Napier Grass Productivity under Different Cropping and Fertilisation Systems in Lushoto Highlands, Tanzania

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Background

- Tanga is one of the most important dairy production region in Tanzania
- In Tanzania, 21.3 million cattle are reared by 1.7 million smallholder farmers. Only 1 million of these are improved dairy breeds, while the remainder are East African Zebu
- Dairy cows are kept in confinement and availed with fodder on daily basis
- However, limited feed availability and poor feed quality, result in low milk yields of 3-5 liters per day for improved dairy breeds.
- To address this, tropical forage technologies have been promoted in Tanzania for sustainable intensification of crop-livestock systems.
- However, adoption remains low and the gap in improving milk yields still not closed.

Materials and methods

- Two on-farm sites were selected (Mbuzii, Ubiri) in Usumbara Highlands, Tanga region where smallholder farmers practice dairy.
- Treatments tested included : local Napier, Napier hybrid, *Brachiaria* hybrid cv. Mulato II); Manure levels (no manure, manure); and cropping system (monocropped or intercropped with *Desmodium uncinatum*.
- Napier grass was spaced at 1 x 1 m^2, while desmodium was at 0.3m x 1m, and where intercropped, desmodium rows were between Napier grass or brachiaria
- The treatments were laid out in the field in a completely randomly block design replicated three times, and at the two sites.
- Agronomic data collected included biomass production harvested every 6 weeks, leaf area index (LAI), and number of tillers. Biomass was based on dry matter yields estimated from samples dried at 65^{o}C for 48 h, while LAI was estimated using accupar
- The data were analyzed in *GenStat* software version 14 and means separated by least significance difference (LSD)

Results

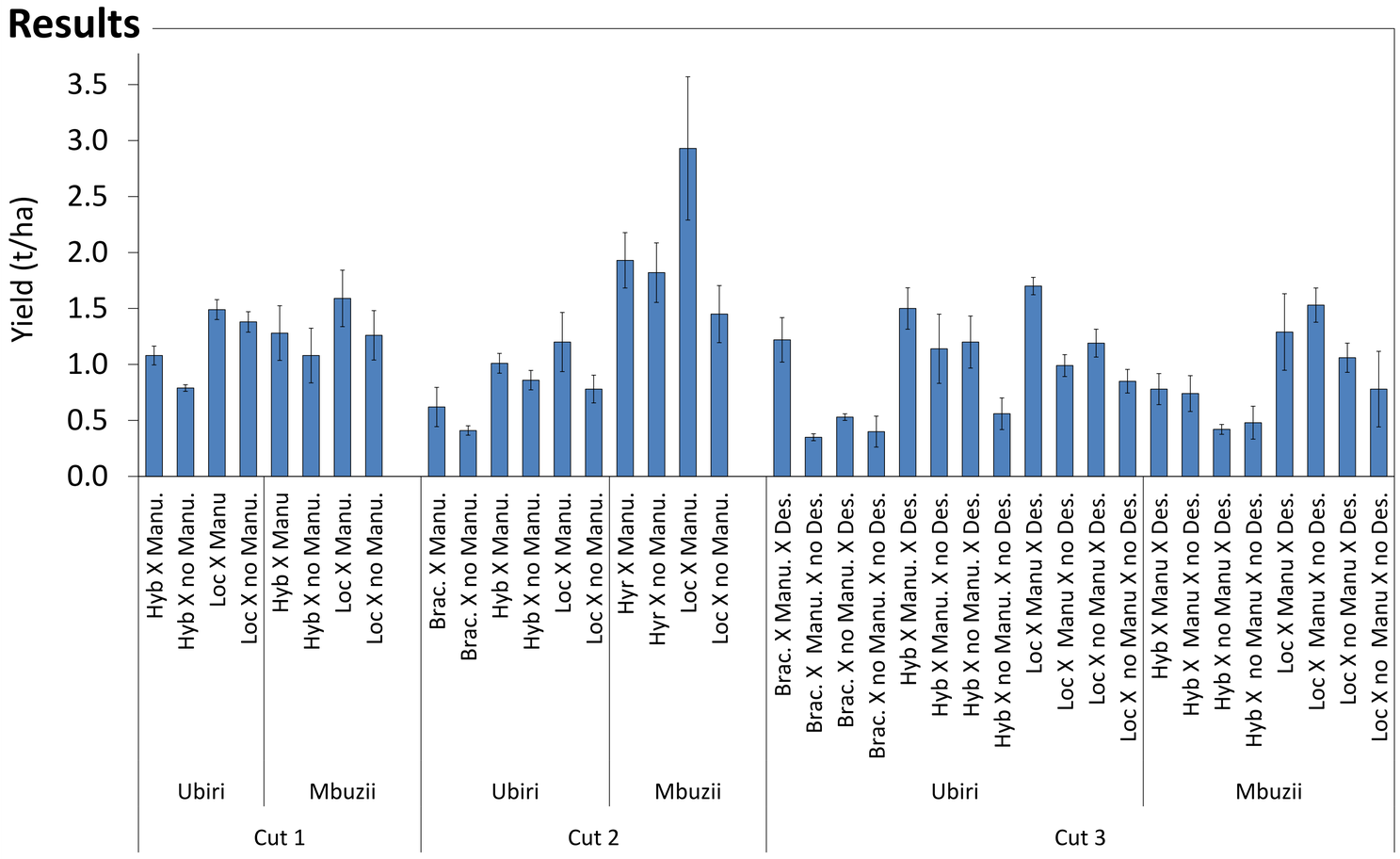

Figure 1. Means (+/-) SE of the biomass yields (t/ha) across the treatments over three growth cycles at Ubiri and Mbuzii

