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Full Length Research Paper

Influence of Compost made by Agro-ores on Biological activity of Podzolic soil of Subtropical zone of Georgia

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Abstract
Agriculture of Georgia faces serious challenges: important dependence on climatic zones; insecurity from extreme weather disasters; low productivity; uncontrolled consumption of mineral fertilizers, chemical pesticides and growth stimulants; filling local market with poor quality products. The way to produce ecologically pure competitive production is usage of organ-mineral fertilizers. Industrial fertilizers having high quality made on the basis of agro-ores, peat, lignite have got prolonged effect and their effect increases in time. The present work deals with the influence of composts made by using organic fertilizers and agro-ores used in the tea cultures on the so-called podzolic soilof the subtropical zone of the Black Sea coastline of Georgia on the soil fertility and on the content of moviable forms of the nutritional elements. We have found out that by using the mentioned fertilizers, the amount of humus increases and reacts effectively on the consistence of the digestive forms of N, P, Kin the upper active layer of the podzolic soil of the subtropical zone occupied with the tea culture.

Key words: *Compost, Zeolite, Peat, Nitrogen, Biological activity.*

Introduction

Agriculture as an ancient field of production had active contact with nature and natural resources before cultural agriculture. In modern world it is impossible to imagine agricultural production without taking into account ecological standards. To its part nature makes great impact on agricultural production. Natural environment defines biological, technical and ecological aspects of production. In step with scientific-technial progress the forms of communication with nature is more and more deteriorated which makes important scientific activity and compliance to ecological processes, all the above-stated is necessary on oen hand for the efficacy of agricultural activity and on the other hand for imprioving excological conditions. The basic purpose of producing herbal plants is providing the population with grocery. The basic criterion in producing and using nutritious products is their quality. Latent demand on organic nutritious products at Georgian market at present is 79,4 million USD which is only 0.05% from global demand [Philip M. Parker, Ph. 2005]. Therefore in high ecological conditions it is necessary to control the intensity of habituation of polluting toxic substances by plants from soil, which depends on reaction of soil solutions, toxicants, admixtures, forms of adulterants, consistency of organic substances in soil and its mechanic and mineral consistency, as well as consistency of carbonates, phosphates, macro and micro elements, moisture level, temperature, etc.[Alasania N., LomtatidzeN., NakashidzeN. 2011].

According to the above-stated purpose of our research is producing ecologically pure products which is importantly influenced by organic and natural mineral fertilizers as by their usage the consistency of basic feeding elements in soils and physical and chemical characteristics of soils are changed which finally are reflected in qualitative indicators of raw and ready products[Codex Alimentarius 2004; Lominadze S., Bigvava L., Tchanukhvadze P., Chikashua K., Jijeishvili G. 2010;Bziava M. -1973; Tsanava V. -1985].

Materials and Methods

Research object was tea plantations at podzolic soils in The Black Sea subtropical zone of Georgia. 24 parts were selected for test of five variant fields. The area of each part was 60-70m^2. Samples of soil were taken at 0-20 and 20-40 cm depth. The following were determined in soil samples: nitrogen with agar-layer method, humus with Turin method; movable phosphorus and potassium with Oniani method, sum of calcium and magnesium by trigonometric method, pH by potentiometer method; changeable acidity by Sokolov method;
The following devices were used: pH-meter N5123; photoelectric colorimeter KF -77; drying closet – SUP 4M; Muffel GHOJI–16251/II-U; flammablephotometer FLAPHO 4 CARLZEISS; analytical scales - AS 220/X. The received results were elaborated

via mathematical dispersion method [Dospechov B.-1985]. The received results are given under table1 from which it is identified that soils of selected plots are typical for tea production. The consistency of potassium and phosphorus is ruffling from average to low level. Potassium in research soil samples is poor.

