# A COMPUTER-BASED PLANT/SOIL-AERATION BIBLIOGRAPHY

Keywords: Soil-oxygen, ODR

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## INTRODUCTION

Numerous reviews of the general topic of plant and soil aeration have appeared in the past generation. Two comprehensive recent examples are Kozlowski (1984) and Glinski and Stepniewski (1985). Each is excellently documented and thoroughly covers its subject matter, though perhaps from somewhat divergent perspectives. As might be expected the source of citations contained in each volume's bibliography largely reflects the geographical orientation and principal area of expertise of the contributors. In each case, undoubtedly, the authors compiled large collections of reprints and second-source citations which were summarized and synthesized into reviews. In the process, the authors characterized the citations of which they were aware, eliminated some of these from final use in the reviews, and probably missed some citations in the literature.

The nature of review writing, until only recently, has demanded that these efforts be largely individual, uncoordinated, tedious, and transitory (the work of collecting and compiling the information is usually lost with the author's shift of interest, retirement, or other activity-influencing career changes). Occasionally such a bibliography may be handed down from major professor to student. Even in these cases, however, the bibliographies are not widely available.

The advent of computer-based information storage and retrieval

has created new opportunities. Commercial literature retrieval services exist that scan organized data bases (e.g., SCI SEARCH* and DIALOG). Even with the continued expansion of the data bases of these systems they have certain shortcomings. For the unfamiliar users of these systems there is usually difficulty in limiting the searches sufficiently to retrieve only desired citations without excluding elusive citations that may be unconventionally titled or that may not contain certain specific keywords needed to retrieve the desired citations. Commercial literature retrieval can also prove to be expensive for some users, particularly if a comprehensive retrospective search is desired.

If a subject matter area were sufficiently limited in scope it could be possible for a few interested researchers to cooperatively compile a highly comprehensive listing of the relevant literature. A familiar example of such an effort was the compilation of a bibliography on the topic of $^{15}N$ by Hauck and Bystrom (1970). Their bibliography, published as a book, provided an excellent fixed resource, but one which lacked the capacity to grow or be manipulated. The advent of powerful micro computers and inexpensive data-base software now enables the compilation of highly-specific manipulatable bibliographies. These bibliographies offer the advantage of being indexed by author, date, keywords, etc., of being sorted by subcategories, and of being copied and shared in a compact format (e.g., on floppy disk, tape, EPROM), and easily updated and expanded.

## METHODS

The authors have used a commercially available bibliographic program (REF 11) from DG Systems, Hartford, CT, to compile a comprehensive bibliography of soil-aeration related literature. The software is compatible with most mini and mainframe computers and several PC's. The software is available for IBM-PC/XT/AT, MS-DOS, CP/M 80, RT-11, TSX-Plus, RSX-11, P/OS, and VAX/VMS operating systems. The authors used it on a VAX-11/750 where the REF-11 used about 75 K-bytes of space for the execution and format files, plus about 256 K-bytes of storage for the 1300 references themselves. Output of the references can be in the VAX/VMS operating system or in ASC II code, indexing the various fields of information with codes such as "AUTHOR=NAME YEAR=1986 TITLE=..." This format uses about 450 K-bytes of storage for the 1300 references. As of this writing approximately 1300 titles have been entered and categorized according to thirty-four topic areas. Each title can be classified by as many as 8 topics simultaneously. Subsets can be extracted by using combinations of topics, dates, or authors. An especially attractive aspect of this particular software is a comment page attached to each title which the librarian may use to enter the abstract and/or to record pertinent notes regarding each article

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for later recall and use.

The keywords used to categorize the plant/soil-aeration bibliography have come about somewhat arbitrarily and reflect the authors' research interests. In the course of compiling the first draft of the bibliography it has become clear that some concepts were not adequately categorized or were not sufficiently specific. Some other categories were not created and may have to be established at a later date; for example, the category of "reviews" was not specifically delineated. Below is an alphabetical listing of the first 34 topic keywords and their approximate conceptual definitions (numbers in parentheses are number of entries so categorized).

