# The Effect of Mulch Type for Turfgrass Establishment within a Refined Wood Fiber Mat over Plastic[1]

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## Abstract

The germination and establishment of perennial ryegrass and supina bluegrass within a refined wood fiber mat (Ecomat®) placed on plastic sheeting was evaluated using seven mulches and a control with no mulch. Percent turfgrass cover (0–100%) was visually estimated as a measure of seedling density at 7, 14, 21, and 28 days after seeding. Three field experiments were initiated on July 3, 1995, September 29, 1995, and July 5, 1996. The three seeding dates were chosen to show the effects of mulches under optimal and sub-optimal growing conditions for cool season turfgrasses. The seven mulches consisted of hydrated fiber mulch, copolymer of sodium acrylamide, crumb rubber, straw, fine grade compost, pelletized fiber mulch, and a native Capac loam soil. Percent turfgrass cover differed among species for the seven mulch treatments and the control, and the three seeding dates. Overall, perennial ryegrass achieved 25% greater cover than supina bluegrass. The straw, pelletized fiber mulch, and hydrated fiber mulch resulted in the greatest turfgrass cover regardless of seeding date. Crumb rubber performed equal to these mulches only during the 29 September 1995 seeding trial. In summary, the use of a particular mulching material will enhance turfgrass cover during seed germination.

**Index words:** days after seeding (DAS), mulch, polymers, pellet mulch, hydro mulch, crumb rubber, native soil, straw, compost, and percent cover.

**Species used in this study:** *Lolium perenne* L. (perennial ryegrass) and *Poa supina* Schrad. (supina bluegrass).

## Significance to the Nursery Industry

Mulching is an important practice for enhancing successful turfgrass establishment from seed. New mulching materials are continually being introduced and an investigation determining their potential is warranted. Pellet mulch is relatively new mulching material and enhanced turfgrass establishment as well as conventional straw mulch. Conversely, the polymer as a mulching material was ineffective in aiding seed germination, and should not be used during seeding.

## Introduction

Conventional sod production is restricted to turfgrasses with a stoloniferous and/or rhizomatous growth habit because the rhizomes and stolons provide cohesiveness for the sod, even after the roots have been sheared during harvest. Monostands of bunch-type grasses have many practical uses in a turfgrass setting. For instance, tall fescue (*Festuca arundinacea* Schreb.) is an excellent grass for shady conditions, and could be produced if the roots remained intact during sod harvesting. Recent experiments at Michigan State University have shown that growing sod on plastic using a refined wood fiber mat (Ecomat®) allows harvesting monostands of bunch-type sods without root shearing (unpublished data). The refined wood fiber (Ecomat®) is an erosion control mat (Canadian Forest Products, New Westminster, British Columbia, Canada). Establishing sod over an impervious layer like plastic and within a soil-less growing medium (Ecomat®) will eliminate root shearing during harvest. This enables the intact roots to provide the necessary strength for turfgrasses with a bunch-type growth habit to be grown as sod. Therefore, growing sod in Ecomat® allows for a greater variety of turfgrass species to be grown.

Ecomat® alone does not retain sufficient moisture and nutrients overtime to ensure satisfactory seed germination. Mulching is one way to correct this problem, but comparison studies of standard and newly developed mulches have not been conducted on cool season grasses, particularly within Ecomat®. Similar studies have been conducted with warm season turfgrasses (3, 8); however, recently available mulches still have not been comparatively investigated.

Mulch is defined as being any nonliving material that forms a cover on the soil surface (9). Mulching has been a practice in turfgrass establishment that has been used for many decades, (7) because it reduces the rate of evaporation from the soil surface (10). Mulches can also increase or decrease surface temperatures during adverse growing conditions (12), reduce potential seed loss to runoff, and greatly reduce wind erosion, and splashing caused by rain or irrigation (2). In the turfgrass industry, most research on mulches has concentrated on prevention of seed and soil erosion. The potential of mulches for aiding germination and turf establishment, on a soil-less growing medium like Ecomat®, has yet to be investigated. Extensive comparisons of different mulches for turfgrass establishment have been evaluated for grass establishment on fill slopes (3). However, recently available mulching materials warrant similar evaluations for turf establishment.

