Efficiency of regular spacing planting designs

Harry V. Wiant, Jr.1

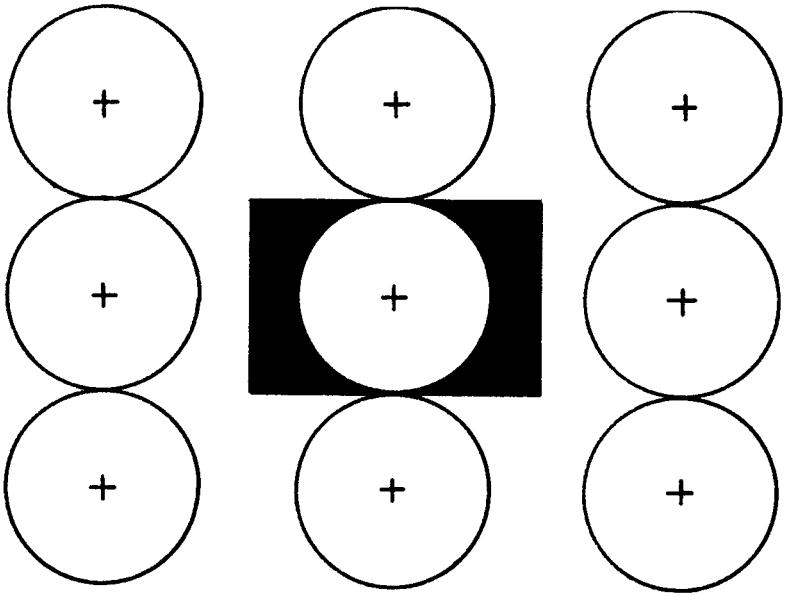
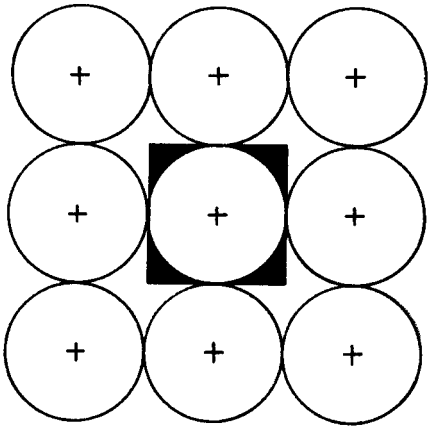


Figure 2.—Hard-to-fill space (shaded area) for rectangular design.

Figure 1.—Hard-to-fill space (shaded area) for square design.



Plantations with regular spacing may be arranged in rectangular, square, superposed squares, or equilateral triangular designs (1). With the square or rectangular patterns, seedlings are set at the four corners and rows cross each other at right angles (figs. 1 and 2). Both patterns have been very popular.

1 Professor of Forestry, School of Foresty, Stephen F. Austin State University, Nacogdoches, Tex. Present address: Division of Forestry, West Virginia University, Morgantown, W. Va. 26506.

The superposed squares design involves planting at the four corners of squares, and at the centers of these squares by a second crew (fig. 3). The same result can be achieved by planting in squares at a spacing equal to the square root of (a squared/2)
where a equals the spacing planned for the original squares.

For the equilateral triangular design, seedlings are set equal distances apart at the three corners of triangles (fig. 4). In this design, if the distance between

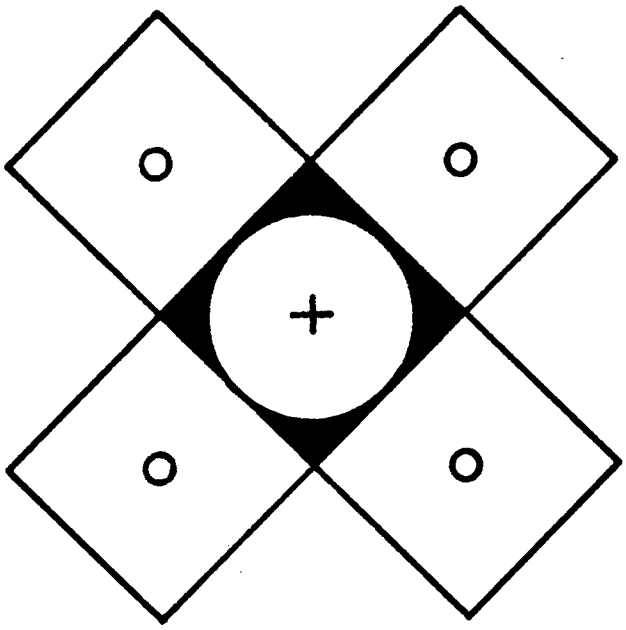


Figure 3.—Hard-to-fill space (shaded area) for superposed squares design (+ = seedlings planted by first crew; o = those planted by second cres).

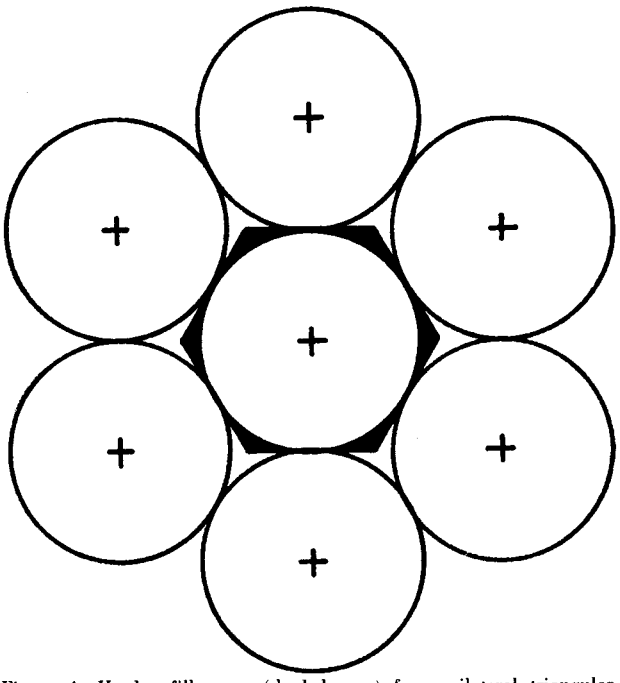


Figure 4.—Hard-to-fill space (shaded area) for equilateral triangular desing.

trees is a, the distance between adjacent rows is $a^2 - \frac{(a)^2}{2}$.

Growing Space

It is useful to consider the utility of the space afforded for horizontal crown extension, and related stem growth, by these spacing patterns. Tree crowns tend to have circular horizontal crown outlines when open-grown. After circular neighboring crowns meet, as in a plantation, the remaining horizontal space tends to be filled, but the growth rate must be less than the potential as the crown is not free to expand in all directions. For the purposes of this paper, the horizontal space allocated to each tree after the circular crowns have met will be termed "hard-to-fill space.

Design Efficiency

The efficiency of spacing planting designs, as illustrated in figures 1, 2, 3, and 4, is shown in table 1. As compared in this analysis, the equilateral triangular design results in less than half as much hard-to-fill space as the square and superposed squares designs (9 percent vs 22 percent). The rectangular design is the least efficient, its hard-to-fill space increasing with increasing differences in side dimensions and always exceeding 22 percent.

Studies are needed to determine the practical importance of these theoretical differences.

TABLE 1.—Percent hard-to-fill space of total horizontal area allocated to each tree by regular spacing planting designs

Planting design	*percent hard-to-fill space*
Equilateral triangular	9
Square	22
Superposed squares	22
Rectangular	more than 22