MULCH BED METHOD OF SEEDLING PRODUCTION

W. C. SHERMAN[1] AND R. E. SHERMAN[2]
Elsberry, Missouri

INTRODUCTION

The mulch bed method of seedling production has been used at the Elsberry Plant Materials Center since its establishment by the U.S. Department of Agriculture, Soil Conservation Service in 1934. Neighboring, Forrest Keeling Nursery has adopted the method because it fits in with weather and soil conditions of the area. Having shared experience for several years, we are presenting this subject jointly.

MULCH MATERIAL

The mulch material used is "header-tow," a by-product of local saw mills making barrel heads The type of material most sought is the long, stringy, saw scurf which results from sawing of the barrel head, hence the name "header-tow." Among the principle advantages of this material are: (1) moisture conservation, (2) prevention of crust and compaction of our fine, silty loam soils, (3) erosion control, (4) temperature control, and (5) suppression of weeds. The most economical and practical way of spreading the mulch material is by means of a manure spreader. It is important to cover the seed beds immediately after seeding to prevent drying and exposure of the seed. The applied depth is from one to two inches, which settles to a depth of from one half to one inch at the time of seedling emergence. The material can cover seed beds several times deeper than the amount of soil covering the seed since it is very porous and light. As a general rule, it is applied deeper on large seeded species, and shallower on the species of plants having smaller sized seeds.

SEEDLING BEDS

Raised seedling beds are used at both the Forrest Keeling Nursery and the Elsberry Plant Materials Center. Because of the adaptability of other equipment, Forrest Keeling Nursery beds are made three feet wide, while those at the Plant Materials Center are four feet in width Height ranges from three to five inches above the two-foot wide pathways. Advantages of raised seedling beds are· (1) good drainage, (2) aeration, and (3) ease of digging seedlings. On flat bottomland there is the problem of cross drainage.

Forrest Keeling Nursery uses a Larchmont bed former. In forming beds with this machine, two or three trips are made over previously tilled soil to achieve the desired raised bed. A five foot wide, mounted, cultipacker is used to firm the soil prior to seeding. The narrow, two inch corrugations of this machine pulverizes and forms the soil into one-inch deep indentations, ideal for seed coverage. After seeding, another trip with the cultipacker covers the seed with soil.

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[1]Forrest Keeling Nursery, Elsberry, Missouri
[2]Elsberry Plant Materials Center, Soil Conservation Service, Elsberry, Missouri

SEEDING

For most seeding at Forrest Keeling Nursery, seed distribution is accomplished by a three foot Gandy seeder. This can be used with seed of almost any size, that is, from seed of the *Lonicera* species to that of most of the *Prunus* species. A shallow metal pan, one foot square, is used to check the seed sowing rate. In cases where stratified seed is not separated from the medium, or where small lots of seed are involved, seed is broadcast by hand. Seed is immediately covered with soil by means of a cultipacker, and the mulch is applied without delay. Density of stand is very important for the following reasons: (1) size and caliper of stock desired, and (2) mutual protection of seedlings such as shading and wind movement effects.

Seed sowing data sheets are maintained on all seed collected or purchased. Data contained includes, accession number, scientific and common name, source, amount, seed per pound, cutting test, estimated emergence, estimated plants per pound, production quota, amount to sow, density desired, square feet of bed space, estimated production, preplanting treatment, days stratified, depth to cover, method of seeding, date to plant, mulch, disease and insect control, emergence notes and digging count

SHADING

Shading is very important on certain species from emergence through the first year. Sometimes it is needed through the second year. However, most deciduous species are grown without shade The chief values of shade are. (1) protection from sunlight, (2) cooling effect, (3) moisture conservation, (4) winter protection, and (5) protection from wind. Lath, or picket fencing is the material used for providing partial shade over seed beds.

