INFLUENCE OF SEEDBED TYPE ON WATER STRESS IN WHITE SPRUCE (*PICEA GLAUCA* (MOENCH) VOSS) SEEDLINGS

PROJECT MS-252

by

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INTRODUCTION

It has become well documented in the literature that in order to establish seedlings in the Riding Mountain National Park and other similar areas in the Boreal Forest Region, site preparation is needed prior to planting. Reasons for this operation include reduction of overhead shading of seedlings by competing vegetation and preparation of a suitable seedbed. Little information is available regarding the effects of different methods of site preparation on plant water relationships. Therefore in the summer of 1968 a project was initiated to examine the relationships between seedbed type and water available to the seedling.

PREPARATION OF THE STUDY AREA

The experiment is being conducted in the Riding Mountain Forest Experimental Area, approximately 180 miles northwest of Winnipeg. The particular site chosen, Twp. 20, Rge. 18, Sec. 19, W.P.M., was clear cut in 1954, after which a young trembling aspen stand (Populus tremuloides) developed (Figure 1).

On May 9, 1968 preparation of the seedbeds began. Twelve, two mil-acre plots were prepared on a wet site (moisture regime 5) and twelve on a dry site (moisture regime 3). These included four seedbed types: mineral soil, cultivated mineral soil, burned seedbed and undisturbed seedbed (control). Each treatment was replicated three times (Figure 2 and 3) on each of the two moisture regimes.

A D-4 traxcavator with a cable operated bucket was used to scrape away the duff exposing the mineral soil. Spades were used to cultivate the mineral soil to a depth of eight inches. Because of strict burning regulations imposed in the Riding Mountain National Park, it was not possible to do any burning in the study area. Instead all loose litter and grass were raked off and a two-inch layer of charcoal laid down to simulate a burned seedbed. Unprepared seedbeds were included as controls.

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Any trees outside the plots that caused shading were removed. To prevent browsing and other damage from wild animals, a seven-foot fence was constructed around both sites.

On May 23 and 24 a total of 240 trees were planted in prepared holes (20 per seedbed) on the dry site. The trees were 10 years old and were obtained from the nursery in Riding Mountain National Park. Planting on the wet site was delayed for one week because of rain but all planting was completed on May 31.

After planting each tree was numbered with a metal tag attached to the stem. Trees numbered 1 to 240 are located on the wet site and trees numbered 241 to 480 are located on the dry site. Each tree height was recorded at the time of planting.

On June 17, 1968 a Casella siphon rain recorder and a hygrothermograph were set up in the experimental area. Percent moisture on the seedbeds was determined by the gravimetric method and water stress in the seedlings was determined by the Schardakow dye method. Each determination was an average of three samples.

A number of maximum and minimum thermometers were placed just under the surface of the soil to determine soil temperatures (Table 2).

RESULTS

Water stress comparisons were made of the different seedbed types and moisture regimes. Due to the unusual wetness of the summer, the seedlings experienced little water stress. The maximum water stress experienced was five atmospheres.

In the fall of 1968 all transplants were examined and their height and condition noted (Table 1). Very little growth had occurred over the summer, presumably because of physical damage to root systems caused by transplanting.

A high rate of mortality occurred on the wet site. This again may be attributable to an abnormally wet year. At times many of the trees were standing in water. No mortality occurred on the dry site.

FUTURE WORK

Height, survival and water stress data will again be collected in 1969 and in succeeding years. No extension of the experiment is envisaged.

TABLE 1

SURVIVAL OF WHITE SPRUCE TRANSPLANTS

Treatment	M.R.	Spring 1968 No. planted	Average Height in ft.	Fall 1968 Percent Survival	Average Height in ft.
Burned	3	60	1.8	100.0	1.9
Control	3	60	1.8	100.0	1.9
Cultivated M.S.	3	60	2.1	100.0	2.2
Mineral soil	3	60	2.0	100.0	2.1
Burned	5	60	2.2	76.7	2.3
Control	5	60	2.1	53.3	2.2
Cultivated M.S.	5	60	2.1	91.7	2.2
Mineral soil	5	60	2.1	93.3	2.2

All dead trees were replaced in the fall of 1968.

