A Novel Method of Vermicompost Placement in Organic Tomato Production

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Ehsan Ebrahimi [1], Peter von Fragstein und Niemsdorff [2]

[1] Department of Soil Sciences, University of Kassel, Germany [2] Department of Organic Farming and Cropping Systems, University of Kassel, Germany

Introduction

The need to produce more crops for feeding a growing population world-wide raises questions of more efficient uses of agricultural inputs. In agricultural fields, composts are commonly applied to the field soil by broadcast. This method does not ensure that nutrients as part of applied compost are available to the plant roots at the right time and at the right quantity. In this field study, we compare the effect of compost placement (in two different methods) to compost broadcast on yield attributes and nutrient uptake for organic tomato field. Due to closer distance of vermicompost to plant roots in our methods, the level of application was reduced down to two thirds of the regular application of vermicompost.

Methodology

Three methods of placement of the vermicompost (VC) were used in a two-year field trial in north east Iran: 1. VC placed in a ***row*** on the soil surface with incorporation, behind the plantation lines **(R)**, 2. ***Broadcast*** on the field **(B)**, and 3. in the transplant hole, ***under** the root* **(U)** which is our novel method for this study (Fig. 1). As a second factor, VC was applied at three different rates of application (3, 6 and 9 t ha^{-1} for R and B, and 2, 4 and 6 t ha^{-1} for U).

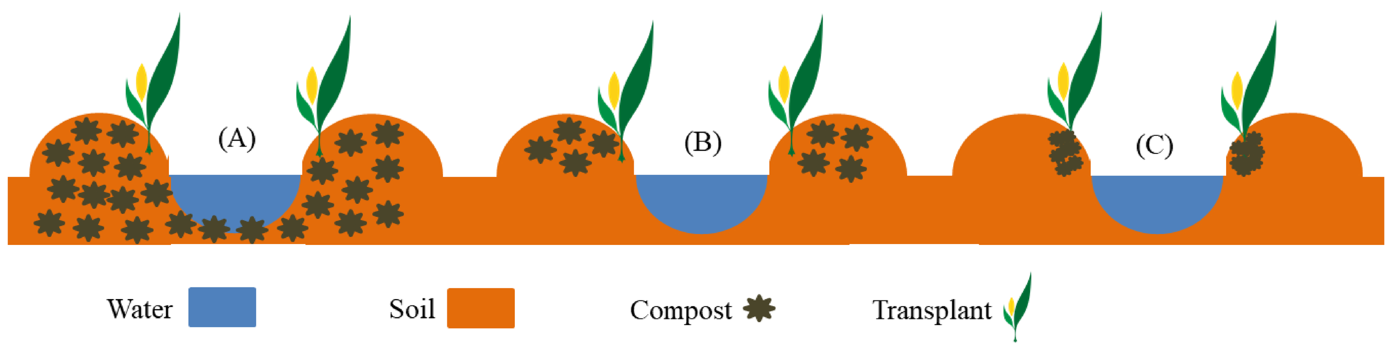

Fig. 1: Placement methods: (A) Broadcast on the field, (B) As a row behind the plantation lines, and (C) in the transplant hole under the root

Photo: Ehsan Ebrahimi (The Organic Research Stations of the Ferdowsi University of Mashhad, Iran)

Table 1: Nutrient uptake (kg ha^{-1})

Source	N		P		K	
Year	**2014**	**2015**	**2014**	**2015**	**2014**	**2015**
Rates (A)						
L	99	131 b	31	10	105	167 ab
M	103	121 b	28	8	103	146 b
H	113	157 a	35	12	81	199 a
Significance	NS	*	NS	NS	NS	*
Methods of Placement (B)						
R	117	132 b	27	9	110	161
B	95	121 b	35	10	92	159
U	102	156 a	33	11	87	192
Significance	NS	*	NS	NS	NS	NS
(A × B)						
LR	93 ab	116 CD	34 ab	7	98	138 d
LB	150 a	150 BC	18 b	10	133	203 ab
LU	55 b	129 BCD	43 ab	12	85	159 bcd
MR	102 ab	120 BCD	18 b	8	110	143 cd
MB	67 b	101 D	25 b	9	75	122 d
MU	140 a	141 BCD	41 ab	7	123	173 bcd
HR	157 a	159 AB	29 b	12	121	201 abc
HB	69 b	114 CD	61 a	10	69	152 bcd
HU	111 ab	197 A	16 b	14	52	243 a
Significance	**	*	*	NS	NS	*

*Note: *, ** and NS indicate significance at $p \leq 0.05$, $p \leq 0.01$ and not significant, respectively.*
Means, within years, followed by different letters are significantly different ($p \leq 0.05$, LSD test).
L: Low, M: Medium, H: High, R: Row, B: Broadcast in the field, U: Under the root.

Results

Treatments with U placement method showed 23% higher N-uptake (**156 kg ha^{-1}**) compared to B method of placement (121 kg ha^{-1}).

A comparison between the treatments with U placement method and high rate (6 t ha^{-1}) of VC and the treatments with R and B placement method and medium rate (6 t ha^{-1}) of VC indicated that our novel method of placement (U) has a significant advantage in N-uptake and K-uptake in the second year (Table 1).

In both years, the different rates and placement methods had no significant effect on the fresh yield of tomatoes. However, in treatments with highest rate and using the **U** placement increased the dry matter (DM) yield of the plants up to **8.4 t ha^{-1}** in the second year. In 2015, the DM production in **HU** was **24 %** and **38 %** higher compared with that of HR and HB, respectively. This was also observed in **MU**, with an increase of **27 %** in the DM yield compared with that in **MB** (Table 2).

Conclusion

Regarding the comparison made with the yield achieved in this experiment, there is no significant difference among treatments. The lower amount of vermicompost in the U method of placement, indicates a valuable hint for sustainable production techniques. In 2015, the differentiation between the placement methods was not very clear for P-uptake, whereas N- and K-uptake were significantly increased by HU. Deep placement of composts could be facilitated by adequate agricultural machinery when agricultural practice is not only labor-intensive or hand-labor dominated.

Table 2: Yield and DM production (t ha^{-1})

	Yield		DM	
Year	**2014**	**2015**	**2014**	**2015**
Rate and placement				
LR	85	47	3.3 abc	5.2 BC
LB	112	64	6.2 ab	6.4 B
LU	76	45	2.5 c	6.3 B
MR	72	53	5.1 abc	6.1 B
MB	85	32	2.5 c	4.4 C
MU	94	57	5.6 abc	6.0 B
HR	92	63	6.6 a	6.4 B
HB	88	53	2.8 bc	5.2 BC
HU	88	68	2.7 c	8.4 A
Significance	NS	NS	*	**

*Note: *, ** and NS indicate significance at $p \leq 0.05$, $p \leq 0.01$ and not significant, respectively.*
Means, within years, followed by different letters are significantly different ($p \leq 0.05$, LSD test).
L: Low, M: Medium, H: High, R: Row, B: Broadcast in the field, U: Under the root.

Refrences

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