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The Effect of Different Organic Fertilizers in Various Compactness Levels on the Amount of Some Nutrients of Sport Lawn in spring

Soheila Javahery*, Hossein Zarei, S.A.R. Movahedi Naeini, Malihe Eftekhari and Gh. Roshani[1]

**Department of Horticulture, Gorgan University of Agricultural Sciences and natural resources (GUASNR), Basij Square Golestan, Gorgan, Iran.*

[1]Academic member of Agricultural Research Center of Golestan Province, Gorgan, Iran.

Abstract: 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 spring season were investigated. Hence, an experiment was conducted as the strip plot design in 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 so that treatments containing manure showed the most nitrogen content in all three compactness levels. As well, in all three compactness levels, the high phosphorus content of plant was also found in manure treatment and the lowest in control and LM. Furthermore, manure, SMC, and treatments containing these two organic fertilizers showed increased potassium of plant toward control and LM.

Keywords: Sport Lawn, Organic Fertilizer, Compactness, Nutrients.

1. Introduction

Due to the vital role of lawn in design and construction of landscape and also its extreme capabilities, protection of favorite quality of lawn throughout the year is critical (Kafi *et al.*, 2004). In addition, considering the high expense of lawn construction and difficult protection, the smallest insouciance in the culture and protection of lawns could make enormous losses (Kafi & Kaviani, 2002). In the case of protection, several studies have been conducted on the effect of human traffic upon soils in the promenade having lawn. All studies have reported that this type of movement increases soil compactness (Lutz, 1945; Dotzenko *et al*., 1967; Settergen and cole, 1970; Monti and Mackintosh, 1979; Reed, 1983; Trumbull *et al*., 1994). Trumbull *et al*., (1994) found that degree of soil penetration decreases significantly in promenades. Leisure use causes are removed from plant covering, compactness erosion of a horizon and decrease of water penetration (Lutz, 1945; Brown *et al*., 1977). Lapage (1962) reported that the decrease of plant cover in silt loamy soils enhances with human traffic on the fine sand. Young (1978) studied Illinois promenades and concluded that due to this type of land application, plant cover decreases 71% and arid lands increase 56% compared to control places. Furthermore, movement in moist places decreases spaces among particles and also reduces available moisture (Dawson *et al*., 1978; Geohring *et al*., 1992; Dunn *et al*., 1980). Lapage, (1962) observed the most predominant effect of compactness in 15cm of the soil surface. Other researchers also found that roots in 15cm of soil surface are damaged (Settergen and Cole, 1970). Plant life in

*Corresponding author:
E-mail: s.javahery20@gmail.com.

promenades could be under stress when roots are damaged (Cole, 1982). Trumbull *et al*., (1994) reported that 28 – 61cm of promenades soil is wasted because of erosion. Lacking plant cover is the most important factor of soil erosion (Hafmann & Ries, 1991). In these conditions, soil organic materials are considered mostly as a key index of soil quality. Organic material determines extreme factors affecting on crop quality such as reserving of plant available water, construction and stabilization of soil aggregates and soil compactness and cation exchange capacity. Mostly, high use of mineral fertilizers decreases soil organic materials because these fertilizers enhance crop yield and their residues in soil (Manna *et al*., 2006; Hati *et al*., 2007). Khan *et al*., (2007) also reported decreasing in soil organic materials following long-term use of minerals. N mineral fertilizers may increase mineralization rate of organic materials (Fox, 2004; Khan *et al.*, 2007). Furthermore, there are opposed findings of the effect of mineral fertilizers on soil structure. Campbell *et al*., (2001) reported that mineral fertilizers increase soil aggregates resistant to water. While Bipfubusa *et al*., (2008) showed that soil large particle size reduces where mineral fertilizers applied in sorghum cultivation. The reason of this reduction was stated by the same researchers as high rate of particles mineralization due to N mineral fertilizer application. According to Layese *et al*., (2002) and Alvarez (2005), N mineral fertilizers are not enough alone for protection of soil organic material level unless by high returning of crop residue to the soil or application of other C resources. Since the usual fertilizer for lawns is an organic fertilizer (Thompson, 1991), in the present study, the effect of 7 types of organic fertilizers, as well as three compactness levels on some nutrient content of sport lawn, were evaluated in the spring.

