International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(1): 2027-2030

Received: 14-11-2018
Accepted: 18-12-2018

A Anjaneyulu
Department of Plantation and Processing, UBKV, Pundibari, Cooch Behar, West Bengal, India

H Bhattacharjee
Department of Plantation and Processing, UBKV, Pundibari, Cooch Behar, West Bengal, India

Correspondence
A Anjaneyulu
Department of Plantation and Processing, UBKV, Pundibari, Cooch Behar, West Bengal, India

Effect of combined application of organic and inorganic fertilizers on yield and quality of young tea (*Camellia sinensis* (L.) O. Kuntze) inter-planted in arecanut

A Anjaneyulu and H Bhattacharjee

Abstract
An experiment was carried during March 2016 to May 2017, to investigate the effect of combined application of organic and inorganic fertilizers on yield and quality of young tea (*camellia sinensis* (l.) o. kuntze) inter-planted in arecanut, at Instructional plot of the Department of Plantation Crops and Processing, Faculty of Horticulture, UBKV, Pundibari, Cooch Behar, West Bengal, India. The experiment was laid out in Randomized Complete Block Design (RCBD) with five treatments T_1 (Control), T_2 (FYM@ 2.0kg+1/2 RDF), T_3 (VC@ 1.0kg+1/2RDF), T_4 (FYM@2.0kg+RDF), T_5 (VC@1.0kg+RDF) and four replications, yield parameters were recorded from 90 to 360 days after planting. Two to three leaves and the terminal buds were harvested from different treatments, quality parameters were estimated like Polyphenol oxidase (PPO) and chlorophyll content. Results were revealed that maximum number of growing buds (94.83%) and minimum number dormant buds (5.18%) were recorded in T_5 (VC+RDF) followed by T_4 (FYM+RDF) and T_3 (VC+1/2 RDF) whereas minimum growing buds and maximum dormant buds recorded in T_1(control) on 360 days after planting, yield parameters were significantly varied among the treatments. With respect of quality parameters chlorophyll, polyphenol oxidase (PPO) there was no significant difference among the treatments.

Keywords: Arecanut, chlorophyll, growing and dormant buds, polyphenol oxidase and tea

1. Introduction
Tea (*Camellia sinensis*) is one of the leading cash crops in world agriculture and India is the largest producer of tea in the world after China. The most popular and the cheapest beverage consumed by the world population. It is grown in more than 60 countries in the world. Major producers are India, China, Sri Lanka, Kenya, Malawi, Vietnam and Bangladesh, contributing the maximum share to the global production. China is largest producer of tea in the world. India is the second largest producer and largest consumer with a production about 1180 million kg from a total area of about 5.80 lakh ha during 2015-16. The major tea growing states in the country are Assam, West Bengal, Tamil Nadu and Kerala. There has been a significant increase in production and productivity of tea during last 50 years. In West Bengal, 323.38 million kg of tea was produced from about 1.41 lakh ha during 2015-16. Stimulative effect of tea is due to the presence of caffeine and considered to be a health drink because of presence of vitamin B-complex, folic acid, poly phenols and anti-oxidants. It reduces blood cholesterol, hypertension and stone formation due to presence of polyphenols and anti-oxidants. Present day population composed of three different races namely Assam, China and Cambod type. Growth of the tea plant is dependent on many factors comprising of those that are inherent in the plant itself and those exerted on the tea crop by nature such as soil and climatic conditions, pest and diseases, and man through crop husbandry and cultural practices. Tea is cultivated in different type of terrains in the North eastern parts of India. It is planted on the mountain slopes of the eastern Himalayas up to a height of 2000 m in Darjeeling and in undulating flat lands ranging from 20-250 m in the Dooars and Assam regions. Tea requires a moderately hot and humid climate. Climate influences yield, crop distribution and quality. Tea grows best on well-drained fertile acid soil on high lands. As Tea, is almost exclusively a rain fed crop, it has been planted in areas under heavy rain fall. On account of this, tea growing areas are intensively leached.

Leaching is known to increase the proportion of iron and aluminum giving rise to red soils or lateritic soils, such soils are found in the tea growing areas of both southern and north eastern regions of India (Benzbauah, 1999) [1].

Fertilizer is one of the major agro-inputs contributing to the cost of production and productivity in tea plantation. For proper maintenance of the health of tea bushes and to obtain high yield, a well-balanced fertilization is necessary throughout the year.

