JUNCUS DIRECT SEEDING METHOD EVALUATION, 2006-2008
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2006 PROGRESS REPORT
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GOAL: To determine the techniques that are most efficient and cost effective for seeding Baltic rush (*Juncus balticus*), and to develop seeding rates for use with those methods that will provide adequate establishment for wetland revegetation.

This project was designed in incremental steps for ease of evaluation and development of seeding rates. The first experiment (trial 1) was conducted in the PMC greenhouse during the summer of 2006. Trial 1 compared seedling establishment from four hydroseed mulches and four dry, inert carriers. The second trial will take place in 2007 with the most promising treatments from trial 1 and compare each treatment with Submerseed™ pellets, a promising treatment from an earlier trial (Tilley and Hoag 2006), in a controlled outdoor seeding in 4’ X 8’ tanks. These studies are the precursors to field testing the best methods of direct seeding into the PMC wetland ponds. Due to volunteer wetland seed contamination, the ponds were chemically treated in 2006 and will be fumigated in 2007 to ensure a clean, weed-free seed bed for use in seeding evaluations that will take place in 2008.

TRIAL 1- EVALUATION OF BROADCAST CARRIERS AND HYDROMULCHES

Introduction

Planting seed of very small seeded species has certain inherent difficulties. Commonly available planting equipment requires a minimum volume of seed to prime the seed box. Many wetland species produce very small seed, over 90 million seeds/pound in the case of Baltic rush, and are extremely difficult to seed at a prescribed rate. Inert carriers have been found to be an effective method of increasing the volume of seeded material and facilitating uniform distribution of seed from drills or broadcast spreaders (St. John and others 2005). Recommended dry inert carriers include rice hulls, shop dry and sand. Hydroseed mulches can also act as an inert carrier in liquid form, much like rice hulls used for dryland plantings. The mulch keeps seed in suspension for more uniform dispersal and also provides structure allowing seed and tackifier to more readily attach to the soil surface. Baltic rush was chosen for this study because the seed exemplifies the problems faced in direct seeding wetland species, i.e. very small seed that floats and seed that requires surface planting to allow adequate light for germination.

Materials and Methods

Because tackifier is designed to be used to hold grass and flower seed to dry soils and slopes it was unknown if the glues in tackifier could withstand sustained flooding and if so, at what rate tackifier should be applied for use in wetland seedings. Turbo Tack® tackifier from Turbo Technologies Inc. was tested at 1x, 5x and 10x the recommended rate of tackifier with 100 seeds on Petri dish blotters by mixing seeds and tackifier in water and pouring it onto the saturated blotters. Each treatment contained six replications. The blotters and tackifier were allowed to dry overnight, and the blotters were then put under running water from a faucet to wash away any loose seed. Essentially no seed washout was observed, and no significant differences of seed washout were detected between treatments (data not shown). For ease of measuring and mixing for small scale greenhouse applications a 5x rate of tackifier was used in trial 1.

Trial 1 was initiated on April 17, 2006 and was concluded on May 8, 2006. Eight seeding techniques were evaluated; four dry methods including no carrier, rice hulls, shop dry and sand, and four wet or hydroseeding methods including tackifier (tackifier alone with seed and water), straw mulch, wood mulch and Fertil-Fibers NutriMulch™ hydroseeding pellets. The Fertil-Fibers pellets are designed to act both as mulch and as a slow-release fertilizer. The pellets are made primarily from chicken manure and rice hulls and have a nutrient ratio of 6:4:1 NPK (Quattro Environmental 2007).

