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PLANT MATERIALS TECHNICAL NOTE

Effects of Erosion Control Blanket on Germination and Germinant Survival of Six Native Species and Potential Management Implications

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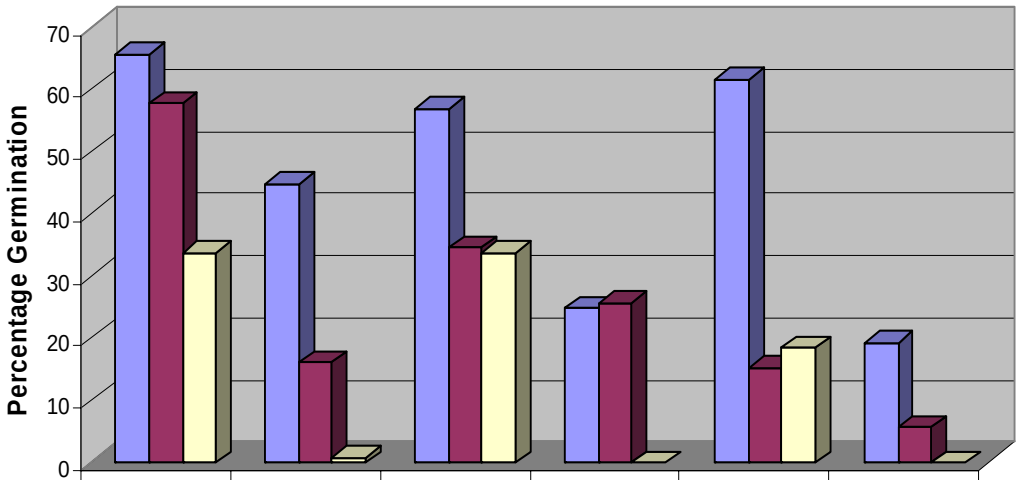
Introduction: Erosion control blankets or agronomy cloths are invaluable tools for reducing soil erosion while providing favorable conditions for seed germination. These products are used on critical areas to stabilize disturbed sites and assist plant establishment. They are constructed of numerous materials and configured in various designs that effect their function and performance. This Technical Note presents research results from the Bridger Plant Materials Center (BPMC) on the effects of one commonly used product on seed germination and germinant survival.

I. METHODS AND MATERIALS: Research was conducted at the BPMC, in cooperation with the National Park Service, to determine the effects of a popular erosion control blanket on six native species used for restoration in Glacier National Park. The experiment consisted of three treatments: No Blanket (full irradiance), Blanket (partial irradiance), and No Light (complete light exclusion). The erosion control blanket was constructed of straw coconut fiber embedded in natural fiber netting. Six species were compared: alpine pussytoes Antennaria alpina, Hayden's sedge Carex haydeniana, Payson's sedge Carex paysonis, dunhead sedge Carex phaeocephala, arrowleaf groundsel Senecio triangularis, and creeping sibbaldia Sibbaldia procumbens. Five replicates of 25 seeds/replicate were established for each species x treatment resulting in 125 seeds/species/treatment. Ninety lots (6 species x 3 treatments x 5 reps) of 25 stratified seeds were placed on double germination pads in petri dishes in an environmental growth chamber maintained at 30°C (86°F) days for 8-hour photoperiods and 20°C (68°F) nights for 16-hour photoperiods. The No Blanket treatments were placed under fluorescent lighting (General Electric® F20T12-CW, 20-watt, Cool White bulbs; mean 25.6 umol, range 13.6 to 48.1 umol under Petri dish cover). The Blanket treatments were covered with erosion control blanket and placed under the fluorescent lights (4.6 umol; range 1.9 to 7.3 umol under Petri dish cover). The No Light treatments were placed inside in an opaque box, which in turn was placed under the fluorescent lights. Daytime temperatures inside the petri dishes at the surface of moistened germination pads averaged 30.5°C (86.9°F) for the No Blanket treatment, 31.2°C (88.2°F) for the Blanket treatment, and 29°C (84°F) inside the opaque box. Germination and biotic contamination data was collected on approximately 14-day intervals. Contamination data included seeds that germinated but then died from what appeared to be fungal infection. After 66 days, the erosion control blanket was removed from the Blanket treatments and the No Light treatments were removed from the box. At this time, both treatments were placed under full irradiance in the growth chamber. Data was collected for an additional 77 days, although no seeds of the No Blanket and Blanket irradiance treatments germinated after 48 days. Statistical verification of results by Chi-Square test or Fisher's Exact test ($p<0.01$).

