The Effect of Different Compost Applications in Organic Production of Lettuce (*Lactuca sativa* L.)

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Implications

It is well-known that compost and manure applications to all kinds of soils if these organic materials are mature and composted under favorable conditions result in improved soil fertility and crop production in terms of yield and quality, but because manure is expensive in our region and the application of in-farm production compost for organic lands and farms of Turkey is limited, there is a great and urgent need for demonstrate compost using advantages to soil fertility, plant yield-quality and food safety (Kir 2006). Vegetables account for only approximately 2% of total organic production in Turkey, but there is great potential for growth of organic production for both export and domestic consumption of organic products in our country. Lettuce (*Lactuca sativa* L.) is one of the most important species for testing effects of compost applications because of its sensitivity related with phyto-toxic effects of compost (Fuchs et al. 2008) and very important to find out productivity and sustainable production levels in crop production. It is obtained from the results at the end of the first two-year trials, respectively of the three year-planned research under organic management (framework of regulations of EU and Turkey) that (1) the artificial organic materials sourced from farms can be composted and applied to lettuce production to get a great profit in terms of environment and economic aspects of organic lettuce production significantly, (2) promising improvement of industry of compost production can be expected, (3) Organic lettuce can be consumed as microbiologically safe, (4) high quality lettuce production can be attained by using compost.

Background and objectives

This research was designed to study the effects of composted plant residues (C), farmyard manure (FYM), and two different certified commercial organic composts (CCC1, CCC2) on lettuce (*Lactuca sativa* L.) total yield and agro-morphological measurements (head weight, number of outer leaves, number of waste leaves, head length, head width), quality (titratable acidity, pH, dry matter, nitrate), and macro-micro elements and on soil macro-micro elements and on microbiological status of lettuce (*E.coli, E.coliO157:H7, Salmonella sp., Eria monocytogenes*) and soil (*Anaerobic-aerobic bacteria, Enterobacteriaceae, E.coli, Clostridium, Salmonella, S. aureus, B. antrachis, Fecalcoliform, Listeria, Pseudomonas, Enterococ/Streptococ, E.coliO157:H7, Actinomycetes, Azotobacter sp.*) during the autumn season. Taken into account the perspective of organic farming tomato was grown during the summer between the lettuce growing seasons.

Study mainly aimed to promote organic agriculture and to increase the use of compost which is sourced local industry and in-farm produced compost (green waste compost) and demonstrate various organic applications of compost to local and small scale organic growers to obtain high yielding and quality lettuce. It is also aimed to reduce to import of organic fertilizers in Aegean Region where center of the organic production. Approximately 40% organic production of total organic production of Turkey has been produced in Aegean Region, especially in Izmir province in recent years.

Key results and discussion

In both years, the highest yields were significantly affected in the FYM treatment (45-48 t ha^{-1}), and the lowest with the application of CCC2 (42-46 t ha^{-1}). In general lettuce yields range between 20 and 60 t ha^{-1} in open field production as we obtained. The highest net returns were resulted in the C treatment (852-905 $ ha^{-1}) and the lowest with the application of CCC2 (825-900 $ ha^{-1}). Nitrate contents in lettuces were ranging from 302.5-322.4 mg/kg to 814,6-854.9 mg/kg in fresh matter (FM) respectively and mean NO_3^- in the FM of organic lettuces were found quite low than the limits of EU regulations. Negative effects of any treatments on lettuce quality were not recorded including microbiological analysis because pathogens were not detected. These findings support the results published by Fischer-Arndt M et al. 2008 and by many other researchers. The effect of treatments on agro-morphological and nutrient measurements of soil and leaves were also significantly different and showed similar ranges with the yields.

How work was carried out?

The trials were carried out at the experimental certified (by ICEA) organic field of AARI in Menemen (Izmir/Turkey) in successive two years (2011, 2012) during autumn season. The local has a Mediterranean climate, with average annual temperatures for the warmest month (July) and for the coldest month (Jan.). Annual average annual rainfall 700 mm and average relative humidity is 60%. Romaine lettuce (*Lactuca sativa* L., cv. Yedikule-5701-standard variety) which has been produced commonly by local farmers was used. CCC1 and CCC2 were organically certified and provided from commercial companies of our region. Physical and chemical properties of the experimental soil (2 times-sampled (a) before application of treatments and transplant the seedlings and (b) after the last harvests), the applied manure, composts and lettuce leaves (sampled at the harvests) were analyzed according to standard methods. The compost material was obtained by composting green residues from the agricultural production of the organic experimental area and Institute lands. Farmyard manure and green wastes were composted for 8 months. The experiments were conducted in randomized block design in 20 parcels with 5 replications, with 144 plants making up each parcel. Distances between the parcels were 2.1 m. Treatments were C (pH:7.09,N:0.66%,C/N:28) FYM (pH:7.44,N:1.04%,C/N:19)CCC1, and CCC2. Application rate of N not exceeded 170 kg/ha/year. Results were statistically evaluated by ANOVA followed by Tukey's test using SAS (SAS version 9.1, SAS Institute, Cary, NC, USA).

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