However, the combined use of organic and inorganic fertilizers will ensure that the problems associated with the use of either organic or inorganic fertilizers are greatly reduced as the combination of organic and inorganic fertilizers complement each other. Ojeniyi (2002) [7] reports that nearly all attempts to maintain continuous crop production with chemical fertilizers alone in the tropics have failed. It has been abundantly shown that combined use of organic and inorganic fertilizers is required for sustainable soil productivity under intensive continuous cultivation. From these study experiment was carried out that effect of combined application of organic and inorganic fertilizers on yield and quality of young tea (*camellia sinensis* (l.) o. kuntze) inter-planted in arecanut.

2. Materials and Methods

The experiment was laid out in Randomized Complete Block Design (RCBD), work was done during June 2016 to May 2017, with five treatments (T_1 to T_5) following treatments like T_1(Control), T_2(FYM@ 2.0kg+1/2 RDF), T_3(VC@ 1.0kg + 1/2RDF), T_4 (FYM@2.0kg + RDF), T_5 (VC@1.0kg + RDF), and four replications (R_1 to R_4), at instruction cum research plots of the Department of Plantation Crops and Processing, Faculty of Horticulture, Uttar Banga Krishi Viswavidyalaya (UBKV), Pundibari, Cooch Behar, West Bengal, India, planting material used for the experiment of tea was biclonal seed stock of TS-462, taken from the Departmental nursery and interplanted in arecanut garden with spacing of 110 cm X 60 cm (single hedge), maintaining a distance of 60 cm from the base of the arecanut palm. The arecanut variety used for the study was Mohitnagar. Spacing of areca nut was followed 2.70 m X 2.70 m, age of areca nut palms 11years old when tea was interplanted in arecanut garden (Planted during 2005). Source of nutrients for the experiment was organic matter as farm yard manure (FYM@2.0 kg/plot) and vermicompost (VC @1kg/plot); nitrogen as urea, phosphorus as single super phosphare (SSP) and potash as muriate of potash (MOP) and recommended dose of fertilizers for tea [Young tea mixture (NPK: 10: 5: 10) @ 200 kg/ha/year], as per recommendation of Tea Research Association (TRA), in case of arecanut recommended dose of fertilizers i.e., NPK @ 100:40:140 g/palm/year was given. The tender apical portion of shoots consisting of two to three leaves and the terminal buds were harvested from different treatments, from the harvested leaves number of growing and dormant buds were separated and counted per plot and expressed in percentage (%). Collection of samples for Bio chemical analysis from the plant part was two youngest leaves and a buds, Polyphenol oxidase (PPO) estimated from two leaf and a bud following the method of Mayer *et al.*, (1965) [6] and Leaf chlorophyll content was measured in the third leaf from tip, readings were taken with the help of a chlorophyll meter (SPAD-502 plus by Konica Minolta, Japan). Observations were recorded on tea yield like number of growing buds, number of dormant buds and quality parameters were polyphenol oxidase (PPO) and Chlorophyll content.

3. Results and Discussion

Yield parameters

Number of growing buds

Numbers of growing buds were recorded from 90 to 360 days after planting presented in Table 1. and Fig.1. From the table minimum numbers of growing buds were recorded in winter months 210 days after planting whereas maximum numbers of growing buds were produced in the active growth period of crop. The maximum number of growing buds (94.83%) were recorded in T_5 (VC+RDF) followed by (91.04%) in T_4 (FYM+RDF) and (89.20%) in T_3 (VC+1/2RDF) whereas the minimum numbers of growing buds (85.11%) were recorded in T_1 (control) on 360 days after planting.

Number of dormant buds

Numbers of dormant buds were significantly difference among the treatments. Dormant buds were increased during the winter months on 210 days after planting compared with other growing days of tea. Maximum numbers of dormant buds (14.89%) were observed in T_1 (control) followed by (8.96%) dormant buds in T_4 (FYM+RDF) and (10.75%) dormant buds in T_3 (VC+1/2RDF) while minimum number of dormant buds (5.18%) were observed in T_5 (VC+RDF) on 360 days after planting. Maximum numbers of dormant buds were produced during the winter months whereas minimum numbers of dormant buds were produced in the sunny days.

Kulasegram and Kathiravetpilliai (1970) [2] observed that lack of sufficient supply of nutrients particularly nitrogenous fertilizers increased dormancy resulting in poor growth. As tea plant needs adequate supply of nutrients for its nourishment of growth and development and buildup of organic tissues from simple inorganic substances. Kumar and Bera (2013) [3] also recorded that highest seasonal response of photosynthetic rate and productivity of young Darjeeling tea clone to organic and inorganic fertilization. Kumar *et al*., (2015) [4] also observed that increased the photosynthetic activity and yield of Darjeeling tea with application of Vermicompost and chemical fertilizers gave best results compared to the control plots.

