containing 25 ppm indolebutyric acid, 12 ppm indoleacetic acid, 12 ppm naphthaleneacetic acid, 10 ppm vitamin B_1, all essential mineral elements and 5 per cent. sugar. The most favorable environment, according to present information, is as follows: well-drained sand as the rooting medium, full sunlight in nursery, high humidity, temperatures between 75° and 90° F., and cuttings exposed to fine spray of water (from atomizing nozzles mounted above the beds), with spray on either continuously or for 5 minutes out of each 10-minute cycle for from 10 to 12 hours each day. The spray system used is an adaptation of the spray chamber technique described by Raines.[4]

All research in propagation is being pointed toward the development of effective vegetative techniques sufficiently simple for large-scale use under nursery conditions. If successful, it is possible that certified high-yielding planting stock will be produced in public nurseries and offered for sale to land owners at or below cost. When one considers the rate at which trees grow in the naval stores belt, and that normally over 100 million trees are planted annually in the Southeast, the possibilities of this undertaking become more apparent. It is reasonable to believe that the development of high-yielding stands would contribute greatly to the solution of production problems which have long troubled the $25,000,000 a year naval stores industry, which supports some 50,000 workers and their dependents. Yield increases of 200 per cent. or more seem possible of attainment. By thus increasing the average output per tree it should be possible to reduce production costs sufficiently to meet low prices and competition from synthetics, and at the same time allow good wages for labor and an adequate profit for the producer.

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A NEED FOR MORE UNIFORM USAGE OF WORDS OF INDEFINITE MEANING

IN science it is our practice to observe, accurately measure and record and, accordingly, we are ever faced with the necessity of posing mathematical relationships. Despite the vast and rapid accumulation of recorded data which makes up the body of our respective sciences, it is nevertheless true that the greater part of our knowledge as individuals consists of a memory of casually observed phenomena which we have not yet taken the time to analyze, accurately measure or record. Thus in our general discussions we are obliged to make use of words of indefinite meanings, such as "few," "some," "very," "many," "much," "most," "frequent," "slightly" and "seldom."

During a discussion with a group of scientific friends I was interested to note that there was no agreement among them as to the relative significance of these words. If to each mind they conveyed differing impressions, these words are not as efficient as they might be as vehicles for our thoughts. It has occurred to me that as these words are such useful tools, it would be a worth-while project to attempt to increase their usefulness by more narrowly restricting their meanings and by securing a more uniform usage.

As a preliminary step I have tabulated the impression some of these words convey to me. I have expressed them in terms of approximate percentage spread of the relative frequence or intensity they indicate to me. Obviously their meanings must indicate approximations, for they indicate frequencies we do not know. In each case also their meanings will vary with the nature of the subject of discussion, but in each case the percentage noted is in relation to a maximum applicable to the particular case. I do not expect acceptance of any of my figures, but it would be of great interest to learn how great will be the variance shown by our readers.

TABLE 1

Per cent. frequency indicated		Per cent. frequency indicated	
1, 2	very few, seldom	60, 70	
3, 4, 5	few, some, slightly	80, 90, 95	most
10, 15, 20, 25	many, much, frequent	98, 99	practically all
		100	all
30, 40	very many		
45, 50, 55	about half, average (in general sense)		

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SCIENTIFIC BOOKS

FOREST TREE SEED

Forest Tree Seed. By HENRY IVES BALDWIN. The Chronica Botanica Company, Waltham, Massachusetts, and G. E. Stechert and Company, New York, N. Y. $4.75.

THE great conservation programs that our country had under way during the middle and late 1930's re-

[4] M. A. Raines, *Am. Jour. Bot.*, 27: 10, 18, 1940.

quired vast quantities of forest tree seeds. Pines, spruces, larches, redwood and Douglas fir were planted for timber; oaks, hickories, ashes, walnut and yellow poplar to stabilize eroding farmland; hackberry, Osage orange, mulberry and green ash for shelterbelts; locusts for road banks; wild cherries and plums for game food; and many ornamentals for landscaping. For all purposes, it is estimated that the United States used annually during the late 1930's some three million pounds of forest seed, costing in the neighborhood of $1,500,000. Species used or considered for use total almost 700 for the country as a whole. In addition, prior to the war our country enjoyed a relatively vigorous export trade in tree seed, and at various times in the past has imported important quantities from Europe.