INDEX TO KEYWORDS

1. # (669) indicates second-source entries for which the authors have no reprint. As such, the additional keywords were derived from titles only, and may be incomplete or partially inaccurate.
2. Biochemistry (105) describes papers that report the effects of plant/soil-aeration on the concentrations of various biochemicals found in plant tissue or soil and the effects on plants.
3. CO2 (123) describes papers that deal with carbon dioxide in the three phase soil system and its relationship to plant/soil-aeration phenomena.
4. Compaction (58) describes papers that report interactions between plant/soil-aeration and variations in soil bulk density, soil strength, or crusting.
5. Diffusion (144) describes papers that deal with the fundamental diffusive properties of the three phase soil system, particularly related to gases, and their relationship to phenomena observed in conjunction with changes in plant/soil-aeration.
6. Disease (29) describes papers that report interactions of plant disease, including nematodes, with plant/soil-aeration.
7. Ethanol (31) describes papers that report the effects of plant/soil-aeration on the concentrations of ethanol found in plant tissue or soil.
8. Ethylene (109) describes papers dealing with soil or plant ethylene resulting from poor soil aeration or flooding, or ethylene related phenomena that relate to syndromes symptomatic of poor plant/soil-aeration.
9. Flooding (372) describes papers which deal predominantly with experimental results from systems which were waterlogged or inundated or which were designed primarily to explain or deal with phenomena deriving from such conditions.
10. Hormones (38) describes papers that report the effects of varying plant/soil- aeration on specific plant biochemical compounds, particularly plant hormones. Ethylene research is so abundant in the literature that it has its own keyword.
11. Light (20) describes papers reporting interactions between

plant/soil-aeration and light intensity or quality on plant response.

12. Metabolism (114) describes papers that report the influence of plant/soil- aeration on plant metabolic function and biochemical pathways, including the chemistry and physiology of photosynthesis.
13. Method (175) describes papers that present new techniques, laboratory procedures, instrumentation, or analytical methods related to plant/soil-aeration. Some mathematical methods are included.
14. Microbiology (117) describes papers that report the effects of plant/soil- aeration on the ecology and performance of soil micro organisms.
15. Model (31) describes papers that deal significantly with conceptual, mathematical, or computer models of plant/soil-aeration related phenomena.
16. N2 fixation (72) describes papers reporting the effects of variation in plant/soil-aeration on nitrogen fixation related phenomena.
17. Nutrition (239) describes papers presenting plant nutrient analyses as affected by soil oxygen. Some papers dealing with soil nutrient transformations and soil fertility are also included.
18. ODR (144) describes papers in which the diffusion rate of oxygen in soil is measured by any one of several methods, or in which diffusion rates are calculated indirectly or otherwise inferred.
19. pH (32) describes papers reporting interactions between plant/soil-aeration and soil pH.
20. Redox (123) describes papers in which oxygen-reduction potential ($E_h$) is considered.
21. Respiration (182) describes papers dealing with the consumption of soil oxygen by roots and other soil organisms and the effect on and by plant/soil-aeration factors. This category includes consideration of mitochondrial phenomena.
22. Root porosity (83) describes papers dealing with aerenchyma or anoxically derived air spaces in root tissue.
23. Rhizobium (12) describes papers that deal quantitatively or qualitatively with interactions between variations in plant/soil-aeration and rhizobial ecology, physiology, or metabolism.
24. Roots (350) describes papers in which some general aspect of root growth or physiology is considered as it relates to plant/soil-aeration.
25. Salinity (27) describes papers that include the interactive effects of varying salinity levels with poor plant/soil-aeration. In some instances papers are included from salt-affected environments where salinity is not a variable.
26. Soil Oxygen (610) is a general category for papers which deal with plant/soil-aeration in a general manner not specifically described by the remaining keywords.

27. Soil water content (230) describes papers that deal with plant/soil-aeration related phenomena as affected by differing soil water contents, particularly between approximately field capacity and saturation.
28. Soil water stress (50) describes papers which report plant responses to soil anoxia or flooding which mimic plant response to soil water stress, particularly reductions in plant water potentials and turgor pressure.
29. Stomata (109) describes papers that report observations of closure of stomata, or observations of transpiration or water use as affected by variations in plant/soil-aeration.
30. Temperature (85) describes papers reporting interactions between plant/soil-aeration and soil or ambient temperature on plant response or on soil oxygen availability.
31. Tillage (18) describes papers that report interactions between plant/soil- aeration and variations in soil tillage practices.
32. Water table (34) describes papers which deal with soil or plant phenomena affected by saturation to within a specified depth below the soil surface.
33. Wetlands (29) is a very general category that describes papers dealing in characterization of species shifts or gross environmental properties associated with the wetland condition, and may not be highly quantitative in either species characterization, environmental characterization, or both.
34. Yield (66) describes papers that present yield data from treatments in which the degree of flooding or soil oxygen has been varied.

