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Legume biomass quantity requirement for maize production with reference tomucuna green manure in Kenya

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Key words : Legume biomass quantity ,maize yield

Introduction $Mucuna\ pruriens$, a potential on-farm legume source of nitrogen, has low biomass production that varies with agro-ecological and niche conditions (Mureithi and Gitahi, 2004). This limits its capability to meet maize N requirement. The objective of this research was to determine effect of different application rates of mucuna green manure biomass on maize grain yield during application season.

Materials and methods Treatments investigated were : mucuna green manure applied at rates of 0, 30, 60, 120, 240 and 480 kg N ha⁻¹ equivalent to 0, 1.5, 3, 6, 12 and 24 t DM ha⁻¹ of biomass ; and inorganic fertilizer-urea at 0, 30, 60 and 120 kg N ha⁻¹. The experimental design was a randomized complete block with four replications , and planting period 2002-2005.

Results Nitrogen source failed to show significant effect on maize grain yield , regardless of application rate (Table 1) . Maize with no fertilizer and that applied with mucuna green manure at 30 kg N ha⁻¹ had comparable grain yield . Maize applied with mucuna at rate of 60 kg N ha⁻¹ showed significant increase in grain yield over the control during long rains , but failed to achieve the same in short rains (Table 1) . Application of mucuna green manure at rates of 120, 240 and 480 kg N ha⁻¹ caused consistent and significant increase in maize grain yield over the control (Table 1) . Mucuna green manure application rates in excess of 120 kg N ha⁻¹ showed little or no further harmonious improvement in maize yield (Table 1) .

Table 1 Effect of mucuna green manure and inorganic fertilizer-urea application rate on maize grain yield during application season, at Mosocho, Kisii, southwest Kenya (2002-2005)*.

$ \begin{array}{c c c c c c c c c c c c c c c c c c c $			Maize grain yield (t · ha ⁻¹)				
$\begin{array}{c c c c c c c c c c c c c c c c c c c $			Short rain 2002	Long rain 2003	Short rain 2003	Long rain 2004	Short rain 2004
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Rainfall (mm)		638	1654	850	999	844
0 1 07 2 07 0 90 1 09 0 70 Mucuna green manure 30 1 30 3 13 0 99 1 52 0 72 60 1 14 3 08 1 52 2 38 0 97 120 1 62 3 96 3 01 3 55 1 53 240 1 68 3 13 2 08 3 51 1 48 480 1 39 3 13 2 36 4 12 1 29 Inorganic fertilizer-urea 30 1 465 2 83 1 40 2 41 0 68	Treatment(Nitrogen, kg N h	a ⁻¹)					
Mucuna green manure 30 1 30 3 13 0 99 1 52 0 72 100 1 14 3 08 1 52 2 38 0 97 120 1 62 3 96 3 01 3 55 1 53 240 1 68 3 13 2 08 3 51 1 48 480 1 39 3 13 2 36 4 12 1 29 Inorganic fertilizer-urea 30 1 465 2 83 1 40 2 41 0 68		0	1.07	2.07	0.90	1.09	0.70
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Mucuna green	30	1.30	3.13	0.99	1.52	0.72
120 1.62 3.96 3.01 3.55 1.53 240 1.68 3.13 2.08 3.51 1.48 480 1.39 3.13 2.36 4.12 1.29 Inorganic fertilizer-urea 30 1.46 2.83 1.40 2.41 0.68	manure	60	1.14	3.08	1.52	2.38	0.97
240 1.68 3.13 2.08 3.51 1.48 480 1.39 3.13 2.36 4.12 1.29 Inorganic fertilizer-urea 30 1.46 2.83 1.40 2.41 0.68		120	1.62	3.96	3.01	3.55	1.53
480 1.39 3.13 2.36 4.12 1.29 Inorganic fertilizer-urea 30 1.46 2.83 1.40 2.41 0.68		240	1.68	3.13	2.08	3.51	1.48
Inorganic fertilizer-urea 30 1.46 2.83 1.40 2.41 0.68		480	1.39	3.13	2.36	4.12	1.29
	Inorganic fertilizer-urea	30	1.46	2.83	1.40	2.41	0.68
60 1.55 3.23 1.42 2.27 0.90		60	1.55	3 23	1.42	2.27	0.90
120 1.32 3.59 1.95 2.07 0.47		120	1.32	3.59	1.95	2.07	0.47
Mean 1,39 3,13 1,62 2,55 0,97	Mean		1.39	3.13	1 .62	2.55	0.97
Nitrogen source F test ns ns ns ns *	Nitrogen source F test		ns	ns	ns	ns	*
LSD Nitrogen source 0.20 0.45 0.43 0.70 0.36	LSD Nitrogen source		0.20	0.45	0.43	0.70	0.36
Nitrogen rate F test	Nitrogen rate F test		*	*	*	*	*
LSD Nitrogen rate 0.35 0.56 0.53 1.01 0.47	LSD Nitrogen rate		0.35	0.56	0.53	1.01	0.47
% C.V. Treatment 17.3 11.8 22.6 27.2 33.3	% C .V Treatment		17.3	11.8	22.6	27 2	33.3

• F=Fischer test ; = Differences significant at $p \leqslant 0$ D5 and , ns= non-significant at $p \leqslant 0$ D5 ; LSD=Least significant difference .

Conclusions Legume biomass from mucuna applied at 120 kg N ha⁻¹ equivalent to 6 t DM ha⁻¹ of the green manure showed consistent significant increase in maize yield over the control , in all seasons . Therefore , application rates less 120 kg N ha⁻¹ could require supplementation with inorganic fertilizer N used in combination , if notable increase in yield is to be expected .

Reference

Mureithi , J . G . and Gitahi , F . M . 2004 . Legume screening database and instructional manual . Legume Research Network projects . Kenya Agricultural Research Institute (KARI) , 23 p .