SOIL AMENDMENTS AND PREPARATION

In general, fertilizer applications are made in accordance with soil tests. Any deficient element is added to the extent necessary to bring that element to a high level of fertility. It is considered essential to meet the fertility needs of the soil because there are so many other limiting factors in seedling production. The basic soil amendment is applied ahead of the formation of the seed beds, of course. Supplemental fertilization, mainly nitrogen, is applied several times, during the growing season, through the irrigaton system.

Our loessal soils (pH 6.0) are not acid enough to require changing the pH to grow most woody seedlings. However, conifer seedling beds are treated with acid forming agents such as sulfur, ammonium sulfate or aluminum sulfate. Since the soils of both Forrest Keeling Nursery and the U.S. Plant Materials Center are of loessal (wind blown) origin, seedling beds are located on either upland or river bottomland The upland areas are located along the first row of river hills above the Mississippi river, where the loessal deposit is deepest. The bottomland seedling areas are located on restricted sites of "made" soil, which is nothing more or less than the loess mantle washed down and deposited near creek mouths on the bottomland during the 100 years since the hills have been farmed.

The loessal (or recent alluvial) soils have excellent characteristics such as good drainage, resistance to compaction, moisture retention, good buffering qualities, good mineral supply and are generally satisfactory for seedling production. They are low in organic matter and there is a need for constant nitrogen nutrition to insure maximum growth. To maintain or build up organic matter in the soil, actual additions of organic materials are needed. The Plant Materials Center has available agronomic seed crop aftermath which is chopped with a forage harvester and worked into their seedling production areas to maintain soil organic matter. An attempt is made, at Forrest Keeling Nursery, to prepare the soil by a preceeding perennial sod crop Any good, fibrous rooted grass-legume combination such as bromegrass-alfalfa or perennial fescueladino, is satisfactory. The fertility level is brought up to optimum during this grass period by whatever fertilizer additions soil tests indicate. The land is grazed but no grass clippings are removed for hay. These perennial sod crops, heavily fertilized, bring the organic matter to a high level and, more important, provide a fibrous residue that will persist in the soil much longer than that provided by an annual green manure crop. The land remains in the sod crop for at least two, and probably three or four years. A very heavy application of nitrogen is in order when the sod is turned under, to provide for a quick breakdown of the heavy grass and maintain a satisfactory carbon-nitrogen ratio.

THE WEED — PATHOGEN COMPLEX

From time to time, at the Forrest Keeling Nursery and the Plant Materials Center, the gamut of selected herbicides have been tried for weed control in seedling beds. Oils (Stoddard solvent, etc.) are excellent in conifer beds, but we are convinced that, for the wide range of seedling material produced, post-emergence control of weeds is essentially the wrong approach. We are convinced that the proper concept is the elimination of weed seeds, together with pathogenic fungi, nematodes and other soil insects, prior to seeding. Ideally, this should be accomplished after the beds are finished and immediately prior to seeding Practically, this time is not always possible as it may be necessary or desirable to seed in cold weather when soil treatments may be ineffectual. We are not completely satisfied with any soil sanitation treatment presently available.

The Plant Materials Center uses methyl-bromide which is extremely effective as a herbicide, somewhat less satisfactory against soil fungi, and excellent against insects. Methyl-bromide is expensive to use and most laborious where several acres are to be treated. At present, at Forrest Keeling Nursery, we believe allyl alcohol to be the most satisfactory soil treatment. It is readily applied through the portable irrigation system and several acres can be treated per day. Even at a very heavy rate of application (75 gal per acre) cost is one-half that of methyl bromide. Actually, we have realized quite good weed control at the 25 gal. per acre rate. The fungicidal and nematicidal qualities of allyl alcohol are not well established, but we believe they can be important. Probably combinations of allyl alcohol and nematicides

such as D.D. (a mixture of dichloropropane and dichloropropene) would enhance the general effectiveness of this treatment. There is definite need for a system to sanitize seed-bed areas with an effectiveness similar to what the florist can accomplish by steaming his greenhouse benches.

