

# VA MYCORRHIZAL STATUS OF BURNED AND UNBURNED SAGEBRUSH HABITAT

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Sagebrush is considered to be an obligate vesicular-arbuscular mycorrhizal plant. Some studies have shown that burning lowers the mycorrhizal inoculum potential (MIP) of the soil (Klopatek and others 1988, 1990; Wicklow-Howard 1989). If this happens, then sagebrush may take longer to reestablish after fire.

A study was performed to investigate the relationship of vesicular-arbuscular mycorrhizae (VAM), Wyoming big sagebrush (*Artemisia tridentata* Nutt. var. *wyomingensis* [Beetle and Young]) and burned vs. unburned soils. The purpose of the study was to:

1. Investigate whether planting mycorrhizal inoculated sagebrush seedlings in burned soils would enhance reestablishment.
2. Monitor the mycorrhizal inoculum potential (MIP) of soils before and after a fire.
3. Compare mycorrhizal root colonization in wild sagebrush found growing in burned soil with that of wild sagebrush growing in unburned soil.

## STUDY SITE

The study site is a 300- by 400-meter section of the Orchard Range Plant Test Site located about 20 miles east of Boise, ID.

The two soil types studied are Tindahay fine sandy loam and Power-Chardoton silt loams. The area is sagebrush dominated with islands of cheatgrass-dominated habitat.

In September 1989, one half of the site was burned, including both sagebrush- and cheatgrass-dominated areas.

## SAGEBRUSH SEEDLINGS

Sagebrush seeds were harvested at the site, grown at the Intermountain Research Station Shrub Sciences Laboratory in Provo, UT, and then planted at the site in May 1990.

Treatment areas consisted of: (a) burned sagebrush, (b) burned cheatgrass, and (c) unburned cheatgrass.

Three randomly selected replicate plots per treatment were planted with mycorrhizal inoculated (M+) seedlings and noninoculated (control) seedlings. VAM inoculant (species *Glomus intraradices*) was purchased from NPI of Salt Lake City, UT.

Roots were harvested in October 1990 and in June 1991, preserved in a solution of formalin, acetic acid, and alcohol (FAA), and later assessed for VAM colonization using the Magnified Intersections Method of McGonigle and others (1990). Arbuscular, vesicular, and hyphal intersections were counted and calculated on a per total root intersections per sample basis. Survivorship and height were assessed.

## MIP IN SOILS

Tindahay and Power-Chardoton soils were randomly sampled in June 1989, before burning, and again in June 1990 and June 1991, after the burn.

A bioassay was run on the soils using sudangrass. Roots were harvested after 6 weeks, preserved in FAA and stained according to the procedure of Philips and Hayman (1970). MIP was calculated by counting the number of VAM-colonized root segments per 100 per sample.

## VAM IN WILD SAGEBRUSH

In June 1991 (1 year and 8 months after burning) wild sagebrush roots were randomly sampled in the burned sagebrush site and in the unburned sagebrush site.

Roots were preserved in FAA, later stained with lactoglycerin trypan blue, mounted on microscope slides, and checked for VAM colonization using the Magnified Intersections Method.

## SEEDLING RESULTS

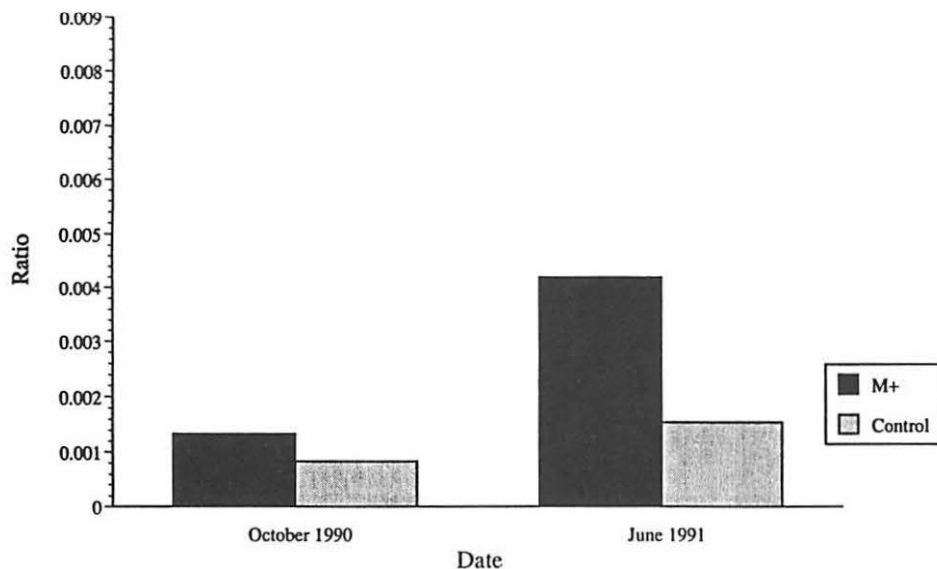
**Burned Cheatgrass**—Seedlings in this treatment did not survive past the first growing season.

