

Dormant Seeding of Switchgrass with and without Seed Treatments in New York

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Introduction and Objectives

Switchgrass (*Panicum virgatum* L.) is being investigated for biomass production in the Northeast for bioenergy and carbon sequestration; however, seedling establishment is challenging in the Northeast due to high soil temperature requirements, long germination time, seed dormancy and short growing season. The time available to plant seeds in plant hardiness zones 4 and 5 in New York is limited to about June 15th. It would be advantageous to be able to successfully plant switchgrass as a dormant seeding, to take advantage of natural stratification, early soil moisture and early establishment the following spring. This would also allow seeding when there is less demand for labor and equipment in the fall. Research at the Big Flats Plant Materials Center in Corning, New York has shown that there is an approximate 75% reduction in seedling emergence the following spring when fall dormant planting is compared to a conventional spring seeding (Fig. 1 and 2). We hypothesized that the longer period of time the seed was in the ground during cool moist conditions may have reduced germination due to soil borne disease or insect predation. The objective of this study was to evaluate the effects of fungicides and biological seed treatments on the emergence of switchgrass seedlings when dormant seeded, compared to dormant and spring seedings with no treatments.

Materials and Methods

'Shawnee' switchgrass lot. 1 (germination and dormancy 73% and 4%, respectively) was used in all years. In 2008, a second seed lot with higher seed dormancy was planted to evaluate the difference in seed dormancy on dormant seedings. The second seed lot. 9 'Cave-in-Rock' switchgrass (germination and dormancy 54% and 18%, respectively) was also used. Seed tests were conducted in 2008. The seed treatments for 2007 are given in Table 1. The seed treatments for 2008 and 2009 are given in Table 2.

All plantings were conducted on a Unadilla silt loam soil, in Corning, New York. The plots, were conventionally tilled then rototilled. The seed was broadcasted by hand then raked and cultipacked. The dormant and spring plantings were conducted on 10/31/07, 11/4/08, 11/12/09 and 5/6/08, 5/8/09, 5/28/10, respectively. The seed was sown at the rate of 10 lb/ac bulk seed in 50 ft² plots. There were 3 randomized plots per treatment set up in a randomized complete block design. Seedlings/ft² were counted the following late spring in 3 randomly placed 1 ft² quadrats in each plot.

Table 1. Switchgrass Fungicide and Biological Seed Treatments 2007

Lot. 1 'Shawnee' Switchgrass, 73% germination, 4% dormant seed.
Coating and treater: Disco (1:1) apply materials in 5% of seed weight.

Chemical names	Trade names	Application Rate	Application Conversion
1) Non-treated check			
2) Thiram	Thiram 42S	8 fl. oz. / cwt	0.60 g / 100 g seed
3) Difenoconazole Mefenoxam	Dividend Extreme ¹	2.0 fl oz. / cwt	0.16 g / 100 g seed
4) Tebuconazole Metalaxyl	Raxil XT ²	0.5 oz. / cwt.	0.21 g / 100 g seed
5) Bacillus spp.	Trigo Cor 1448	5.0 ml / 100 g seed	5.0 g / 100 g seed
6)Trichoderma harzianum	T-22	1.5 oz. / cwt (organic binder)	0.094 g / 100 g seed

¹Dividend Extreme at 2.0 oz product per 100 lbs will deliver 12 grams ai/100 kg (120 ppm) of difenoconazole and 3 grams ai/100 kg (30 ppm) of mefenoxam.

²The 0.50 oz/cwt rate of Raxil XT will provide 6.25 grams of metalaxyl per 100 kg (62.5 ppm) and 4.69 grams of Tebuconazole per 100 kg (46.9 ppm).



Fig. 1. Fall dormant seeding, photo 6/23/11 seeded 11/12/09, average 4.4 seedlings/ft².



Fig. 2. Spring seeding photo 6/23/11 seeded 5/28/10, average 15.3 seedlings/ft².

Table 2. Switchgrass Fungicide Seed Treatments 2008 and 2009

Lot. 1 'Shawnee' 73% germ, 4% dormant Lot. 9 'Cave-in-Rock' 54% germ, 18% dormant seed.
Coating and treater: Seeds brushed in Debearder before treating with Geneva switchgrass coating.