TABLE 2

AVERAGE MAXIMUM AND MINIMUM TEMPERATURES

Treatment	M.R.	Average Max. Temp. (F°)	Average Min. Temp. (F°)
Burned	3	87.3	45.5
Control	3	77.2	44.5
Cultivated M.S.	3	83.1	46.8
Mineral Soil	3	85.6	49.2
Burned	5	83.7	43.6
Control	5	79.0	41.8
Cultivated M.S.	5	85.3	45.5
Mineral Soil	5	84.4	46.8

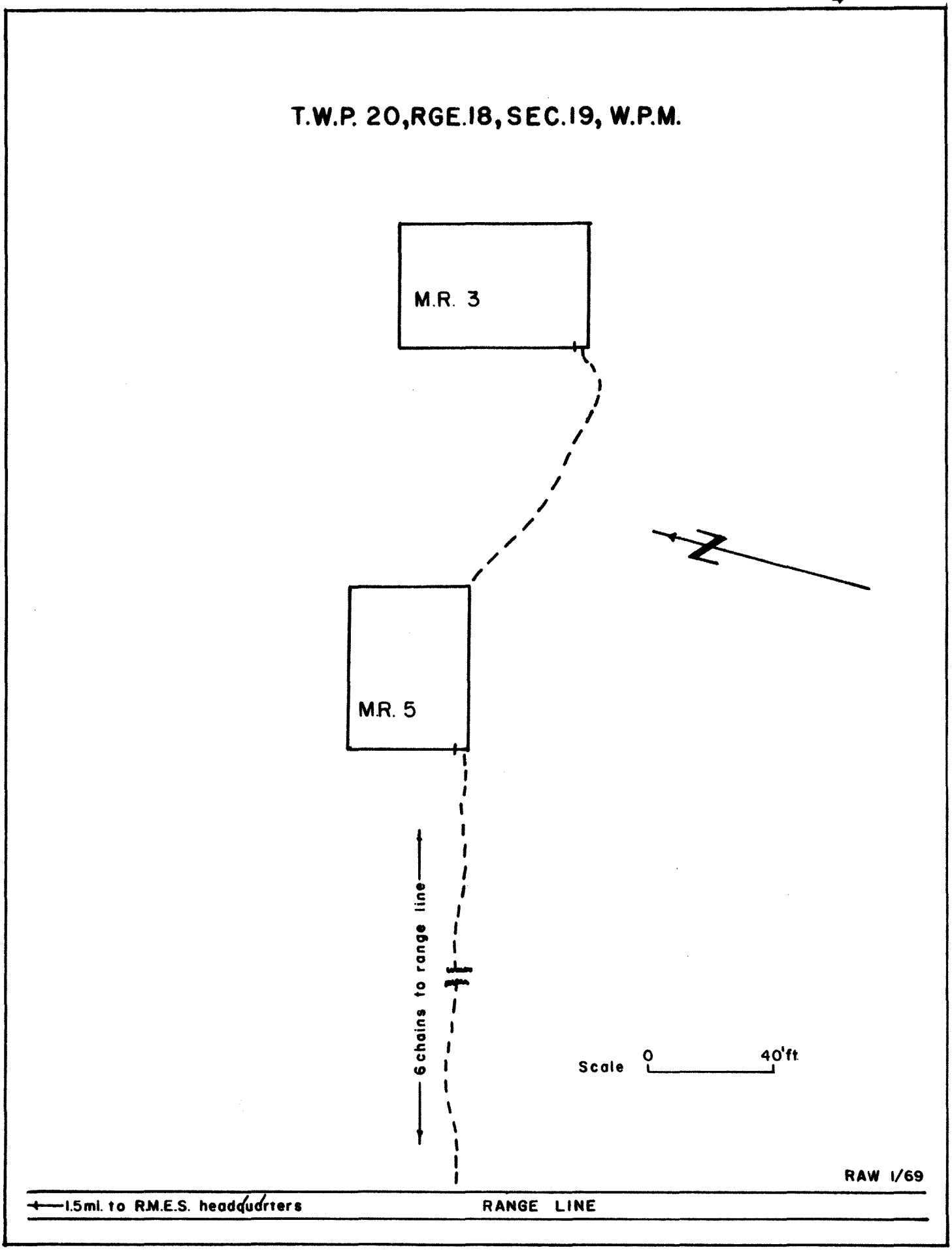

Fig. 1 Location of study area M.S. 252

