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Effect of Several Organic Fertilizers along with Some Soil Compactness Levels on Nutrients Content of Sport Lawn in Fall Season

Soheila Javahery[1*], Hossein Zarei[2], S.A.R. Movahedi Naeini[3], Gh. Roshani[4], Elahe Mirabi[5]

[1,2,3]*Department of Horticulture Science, Gorgan University of Agricultural Sciences and Natural Resources, Golestan Province, Gorgan, Iran.*
[4]*Agricultural Research Center of Golestan Province, Gorgan, Iran.*
[5]*Department of Horticulture Science, Ferdowsi University of Mashhad, Khorasan, Iran.*

Abstract: The lawn has an incredible role in designing and construction of landscape areas and lawn bed provides aeration, moisture and nutrients, which is essential for having an acceptance lawn, so the role of organic matter and degree of soil compactness need to be studied. In the current study, the effect of some bed mixtures including Leaf Mold (LM), Rice Husk (RH), manure, Spent Mushroom Compost (SMC), a mixture of LM, RH and SMC (mixture 1), a mixture of LM, RH and manure (mixture 2) with the ratio of 1:1:1 and control (no fertilizer), also the effect of some different soil compactness (roller weights of 36, 56 and 76 kilograms) on the content of some nutrients of sport lawn in fall season were investigated. Hence, an experiment was conducted at the strip plot design with three replications, in research farm of Gorgan University of Agricultural Sciences and Natural Resources during 2008-09. According to the results of this study, interaction of fertilizer and soil compactness was significant for most measured factors. The manure and control treatments showed the most and the least amount of nitrogen in all compactness treatments respectively. The manure and SMC treatments and also treatments containing these organic matters increased plant phosphorus content in comparing with RH, LM and control treatments. Also in three compactness, manure and SMC treatments showed more plant potassium in contrast to control.

Keywords: Lawn, Culture Bed, Roller, Nitrogen.

1. Introduction

Protecting and development of landscape improve living conditions in contaminated and stressful environments of cities in direct or indirect ways. Lawn plays a critical role in the development of all landscapes as a background. Lawn nutrition is as one of the most important and general difficulties in lawn's maintenance management [12]. Organic fertilizers are common fertilizers in the cultivation of most kinds of lawns [20]. As a whole, organic material is a part of soil which has been produced by organisms. This includes plant and animal residues in different stages of decomposition and also microbial cells and materials produced by animals in the soil [9]. Different researches have been conducted on the organic material application as culture bed in which their positive effects have been confirmed. For example, nutrients slow releasing of organic fertilizers inhibit plant necrosis as well as prevent nutrients leaching and in result reducing their application [6]. In addition, soil organic materials help to increase the soil nutrients mineralization and their availability for plants [22]. In this case, a research has been carried out on the impact of different amount of compost on the content of phosphorus, nitrate and organic carbon of *Stenotaphrum secundatum* lawn. It was revealed that after 29 months of adding compost, the content of soluble organic C and also P availability enhanced but nitrate availability decreased severely [23]. These materials provide appropriate conditions for soil useful micro and macroorganisms' activities by supplying adequate water, nutrients, air and temperature [19]. Proper using of organic materials brings about decomposing of residual pesticides in soil and also

*Corresponding author:
E-mail: elahe.mirabi@yahoo.com, s.javahery@yahoo.com.

decreasing some lawn diseases such as Dollar spot [13]. The heat produced by organic fertilizers decomposition eradicates pathogens and weed seeds [21]. Considering the positive role of organic material in improving soil physical and chemical properties and considering nutrient absorption different quantity in various soil compactness, we examined the effect of several bed cultures and some soil compactness levels on sport lawn nutrient contents in Gorgan conditions.