SEED HANDLING AND PRE-TREATMENT

This is a topic in itself and was most adequately covered last year by Miss Lela Barton, of the Boyce Thompson Institute. Suffice this to say that any seedling growers will do well to have the complete Boyce Thompson library of bulletins on woody plant seed studies. Another "must" is the U.S. Forest Service "Woody-Plant Seed Manual," Misc. Pub. No. 654. Among recent seed studies, Coggeshall's reports are some of the more helpful in ascertaining pre-treatment needed for a number of relatively rare species.

For 20 years we have vacillated between fall seeding vs stratification and spring seeding. There are hazards either way. About the time we adopt fall seeding, a series of late spring freezes which decimate resulting stands will make stratificaton and mid-spring sowing look mighty good. Then, when it never stops raining in April and May, as happened this year, you kick yourself for not fall seeding If you don't have controlled cold storage, you will find stratified seed can 'blow up in your face" while you are waiting for the rain to stop. We find it possible to standardize our pre-treatment practices to a large measure. For example, all seed after-ripening is satisfied by either fall seeding (which may mean summer or spring seeding, depending upon species) or warm or cold stratification for required periods. All scarification, where an impermeable seed coat is a problem, is handled by an appropriate bath in commercial sulphuric acid.

SEED PROCUREMENT

While most conifer seeds are satisfactorily available on the commercial market, this is not true with many or most deciduous species. Seedling nurserymen are well aware that it is well nigh impossible to order many deciduous varieties from commercial sources and expect delivery in time for necessary stratification or other pre-treatment. Often too, seed arrives in a condition of questionable viability.

For many, if not most, deciduous species the answer lies in local seed sources. To supplement local sources in parks, private gardens, botanical gardens, and native trees, shrubs and vines, we have for several years been in the process of establishing hedge rows and plantings of trees, and shrubs that fruit early in life and are generally difficult to come by. Already these "seed orchards" are providing much of our seed needs.

While the above practices and procedures have proved effective for us, we are still seeking newer and more efficient means of production. It is probable that the swiftly changing field of chemistry will contribute technological advances that will alter our whole production program in the near future

Table 1.—Seed treatment, date of planting and stands of ornamental plants.

Species	Preplanting Treatment	Date Planted	Days Stratified	Live Plants per square ft (11/1/'57)
Albizzia julibrissin	Sulfuric Acid — 30 min.	5-13-57		40
Ampelopsis tricuspidata	Stratify[1]	5- 9-57	120	20
Crataegus crus-galli	Planted dry; 1 year seed	8-29-56		43
Elaeagnus augustifolia	Soaked 48 hrs, froze 18 hrs	5-14-57	8	6
Hamamelis vernalis	Planted dry; 1 year seed	8-29-56		47
Ligustrum amurense	Stratify	5- 1-57	78	19
Lonicera maacki podocarpa	Planted dry	10-31-56		10
Mahonia aquifolium	Stratify	4- 0-56	112	18
Malus, Bob-White	Stratify	5- 1-57	39	36
Malus baccata mandshurica	Stratify	5- 1-57	39	20
Malus baccata Rosybloom	Stratify	5- 1-57	39	25
Phellodendron amurense	Planted dry	11- 1-56		42
Pinus echinata	Stratify	5 -1-57	58	44
Pinus nigra	Stratify	5- 1-57	38	18
Pinus sylvestris — Jennings	Stratify	5- 1-57	38	38
Pinus sylvestris Nye Branch	Stratify	5- 1-57	38	36
Pinus sylvestris Boonville	Stratify	5- 1-57	38	70
Prunus yedoensis	Stratify	5-14-57	130	6
Prunus mahaleb	Stratify	5-14-57	114	6
Pseudotsuga douglasi glauca	Stratify	5- 1-57	50	44
Rosa multiflora	Planted dry	12- 6-56		28
Rosa wichuriana	Planted dry	12- 6-56		22
Syringa amurensis	Planted dry	10-16-56		12
Syringa pekinensis	Planted dry	10-16-56		27
Ulmus pumila	Planted dry — fresh seed	6-10-57		28
Ulmus parvifolia	Stratify	5-14-57	125	15

[1] Stratify in a mixture of sand and peat at a temperature of 40°F

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(Editor's note). Mr. Roger E. Sherman of the Plant Materials Center, Elsberry, Missouri, supplemented this discussion with a series of color slides depicting salient features brought out in the preceding talk.