Table 1. Agro-chemical indicators of soil

Agro-chemical indicators of soil		**Soil layer depthcm**	
		0-20	20-40
pH suspension	HH_2O	4,8	4,9
	HKCl	3,8	3,9
Changeable pHmg./equal		6,6	8,5
Humus %		4,8	3,3
General nitrogen %		0,24	0,16
Movable forms mg. in 100g. soils	Hidr. N	_	_
	P_2O_5	43,7	26,5
	K_2O	10,5	6,2
	CaO	30,8	14,2
	MgO	13,0	22,0

Organic components were used for producing composts: manure, peat, lignite coal, zeolite and phosphate powder/flavour. Physical-chemical analyses were conducted in separate components before making composts. The received results from the mentioned analysis are given under Table 2. The results demonstrate that local peat totally meets requirements under national legislation. The consistency of organic admixtures, nutritious elements, ash consistency and dissolution quality are under norms.

Table 2. Physical-chemical indicators of raw material used for producing compost

#	**Name of raw material**	**humidity %**	**pH KCl**	**Quality of dissolution %**	**Nash %**	**OOrganic substances%**	**General forms from fry weights %**				
							N	P_2O_5	K_2O	CaO	**MgO**
1	Peat	52	5,5	21	25	75	1,85	0,12	0,14	1,2	**0,24**
2	Manure	48	6,8	_	22	78	1.64	0.2	1,5	_	_
3	Mlignite coal	27	5,2	_	35	65	0.5	0,01	_	_	_
4	Zeolite	5_10	8,0	_	_	_	_	0,3	1_1,8	3,0_6,0	**1_1,5**
5	**Fphosphate flavour/powder**	**5,1**	_	_	_	_	_	**20**	_	_	_

Manure is one of the basic components for making composts the physuicala nd chemical consitency of which mostly defines the final quality of the product (compost). The results of conducted analysis demonstrate the compliance of manure we have used to the requirements set for composts. In the manure humidity, organic admixtures and consistency of basic nutricisious products are under norm. Mixing the manure to other raw materials will create great basis for activation of micro organisms and mineralizetion of hardly soluble organic admixtures

For producing organic production lignite coal rich with Humin acids (20-30%) are widely used with manure and peat. Zeolite and phosphate powder/flavour were used for producing compost from agro-ores. It is widely known that natural zeolites consist of macro and micro elements necessary for plants, they have got long-term and strong ability of keeping water inside and they do not suffer from swelling which contributes to maintain constant correlation among solid, soluble and gas layers in the soils. Herewith zeolites contribute long-term maintenance of nutritious products at nutritious area and accordingly pollution process of environment is constrained [Andronikashvili T.G., Urushadze T.F., Kordzakhia T.N., Eprikashvili L.G., Dzagania M.A. 2012, Mumpton F.A. 1999].

Phosphate flavour/powder is finely milled agro-ore which is widely used in chemical industry and agriculture as direct fertilizer at specially acidic soils. While composting organic fertilizers using this latter is useful for many aspects. First of all it is source of phosphorus and enriches them in acidic area with the easy habituating forms. In the rock it is with calcium and as a result of hydrolysis it neutralizes over acidity and positively impacts at activation of biological processes so at mobilization of organic-huminopent admixtures.

The fertilizers which are approved for grocery made organically were used for making composts [Codex Alimentarius- 2004] with the following combinations and correlation:

1. Peat-manure;
(manure-4,8t+peat - 3,0t+phosphate powder/flavour-200kg)- in total 7t.
2.Nmanure-coal;
(manure -4,8t+coal-2,0t+ phosphate powder/flavour -200kg)-in total -7t.
3. Peat - coal - manure
(Peat-2,0t+ manure-3,0t+ coal -1,5t+ phosphate powder/flavour -200kg)-in total-6,7t.
4. Peat - coal - manure-zeolite
(Peat -2,0t+ coal -1,5t+ manure-3,0t+zeolite-0,8t+ phosphate powder/flavour -200kg)-in total-7,5t.
5. Peat - coal - manure
(Peat -2,0t + coal -1,5t+ manure-3,0t+ phosphate powder/flavour -200kg)-in total6,7t.

On pilot variant industrial mineral fertilizers –NPK are used. The very first four composts will be taken at pilot part of tea with the pre-suppose that norm of nitrogen per each variant should be equal to the norm of the first variant. The used dosages of basic nutritious elements in 100 g soils in field experiment are as follows: Nitrogen N-200kg/ha, phosphorus P_2O_5 -150 kg/ha, potassium K_2O-100 kg/ha taking into account the fact that optimal quantity of movable forms in soils should be taken to P_2O_5 - 50-60 mg and K_2O-25-30 mg.

