in cowpea-maize-oat green manuring sequence. The lowest forage yield was recorded in fodder production capacity among the three green manuring crop sequences may be due to different ability of legume crop which had beneficial effect on succeeding crop by fixing the atmospheric nitrogen in soil. The N added through the shoot portion of sesbania, sunnhemp and cowpea was 165, 145 and 110kh/ha, respectively. The results also match with findings of M.I. Sultani et.al. (2007). He reported that Highest fresh biomass was observed in sesbania (23 t/ha) followed by cluster bean (19 t/ha) and lowest in rice bean (17 t/ha). Maximum crude protein content was found in sesbania (17%) followed by rice bean (10%) and cluster bean (8%). Green manuring crops, on average reduced soil bulk density (5%), enhanced total porosity (8%), and macropores and large mesopores (28%). Maximum reduction (7%) in soil bulk density, and an increase (11%) in total soil porosity and available water (17%) was observed in plots where sesbania was incorporated as green manuring crop. The order of effectiveness in improving bulk density, macro and mesopores was sesbania > cluster bean > rice bean. Sesbania produced greater number of macro and large mesopores about 41% increase over control followed by cluster bean (29%) and rice bean (16%). Sesbania and sunnhemp added equal amount of dry matter (6.0 t/ha) whereas, cowpea added relatively less dry matter (5.6t/ha). Organic and inorganic fertilizer showed great benefits not only for the increase in the N uptake by plant and in soil available N but also for the improvement of maize yield as reported by F.C. Oad *et al.* (2004).

Effect of fertility levels

The data given in table 1 and figure 2 shows that green forage yield also increased gradually from first to second year in case of treatment of different fertility levels. Increased yield in subsequent year may be attributed to gradual and residual effect of green manuring and organic amendments. Similar was reported by Sharma (1983). Application of 75% recommended dose of NPK with 5t/ha FYM + 5t/ha VC in rabi season produced higher forage yield of oat and followed by with other combinations viz 50% recommended dose of NPK with 10t/ha Farm Yard Manure (FYM) or Vermi Compost (VC) in both the years. However, these followed yields were found to be higher than the application of 75% recommended dose of NPK alone. The higher green forage yield might be due to higher supply of essential macro and micro nutrients through FYM and VC when these combined with NPK fertilizers. It might also be improved the properties of soil for better soil plant relationship. Almost similar trend was also observed in dry matter production in both the years. This similar result was also reported by N.K. Fageria (2007). F.C. Oad et al. (2004) reported that all the maize plant parameters were significantly affected with the incorporation of FYM and nitrogen levels. All the plants characters maximum stem girth, more and higher maize fodder yield were observed with the application of 120 kg/ha with combination 3t/ha FYM. Materechera and Salagae were also in the opinion that higher plant height of maize could be achieved with the application of chicken and catter manure. Vadivel et. al.(2001) observed that enriched farmyard manure and 60kg N ha-1 gave the tallest plants of maize. All these researches were in the idea that combination of organic and inorganic fertilizers increased the thickness of the stems. They also observed that cattle and chicken manure increase the leaves per plant of maize crop.

Objectives

To study the effects of organic amendments and green manuring through intigrated input management.

To maintain productivity and sustainability in the rice-wheat system. Organic farming to meet WTO challenge.

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