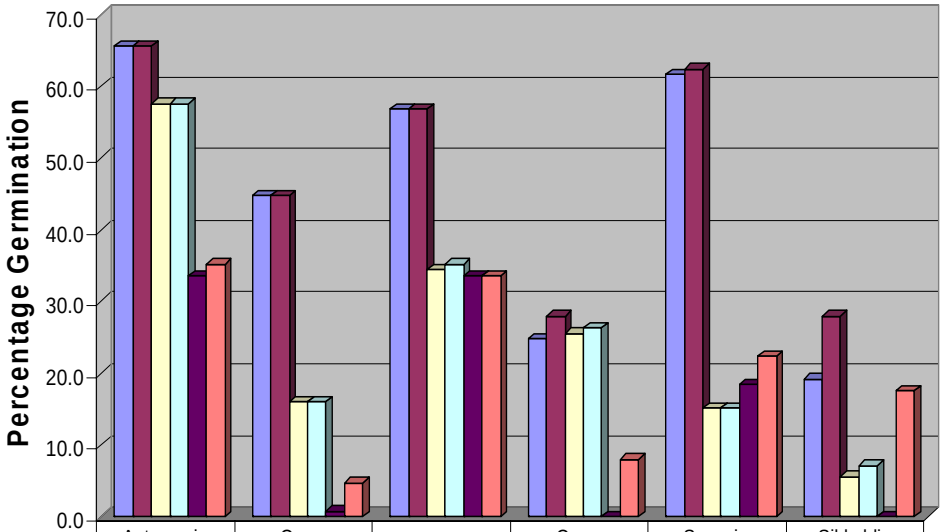
II. RESULTS: The results of this experiment are abbreviated and generalized in this document to conserve space. For design and result detail, reference *Alpine Light Study* in Bridger Plant Materials Center 1996-2003 Technical Report, Volume 2 – Woody Plant, Propagation, and Germination Research. Mean percentage germination by treatment appears in Chart 1. Mean percentage germination before and after exposure to a secondary full irradiance treatment appears in Chart 2. Percentage germinant mortality resulting from contamination prior to secondary full irradiance appears in Chart 3. Percentage germination by treatment adjusted for germinant mortality prior to secondary full irradiance appears in Chart 4.

Chart 1. Mean percentage germination by treatment.



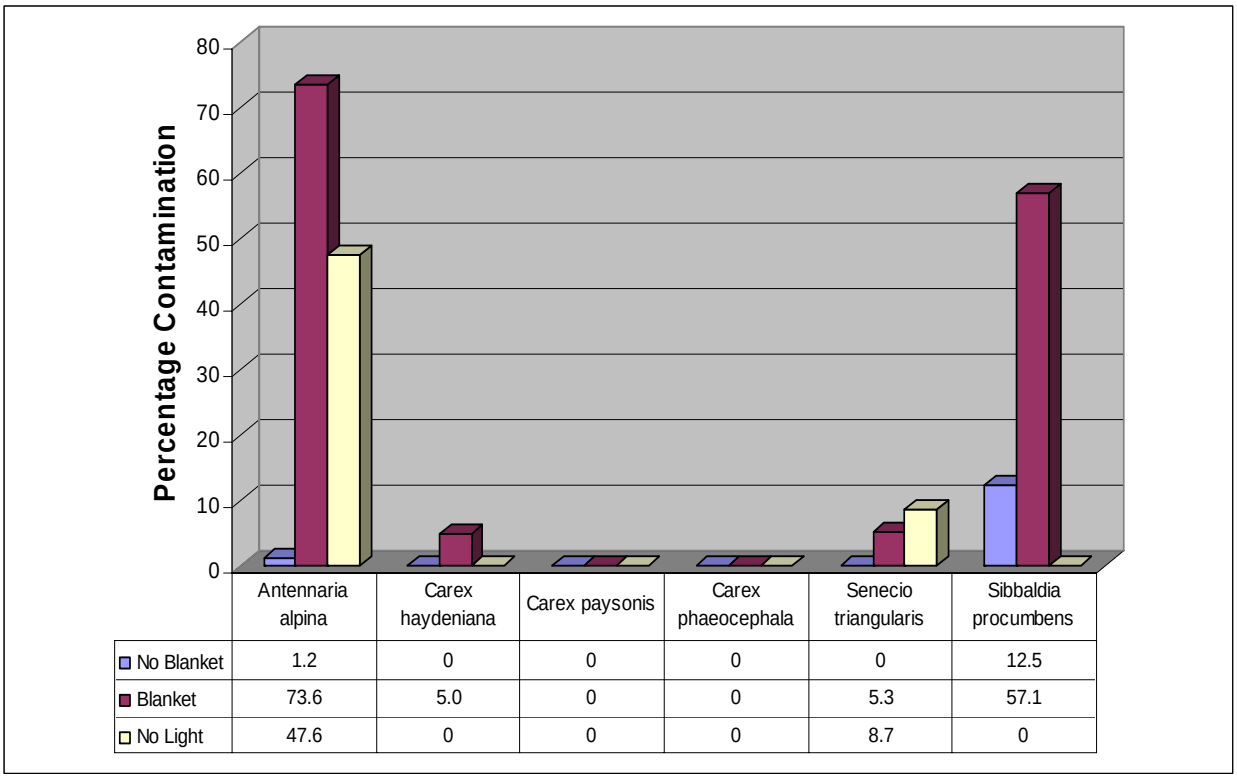
	Antennaria alpina	Carex haydeniana	Carex paysonis	Carex phaeocephala	Senecio triangularis	Sibbaldia procumbens
No Blanket	65.6	44.8	56.8	24.8	61.6	19.2
Blanket	57.6	16.0	34.4	25.6	15.2	5.6
No Light	33.6	0.8	33.6	0.0	18.4	0.0

