23. Koranski, D., and A. Hanza. 1978. Growing plants in composted hardwood bark. p. 18-20. *In* Proc. of the Second Woody Ornamental Disease Workshop. Univ. of Missouri, Columbia. 31 p.

24. Krogstadt, O., and K. Solbraa. 1975. Effects of extracts of crude and composted bark from spruce on some selected biological systems. *Acta Agric. Scandinavica* 25:306-312.

25. Malek, R.B., and J.B. Gartner. 1975. Hardwood bark as a soil amendment for suppression of plant parasitic nematodes on container grown plants. *HortSci. 10*:33-35.

26. Parr, J.F., E. Epstein, and S.B. Wilson. 1978. Composting sewage sludge for land application. *Agriculture and Environment* 4:123-137.

27. Solbraa, K. 1974. Composting of bark. Proc. Symp. West-European Working Group on the Standardization of Bark Compost in Horticulture. Ghent. 10-14:39-85.

28. Still, S.M., M.A. Dirr, and J.B. Gartner. 1974. Effect of nitrogen and composting on decomposition of barks from four hardwood species. *Forest Prod. J.* 24:54-56.

29. Still, S.M., M.A. Dirr, and J.B. Gartner. 1976. Phytotoxic effects of several bark extracts on mung bean and cucumber growth. *J. Amer. Soc. Hort. Sci.* 101:34-37.

30. Uemura, S. 1973. Production and application of composts from wood residues. *Wood Industry* 28:237-248.

PLANNING, RECORDING, AND REPORTING PROPAGATION PROCEDURES AND RESULTS

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In obtaining new information from experimental studies, a set of procedures has been developed by the scientific community which, over the years, has worked very well and is generally adhered to.

For the IPPS, it is advisable for us to follow this same pattern in planning, conducting and reporting experimental projects (1,2). This article has been prepared to assist Society members in setting up experiments, recording results, and preparing their papers for publication in the IPPS Proceedings.

The general outline of these accepted procedures, and how they transform into a manuscript ready for publication are listed below and will be discussed using the final sections of the completed articles as an outline:

1) **Title of article.** Considerable thought should be given in selecting a title which will be brief yet informative and complete. The title of the article is all the reader will see in literature citation lists or reviews so the title should be as informa-

tive as possible.

2) **Authors names and addresses.** Often more than one author is involved in the project. Be sure all persons who have made significant contributions to the project are included as authors. It can be a diplomatic problem sometimes deciding whether a co-worker should also be a co-author or merely receive an acknowledgement for his efforts. The degree of contribution is the criterion to use in making such a judgement. The institution where the work is done should be listed as the address so it will receive credit for its contributions. If one or more of the authors has since moved, or will move, to another location this can be indicated as a footnote giving the new address.

3) **Abstract.** The abstract should be thought of as a very brief condensation of the entire article: what was done, what was found out, and what were the significant conclusions from the work. If the title of the article interests the reader, he will next read the abstract to see if the article is about what the title says it is and, if so, may feel it is worth his time to study the article in detail. The abstract serves a very useful purpose but is often difficult to prepare, putting into a few words the really significant points in the article.

4) **Introduction.** This should be short and may or may not be labelled as an introduction. An introductory paragraph is necessary, however, giving some background about the problem, stating the importance of the project, the necessity for doing the work and what new information is needed.

5) **Review of literature.** It is important to determine the current status of knowledge about a subject before the planning and actual work on the project begins. This may save repeating work already done elsewhere with the knowledge already well accepted. A thorough literature review may give some good clues from other articles as to how to plan the work and what methods to use. Sometimes it is helpful to contact previous workers on the same subject directly and talk to them about pitfalls to avoid and to gain suggestions from them for the proposed project.

Good sources of published articles to study dealing with various aspects of plant propagation are:

Proceedings of the International Plant Propagators Society. An issue has been published each year since 1951. An index for Vols. 1 through 22 is available. The Proceedings contain invited papers presented each year at all the Regional Annual Meetings.

The Plant Propagator — (IPPS Newsletter) Vols. 1 through 25 have been published. This contains short contributed articles.

Journal of the American Society for Horticultural Science, the earlier *Proceedings* of the *ASHS*, and the companion publication, *HortScience*. These publications contain many articles dealing with various aspects of plant propagation. The last issue of the Journal each year contains an index for that year. These publications would be in libraries of universities having agricultural colleges.

Horticultural Abstracts. Monthly publication prepared by the Commonwealth Bureau of Horticulture and Plantation Crops, East Malling Research Station, Maidstone, Kent, England. Abstracts of articles on all phases of horticulture including plant propagation, taken from journals from all over the world are listed by subject matter. Horticultural Abstracts would be available in the library of universities having agricultural colleges.

