

Utilization of Rice Hull as a New Substrate for Turf Grass Seed Germination in Sod Production as a Sustainable Approach

Mohammad Ali Golestani^{1*}, Ali Dolatkhahi², Navid Vahdati² and Omid Nouri Roudsari³

¹Department of Landscape Architecture, Faculty of Agriculture, Branch, Islamic Azad University, Chalous, Iran.

²Ph.D. Student, Department of Horticultural Sciences, Ferdowsi University of Mashhad, Mashhad, Iran.

³Department of Agroecology, Environmental Sciences Research Institute, Shahid Beheshti University, Evin Street, Tehran, Iran.

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*Corresponding author's email: golestani554@gmail.com

Sod culture is one of the important methods in establishing and repairing of turf grass, especially in sport fields. Nowadays, a mixture of sand and peat are commonly used in sod production in Iran. Because peat media is expensive, it seems necessary to find an alternative medium. Rice hull, tea waste and leaf compost as economical organic material that are available in huge loads in north of Iran. The objective of this study was to evaluate the utilization of low cost organic matter on seed germination and uniformity of turf grass in sod production. Therefore a completely randomized design with 3 replications and 6 treatments: 1- mixture of leaf compost and sand (1:1) (v.v), 2- tea compost and sand (1:1) (v.v), 3- sand, 4- mixture of rice hull and sand (3:1) (v.v), 5- mixture of treatments 1, 2, 3, 4 and 6- petri dish as control was carried out in the experimental field of agricultural school of Islamic Azad University, Chaloos branch during summer 2008. Turf grass species used was *Lolium prene*. According to the results, it was revealed that the effect of different substrates was significant on seed germination percentage ($p \leq 0.05$). Results showed that mixture of rice hull and sand (3:1) (v.v) increased germination percentage over other treatments. This was probably related to high water retaining capacity and well aeration of rice hull. Furthermore, the lowest and highest uniformity rate was related to mixture treatment and sand media, respectively. It generally seems that these waste products can be used for this purpose economically and sustainably.

Abstract

Keywords: Agricultural waste, Rice hull, Seed germination, Sod turf grass production, Uniformity.

INTRODUCTION

Sustainable agriculture is a system of farming which empowers the farmer to work with natural processes to conserve resources such as soil and water, whilst minimizing waste and environmental impact (Mason, 2003). Nowadays, most efforts have been directed towards using renewable resources. Sod is the established turf that is harvested with roots and soil attached to it and transplanted from its place of origin to grow in another place (Pessarakli, 2008). Sodding may be a quick and simple solution to repair of sports-field damage and thick-cut sod is used if there is little time for rooting (Pessarakli, 2008). Sod production could use large quantities of solid-waste compost as an end product, thus benefiting recycling efforts (Cisar and Snyder, 1992). Organic amendments, including municipal and animal sources of bio-solids, can be applied to improve soil physical and chemical properties and turf grass establishment, growth, and quality (McCoy, 1998).

Producing sod on soilless media spreads over plastic has important advantages over conventional sod production (Roberts *et al.*, 2001). Conventional methods of grass sod production on soil require considerable time and expense, producing sod in a soilless growing medium spread over plastic can be accomplished more efficiently in much less time (Decker and Decker, 1988). Aeration, moisture and nutrition of medium composition have a major role in growth and optimum quality (Bruce *et al.*, 2000; Brien and Barker, 1995). Organic materials are among the kinds of compositions. The main medium for sod and roll production in Iran is a mixture of sand and peat. Peat is an expensive medium in Iran, so finding a suitable alternative for this purpose seems to be necessary. Rice hull, tea factory waste and leaf compost which are found in large volumes in the north of Iran and are very cheap and also easily available. Using these types of material will additionally help natural recycling. McCoy (1992), showed on a sport lawn, increasing organic material to 3.5% (v/v %) can increase water holding capacity up to 2 folds. Cisar and Snyder (1992) reported, lawns that grew on urban compost showed a better quality and were ready for transport earlier. Hensler *et al.* (1998) also reported successful sod production on a debris Knaf web. Results of Mirtchall *et al.* (1994) research on compost and saw dust, showed the positive effect of these constituents on lawn density and growth. The considerable effects of leaf compost and animal manure on shoot dry weight increase of some cultivars was hence observed (Hensler *et al.*, 1998; Mirtchall *et al.*, 1994). Sod production duration on plastic with use of organic material in comparison to its conventional soil, decreased from 2 years to 7-10 weeks for Tall fescue (*Festuca auran-dinaceae*) (Decker, 2001; Decker, 1989). Disease infections were also declined to use of organic material (Bruce *et al.*, 2000; Munster *et al.*, 2004; Bertran *et al.*, 2004, Garcia-Gomez *et al.*, 2002). The main aim of this research was to evaluate the impact of rice hull, tea factory waste and leaf compost as a cheap, biodegradable and good alternative media for sod lawn production and seed germination, germination rate and establishment.

MATERIAL AND METHODS

This experiment was planned as a completely randomized design with 6 treatments (½ leaf compost + ½ sand, ½ tea compost + ½ sand, sand, ¾ rice hull + ¼ sand, mixture of leaf compost + tea compost + sand + rice hull and petri dish as control) (Table 1) and 3 replicates and it was

Table 1. Physical characteristics of the media used for sod production in this experiment.

