Volume 18(4), 1- 6, 2014
JOURNAL of Horticulture, Forestry and Biotechnology
www.journal-hfb.usab-tm.ro

Compare the different media on the growth characteristics of sports turf

Mina Taghizadeh[1*], Iman Shahrjerdi[1], Maryam Ahsani[1]

[1]Department of Horticultural Engineering, Faculty of Agriculture and Natural Resources, Arak University, Arak 38156-8-8349, Iran

*Corresponding author. Email: m-taghizadeh@araku.ac.ir

Abstract Turfgrass due to sensitivity to water stress are required to cover the seeds as mulch. Organic fertilizers due to pathogen contamination problems, unpleasant odor, having weeds seed and other are environmental problems. In this experiment, using various combination of vermicompost, coco peat, perlite and soil as mulch layer and cultured media were studied and the effect these substrates on growth characters of sports turf were evaluated. Treatments were prepared using five medium volume ratio of vermicompost, cocopeat and perlite and was compared with soil. Visual turf quality, turf density, color and were record weekly during the growing season. Other traits turfgrass include fresh and dry weight, organic matter, chlorophyll and relative water content were calculated. The use of organic fertilizer vermicompost in combination with soil, turfgrass physiology traits such as shoot length, shoot dry weight, total organic matter and quality were improved. In contrast, the combination of soil and cocopeat reduced growth traits of turfgrass. Advantages of vermicompost in agriculture as soil organic matter due to the wide range of features that improves its physical and biological characteristics. Therefore be stated that vermicompost can be used as a mulch cover and media lawns in the industry to be used.

Key words

Coco peat- Growth- Perlite- Turfgrass- Vermicompost

Today, turfgrass as one of the main elements of the cover plant at landscape design and have the main role in remediation in air and soil. Turfgrass not only is sensitive to water stress in early stages of growth, but also required to cover the seeds as mulch. Also, due to the constant mowing, the loss of stored nutrients and competition with other plants for nutrients and water absorption, especially at the seedling stage it is necessary to add fertilizer before and after turfgrass establishment. The use of mineral fertilizers damages structural, chemical and biological soil characteristics and caused environmental pollution (Albiach et al., 2000). For years, the use of manure is used for turfgrass as mulch, but recently there has been widespread use of composting of municipal waste and sewage sludge, mushrooms composting waste, etc. Organic fertilizers due to pathogen contamination problems, unpleasant odor, having weeds seed and other have environmental problems (Haghighi et al.,2004). Therefore, use of other organic and inorganic material alternatively for these problems seems to be beneficial. Growing plants in soilless media have several advantages such as proper nourishment, reducing the incidence of diseases and pests and increase quantity and quality of crops are preferred in relation to soil culture (Verdoncket al. 1982). Properties of various components used as soilless media have useful effects on plant growth and crop production directly or indirectly (Rahimi et al., 2003). These media provides aeration and drainage, yet retains and holds substantial amounts of water that it releases when needed and produce healthier plants that require less labor and watering Compared with soil cultures. Some of the most common soilless growing mediums include peat, perlite, vermiculite, coco peat and rock wool. Generally, these mediums are mixed together rather than used alone, as each usually provides its own function. Fertilizers are also commonly added to the mix, providing important nutrients. Recently materials like compost and vermicompost as component of media have been considered among researchers and growers of horticultural crops. Vermicompost is resulted interaction between earthworms and microorganisms to decompose organic materials. Compost material passes through the gastrointestinal mucosa of worm and enriched in vitamin and enzyme and finally can be used as a very useful organic fertilizer (Arancon et al.,2004). Vermicompost as a stable humus material, have a high water holding capacity due to spongy tissue. Among other media substrates, Coco peat is an organic compound derived from coconut fruit processing mesophile that is similar to peat moss (Noguera et al., 2000). This matter recently is used to cultivate horticultural plants such as Rose, Lilium, Gerbera, Hyacinth, potted plants, vegetables and has satisfactory effect on plant

production (Tehranifar et al., 2000; Hesami et al., 2012; Treder, 2008; Nazari et al., 2011). Moreover perlite is a form of expanded volcanic rock has been widely as one of the more common ingredients in commercial potting mixes to increase ventilation and drainage rhizosphere (Maloupa et al., 1993).
Since the planting media a large impact on the germination and final quality of turfgrass, the objective of this study was to examine the effects of combination vermicompost, coco peat, perlite and common soil as media on growth properties of sports turf.

