

QUALITY OF PINE SEED COLLECTED FROM
THE NET RETRIEVAL SYSTEM

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Abstract. -- Tests in three USFS loblolly pine seed orchards and one shortleaf orchard have shown no short term detrimental effects on seed quality from the net retrieval system. Germination capacity and rate of germination of seeds left on the net for several months suggest no adverse effects on seed biology. Germination capacities and the number of filled seeds determined by X-rays are closely aligned. There has been no apparent damage to seeds from mechanical retrieval and cleaning. Study data represent germination and not necessarily seed quality as affected by storage.

Additional keywords: Germination, seed tests, X-ray, Pinus taeda, P. echinata.

The Net Retrieval System (NRS) is a relatively new method of collecting and retrieving orchard seed. It was first used by the Georgia Forestry Commission (Wynens and Brooks 1979). The U. S. Forest Service has modified the system with increased mechanization to allow safe, efficient, cost-saving seed retrieval. The USFS new system has been tested for the past two years at Stuart Seed Orchard, Pollock, LA; Erambert Seed Orchard, Brooklyn, MS; Francis Marion Orchard, Moncks Corner, SC; and Ouachita Seed Orchard, Mt. Ida, AR.

Aside from the efficiency and cost of NRS, there was also concern about possible mechanical and biological damage to the seeds. This concern brought about a cooperative research effort by scientists at our facility and at the previously mentioned seed orchards.

MATERIALS AND METHODS

Ten to 15 sampling points were established in the NRS area of each seed orchard to represent typical trees and locations for that site. Throughout the period of seed fall, 100 to 125 seeds were collected from the net at each sample tree location at 1- or 2-week intervals. Seeds were sampled from each location at random with no regard for seed appearance being good or bad.

In addition to the seeds collected from the sample points, seeds were taken from the bulk collector after net retrieval for testing.

Seeds were collected in plastic bags and returned to the laboratory where they were air-dried overnight. If necessary, seeds were dewinged by hand. This step was usually not necessary, as exposure to alternate wetting and dry-

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ing on the net provided a natural dewinging. After cleaning, the seeds were radiographed and placed in conductivity trays to determine leachate conductance (Bonner and Vozzo 1982). All seeds were stratified at 2°C for 28 days and germinated according to AOSA rules (AOSA 1981). Peal values (PV) (Czabator 1962) were calculated to measure germination rate.

All seeds were radiographed on Kodak ^{2/} Industrial Type M film for 30 seconds at 30 kVp, 3 mA, and 65 cm film focal distance. An ASA-610 (Applied Intelligence System 2/ was used [or leachate conductivity measurements at a partition value of 65 on a scale of 4. All seeds were pre-soaked for 24 hours before determining leachate conductivity.

Twenty trees were identified and sampled at the beginning and ending of the collection period in 1983-84 to estimate natural seed fall. The percentage of filled seeds remaining in the cones at the time of net retrieval was determined by comparing seeds of five cones from each sample tree at the beginning and end of the net collection period. The difference was considered to be the percent of filled seeds which did not fall on the net during the collection period.

Predator loss was estimated in 1983-84 by sampling twenty tree locations at each orchard. At each location a closed wire screen envelope of 100 seeds was placed alongside an open wire screen tray with 100 seeds. The missing seeds from the open tray at the end of the collection period were assumed lost to predators. Seeds in the closed envelope were examined for insect damage.

RESULTS AND DISCUSSION

Cone crops were generally better in 1983 than in 1982, and seed quality reflected this difference. Unusually rainy weather during the 1982 collection period also delayed cone opening and seed dissemination.

Data from the Stuart orchard gave no indication of any damaging effect of the NRS on seed quality (Table 1). Radiography showed a high number of empty seeds in 1982-83, but germination tests confirmed that practically all filled seeds germinated. This same relationship held true in 1983-84, when the filled-seed percentages were about twice those of 1982-83. Germination rates, expressed as peak values, were quite good. There was a trend of decreasing PV's over the collection period in 1982-83, but this reflects the decreasing germination capacities. PV is partly a function of germination capacity. In 1983-84 when germination did not decline, PV's were steady.

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Table 2. Loblolly seed test results from Erambert Seed Orchard, 1982-84.
Data represent 100 seeds each collection date.

Collection Week		1982-83			1983-84		
		Filled Seed	Germination Capacity	PV	Filled Seed	Germination Capacity	PV
82-83	83-84	%	%	%/day	%	%	%/day
OCT							
	31	-	-	-	80	73	4.0
NOV							
1		80	80	7.4	-	-	-
8	7	80	79	7.7	89	81	4.3
15	14	78	77	7.4	87	83	4.4
22	21	76	76	7.4	88	85	4.8
29	28	75	73	5.3	87	84	4.4
DEC							
6*	5	75	72	6.2	88	87	4.7
	12	-	-	-	88	84	4.5
20	26	65	59	4.1	85	82	4.2
JAN							
	9	-	-	-	85	-	-
18*		-	35	2.6		83	4.8

* Sample taken from bulk collector after net retrieval.

