Impact of Guinea Grass, Congo Signal and *Stylosanthes hamata* on Soil Physico-Chemical Properties and Beneficial Micro Fauna in Mango and Sapota Plantations

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Introduction

Farming systems are considered to be most important upcoming enterprises to reduce soil erosion and land degradation besides provide timber, fruits, nutritious fodder for live stock population in the poor soil areas (Roy *et.al*., 2000). Horticulture based farming systems have been recommended as alternate land use systems for sustainable agriculture in semi arid ecosystem for efficient soil plant management and soil fertility management. Studies on micro flora and micro fauna under farming system are required to increase the farming system productivity. Higher species diversity of soil arthropods was observed in grassland system closely followed by the silvipasture systems when compared to areas having no vegetation in central India. Abundance, diversity and species richness decreased along the gradient, with the agricultural site presenting an impoverished community. Diversity descriptors were positively and significantly correlated with habitat diversity, measured on the basis of the proportion of the different soil-use types present at each land-use unit (Sousa *et.al*., 2004). The influence of three spatially hierarchical factors like local depth of the soil, ground cover type on the soil samples (bare ground, grass tufts, dead trees lying on the ground), dimensions of the grass tufts sampled (size and shape), significantly affected the morphospecies richness and/or density of the soil macrofauna. The type of ground cover had the strongest influence, affecting the total richness and density of the soil macro fauna and of almost all the groups represented. In the present study efforts were made to know the impact of guinea grass *Panicum maximum,* Congo signal grass *Brachiaria ruziziensis* and a legume *Stylosanthes hamata* on thephysico-chemical properties of mango and sapota based hortipasture systems.

Materials and Methods

The grasses namely guinea grass *Panicum maximum,* Congo signal grass *Brachiaria ruziziensis* and legume *Stylosanthes hamata* were planted in *Kharif* 2010 in the three year old mango and sapota orchard and observations on soil physico-chemical properties and beneficial micro fauna in mango and sapota plantations available nutrients and micro flora and micro fauna were recorded in 2011 and 2012. Soil samples were taken randomly from the mango and sapota plantations before the planting Bracharia, Guinea grass and Stylosanthes and testred for the soil physic-chemical properties namely PH, EC (mhos/cm), O.C (%), Available N, P, K (Kg/ha), S (ppm), mg (ppm), Ca (%), CEC (meq/100 gm) and beneficial micro flora namely in the form of colony forming units per gram of soil for *Rhizobium, Azospirillum, Azotobacter*, Free living N fixers, and Phosphorous Solubalising Bacterai (PSB). Growth parameters of mango and sapota including *Bracharia, Guinea* grass and *Stylosanthes* were recorded and per cent increase in growth parameters after planting of grasses and a legume was recorded.

Results and Discussion

There was a significant improvement in the soil physico-chemical properties in different horti-pastoral systems after the planting of grasses and a legume compared to a sole mango and sapota system. There was an improvement in the soil PH conditions and available Nitrogen after the planting of *Stylosanthes* and there was not much difference in the available P and K. Similarly, all the beneficial micro-flora like *Rhizobium, Azospirillum, Azotobacter,* Free living N fixers and PSB were significantly improved in both sapota and mango based horti-pasture systems compared to sole systems. Due to the fixing of atmospheric N by *Stylosanthes*, it was more evident in legume based systems compared to the grass based systems. Growth parameters in the mango and sapota indicated that there was not much difference in the height, girth and canopy of either sole or combined system. Woldeyohannes *et al.*, 2007.) reported nodulation and nitrogen fixation of *Stylosanthes hamata* in response to induced drought stress. In India, where there is a long standing practice of growing fodder crops in fruit orchards, *Stylosanthes hamata* has been tested in a various instances of such “horti-pastoral” systems.

When *Stylosanthes hamata* was sown after the monsson in guava, lemon, mango or kinnow orchards, yiels were improved with fertilization and were the highest under lemon and kinnow.

Table 1. Physico-chemical properties of soil before the establishment of horti-pasture system

Name of Sample	PH		EC (mhos/cm)		O. C. (%)		Avail – N (Kg/ha)		Avail – P (Kg/ha)		Avail – K (Kg/ha)		CEC (meq/100 gm	
	BP*	AP**	BP	AP	BP	AP	BP	AP	BP	AP	BP	AP	BP	AP
Mango	5.87	6.05	0.13	0.17	1.57	1.61	287	306	13.9	14.7	130	153	12.1	11.5
Mango+Stylo	5.36	6.10	0.63	0.15	1.75	1.48	375	310	12.3	16.4	218	164	12.5	10.2
Mango+ Brach aria	6.79	5.91	0.21	0.26	1.66	1.52	301	285	13.9	15.9	111	156	12.1	10.8
Mango+Guinea	5.86	5.98	0.16	0.21	1.66	1.76	276	296	14.9	14.9	102	128	10.6	11.6
Sapota	5.81	5.82	0.14	0.08	1.48	2.06	279	375	15.9	10.3	156	183	11.9	12.0
Sapota+Stylo	5.92	6.42	0.14	0.07	1.43	1.70	290	282	16.4	14.8	126	108	10.5	11.2
Sapota+Brachiaria	6.02	5.80	0.11	0.18	1.54	1.78	265	353	11.4	13.3	137	248	12.4	12.0
Sapota+Guinea	5.72	5.78	0.09	0.16	2.04	1.68	395	304	10.3	14.6	197	203	13.3	11.2

BP* = Before planting AP**= After Palnting

Table 2. Beneficial micro flora before the planting of grasses and legumes in the horti-pasture system

Horti-pasture system	Colony forming units / g soil									
	***Rhizobium* (*x*10)^4**		***Azospirillum* (*x*10)^6**		***Azotobacter* (*x*10)^4**		**Free living N fixers (*x*10)^2**		**PSB (*x*10)^4**	
	BP	AP	BP	AP	BP	AP	BP	AP	BP	AP
Mango	10	10	0.24	1.2	2	2	4	4	13	13
Mango+Stylo	3	6	0.33	2.3	3	5	2	5	11	21
Mango+Bracharia	5	9	1.40	1.4	2	2	1	4	18	14
Mango+Guinea	4	6	0.17	0.20	1	5	3	3	4	4
Sapota	6	5	0.14	0.40	4	3	Nil	Nil	8	8
Sapota+Stylo	9	6	0.27	0.70	1	1	Nil	Nil	12	12
Sapota+Bracharia	6	5	0.27	0.40	3	3	Nil	Nil	19	13
Sapota+Guinea	5	4	1.10	1.10	7	8	Nil	Nil	10	10

Table 3. Growth parameters of mango and sapota after the panting of grasses and a legume

Planting system	Per cent (%) Increase in growth parameters		
	Height	**Girth**	**Canopy**
Mango	25.40	14.40	21.20
Mango+ Stylo	24.50	14.40	23.70
Mango+ Brachiaria	22.40	12.60	22.40
Mango+ Guinea	21.50	12.20	21.30
Sapota	45.50	22.20	10.40
Sapota+ Stylo	57.90	24.40	12.40
Sapota+Brachiaria	55.20	20.20	10.00
Sapota+ Guinea	52.40	20.00	10.80

Conclusion

There was in improvement in the availability status of many of the nutrients as well as beneficial flora like *Rhizobium*, *Azospirillum*, *Azotobacter*, Free living N and phosphate solubalising bacteria in horti-pastoral blocks compared to sole mango and sapota. Among the combination of treatments, the highest beneficial flora was observed in mango plantations with *Stylosanthes hamata* as compared to other combinations.

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