Materials and Methods

This research was carried out in the research greenhouse of Arak University in April, 2013 to determine the effect of different substrate on the growth characteristics of sport turfgrass as mulch. In this study mixed seed of sport turfgrass include 60% Fescue, 30% ryegrass and 10% Bluegrass was used. The experiment was designed as a completely randomized design with six treatments and three replications. The media were prepared using three substrates vermicompost, coco peat and perlite with equal proportions of each in the pots (all treatments ratio was 1:1 v/v). Treatments include; (perlite+ wermcompost), (soil+ coco peat), (soil+ perlite), (soil+ vermicompost), (wermcompost+ coco peat) and the loam soil was used as control. Seeds were culture at 25 g per pot, seeds were covered using mulch treatments mentioned as one cm layer, irrigation applied to prevent drought stress, and applications of a soluble fertilizer every 14 d in all treatments. Growth rate of shoots was recorded after each mowing weekly with a millimeter ruler at three points of each replication. The amount of leaf chlorophyll was measured by the device of chlorophyll meter (SPAD) at the end of the experiment. Visual turf quality, turf density and color were made weekly during the growing season. The apparent quality of turfgrass parameters of color, density, texture and uniformity based on NTEP (The 1993 national turfgrass evaluation program) were evaluated on a scale from 1 to 9. Number 9 shows a dense, uniform and green lawn and number 1 shows completely brown and spares lawn. At the end of experiment, whole shoots and roots were harvested separately and roots after washing with water were kept at room temperature for 12 hours. After measuring the fresh weight of shoots and roots, the plant material dried in oven at 70°C for 24h and dry weight were measured. Then samples of roots and shoots were placed in an oven 550 °C for two hours and ash weight of shoots and roots were measured separately. Others turfgrass traits include Relative growth rate, organic matter and relative water content of leaves were calculated according to formula 1, 2 and3. Analyses were performed with a personal computer using the MSTATC software. A factorial analysis of variance (ANOVA) was performed for all parameters. In addition the Duncan's Multiple Range Test (DMRT) (P = 0.01) was used to conduct mean comparison of treatments.

$$(1)\quad Ralative\ growth\ rate = \frac{Shoot\ length\ before\ mowing_{n+1} - Shoot\ length\ after\ mowing_{n}}{Mowing_{n}} \times 100$$

$$(2)\quad Organic\ matter\,(\%) = \frac{Dry\ weight - Ash\ weight}{Dry\ weight} \times 100$$

$$(3)\quad Relative\ water\ content\,(\%) = \frac{Fresh\ weight - dry\ weight}{Fresh\ weight} \times 100$$

Results and Discussions

Analysis of variance showed that the effect of different substrate on turfgrass growth characteristics was significant except for the average distribution of roots, fresh and dry root weight, root and shoots mineral matter and root organic matter (Table 1). Comparison of the effects of different media on turf characteristics are shown in Table 2. Based on the results, only soil+ Coco peat and Coco peat + vermicompost treatments significant effect on chlorophyll were compared to each other. Soil+ Coco peat and Coco peat +vermicompost treatments showed respectively lowest (18.3) and highest (43.6) leaf chlorophyll content. Maximum root length (47.7 cm) was observed in soil+ perlite media that had significant difference compared with soil and vermicompost+ Coco peat (table 2 and Figure3). In soil + wermicompost media maximum shoot length (15 cm) and soil + Coco peat media lowest shoot length (4.6 cm) was obtained that had significant difference compared with other treatments. The use of different media on the growth sport turfgrass had a significant impact where the most shoot and total fresh weight were obtained in vermicompost+coco peat media (respectively 82/5 and 123/6 g) and soil+Coco peat treatment had lowest shoot and total fresh weight (respectively 21/1 and 44/1g) that were significantly different from each other. Turfgrass shoot dry weight, the most value in soil + wermiompost media (32 g) and lowest in soil + perlite media (8/7 g) showed that the treatments were significantly different from each other. Total dry weight of the plants were planted in soil + wermicompost media (38/1g) and vermicompost + Coco peat media(35 g) were significantly higher than those that were planted soil + coco peat media. Like other turfgrass characterizations when vermicompost

