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Influence of Pongamia, Mahua and Neem cakes on finger millet productivity and soil fertility

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Abstract: A field experiment conducted at Bio-fuel park, Agricultural Research Station, Madenur, Hassan in *Kharif* season of 2009 to asses the performance of finger millet (*Eleusine coracana* L.) under different organic manure treatment consisting of four treatments viz., recommended FYM and NPK through inorganic fertilizers as control, Pongamia, Mahua and Neem cake with 5 replications laid in randomized complete block design. The results revealed that application of recommended FYM along with neem cake equivalent to 100% recommended N performed better in respect of finger millet productivity and maintenance of soil fertility followed by recommended FYM with 100% NPK through fertilizers. Nutrient supplementation with different oilcakes proved superior in respect of soil sustainability.

Keywords: Finger millet, Oilcakes, Pongamia, Mahua, Neem

INTRODUCTION

India is self sufficient in food grain production due to intensive cropping with increased use of chemical fertilizers under irrigated conditions. However, modern chemical based agricultural practices have led to several new challenges viz., degradation of soil, declined productivity, increased pollution hazards etc. Under such situation, organic and integrated nutrient management has played significant role in improving productivity and sustaining soil fertility.

The likely large-scale bio-energy crop plantations for producing bio-fuels following promotional activities of the governments and increased awareness among the public are expected to result in the production of large quantities of by-products such as oil cakes (after oil expulsion from seeds). The resulting oil cakes can be recycled as valuable major and micro-nutrients sources. The utility of neem oil seed cake as a fertilizer as well as a pesticide on economically important crop species is well established. However, the studies on the manurial value of pongamia, mahua and neem oil seed cakes on the productivity of annual crop plants and their impact on soil nutrient status are limited (Ramesh *et al*., 2009).

Finger millet is recently emerging as vital dietary food crop owing to increased public awareness on diabetics. This is also an important crop resource of poor farmers in rainfed areas where biofuel species viz., pongamia, mahua and neem are concentrated. Hence, the present study was undertaken to findout the suitable organic nutrient management options for grain, fodder productivity and soil sustainability in finger millet during Kharif 2009 at Biofuel Park, Madenur, Hassan.

MATERIALS AND METHODS

A field experiment was conducted during Kharif season 2009 to study the impact of different biofuel oil cakes with recommended FYM on grain and fodder yield of finger millet (*Eleusina coracana* L.) at the Biofuel Park, Madenur, Hassan, University of Agricultural Sciences, Bangalore. The experiment consists of four treatments: with five replications laid in randomized complete block design. Each treatment consisted of 20 rows of 4 m length with a plot size of 24 m^2. The seeds of finger millet variety, GPU 28 were sown with a spacing of 0.3 m between rows of 4 m length. Later, seedlings were thinned to maintain 0.1 m intrarow spacing. Oilcakes of Pongamia, Mahua and Neem were analysed for its nitrogen nutrient content and indicated in Table 1. Oil cakes were incorporated on Nitrogen equivalent basis before sowing. The data on per plot grain and fodder yield (kg) in all the treatments were recorded and converted to hecatare basis for statistical analysis.

Soil samples were also taken before and after experimentation to assess the impact of application of different oil seed cakes on soil fertility in terms of major nutrients and organic matter. The experimental site was medium in respect of soil fertility status with sandy and

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Table 1. Effect of different oil cakes on grain and dry fodder yield of finger millet at Biofuel Park, Madenur, Hassan during kharif 2009.

Treatment	Grain yield (kg ha^{-1})	% Change over control	Dry fodder yield (kg ha^{-1})	% Change over control
T_1: Rec. FYM + 100% NPK through inorganic fertilizers **(control)**	2175	-	8292	-
T_2: Rec. FYM +100% N through Pongamia cake	2054	-5.56	7500	-9.55
T_3: Rec. FYM+ 100% N through Mahua cake	1808	-16.86	6158	-24.74
T_4: Rec. FYM+ 100% N through neem cake	2454	12.84	8833	6.52
'F' test	*		*	
S.Em.±	63.5		638	
CD (p=0.05)	191.7		2046	

gravel soil.