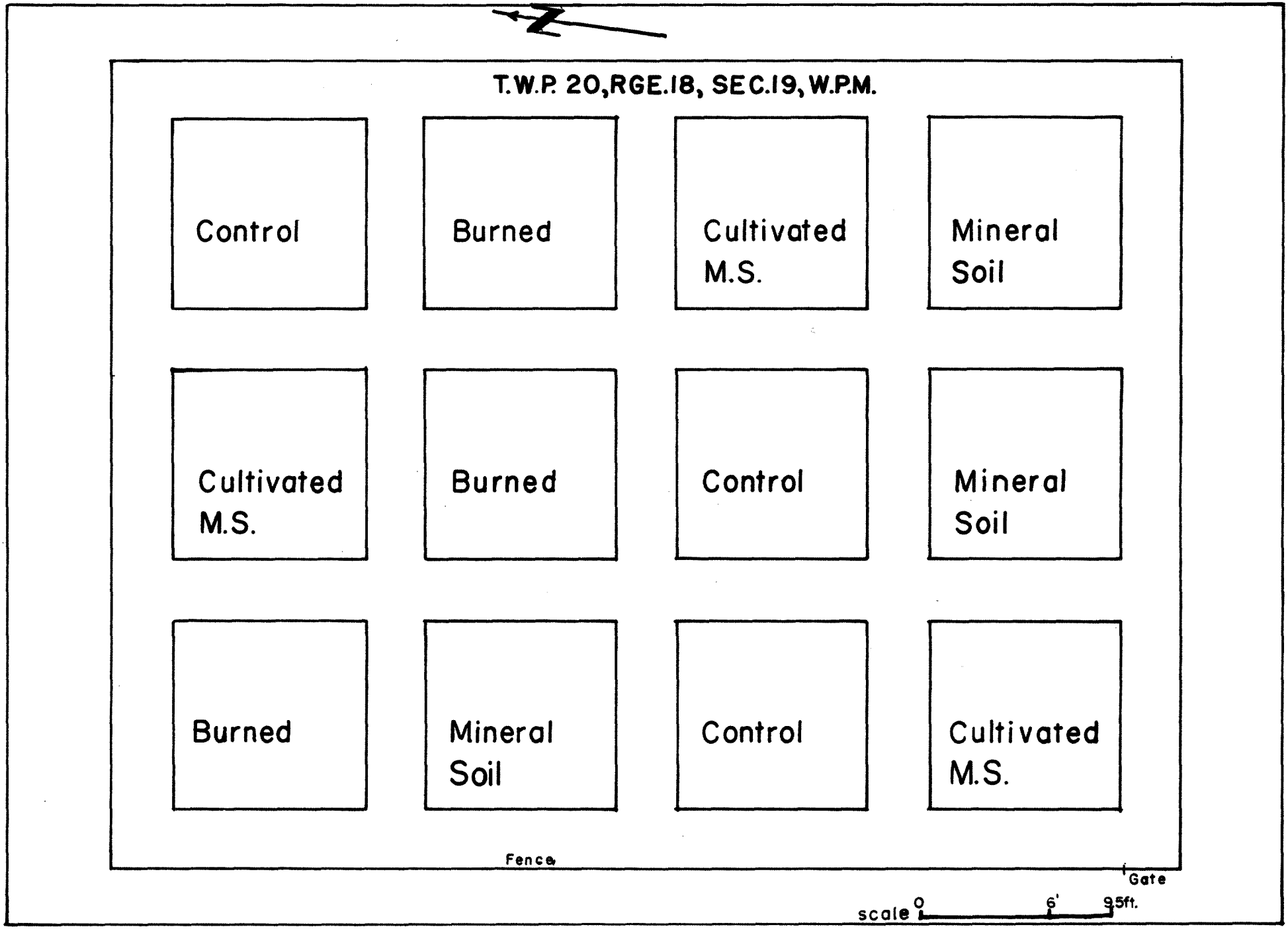

Fig. 2 M.S. 252 Distribution of seedbeds on M.R. 3 site RAW 12/68

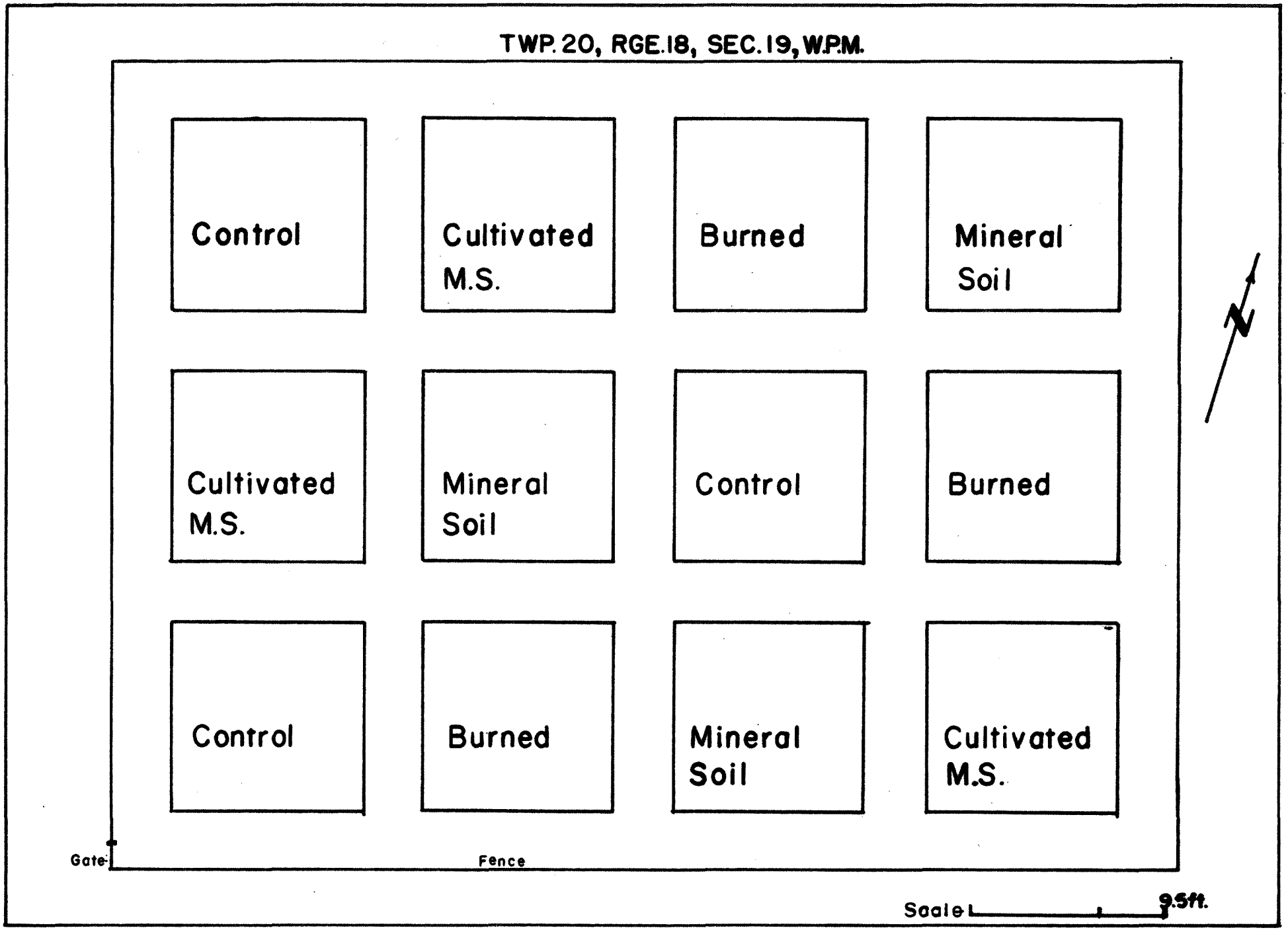

Fig. 3 M.S. 252 Distribution of seedbeds on M.R. 5 site RAW 12/68