U.S.D.A. Current Research Information System (C.R.I.S.). Those working in the U.S.D.A. and State Agricultural Experiment States who prepare annual progress reports under this sytem are eligible to use C.R.I.S. to obtain computer print-outs describing work in progress and the investigations involved on a given subject throughout the system. For example, a request for: PLANT PROPAGATION/CUTTINGS brought a stack of progress reports ¾" thick.

Look in the literature citations of articles you have at hand for further references of interest to the project. Often all the published literature on a subject can be tracked down in this way if good library facilities are available.

6) **Materials and Methods.** Here the description of the materials used in the experiment and the methods involved are discussed. Considerable planning should take place before the actual onset of the work. The plots should be planned so that some type of statistical analysis of the data can be made. Replicates of the various treatments are required for statistical analysis, laid out so that all receive equal treatment except for the treatment under test. It is necessary to be able to determine whether any differences obtained in the experiment are due to the treatment (s) being given or are due merely to chance.

There are some simple, easy to read, statistic books available to assist in setting up experimental plots (4).

The materials and methods described in the article should be detailed enough so that someone else could repeat your experiment from the information given. Dates, temperatures, humidity, moisture levels, light intensity and exact and correct names of plant materials used are items that should be stated.

All pertinent factors should be mentioned. For example, if rooting percentages are being reported from cuttings of a plant known to be almost impossible to root, but the cuttings were taken from a one-year-old seedling plant rather than from a mature plant, this should be stated so the reader will know that the juvenility factor is likely to be involved.

7) **Results.** Take copious, diary type notes throughout the course of the experiment. They may help explain unexpected results at the end of the trial. Keep precise numerical records of all changes taking place. For example, it is of little value to state, "that the plants in group A were larger than those in group B". Measure the height of either all, or a representative sample of plants in replicate lots of both groups. Data can be presented either in tables or as graphs.

Tables should be a condensation of raw data, brief and arranged so that the comparisons being made are obvious. Tables should also contain the statistical analysis of the data. Do not repeat data presentation in tables, graphs, and narrative. Let the narrative supplement the basic presentation of results in tables or graphs. Plan the legend for the table or graph carefully to explain clearly what the data being presented is about. Footnotes are often helpful in supplementing the legend. Graphs should be drawn with black India ink on heavy paper. Lettering should be done with press-on letters or a lettering guide (never with a typewriter). Letters on the graph should all be the same size and large enough so they will not disappear when the graph is reduced for publication (5).

When submitting graphs or drawing for the IPPS publications prepare them exactly as they need to be for publication. Do not submit pencil sketches as we have no facilities for preparing the final inked drawings.

We should be using more photographs in the IPPS Proceedings than we do. Photographs are often very effective in presenting results. For publication, use only black and white prints made on glossy, high contrast paper. Take photographs of plants out-of-doors in solid light shade, rather than in sunlight, so that distracting shadows do not appear. Take close-up shots of plants with only a few comparisons in the photo. Do not include labels in the photo; these can be added in the legend. For example, three groups of plants in a photo could be identified and described in the legend as "left", "center", and "right". A professional photo shop should develop negatives and make prints.

Prepare each figure or table on a separate sheet of 8½ × 11 paper. When preparing a figure remember that the legend goes below the figure, but in a table the legend is across the top.

8) **Discussion of results.** This is often the most difficult part of the paper to prepare but it can be the most interesting. The pertinent new information from the experiment can be pointed out and related to existing information on the same subject. Does it agree or disagree with information from previous similar studies? Statements as: "These results are in agreement with those reported by Jones ( )" are better than, "Jones' ( ) conclusions are in agreement with our results". Jones reported first. Unexplained results can be mentioned as well as areas where further work is needed. The importance of the new information developed can also be stressed.

9) **Acknowledgements.** Thank persons who aided in the study in work or advice, but not sufficiently to warrant recognition as a joint author. Give credit for financial assistance from any grant funding agency or commercial grower or industrial group.

10) **Literature Cited.** This consists of papers mentioned in the literature review and discussion sections. Only pertinent articles are usually listed to keep this section from becoming too lengthy. For IPPS publications, use the style for literature citations found in recent issues of the IPPS Proceedings.

We have been considering so far articles resulting from planned experiments where several different treatments may have been given. Some of the valuable articles appearing in the IPPS Proceedings are based, however, on results obtained by many years of observations with particular plants under particular conditions by observant horticulturists or plant propagators. This experience often involves hundreds of thousands of plants for a number of years. While no controlled experiments are set up the information obtained from such practical situations is invaluable and is certainly worth recording in the Society publications.