Francis Marion orchard data (Table 3) showed the same trends as the other two: (1) close agreement between filled seeds and germination, (2) slower germination in 1983 seed, and (3) no apparent detrimental effect of the NRS on seed quality.

Table 3. Loblolly seed test results from Francis Marion Seed Orchard, 1982-83. Data represent 100 seeds each collection date.

Collection Week		1982			1983		
		Filled Seed	Germination Capacity	PV	Filled Seed	Germination Capacity	PV
82	83	%	%	%/day	%	%	%/day
NOV							
1		88	89	7.5	-	-	-
	7	91	88	6.3	85	74	3.9
15		90	87	7.5	-	-	-
22		87	86	7.2	-	-	-
29		87	86	6.1	91	86	4.7
DEC							
6*		86	80	6.0	-	-	-
	19	-	-	-	80	72	4.3
	26	-	-	-	73	62	3.1

Table 1. Loblolly seed test results from Stuart Seed Orchard, 1982-83. Data represents 100 seeds each collection date.

Collection Week		1982-83			1983-84		
82-83	83-84	Filled Seed %	Germination Capacity %	PV %/day	Filled Seed %	Germination Capacity %	PV %/day
	OCT						
	31	-	-	-	-	79	5.0
	NOV						
1		47	45	4.7	-	-	-
8	7	44	44	4.6	83	75	4.4
15	14	43	42	4.3	78	84	5.0
22	21	41	40	4.1	88	85	6.0
29	28	37	36	2.9	88	82	5.2
	DEC						
6*	5	28	27	3.6	83	80	5.4
	12	-	-	-	84	80	5.8
	JAN						
	2*	-	-	-	81	77	4.9

* Sample taken from bulk collector after net retrieval.

Data from the Erambert orchard (Table 2) showed basically the same trends as described for Stuart. In both years filled-seed counts from radiographs matched germination capacities very closely. As with Stuart data, no decline was observed in seed quality over the collection period in 1983-84. A considerable difference occurred in PV between the two years in the November and early December collections. Since PV did not change in 1983-84, this difference is not considered as related to NRS, but is probably a case of 1983 seed being more dormant than 1982 seed from this orchard.

The NRS was also installed in the Ouachita orchard for shortleaf pine in 1983. There were heavy predator losses, especially in December from flocks of seed-eating birds. Samples were collected from November 14 to December 12, and the data were similar to those from loblolly collections in the other orchards (Table 4). Very good agreement was found between radiograph counts of filled seeds and germination capacity. The declining percentage of filled seeds is probably, just as in the other orchards, a result of two factors: predator loss of filled seeds on the net and a declining percentage of filled seeds disseminated late in the season. In other words, the best seeds are disseminated early in the season. Although data from Ouachita orchard are limited, there was no evidence at this point to show a detrimental effect of NRS on seed quality.

Table 4. Shortleaf seed test results from Ouachita Seed Orchard, 1983. Data represent 100 seeds each collection date.

<u>Collection Week</u>	<u>Filled Seed</u> %	<u>Germination Capacity</u> %	<u>Peak Value</u> %/day
NOV			
14	79	70	2.8
21	85	82	5.6
28	72	68	3.8
DEC			
5	50	48	3.4
12*	15	14	1.2

* Only 50 seeds available at each sample point.

One inherent problem of the NRS is that seeds collected from the net may not be entirely from the current year's seed crop. As shown in Table 5, relatively large numbers of seeds can remain in cones after net retrieval. Data from Francis Marion show that seeds from cones which had matured in 1982 and which had been selectively picked in November, 1983 had a germination capacity of 52%. The seed sample also included 40% rotten seed, and 2% of that germinated and produced abnormal seedlings. If these year-old seeds are disseminated on the net with current-year's crops, the overall seed lot quality will be reduced.

Table 5. Estimated seed loss from unopened cones and predator losses at four R-8 seed orchards, 1983-84.

<u>Orchard</u>	<u>Collection Date</u>	<u>Left in Cone</u> ^{1/} %	<u>Predator Loss</u> ^{2/} %
Stuart	December 14	43	20
Erambert	January 10	16	64
Francis Marion	January 3	25	18
Ouachita	January 17	11	78

^{1/} Data represent seeds collected from five cones each of 20 trees.

^{2/} Data represent 100 seeds each at 20 locations.

Natural predation by rodents and birds is a very serious problem. Collecting seed samples from the net allowed easy observation of predator losses, which might ordinarily be less obvious when left on the forest floor. The values in Table 5 are only rough estimates, but they do demonstrate the potential for Loss.

Conductivity measurements with the ASA-610 were not meaningful, because of the numerous empty seeds in many samples. These data are not included.

The NRS appears to be a biologically secure method of seed collection if the seeds are utilized within 6 months. Tests are now underway to determine if NRS seeds lose quality in long-term storage quicker than seeds collected by conventional means. Seed quality will be tested at 6-month intervals. Preliminary results from short-term storage show no reason yet to suspect seed abuse from NRS.

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