Comparison of Dry Matter Partitioning of Organically and Conventionally Grown Tea for Carbon Sequestration Potential

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Introduction

Climate change is evident in almost all the regions in the world. In agriculture, it poses a significant impact in relation to productivity, quality and sustainability. Carbon sequestration is an adaptation strategy to climate change. Organic agriculture has a greater potential to sequester carbon in biomass and soil than most forms of conventional agriculture (Fan *et al*, 2005). Information on Carbon storage by tea plantations can fill the gap for comparison with native forests and changes in agricultural land use (Kamau *et al.*, 2008). However, the scientific validations to carbon storage in tea either in conventional and organic systems are scares. Therefore, it was identified important to generate information on dry matter partitioning of the tea bush and to compare the organic carbon content as dry matter partitioning of each part of the tea bush grown conventionally and organically to establish carbon sequestration potentials of organically grown tea as compared to conventionally grown tea.

Methodology

One bush each of sixteen year old tea was randomly selected from each plot of the on – going long term organic (treated with Tea Waste, Neem Oil Cake, Compost) and conventional field trial (TRIORCON' trial) and uprooted carefully, recovering all the roots by careful sieving process. Each bush was separated into different parts, i.e. leaves, stems, roots and flowers/ fruits. Leaves were further separated into immature (flush) and mature. Fresh weight of each sample was measured using digital electronic balance and recorded separately. The fresh samples were oven dried to get the dry weight at 80 ^{0}C until a constant weight was reached. Then the dry weight of each sample was measured and the total dry weight was calculated. Data were statistically analyzed.

Results and Discussion

Data on dry matter partitioning in field grown tea exposed to organic and conventional cultivation systems are presented in Table 1 and 2. There was a significant variation in total dry matter partitioning in tea under the two cultivation systems but carbon storage potentials were much towards in the organic system.

Table 1: Mean dry weight of the tea bush grown under different treatments

	Treatment	Total bush weight (g dry weight bush^{-1})
Organic	TW (Tea Waste)	3514.30 ± 161.6
	NOC (Neem Oil Cake)	3970.39 ± 510.24
	COM (Compost)	4213.77 ± 514.19
	CONV (Conventional)	6015.71 ± 928.94

Table 2: The dry matter partitioning in to different parts of the tea bush as a percentage of the total dry weight, under different management systems

Part of the Bush	Organic			CONV
	TW	NOC	COM	
Collar	26.58±11.65	23.48±7.465	22.82±4.814	24.19±7.386
Primary branches	13.72±7.46	12.06±1.94	10.92±3.42	11.77±7.53
Secondary branches	7.90±1.22	8.21±2.78	9.26±2.12	12.13±4.10
Tertiary branches	18.90±7.44	22.81±9.22	17.98±13.50	18.29±4.87
Big roots	20.23±14.82	20.24±11.98	28.41±13.12	21.58±11.33
Small roots	3.61±1.66	3.14±0.45	3.90±1.60	2.03±0.75
Mature leaves	8.50±2.19	9.61±4.82	6.27±4.24	9.53±4.82
Flush	0.51±0.22	0.400±0.17	0.38±0.19	0.41±0.25
Fruits and flowers	0.018±0.01	0.028±0.2	0.032±0.023	0.037±0.02

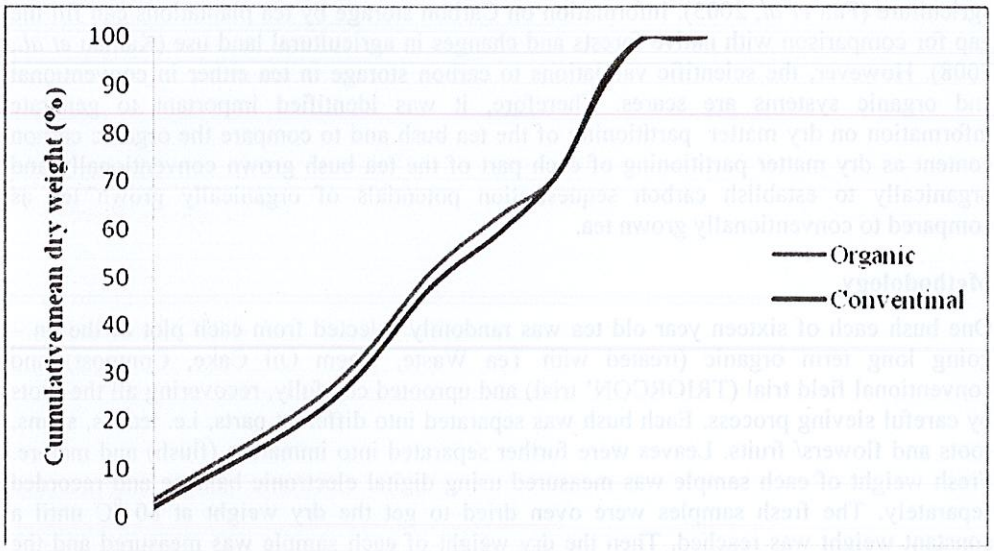

Figure 1: Cumulative mean dry weight (%) of the tea bush under organic and conventional system

Conclusion

Dry matter partitioning in field grown tea under organic and conventional systems was statistically significant at p=0.05 level .The highest mean dry weight of the bush was recorded in conventionally grown tea. Among the organic treatments the highest mean dry weight was recorded in Compost treated systems.

Irrespective of the cultivation system, the highest dry matter partitioning was seen in collar (23%-27%) region of the tea bush followed by the large roots (20%-28%) and then the tertiary branches (18% -23%).

The dry matter partitioning in the flush was 0.4%-0.5% and it was quite low when compared to other parts of the bush. The lowest amount of dry matter was allocated to fruits and flowers (0.02% -0.04%) (Table 2).

Cumulative mean dry weight (%) of the tea bush under organic and conventional systems were comparable (Figure 1). This in turn exhibited that the organically grown tea plants are not under any stress condition resulting as a sustainable system.

Further, the organic system of cultivation of tea doesn't consume fossil energy sources for nutrient supply, pest and disease control and growth boosting etc. Instead, local natural resources are been harnessed for such purposes which will not encounter any external energy sources. In the meantime, organically grown tea has shown a comparative dry matter partitioning. Moreover, the root growth is superior under organic cultivation systems with respect to depth and volume. When overall dry matter partitioning of 20%-28% observed in the large roots is considered, the organically grown tea seems to sequester a comparatively greater volume of carbon than that of conventional system. In addition, organic method of cultivation owing to avoidance of synthetic inputs and natural and organic supplements, significant increases in soil carbon and biological activity were evident (data unpublished). Thus it proves the greater potentials in carbon sequestration under organic tea cultivation.

References

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