Chemical names	Trade names	Application Rate	Rate (mg ai / 100 g)
1) Non-treated check			
2) Thiram	Thiram 42S	8 fl. oz. / cwt	250.0
Captan	Captan 400	8.25 fl. oz. / cwt	245.0
3) Thiram	Thiram 42S	8 fl. oz. / cwt	250.0
Captan	Captan 400	8.25 fl. oz. / cwt	245.0
Tebuconazole/ Metalaxyl	Raxil XT ¹	0.5 oz. / cwt.	4.7 6.25
4) Thiram	Thiram 42S	8 fl. oz. / cwt	250.0
Captan	Captan 400	8.25 fl. oz. / cwt	245.0
Difenoconazole/ Mefenoxam	Dividend Extreme ²	2.0 fl oz /cwt	12.0 3.0

¹Raxil XT at 0.5 oz / cwt = 11 mg total ai/100 g, 6.25 mg ai metalaxyl, 4.7 mg ai tebuconazole.

²Dividend Extreme at 2.0 oz product per 100 lbs will deliver 12 mg ai/100 g (120 ppm) of difenoconazole and 3 mg ai/100 g (30 ppm) of mefenoxam.

Results and Conclusions

Seedling establishment was measured by counting the seedlings/ft². The seedlings/ft² for the non-treated fall dormant control, the average of all dormant seed treatments and spring control were for 2007: 4.1, 6.1, and 11.8; for 2008: 6.3, 9.9, and 12.4; and for 2009: 2.8, 4.4, and 15.3, respectively (Table 3-5 and Fig. 3-5). The spring seeding date produced significantly more seedlings/ft² than all other treatments. There was no significant difference between seed treatments and fall dormant control except in 2009 where the Thiram/Captan (T/C) treatment for lot. 1 was significantly higher. In general there was a trend toward increased seedling density with the use of seed treatments in the fall compared to the dormant non-treated (Fig. 6). The use of Thiram alone in 2007 (Table 3) performed as well as the average of all seed treatments and is currently labeled for grasses. In 2008 and 2009 (Table 4), the addition of Dividend Extreme and Raxil XT to the T/C treatment did not improve the performance over the use of the T/C combination alone. There was no difference between seed lots in 2008. In 2009 the surface sown fall seeding established as well as the incorporated raked in seed.

It is possible to obtain stands with dormant seedings but there is increased risk and less seedling density to compete with weeds. Spring tillage and weed control also reduces early germinating weeds. To improve fall dormant seedings for a biomass planting, it would be recommended to use approved fungicides and to increase seeding rates approximately 50% over the spring seeding rate to obtain the same seedling density. Increased attention to weed control will be needed.

Table 3. Seed Treatment Results 2007

Treatment	Ave. Seedlings/ft ²
Spring control	11.8 a
Fall control	4.1 b
Raxil XT	6.9 b
Dividend Extreme	6.0 b
Thiram 42S	6.5 b
Trigo Cor 1448	6.3 b
T-22	4.8 b
Average seed treatments	6.1

Means followed by the same letter are not significantly different

Table 4. Seed Treatment Study Results 2008

Lot#	Treatment	Ave. Seedlings/ft ²
1	Dividend T/C ¹	10.3 ab
1	Fall check	4.8 b
1	Raxil T/C	7.8 ab
1	Spring check	13.3 a
1	T/C	10.1 ab
9	Dividend T/C	9.8 ab
9	Fall check	7.8 ab
9	Raxil T/C	11.3 ab
9	Spring check	13.3 a
9	T/C	10.0 ab
Ave 1 & 9	Dividend T/C	10.1
Ave 1 & 9	Fall check	6.3
Ave 1 & 9	Raxil T/C	9.3
Ave 1 & 9	Spring check	12.7
Ave 1 & 9	T/C	10.5
Ave 1 & 9	Average seed treatments	9.9
Ave lot 1	All treatments	9.1
Ave lot 9	All treatments	10.4

Means followed by the same letter are not significantly different

Lot. 1, 'Shawnee' switchgrass, germination and dormancy 73% and 4%, respectively.