One of the great strengths of the IPPS is the mingling of information resulting from work by the Society members trained in the use of scientific methodology with articles resulting from observations over the years by our nursery members who have accumulated considerable information by dealing with great quantities of plant material year after year.

After the article has been written in a first draft it is advisable to have several persons read it over for clarity, grammar, and brevity. Be particularly careful to use correct plant nomenclature, using the latest accepted species and cultivar names. Consult a recognized authoritative work (3,6) to check the plant names you are using. Note that in IPPS publications, in conformity with modern plant science terminology, the word, *cultivar*, is used rather than the word, *variety*. Be careful, too, of

the word "media", which we use a lot: "media" is plural — "medium" is singular.

The final article should be typed double spaced on heavy bond white 8½ × 11 inch paper (not legal size). Three copies should be prepared — two, including the original, to go to the Regional Editor, one of which will be sent on to the International Editor. One copy should be kept by the author or authors. Carbon copies, which can get blurred, should not be submitted to the editors.

For publication in the IPPS Proceedings, all manuscripts are edited first by the Regional Editor, then the International Editor, then are checked by the Botanical Editor for accuracy of plant names. The manuscripts then go to the printer in batches, Region by Region, in the order they are received. Galley proofs are returned to the Regional Editors who sends to each author the galley proof of his, or her, article. Corrections or changes can be made by the author, Regional Editor, or International Editor at this stage. Changes should be held to a minimum, since the Society is charged for any changes made at the galley proof or at later stages. After corrected galley proofs have been received from all six Regions and Chapters (which takes about 9 months), they are returned to the printer who makes all corrections and returns a set of page proofs to the International Editor. These are compared with the corrected galley proofs for accuracy. At this stage a Table of Contents and an Index is prepared. The Secretary-Treasurer prepares the membership directory as well as an annual report to go in the front part of the book. A final "silver" proof is sent by the printer to the International Editor for a last inspection before printing is done. All photographs and line drawings have been inserted at this stage and must be checked for correctness.

After all copies are printed they are mailed by the printer in Sacramento, California to all members whose dues have been paid.

About 12 months are required from the time the first Region's manuscripts are received until the book is finally published.

LITERATURE CITED

1. American Institute of Biological Sciences. 1979. C.B.E. Style Manual. *A.I.B.S. Arlington, VA.*
2. American Society for Horticultural Science. 1979. Information on publishing in the Journal of the A.S.H.S. *A.S.H.S., Mount Vernon, VA.*
3. Bailey, Liberty Hyde and Hortorium Staff. 1976. Hortus Third. Macmillan, New York.
4. Little, T.M. and F.J. Hills, 1978. Agricultural Experimentation, Design and Analysis. John Wiley, New York.

5. Maxie, E.C. and D. Edwards. 1971. Preparing graphic materials for publication. *HortScience* 6/377-331, 574.
6. McClintock, E. and A.T. Leiser. 1979. An annotated checklist of woody ornamental plants of California, Oregon, and Washington. *Univ. Calif. Div. Agr. Sci. Publ. 4091.*

SYSTEMS APPROACH FOR OPTIMIZING NURSERY OPERATIONS

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Mechanization of any operation is done for the purpose of increasing its efficiency. Often the attitude is taken that machines are installed to replace workers. Instead we should view mechanization as a means of improving workers' efficiency and making their jobs easier. Men and machines must work together in an integrated fashion before an overall system can be improved. Machines do not necessarily improve every situation. We must look at the entire operation before we can decide whether or not a machine is needed for a particular job. To often a machine is installed at one point in production while operations before and after are not changed. As a result the machine cannot be utilized on a continuous basis. Systems analysis can help pinpoint such problems.

Systems analysis using a dynamic computer simulation model is a logical-mathematical representation of a system used for analyzing and identifying problems in a wide variety of industrial and agricultural problems. Numerous simulation models have been developed and usefully employed in various decision-making processes and identifying critical problems in systems ranging from scheduling tillage operations to harvesting and handling agricultural products. However, this valuable technique has not been employed for nursery production analysis. This paper briefly explains how this technique can be used for analyzing a simple system and then describes the analysis of two nursery operations, soil mixing and transporting containers to the field.

Let us consider a simple system consisting of a barber and customers who are seeking the services of the barber. For our example, let us consider that only one barber is available and customers arrive randomly. It is to be determined whether there is a need to add another barber to provide an efficient service so