Three replications of each treatment were seeded in 12” X 18” (1.5 ft^2) greenhouse trays placed randomly in a 4’ X 8’ X 1’ artificial wetland tank in the PMC greenhouse. Mulch was applied at the recommended rate of 2000 lb/ac or 31.5g/tray (McClure, 2006). Tackifier was applied in all wet treatments at 5X the recommended rate (0.25g/tray) which equates to 16.25 lb/ac. The seed used for this trial was Sterling Selection of Baltic rush with a PLS of 89.1%. To more easily handle the very small amount of seed necessary, it was decided to use a very high seeding rate of 500 PLS/ft^2 (0.055g/tray). Hydroseeding applications were simulated by mixing seed, water, mulch and tackifier into a 2 liter kitchen measuring pitcher. The slurry was mixed and agitated for several minutes allowing tackifier crystals to dissolve and a uniform suspension to be made. The hydroseed slurry was then poured over the soil as evenly as possible. Any large clumps of mulch were smoothed out with a spoon. Hydroseed treatments were applied on April 17 and allowed to dry overnight to allow the tackifier to set (figure 1). Soil in each tray was a 1:1:1 mixture of peat, sand and perlite.

Figure 1. Treatments in greenhouse trays prior to flooding.

The dry treatments were initiated on April 18, so that all treatments could be flooded at the same time. Seed rates for the dry treatments were the same as those for the hydroseed treatments. Seed was mixed with approximately 1 tablespoon of inert carrier (2.0 g rice hulls, 10 g shop dry and 22 g sand). Inert carriers and seed were mixed in a small tray and spread as evenly as possible by hand over the soil. The no-carrier treatment was sprinkled by hand. Following broadcasting, the dry treatments were pressed into the soil with an imprinting jig designed to simulate a packer wheel.

The wetland tank was flooded on April 18 to a depth of approximately 2 inches above the top of the soil, and water was allowed to spill over the edge of the wetland tank. The overflowing of water caused any floating seed, mulch or inert material to be swept over the edge of the tank. This insured that no seed was spread to any other tray in the trial. All treatments were totally submerged for 15 minutes. After the first flooding, the water levels were dropped below the bottoms of the trays so the soil could dry slowly and optimum germination conditions could be met. Seventeen days after planting, on May 4, after the plants had a chance to become established and the soil was beginning to dry, the tanks were flooded again, this time for 24 hours, to test if established plants would wash out. Greenhouse temperatures ranged from 75 to 100° F for the length of the trial.

Seedling emergence was evaluated on May 1 (14 days after planting), and again on May 8 (21 days after planting) following the second flood. Four 2” X 12” strips running the 12” length of each tray were evaluated for seedling emergence. Germinants in each strip were totaled and added together to avoid pseudo replication. This total was then converted to plants/ft².

RESULTS

At the time of the first flooding event, there seemed to be a lot of seed washing out from the dry broadcast treatments, significantly more than from Fertil-Fibers and tackifier treatments. This was confirmed in the plant density evaluation (table 1). Fertil-Fibers had an average plant density of 300 plants/ft², and the tackifier treatment averaged just over 200 plants/ft², 2 to 4 times more germinants than the next highest density, the straw mulch treatment. Straw and wood mulch appeared to be too thick and may have been covering *Juncus* seeds and inhibiting germination. A lighter mixture of straw or wood may be as effective as Fertile Fibers or tackifier. It would be inaccurate to assume at this point that straw and wood mulches don’t work, only that they don’t work at the tested rates. Fertil-Fibers appear to be a thin enough slurry to not cover seeds, and it also works as an effective inert carrier to disperse seed and hold it to the soil. Results from Fertil-Fibers and tackifier alone seem promising enough to try these methods in the outdoor trial with 100 PLS/ft² as opposed to 500 PLS/ft. This matches the seeding rate to be used with Submerseed pellets and is a more realistic rate for field applications.

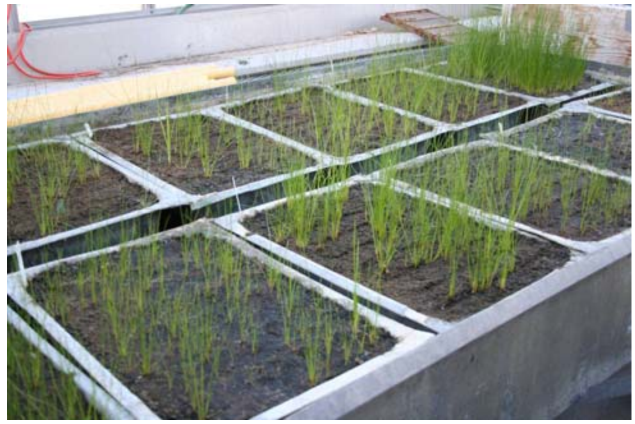


Figure 2. Juncus seedlings after 21 days.