	Water holding capacity (%)	Total porosity (%)	Bulk density (g/cm ³)	Particle density (g/cm ³)
Media				
Leaf compost	190	88	0.062	0.78
Tea compost	324.1	95	0.07	1.53
Sand	210	56	0.12	1.75
Rice hull	410	79	0.081	0.36

conducted in experimental field of Islamic Azad University, Chalooos branch in 2008. *Lolium perenne* was used for sod production. Germination percentage was calculated according to equations below:

Germination in the various treatments was described by the final germination percentage (FGP = Σn , where n is the number of seeds that germinated at each counting) and germination rate [GR = $\Sigma (n/D)$, where D is the number of days to germinate].

Data were analyzed as factorial ANOVAs using SPSS. Where significant ($p \leq 0.05$) treatment effects were determined by ANOVA, data means comparison were separated by the LSD test.

For visual quality of sods, the uniformity was evaluated. This is a difficult procedure and for this purpose visual observations are usually used. Visual observations therefore are usually done by 10 lawn experts. Different aspects of determination number range were 1-9 which 1 showed the least and 9 the best quality, and numbers more than 6 are considered acceptable for lawn and turf grass (Patton *et al.*, 2010). After determining of each parameter, scores are added and then the mean is reported as the qualification rate of the turf grass.

RESULTS AND DISCUSSION

The present study revealed that different substrates for sod can impact uniformity trait and seed germination percentage. Results showed that seed germination percentage in media with $\frac{3}{4}$ rice hull and $\frac{1}{4}$ sand (v/v) were significantly higher compared to other media ($p < 0.05$) (Table 2 and Fig. 1).

It is interesting to note that germination percentage in medium with rice hull and sand was higher than other treatments of pure sand medium and petri dish. The principal reason for this result may be a high water retention capacity of rice hull and also it's higher aeration from others. The results showed that mixtures of sand and leaf compost have the potential to inhibit germination of cool-season turf grass (*Lolium preenne*). Turf grass quality is determined by uniformity, smoothness, texture, and color. Among these, the uniformity of stand is very important for the sod grower (Pessarakli, 2008). Our results showed that different substrates had significantly affected the uniformity ($p \leq 0.01$) (Table 2 and Fig. 2).

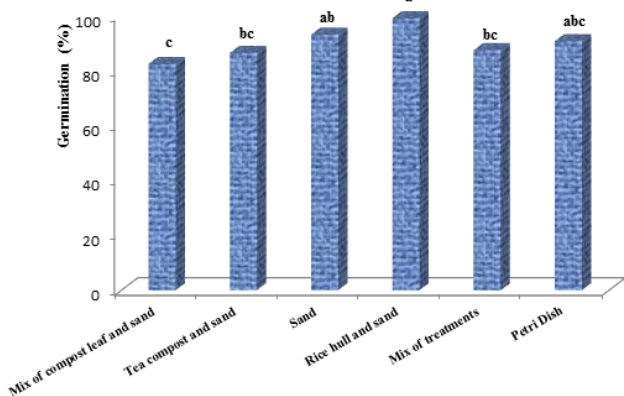


Fig. 1. Effect of different growing media on seed germination percentage of turf grass.

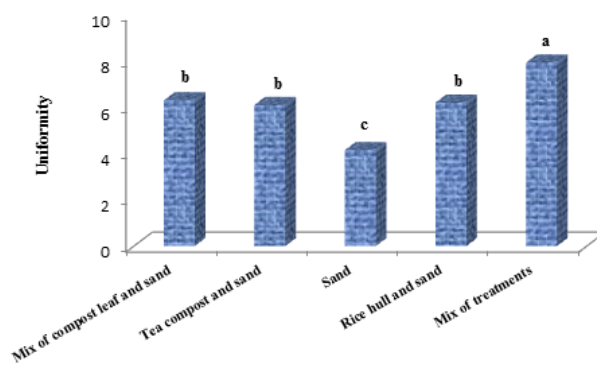


Fig. 2. Effect of different growing media on uniformity of turf grass.

Table 2. Analysis of variance for turf grass to evaluate effects of different growing media on studied traits.

Mean squares			Mean squares		
Source of variation	df	Germination (%)	Source of variation	df	Germination (%)
Treatments	5	508.444*	Treatments	4	17.98**
Error	12	4.830	Error	45	0.466

*: Significant at $p \leq 0.05$, **: Significant at $p \leq 0.01$.

Sod produced on full mixed treatment (sand + rice husk + tea compost + compost leaf) showed acceptable quality than other treatment and appeared to handle well when harvested. In this experiment, the lowest uniformity was related to growing sod on sand beds. One reason for this may be that sand requires special care and regular watering, and usually does not provide under field conditions. It is important that increasing the amount of organic material greatly increased uniformity of turf grass. There are many reports that increasing of organic matter increased water holding capacity and therefore the quality of the grass (McCoy, 1992; Hensler *et al.*, 1998). McCoy (1992) reported that using of various organic materials in sand-based root zone mixes can increase nutrient retention and maintain a stable supply of nutrients which plants can use between regular fertilizer applications. Producing sod by rice hull could reduce the costs associated with expensive substrate materials such as peat. Recycling waste for sod production play a role important in reducing the potential source of waste and preserving agricultural soils (Cisar and Snyder, 1992). According to the results of this experiment, it is concluded that mixture of sand and rice hull is the best growing media for sod production. Because of rice hull as a low cost organic matter is very abundant in the north of Iran, it can be recommended for utilization for sod production as an alternative substrate.

CONCLUSION

Sod culture is one of the important methods in establishing and repairing of turf grass, especially in sport fields. Nowadays, a mixture of sand and peat are commonly used in sod production in Iran. Rice hull, tea factory waste and leaf compost are economical organic material and there is great resource of them in the north of Iran, and considered suitable alternatives. Germination percentage in medium with rice hull and sand was highest among treatments. The principal reason for this may be a high water retention capacity of rice hull and also its higher aeration.

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