2. Materials 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 was 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). Mixture of LM, RH and SMC (mixture 1), mixture of LM, RH and livestock manure (mixture 2), with the ratio of 1:1:1 and control (no fertilizer). In addition, three compaction treatments contained roller weights of 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 × 2m^2 and the distance between the experimental units was considered one meter. Then organic fertilizers applied to the soil surface in a 3cm layer and incorporated with shovel to a depth of 10-15cm. At the end of each month, 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 spring, 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^{0}C for 48 hours (Adavi *et al.*, 2005). Measurements were conducted on dried specimens to determine nutrient elements including nitrogen, phosphorus and potassium. To determine the nitrogen in plant tissues, Kjeldahl device was used (Emami, 1996). After the preparation of plant tissue extract, the amount of potassium and phosphorus were measured by flame photometer and spectrophotometer device respectively (Aliehyaii and Behbahani, 1993). Statistical analysis was performed with SAS software. Significant differences between means were determined by LSD test at 5% level (Soltani, 2007).

3. Results and Discussion

3.1 Nitrogen

The amount of N in the leaf tissue of lawn ranges extensively and depends on species, cultivar, sampling time, using rate of N and K fertilizers in soil and maintenance operations (Kafi and Kaviani, 2002). The interaction effect of fertilizers and compactness treatments on the content of N in the plant was significant. As it is obvious in Fig. 1 in the first compactness, mixture 1 and in the second and third compactness, manure showed the highest N content. The lowest N content of plant in the first compactness was also attributed to LM and the second and third compactness was attributed to control. N content measurement of 4 organic materials before treating also detected that manure and RH contained the most and least N content respectively (Table 1). On the other hand, N mineralization existing in organic residues depends on different factors such as type of residues (Norbakhsh, 2004). Larger particles or ones contained more lignin and cellulose will decompose latter (Haghnia, 1995). In this research also plants grown on LM and RH (alone) in most compactness contained less N to other treatments (except control) because of having less N, more lignin and cellulose and in result less mineralization.

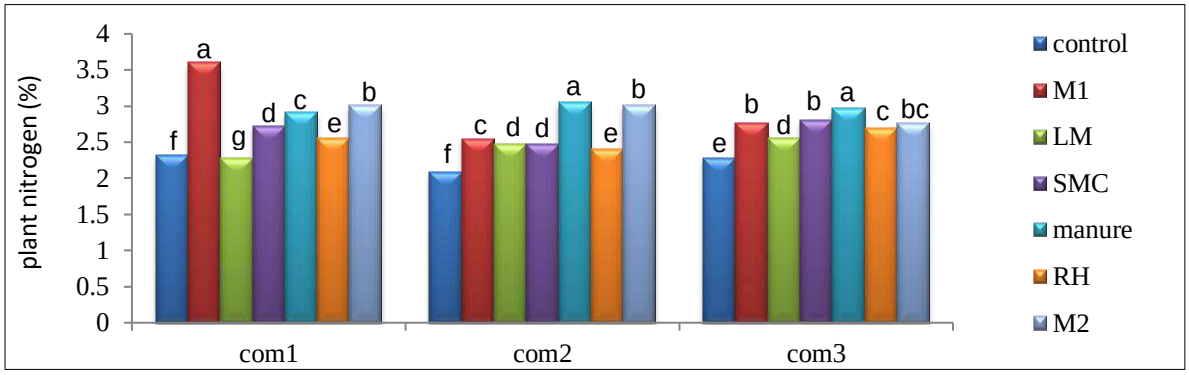

Fig. 1. Comparison of fertilizer and compactness treatments on N content of plant in spring.

Table 1. Chemical analysis results of four organic fertilizers [Same letters in a column shows insignificant differences (p 0.05)].

Nutrient	LM	RH	SMC	Manure
Nitrogen (%)	0/94/0 ^{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}

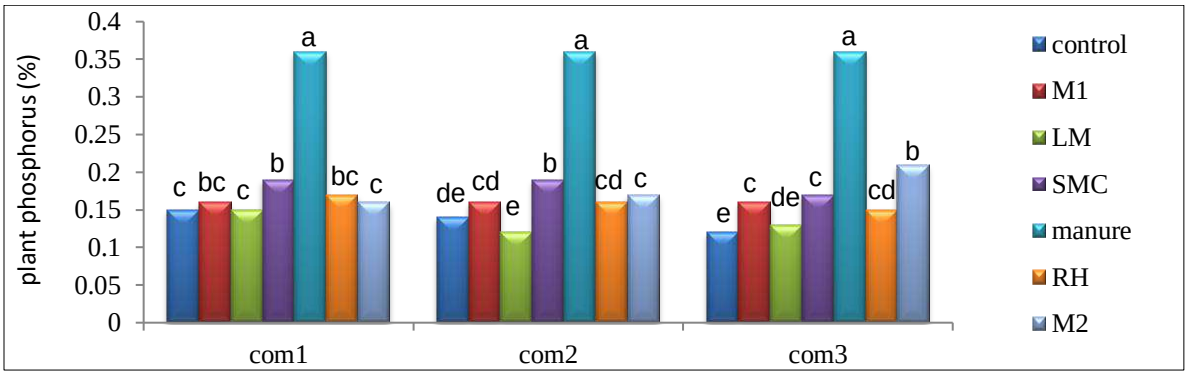

Fig. 2. Comparison of fertilizer and compactness treatments on P content of plant in spring.

