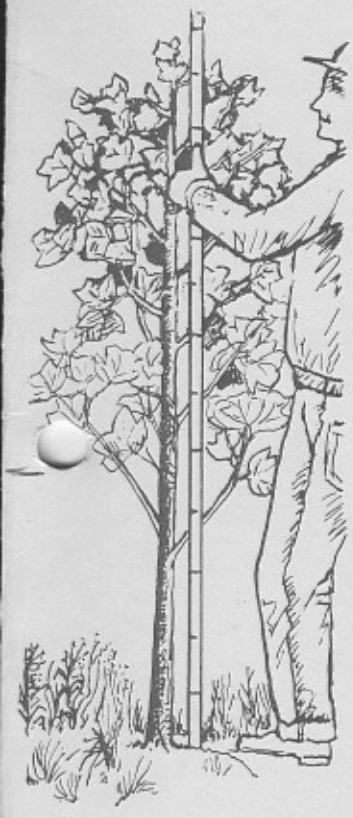

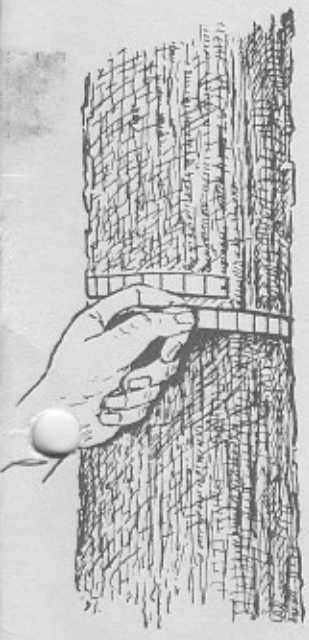

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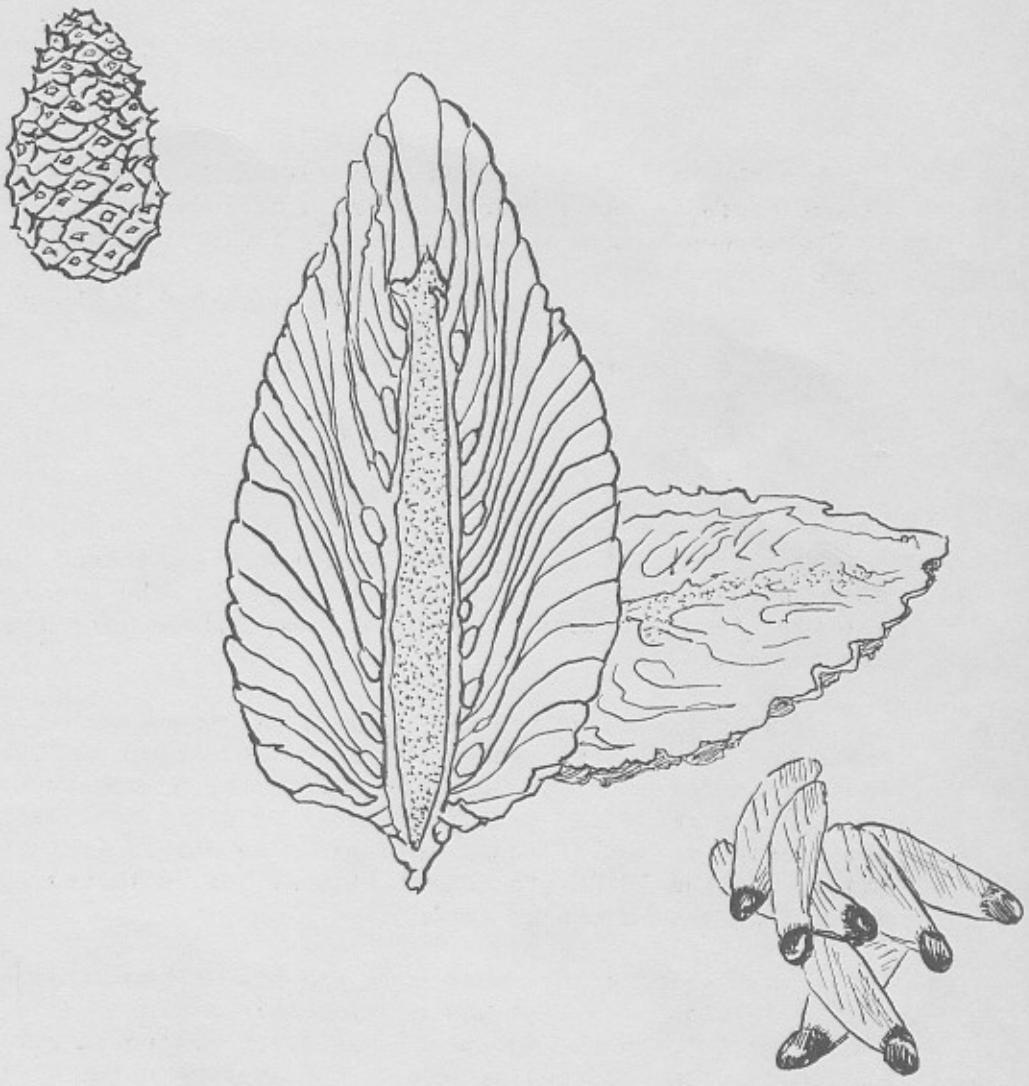
CUTTING CONES to predict sound seed



