PRELIMINARY TRIALS ON UPGRADING *PLATANUS OCCIDENTALIS* WITH THE HELMUTH ELECTROSTATIC SEED SEPARATOR[1]

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ABSTRACT: The electrostatic seed separator is a recently invented seed conditioning machine which uses the force of an electrostatic field to separate particles of different area and weight. It has been successfully used to size, clean, and improve germination of *Platanus occidentalis* seed. The seed separator also should be useful on other tree seed.

INTRODUCTION

Upgrading reters to steps that exceed basic cleaning which improve the quality of seed. Therefore, upgrading includes removing empty seed, fungus or insect damaged seed, and stones or pitch. Sizing seed can also be considered upgrading because speed of germination can vary for different seed sizes. Several authors have stressed the importance of upgrading and how to accomplish it (Belcher 1978; Bonner 1978).

Sycamore (*Platanus occidentalis* L.) seed is generally low in viability and difficult to upgrade because of its small size. The electrostatic seed separator was tested on sycamore to determine how it might resolve this problem.

Principles of Electrostatic Separator

An elementary demonstration of the electrostatic movement of particles includes lifting particles of paper with a piece of plastic that has been charged by rubbing it with a dry cloth. The paper is drawn to the plastic by an electrostatic field. Heavier seed can be separated from lighter seed by the same principle if the strength and design of the electrostatic field is carefully controlled.

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[1]Mention of trade names is only to identity equipment used and does not imply endorsement by the U.S. Department of Agriculture. U.S. patents have been granted on this equipment.

The Helmuth electrostatic seed separator consists of a hanging electrode and adjustable ground plates (fig. 1) Voltage applied to the stationary electrode creates an electrostatic field between the electrode and the ground. As seed is poured between the ground and the electrode by the vibratory feeder, the static field carries the lighter seed and impurities towards the ground. The stronger the static field, the farther the particles will be pulled. The strength of the field is controlled by adjusting the voltage applied to the electrode. For each seed lot, there is a voltage that produces a maximum distance between the lightest and heaviest seeds being separated. This voltage must be determined by trial during processing just like adjusting other seed conditioning equipment. Using a voltage higher than the one producing the maximum speed will only move all the seeds closer to the movable ground and not give any better separation. The purpose of the ground's mobility is to adjust the distance so the seed can separate. When the seeds have reached the bottom of the static field, they are collected in a tray. Adjustable vanes in the collection tray keep the fractions separated.

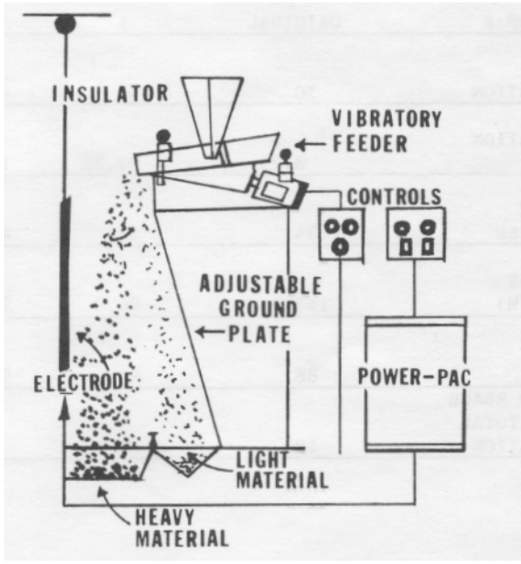

Figure 1.--Diagram of the electrostatic seed separator.

MATERIALS AND METHODS

One lot of sycamore was rough cleaned on a Clipper office tester using a 5/64 x 3/4 slotted screen on top and a number 7 round hole screen on the bottom. This removed the bulk of the fluff which prevented the seed from flowing freely. A portion of seed was taken from the tester and designated as the original sample. This original lot was upgraded on the Helmuth electrostatic separator. The electrode is 80 cm x 130 cm. Voltage can vary from 0 to 120,000 volts to accomodate many particle sizes. The voltage setting and feed rate established by preliminary trials and x-ray analysis will determine full seed percentages. Although voltages are high, no danger can occur to the operator it the machine is used properly.