Many types of mulching materials are available; selection of a given type is based on its availability, cost, ease of application, potential for preventing weeds, effectiveness in erosion control, and the microenvironment it provides for seed germination (2). The unique physical characteristics of each mulch type determine how they perform for turfgrass establishment. For instance, the color and water holding capacity of the mulch may determine the time of year when a particular mulch is most effective; during adverse growing conditions (e.g., mid-summer heat and drought) a particular mulch (e.g., crumb rubber) may exacerbate the already unfavorable growing conditions (3). Absorbing heat and raising seedbed temperatures does this. Previous research evaluated differ-

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ent mulches and their effect on microclimate and establishment (1). However, it is important to compare new mulch materials that may differ in effectiveness under various environmental conditions. Seven mulches were chosen for comparison: hydrated fiber mulch, copolymer of sodium acrylate and acrylamide, crumb rubber, straw, fine grade compost, pelletized fiber mulch, and a native Capac loam soil.

This experiment was designed to assess the effect of these different mulches on turfgrass germination and establishment under soil-less growing conditions (Ecomat® on plastic). The experimental design included comparison of two turfgrass species: supina bluegrass (*Poa supina* Schrad.) and perennial ryegrass (*Lolium perenne* L.). Supina bluegrass has a strongly stoloniferous growth habit as well as a relatively long germination period. This grass has potential for use in high traffic turf areas, but management strategies have not been well developed. Perennial ryegrass has a short germination time and is also very popular for use in high traffic areas.

## Materials and Methods

The experimental design was a 2 × 8 × 3 (species × mulch type × seeding date) split-plot randomized complete block design with three replications. Each of the 48 refined wood fiber plots measured 1.21 m × 0.91 m (4 ft × 3 ft), and were placed over perforated 6 mil (0.006 in) black polyethylene sheeting. Plots were located at the Hancock Turfgrass Research Center on the Michigan State University campus in East Lansing, MI. Two turfgrass species, supina bluegrass 'Supranova' (*Poa supina* Schrad., Saatzucht Steinach GmbH, Steinach, Germany) and perennial ryegrass 'Manhattan II' (*Lolium perenne* L., Turf Merchants, Hubbard, OR), were seeded at a rate of 7.6 g/sq m (1.5 lbs/1000 sq ft) and 20 g/sq m (4 lbs/1000 sq ft) respectively.

Seven mulches were chosen for comparison: hydrated fiber mulch, copolymer of sodium acrylate and acrylamide, crumb rubber, straw, fine grade compost, pelletized fiber mulch, and a native Capac loam soil. The copolymer of sodium acrylate and acrylamide serves as a sticking agent intended to maintain moisture levels and prevent erosion. Straw is a traditional mulch that allows good air movement and is relatively inexpensive; however, straw has the potential to introduce weed seeds. Fine grade compost provides nutrients in organic forms and improves surface moisture retention (2). Crumb rubber (5 to 6 mm (0.20 to 0.24 in) particle size) can provide higher temperatures for longer periods of time as a result of its black color. Easily applied, crumb rubber protects the crowns of turfgrass plants, which is important for sod survival in heavy traffic situations (6). Hydrated fiber mulch consists of shredded paper pre-mixed with water into a slurry and applied through a hydroseeder or hydroplanter (2). Hydroseeders and hydroplanters are bulky machines that are relatively costly compared to other methods of mulching. Pelletized fiber consists of compressed pellets of shredded paper applied by a drop spreader. When the mulch is irrigated the pellets swell and provide a uniform cover. The Capac loam soil (Fine-loamy, mixed, mesic Aeric Ochraqualfs) as a mulch mimics traditional seed establishment conditions, combining seed-to-soil contact with an adequate nutrient holding capacity. Five mulches (pellet mulch, hydro mulch, crumb rubber, native soil, and straw) were applied at rates that result in equal coverage to a 0.6 cm (0.23 in) depth. The polymer mulch was applied at 5 g/sq m (1 lb/1000 sq ft), and the straw was laid to the equivalent of one bail per 46.5 sq m (500 sq ft). A control treatment without mulch was included.