In contrast to most agricultural seed, forest tree seeds are notoriously difficult to handle. Many species bear usable seed crops irregularly, and often these are destroyed by seed-eating birds and rodents that congregate in extraordinary numbers at the time seed is shed. The fruits or cones must be harvested from tall trees or diligently searched for in well-secluded squirrel caches. Extraction techniques are involved and great care must be taken not to injure the delicate seed in the process. Unless the seed is stored under optimum moisture and temperature conditions, viability is limited in many cases to a few days' or a few weeks' time. Germination after sowing is often irregular and frequently delayed for at least a full year while seed coats disintegrate and the embryos after-ripen.

The study of tree seed cuts across the fields of genetics, embryology, histology, morphology, physiology and biochemistry on the one hand, phenology, bioclimatics, ecology, pathology, parasitology and entomology on the other. An authoritative book on tree seed is therefore both a welcome addition to plant science literature and a much-needed reference book for the many men who are engaged directly or indirectly in the use of tree seed for forest, ornamental or other planting. The preparation of such a book was an ambitious undertaking. It is fortunate that the author is widely experienced in forest research and thoroughly familiar from first-hand knowledge with a large number of tree seeds and with the techniques developed in the important American and European seed laboratories.

The first seven chapters of the book present information that the seed collector and seed dealer require, but with a broad enough background to interest students as well. Here is included the general description of seed, their life histories, their physical and chemical structure and their various economic uses. Collectors will be particularly interested in the discussion of periodicity of bearing, forecasting of seed crops and the natural distribution of seed. The seed user needs to know how many desirable hereditary characteristics are related to the geographic origin of the seed. This subject, widely studied in Europe, is receiving increasing attention in the United States by both agriculturists and foresters. However, only a few American species have been tested experimentally to determine the extent to which they contain racial differences dependent on the climate and soils of their native habitats.

Baldwin has done an excellent job in covering the collection, extraction and storage of coniferous seed. The treatment of these subjects includes both a historical résumé and the latest modern technique. Such treatment is highly desirable, inasmuch as we can find in America to-day all stages of crudity and refinement in the collection, extraction and storage of tree seed. Modern techniques of extracting seed from cones have been based on thorough experience in the artificial drying of lumber. As a result, it is now possible to use high kiln temperatures, low humidities and short extracting times, thereby recovering seed of high viability and containing the proper moisture content for storage.

The entire second part of the book is devoted to seed germination and seed testing. The fascinating interrelationships between forest seed and their natural environment, especially their mode of dispersal, storage and germination under natural conditions, unfold a field of ecology, the many ramifications of which are at present only dimly surmised. Baldwin describes clearly the many causes of dormancy and touches briefly on the utility of dormancy mechanisms in protecting the seed against loss through premature germination. The influence of external factors on germination and the chemistry of germination are both adequately handled in view of current information on these subjects. The author goes into minute detail in discussing the techniques used in seed testing and purity analyses by seed laboratories in our own country and foreign laboratories operating under the international rules for seed testing. The chapter dealing with the determination of origin by laboratory means describes a number of techniques that have been proposed, but does not point out adequately the difficulties involved in their use. Techniques that have proven more successful in determining the origin of agricultural seed, such as weed seed content, the reaction of the seedlings to various lengths of day and various physiological tests, are passed over largely because these have not yet been adapted successfully to tree seed analysis.

