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Original Article

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EFFECT OF COMPOST APPLICATION ON THE GROWTH OF *ACACIA NILOTICA*

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ABSTRACT. *Acacia nilotica* is an important agroforestry specie, which is used in both compact and linear forms. The objective of the current study was to evaluate the effect of compost on the growth performance and biomass production of *A. nilotica*. Completely randomized design (CRD) was used to analyze the variations among several growth morphological traits. Two parallel trials, pot trial (seedlings), field trial (saplings) were conducted simulta-neously. Compost and litter mixture were applied in mentioned trials. Following treatments were used: T0 – control; T1 - 25% of compost and 75% of nursery soil; T2 - mixture of 50% nursery soil and 50% compost; T3 - mixture of 75% compost and 25% of nursery soil; T4 - where 100% compost was applied. Increase in plant growth was observed with the increases in the amount of compost mixture. In field trial maximum plant height, shoot length, root length, root-shoot ratio and biomass production was observed when 100% compost level was applied, while minimum was observed without any compost appli-cation. In pot trials, the maximum plant height, root-shoot ratio and biomass production was recorded when 75% compost level was applied. Overall, *Acacia* performed better with 100% of compost application in field trail and 75% of compost application in pot trial. The results of this study demonstrated the positive effects of compost on the growth of *Acacia.* The seedling development was improved considerably with different levels having greater percentage of organic fertilizer and it was concluded that compost improves soil fertility and it should be used as organic fertilizer in farming and forestry practices for improving crop growth and yield.

Keywords: morphological traits; biomass production; litter; organic manure; complete randomized design.

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INTRODUCTION

Acacia nilotica (kikar) is multipurpose nitrogen fixing specie, which is commonly found in subtropical and tropical areas of the world (Kaur *et al.,* 2005; Ahmad *et al.,* 2017). Most of the *Acacia* species are local to Africa and Indian subcontinent, especially in India and Pakistan. It is well grown in dry and semi dry regions and widely used in the farmlands as linear plantations both in public and private plantations (Singh *et al.,* 2009). It provides gums, silage, tannins, furniture wood, timber wood and also used as medicinal plant (Cooperband *et al.,* 2002).

Because of the fast growth and short-rotation policy it is one of the best species for afforestation and agroforestry practices, in particular has the ability to grow on poor soils (Amin *et al.,* 1995). The plantation of *A. nilotica* as agroforestry tree is better, as compared with other slow growing species.

The decayed organic material, which is used as natural synthetic manure, is called as compost. Compost is a commonly used soil ameliorator in forestry and agriculture practices (Duong *et al.,* 2012). Good quality of compost is important in the annihilation of pathogens and weeds (Diver and Greer, 2001). The adhesive and flexible surface of humus-like materials in compost is better for growth of the plants and addition of proper amount of compost in the soil resulted in the better growth of agroforestry trees (Mylavarapu and Zinati, 2009). Variety of microorganism is present in the environment, which are involved in the decomposition and enhance the compost making process (Misra *et al.,* 2003; Daldoum and Ameeri, 2013).

Compost usually increase the amount of soil organisms (Paulin and O'Malley 2008; Cheng and Grewal, 2009). Through this procedure, a series of aerobic microorganisms disturb and convert the organic material into progressively more complex organic materials (CIWMB, 2004).

Compost manure is formed by the biological decomposition of living material and negative impacts of compost on seedlings are exceptionally rare (Wichuk and McCartney, 2010).

Due to the exploding population of Pakistan, demand of furniture wood, timber and wood products is increasing and ultimately deforestation rate is increasing due to commercialization.

Although efforts to overcome the soil related problems has been increased, but still water logging, salinity, low organic matter are major concerns of Pakistan agriculture, especially in the areas situated near industrial zones and big cities. In such conditions, it is dire need of time to grow multipurpose trees with short rotation.

A. nilotica is one of the best fast growing agroforestry tree species, which can grow in dry areas with

biotic and abiotic stresses. In the present study, we evaluated the effect of different levels of compost on the growth of *A. nilotica*. To study the variations among growth morphological traits of *A. nilotica* under different levels of compost, both field and pot trail were conducted. It will be helpful for the researchers and progressive farmers to get maximum timber yield and revenue from the *A. nilotica.*

MATERIAL AND METHODS

Experimental site description

The experiment was conducted in the experimental area of the Department of Forestry and Range Management, University of Agriculture Faisalabad.

The experimental site lies at an altitude of 130 to 150 m between the latitude 30.35°N to 31.47°N and longitude 72.08°E to 73°E. Mean minimum temperature was 6°C, while the mean maximum temperature was 39°C.

Site preparation

First, the soil in the pots was prepared with the compost mixture and litter was mixed. After preparing the soil we measured the different amounts of compost with the help of weighing balance, which were applied in different doses according to treatments. Weeding and irrigation were done regularly. To analyze the variations among growth morphological traits of *Acacia nilotica* under different levels of compost, both field and pot trials were conducted.