The three seeding dates, July 3, 1995, September 29, 1995, and July 5, 1996, represented both adverse (summer) and ideal (fall) seeding times for establishment of cool season grasses. Fertilizer was applied to all plots once per week for four weeks using 13–25–12 (Lebanon Co. Lebanon, PA) starter fertilizer at 5 g P/sq m (1 lb P/1000 sq ft). Percent cover was visually estimated every 7 days after seeding (DAS) for 4 weeks to estimate turfgrass cover (0–100%). Daily high and low temperatures were recorded for the 28 DAS, and irrigation was applied as needed. The data were analyzed for statistical differences using analysis of variance using the SAS system under Microsoft Windows. Treatment means were separated using Fischer's LSD at P = 0.05.

## Results and Discussion

Critical time during seed germination is the first 28 days after seeding, and differences between the three seeding dates occurred as a result of the different environmental conditions (Fig. 1). Any significant sub or supra optimal temperature change can adversely affect seed germination and establishment. One potential function of mulch would be to minimize the effects of these temperature changes. In July 1995, ten of the 28 days had some portion of the day at least five degrees centigrade above the optimal germination. Conversely, there were only four dates in 1996 (Fig. 1).

Significant differences between mulch type, turf species, and seeding date occurred throughout the experiment (Table 1). The data presented focused on results 28 DAS, at the end of the turfgrass germination period.

The moisture content of the mulches varies depending on their physical and chemical properties, and the total moisture lost from the seedbed surface varies accordingly. That is to say, the more absorptive the mulch the more moisture is lost from the seedbed. Since the purpose of a mulch is to protect the seedbed surface from exposure to the evaporative water loss, the less absorptive the mulch the less water is brought up to the surface to be exposed and therefore the more moisture is held in the seedbed. This explains why the loam, polymer, and compost with high microporosity were poor mulches in this experiment. Harris and Yao (4) compared mulches for growing vegetable crops and found that there was a correlation between the moisture lost from the soil and the moisture contained in the mulches. Harris and Yao (4) concluded in their experiment that the straw mulch was the best because it had a lower capillary rise than the hay, wood shavings and manure mulches tested, and this is also supported by the results found in our experiment.

Overall, the straw, pelletized fiber mulch, and hydrated fiber mulch appeared to be the best mulches for turfgrass cover regardless of the seeding date (Table 2). All three mulches resulted in consistently greater turfgrass cover than the control. The crumb rubber in the fall of 1995 showed a significantly greater turfgrass cover versus the other two seeding dates. This is likely a result of the dark color, and macroporosity of the crumb rubber where, during hot and dry growing conditions (summer seeding trials), the crumb rubber was not able to hold sufficient moisture. The compost as mulch showed significant differences in turfgrass cover versus the control for the first two seeding dates but not during the second year of seeding. The consistency of the com-

