Improving `Neoton` Tomato Seed Germination and Seedling Vigor with Compost Tea Treatment

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ABSTRACT

This study was conducted at the experimental station of Al-Balqa' Applied University, Jordan to investigate the effect of compost tea on `Neoton` tomato cultivar seed germination and seedling vigor under greenhouse conditions. Seven treatments of 100 seeds each were used. The treatments were; 0:0, 1:1, 1:20, 1:40, 1:60, 1:80, 1:100 of compost: water, respectively. The seeds were germinated in a sandy loam soil mixed with rounded peat pellets (Jiffy -7) in a greenhouse with 23±1 C° temperature and 77% humidity. A randomized complete block design was used with three replications. Treating the seed with compost tea significantly reduced the number of days for germination, compared with the control treatment. The least number of days for germination (almost 3 days) was achieved by applying 1:40 compost: water. The shortening of time between seed sowing and seeding emergence is desired by vegetable growers as it gives them an advantage of earlier transplanting. Compost tea improved seedling vigor by producing taller seedlings with larger stem diameters, which lead to improved crop yield. Accordingly, using compost tea had improved seed germination and seedling vigor of the tomato cultivar `Neoton`.

Keywords: *Lycopersicon esculentum* M., tomato seedlings, compost tea.

INTRODUCTION

A successful crop establishment is very important for vegetable growers (Swiader et al., 1992). Seed treatments may be applied by seed producers or on the farm (Hartmann et al., 2011). Seed priming improved seed and seedling vigor, germination rate, uniformity, and total germination percentage. For example, Farooq et al., (2005) improved tomato germination and seedling vigor were obtained by osmopriming the seeds. Another option available to growers was the use of coated or pelleted seed. Compost tea was used to suppress diseases caused by plant pathogenic fungi (Dukare et al., 2011) and seedling damping-off (Scheuerell et al., 2004), to improve pine germination (Lazcano et al., 2010), and yield and oil constituents of thyme plants (Hendawy et al., 2010), and to increase chickpea production (Robles-Hernández et al., 2009).

In Jordan, compost use became a well-established practice over the last few years. Jordan's intention is to hold the national organic farming law and follow up the academia demand to minimize fertilizer and pesticide use. Tomato is the most important vegetable crop grown in Jordan. According to the statistics of the Ministry of Agriculture (MOA, 2010), the number of plastic houses in 2005 increased from 7842 with a production of 30137 tons to 14977 plastic houses in 2009 with an annual production of 88984 tons. However, using aqueous extracts of compost termed "compost tea" received a little attention in Jordan, although it is much easier to be transported and applied to horticultural crops, including tomatoes, than the solid compost itself. The objective of this study was to evaluate the effect of compost tea on `Neoton` tomato seed germination and seedling vigor under greenhouse conditions.

MATERIALS AND METHODS

This study was conducted at Al- Balqa' Applied University Greenhouse Unit, located at Al-Salt, Jordan. `Neoton`, a popular indeterminate greenhouse tomato *Lycopersicon esculentum* M. cultivar, was used in this study. Seed lots were seeded into 200-cell plug trays on August 2, 2012. The seeds were germinated in a sandy loam soil mixed with rounded peat pellets (Jiffi-7). The germination temperature was 23±1 C°, inside the greenhouse, and it was controlled using a thermostat. A randomized complete block design was used with three replications. Seven treatments of 100 seeds each were used. The ratio treatments of compost to water were as follow: 0 water (control), 1:1, 1:20, 1:40, 1:60, 1:80, and 1:100. The compost was consisted of 36% organic matter, 2.5 v/v N, 0.46 v/v P, and 0.95 v/v K and was used as the source of the extracted tea. The pH of the compost tea was 7.5. The "tea" was prepared by mixing the solid compost component with water. Seed germination dates on daily bases; seedling stand quality characteristics; and dry matter contents, at 30 day-age (from seed sowing), were recorded. All statistical analyses were performed using SAS/STAT Version 9.2 and Analysis of Variance was conducted by the PROC GLIMMIX procedure. Means separation was conducted following the Duncan's Multiple Range Test (D.M. R. T.) at 0.05 level of significance.

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RESULTS AND DISCUSSION

The results of this study are presented in Table (1). Treating the seeds with compost tea significantly reduced the number of days for germination compared with the control treatment (Table 1). The least number of days for germination (3.3 days) was achieved by applying 1:40 treatment. Vegetables growers desire shortening the time between seed sowing and seedling emergence. This goal gives the grower an advantage of earlier transplanting of the seedlings and provides the grower with earlier production potential.