2. Material and Methods

Current research was conducted in two stages of field and laboratory, at research farm and laboratories of plant production faculty of Gorgan University of Agricultural Sciences and Natural Resources during 2008-2009. The experimental design was a strip plot with three replications. Lawn used to be sport lawn, seed mixture of *Lolium perenne* cultivar "Rival" (55%), *Poa pratensis* cultivar "Geronimo" (35%), *Festuca rubra* cultivar "Rubra" (5%) and cultivar "Apache" (5%). Organic fertilizers which were mixed to the topsoil surface included leaf mold (LM), rice husk (RH), livestock manure, spent mushroom compost (SMC), a mixture of LM, RH and SMC (mixture 1), a mixture of LM, RH and livestock manure (mixture 2), with the ratio of 1:1:1 and control (no fertilizer). In addition, three compactness treatments contained roller weights about 36, 56 and 76 kilograms. The area of project land was $350m^2$. After plowing, leveling and implementation scheme, the land was divided into 63 experimental units with dimensions of $2 \times 2m^2$ and the distance between the experimental units was considered one meter. Then organic fertilizers applied to the soil surface in a three cm layer and incorporated with shovel to a depth of 10 to 15cm. Three compactness treatments were applied with a roller which its weight could be changed by adding or removing water. After sowing seeds with the amount of 45gr/ m^2, other lawn maintenance operations were conducted regularly and similarly in all plots. At the mid of fall, samples of every plot were taken using a mower with cutter blade set at 5cm above ground. The dry matter rate of different treatments was determined after drying fresh samples at 75-80˚C for 48 hours [2]. Measurements were conducted on dried specimens to determine nutrient elements including nitrogen, phosphorus, potassium, magnesium and calcium. To determine the nitrogen in plant tissues, Kjeldahl device was used [5]. After the preparation of plant tissue extract, the amount of potassium and phosphorus were measured by flame photometer and spectrophotometer device respectively [3]. Also, the amount of magnesium and calcium were determined by atomic absorption device [3]. Statistical analysis was performed with SAS software. Significant differences between means were determined by LSD test at the 5% level [18].

3. Results and Discussion

3.1 Nitrogen

In this study, the interaction of fertilizer and compactness treatments was significant. As it has been shown in Fig. 1, in all three compactness levels, the highest and lowest N amounts were found in manure and control treatments respectively. Measuring N content of four organic materials before application showed the highest and lowest amounts of manure and RH respectively (Table 1). On the other hand, N mineralization in organic residuals depends on different factors such as residuals' type and form [16]. Larger particles and more lignin and cellulose content will result in lower decomposition rate [9]. The present study demonstrated as well that plants cultured in LM and RH (alone) contained lower N towards the rest treatments (except control) due to comprising lower N, higher lignin and cellulose and in result lower mineralization in the most compactness.

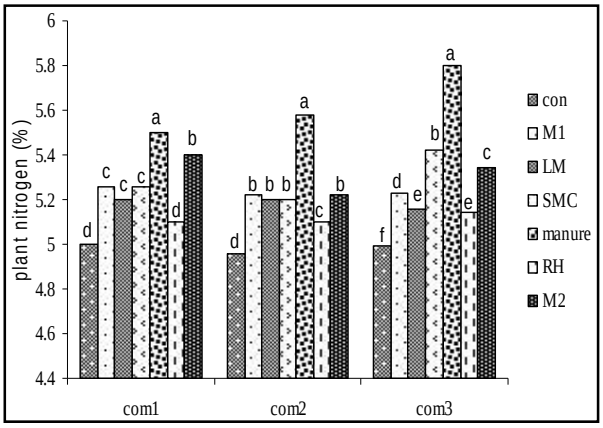

Fig. 1. Comparison of fertilizer and compactness treatments on N content of plant in fall.

Table 1. Chemical analysis results of four organic fertilizers before treatment application.

Nutrient	LM	RH	SMC	Manure
Nitrogen (%)	0.94^{c}	0.87^{d}	1.53^{b}	1.96^{a}
Phosphorus (%)	0.08^{d}	0.13^{c}	0.2^{b}	0.35^{a}
Potassium (%)	0.2^{d}	0.52^{c}	1.54^{a}	1.28^{b}
Magnesium (%)	0.61^{c}	0.19^{d}	0.94^{b}	0.97^{a}

Same letters in a column show insignificant differences ($p < 0.05$)

3.2 Phosphorous

The interaction of fertilizer and compactness treatments on plant P content was insignificant while the effect of fertilizer on it was significant. Maximum and minimum P concentrations in this season were found in manure and control treatments respectively (Fig. 2). Measuring P content of four applied organic materials, manure and SMC contained the highest P content (Table 1). In fact, organic materials improve nutrient absorption by decreasing acidity and producing organic-metal complexes [1, 11, 14, 17]. A similar

study reported reducing acidity and resulting decrease in P stabilization and its availability following application of compost organic fertilizer [8, 15, 23].

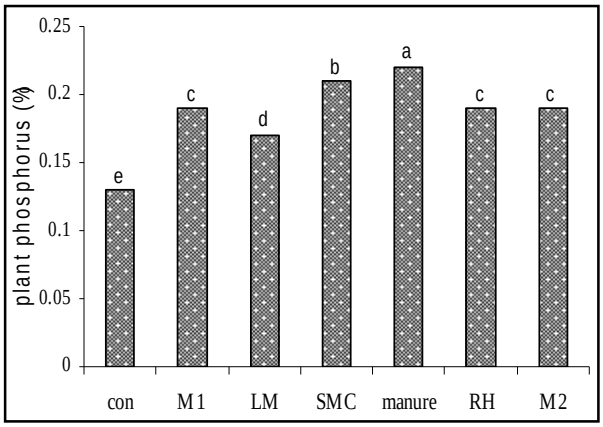

Fig. 2. Comparison of fertilizer and compactness treatments on P content of plant in fall.

