The Effect of Seed Handling Procedures on the Laboratory Germination of Juglans nigra L. A Preliminary Report to Nursery Supervisors.

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ABSTRACT

A cooperative study of the influence of seed handling procedures on the germination of Juglans nigra was conducted by the Minnesota DNR and the USDA Forest Service. The results suggest that the mechanical husking operation is injurious to the viability. Further data is necessary before a definite conclusion can be made about husking procedures.

Introduction

For many years it has been noted that the germination of black walnut (Juglans nigra L.) in the nurseries of the north central region of the United States has been poor. This has caused the production of seedlings to be below the desired level. Investigations of the nursery bed to find a causal agent for the low germination have not led to a solution. Proper seed handling procedures are critcal to the maintenance of high viability of seed. Therefore, a logical next step to resolving the problem of low nursery germination was to investigate the seed handling procedures. The Minnesota Department of Natural Resources in cooperation with the USDA Forest Service, National Tree Seed Laboratory and the USDA Forest Service, Northeastern Area State and Private Forestry began an investigation of seed handling procedures in the fall of 1983. The findings of this preliminary study are here reported.

Methods and Materials

Samples of walnuts were collected by personnel of the Minnesota Department of Natural Resources at 5 steps in the collection and handling process. These steps were:

1. Arrival of nuts at the buying station. This collection established a base line of nut viability.

2. Loading at the buying station for transport to the nursery. This sample would allow for measuring loss of viability at the buying station.

3. Arrival at the nursery. This sample would allow for measuring vialbility loss while in transport to the nursery.

4. After husking. This sample allows for measuring the effect of the husker on viability.

5. Time of sowing. This sample allows for measuring the effect of temporary storage between husking and sowing.

In summary the principle for evaluating the procedures was to sample before and after each major step in the handling process and to test for any losses of viability between steps. Where a loss is detected, a change in procedure is indicated to find a way of handling the nuts without causing loss of viability.

All samples were kept in cold storage at 4°C until tested except as absolutely necessary for handling and shipment. All lots were shipped at the same time to maintain uniformity of test conditions.

Upon arrival at the National Tree Seed Laboratory the nuts were cleaned for 10 seconds in a Dybvig macerator to remove a small amount of husk still on them. This was done as a precaution against mold problems during the germintion test. All nuts were given this treatment. The germination media was a sterilized commercially prepared peat-vermiculite-perlite mixture. Both stratification and germination were conducted on this media in clear plastic boxes measuring 27cm x 19 cm x 7.5 cm. The lids of these boxes are sufficiently airtight so that water had to be added only at the beginning of the experiment. Statification was for 90 days at 4 C. Germination was conducted with an alternating temperature of 20° C for 16 hours and 30° C for 8 hours. Light was provided during the 8 hours of higher temperature. Each dish held 20 nuts. The number of dishes for each sample ranged from 8 to 15. Germintaion counts were made every 7 days for 6 weeks. Following germination all ungerminated nuts were cracked open to determine how many were still fresh.

Results and Discussion

The germination results are presented in table 1. The data are suggestive that the husking process is deleterious to the germination of the 3 samples before was 48.4 while the average germination of the 2 samples after husking was 26.0. When a significant drop in germination occurs following a specific process in handling it is interpreted as meaning that the step has a deleterious effect on the seed.

Table 1. Germination of Black Walnuts Collected at Each Handling Step From Purchase to Sowing.

Lot Description	No. of samples of 20 nuts.	Germination Mean	S. E.	Full Seed Basis
Arrival at buying station.	10	37	18.4	39
Loading at buying station.	10	62	8.2	64
Arrival at nursery.	10	41	17.1	42
After husking	15	14	9.2	14
Time of sowing	8	38	18.3	38

viability. Unfortunately the results are not conclusive because the last sample of walnuts had germination equal to that of the first sample before husking. There was little difference among the lots in speed of germination. All the lots essentially reached 90% of their total germination in 28 to 35 days.

The number of ungerminated nuts with soft meat at the end of the test supported the findings of the germination. The data is given in table 2. There is a slight progressive trend towards more

Table 2. The Number of Ungerminated Nuts With Soft Meat.

Lot Description	Soft Nuts	
	Number	Percent
Arrival at Buying Station	5	2.5
Loading at Buying Station	10	5.0
Arrival at Nursery	13	6.5
After Husking	17	5.7
Time of Sowing	15	9.3

deteriorated nuts when we compare the earlier collected samples with those collected at the later stages of handling. More deterioration would indicate more damage from handling. A random sample of ungerminated nuts was placed in tetrazolium chloride after cracking. Although the nuts appeared firm, the tetrazolium staining indicated that there was weakness in the ungerminated nuts. Therefore, we are led to believe that the differences in germination values was a viability difference and not a problem of

dormancy.

The senior author was able to obtain some additional data in the fall of 1983, while working with another state. Walnuts were transported in bulk in a stake body truck. A few days delay in sowing the nuts occurred because of stormy weather. The truck was not unloaded. Upon turning the pile with a shovel it was seen that heating had taken place. A max-min thermometer was placed in the pile over night. The next morning the temperature was read to be 105 F, even though the ambient temperatures were below freezing. A sample of nuts was then taken from the surface of the pile and from a minimum depth of 12 inches. Many locations in the load were sampled in order for the results to be representative. The 2 samples were then cracked open. Nuts from the surface of the pile were estimated to be 84% firm while those from within the pile were estimated to be only 34% firm. Proper ventilation would have prevented this problem. However, it is necessary to prevent walnuts from drying below 20% moisture content to preserve viabilty. Therefore, ventilation should not be allowed to lead to drying of the nuts.

From this data the exact cause of the low germination percentages of black walnuts in the nurseries has not been identified. However, the large average drop in germination following husking strongly indicates that the study should be continued to conclusively determine if handling procedures are the cause of the low viability.