Table 1. Means of leaf area index (LAI), tiller numbers and height, over three growth cycles at Ubiri and Mbuzii

Harvest	Site	Treatment	Tiller number	Tiller height (m)	LAI
Cut 1	Ubiri	Hyb X Manu.	2	0.87	1
		Hyb X no Manu.	15.7	0.74	0.78
		Loc X Manu	8.5	0.88	1.36
		Loc X no Manu.	7	0.68	1.25
		LSD p=0.05	*5.2**	*0.2*	*0.44**
	Mbuzii	Hyb X Manu	9.2	0.81	1.22
		Hyb X no Manu.	6.3	0.67	0.97
		Loc X Manu.	6.2	0.85	1.44
		Loc X no Manu.	4.2	0.7	1.13
		LSD p=0.05	*2.63**	*0.15*	*0.28**
Cut 2	Ubiri	Brac. X Manu.	34	0.71	1.4
		Brac. X no Manu.	30.8	0.58	0.52
		Hyb X Manu.	19.7	1.47	0.77
		Hyb X no Manu.	14.7	1.28	0.74
		Loc X Manu.	11.3	1.37	1.15
		Loc X no Manu.	7.8	1.25	0.72
		LSD p=0.05	*8.01***	*0.22****	*0.89*
	Mbuzii	Hyr X Manu.	54.5	1.45	1.21
		Hyr X no Manu.	43.2	1.29	0.92
		Loc X Manu.	23.2	1.35	1.91
		Loc X no Manu.	18.7	1.15	0.92
		LSD p=0.05	*12.9****	*0.20**	*0.53*
Cut 3	Ubiri	Brac. X Manu. X Des.	70.7	0.57	4.37
		Brac. X Manu. X no Des.	50.8	0.48	0.32
		Brac. X no Manu. X Des.	44.3	0.38	1.75
		Brac. X no Manu. X no Des.	57.5	0.47	0.38
		Hyb X Manu. X Des.	35.5	1.04	2.34
		Hyb X Manu. X no Des.	43.8	1	1.79
		Hyb X no Manu. X Des.	33.7	0.88	1.56
		Hyb X no Manu. X no Des.	28	0.85	0.54
		Loc X Manu X Des.	24	1.03	3.35
		Loc X Manu X no Des.	32.3	0.95	1.35
		Loc X no Manu X Des.	19.7	0.89	2.55
		Loc X no Manu X no Des.	14	0.87	0.78
		LSD p=0.05	*29.5**	*0.17**	*1.47**
	Mbuzii	Hyb X Manu X Des.	119.7	0.85	0.81
		Hyb X Manu X no Des.	65.3	0.86	0.9
		Hyb X no Manu X Des.	55.3	0.73	0.34
		Hyb X no Manu X no Des.	86.7	0.73	0.42
		Loc X Manu X Des.	44	0.95	0.83
		Loc X Manu X no Des.	56.7	0.73	1.5
		Loc X no Manu X Des.	43.3	0.84	0.91
		Loc X no Manu X no Des.	33.7	0.76	0.77
		LSD p=0.05	*54.2**	*0.23*	*0.82*

Discussion and conclusion

- During the first (and the second) growth cycle, Brachiaria and Desmodium had not established well and were thus only harvested from the second (and third) cut respectively
- In the first two growth cycles, Local Napier produced higher biomass than the hybrid, with a clearly higher biomass where manure was applied. In cycle 3 that had Desmodium, biomass was generally higher where Napier was intercropped with Desmodium (Miano *et al.*, 2004), and was higher for Napier than Brachiaria-desmodium intercrop.
- Hybrid Napier produced higher number of tillers than local Napier throughout all three growth cycles. However, this did not translate into higher biomass suggesting the tillers were thin as both cultivars produced largely similar ($P>0.05$) plant height. Leaf area index (LAI) values were higher in growth cycle 3 than either in cycle 1 or 2. Local Napier generally had higher LAI than hybrid Napier especially in first growth cycle explaining the relatively higher biomass in Local Napier.
- Bachiaria under either manure or Desmodium intercrop did not out-yield either of the Napier provenances, but Brachiaria-Desmodium intercrop had the highest canopy ($P<0.05$), attaining LAI constant of 4.37
- In conclusion, intercropping with Desmodium with either of the grasses increases the dry matter yield per unit area which, especially under manuring. Therefore, smallholder dairy farmers should preferably grow Napier when intercropped with Desmodium for increased forage productivity.
- Future research will highlight forage nutritive values, soil quality and climate data. This data enables us to model data with the CropSyst model for scenario evaluation, eg growth under changing climate, or impact of the different treatments on N_2O emissions

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