Chart 2. Mean percentage germination before vs. after secondary full irradiance treatment.



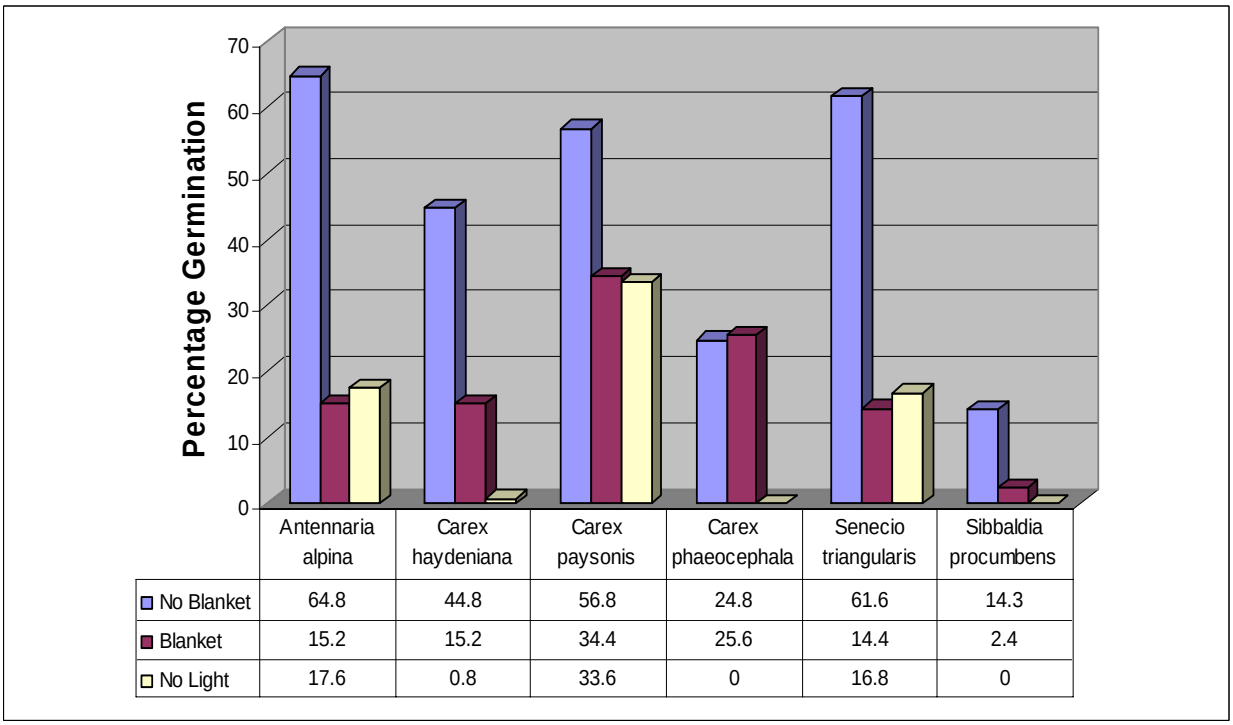
	Antennaria alpina	Carex haydeniana	Carex paysonis	Carex phaeocephala	Senecio triangularis	Sibbaldia procumbens
No Blanket	65.6	44.8	56.8	24.8	61.6	19.2
No Blanket + Secondary Irradiance	65.6	44.8	56.8	28.0	62.4	28.0
Blanket	57.6	16.0	34.4	25.6	15.2	5.6
Blanket + Secondary Irradiance	57.6	16.0	35.2	26.4	15.2	7.2
No Light	33.6	0.8	33.6	0.0	18.4	0.0
No Light + Secondary Irradiance	35.2	4.8	33.6	8.0	22.4	17.6