RESULTS AND DISCUSSION

Finger millet productivity: The ANOVA indicated that on an average, treatments comprising different combinations of organic nutrients such as pongamia, mahua neem with FYM and inorganic fertilizers appeared to have significant effect on grain yield of finger millet. Significantly higher grain yield of finger millet was recorded with application of recommended FYM along with 100% N through neem cake (T_4: 2454 kg ha^{-1}) compared to all other treatments (Table 1). This was followed by the control treatment (T_1) of Rec. FYM + 100% NPK through inorganic fertilizers (2175 kg ha^{-1}). Application of recommended FYM with pongamia (3.95% N content) and mahua oil cake (2.55% N content) equivalent to recommended N recorded lower yield (5.56 and 16.86%, respectively) over control. It is interesting to note that application of neem oil seed cakes (5.25 % N) equivalent to 100% recommended N resulted in 12.84% higher grain yield than control treatment. This might be associated with the higher nitrogen concentration coupled with rapid release of nutrients to cope up with the crop demand. This can be substantiated with the available nutrient status after the experimentation. The results are in conformity with the findings of Ramesh *et al.* (2009). The yield reduction with application of mahua oil cake may be associated with the lower nutrient concentration and slower nutrient release, which might have pressed the plant for hunger and starvation. Similar results were also observed with respect to straw yield. Higher straw yield was observed with application of recommended FYM along with 100% N through neem cake (8833 kg ha^{-1}) followed by control treatment (8292 kg ha^{-1}). Lower straw yield was observed in T_3 (6158 kg ha^{-1}) followed by T_2 (7500 kg ha^{-1}), which were 24.74 and 9,55 per cent lower than control. Similar results were also reported by Som *et al.* (1992), Wani and Sreedevi (2005).

Impact on soil fertility: Marginally improved soil fertility status was noticed after the experimentation (Table 2). The organic carbon status after experimentation was improved to the tune of 0.03 to 0.06% with different treatments after experimentation. The increase in organic carbon was higher with alication of neem cake followed by pongamia, mahua oil cake. There was a built up of available N, P_2O_5 and K_2O were also observed with application of neem cake equivalent to 100% recommended N with FYM. This might be associated with the rapid mineralization of nutrients associating with narrow C : N ratio in the concentrated organic manures. Soil fertility build up was minimal with control (T_1) compared to all other treatments. This may be associated with rapid nutrient release pattern of fertilizers which might also contribute for nutrient losses viz., leaching, volatilization, denitrification and fixation. The reduced loss of nutrients in oilcake treatments is the reason for higher soil fertility and higher nutrient status in neem cake is the cause of higher status in soil than mahua cake. Similar results of enhanced soil fertility with organic manure application was noticed by Bhattacharyya *et al.* (1984) and Lei Meng *et al.* (2005).

Inference: Grain and dry fodder productivity of finger

Table 2. Soil nutrient status as influenced by different treatments.

Treatment	Organic C (%)	Available N (kg ha^{-1})	Available P_2O_5 (kg ha^{-1})	Available K_2O (kg ha^{-1})
Before Experiment	0.44	306.8	28.6	235.3
T_1: Rec. FYM + 100% NPK through inorganic fertilizers **(control)**	0.47	315.2	29.7	259.9
T_2: Rec. FYM +100% N through Pongamia cake	0.49	357.5	38.2	344.8
T_3: Rec. FYM+ 100% N through Mahua cake	0.48	330.6	35.2	333.7
T_4: Rcommended FYM+ 100% N through neem cake	0.50	391.4	50.3	391.2

millet crop grown using recommended nutrient application is comparable to that grown using nutrient application through neem cake. Application of nutrients only through organic source of fertilizers such as neem and pongamia cake will have long-term benefits in terms of building up of soil organic matter which favor multiplication of microorganisms besides improving soil physical properties. Further, organic fertilizer sources also supply micronutrients, which are highly deficient in many soils and are essential for optimal crop growth and yield. However, it is to be noted that the present results are outcome of feeler experiment and one season field experiment. Further multilocation and repeated trials would help in recommendation for package of practice.

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