The Effect of Different Vermicompost Doses on Wheat (*Triticum vulgaris* L.) Nutrition

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Vermicompost is an organic material that is received after a process of digestion some kinds of wastes (harvest, kitchen, manure etc.) by earthworms. It has an extensive usage in agriculture such as soil conditioner, source of organic fertilizer in both organic and inorganic agriculture. In this study, it is aimed to investigate the effects of increasing doses of vermicomposts combined to soil and peat on wheat (*Triticum vulgaris* L.) growth and nutrition. For this purpose, air dried soil and peat were mixed with three rates of vermicompost equivalent to 0% (control), 25% and 50% (v/v) combinations. The treatments were replicated three times. The data revealed that nutritional concentration of aerial parts was influenced significantly by the application of vermicompost in the growth media. This study suggests that the vermicompost use in plant production has a role as a source of nutrients for plant growth.

Keywords: Vermicompost, cow manure, wheat, *Triticum vulgaris* L., plant nutrition, peat

Farklı Dozlarda Vermikompost Uygulamalarının Buğday (*Triticum vulgaris* L.) Bitkisinin Beslenme Durumu Üzerine Etkisi

Vermikompost, kimi atıkların (hasat, mutfak, gübre vb. gibi), toprak solucanları tarafından sindirilmesi sonucu elde edilen organik bir materyaldir. Hem organik hem de konvansiyonel tarımda, toprak düzenleyicisi ve organik gübre olarak geniş bir kullanım alanı mevcuttur. Araştırmada, toprak ve torfa uygulanan artan vermikompost dozlarının buğday (*Triticum vulgaris* L.) bitkisinin büyüme ve gelişimine etkileri incelenmiştir. Bu amaçla, hava kurusu toprak ve torf, %0 (kontrol), %25 ve %50 (v/v) oranlarında olmak üzere 3 farlı vermikompost dozu ile kombine edilmiştir. Deneme 3 tekerrürlü olarak kurulmuştur. Elde edilen bulgulara göre, yetiştirme ortamlarına uygulanan tüm vermikompost dozlarının bitkilerin kök üstü organlarının beslenme durumuna istatistiki olarak önemli düzeyde etki ettiği izlenmektedir. Araştırma sonucunda, vermikompostun bitkisel üretimde bitki gelişim ve büyümesi açısından önemli bir besin kaynağı görevi üstlendiği söylenebilmektedir.

Anahtar kelimeler: Vermikompost, inek gübresi, buğday, *Triticum vulgaris* L., bitki besleme, torf

Introduction

Cow manure is basically made up of digested grass and grain. It is high in nutrients and recommended to use after being aged because of ammonia and dangerous pathogen contents. It is also used as a source of vermicompost production after aerobically decomposed (Hand et al., 1988). Vermicompost applications are healing in both organic and conventional agriculture because of its advantageous characters such as promoting plant growth, increasing the physical, chemical and biological properties of soil, restoring and improving its natural fertility (Sinha, 2009).

After destruction of soils by mismanagement of fertilizers, many farmers tended to ameliorate soils via some organic materials. That's why vermicompost production and consumption increased in last decade. There have also been many researches on vermicompost's effect on various plants.

Bellitürk et al., (2017) studied on the effects of different concentrations of vermicompost, sheep manure and cow manure on curly lettuce production. As a result of this study, application of cow manure resulted in higher levels of N uptake.

Özkan and Müftüoğlu, (2016) conducted an experiment to assess the increasing doses of vermicompost applications on lettuce growth. It is reported vermicompost application increased significantly the leaf numbers of lettuce.

Sultana et al., (2015) researched the comparative effect of cow manure vermicompost and NPK fertilizers on the growth and flower production of Zinnia (*Zinnia elegans*). As a result of this study, the growth parameters (shoot height, root length, leaf number, total number of flower, flower diameter, fresh and dry weight of flower) of Zinnia plant increased by the application of vermicompost and the effect of NPK fertilizer was not found effective.

Kantürer et al., (2013) investigated the effects of different doses of vermicompost, compost, chemical fertilizer and barnyard manure on pepper. Results indicate that vermicompost application is more advantageous on yield and quality.

Wang et al., (2010) investigated the effects of cow manure vermicompost on plant growth of Chinese cabbage. It is found vermicompost application significantly increased the nutritional value, soluble sugar, soluble protein and vitamin C contents. Arancon and Edwards (2005), reports vermicompost application has a role on ripening of various plants even it is used in low doses.

Atiyeh et al., (2000a) reports that vermicompost has higher N availability than the conventional compost. In other studies Atiyeh et al,. (2000b and 2000c) vermicompost is also compared to other composts regarding nutrients removal. It is found that, P, K, S and Mg are significantly increasing in vermicompost application more than conventional compost application.

The main purpose of this study is to assess different doses of vermicompost combined to soil and peat on wheat nutrition.