To the uninitiated reader it may appear that Baldwin's treatment of many subjects is hurried or super-

ficial, even though the book does contain an impressive bibliography of more than 800 citations. Actually, such an accusation has little justification. A truly exhaustive search of the literature has been made, and relatively few important omissions will be uncovered even by the specialist in the field. Suggestions for improvement can, of course, be made. For instance, the text bears signs of important omissions of data and condensations of treatment that rob it of much of the richness possible to include in a larger volume. Little space is devoted to methods of collecting, cleaning and storing the seeds of hardwoods that recently have come into wide use for shelterbelt, erosion and game food planting. It is true that little has been published on hardwood seeds even though much is known. Readers particularly interested in hardwoods will find a more complete treatment in the recent nursery handbook prepared by Engstrom and Stoeckeler.[1] The discussion of periodicity of seed production could have been strengthened materially by drawing upon horticultural literature on irregular bearing of apples and other fruits. Important studies of wind dissemination by Hesselman and others merit mention. The present status and future needs in the field of tree seed research are inadequately set forth. However, throughout the several chapters suggestions for valuable research will occur to the imaginative reader. Other subjects that might have been more completely developed for the American reader include the life history of seed, provenance and the behavior of seed in their natural environment. The Swedish and German explanations on maps and diagrams shown in the text should have been translated for American readers. The book does not bring together the status of knowledge on individual species. A manual covering this subject is now under preparation by the U. S. Forest Service.

On the whole, however, the book is scholarly, readable and informative. It fills a long-felt need. Not the least of its valuable contents is the 16-page glossary of tree seed terminology that immeasurably increases its utility. It is hoped that this book will help to open the field for intensive study during the coming years.

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ALLEGHENY FOREST EXPERIMENT STATION

SPECIAL ARTICLES

CROSS-CIRCULATION AS A METHOD IN THE STUDY OF DRUG FIXATION AND POISONING

IN the endeavor to study the mode of the vago-paralytic action of amytal, two cross-circulation experiments were performed in which one animal received amytal and the other paraldehyde; the latter does not paralyze the vagus. Both drugs were given one hour previous to the beginning of cross-circulation. It was believed that if amytal did not prevent the formation of acetylcholine the partner under paraldehyde anesthesia might show cardiac inhibition and fall of blood pressure following the stimulation of the vagus of the amytalized animal. The results were disappointing, however, because before the beginning of cross-circulation the vagus of the amytalized animal was paralyzed and the vagus of the other animal was not, whereas during the progress of the cross-circulation the vagus of the amytalized partner became more responsive and the vagus of the other partner less and less responsive to faradic stimulation. This substantiated the original assumption of the authors[1] that fixed anesthetics do not actually remain permanently fixed in the tissues.

It was decided to study this problem further by administering 250 mg of barbital sodium per kgm of body weight to five dogs intravenously and wait for about 2 hours until the barbital action was at its maximum. Then each of these dogs was united with an etherized partner weighing almost three times as much and cross-circulation was begun.

The pairs of dogs used in these experiments were given 2,000 Roche Inhibitor Units of heparin (Roche) per kgm. Then the left carotid artery of the first dog was connected with the right external jugular vein of the second dog, and the right carotid artery of the second dog was connected with the left external jugular vein of the first dog. This operation was carried out by tying off the cephalic end of each vessel in the neck and inserting the ends of the U-connecting cannulae into each vessel caudally. Each of the small U-cannulae was filled with normal saline and all air expelled before the ends of the cannulae were tied in place. The bull-dog clamps were removed from both carotid arteries simultaneously when cross-circulation was begun.

The cross-circulation lasted for an hour, using ether whenever necessary for tranquilization, and after this period the partners were separated from each other and their wounds closed. The dogs receiving 250 mg of barbital sodium recovered[2] in an average time of

[1] H. E. Engstrom and J. H. Stoeckeler. 1941. Nursery Practice for Trees and Shrubs. USDA Misc. Publ. 434.

[1] Dille, Linegar and Koppanyi, *Jour. Pharmacol.*, 55: 46, 1935.

[2] Recovery-animals can stand without support. These animals were in about the same state as those receiving 50 to 70 mg of barbital sodium per kgm.