Use of Biosol Forte as a Seed Coating to Improve Stand Establishment of Native Bunchgrass Species

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INTRODUCTION

The microsite in which a seed is sown exhibits a strong control on the seeds potential to produce an established plant (Boyd and Davies 2012). Soil fertility is one microsite characteristic that can influence recruitment processes. Seedlings growing in microsites with higher fertility have earlier emergence and faster growth rates, which allows the plants to preempt resources, achieve greater initial size, outcompete other seedlings in less favorable sites, and persist through periods of high environmental stress.

Generally speaking, in nutrient limited environments, appropriate applications of fertilizers can be used to improve soil fertility. However, the use of fertilizers is typically not recommended for rangeland restoration projects. This is because traditional fertilizer applications are often economically infeasible and can inadvertently promote colonization of weeds that outcompete seeded species.

Seed coating is a mechanism of applying needed materials in a way that they affect the seed or soil at the seed-soil interface. It may be possible to use this technology to load efficient quantities of fertilizer onto seed, to enhance microsite fertility and subsequent establishment of seeded species.

Biosol Forte® (Rocky Mountain Bio Products, Denver, CO) is an organic fertilizer whose compositional properties make it an ideal candidate for evaluation within a seed coating treatment. The fertilizer is the by-product of penicillin fermentation and exhibits slow release properties due to dissolved nutrients being contained within fungal and bacterial biomass. Slow-release properties and low salt content associated with Biosol Forte allows for relatively high amounts of fertilizer to be coated onto the seed with less chance of fertilizer burn. Biosol Forte supplies a blend of both macro and micro-nutrients and has been shown to provide disease resistance within plants.

Objective

Evaluate the efficacy of Biosol Forte fertilizer for use as a seed coating treatment to improve seedling emergence and plant establishment of bluebunch wheatgrass (*Pseudoroegneria spicata* (Pursh) Á. Löve) and basin wildrye (*Leymus cinereus* (Scribn. & Merr.) Á. Löve).

BIOSOL FORTE

Nutrient Content

N-P-K = 7-2-1

Organic Substance	>70%
Carbon/Nitrogen ratio	6:1
Nitrogen (total)	>7%
Nitrogen (water soluble)	<0.5%
Phosphorus	1-2%
Potash	1%
Ph	7.1

REFERENCE: Boyd, C. S., and K. W. Davies. 2012. Spatial variability in cost and success of revegetation in a Wyoming big sagebrush community. Environmental management 50: 441-450.

METHODS

Study Site

» Wyoming big sagebrush steppe community located at the USDA-ARS, Northern Great Basin Experimental Range. Soil texture = silt loam. Annual precipitation = 300 mm.

Study Design

» Randomized block design (eight blocks), with three seed treatments (Biosol Forte +diatomaceous earth, diatomaceous earth (check), and uncoated seed (ctrl).
» Study was installed Dec. 2011 and monitored through Aug. 2012.
» Plot size = 1m^2
» Seeding rate = 500 pure live seeds m^{-2}

Seed Coating

Seed coating was performed at the Burns OR, ARS seed coating laboratory using a RP14DB rotary coater (BraceWorks Automation and Electric, Lloydminster, SK, CAD). Selvol-205® binder (Sekisui Specialty Chemicals America, Dallas TX, USA), prepared with an 8% solid content, was used to attach the dry material to the seeds. To improve seed coating quality Biosol Forte was finally ground (bulk < 75 microns) and mixed with diatomaceous earth at ratio of 60% Biosol to 40% diatomaceous earth. This mixture was added at 200% weight of product to weight of seed (w/w). Coatings with only diatomaceous earth were applied at the same weight as applied to the Biosol®+diatomaceous earth coating.

Analysis

» Mixed model analysis, with mean values separated using the LSMEANS procedure in SAS (P< 0.10).

RESULTS

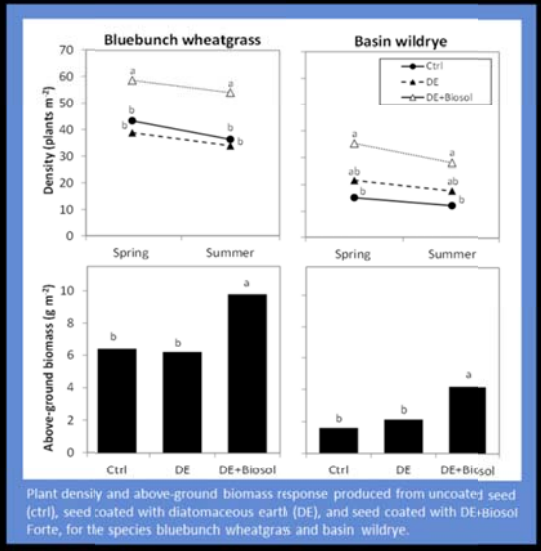
Weather

» Over the period of the study, precipitation was 58% of normal

	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
Temperature (°C)									Mean
20 year average	2.5	-2.1	-0.4	3.3	6.1	10.5	14.8	20.0	6.2
study period	2.9	-1.9	-1.2	2.8	6.2	9.8	13.0	21.4	5.9
Precipitation (mm)									Total
20 year average	41.1	29.7	23.4	30.0	25.7	35.6	21.3	12.2	218.9
study period	1.4	25.9	5.1	27.9	24.9	8.9	20.1	8.4	127.5

Vegetation

» Biosol coated seed increased the number of established bluebunch wheatgrass plants by 49% and above-ground biomass by 53%
» Plant density and above-ground biomass of basin wildrye was 131% and 159% higher in the Biosol coating treatment.



Plant density and above-ground biomass response produced from uncoated seed (ctrl), seed coated with diatomaceous earth (DE), and seed coated with DE+Biosol Forte, for the species bluebunch wheatgrass and basin wildrye.

CONCLUSIONS

» Seed coating of Biosol Forte improved plant establishment and biomass production of native bunchgrass species, within a drought year. These results provide evidence that this seed coating technology may provide land managers with a cost-efficient strategy for improving rangelands revegetation success.
» Based off of previous studies, the mechanisms responsible for enhanced establishment success may be due to Biosol Forte improving disease resistance and seedling vigor during the establishment phase.
» Additional research is merited for determining long-term effects of Biosol Forte seed coating, on different ecological sites and planting years.