Journal of Agricultural Technology 2015 Vol. 11(8): 2205-2210
Available online http://www.ijat-aatsea.com
ISSN 1686-9141

To study the effect of microbial products on yield and quality of tea and soil properties

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Ha T.T.D. and Nguyen V.T. (2015). To study the effect of microbial products on yield and quality of tea and soil properties. Journal of Agricultural Technology. 11(8): 2205-2210.

Microbiological productions have a role in supplying microorganism types and are utilized from the agricultural waste by-products to create the local organic fertilizer sources supplied for tea plants. The study on the use of the 4 microbiological products suggest that the cellulose decomposing product supported the highest tea productivity (13.71 quintals/ha). Besides, teas with class A+B reached the highest proportion (8.37% higher than the controlled treatment). The use of microbiological products for the pruned tea branch and leaf, which was equivalent to 30% of inorganic nitrogen, increased the organic content and number of soil microorganisms. The use of the cellulose decomposing product created the highest content of organic matter (3.75%).

Keyword: Microbiological, tea plants, prune tea plant, productivity

Introduction

In a majority of tea cultivation systems in Vietnam, the long-term overuse of chemical fertilizers has led to the degradation of tea plants, the decrease in growth, the increase in the risk of high nitrat content in products and the depletion of quality. On the other hand, the soils are also degraded and impoverished, and their physical properties negatively impacted. The tea plant is usually farmed on soils that have high risk of erosion, poor in nutrients, particularly humus content, and have low moisture. Therefore, biofertilizers should be added to cultivated tea plants. However, this solution still has limitations such as annual erosion of millions of tons of soil with high nutrient and humus contents. The degradation of soil is a popular trend for many regions, in particular hilly and mountainous ones. In order to enhance land use efficiency or strengthen sustainable production on steep slopes, sustainable and efficient land use techniques are first paid attention; intensive farming must be accompanied with protecting and enhancing the fertility of sloping soils.

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Microbiological productions have a role in supplying microorganism types and are utilized from the agricultural waste by-products to create the local organic fertilizer sources supplied for tea plants. This is a new heading concerned by many scientists. From the issues mentioned above, we conducted the study titled: *To study the effect of microbial products on yield and quality of tea and soil properties*

Materials and methods

Subjects and study materials

- Reasearch materials: LDP1 tea variety in production period
- Preparations of micro-organisms including: Preparations of celluloza resolution, EM preparations, EMUNIV preparations, preparations of Compost Maker.

Time and place of study

Study period: From 2010 - 2012

Location research: Institute of Agricultural Science and Technology For Northern Mountainous Region, Phu Ho commune, Phu Tho town, Phu Tho province.

Research Methodology

The experiment was arranged in randomized complete block, consisting of 5 treatments, each formula includes 3 replicates.

Treatment 1 (Controlled): 300 N + 100 P_20_5 + 100 K_20 (**I)**

Treatment 2: 70% **(I) +** EMUNIV preparations

Treatment 3: 70% **(I) +** preparations of Compost Maker

Treatment 4: 70% **(I) +** EM preparations

Treatment 5: 70% **(I) +** Preparations of celluloza resolution

- Soil sampling method: according to ISO 7538-6:2010 .
- Measurement of growth and yield: according to methods of the Center for Tea Research and Development, Research Institute of Agriculture and Forestry Science and Technology For Northern Mountainous Region..
- Investigate pests and diseases according to ISO 01-38: 2010 issued by the Ministry of Agriculture and Rural Development.
- The sensory evaluation of green tea quality by ISO 3218-1993.

Results

Effect of microbial products on yield of tea

Table 1. Effect of microbial products on yield of tea and yield components

Year	Treatment	Bud density (bud/m^2)	Weigh of bud (gr/bud))	Leng of bud (cm)	Rate of effective bud (%)	Average yield per harvest time (quintal/ha)
2010	Treatment 1 (Controlled)	140.12	0.61	6.24	82.45	9.11
	Treatment 2	167.30	0.67	7.14	91.18	10.60
	Treatment 3	172.76	0.71	7.20	92.34	10.75
	Treatment 4	168.97	0.67	7.21	91.43	10.65
	Treatment 5	174.03	0.70	7.25	91.74	10.54
	CV%	**5.5**				**7.4**
	LSD_{05}	**16.98**				**0.66**
2011	Treatment 1 (Controlled)	153.06	0.62	6.04	83.85	10.01
	Treatment 2	188.85	0.74	7.65	92.90	11.56
	Treatment 3	194.36	0.76	7.67	92.52	11.78
	Treatment 4	188.45	0.75	7.60	93.41	11.58
	Treatment 5	193.91	0.74	7.66	93.30	12.51
	CV%	**6.3**				**6.6**
	LSD_{05}	**8.03**				**0.99**
2012	Treatment 1 (Controlled)	171.03	0,64	6,28	85,15	11,12
	Treatment 2	201.09	0.80	7.73	93.68	13.13
	Treatment 3	208.52	0.82	7.83	94.18	13.59
	Treatment 4	203.15	0.80	7.52	92.59	13.18
	Treatment 5	207.18	0.84	7.70	93.65	13.71
	CV%	**6.5**				**5.7**
	LSD_{05}	**5.52**				**0.91**

- Bud density have distinct differences between fertilizer treatmenttions supplemented microbial products. After three years of experiments, treatment 3 produced highest bud density (208.52 bud/m^2).

Length of buds and bud weight disparity between the supplemented treatment fertilizers and microbial products were higher than the control treatment does not apply. In the treatment 3 (Com posmarker fertilizer) and treatment 5 (celluloza preparations rapid resolution) weighing of bud and bud length are reach maximum.