Chart 3. Percentage germinant mortality resulting from contamination prior to secondary full irradiance.



	Antennaria alpina	Carex haydeniana	Carex paysonis	Carex phaeocephala	Senecio triangularis	Sibbaldia procumbens
No Blanket	1.2	0	0	0	0	12.5
Blanket	73.6	5.0	0	0	5.3	57.1
No Light	47.6	0	0	0	8.7	0

Chart 4. Percentage germination adjusted for germinant mortality prior to secondary full irradiance.



	Antennaria alpina	Carex haydeniana	Carex paysonis	Carex phaeocephala	Senecio triangularis	Sibbaldia procumbens
No Blanket	64.8	44.8	56.8	24.8	61.6	14.3
Blanket	15.2	15.2	34.4	25.6	14.4	2.4
No Light	17.6	0.8	33.6	0	16.8	0

II. RESULTS (continued):

1) In most cases, the use of erosion control blanket (Blanket) resulted in statistically less germination than when no erosion control blanket (No Blanket) was used.

2) In all cases, No Light treatments (complete light exclusion) resulted in statistically less percentage germination than the No Blanket treatments, and in most cases, less percentage germination than the Blanket treatments.

3) Although species dependent, the exposure of the three treatments to a secondary full irradiance treatment frequently resulted in additional germination. This appears to be both irradiance duration and intensity related.

4) There was greater percentage contamination of germinated seeds of some species with the Blanket and No Light treatments than the No Blanket treatment.

III. CONCLUSIONS/DISCUSSION: Erosion control blanket reduced percentage germination and increased germinant mortality of some test species. For short-lived seeds, this may result in poor stand establishment and/or possible weed invasion. For long-lived or dormant seeds, deterioration of the erosion control blanket over time may merely delay germination, although the likelihood of weed invasion remains high. The results indicate that reduced germination of some species can be offset by a subsequent high irradiance treatment. This suggests that removing erosion control blanket at the proper time, if practical, may result in additional germination of some species. The optimum timing of increased irradiance was not determined and will probably be species and environment specific. The increase in germinant contamination and mortality of some species in the Blanket and No Light treatments may reflect high relative humidity inside the Petri dishes that are unlikely in a field situation. Surface sterilization and/or seed treatment with fungicides prior to sowing should prevent this potential problem in the field. It is important to note that these studies were conducted under laboratory conditions, and in-situ field testing is needed to determine whether any type of erosion control blanket results in a net loss or gain in germination. **Increased soil and seed moisture content and retention, reduced soil erosion, decreased seed predation, and other factors may offset reductions in germination and early seedling survival resulting from the use of erosion control blanket. In addition, it is likely that variation in the construction and performance of the various types of erosion control blanket will produce variable results.** When using any erosion control blanket, consider these management techniques to improve stand establishment:

1) Determine the light requirements of each species when developing species mixes.

2) Use high quality seeds (certified if possible) with a current germination test.

3) Monitor stand establishment to determine seedling emergence and survival by species.

4) Increase seeding rates prior to blanket installation to compensate for potential reductions in germination and survival or follow-up poor germination and establishment with a secondary seeding.

5) Surface-sterilize and/or treat seeds prior to sowing with a broad spectrum fungicide.

6) Use erosion control blanket that provides adequate erosion protection and optimum light transmission.