SEED YIELDS PER BUSHEL: ORCHARD VS NATURAL STANDS

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Abstract.--Seed yields per bushel for loblolly (Coastal Plain and Piedmont North Carolina Provenance), longleaf, Eastern white pine, and Fraser fir are documented. North Carolina Division of Forest Resources orchard yields are compared with yields of commercial collections from natural stands in North Carolina. Orchard seed yields per bushel are greater than natural stands for loblolly, longleaf and Fraser fir.

Additional Keywords: Pinus palustris Mill., Pinus strobus L., Pinus taeda L., Abies fraseri (Pursh) Poir.

Cones from stands within the species natural geographic zones in North Carolina were used for this comparison. The natural range of loblolly (Pinus taeda L.), longleaf (Pinus palustris Mill.), Eastern white pine (Pinus strobus L. and Fraser fir (Abies fraseri (Pursh) Poir.) are illustrated on the map of Figure 1 (Little 1971). Seed orchards of these four species are located within the natural range of each species except for Fraser fir. The Fraser fir orchard is at a lower elevation (3400 feet) than naturally occurring stands. Fraser fir begins to occur mixed with red spruce at 4500 feet elevation on some sites in the Great Smoky Mountains National Park and at 5000 feet on Roan Mountain. As elevations increase, Fraser fir becomes the dominant component of the tree canopy. (Holmes 1911, Whittaker 1956, Mark 1958, Crandall 1958)

Early discussions of the value of orchard production over natural stand production have given greater consideration to potential genetic value over that of increased seed yield per bushel of purchased or harvested cones. (Perry and Wang 1958, Zobel et al. 1958). At the early stages of orchard development, data was not available to compare orchard tree yields with natural stands because of the young age of orchard trees. This presentation will document the yields of 20 year old orchard trees with those of natural stands for the above four species.

METHODS

The natural stand seed collection data is taken from cone purchase and clean seed inventories of 1978-81 (Table 1). The orchard seed collection data is taken from cone harvest and clean seed extraction inventories of 1981-84 (Table 2). Although the years of harvest between natural stand and orchard are different, this does not prevent comparing the data. From the seed yields expressed in Table 3 (Schopmeyer 1974), it is evident that yields of North

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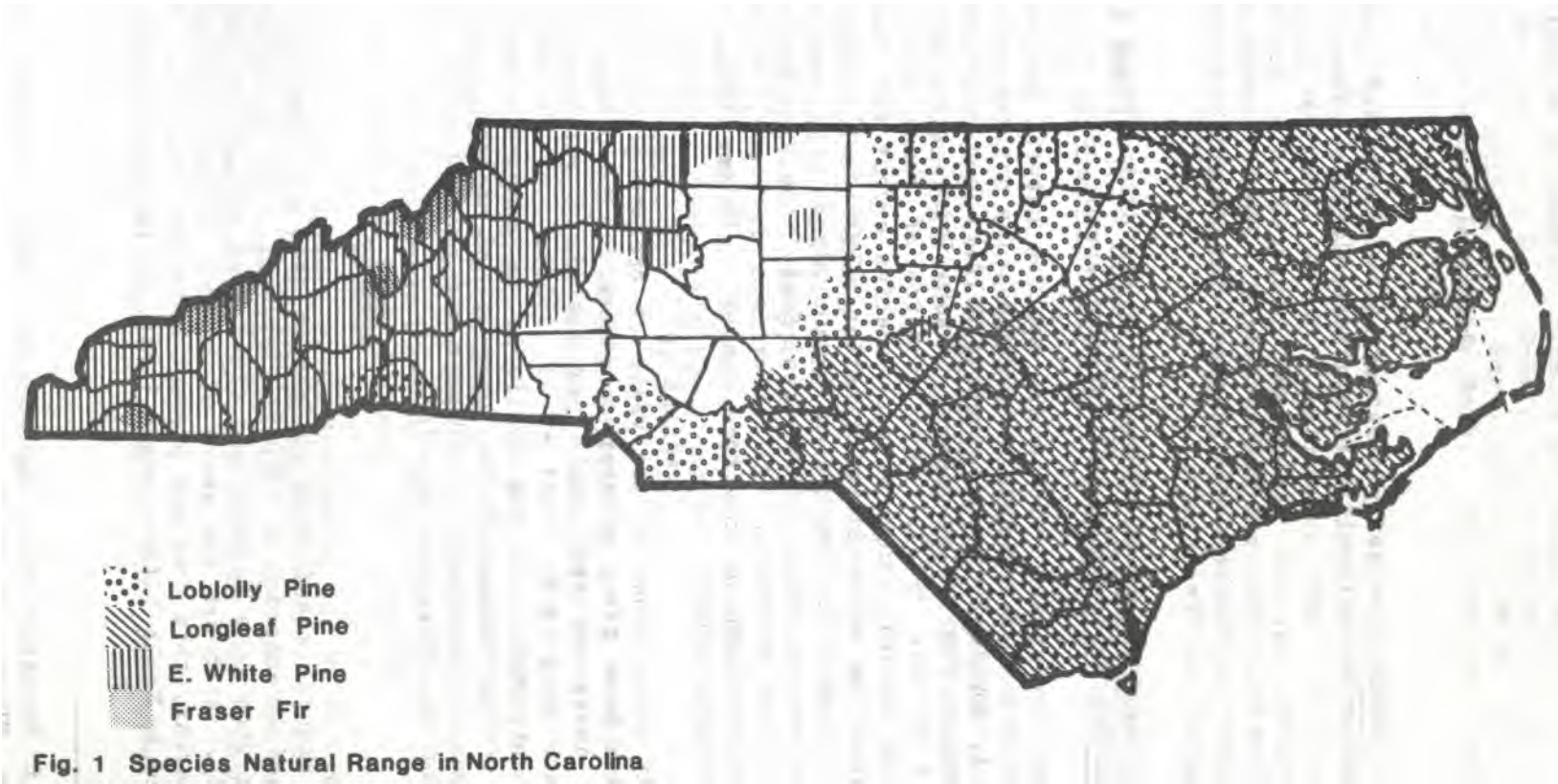