Materials and Method

This research was conducted as randomized block experimental design with 3 replications in viols. Wheat seeds were planted at 21th of January and harvested at 3rd March. Vermicompost was applied to soil and peat in 0-25 and 50% (v/v) rates.

Clay textured, neutral soil sample was used in the experiments. The properties of soil, vermicompost and peat those are used in the experiment are given in Table 1. Total Nitrogen analysis in plant samples was performed with Modified Kjeldahl method. Plant samples were wet digested with a mixture of $HClO_4$:HNO_3 (1:4) for other plant nutrients (P, K, Ca, Mg, Fe, Cu, Mn and Zn) (Kacar and İnal, 2010). Phosphor was determined spectrophometrically, K and Ca were measured with flamephotometer and Mg, Fe, Cu, Mn and Zn concentrations were determined with AAS (Kacar, 1972; Kacar and Kovancı, 1982). The SPSS software package was used to perform the variance analysis (Eymen, 2007).

Results and Discussion

It is seen that Ca, Mg, Fe, Mn and Cu concentrations are in adequate levels, however, P and K are in inadequate levels in all applications, Zero vermicompost application to both soil and peat presents inadequate levels for N, P, K and Zn (Jones et al., 1991). The highest concentrations among results are seen in 25% vermicompost + 75% soil application. The lowest concentrations (except for Ca) are also seen in 100% soil application (Table 2).

Conclusions

All treatments have significant roles on elemental concentrations (except for Ca) of plant samples with a comparison of 3 control groups (soil, peat and vermicompost). It can be concluded that, 25% Vermicompost + 75% Soil treatment is the most effective treatment on nutritional concentration of plants.

Agriculture is a one of the main areas of development in developing countries like Turkey. The increasing interest in the use of vermicomposts as plant growth media, and soil amendment should extend to its use in many purposes. Apart from environmental clean-up, other co-benefits that may arise through this practice ranges from raising soil organic matter to reduced soil problems, all of which will in the end improve soil quality and productivity within sustainable agriculture (Belllitürk, et al., 2015).

It is thought that, vermicompost usage can also be useful to other cultivars. However, field experiments are also needed to obtain more detailed information on vermicompost use on plant growth.

Table 1. The properties of soil, vermicompost and peat

Parameters	Soil (S)	Vermicompost (VC)	Peat (P)
pH	7,2	6,5	8,0
EC (dS/m)	0,29	3,44	2,19
Soluble Salts (%)	0,01	-	-
$CaCO_3$ (%)	0,22	-	-
Organic Matter (%)	1,61	-	-
Texture	Clay	-	-
Total N (%)	0,08	1,72	2,84
Available P (mg kg^{-1})	18,85	0,33*	0,10*
Available K (mg kg^{-1})	142,53	1,19*	0,30*
Available Ca (mg kg^{-1})	4859,00	1,24*	0,13*
Available Mg (mg kg^{-1})	357,00	0,91*	0,07*
Available Fe (mg kg^{-1})	10,49	0,36*	0,05*
Available Cu (mg kg^{-1})	3,74	0,11*	0,01*
Available Mn (mg kg^{-1})	8,95	0,13*	0,01*
Available Zn (mg kg^{-1})	0,62	0,21*	0,04*

*datas are given in : %

Table 2. Macro and micro elements concentrations of plant samples

	%					mg kg^{-1}			
Treatments	N	P	K	Ca	Mg	Fe	Zn	Mn	Cu
100% S	1,50 b	0,03 c	0,63 c	2,84	0,21 c	30,8 e	13,4 c	16,1 d	7,6 b
100% P	1,51 b	0,04 c	0,68 c	0,27	0,22 c	31,4 e	13,8 c	16,7 d	8,3 b
100% VC	1,97 ab	0,10 ab	1,34 a	0,41	0,29 ab	43,6 ab	27,4 ab	33,5 ab	14,1 a
25% VC +75% S	2,35 a	0,11 a	1,43 a	0,46	0,34 a	48,6 a	30,5 a	37,0 a	15,5 a
25% VC + 75% P	2,16 a	0,09 bc	1,27 ab	0,35	0,25 bc	40,4 bc	25,6 ab	31,5 abc	13,4 a
50% VC + 50% S	2,05 a	0,09 abc	1,25 ab	0,33	0,26 bc	39,8 cd	23,8 b	30,7 bc	14,7 a
50% VC + 50% P	2,00 ab	0,07 b	1,07 b	0,29	0,23 c	36,3 d	22,8 b	27 2 c	13,1 a
LSD	0,538**	0,021 **	0,264**	ns	0,052 **	3,668 **	5,008**	5,691 **	3,716 **

*p < 0,05 ; ** p < 0,1 ; ns= not significant

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Conflict of Interests

The authors have not declared any conflict of interest.

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