was used in combination with soil and coco peat, organic matter accumulation in turfgrass shoot increased. So, The maximum shoot organic matter was observed in soil + vermicompost treatment (31/6g) and vermicompost + Coco peat (27/4g) that had significant differences compared with soil+ coco peat with as a minimum organic matter (8/7 g) . Similarly, Plants cultured in soil + vermicompost and vermicompost + Coco peat media had the highest total organic matter (respectively 37/2 and 35g) and those planted soil +Coco peat had the lowest total organic matter (12/4g) in this experiment. Shoot relative water content was also affected by the media so vermicompost+ perlite treatment has maximum amount of relative water (%70/1) and in the soil + vermicompost has least amount of relative water (%53) that significant difference between the two treatments were compared. Relative water root content of soil+ Coco peat media was highest (% 80/7) and lowest in the soil (% 62). The apparent quality of the turfgrass grown on different media were varied that soil+vermicompost treatment had highest quality (8/6) in all of treatments (Table 2 and Figure 2).

Assessment of the relative growth rate of sports turfgrass were cultured in different medium showed that vermicompost + soil and vermicompost + Coco peat treatments were stimulated relative growth rate during the cultivation period to other treatments. Although the slow growths of turfgrass were cultured in vermicompost + perlite media, but at the end of the growing season, turfgrass could compensate for this delay. Turfgrass grown on soil, soil+ coco peat and soil + perlite showed relative growth weaker than other treatments in the entire period of experiment. Generally, in most treatments relative growth rate were decreased with prolonged experiment time except for the vermicompost+ Perlite media. (Figure 1).

Add some organic and inorganic compounds in the soil due to some problems include the pathogens common, the lack of plenty of ventilation, increase the cost of high-density labor is recommended in lawn establishment (Mohamadi Ghahsare et al. 2012). In this experiment, physiological traits of sport turfgrass such as shoot length, shoot dry weight, total organic matter and quality were improved by composition of vermicompost to soil. In contrast, the combination of soil and coco peat was reduced growth traits of turfgrass. Vermicompost as a stable humus material has a high capacity to hold water and nutrients needed for plants such as S, Mg, K, Ca, P and N (Dominguez 2004). Advantages of vermicompost in agriculture as soil organic matter due to the wide range of physical and biological features that be changed, such as a slow release elements for the plant (Chaoui et al., 2003), improved soil texture and medium physical traits (Kahsnitz, 1992; hidalgo et al., 2006) and microbial activity (Dominguez2004). Furthermore, the biological activity of metabolites such as plant growth regulators (Tomatiet et al., 1987; harti et al., 2001) and humitase (Canellas et al., Atiyehet et al., 2002) have been reported to be improved at vermicompost substrate. Studies have shown that when different species are planted in vermicompost, caused better performance than conventional greenhouse growth media (Atiyeh et al., 2000; Arancon et al., 2005). Subler et al (1998) observed that combination of vermicompost and soil improved plant growth and germination of petunia, marigold, peppers, cabbage and tomatoes. Also application of vermicompost as a component of *Myristica fragrans* media showed that seed germination, seedling height, diameter and number of leaves, shoot and root length and plant biomass increased (Abirami et al., 2010). Mathivanan et al. (2012) showed that seedlings of peanuts grown in soil amended with vermicompost have maximum length, chlorophyll, carotenoid and protein than control. Findings of this research and our findings show beneficial effects of vermicompost in combination with cultured media. Although, using perlite as an ingredient media increased growth and yield in some plants coco peat strawberries, peppers and Lilium (Tehranifar et al, 2007; Zakeri et al., 2013; Hesami & Khorami, 2012), but this mineral substrate did not stimulate growth and even in some cases to reduce the growth of sport turfgrass in our experiments. Only in one case root length increased in growth media containing perlite due to lack of nutrients and plant response to higher nutrient availability in the rhizosphere. The relative growth slowdown during the warmer months of the year due to the cold turfgrass species is obvious in this research. In general, the result showed that applications of vermicompost as a component of the media especially in combination with soil and coco peat increased chlorophyll content, length, dry weight and organic matter in sports turfgrass tissuess, and this effect was most prominent under organic media substrate. Overall, results from these studies improve the understanding of vermicompost effects on growth and quality of sport turfgrass.