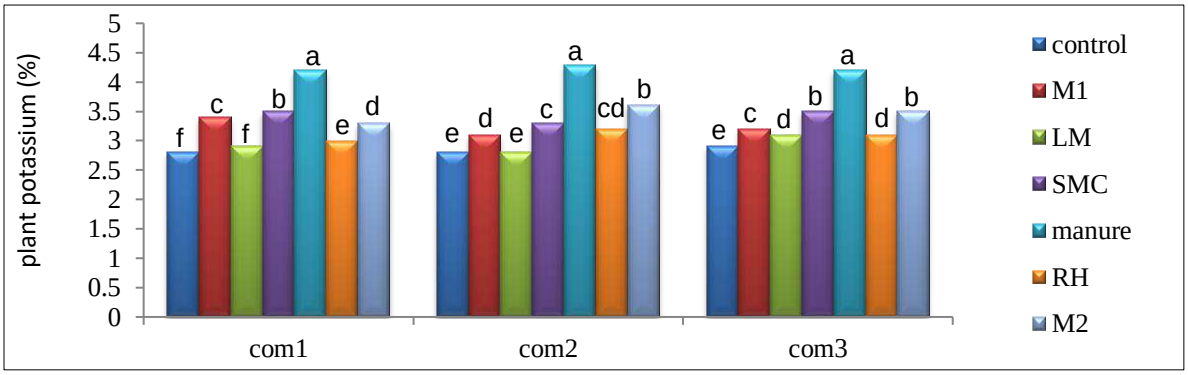

Fig. 3. Comparison of fertilizer and compactness treatments on K content of plant in spring.

3.2 Phosphorous

Organic materials are the main sources of plant P reserve. During decomposition of these materials, P will be available for plant (Kochaki and Khalghani, 1998). The interaction effect of fertilizer and compactness treatments on P content was significant. In this season, the maximum P concentration was related to manure. LM in first and second compactness and control treatment in third compactness had the least P content (Fig. 2). Measurement of P content of four studied organic materials showed that manure and SMC contained the most P content (Table 1). In fact, it is concluded that organic materials improve absorbing nutrients by decreasing acidity and construction of organic-metal complexes (Samar and Malakoti, 1998; Abdollahi, 2004; Kabiri Nezhad *et al*., 2009; Keshavarz and Delavari, 2009). Also, in similar research, reducing of acidity and consequently decreasing of P

stabilization and increasing of its availability by application of organic fertilizer or compost were reported (Forghani and Kalbasi, 1994; Naghizade Asl *et al*., 2009; Wright *et al*., 2008).

3.3 Potassium

Considering the important role of K in growth-enhancing and wear tolerance of the lawn, the amount of this element was also measured in spring. The interaction effect of fertilizer and compactness treatments was also significant in the case of K so that the highest absorbing rate in all three compactness was attributed to manure and the least K content in first and third compactness was detected in control and in the second compactness was recognized in LM (Fig. 3). Totally, treatments containing manure or SMC showed the most K content due to more K existing 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 the control (Bostani *et al*., 2009; Keshavarz and Delavari, 2009; Hatam *et al*., 2009; Fateh *et al*., 2009).

4. Conclusion

Since two organic fertilizers, types of manure and SMC were found as the most effective ones in increase of measured macronutrient content, in order to improve the deficiency of each assessed nutrient considering the regard of related expert, above fertilizers, may be used as much as needed.

References

[1]. Abdollahi, K. (2004). Effect of organic matters of the Sar Sari Abbandan marsh on soil physicochemical properties and the possibility of its application in pot cultures. M.Sc. Thesis. Gorgan University of Agricultural Sciences and Natural Resources, Iran.

[2]. Aliehyaii, M. and Behbahani, E.A. (1993). Methods of soil chemical analysis. Soil and water researches institutions.