Virginia Division of Forestry
Department of Conservation and Economic Development

PREDICTING NUMBER OF SOUND SEEDS PER CONE
FROM
A CONE CUTTING STUDY IN A 12 YEAR OLD LOBLOLLY ORCHARD

By: T. A. Dierauf and R. G. Wasser

In the Fall of 1973, 600 open-pollinated cones were collected from the oldest trees in the Virginia Division of Forestry loblolly pine seed orchard at Providence Forge, according to the following sampling procedure:

2 orchards (Coastal Plain and Piedmont origin)

10 clones per orchard

6 ramets per clone

5 cones per ramet

Each cone was cut in half length-wise on a band saw, and the sound, cut seed on each face were counted and removed. The average of these two counts was used in the analysis. The two cone halves were placed in a bag for drying and extraction.

When the cone halves had opened, all seeds were picked out. Hollow seeds were floated off and sound seeds were counted. The total number of sound seed for each cone was the sum of the average number of sound, cut seed on the two faces plus the number of sound seed extracted after drying. The average number of sound seed per cone was 58 for the 10 Piedmont clones and 59 for the 10 Coastal Plain clones, but there was considerable variation among clones as shown in Table I.

Separate plottings were made and linear regressions calculated for each of the 20 clones. There was considerable difference in the slopes of the regressions (b), in the amount of variation accounted for by the regressions (r^2), and in the standard deviations at the average value of the independent variable (average number of sound, cut seed per cone). Table I presents this data for the 20 clones.

Table I. Average number of sound seed per cone, regression coefficients, r^2 values, and standard deviations by orchard and clone.

Orchard	Clone	Average Number Of Sound Seed Per Cone	Regression Coefficients a	b	r^2	Standard Deviation
Piedmont	506	53	20.3	4.6	.52	13.4
	6-7	83	26.8	7.2	.27	28.8
	521	54	12.9	7.5	.67	16.0
	508	74	48.5	2.4	.04	26.1
	524	37	8.1	5.1	.51	17.8
	525	66	30.3	4.4	.30	15.6
	532	59	24.7	6.5	.38	19.8
	517	64	26.3	4.8	.27	20.3
	512	51	60.6	-1.2	.01	16.7
	14-15	40	12.8	4.4	.56	13.4
	Average = 58					
Coastal Plain	523	32	11.1	8.8	.71	12.0
	2-8	46	11.9	8.2	.53	20.6
	529	52	6.1	5.1	.51	15.0
	503	95	22.5	5.7	.67	15.9
	543	29	3.1	6.4	.51	12.4
	513	71	26.4	6.1	.64	16.4
	504	82	10.6	8.6	.84	12.6
	4-18	48	19.4	7.6	.65	14.5
	6-13	93	45.0	6.8	.41	20.1
	6-28	46	16.8	7.0	.80	10.8
	Average = 59					

In Table I, it is apparent that regression slopes were steeper on the average for the Coastal Plain clones. Pooled regressions were calculated for each orchard. When these pooled regressions were tested for common slopes, the slopes were different at the .005 level. These pooled regressions, and a single pooled regression for both orchards are presented below and in Figure I.

Piedmont :	$\hat{Y} = 21.88 + 4.98\ X$	$r^2 = .32$, Std. Dev. = 22.0
Coastal Plain :	$\hat{Y} = 18.85 + 6.44\ X$	$r^2 = .63$, Std. Dev. = 20.5
Combined :	$\hat{Y} = 19.44 + 5.79\ X$	$r^2 = .49$, Std. Dev. = 21.6

$\hat{Y}$ = estimated total number of sound seed per cone
X = average number of sound cut seed

Although these equations were developed from cones collected from 12 year old grafted trees, they may be applicable to natural stands and older trees. The coastal plain equation is almost identical to an equation developed by B. F. McLemore. 1/

$$\hat{Y} = 18.06 + 6.52\ X$$

Table 3 presents the estimated total number of sound seed per cone for different values of the independent variable, for the 4 equations above and a suggested "rule-of-thumb" equation for field use in both the Piedmont and Coastal Plain of Virginia.