Table 1

Analysis of variance of studied traits of sport tutfgrass in different media

		Mean square																					
	df	Quality	Root relative water	Shoot relative water	Total organic matter	Root organic matter	Shoot organic matter	Root mineral matter	Shoot mineral matter	Total dry weight	Total fresh weight	Root dry weight	Root fresh weight	Shoot dry weight	Shoot fresh weight	Shoot length	Roots average distribution	Root length	Total chlorophyll	Relative growth rate4	relative growth rate3	Relative growth rate2	Relative growth rate1
Treatment	5	31**	185**	142**	2.6**	1.2^{ns}	2.8**	0.4^{ns}	0.1^{ns}	2.5**	5.9**	1.1^{ns}	1.8^{ns}	2.8**	7.2**	44**	48^{ns}	99**	1.4**	1.6**	20**	41**	0.5**
Error	12	0.3	85	40	1.1	0.9	0.9	0.1	0.01	1	3.8	0.8	1.6	0.9	3.8	0.2	0.8	38	0.7	0.1	2.2	1.6	0.1
(%) CV		12	12	10	21	36	22	25	14	20	22	34	25	22	27	16	22	15	16	18	29	27	18

ns , ** are non-significant and significant at 1% probability level, respectively.

Table 2

Mean comparison of sport turfgrass characteristics in different media

	Quality	Root relative water	Shoot relative water	Total organic matter	Shoot organic matter	Total dry weight	Total fresh weight	Shoot dry weight	Shoot fresh weight	Shoot length	Root length	Total chlorophyll	Relative growth rate4	relative growth rate3	Relative growth rate2	Relative growth rate1
Soil	1.6667cd	62.059 b	57.731bc	28.89ab	14.25ab	29.41ab	70.12ab	14.32bc	35.41ab	7.67c	32b	25.87ab	3.33b	4.83bc	2cd	2.5bc
Perlite+vermicompost	7.6667ab	65.055ab	70.184a	22.543ab	13.61ab	23.14ab	76.44ab	13.68bc	50.43ab	11.67b	39.33ab	32.48ab	7.33a	2.667c	4.333c	4ab
Soil+Cocopeat	2.6667c	80.796a	58.793abc	12.433b	8.717b	12.99b	44.14b	8.77c	21.18b	4.67d	41.67ab	18.38b	2bc	2.833c	1.167d	1.5c
Soil+Perlite	1.3333d	78.713ab	68.77ab	21.257ab	18.22ab	21.85ab	77.74ab	18.29abc	60.9ab	6dc	48.67a	29.79ab	0.33c	3.833c	2.83cd	1.5c
Soil+Vermicompost	8.6667a	73.413ab	53.029c	37.28a	31.68a	38.167a	92.27ab	32.08a	70.44ab	15a	42.33 ab	30.97ab	7a	9.333a	10.83a	4.833a
Vermicompost+Cocopeat	6.6667b	78.725ab	66.205ab	35.073a	27.46a	35.347a	123.63a	27.543ab	82.58a	7.667c	35.667b	41.656a	2bc	7.167ab	7.667b	4.8333a

Means with the same letter in each column are not significantly different at 5% level of probability