[3]. Alvarez, R. (2005). A review of nitrogen fertilizer and conservation tillage effects on soil organic carbon storage. *Soil Use and Management*, 21:38-52.

[4]. Bipfubusa, M., Angers, D.A., Dayegamiye, A.N. and Antoun, H. (2008). Soil aggregation and biochemical properties following the application of fresh and composted organic amendments. *Soil Science Society of America Journal*, 72:160-166.

[5]. Bostani, H.R., Ronaghi, A and Safar Zade Shirazi, S. (2009). Comparison of application of chemical fertilizer and sewage sludge in three soil textures on bioavailability of N, P and K in corn cultivation. In 11th Iranian soil sciences congress, 12-15 Jul., Gorgan University of Agricultural Sciences and Natural Resources, Iran, Gorgan. 192.

[6]. Brown, J.H. Jr., Kalisz, S.P. and Wright, W.R. (1977). Effects of recreational use on forested sites. *Environmental Geology*, 1:425- 431.

[7]. Campbell, C.A., Selles, F., Lafond, G.P., Biederbeck, V.O. and Zentner, R.P. (2001). Tillage-fertilizer changes: effects on some soil quality attributes under long-term crop rotations in a thin black chernozem. *Canadian Journal of Soil Science,* 81(2): 157-165.

[8]. Cole, D.N. (1982). Wilderness campsite impacts: Effect of amount of use. United States Department of agriculture, forest service research paper INT-284. Intermountain forest and range experiment station, Odgen, Utah, 34 pp.

[9]. Dawson, J.O., Countryman, D.W. and Fittin, R.R. (1978). Soil and vegetative patterns in northeastern Iowa campgrounds. *Journal of Soil and Water Conservation*, 33:39-41.

[10]. Dotzenko, A.D., Papamichos, N.T. and Romine, D.S. (1967). Effects of recreational use on soil and moisture conditions in Rocky Mountain National Park. *Journal of Soil and Water Conservation,* 22:196-197.

[11]. Dunn, B.A., Lockaby, B.G. and Johnson, E.E. (1980). Camping and its relationship to forest soil and vegetation properties in South Carolina. Forestry research series number 34. Department of Forestry, Clemson University, Clemson, South Carolina. 20 pp.

[12]. Emami, E. (1996). Methods of plant analysis. Agricultural research, education and extension Organization.

[13]. Fateh, E., Chaii chi, M.R., Sharifi Ashour Abadi, E., Mazaheri, D. and Ashraf Jafari, A. (2009). The effect of chemical and organic fertilizers on some characteristics of soil and *Cynara scolymus*. In 11th Iranian soil sciences congress, 12-15 Jul., Gorgan University of Agricultural Sciences and Natural Resources, Iran, Gorgan. 277.

[14]. Forghani, A. and Kalbasi, M. (1994). Factors affecting on capability of phosphorus and residual phosphorus absorption in some major soils of Isfahan province. In 4th Iranian soil sciences congress. Isfahan University of technology, Iran, Isfahan.

[15]. Fox, T.R. (2004). Nitrogen mineralization following fertilization of Douglas-fir forests with urea in western Washington. *Soil Science Society of America Journal*, 68:1720-1728.

[16]. Geohring, L.D., Palazzo, A.J., Duell, R.W. and Jones, R.C. (1992). Drainage and soil compaction improvements to the US Military Academy Parade field. Pages 186-195. Inland reclamation: Advances in research and technology. Proceedings of an international symposium.