The objective of seed enhancement is to improve seedling vigor. Tallest seedlings were achieved by applying the 1:60 treatment. Although the plant height was not significantly different from those of 1:40 and 1:80 treatments, it was found to be significantly different from those of the control and the 1:1 treatment. Applying compost tea with a 1:1 ratio resulted in the shortest seedlings of all, about 8.8 cm (Table 1). Short seedlings are undesirable for transplanting because they are more difficult to handle.

Stem diameter was improved using compost tea with the ratios 1:40 and 1:60 (Table 1). Both ratios affected highly significant differences from the other treatments. For transplanting handling, seedlings with larger stem diameters are easier for the growers to use.

There was no clear effect on the number of leaves per seedling (Table 1). However, plant dry matter percentage showed a higher value with application of 1: 20 compost tea, which was significantly different from the other treatments. The remaining compost tea ratios were also significantly different from the control.

Compost tea is gaining importance as an alternative to chemical fertilizers and pesticides. The microbial population in the compost tea contributes toward its effectiveness (Naidu et al., 2010). In addition, it is assumed that microbial biomass activity and nutrients can be transferred from compost into the tea. In this regard, these authors reported that macronutrients (N, P, and K) as well as micronutrients (Ca, Fe, and Mn) were high in compost tea and even higher in a microbial-enriched compost tea. The pH 7.5 used in this study, was suitable for the growth of the tomato seedlings, since there was not any indication of nutrient deficiency symptoms.

Sæbø and Ferrini (2006) mentioned that regarding compost studies, future work should focus on developing methods for predicting how much nutrients can be mineralized over a given time (season), and thus support plant growth; on examining soil qualities and compost additives, that give the best growth; and on developing products (compost mixes) which should be designed for specific uses. In this study, the improved seedling vigor traits; such as plant height and stem diameter; might be considered very critical issues for tomato transplanting. This has an effect on uniformity, crop stand density, and the efficient use of the nutrients and water resources available to the crop. The previous positive characters ultimately affect the yield and quality of the produced crop.

CONCLUSIONS

It can be concluded that compost tea had improved `Neoton` tomato seed germination and the seedling vigor under greenhouse conditions. Compost tea applications shortened the number of days for germination, resulted in taller seedlings with larger stem diameters. Improving compost components and methods of applications are warranted.

Table 1. Effects of compost tea concentrations on seeds germination and seedlings vigor of `Neoton` tomato cultivar

Treatment Compost: Water Ratio	Days for germination	Plant Height (cm)	Stem Diameter (mm)	Leaf Number	Plant Dry Matter %
0 (only water)	6 a	11.0 b	1.35 bc	4	11.21 c
1:1	6 a	8.8 c	1.21 c	4	15.90 b
1:20	4 bc	11.0 b	1.23 c	4	17.80 a
1: 40	3.3 c	12.1 ab	1.90 a	5	16.37 b
1: 60	4 bc	13.0 a	2.00 a	5	16.17 b
1: 80	5 ab	12.0 ab	1.75 b	4	15.98 b
1: 100	5 ab	11.3 b	1.45 bc	4	15.67 b

Similar letters in columns indicate insignificant differences according to D.M.R.T at 0.05 level of significance.

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الملخص العربي

تحسين إنبات بذور البندورة صنف"نيوتن" وقوة نمو البادرات بمعاملات شاي الكومبست

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تم إجراء هذه الدراسة في محطة البحوث الزراعية التابعة لجامعة البلقاء التطبيقية في الأردن، بهدف دراسة تأثير شاي الكومبست على إنبات بذور البندورة صنف"نيوتن" وقوة نمو البادرات تحت ظروف البيوت البلاستيكية. تم استخدام مئة بذرة لكل من المعاملات السبع التالية: 0:0، 1:1، 20:1، 40:1، 60:1، 80:1، و 100:1 نسبة الكومبست إلى الماء. تم إنبات البذور في مزيج من الرمل وأقراص(جيفي-7) في بيت زجاجي تحت ظروف درجات حرارة 23±1 درجة مئوية ورطوبة نسبية 77%.صممت التجربة باستخدام تصميم القطاعات الكاملة العشوائية بثلاثة مكررات. قللت معاملة البذور بشاي الكومبست وبشكل معنوي عدد الأيام المطلوبة للإنبات مقارنةً مع الشاهد. لوحظ أن أقل الأيام المطلوبة للإنبات (حوالي3 أيام) تم تحقيقها باستخدام نسبة كومبست إلى ماء 40:1. تقصير المدة المطلوبة لإنبات البذور هدف منشود من قبل مزارعي الخضراوات حيث يمنحهم ميزة الزراعة المبكرة. شاي الكومبست حسن من قوة البادرات بإنتاج بادرات أكثر طولاً وأسمك ساقاً وهاتين الميزتين ستعملان على تحسين الانتاج. وبالتالي، فإن استخدام شاي الكومبست حسن من إنبات بذور البندورة صنف"نيوتن" وقوة نمو البادرات.