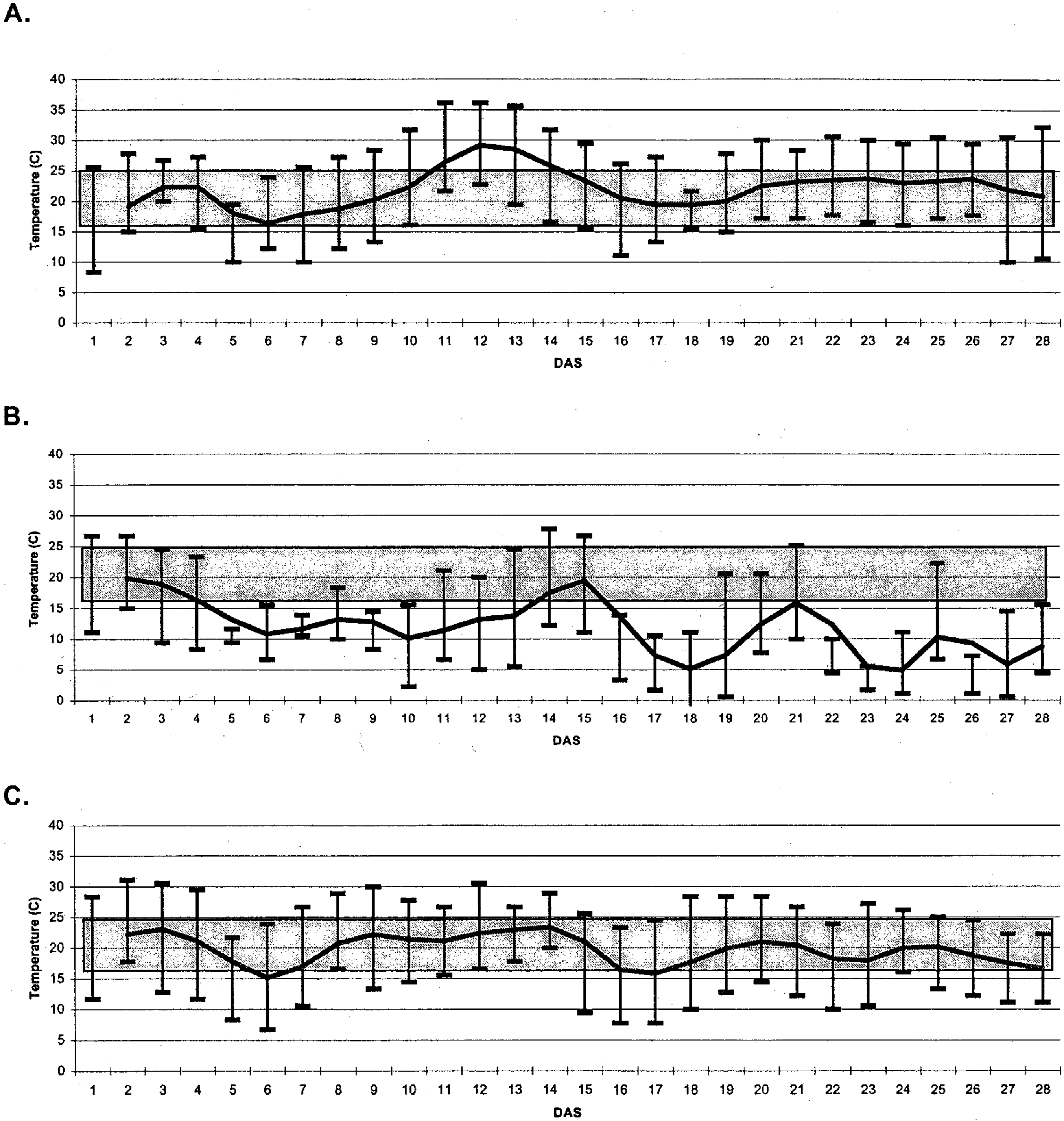


**Fig. 1.** **Daily high, low, and average temperatures (C) for the first 28 days after seeding (DAS) for July3, 1995 (A), September 29, 1995 (B), and July 5, 1996 (C) seeding dates. ▩ Indicates optimal temperature range for cool season turfgrass growth. ━ Indicates daily average temperature, East Lansing, MI.**

post may have deteriorated from the first year (1995) giving inconsistent results during the second year of testing, because the turfgrass cover for the compost treatment was much greater during both seeding dates in 1995 than in 1996.

Both turfgrass species showed significant differences in turfgrass cover for the three seeding dates (Table 3). The summer 1995 and fall 1995 seeding dates showed that the perennial ryegrass produced significantly more turf cover than the supina bluegrass, which was to be expected because of the faster germination rate of the former. The species by seeding date interaction occurred during the summer 1996 seeding, wherein supina bluegrass produced more turf cover than perennial ryegrass (Table 3). The reason for supina bluegrass having a greater turf cover is possibly related to the consistent growing conditions of the germination period (Fig. 1).