**Unburned Cheatgrass**—Arbuscular colonization was not significantly different between M+ and the control (fig. 1). The dates were also not significant. Hyphal colonization (fig. 2) remained significantly greater between M+ and the control through June 1991. There was no difference in survivorship between inoculated and non-inoculated seedlings.

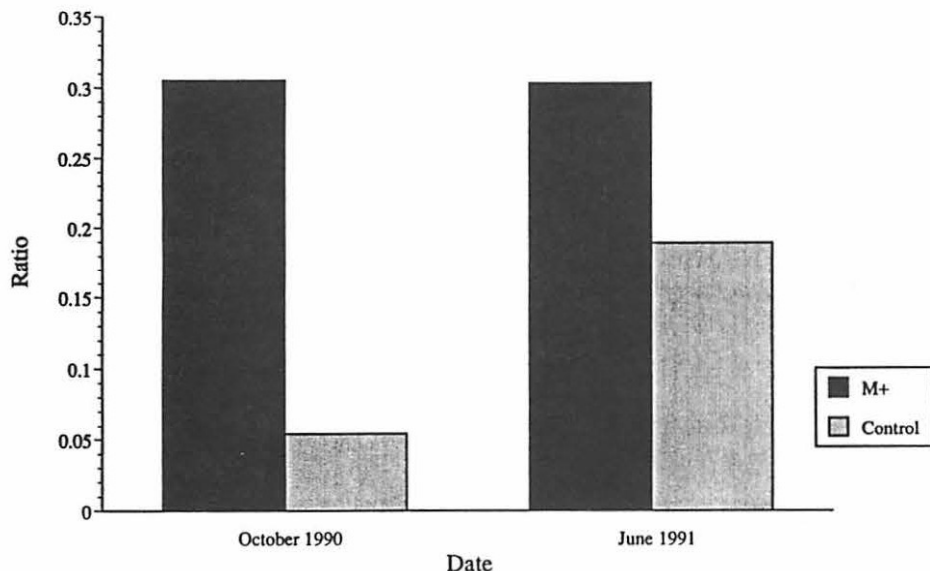
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**Figure 1**—Arbuscular colonization of sagebrush seedling roots (M+ and the control) in the unburned cheatgrass treatment. Roots were sampled in October 1990 after the first growing season and in June 1991, 1 year after planting. Ratio given is the number of root intersections containing arbuscules per total root intersections per sample. Values are means of samples from each date. There was no significance.



**Figure 2**—Hyphal colonization of sagebrush seedling roots (M+ and the control) planted in May 1990 in the unburned cheatgrass treatment and harvested October 1990 and June 1991. Ratio is the number of root intersections containing hyphae per total root intersections per sample. Values are means of the samples from each date. M+ remained significantly greater than the control.

**Burned Sagebrush**—Arbuscular colonization was not significant (fig. 3). Hyphal colonization (fig. 4) was significantly greater in M+ than in the control for October 1990 but not by June 1991, 1 year after planting. Survival and growth of seedlings were the same among inoculated and noninoculated seedlings.

More seedlings (both M+ and the control) survived and height measurements were greater in the burned sage site than in the burned or unburned cheatgrass sites.