American society of agricultural engineers, St. Joe, Michigan.
[17]. Haghnia, Gh. H. (1995). Water penetration problems in soil. Translated in Farsi, Singer, M.G. and Donald, M.N. (author). Ferdowsi University of Mashhad Publication No. 183.
[18]. Hatam, Z., Ronaghi, A., Karimian, N.A. andYasrebi, J. (2009). The effect of urban wastes on growth and chemical composition of corn and bioavailability of some elements in two different textures. In 11th Iranian soil sciences congress, 12-15 Jul., Gorgan University of Agricultural Sciences and Natural Resources, Iran, Gorgan. 209.
[19]. Hati, K.M., Swarup, A., Dwivedi, A.K., Misra, A.K. and Bandyopadhyay, K.K. (2007). Changes in soil physical properties and organic carbon status at the topsoil horizon of a vertisol of central India after 28 years of continuous cropping, fertilization and manuring. *Agriculture, Ecosystems & Environment*, 119:127-134.
[20]. Hofmann, L. and Ries, R.E. (1991). Relationship of soil and plant characteristics to erosion and runoff on pasture and range. *Journal of Soil and Water Conservation*, 46:143-147.
[21]. Kabirinezhad, S.H., Abtahi, A. and Hodgi, M. (2009). Effect of increasing phosphorous in calcareous soil treated with municipal sewage sludge on growth and yield of corn. In 11th Iranian soil sciences congress, 12-15 Jul., Gorgan University of Agricultural Sciences and Natural Resources, Iran, Gorgan. 287.
[22]. Kafi, M. and Kaviani, S.H. (2002). Management of construction and lawn maintenance. Shaghayegh Rosta artistic and cultural institution.
[23]. Kafi, M., Arghavani, M. and Naderi, D. (2004). Made-up lawn- introduction, production, application Sabzineh. Forth year N 6.
[24]. Keshavarz, P. and Delavari, M. (2009). Short-term effects of compost and cow manure consumption in two types of soil on yield and Nitrogen, Phosphorus and Potassium uptake in corn plant. In 11th Iranian soil sciences congress, 12-15 Jul., Gorgan University of Agricultural Sciences and Natural Resources, Iran, Gorgan. P 288.
[25]. Khan, S.A., Mulvaney, R.L., Ellsworth, T.R. and Boast, C.W. (2007). The myth of nitrogen fertilization for soil carbon sequestration. *J Environ Qual.*, 36:1821-1832.
[26]. Kochaki, E. and Khalghani, H. (1998). Sustainable agriculture in temperate zones. Mashhad University of Ferdowsi.
[27]. LaPage, W.F. (1962). Recreation and the forest site. *Journal of Forestry*, 60: 319-321.
[28]. Layese, M.F., Clapp, C.E., Allmaras, R.R., Linden, D.R., Copeland, S.M., Molina, J.A.E. and Dowdy, R.H. (2002). Current and relic carbon using natural abundance carbon-13 1. *Soil Science*, 167:315-326.
[29]. Lutz, H.J. (1945). Soil conditions on picnic grounds in public forest parks. *Journal of Forestry*, 43:121-127.
[30]. Manna, M.C., Swarup, A., Wanjari, R.H., Singh, Y.V., Ghosh, P.K., Singh, K.N., Tripathi, A.K. and Saha, M.N. (2006). Soil organic matter in a West Bengal inceptisol after 30 years of multiple cropping and fertilization. *Soil Science Society of America Journal*, 70:121-129.
[31]. Monti, P.W. and Mackintosh, E.E. (1979). Effect of camping on surface soil properties in the boreal forest region of northwestern Ontario, Canada. *Soil Science Society of America Journal*, 43:1024-1029.
[32]. Naghizadeasl, Z., Dordipoor, A., Gholizade, E. and Kiani, F. (2009). Evaluation of relationship between plant available phosphorus and some of soil properties in south of Gorgan River soils. In 11th Iranian soil sciences congress, 12-15 Jul., Gorgan University of Agricultural Sciences and Natural Resources, Iran, Gorgan, P322
[33]. Norbakhsh, F. (2004). Potential of organic fertilizer use in landscape. Sabzineh, Fourth year. Fourth number.
[34]. Reed, A.H. (1983). The erosion risk of compaction. *Soil and Water*, 11:29-33.
[35]. Samar, S.M. and M.J. Malakouti (1998). Effect of sulfur, ferrous sulfate, and manure and methods of application on soil extractable Fe. *Iranian Journal of Soil and Water Sciences*, 12(6):55-61.
[36]. Settergren, C.D. and Cole, D.M. (1970). Recreation effects on soil and vegetation in the Missouri Ozarks. *Journal of Forestry*, 68:231-233.
[37]. Soltani, A. (2007). Application of SAS software in the statistical analysis (for agricultural fields). Jahad- Daneshgahi Mashhad press.
[38]. Thompson, B. (1991). An illustration Guide to organic gardening. Menlo Park. 96 p.
[39]. Trumbull, V.L., Dubois, P.C., Brozka, R.J. and Guyette, R. (1994). Military camping impacts on vegetation and soils of the Ozark Plateau. *Journal of Environmental Management*, 40:329-339.
[40]. Wright, A.L., Provin, T.L., Hons, F.M., Zuberer, D.A. and White, R.H. (2008). Compost impact on dissolved organic carbon and available nitrogen and phosphorus in turfgrass soil. *Waste Management*, 28(6): 1057-1063.
[41]. Young, R.A. (1978). Camping intensity effects on vegetative ground cover in Illinois campgrounds. *Journal of soil and water conservation*, 33:36-39.