Following parameters were studied during both trials: 1) plant height; 2) shoot length; 3) root length; 4) shoot fresh weight; 5) root fresh weight; 6) shoot dry weight; 7) root dry weight; 8) root/shoot ratio and biomass productions.

Compost collection

The compost was obtained from the research area of Agronomy farm and nursery research area of the Department of Forestry and Range Management, which were applied in pots and field experiment at seedling and sapling stages. Litter was also collected from the experimental area of the Department of Forestry and Range Management, University of Agriculture Faisalabad.

Experimental design

Experiment was conducted in completely randomized design (CRD). In both field and pot trials five different treatment were used: T0 - control (compost 0%); T1 - nursery soil 75% + compost 25%; T2 - nursery soil 50% + compost 50%); T3 - nursery soil 25% + compost 75%; T4 - nursery soil 0% + compost 100%. With five treatments five replications were used in both pot and field trial by making a total of 25 plants for each trial. For the trial, seedlings having one-foot height were planted. The water was applied on regular basis.

Statistical analysis

The trial was conducted in completely randomized design (CRD). Two-way ANOVA with least significant test (LSD) were used. All statistical analysis were conducted using SPSS Statistical Package (SPSS 17.0, SPSS Ins., IL, U.S.A.). Results were statistically analyzed using a $p< 0.05$ level of significance.

RESULTS AND DISCUSSION

Plant growth

According to the analysis of variance, *Acacia nilotica* showed significant variations in growth against all treatments (p= 0.05). The plant height ranged from 1.15 ± 0.2 m to 1.77 ± 0.3 m in field trial, while from 0.97 ± 0.08 m to 0.14 ± 0.06 m in pot trail among the all treatments. Shoot length ranged from 0.86 ± 0.04 m to 1.20 ± 0.09 m in field experiment, whereas 0.72 ± 0.03 m to 0.94 ± 0.10 m in pot trial. Root length ranged from 0.29 ± 0.01 m to 0.59 ± 0.02 m in field experiment, whereas 0.24 ± 0.03 m to 0.35 ± 0.01 m in pot trial. Root shoot ratio ranged from 0.88 ± 0.2 m to 2.00 ± 0.4 m in field experiment, whereas 0.29 ± 0.1 m to 0.58 ± 0.4 m in pot trial.

In field trial, maximum plant height was observed in treatment (T4) and minimum in treatment (T0), while in pot trials the maximum shoot length was observed in treatment (T3) and in minimum in treatment (T0).

Shoot length and root length in both field and pot trail was found maximum in treatment (T4) and minimum in treatment (T0).

Root shoot ratio was higher in treatment (T4) in field trail and for pot trial it was higher in treatment (T3), while in both trials it was minimum in treatment (T0) (*Fig. 1*).

Biomass production

Fig. 1 showed that shoot and root dry weight of *Acacia nilotica* are significantly varied according to the different levels of compost. The analysis of variance indicated significant differences among different treatments (p= 0.05). According to the results, shoot dry weight ranged from 0.027 ± 0.001 kg to 0.060 ± 0.001 kg and 0.009 ± 0.001 kg to 0.015 ± 0.001 kg in field and pot trials, respectively, while root dry weight ranged from 0.007 ± 0.001 kg to 0.04 ± 0.003 kg in field trials and 0.003 ± 0.002 kg to 0.009 ± 0.001 kg in pot trial.

Bars of *Fig. 2* showed that biomass production ranged from 0.067 ± 0.001 kg to 0.197 ± 0.06 kg in field trial and 0.02 ± 0.002 kg to 0.04 ± 0.002 kg in pot experiment.

In field trial, maximum biomass production was observed in treatment (T4) and minimum in treatment (T0), while in pot trials the maximum shoot length observed in treatment (T3) and in minimum in treatment (T0).

The use of organic fertilizer is very important for crop, as well as tree growth. If the organic manure is used as a mixture of litter and farm yard manure (FYM), which is prepared in certain conditions will be called as compost (Smith, 2009). It is the artifact of the planned alteration of organic matter into humus through biological and chemical breakdown (Abdelrahman *et al.,* 2017).

Acacia nilotica is an important tree species and used for many purposes (Kaur *et al.,* 2005). It is an important agro-forestry tree and commonly found in different agro-forestry systems (Solomon-Wisdom and Shittu, 2010). Plant growth and biomass

production are the important factors to determine the growth performance of tree species (Zhou *et al.,* 2016; Campioli *et al.,* 2015).

Generally, plants contain maximum plant height and biomass production considered as healthy and vigorous, while those having less height and biomass production are considered as less vigorous with stunted growth. Compost changes had deliberately augmented the biomass of the *Acacia* seedlings, as compared to silt soil. The inferences of this experiment endorse the positive effects of compost on the growth of *Acacia* (Daldoum and Ameeri, 2013).