Table 1. Seedling Germination

Treatment	5/1 (after 1 flood) Plants/ft²	5/8 (after 2 floods) Plants/ft²
No carrier	44 c	50 b
Rice hulls	67 c	71 b
Shop dry	52 c	55 b
Sand	45 c	48 b
Fertil-Fibers	311 a	300 a
Straw	74 c	100 b
Wood	31 c	42 b
Tackifier	211 b	206 a

Results were similar after the second flood event except seedling emergence in the Fertil-Fibers treatment was not significantly different from the tackifier treatment. No significant gains or losses in number of seedlings were detected between the first and second flooding treatments (data not shown). This indicates that once seed has germinated and have initiated some root growth into the soil, plants are very unlikely to be washed out by low energy flooding.

PROPOSED TRIAL 2- OUTDOOR TRIAL OF BEST PERFORMERS

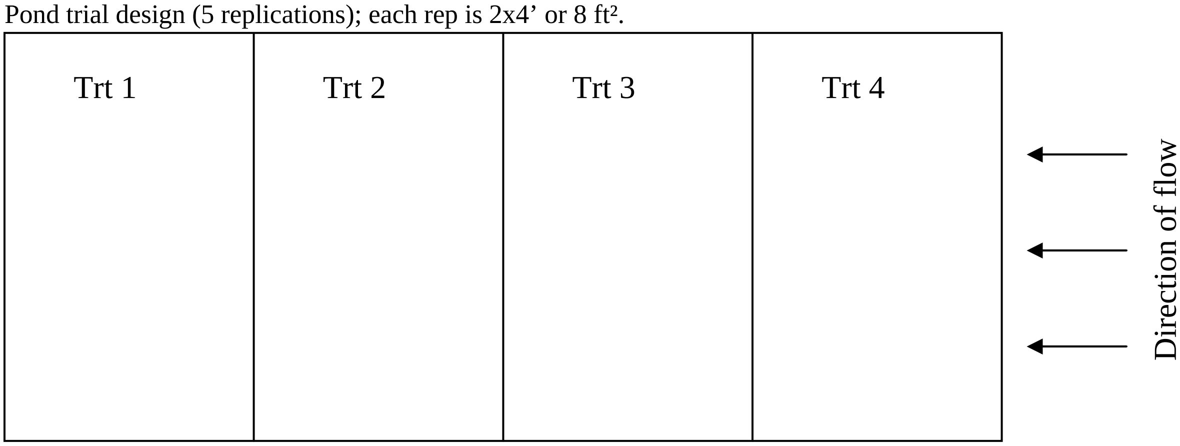
Based on the results from Trial 1 and results from Tilley and Hoag (2006) it is proposed that the following wetland seeding methods be evaluated under controlled, outdoor conditions during the summer of 2007.

- Submerseed
- Broadcast (rice hulls) w/ imprinter
- Hydroseed (tackifier w/o mulch)
- Hydroseed (Fertil-Fibers)

This trial is designed to be a bridging step between greenhouse scale trials and large scale field experiments. The experimental design incorporates a high degree of water control and eliminates the concern of volunteer wetland plant germination.

The four treatments would be planted in five 4' X 8' wetland tanks placed outside at the PMC farm. Each tank would be divided into four 2' X 4' plots, one per each treatment. Each tank would thus represent one of five blocks or replications. Because the plot size is so small, seeding with a broadcaster or hydroseeder would not be feasible; therefore seeding would have to be done in a manner similar to that described for trial 1. However, seed and tackifier rates could be adjusted to the rates recommended for large area plantings and germination rates would more accurately reflect those that might be observed in field plantings.

Pond trial design (5 replications); each rep is 2x4' or 8 ft².



The results of this trial will be used to generate a potential cost analysis between the available methods to revegetate wetlands. Factors such as seed cost, labor, and specialized equipment can be broken down to produce an approximate cost per acre for each method.

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