THE DATA BASE

This bibliography attempts to be highly comprehensive. It has been compiled from several published bibliographies, from personal collections, and from an 8-yr search of AGRICOLA (U.S. Natl. Ag. Library ... formerly CAIN), Biological Abstracts, Chemical Abstracts, Commonwealth Agricultural Bureau file, U.S. Government Reports and Announcements, and Water Resources Abstracts. As with any attempt to compile a bibliography, however, it does have limitations. The particular subject areas of horticulture, forestry, and rice culture are not as comprehensively presented as they might be. Forestry and horticulture are less familiar fields to the authors (who are crop-oriented) and their personal collections of these topics were smaller for this reason. The rice data base is smaller because initially the authors excluded consideration of rice-related titles due to rice's high degree of adaptation to flooding or poor soil-aeration. The authors reasoned that flooding in rice produces stress responses that are not applicable over a wide range of plant species. In an effort to broaden the data base rice-related titles have been included. Nonetheless at this time the rice-related data base is still less fully comprehensive.

As with all bibliographies, recent titles are better represented. Figure 1 shows the distribution of titles with date of publication. Notable is the increase in number of titles with time, and particularly

after about 1960. This probably reflects two factors which are difficult to separate. First is the general increase in published information with time. Second is the probability of greater success of identifying and citing more recent publications. The authors encourage readers whose own work has been omitted or who are aware of important titles that have been omitted to send the senior author (at the address below) copies of reprints or listings of complete citations to help complete the bibliography.

## AVAILABILITY, USE, AND REVISION OF THE BIBLIOGRAPHY

The authors encourage and welcome use of the bibliography. We ask that if you make significant use of it, please cite it (this paper). Arrangements are being made to make the bibliography available through the senior author, via the International Society of Anaerobiosis. The bibliography is available in hard copy and will be available on magnetic media when computer logistics are overcome. Similarly, efforts are being made to arrange for periodic revision of the bibliography. Enquiries should be addressed to R. E. Sojka, USDA-ARS, Route 1, Box 186, Kimberly, ID 83341, U.S.A.

## ACKNOWLEDGEMENT

The authors thank Ms. Kim Gundler for perseverance in the initial entry of data in this bibliography.

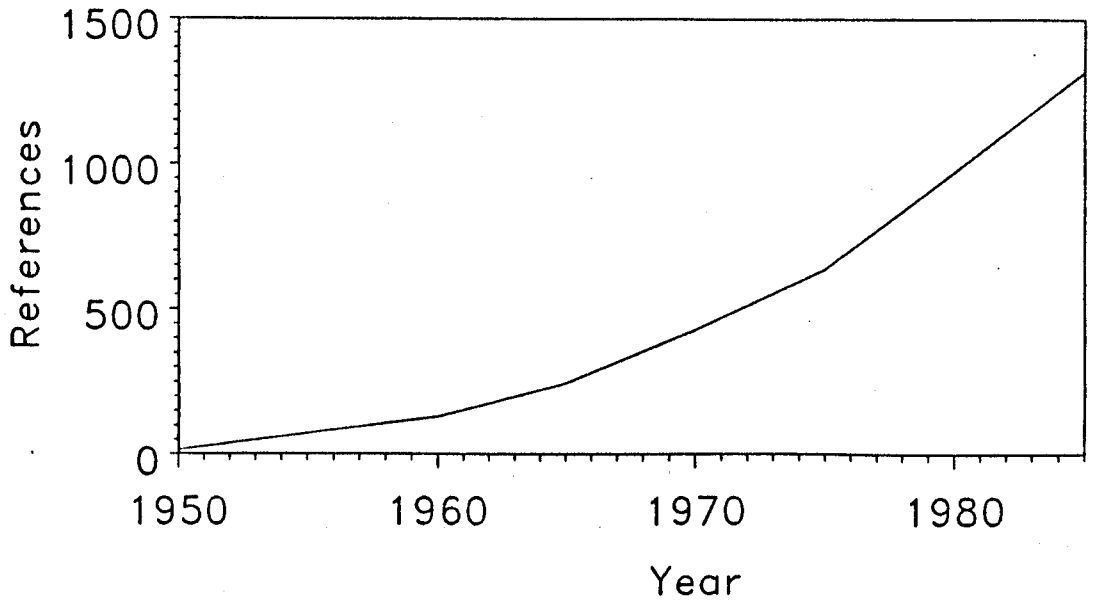


Fig. 1. Time dependence of accumulated references

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Hauck, R. D. and M. Bystrom. 1970. $^{15}N$ - A Selected Bibliography for Agricultural Scientists. Iowa State University Press, Ames, Iowa, 206 pages.

Kozlowski, T. T. 1984. Flooding and Plant Growth. 356 pp. Academic Press, Orlando.

Glinski, J. B. and W. Stepniewski. 1985. Soil Aeration and Its Role for Plants. 229 pp. CRC Press, Boca Raton.