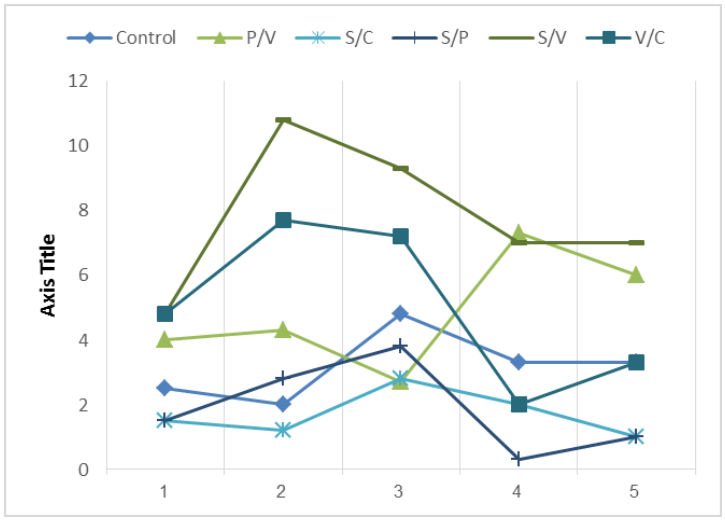

Fig. 1. The Relative growth rate of sport turfgrass in different media during growth season
Control: soil, P/V: perlite+vermicompost, S/C: soil+cocopeat, S/P: soil+perlite, S/V: soil+vermicompost, V/C: vermicompost+cocopeat

Fig. 2. Estblishment sport turfgrass in different media. 1: Perlite+vermicompost, 2: Soil+Vermicompost, 3: Soil+Perlite, 4: Soil+Cocopeat, 5: Vermicompost+Cocopeat, 6: Soil.

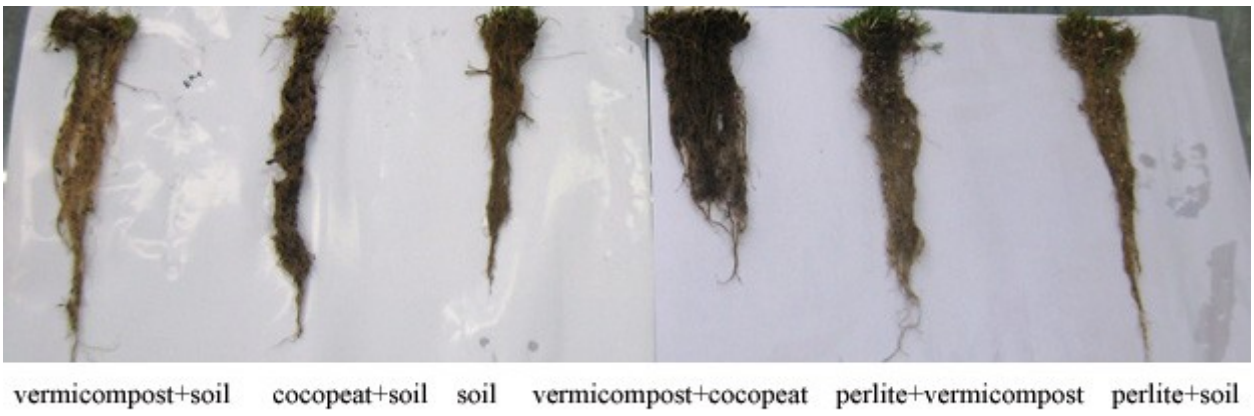

Fig. 3. Root length of sport turfgrass in different media

References

1.Abirami K., J. Rema, P. A. Mathew, V. Srinivasanand S. Hamza. (2010). Effect of different propagation media on seed germination,seedling growth and vigour of nutmeg (Myristica fragrans Houtt.) journal of Medicinal Plants Research Vol. 4(19), pp.2054-2058.

2.Albiach, R., Canet, R., Pomares, F. and Ingelmo, F. (2000). Microbial biomass content and enzymatic activities after the application of organic amendments to a horticultural soil. Bioresour. Technol., 75: 43-48.

3.Arancon, N.Q., Edwards, C.A., Dick, R. and Dick, L. (2007). vermicompost tea production and plant growth impacts.Biocycle 48(11): 51-52.

4.Atiyeh, R.M., Arancon, N.Q., Edwards, C.A., and Metzger, J.D. (2002). Influence of earthworm processed pig manure on the growth and yield of greenhouse tomatoes. Bioresource Technol 75:175-180.

