MITIGATION OF WATER STREES FOR SORGHUM CROP USING SOIL MULCHING AND POULTRY MANURE.

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ABSTRACT

Soil and water agro-management techniques play an important role in grown crops for high profit, supplying available water in the root zone environment, and maintaining soil fertility.The present investigation was planned to determine the effect of deficit irrigation, mulching and poultry manure levels on sorghum grains, forage yield and water use efficiency. Two field experiments were conducted during 2016 and 2017 growing seasons at Demo farm (sandy loam texture), Fayoum Fac. of Agric.- Egypt. The experiments were designed as split-split-plot that arranged in a randomized complete blockdesign with three replications.Eighty treatments comprising of two rates of rice straw as soil mulching (SM) (zero and 4 ton/fed), three irrigation treatments ($I_{100\%}$ =100%, $I_{85\%}$ =85% and $I_{70\%}$ = 70% of crop evapotranspiration (ETc) and three poultry manure (PM) levels (0,10 and 15 m^3/fed)were studied each season under controlled surface irrigation system.The results showed that there wasa significant increase in some sorghum growth attributes (plant height, stem diameter, leaves area), seed and forage yield, water use efficiencies (S-WUE and F-WUE) were significantly ($p < 0.05$) affected by irrigation quantity and both soil mulch and poultry manure application. The applied soil mulching, poultry manure and /or irrigation treatments resultedsignificant decrease insoil bulk density values and hydraulic conductivity.The treatment ($I_{100} \times PM_{15} \times SM_4$) is the most suitable for

producing high seed and forage sorghum yield. The results showed that under limited irrigation treatment (I_{85} $\times PM_{15}\times SM_4$), was found to be favorable to save 15% of the applied irrigation water, and produced the same sorghum crop yield.
Keywords: Sorghum crop, soil management, irrigation, and water use efficiency.

Introduction

Recently, the available amount of water to agriculture is decreasing worldwide because the rapid population growth and the greater incidence of drought caused by climate change and different human activities (World Bank, 2006). The declining availability of fresh water has become a worldwide problem, especially in arid and semi-arid regions where irrigation is necessary for crop production (Wei *et al.,*2016). Agricultural irrigation is vital to food production in many parts of the globe and a critical tool for ensuring food security (Liang *et al.,*2016). More than 80% of water resources have been exploited for agricultural irrigation (Wang *et al.,* 2001). Therefore, it is necessary to develop strategies to optimize the efficiency of water use, while maintaining the quantity and quality of the production, Pereira *et al.,*2012 and Nangare*et al.,* 2016). Sorghum (*Sorghum bicolor*) is an important annual cereal crop grown for both grain and palatable green forage production. Sorghum can be grown as important dual-purpose crop for grain and forage yields in many arid and semi-arid regions of the world, due to its advantages over. In Egypt, grain sorghum is the fourth cereal crop, after wheat, maize, and rice, especially after the introduction of early maturing and high yielding hybrids. Fast re-growth after cutting makes sorghum a reliable and profitable summer and fall crop for food and feed productions. Thus, it is greatly preferred by most farmers, where it widely cultivated in middle and upper Egypt during summer and autumn in the area reached 140.000 ha in 2010 season. Also, it is one of the most important cereal crops in upper Egypt and it is a major cereal crop in southern Egypt (area 150000 ha: production 800 thousand tons.Deficit irrigation (i.e. irrigation below the optimum crop water requirements) is a strategy for water-saving by which crops are subjected to a certain level of water stress either during a particular period or throughout the whole growing season (Pereira *et al.,* 2002). The main goal of using DI is to increase WUE by reducing the amount of water applied with watering or by reducing the number of irrigation events (Kirda, 2002). Therefore, it is necessary to evaluate the impact of DI strategies with multi-years open field experiments, before generalizing the most appropriate irrigation scheduling method to be adapted in a specific location for a given crop (Scholberg*et al.,* 2000 and Berihum 2011). Mulching, is a useful practice with the potential of conserving moisture, reducing evaporation, modifying soil temperature, and improving aeration as well as releasing nutrients in the soil profile (Sharma *et al.,*2005; Zhang *et al.,*2016). Mulching involves the use of organic materials (e.g. crop residues, straw, grasses, and farmyard manure) or inorganic, synthetic materials, (e.g. polyethylene sheets, and gravels). Organic mulch adds nutrients to thesoil when decomposed by microbes and helps in carbon sequestration (Chattopadhyaya and Mukherjee, 1990 and Zhang*et al.,*2009). Straw mulch can conserve soil water and decrease temperature because it increases residue accumulation and reduces soil disturbance on the soil surface (Baumhardt and Jones 2002 and Zhang, *et al.* 2011). Organic matter inputs through organic amendments, in addition to supplying nutrients, improve soil aggregation and stimulate microbial diversity and activity (Shiralipour*et al.,*1992; Carpenter-Boggs *et al.,*2000;

Abd El-Wahed 2009 and Semida*et al.,*2014). Improvement of soil aggregation through its effects on soil water content, temperature, aeration and mechanical impedance influences root development and seedling emergence (Ferreras*et al.,*2000). Therefore, the present investigation was planned to determine the effects of deficit irrigation, mulching rates and poultry manure onsome soil physical properties, plant growth, sorghum yields, and water use efficienciesin thenewly reclaimed soil.