

Re: Murray

Division of Forest Pathology

P. O. Box 4006
Tucson, Arizona
10 December, 1951

Mr. M. R. Tillotson
Regional Director, N.P.S.
Box 1728
Santa Fe, New Mexico

Dear Mr. Tillotson:

A recent letter from Dr. Lake S. Gill, of our Division office at Albuquerque, New Mexico, stated that an inquiry had been made of him by Mr. S. T. Carlson, Regional Forester, N.P.S., concerning plans for our saguaro mortality studies, and research into planting practices for Saguaro National Monument. Dr. Gill advised that I contact you about these matters.

Present plans regarding the saguaro mortality study are to continue the annual observations within the test plots at the Monument, as has been done by the Albuquerque office during the past ten years under direction of Dr. Gill. In addition, a census and observations of individual lesions occurring naturally will be initiated to obtain information that may be compared with data obtained from similar studies made outside of the Monument, of lesions produced by inoculations with cultures of suspected pathogens.

Plans for planting saguaros that have been grown from seed in a nursery to replace those lost from disease, windthrow and other factors have been tentatively outlined after due consideration of the conditions and facilities essential for the success of such a program. This program is considered highly desirable because the natural reproduction that is now occurring on the test plots, and in the areas that have the greatest scenic attraction in the Monument, is considerably less than is necessary to replace the losses sustained among the larger saguaros. A brief report of the plans is enclosed for your information and approval, if you so concur. The report is based upon field observations and my experience in growing saguaros from seeds on a small scale, for research purposes, and at best must be considered an estimate of the needs and results.

In accordance with the wishes of the National Park Service, and perhaps to gain information that may be pertinent in mortality studies or other related investigations, our Division has begun annual measurements of

2-Mr. M. R. Tillotson-12-10-51

the growth of ten per cent of the plants (all height classes included) in our six ten acre test plots in Saguaro National Monument. Through the use of an accurate measuring device, designed by us specifically for this purpose, we believe that the measurements obtained from this year forward should provide a reasonably accurate indication of the growth rate of saguaro subject to similar conditions.

I shall welcome any criticism or suggestions from you or your staff concerning our projected studies or plans.

Very truly yours,

William C. Bryan
Asst. Pathologist

cc: Fowler
Gill
King

Enclosures

Data for Saguaro Nursery and Planting of Seedlings

1. Cheapest way to start and establish plants from seed:

A shelter should be constructed, probably similar to a conventional lath-sided nursery shelter, but with solid roof. Saguaro seeds may be thickly sown in a few flats of sand capable of being watered from the bottom; thus, very little labor and time will be required to germinate enough plants to begin a project for replanting Saguaros killed by bacterial necrosis, or lost from other causes.

The seedlings should be transplanted from the flats to small pots - 1 plant per pot - after formation of their first spines. It is believed that the common tar-paper pots would be large enough to allow full development of roots, would utilize all space and might be placed closely together because of their square shape, and in addition, are low in cost. Such pots would be placed on a frame having a 1/8" mesh galvanized hardware cloth (screen) bottom, to facilitate watering of the pots by absorption of water and capillary dispersion in the soil, when the open bottoms of the pots are placed in water. The perforated or open bottom of each pot would be filled with pea-sized gravel, upon which would be packed a mixture of one-half good rich soil, and one-half sand, to within one inch of the top. The frame upon which the pots were placed would have 4-inch high sides to support the pots firmly during the 5-year (tentative) period in the nursery, and in case the tar-paper pots should decompose somewhat, which they might well do in such a long period of contact with moisture and soil organisms. Also, the frames and pots could be readily lifted and carried as a unit from the nursery to a truck bed when the time came for transporting them to the field for transplanting. It is believed that the tar-paper pots would furnish each seedling with a barrier of a sort against spreading pathogens of the damping-off type (and would last longer and form a more effective barrier if treated before use with a highly-residual, non-phytotoxic disinfectant or preservative). The pots should afford, when transplanting time arrives, a somewhat more rapid separation and handling of plants in the field than would be possible were the plants placed unseparated in large flats.