After the preliminary trials, six tractions were obtained from the original lot. Each traction was evaluated for germination, Czabator's germination value (Czabator 1962), purity, full seed percentage, and seed per pound. Tests were conducted according to the Association of Official Seed Analysts' rules. Stratification was for 60 days at 3^0C on the germination media. Germination was on crepe cellulose pager with a temperature of 20^0C at night and 30 C during the 8 hour day. Germination counts were made daily; the final count was made on day 12. There was no statistical analysis. Table 1 presents the data.

RESULTS AND DISCUSSION

Notable accomplishment was made with all seed quality measurements. The results are summarized in table 1. Purity was improved from 88 to 99 percent or better, and full seed percentage from 34 to a maximum of 52. The larger seed are almost twice as big as the smaller seed. The best germination was 18 percent better than the original lot. The largest three sizes of seed were also the most vigorous as shown by their sizeable germination values.

The improvement in viability and vigor is best understood by examining the data on a full seed basis (table 2). The pattern in germination is substantially modified. Instead of the best lot germinating 25 percent higher than the poorest Lot, it is only 7 percent better on a full seed basis. The computed germination value, using full seed data, is actually higher for the smaller seed. This is because the smaller seed reached 90 percent of their total germination sooner than the larger seed. Therefore, the higher full seed percentage of the best lots
is largely responsible for the better germination and germination values.

Removal of empty seed was not, however, the only effect of the seed separator. The tact that the smaller seed germinated the fastest, shows there were also physiological differences among the seed sizes.

Table 1.--Seed test results of the original seed lot and the six samples obtained by electrostatic seed separation. Values are based on actual germination data.

FRACTION #	ORIGINAL	1	2	3	4	5	6
ACTUAL GERMINATION	30	48	40	43	37	33	23
GERMINATION VALUE	8.23	22.28	16.65	18.94	15.92	13.28	7.05
PERCENT FULL SEED	34	52	46	46	40	37	26
SEED PER POUND (M)	147.0	94.9	99.0	101.7	118.7	152.2	168.0
PURITY	88	99	99	100	100	100	100
DAYS TO REACH 90% OF TOTAL GERMINATION	10	9	8	8	7	7	6

Table 2.--Germination and germination value computed on full seed basis.

FRACTION #	ORIGINAL	1	2	3	4	5	6
GERMINATION	88	92	87	93	93	89	85
GERMINATION VALUE	71.7	82.15	78.66	88.58	100.75	96.46	95.58

According to the data obtained, the electrostatic separator appears to have definite potential to effectively upgrade small tree seed. Other species that might be effectively upgraded would include birch, sweetgum and conifers such as white spruce. In a preliminary trial, redwood purity was visually much improved with the Helmuth separator. There were no laboratory test data. In the nursery, the upgraded seed will give more uniform germination and provide more uniform seedling densities, greater numbers of plantable seedlings per pound of seed, and more efficient use of nursery space.

PUBLICATIONS CITED

Belcher, E. W.; Karrtalt, R. P. The processing of conifer seed. In: Proc. Small Lot Forest Seed Processing Workshop; 1977, Oct. 18-20; Atlanta, GA. USDA Forest Service, Southeastern Area, pp 9-18. 1978.

Bonner, F. New developments in seed processing. In: Proc. Small Lot Forest Seed Processing Workshop; 1977, Oct 18-20; Atlanta, GA. USDA Forest Service, Southeastern Area, pp 19-23. 1978.

Czabator, F. J. Germination value: an index combining speed and completeness of pine seed termination. For. Sci. 8: 386-396; 1962.

In: Murphy, Patrick M., compiler. The challenge of producing native plants for the Intermountain area: proceedings: Intermountain Nurseryman's Association 1983 conference; 1983 August 8-11; Las Vegas, NV. General Technical Report INT-168. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station; 1984. 96 p.