The results showed a significant correlation between seedling development and the different amounts of biological fertilization (Amin *et al.,* 1995).

In field trial maximum, plant height, shoot length, root length, root-shoot ratio and biomass production was observed when 100% compost level was applied, while minimum was observed without any compost application.

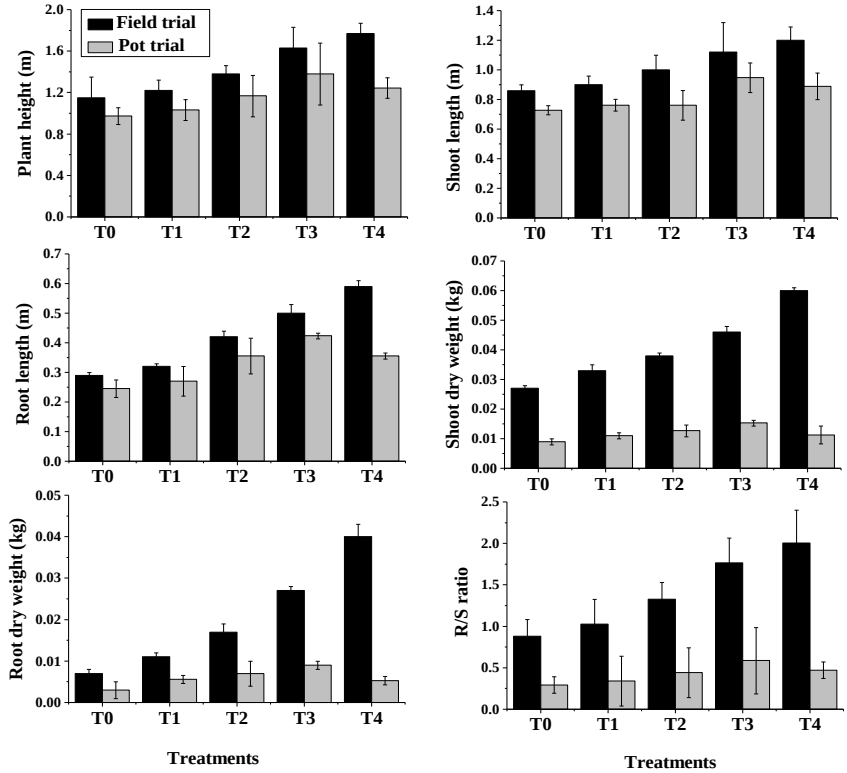

Figure 1 - Variations among morphological growth traits of *Acacia nilotica* treated with five different treatments of farm manure treatments in field and pot trial.
Columns are mean ± SE (p< 0.05, two-way ANOVA and Tukey's multiplecomparison tests).

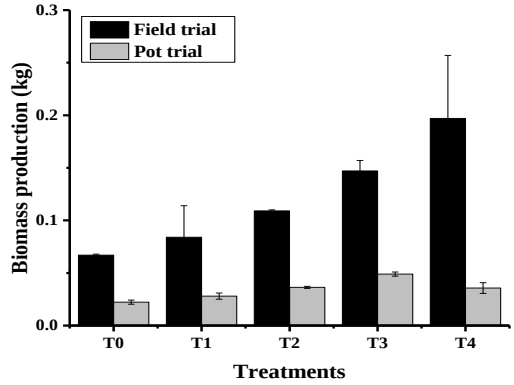

Figure 2 - Variation in biomass production (kg) of *Acacia nilotica* treated with five different treatments of farm manure treatments in field and pot trial.
Columns are mean ± SE (p< 0.05, two-way ANOVA and Tukey's multiple comparison tests).

In pot trials, the maximum plant height, root-shoot ratio and biomass production was recorded when 75% compost level was applied. Overall, *Acacia* performed better with 100% of compost application in field trail and 75% of compost application in pot trial.

Compost improves soil fertility and it is used as crop fertilizer in farming and forestry practices. In forest and horticultural nurseries, completely prepared compost is used in place of other soil media for better plant growth (Landis *et al.,* 1990; Jaenicke, 1999; Diver and Greer 2001; Chu *et al.,* 2017).

The seedling development was improved considerably with different levels having greater percentage of organic fertilizer (Uddin *et al.,* 2012).

CONCLUSION

Positive effect was recorded on growth of *Acacia nilotica* by applying different levels of compost. The results showed a significant correlation between seedling development and the different amounts of biological fertilization.

Overall, *A. nilotica* performed better with 100% of compost application in field trail and 75% of compost application in pot trial. Compost improves soil fertility and it is used as crop fertilizer in farming and forestry practices.

Thus, it is recommended that the plantation of *A. nilotica* by applying compost can increase the growth and biomass production. This study will encourage the farmers in the promotion of *A. nilotica* plantations on farmlands.

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