The frame upon which the potted plants would be placed would be mounted in a tar-paper or roofing-paper lined wooden bench tank, sealed with tar so it would hold water during the times that the pots are watered from the bottom. The tanks would be equipped with a drain to allow them to be emptied after watering of the plants had been completed. This method of watering would be very time-saving, for with water piped directly to the tanks, one would have but to operate valves until the water level was about one-half way up to the top of the pots, let the set-up stand until water showed at the soil level in the pots, and then let the water drain off. Such a set-up would also contribute to good conditions for raising succulent plants (good air circulation, but with high humidity from the large, moist soil mass).

During wintertime the plants should not need watering more often than once per week, especially if each tank and two contained frames has a cover-frame of cello-glass. In winter, such a cover would afford enough light, sufficient warmth to prevent cold injury, and protection from insects, birds and rodents. The cello-glass-covered frames should be exchanged for plain window-screen-covered frames during the hot summer weather ~~weather~~ to prevent the plants from being scalded from a combination of temperature and humidity that is too high. Under typical summer conditions seedlings should be watered twice

per week, at least.

It is estimated that a 10 x 20 ft. nursery shelter, 10 ft. high, with two benches approximately 20 x 3½ ft. (one on each side, with a 2½ ft. walkway in center) should afford enough space to grow approximately 4,000 potted plants. If the benches were properly placed, one above the other on each side of the walkway, so that they would not be shaded for but short periods during the day, the number of plants estimated that might be cared for in the above described manner, on the same 200 sqft. area, would be increased to approximately 8,000. Such a number of plants, from observations of present plant population densities (20-25/A.) should replant a total area of approximately 350 acres every 5 years. Additional plants could be propagated, of course, by increasing the length of the nursery shelter, or, with proper spacing and arrangement of bench tanks, the width of the nursery might be increased.

2. Age (size) at which seedlings should be transplanted to protected outdoor locations or natural growth sites:

It is believed that the seeds should be planted in nursery shelters as described above, and in addition should be protected and cared for within the same nursery shelter for an estimated period of 5 years before transplanting to natural sites. In such a period, the seedlings should have developed large enough root systems to enable them to become firmly established after being moved. Spines also should have, by that time, become well-enough developed to afford the young plants protection against rodents or other animal enemies.

3. Species that make the most effective nurse plants:

On the basis of field observations, any plant that has either a low, bushy habit, or forms a heavy, coarse litter at its base, and furnishes a moderate amount of shade, seems to function well as a nurse plant. The main functions of the nurse plant seem to be: Mechanical protection - either from branches surrounding the small plant, or heavy, coarse litter of branches and twigs on the ground beneath the nurse plant; Shading - young, tender succulents are extremely susceptible to burning, and until the root system has developed sufficiently, direct rays of the sun will cause a plant to lose more moisture to the air than the roots can absorb and a small plant can store; Prevention of erosion and moisture retention - small plants are at the mercy of the heavy, "cloudburst" type of rainfall that is characteristic of this section of the country, especially just following the period of flowering and seed-formation in saguaro; if seedlings do not become established in a location protected from such erosion, they are certain to be washed away or left bare-rooted. Soil that is held around the bases of nurse-type plants also is usually more rich in nutrients and more retentive of moisture than soil in open locations; Concealment - small saguaros that are growing at the bases of low, bushy plants, or in coarse litter of branches and twigs below plants of shrubby or tree habit, are afforded a measure of concealment that is undoubtedly a contributing factor to their survival from enemies or other agencies seeking them for various purposes.

Plants that have been noted most frequently assuming the role of nurse plant are as follows, the species depending, of course, upon the suitability of a location for its growth: Bur Sage (*Fraseria deltoidea*); Palo Verde (*Cercidium microphyllum*); and Creosote Bush (*Larrea tridentata*). Other plants may function equally as well, and in fact, others have been noted

that were apparently fulfilling the role adequately. The main consideration is that a plant to be chosen for a nurse plant should exhibit the above-listed characteristics and qualities.

4. Cost of the project:

According to estimates, on consultation with Mr. Sam King, Superintendent of Saguaro National Monument, it should be possible to build the described nursery, and initiate the project for approximately \$200., such a figure probably needing to be revised upward as time passes, because of increasing costs of materials and labor. Subsequent costs would be very nominal, as there should be very little wear and tear on the equipment during a seedling-growing period, and a new crop of seedlings should entail little expense other than new pots, disinfectant or preservative, and minor repairs to the components receiving the most handling or use.

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