Lot. 9, 'Cave-in-Rock' switchgrass, germination and dormancy 54% and 18%, respectively.

¹T/C=Thiram/Captan

Table 5. Seed Treatment Results 2009

Treatment	Ave. Seedlings/ft ²
Fall control	2.3 c
Fall control sf ¹	3.3 c
Fall Dividend T/C ²	4.7 bc
Fall Raxil T/C	3.1 c
Fall T/C	5.3 b
Spring 5/28/10	15.3 a
Average seed treatments	4.4

¹ sf = surface sown

² T/C = Thiram/Captan

Means followed by the same letter are not significantly different

Fig. 3. 2007 Dormant Switchgrass Seeding Seed Treatment Comparisons

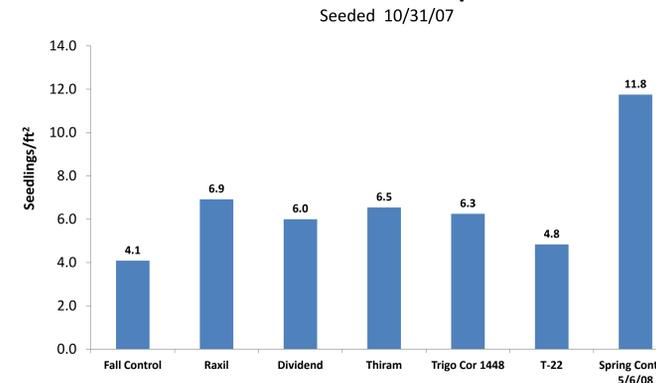


Fig. 4. 2008 Dormant Switchgrass Seeding Seed Treatment Comparisons

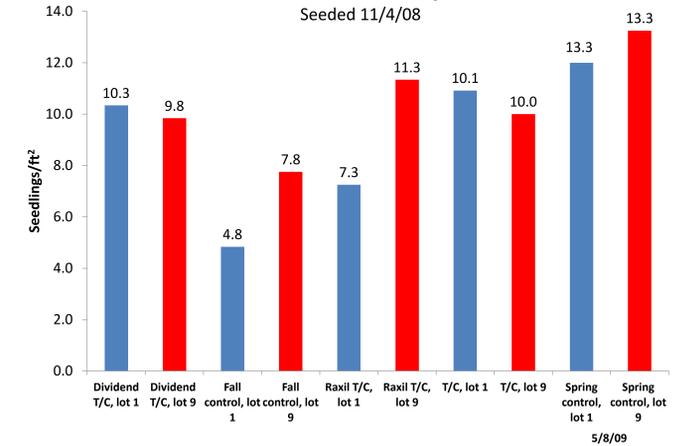


Fig. 5. 2009 Dormant Switchgrass Seeding Seed Treatment Comparisons

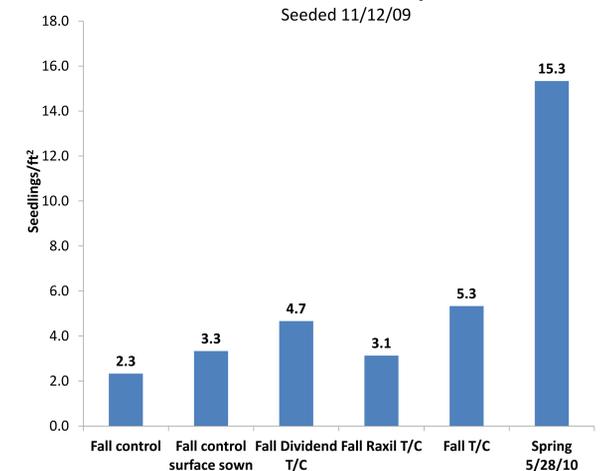


Fig. 6. Photo 6/23/11 seeded 11/12/09. On left foreground, dormant control 2.3 seedlings/ft², on right Dividend Extreme plus T/C 7.25 seedlings/ft².