5.Canellas, L.P., Olivares, F.L. and Okorokova-facanha, A.R. (2002). Humic acids isolated from earthworm compost enhance root elongation,lateral root emergence and plasma membrane H+_ATPase activity in maize roots. Plant Physiol 130:1951-11957.

6.Chaoui, H.I., Zibilske, L.M. and Ohno, T. (2003). Effects of earthworm casts and compost on soil microbial activity and plant nutrient availability. Journal Soil boil biochem 35:295_302.

7.Dominguez, J. (2004). State of the art and new perspectives on vermicompost research.In:Edwards CA(ed) earthworm Ecology,2nd ed.CRC press,Boca Raton,FL,USA, pp,401_424.

8.Haghighi, M., Tehranifar, A., Kafi, M. and Nikbakht, A. (2004). The best use of organic waste of agriculture for alternative production ofmushroom and lawn. Proceeding of The first conference of waste organic agriculture. March 14, 2004, Tarbyat Madders University,Tehran, Iran.

9.Hesami, A. and Khorami S. S. (2012). Application of date palm petiole (date-peat) in hydroponic culture of strawberry (*Fragaria Ananassa*). The 1th International and The 4th National Congress on Recycling of Organic Waste in Agriculture 26 – 27 April 2012 in Isfahan, Iran.

10.Hidalgo, PR., Matta, FB. and Harkess, RL. (2006). Physical and chemical properties of substrates containing earthworm casting and effects on marigold growth. Hort Science 41:1474-1476.

11.Maloupa, E. I., Mitsios, P., Martinez, F., and Bladenopoulou, S. (1993). Study of substrates used in Gerbera culture in plastic greenhouse, Acta Hort, 323: 139-144.

12.Mathivanan, S., Chidambaram, A.L.A. Sundaramoorthy, P. and Kalaikandhan, R. (2012). Effect of vermicompost on germination and biochemical constituents of ground nut *(Arachis hypogaea.* L.*)* Seedling. International Journal of Research in Biological Sciences; 2 (2): 54-59.

13.Mohamadi Ghehsareh A., Hematian, M. and Kalbasi, M. (2012). Comparison of date-palm wastes and perlite as culture substrates on growing indices in greenhouse cucumber. International Journal Of Recycling of Organic Waste in Agriculture, 1:5.

14.Nazari F., Farahmand, H., Khosh-Khui, M. and Salehi, H. (2011). Effects of coir as a component of potting media on growth, flowering and physiological characteristics of hyacinth (*Hyacinthus orientalis* L. cv. Sonbol-e-Irani) International Journal of Agricultural and Food Science. 1(2): 34-38

15.Noguera, P., M., Noguera, V., Puchades, R. and Maquieira, E. (2000). Coconut coir waste, a new and ecologically-friendly peat substitute. Acta Hort. 517: 279-286.

16.Rahimi, Z., Aboutalebi A. and Zakerin A. (2013). Comparison of different medium for production of Sweet pepper transplant. International Research Journal of Applied and Basic Sciences. Vol, 4 (2): 307-310.

17.Subler, S., C.A. Edwards and J. Metzger. 1998. Comparing vermicomposts and composts. BioCycle,39:63-6.

18.Tehranifar, A., Poostchi, M., Arooei, H. and Nematti, H. (2007). Effects of seven substrates on qualitative and quantitave characteristics of three Strawberry cultivars under soilless culture. Acta Horticultural, 761: 485-488.

19.Tomati, U., Grappelli A. and Galli, E. (1987). The presence of growth regulators in earthworm-worked wastes. In:Bonvicini Paglioi AM,Omodeo P(eds) on earthworms. Modena,Italy,pp 423-435.

20.Treder J. (2008). The effects of coco peat and fertilization on the growth and flowering of oriental lily 'star gazer'. Journal of Fruit and Ornamental Plant Research Vol. 16: 361-370.

21.Verdonck, O., Vleeschauwer, D. De and Boodt, M. D. (1982). The influence of the substrates to plant growth. Acta Hort. 126: 251-258.