Table 3. Estimated Number of Sound Seed per Cone for Different Numbers of Sound Cut Seed

Average number of cut seed	Virginia Seed Orchard			McLemore	Rule-of-Thumb $\hat{Y} = 6X + 20$
	Piedmont	Coastal Plain	Combined		
2	32	32	31	31	32
4	42	45	43	44	44
6	52	57	54	57	56
8	62	70	66	70	68
10	72	83	77	83	80
12	82	96	89	96	92
14	92	109	100	109	104

1/ McLemore, B. F., 1961. Estimating Pine Seed Yields. Southern Forest Experiment Station. Southern Forestry Note No. 134.

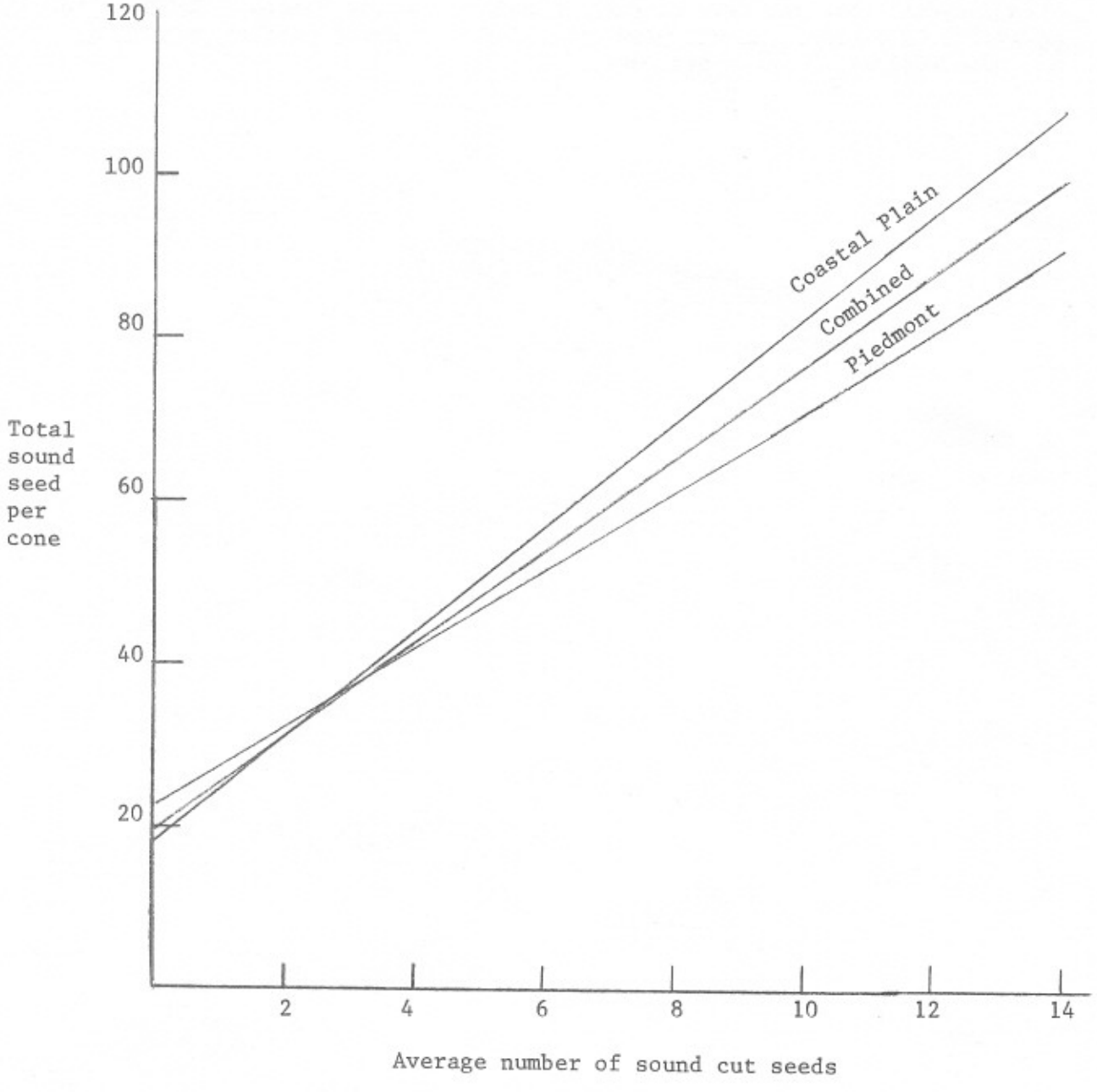


FIGURE I. Regressions for Coastal Plain clones, Piedmont clones, and both combined.

Based on the standard deviation for the combined equation, for the average yield of about 60 sound seed per cone, a sample of 15 cones would have been needed to estimate the average number of sound seed per cone with a 95% confidence interval of $\pm$ 20%, and a sample of about 50 cones for a 95% confidence interval of $\pm$ 10%. Because of the great variation from tree to tree (note the variation among clones in Table I) it is suggested that only one cone per tree be used in collecting the sample. Cones collected should be typical and come from the middle or upper part of the crown, not from suppressed lower branches.