A three-way interaction occurred at 21 DAS between turf species, mulch type, and seeding date (data not shown). The interaction occurred during the summer 1996 seeding date

**Table 1.** **Significance of treatment effects and main effects for turfgrass cover on Ecomat® mulching study, East Lansing, MI, 1995–96.**

| Source | Df | Days after seeding 7 | 14 | 21 | 28 |
|---|---|---|---|---|---|
| Turf sp. (TS) | 1 | *[z] | ** | * | ** |
| Mulch type (M) | 7 | ** | ** | ** | ** |
| TS × M | 7 | * | ** | NS | NS |
| Seeding date (D) | 2 | ** | ** | ** | ** |
| TS × D | 2 | ** | ** | ** | ** |
| M × D | 14 | ** | * | ** | ** |
| TS × M × D | 14 | NS | NS | ** | NS |
| **Mulch type** | | | | | |
| Control | | 2 | 4 | 8 | 15 |
| Polymer | | 2 | 6 | 11 | 23 |
| Pellet mulch | | 4 | 12 | 38 | 55 |
| Hydro mulch | | 3 | 9 | 29 | 50 |
| Crumb rubber | | 5 | 7 | 23 | 31 |
| Native soil | | 1 | 4 | 8 | 14 |
| Straw | | 5 | 13 | 44 | 59 |
| Compost | | 2 | 5 | 16 | 28 |
| $LSD_{(0.05)}$ | | 2 | 2 | 8 | 9 |
| **Turf species** | | | | | |
| *Poa supina* | | 1* | 6** | 17* | 29** |
| *Lolium perenne* | | 5 | 9 | 27 | 40 |

[z]Significant at the 0.05, 0.01 probability levels, respectively.

by the high percentage of supina bluegrass cover in the straw mulch, and the low cover of perennial ryegrass in the pellet mulch. This interaction was not repeated 28 DAS and the relative significance of this interaction is questionable.

Although the effectiveness of mulching has been ascertained during this experiment, the question of the relative effectiveness of mulch materials naturally arises. Almost any lifeless material can be used for mulching, but the relative effectiveness of the different mulch materials varies according to their physical and chemical properties (4, 5, 11).

**Table 2.** **Mulch type by seeding date[z] interaction 28 days after seeding averaged over turfgrass species[y], East Lansing, MI, 1995–96.**

| Mulch type | Percent cover (%) Summer 1995 | Fall 1995 | Summer 1996 |
|---|---|---|---|
| Control | 12 | 14 | 20 |
| Polymer | 22 | 20 | 27 |
| Pellet mulch | 45 | 64 | 55 |
| Hydro mulch | 44 | 52 | 54 |
| Crumb rubber | 9 | 65 | 18 |
| Native soil | 7 | 13 | 22 |
| Straw | 44 | 53 | 80 |
| Compost | 34 | 41 | 11 |
| $LSD^{x}_{(0.05)}$ | | 18.1 | |
| $LSD^{w}_{(0.05)}$ | | 19.5 | |

[z]Includes July 3 and September 29, 1995, and July 5, 1996, seeding dates.
[y]Species includes *Poa supina* and *Lolium perenne*.
[x]LSD for different mulches within the same seeding date.
[w]LSD for different seeding dates within the same mulch type.

**Table 3.** **Turf species by seeding date[z] interaction 28 days after seeding averaged over all mulch types[y] and the control, East Lansing, MI, 1995–96.**

| Turfgrass spp. | Percent cover (%) Summer 1995 | Fall 1995 | Summer 1996 |
|---|---|---|---|
| *Poa supina* | 16 | 30 | 41 |
| *Lolium perenne* | 38 | 50 | 30 |
| $LSD^{x}_{(0.05)}$ | | 9 | |
| $LSD^{y}_{(0.05)}$ | | 10 | |

[z]Includes 3 July 1995, 29 September 1995, and 5 July 1996 seeding dates.
[y]Mulches include polymer, pellet mulch, hydro mulch, crumb rubber, native soil, straw, and compost.
[x]$LSD_{(0.05)}$ for different turves within the same seeding date.
[w]$LSD_{(0.05)}$ for different seeding dates within the same turf.

Among the seven mulches tested, straw, pelletized fiber mulch, and hydrated fiber mulch were the best mulches for providing the greatest turfgrass cover regardless of the seeding date. However, the crumb rubber mulch was very effective, and performed as well as the aforementioned mulches when growing conditions were less favorable (fall 1995).

Turfgrass cover was enhanced with the use of some mulching materials. The greatest turfgrass cover was achieved when straw, pellet mulch, and hydro mulch were applied, respectively. Crumb rubber performed equally as well only during the fall 1995 seeding date when temperatures were cooler. However, the polymer, and native loam soil did not provide significantly more cover than the control.

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