Quality parameters

Chlorophyll content

Chlorophyll content wasrecorded in third leaf from top of the plant, presented in Table 3. There was no significant difference in chlorophyll content in all treatments. Whereas high fertilized treatment T_5 (VC+RDF) showed maximum chlorophyll content. Kumar *et al*., (2013) [5] also reported that maximum chlorophyll content was recorded in fertilized plots.

Polyphenol oxidase activity

Polyphenol oxidase activity was observed in two leaf and a bud (Ab/min/g fresh leaf) and presented in Table 3. Statistically not significant difference on PPO activity in all treatments. PPO activity was more when the initial time, while PPO activity was gradually decreased when the time increased.

As the commercial portion of the tea crop consist of leaves (two leaf and a bud) therefore highly responsive to nitrogen fertilizers. The increased harvestable fresh and dry weight could be attributed to enhanced soil fertility following application of manures and fertilizers, these were improved structural and biological soil condition. Lack of sufficient supply of nutrients particularly nitrogenous fertilizers increased dormancy resulting poor growth, Fertilizers

increased leaf yield of tea plants through increased growth rate and density of harvested shoots.

4. Conclusion

The study concluded that, yield parameters were significantly varied among the treatments, maximum number of growing buds (94.83%) and minimum number dormant buds (5.18%) were recorded in T_5 followed by T_4 (FYM+RDF) and T_3 (VC+1/2 RDF) whereas the minimum yield was recorded in T_1(control) on 360 days after planting. With respect of quality parameters chlorophyll, polyphenol oxidase (PPO) there was no significant difference among the treatments.

Table 1: Number growing buds on days after planting per plot (%)

Number of growing buds								
Treatments	**90 DAP (Augst' 16)**	**120 DAP (Sept' 16)**	**150 DAP (Oct' 16)**	**180 DAP (Nov' 16)**	**210 DAP (Dec' 16)**	**300 DAP (March' 17)**	**330 DAP (April' 17)**	**360 DAP (May' 17)**
T_1-Control	84.95	82.69	79.35	67.86	36.85	82.23	83.96	85.11
T_2-FYM+1/2 RDF	87.18	84.38	82.21	70.14	38.60	84.68	85.53	88.72
T_3-VC+1/2 RDF	91.18	87.39	83.20	72.10	41.57	85.80	87.08	89.20
T_4-FYM+RDF	91.87	88.63	86.15	76.95	45.44	86.88	89.44	91.04
T_5-VC+RDF	93.40	92.57	88.50	80.04	48.03	89.80	93.25	94.83
SEm (±)	1.28	1.08	1.16	1.61	1.28	1.10	1.08	0.56
C.D at (0.05)	3.94	3.32	3.56	4.95	3.95	3.38	3.33	1.73

DAP: Days after planting, RDF: Recommended dose of fertilizers, (FYM: Farm yard manure, VC: Vermicompost)

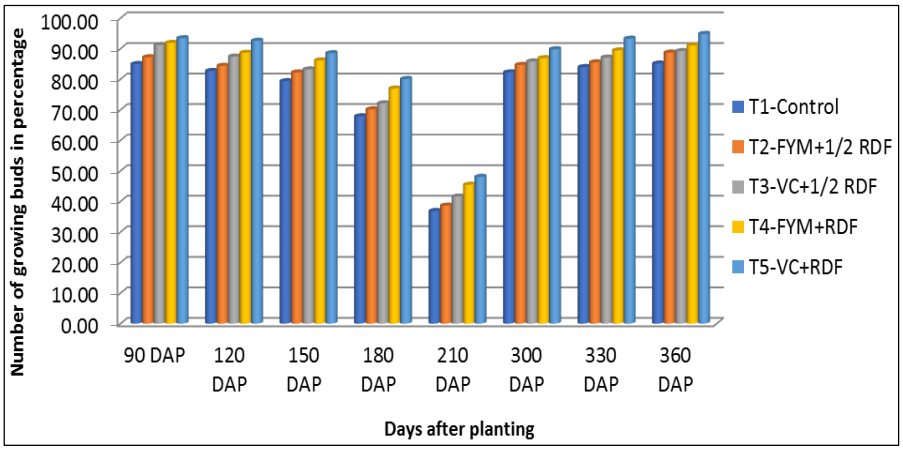

Fig 1: Number of growing buds on days after planting per plot (%)

Table 2: Number dormant buds on days after planting per plot (%)