## MIP RESULTS

MIP (fig. 5) increased the first year after the fire in the Tindahay soil, then decreased the second year after the

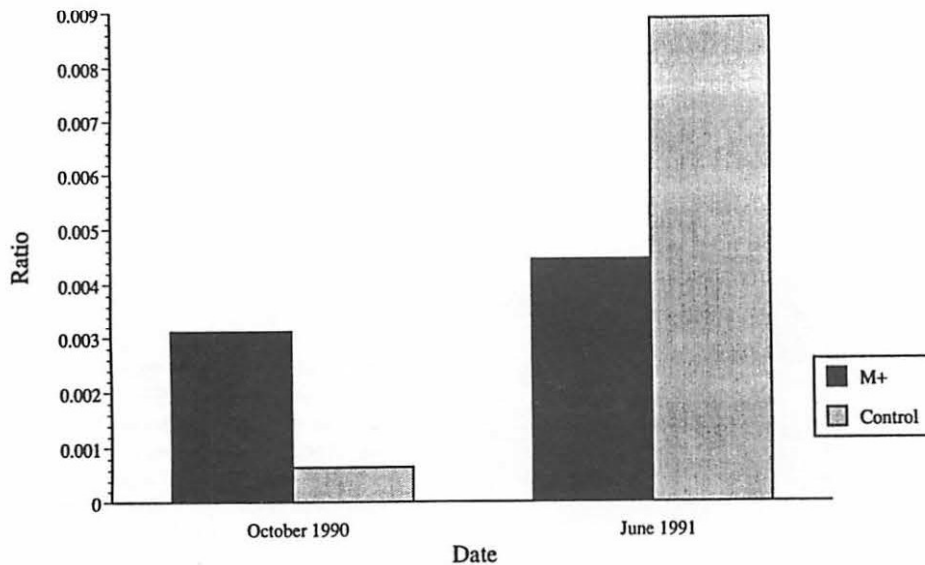
fire. In the Power-Chardoton soil MIP decreased each year after the fire. The decrease in MIP was not statistically significant, however.

## WILD SAGEBRUSH ROOTS

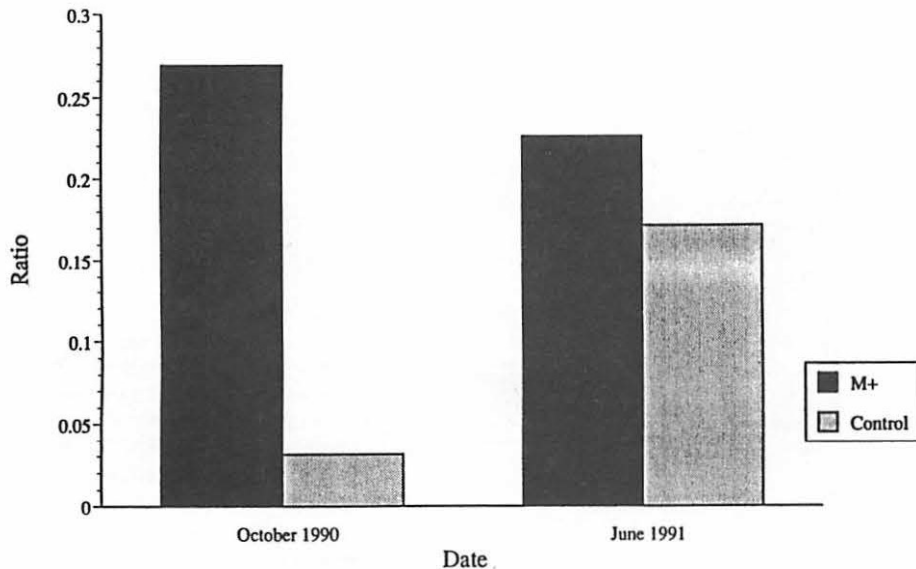
Wild sagebrush roots (fig. 6) from the burned site had significantly less arbuscular and vesicular colonization than wild sagebrush roots from the unburned site.

## CONCLUSIONS

VAM-inoculated seedlings did not exhibit increased arbuscular or vesicular colonization, but they did have



**Figure 3**—Arbuscular colonization of sagebrush seedling roots (M+ and the control) in the burned sagebrush treatment site. Ratio is the number of root intersections containing arbuscules per total root intersections per sample. Values given are the means of samples from each date.



**Figure 4**—Hyphal colonization of sagebrush seedling roots (M+ and the control) harvested from the burned sagebrush area after the first growing season (October 1990) and 1 year after planting (June 1991). Ratio is the number of root intersections containing hyphae per total root intersections per sample. Values given are means of samples from each date. Mean values were significantly different for October 1990.

an increase in hyphal colonization. This may not be due to VAM colonization. It could be hyphal colonization from other fungal species.

Seedlings in the burned cheatgrass and unburned cheatgrass sites did not survive, or they did not survive as well, as those in the burned sagebrush site.

