Effect of organic manure and tillage depths on sunflower (*Helianthus annuus* L.) production

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Abstract

One of the factors affecting the productivity of sunflower is poor management of soil service operations such as tillage depth. As choosing the depth of tillage helps in increasing the growth of the root system, which is reflected in the plant vegetative growth. Although the addition of animal manure can increase the activities of microorganisms in the soil and the soil contents of available nutrients, the effects on sunflowers were not tested under dry land conditions of Basrah province. Field experiment was carried out during the 2020 growing season, at two locations, to determine the effect of three tillage depths (10, 20 and 30 cm) and four organic manure levels (M0= without manure, M1= 6 t ha^{-1}, M2= 8 t ha^{-1}, M3= 10 t ha^{-1}) on sunflower performance, seed yield and selected soil properties. Results showed that, the maximum vegetative parameters, yield component and yield were recorded at 30 and 20 cm tillage depth treatments at the both growing locations without significant differences between them compared to 10 cm tillage depth. Number of seeds $head^{-1}$ was not influenced by tillage depth treatments over the two locations. Tillage depth of 30 cm significantly improved seed yield as compared to 10 cm tillage depth. The maximum seed yield recorded by 30 cm tillage depth. The application of organic manure had a significant effect on sunflower seed yield, biomass yield, head diameter, 500 seed weight, seeds $head^{-1}$, leaf area, leaves $plant^{-1}$, plant height and stem girth at the both growing locations.

1. Introduction

One of the annual oleaginous crops is Sunflower (*Helianthus annuus* L.), that belongs to the class of dicotyledons. The crop was widely used in many countries for cooked oil production compared to alternative oilseeds [1]. In the recent years, sunflower consumption has increased. The local average of seed production of sunflower was 2333.2 kg ha^{-1} in 2019 [2]. The production is still, therefore, below current needs, consequently, improved productivity of this crop is essential to meet supply shortages. Sunflower crops have been poor productivity in some areas in southern Iraq, due to the use of low-capacity conventional cultivars and the lack of suitable practices such as mineral nutrition and sufficient depth of tillage. The poor content of nitrogen and phosphorus characterizes much of the soils in Iraq southern parts. The use of high doses of mineral fertilizers, usually offsets this deficiency [3] that considered an economically and environmentally unsatisfactory solution. For these reasons, there has been an increase in the search for alternate fertilizer sources, which are less environmentally damaging and economically effective.

Organic manure contains large macro-nutrient quantities (i.e., N, P and K) [4]. Organic manure contains other elements, including secondary nutrients and micro-nutrients, which are significantly responsible for increased crop yield [5]. It was also observed that after application of 15 t. ha^{-1} and 30 t. ha^{-1} cattle manure and 10 t. ha^{-1} and 20 t. ha^{-1} polymers, soils pH, organic matter, Nitrogen, available phosphorus, exchangeable potassium, calcium and magnesium were increased relative to control [6]. Several organic fertilizer sources are currently used in agriculture. However, little information is available about the amounts to be used in sunflower crops to achieve a better yield. The purpose of this study was therefore to evaluate the effects of depths of tillage and organic manure fertilization on yield components and yield of sunflower, cultivated at two growing locations.

2. Material and methods

Field experiment was conducted during 2020 growing season at Shatt Al-Arab (SL) 17 km east Basra province, and Al-Qurna (QL), 74 km northwest Basrah province, Iraq, to investigate the response of sunflower to tillage depths and organic manure.