PRESIDENT VANDERBROOK: Before I call for questions I would like to announce that one of our members, Mr. Don Vanderbrook, employed by C. W. Stuart Nursery Co, Newark, New York, has had an acute appendicitis operation, is doing fine, and that flowers have been sent by the Society.

There is one thing I notice, particularly in so many of these talks, and that is, the construction of supports for shade on beds. I notice so many are using ground stakes and going through the laborious process of putting on wire. We used to do that for a long time, but since have adopted a newer arrangement. The method we use now is simple, quick and doesn't make use of stakes which rot in the ground and require replacement. We now use a 14-foot strip of 2″ x 3″ timber, in which we drill a half or three quarters inch hole half-way through it, about 18 inches from the end. This is repeated on the other end, and once more in the middle of the strip of timber We then go to the junk yard and pick up all the one-half or three-quarter inch galvanized

pipe they have and cut this into lengths with a pipe cutter or acetylene torch It is easy to drive the stakes in the ground with a sledgehammer, position your 14-foot drilled strip, and then roll on your lath.

Are there any questions you would like to ask either one of these speakers?

MR. HOOGENDOORN: I would like to ask Mr. Roger Sherman if he covers his seed with soil and if the seed is pressed in?

MR. ROGER SHERMAN: The seed is covered with the Cultipacker running over the bed for the second time. It is then pressed in.

MR. HANS HESS: I'd like to ask Mr. Sherman whether the smaller seedling conifers, such as the spruce and pine, are grown also with this mulch cover

MR. ROGER SHERMAN: Yes, we do mulch these seedbeds. However, with those small seeds we don't have quite an inch of mulch on them by the time they germinate. By spring, at emergence time, it has settled down to maybe a quarter of an inch. It is important not to get it too thick on those seeds.

MR HESS: One more thing Is there a greater danger from fungus infection with the type of mulch covering you are using? We have always used sand to cover the seed and a hay cover over that which we remove at the time of germination. Isn't there a very large potential danger of fungus damage?

MR. ROGER SHERMAN: By using methyl bromide prior to seeding, as well as a soil drench of Fermate, Captan, and DDT at the time of emergence, we have had no stand reduction.

MR. HAROLD BARNES (Barnes Roses, Inc., Huron, Ohio): I would like to ask Mr. Sherman a question about the hammermill. Is that a standard hammermill which is used for cleaning seed or do you have to modify the commercial unit?

MR. ROGER SHERMAN: That is a Forrest Keeling Hammermill in which the hammers are stationary.

MR. VAN HOF: I would like to ask Bill Sherman how he cleans the seeds out of a vermiculite and peat stratification medium.

MR. WILLIAM SHERMAN. This is a very good question. We dry the seed slightly on a seed-drying screen, just enough so that the vermiculite becomes lighter, and then run the seed through a fanning mill, blowing out the vermiculite. Then by the use of screens you may separate your seed from the vermiculite.

MR. STEAVENSON: I think one comment that I would like to make is in order. The Soil Conservation Service has gotten out of the nursery business. Their production at the Plant Materials Center is restricted, as you observed, to those experimental plots of material which they are trying out, in an attempt to provide better material for use on farms in erosion control. The Soil Conservation Service has been outstanding in getting out of the nursery business. I only wish we could say the same of the state and other federal agencies.

PRESIDENT VANDERBROOK: We stand adjourned until 1:30 P.M. I want to compliment you fellows in the audience, as well as our panel for a very lively and interesting meeting

The session recessed at 12·15 o'clock.