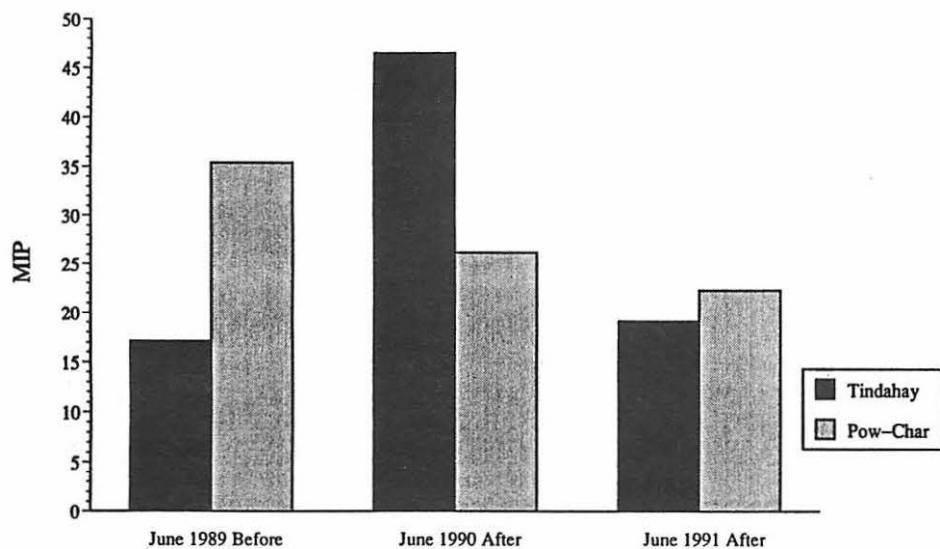
Although MIP of the two soil types was not significantly lower after burning, the VAM infection level of sagebrush seedlings was low. VAM infection level of wild sagebrush coming up in the burned site was significantly lower than in the unburned site.

Additional research is needed to assess the effects of commercial VAM inoculant. Another inoculant species

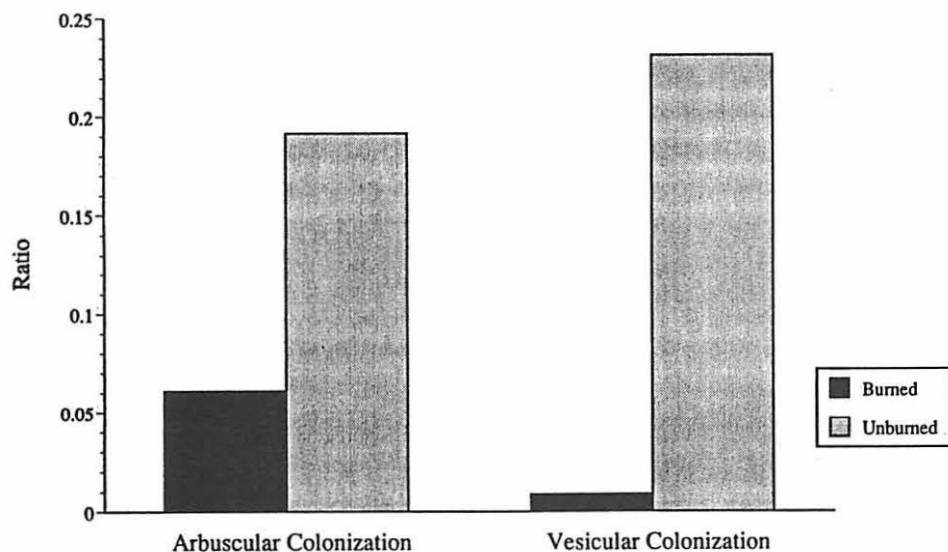
may work better. Attention should be paid to various planting techniques. Perhaps a study of seeds vs. seedlings should be done incorporating tilled vs. nontilled soil.

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**Figure 5**—Mycorrhizal inoculum potential of two soils following fire. Pow-Char = Power-Chardoton soil. MIP is the percent root segments colonized by VAM per 100 root segments per sample. Value given is the mean of soil sample types at each date. The June 1989 sample was before burning and June 1990 and 1991 sample dates were after burning.



**Figure 6**—Arbuscular and hyphal colonization of wild sagebrush roots sampled in the burned site and the unburned site. Ratio is the number of root intersections containing arbuscules or hyphae per total root intersections per plant sample. The value given is the mean of the samples per date and site type.

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