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INTRODUCTION

Globe artichoke (Cynara scolymus L.) cv. Fransawy in a randomized complete block, factorial. Factor 1 was manuring (M) treatments of mineral nutrients " as a reference treatment” “RT” (M1), farmyard manure “FYM” (M2), vermicompost “VC” (M3), chicken manure “CM” (M4) and biogas compost “BC” (M5). Factor 2 was Arbuscular mycorrhiza (A) with treatments of none (A0) and mycorrhiza (A1). Mineral fertilizations (kg ha⁻¹) were 124 N+65 P+200 K. Organic fertilization was on basis of applying 124 kg total N ha⁻¹ of each source with the associated P and K in each. Rates of sources (kg ha⁻¹) were 3497.2 FYM, 4124.6 CM, 6887.9 BC and 7614.9 VC (as an average in both seasons). RT gave greater values of number of leaves, number of off-shoots, plant height as well as NPK contents and yield than any of the organic manures with relative yield production efficiency of 80.9, 76.7, 68.2 and 66.7 % for VC, CM, FYM and BC respectively relative to RT. Vesicular Arbuscular Mycorrhizal (VAM) caused increases in all parameters only under conditions of organic manuring.

Keywords: artichoke, mycorrhiza, farmyard manure, vermicompost, chicken manure, biogas, productivity

ABSTRACT

A field experiment was conducted for two successive seasons (2015/2016 and 2016/2017) on globe artichoke (Cynara scolymus L.) cv. Fransawy in a randomized complete block, factorial. Factor 1 was manuring (M) treatments of mineral nutrients “ as a reference treatment” “RT” (M1), farmyard manure “FYM” (M2), vermicompost “VC” (M3), chicken manure “CM” (M4) and biogas compost “BC” (M5). Factor 2 was Arbuscular mycorrhiza (A) with treatments of none (A0) and mycorrhiza (A1). Mineral fertilizations (kg ha⁻¹) were 124 N+65 P+200 K. Organic fertilization was on basis of applying 124 kg total N ha⁻¹ of each source with the associated P and K in each. Rates of sources (kg ha⁻¹) were 3497.2 FYM, 4124.6 CM, 6887.9 BC and 7614.9 VC (as an average in both seasons). RT gave greater values of number of leaves, number of off-shoots, plant height as well as NPK contents and yield than any of the organic manures with relative yield production efficiency of 80.9, 76.7, 68.2 and 66.7 % for VC, CM, FYM and BC respectively relative to RT. Vesicular Arbuscular Mycorrhizal (VAM) caused increases in all parameters only under conditions of organic manuring.

INTRODUCTION

Globe artichoke (Cynara scolymus L.) is an important vegetable crop in Egypt (Shams, 2014). Its immature inflorescence (head) is the edible part (Rouphael et al., 2017). It is rich in inulin and vitamins (Frutos et al., 2019), fibers, minerals (Lattanzio et al., 2009), polyphenols (Fratianni et al., 2007) and antioxidants (Liorach et al., 2002). Thus, it gained a high importance for export to the European markets (Barno et al., 2011).

Although inorganic soluble fertilizers are commonly used for vegetable crops (Lampkin, 1990) in view of their quick utilization by plants (Vernon, 1999; Duhan et al., 2017). However, the extensive fertilization contributed in environmental pollution (Abdelhafiez et al., 2012) besides their high cost of application (Horton and Manner, 2018). On the other hand, biofertilizers and organic amendments and fertilizers can be used as environment-friendly sources for plant nutrients although they may not be as efficient in crop production as chemical fertilizers (Farid et al., 2014; Abdelhafiez et al., 2017; Alshaal et al., 2019; Bassouny and Abbas, 2019; Wakindiki et al., 2019). Organic manures such as compost are thought to improve the soil structure, aeration and support plants with slow release nutrient (Uddin et al., 2009); however, the immature compost might have negative impacts on soils and plants (Duggan and Jones, 2016). Composting using worms is also thought to be a suitable alternative (Kumar et al., 2015). This product has lower pH value and narrower C/N ratio as compared with the compost (Duggan and Jones, 2016). Biogas is another organic amendment that can increase soil fertility; hence improve the growth of plants (Farid et al., 2018). Farmyard manure can increase enrich soil with nutrients (Nest et al., 2016). All such organic amendments can enrich soil with nutrients (Abdelhafiez et al., 2018; Mupambwa and Mnkenti, 2018) and stimulate the microbial biomass activities in soil (Sadnick et al., 2018). Mixed applications of these amendments can be more efficient in improving plant growth and yield (Farid et al., 2018).

Phosphorus (P) affects plant productivity particularly in soil where its fixation occurs easily, such as many soils in Egypt (El-Katkat, 1992). Organic amendments can release P slowly upon their decomposition (Ahmed et al., 2013). However, application of the organic treatments with no other amendments might not be the optimum solution to improve the availability of P. In this concern, mycorrhiza is one of the promising bio-techniques that can improve P uptake by plants (Ardakani et al, 2011and Mohamed et al., 2019) such as artichokes (Ezz El-Din et al, 2010). This takes place through different mechanisms such as solubilizing soil P (Rai, 2006). Extended mycorrhiza hyphae can penetrate soil and increasing the absorption area of the plant roots (Wiedenhoeft, 2006). Applying VAM can increase N utilization by plants (Verzeaux et al., 2017; Vadeboncoeur et al., 2015 and Zhang et al., 2018). The current study is aiming at assessing the effect of different organic amendments vermicompost, chicken manure, biogas compost or farmyard manure applications with or without VAM on yield and properties of Globe artichoke grown on a clay alluvial soil in Egypt Delta.

MATERIALS AND METHODS

Materials:

Both soils of the experimental fields were clay nonsaline slightly alkaline alluvial soils; the main properties of the soils are given in Table 1. The manures and VAM fungi (Glomus mosseae) were obtained from Ain Shams University, Faculty of Agriculture. The main properties of the manures are given in Table 2.

| Table 1. Main properties of soils of the fields of the experiment | Sand | Silt | Clay | Texture | pH | EC (dS m⁻¹) | O.M | CaCO₃ | N | P% | K |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Season | % | % | % | | | | | | | | | |
| 2015 | 21.06 | 25.16 | 53.78 | Clay | 8.2 | 1.03 | 10.1 | 153 | 1.2 | 3.1 | 1.1 |
| 2016 | 21.25 | 26.21 | 52.54 | Clay | 8.5 | 0.95 | 11.3 | 144 | 1.4 | 4.2 | 1.3 |

pH in soil:water suspension (1:2.5), EC in soil paste extract