- The average yield per harvested time in the fertilizer treatment supplemented microbial products have obvious differently in comparement to the control treatment. After 3 years, the average yield per harvested time of treatment 5 (13.71 quintal/ha) and treatment 3 (13.59 quintal/ha) are highest.

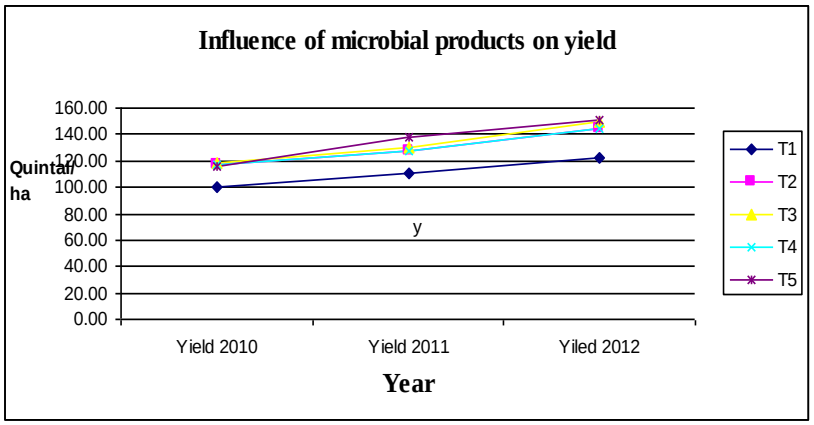

Figure 1: Chart discribe the influence of microbial products on yield

Effect of microbial products to drinking quality of green tea

Table 2. Effect of microbial products on raw tea quality

Treatment	Green tea A (%)	Green tea B (%)	Green tea C (%)
Treatment 1 (Controlled)	25.40	56.20	18.40
Treatment 2	37.00	53.09	9.91
Treatment 3	28.60	55.63	15.77
Treatment 4	33.65	53.00	13.35
Treatment 5	40.09	50.00	9.91

All treatment supplementation of microbial products have ratio green tea A + B higher than the control. Of which, treatmen 5 have the rate green tea A + B highest and higher than the control 8,49%.

Table 3. Effect of microbial products to drinking quality of green tea

Treatment	Score of outside characters	Score of water colour	Score of scienteed	Score of taste	Total score	Ranking
Treatment 1 (Controlled)	4.33	4.20	4.00	3.75	16.15	Good
Treatment 2	4.75	4.20	4.00	3.75	16.55	Good
Treatment 3	4.50	4.20	4.00	4.25	16.92	Good
Treatment 4	4.33	4.30	4.25	4.25	17.17	Good
Treatment 5	4.75	4.40	4.25	4.25	17.59	Good

The experimental Treatments were not different from the controlled one, and had a good ranking. Therefore, the Treatments added by microbiological products did not influence the tea quality but did on the classes of tea leaves. This is profitable for producing safe tea products oriented to sustainable cultivations in the tea planting regions of the country.

Effect of microbial products in bio-chemistry quality of tea

Table 4. Effect of microbial products in bio-chemistry quality of tea

Treatment	Tanin (%)	Caffeine (%)	Reducing sugar (%)	Amino acid (%)
Treatment 1 (Controlled)	30.50	2.48	2.03	1.05
Treatment 2	31.30	2.38	2.34	1.12
Treatment 3	33.73	2.07	2.38	1.14
Treatment 4	32.71	2.17	2.40	1.06
Treatment 5	33.30	2.59	2.43	1.17

- There is a different tannin content between the treatments that used microbial products, ranging from 30.50 to 34.73% . Of which, treatment 3 (use of Composmarker) had the highest tannin content (34.73 %) .

- There is a different caffeine content between the treatments that used microbial products, ranging from 2.07 to 2.59%. Of which treatment 5 have caffeine content higher than the control.

- There is a different reducing sugar content between treatment. Of which, treatment 1 (no additional fertilizer and biological products) have lowest reducing sugar content (2.03 %) and the highest is the treatment 5 (2.43 %) .

- Amino acid content in treatment without variation, ranging from 1.05% to 1.17 % . Of which, treatment 5 had the highest amino acid content.

Effect of microbial products in bio-chemistry on tea soil characteristics

Table 5. Effect of microbial products in bio-chemistry on tea soil characteristics

Treatment	pH_{KCl}		Organic matter (%)		Al^{3+}(ldl/100g)	
	After year 1	*After year 3*	*After year 1*	*After year 3*	*After year 1*	*After year 3*
Treatment 1 (Controlled)	4.27	4.55	2.57	3.04	4.91	5.35
Treatment 2	3.96	3.72	3.02	2.09	6.45	4.66
Treatment 3	4.02	3.54	3.58	2.92	6.72	5.57
Treatment 4	4.10	3.60	3.95	3.03	7.48	5.96
Treatment 5	3.88	3.75	4.04	3.75	8.82	7.62

The results show that the use of microbial products in the treatments will increase the acidity of the soil than in treatments not use probiotics (Controlled) and soil before the experiment.

At the year 3: of using microbial preparations, organic matter content in the soil was significantly improved. Of which, treatment 5 have organic matter content highest (3.75%).

Discussions

The study on the use of the 4 microbiological products suggest that the cellulose decomposing product supported the highest tea productivity (13.71 quintals/ha). Besides, teas with class A+B reached the highest proportion (8.37% higher than the controlled treatment). The use of microbiological products for the pruned tea branch and leaf, which was equivalent to 30% of inorganic nitrogen, increased the organic content and number of soil microorganisms. The use of the cellulose decomposing product created the highest content of organic matter (3.75%).

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