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Influence of Fodder Crops on Physical Fertility of Oxisols

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ABSTRACT

Studies conducted on soil samples collected from coconut gardens, intercropped with fodder grass reveal that there was 30% increase in moisture content in fodder cultivated plot when compared to the control plots. Water holding capacity of soils with forage was found to be higher than control plots particularly in the sub surface layers. A maximum value of hydraulic conductivity of 152.81 cm hr-1 was observed in plots grown with setaria grass, while the control plots showed a value of 61.37 cm hr-1. The infiltration rate was maximum in plots grown with hybrid napier grass. The results show the feasibility of growing fodder grass in coconut garden to improve the physical fertility of soil.

Introduction

Physical fertility of soil is gaining more importance, as the availability of land for cultivation is reducing. Soil water is the prime characteristic, which influences the other physical parameters in a soil. Free land for cultivation of fodder grass is meagre. Farmers are generally under the impression that growing of grass in coconut garden will reduce the coconut production, by deteriorating the physico-chemical properties of soil. Fodder can grow well under the partial shaded conditions as in coconut gardens. Soil water influences the various soil physical properties and nutrient movement in soils. Scientifically it has to be proved that the intercultivation of fodder grass does not deteriorate, on the other hand, it influences the physical fertility of the soils. With this fact in view the present investigation has been undertaken to study soils from coconut garden intercropped with fodder grasses, in respect of their physical properties.

Materials and Methods

Soil samples from plots grown with different varieties of fodder grasses in coconut garden were collected from experimental area. The coconut palms are of the age 50 years and fodder has been cultivated under these gardens for 10 to 12 years continuously. The samples were collected from two depths, namely 0-15 and 15-30 cm from the soil surface. These samples were analysed for the moisture content, water holding capacity, hydraulic conductivity, bulk density, particle density and porosity. The infiltration rates were measured in the experimental plots using the double ring method. Hydraulic conductivity was measured using constant head permeameter. Moisture percentages were determined by gravimetric method and other physical parameters were measured as outlined by Gupta and Dakshinamoorthi (1980).

Results and Discussion

The moisture percentage and water holding capacity values are given in table 1. The moisture content in subsurface soil was slightly higher than that at the surface soil. The values ranged from 7.98 to 9.94 and 8.45 to 9.95% at 15 and 30 cm depths, respectively and the maximum value was obtained in plots with guinea grass. The crop canopy was more predominant in guinea, setaria and congo signal when compared to molasses and hybrid napier grass. Hence in these plots evaporation losses might be less compared to other plots. The control plot with no grass showed the minimum moisture content. The higher values at 30 cm than at 15 cm in control plots indicate that the surface soil has acted as mulch and prevented evaporation of moisture from the subsurface soil to some extent. This might be the reason for the nonsignificant effect of the treatments over control at 30 cm depth. The root distribution of coconut is found to be of the order of 30-120 cm deeper from the surface, being deeper than roots of fodder grass. Hence the moisture stress may not be experienced by the coconut roots. The present results show that fodder grass utilises the water mostly from the surface layer. The evaporation from surface layer is restricted by the presence of fodder canopy.

The water holding capacity of control plot was much less when compared to fodder cultivated plots (Table 1), though it was not significant at 15 cm depth. Plots with setaria grass have showed high

Table 1. Moisture percentage and water holding capacity (percent) of 0-15 and 15-30 cm soil depths

Treatments	Moisture percentage		Water holding capacity (%)	
	15 cm	30 cm	15 cm	30 cm
Congo signal grass	9.74	9.79	35.24	34.87
Setaria grass	9.49	9.68	37.11	36.23
Molasses grass	8.24	8.79	34.91	33.07
Hybrid Napier grass	9.02	9.20	34.79	36.75
No grass	7.98	8.45	32.00	31.13
CD at 5% level	1.76	NS	NS	3.01

Table 2. Hydraulic conductivity at 15 and 30 cm depths and infiltration rate (both in cm hr^{-1})

Treatments	Hydraulic conductivity		Infiltration rate
	15 cm	30 cm	
Guinea grass	85.05	53.92	37.20
Congo signal grass	120.05	102.07	28.30
Setaria grass	152.81	128.72	38.40
Molasses grass	103.02	102.73	42.25
Hybrid Napier grass	105.79	92.25	43.15
No grass	61.37	77.19	37.05
CD at 5% level	30.50	26.78	NS

Table 3. Bulk density, particle density and porosity at 15 and 30 cm depths

Treatments	Bulk density (Mgm^{-3})		Particle density (Mgm^{-3})		Porosity (%)	
	15 cm	30 cm	15 cm	30 cm	15 cm	30 cm
Guinea grass	1.16	1.19	1.79	1.90	42.33	40.78
Congo signal grass	1.21	1.21	1.94	1.87	39.47	41.01
Setaria grass	1.22	1.22	1.85	1.85	38.70	38.75
Molasses grass	1.20	1.23	1.90	1.88	39.42	36.83
Hybrid Napier grass	1.20	1.25	1.77	1.94	39.16	41.48
No grass	1.46	1.20	2.07	1.91	41.59	40.82
CD at 5% level	NS	NS	NS	NS	NS	NS

values of water holding capacity ie. 37.11 and 36.23% for 15 & 30 cm, respectively. The roots of setaria grass are much proliferated and this might have helped in increasing the water holding capacity of the soil by way of improvement of structure in these soils. Spread of fodder grass on the surface soil might have increased the water holding capacity in the subsurface layer.

Hydraulic conductivity depicts the readiness of the soil to conduct the water. When fodder grass was grown hydraulic conductivity was enhanced in the soils (Table 2). But guinea grass showed no influence on this property. Maximum conductivity of 152.81 cm hr-1 was obtained in plots with setaria grass. The values obtained for 30 cm depth were comparatively lower than that observed for 15 cm depth excepting control where a higher value was recorded at 30 cm depth (Bhatia and Srivastava, 1982). Bhagat and Acharya (1988) have shown that continuous cultivation increases the saturated hydraulic conductivity.

The infiltration rate was also found to be influenced by fodder cultivation although the differences among the treatments were not statistically significant. The abundant growth of roots in hybrid napiergrass may be one of the reasons for the high infiltration rate obtained for these plots. According to Fahad *et al.* (1982) low infiltration rate is associated with low macro porosity and decreased aggregate stability.

The data on the effect of different fodder grasses intercropped in coconut garden on the bulk density, particle density and porosity of soil at surface and subsurface are given in table 3. The bulk density value for control without grasses was much higher, though not statistically significant. At subsurface no differential effect was observed. This was due to the proliferation of grass roots in the surface than in the subsurface. The same trend was observed in the case of particle density also. Maximum value of porosity of 42.33% was obtained in plots with guinea grass where the effect on distribution of pores was more due to the proliferation and density of roots of guinea grass. There was not much variation between the surface and subsurface values.

Conclusion

All the hydraulic characteristics of soil in the coconut garden are influenced by fodder cultivation. The latter prevents the water loss by run off and will definitely increase the water balance in the soil. The bulk density values are reduced by growing fodder crops and thereby they improve the structure by changing pore size distribution in the soil.

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