Fig. 1 Species Natural Range in North Carolina

Carolina natural stand sources (Table 1) are within previously reported limits of the total range for these four species. Results of nine years (1978-86) of cone/seed yields (1.47 pounds of seed per bushel average) for loblolly pine reported by the North Carolina State Industry—Cooperative Tree Improvement Program indicate that the North Carolina orchard yield data presented in Table 2 is comparable. (North Carolina State University 1987)

Table 1.--Bushels of cones and pounds of seed yields of natural stands in North Carolina[2]

	Loblolly Pine				Longleaf Pine		Eastern White Pine		Fraser Fir	
	Piedmont		Coastal Plain							
Year	Bu	Lb	Bu	Lb	Bu	Lb	Bu	Lb	Bu	Lb
1978	390	126	703	444	113	43	3054	1761	332	694
1979	764	432	637	1010	2575	2141	141	59	NO CROP	
1980	291	403	3420	1492	2515	1829	52	123	NO CROP	
1981	51	27	1158	1687	7732	6182	5111	3490	2442	4710
TOTAL	1496	988	5918	4633	12935	10195	8358	5433	2774	5404
AVG	374	247	1480	1158	3234	2549	2090	1358	694	1351
LB/BU	.66		.78		.79		.65		1.95	

Table 2.--Bushels of cones and pounds of seed yields of seed orchard crops in North Carolina[2]

	Loblolly Pine				Longleaf Pine		Eastern White Pine		Fraser Fir	
	Piedmont		Coastal Plain							
Year	Bu	Lb	Bu	Lb	Bu	Lb	Bu	Lb	Bu	Lb
1981	1284	2244	885	1630	1193	1617	658	298	148	336
1982	442	862	233	337	726	726	NO CROP		54	166
1983	228	302	283	373	570	558	957	455	101	286
1984	898	1145	1081	1365	814	769	5004	3633	218	702
TOTAL	2852	4553	2482	3705	3303	3670	6619	4386	521	1490
AVG	713	1138	621	926	826	918	1655	1097	130	373
LB/BU	1.60		1.49		1.11		.66		2.87	

[2] Cone/seed data taken from cone purchase and orchard harvest records of North Carolina Division of Forest Resources, Nursery/Tree Improvement Program

Table 3.--Pound of seed per bushel as reported in Seeds of Woody Plants in the United States

Loblolly Pine	Longleaf Pine	Eastern White Pine	Fraser Fir
.6 - 1.3	.8	.3 - 1.7	2 - 3

RESULTS

Orchard seed yields per bushel of cones for Piedmont loblolly pine is .94 pounds greater than natural stand production and Coastal Plain loblolly is .71 pounds greater. Longleaf orchard yield is .32 pounds higher than natural stand production. White pine orchard yield (pounds of seed per bushel) is only .01 more than natural stand production. Fraser fir orchard production is .92 pounds greater than the natural stand production.

DISCUSSION AND CONCLUSION

With the exception of Eastern White pine these orchard seed yields are an improvement over natural stands. There may be several reasons for the low orchard seed yield for Eastern white pine in the North Carolina orchard. Insects (white pine cone beetle, Conephthorus coniperda, Schwarz and cone borer, Eucosma tocullionana, Heinrich) have caused a reduction or complete loss of cone crops. Currently available insecticides do not provide adequate protection from these two insects. Cones are harvested without regard to clonal variation in cone ripeness. Eastern white pine cones that are not ripe when harvested will case harden and not open during seed extraction processes. Harvesting by clonal groups that ripen near the same time should improve seed yield.

Longleaf seed yields have been increased by a foliar spray mixture of cytokinin and boric acid (Hare 1987). This spray also is reported to reduce the amount of conelet abortion that happens with longleaf pine. Including this spray application in the cultural practices of longleaf orchard operations could improve yields by one half.

The loblolly seed yields are not up to the two pound per bushel reported for some orchards in the 31st Annual Report of the North Carolina State University Cooperative. More complete monitoring for seed bug damage may indicate a reason for some of the lower yield per bushel.

At this time the Fraser fir seed orchard at Crossnore, North Carolina is the only one that is old enough to produce cones and seed for which records are available. In the future younger clonal orchards should provide data for comparison. Insects other than seed chalcids have not been identified as causing cone or seed loss in Fraser fir. (Hedlin, et al. 1980)

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