Results

Research results approve that while long-term cultivation of tea plants soil cultivation process and humus gathering process takes place at NPK variant, upper layer of soil is to 5% after a year from usage of organic composts humus 0,8% increase is observed at upper layer of soil as a result of using peat-manure, in the rest variants humus is gathered with lesser amount but positive influence of both fertilizers is vivid at lower layers of gathering the humus.The data are given in the table 3.

Table 3. Influence of organic fertilizers at changeability of organic substances, general nitrogen and their movable forms in soil

#	Variants	Depth of taking samples cm	HHumus %	C soils %	General nitrogen %	Movable forms in mg. 100g soils				
						NNHydrolyst	$N\text{-}NH_4$	$N\text{-}NO_3$	P_2O_5	K_20
1	NPK by agro-rules	0-20	4,8	2,7	0,35	14,7	4,6	2,3	26,5	19,1
		20-40	2,5	1,6	0.22	8,5	3,3	1,7	15,0	15,3
2	Compost with peat and manure	0-20	6,6	3,8	0,36	16,6	5,1	3,1	27,2	22,2
		20-40	3,2	1,8	0,27	9,4	3,8	2,2	21,1	16,3
3	Compost with coal and manure	0-20	6,2	3,6	0,40	15,9	6,6	3,3	28,5	24,7
		20-40	2,5	1,4	0,23	10,3	3,5	2,0	19,2	14,5
4	N Compost with manure coal and peat	0-20	5,8	3,3	0,38	15,3	5,1	2,9	28,5	23,4
		20-40	3,2	1,8	0,27	8,6	3,2	1,6	20,1	13,8
5	N Compost with manure, coal, peata nd zeolite	0-20	5,5	3,2	0,41	16,4	6,0	3,2	30,3	24,6
		20-40	3,0	1,7	0,28	10,7	3,7	1,8	20,5	14,0

According to the researches sufficient amount of nitrogen is gathered in soils as a result of long-term usage of mineral fertilizers at subtropical podzolic soils under tea plants and in NPK variant at upper layer it achieves 0,35% at lower layer the consistency is significantly reduced down to 0,22%. Gathering of general nitrogen using organic fertilizers continues and at upper layer it is increased up to 0,38-0,40%. We should presume that this process will continue and will be reflected in improving qualitative indicators of the tea.

The mentioned processes first of all should be expressed in crteating better conditions for habituation of nitrogen movable forms in the plants but as received results show the changeability of nitrogen movable forms – hydrolized nitrogen, ammoniac and nitrate forms create better conditions for providing the plant with this element as a result of using organic composts compared to NPK. Though this process is demonstrated only at upper 0-20 cm layer of soil but as a result of stabile weather conditions the lower layer of the soil will be improved.

Positive influcen of organic fertilizers can be approved by gathering movable phosp[horus and changebal potassium. Their influence is vividly observed at upper layer of soil where taken organic fertilizers were fixed. Movable phosphiorus is at average level and changeable potassium consistency achieves optimal dosage. As for the lower 20-4 cm the positive tendency can be observed even here especially in the case of phosphorus and the potassium is the same at all layers as in the variant of NPK.

Conclusion

The following conclusions can be made on the research results made on podzolic soils where tea plants are planted in West of Georgia.

1. Using organic fertilizers-composts under tea plants on podzolic soils causes gathering of humus by 0, 3% compared to mineral fertilizers and general nitrogen more by 0,3-0,5%. Besides positive attitude of organic fertilizers to the forms of other nutritious elements was fixed.
2. The positive influence on movable forms of nitrogen is fixed under tea plants using organic fertilizers-composts in podzolic soils but changeability is minimal compared to NPK variant as research period equaled to 2 years and we should presume that the process will continue in further years and it will be fixed more vividly in agro-chemical indicators of soils and improving tea leaf quality;
3. According to the above-stated it is recommended to use organic fertilizers with the norms equal to mineral fertilizers in tea plantations on podzolic soils or with existing agro-technical norms for prolongation of effect for 3-4 years, besides joint usage of organic and mineral fertilizers is to be foreseen.

Ethics

All the authors read and approved the manuscript and no ethical issues involved.

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