3.3 Potassium

The interaction of fertilizer and compactness on plant K was significant. In the case of this element, the highest and lowest absorption extents in all three compactness also were found in manure and control respectively (Fig. 3). Overall, treatments that contained manure or SMC detected highest K amount as well because of more K content in these two organic materials. Likewise, many researchers found that application of organic fertilizers enhances significantly absorbing rate of N, P and K in the aerial parts of the plant toward control [4, 7, 10, 14].

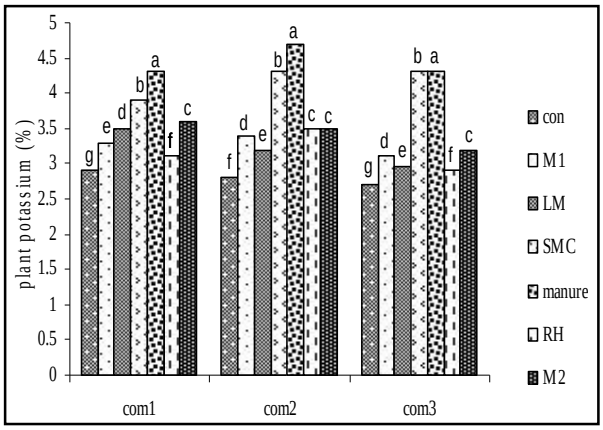

Fig. 3. Comparison of fertilizer and compactness treatments on K content of plant in fall.

3.4 Calcium

The interaction of fertilizer and compactness with Ca content of leaf tissue was highly significant ($p<0.01$). According to Fig. 4, the highest Ca content was found in the control treatment of all three compactness levels and the lowest Ca content was devoted to manure and SMC in first compactness, SMC and RH in second compactness and SMC in third compactness.

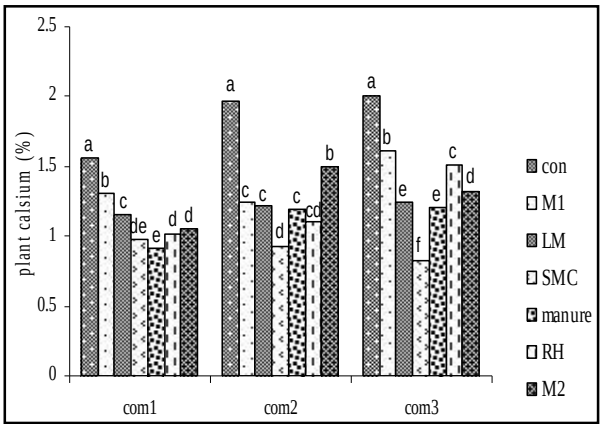

Fig. 4. Comparison of fertilizer and compactness treatments on Ca content of plant in fall.

3.5 Magnesium

The interaction of fertilizer and compactness treatments on plant tissue Mg percent was highly significant ($p<0.01$). As it is obvious in Fig. 5, the highest Mg content was attributed to the LM in the first compactness, control, mixture 1 and mixture 2 in the second compactness and control in the third compactness. The lowest Mg content was related to RH in the first compactness and SMC in the second and third compactness.

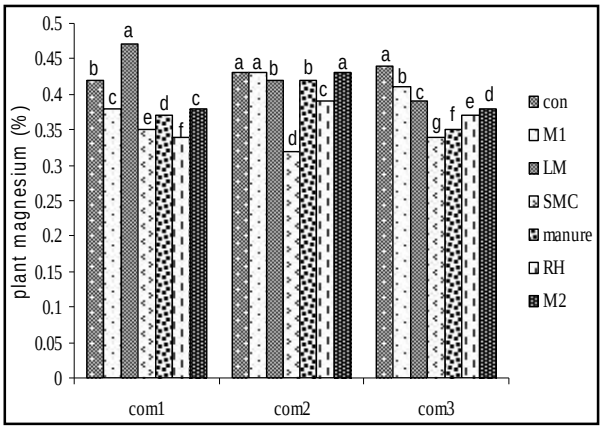

Fig. 5. Comparison of fertilizer and compactness treatments on Mg content of plant in fall.

Ca and Mg have an antagonist relationship with K [12, 24]. Due to this antagonism, treatments which resulted in more K absorption (treatments containing SMC and manure) showed the lowest Ca and Mg in plants cultured in them.

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