Number of dormant buds								
Treatments	**90 DAP (Augst' 16)**	**120 DAP (Sept' 16)**	**150 DAP (Oct' 16)**	**180 DAP (Nov' 16)**	**210 DAP (Dec' 16)**	**300 DAP (March' 17)**	**330 DAP (April' 17)**	**360 DAP (May' 17)**
T_1-Control	15.05	17.20	20.65	32.15	63.15	17.78	16.04	14.89
T_2-FYM+1/2 RDF	12.82	15.63	18.04	29.87	61.41	15.32	14.40	11.28
T_3-VC+1/2 RDF	8.83	12.61	16.80	27.90	58.43	14.20	12.92	10.75
T_4-FYM+RDF	8.14	11.37	13.86	23.56	54.56	13.12	10.56	8.96
T_5-VC+RDF	6.60	7.43	11.51	19.96	51.97	10.13	6.75	5.18
SEm(±)	1.28	1.07	1.15	1.53	1.28	1.09	1.09	0.56
C.D at (0.05)	3.94	3.28	3.55	4.73	3.95	3.36	3.36	1.73

(DAP: Days after planting, RDF: Recommended dose of fertilizers, (FYM: Farm yard manure, VC: Vermicompost)

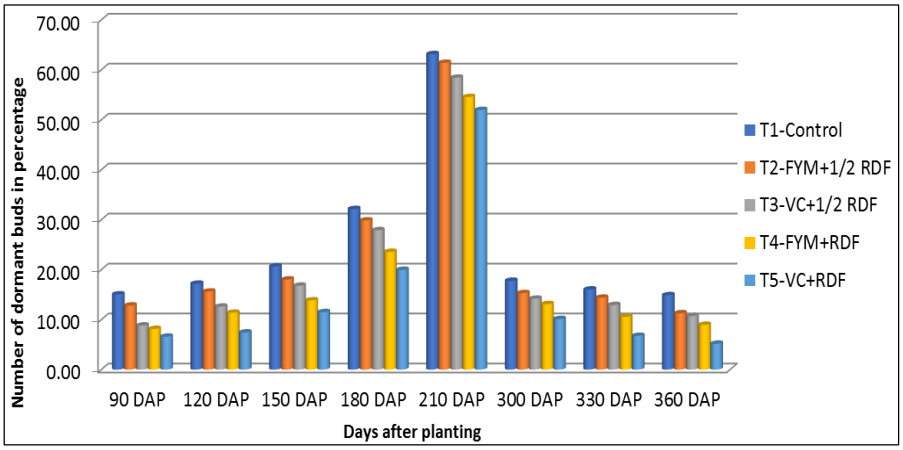

Fig 2: Number dormant buds on days after planting per plot (%)

Table 3: Quality parameters Chlorophyll and PPO

Treatments	Chlorophyll (SPAD Units)	PPO (Ab/min/g of fresh leaf)
T_1-Control	38.22	9.21
T_2-FYM+1/2 RDF	38.93	9.45
T_3-VC+1/2 RDF	42.42	9.91
T_4-FYM+RDF	42.21	9.27
T_5-VC+RDF	47.72	9.25
SEm(±)	2.18	0.69
C.D at (0.05)	NS	NS

(RDF: Recommended dose of fertilizers),
(FYM: Farm yard manure, VC: Vermicompost)

References

1. Benzbauah HP. In: *Global Advances in tea science* (jain NK, Ed. I, Aravali books Int. Pvt. Ltd., New Delhi, 1999, 383-392.
2. Kulasegram S, Kathiravetpilliai A. Effects of levels of shade and nitrogen on growth of young tea (*Camellia sinensis* L.). Tea Quart. 1970; 49:112-124.
3. Kumar R, Bera B. Seasonal response of photosynthetic characteristics and productivity of young Darjeeling tea clone to organic and inorganic fertilization. J Crop Weed. 2013; 9(2):142-153.
4. Kumar R, Bisen JS, Mahipalsingh Bera B. Effect of pruning and skiffing on growth and productivity of Darjeeling Tea (*Camellia sinensis*). Int. J Tech. Res. Appl. 2015; 3:28-34.
5. Kumar R, Singh M, Bera B. Influence of Organic, Inorganic and Combined based Fertilizers on Bush Physiology of Darjeeling Tea (*Camellia sinensis*.). International Journal of Basic and Applied Biology. 2013; 2:265-271.
6. Mayer AM, Harel E, Shaul RB. Assay of catechol oxidase: a critical comparison of methods. Phyto chem. 1965; 5:783-789.
7. Ojeniyi SO. Soil management, national resources and environment. Oke-Ado: Adeniran press, 2002, 24.