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NEW HORIZONS IN AGRICULTURAL INFORMATION MANAGEMENT

PROCEEDINGS

OF AN INTERNATIONAL SYMPOSIUM

MARCH 13-16, 1991

BEIJING, CHINA

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Table of Contents

Foreword viii

Keynote Address

Problems, Issues, and Challenges for Agricultural Information Systems and Services in the Developing World
L. J. HARAVU 1

Session I: Management and Development of National Agro-Information Systems

Database Design at ICRISAT and the Experience of Using External Databases
L. J. HARAVU 13
Implementation Results, Roles and Effects of the Chinese Agricultural Information Services Project
WANG Xianfu 24
The AGRIS System and the Participation of China
Helga SCHMID 32
Ten Years' Progress in China's Computerized Information Retrieval and Its Future (Abridged)
ZENG Minzu 40
A Brief Introduction to the Computerized Agricultural Information Retrieval Systems in China
Chunpei HE 47
Efficient Architecture and Development Strategy of Agricultural Information Systems in Developing Countries
CHEN Qiben 54

Session II: Information Management and New Technology Application

The Infusion of Quality in Agricultural Information Services
Syed Salim AGHA 58
Access Points to the Database of Bibliographies of Agricultural Documents in China and Their Retrieval Functions
WU Zeyi 64
Management of the AGRIS and CARIS Regional Centers in Southeast Asia
Josephine C. SISON 75
Preliminary Study on the Microcomputer-aided System for Compiling an Agricultural Thesaurus and the Establishment of a Descriptor Database Management System
FANG Luming and WANG Caihua 85

Digitized Image Transmission Using High Speed Telecommunications Networks
Gary K. MCCONE 92
The Integrated System of Database Creation and Computer-based Editing and Composition
WANG Huaihui 98
Expert Systems for Agricultural Use: Recent Developments and Applications
A. Mangstl and V. Troll 103
A Study of the Khonkaen University Research Information System
Daruna SOMBOONKUN 114
Establishment of the Chinese Agriculture Abstracts Database
GUO Jian 120
On the CAB Thesaurus
HOU Hanqing and XU Jia 125
Realization and Application of Large Capacity Chinese Character Disk Operating System (LCCDOS)
NIU Zhan Liang, BAI Juping and LIU Huifang 134
The Close Associations between Indexing and Microcomputer Software Maintenance
BI Jinping 140
Program for Automatic Creation of Subject Indexes by Computer
WANG Huaihui 145

Session III: Management and Development of Regional Agro-Information Systems

SEAWIC: Its Organization, Objectives and Activities
Ruben C. UMALY and Soetitah SOEDOJO 152
Strengthening the Establishment of a Chinese Regional Monographic Agricultural Document Database
YAN Ming-zhi, LU Ping and MA Tao 162
Indonesian Plan for an Integrated Management Information System for Agricultural Research and Development
Prabowo TJITROPRANOTO and Liannie K. DAYWIN 169
Creation of an Information Database and a Developmental line of Agro-Information Retrieval Techniques in Northeast China
ZHENG Yegang and XIN Huajun 173
Cybernetic Analysis of Scientific Information Services for Agricultural Development in China
CHENG Xiaolan and CAI Jianfeng 178
Functioning of the National Agricultural Information Network (AGRINET)
D.Y. RATNAVIBHUSHENA 190
Agricultural Information Services of Hupei Province
LI Zezhou 200

Some Ideas on the Tendencies of Information Services by the Regional Information Agencies of Agricultural Science and Technology
PU Yunfeng and LI Pushen 205
Ideas on Effective Ways of Transforming Agro-Information into a Productive Force
SUN Tianshi and XUE Yajie 213
Present Situation and Strategy of Development in Information for Agricultural Science and Technology in the East China Administrative Area
CHEN Dingru 218
Coordination of Information Work on Agricultural Literature in Northwestern China
MA Yingcai and ZHENG An 224
Discussion on Elementary Assignment on Information of Agricultural Sciences and Technology at the Provincial Level
MA Yikang and ZHOU Guangheng 231
A New Domain of Agricultural Information Service at the Provincial Level -- The Combination of Information Analysis and Database Building
YUAN Zhiqing 237

Session IV: Scientech Information and Productivity

The System of the PCARRD Applied Communication Division in Transferring Agricultural Technology to Farmers
Teresa H. STUART 242
Discussion on Functions of Agricultural Scientific and Technical Information in the Development of a Rural Commodity Economy
BAI Erdian, CHEN Enping and GAN Jintian 257
Information as an Economic Resource in Agricultural Development
T. H. TAY 266
Scientific and Technological Information is a Potential Productive Force
ZHU Binlong 274
Integrated Root Crop Program (Philippines): A Coordinated Approach in Research Development and Extension
Perfecto U. BARTOLINI 279
Farm Management Data for Thai Farmers
Mrs. Kanitha SOPANON 290
On Effective Ways for Information Research to Serve the Rural Economy
CHEN Ming 292
Preliminary Study on Ways of Transforming Agricultural Science Information into Productive Forces
CHEN Qi Rong 298
Studies on Agricultural Information Research for the Development of a Rural Commodity Economy
LI Wenmao and NIE Shangqi 305

Joining the Main Front for Economic Construction to Open Up a New Aspect of Information Research
SUN Xuequan and LIU Qingshui 314
Establishing a New System of Agricultural Information Technology, Production and Marketing, and Promoting the Agricultural Technological Development of China
TONG Dijuan 319
On the Transformation of Agricultural Scientific and Technical Information -- Thoughts on Transforming Information into a Productive Force
YUAN Weimin 325
An Effective Way for Transforming Scientific Information into Productive Forces
LI Lunliang and YU Ying 331
Broadening the Media of Communication of Agricultural Information and Its Role in Agricultural Development
LIU Shixing, LI Cuie and GONG Junjie 334

Session V: Development and Utilization of Agro-Information Resources

A New Approach to Information Systems Management at the International Potato Center (CIP): The Case of Information Services for National Potato and Sweet Potato Programs
Carmen SIRI 340
Preparing English Abstracts of Chinese Documents -- an Important Step Toward International Sharing of Chinese Information Resources
LI Kaiyang 351
Linking Information Resources Sharing Management and Library Training in the South Pacific
Esther W. WILLIAMS 354
Resources of Chinese Agricultural Documents and Their International Exchange
ZHAO Huaying 369
Developmental Status and Trends of the Retrieval Journal System for Agricultural Information in China
JIA Shangang 377
Exploitation and Utilization of Sericultural Information Resources in China
GAO Zhicheng and CHEN Xichao 385
The Agricultural Information Users in China and Changes in their Requirements
PAN Shuchun 390
BIOSIS as an Agricultural Information Resource
E. HODAS, M. O'HEARN and M. KELLY 398
On the Exploitation and Utilization of Agricultural Scientech Information
DING Jincheng 406
Exploitation and Effective Use of Scientific and Technological Information on Agriculture
LIU Yixian 410

On Information Obstruction
YOU Xiu-Ling 415
Prospects for the Chinese Agro-library and Information Education
XUE Zihua 423
A Database of Bamboo Abstracts
ZHU S. L. and ZHANG X. P. 429
Multi Level Services for User Needs in Agriculture
XING Zhiyi 435
Results and Benefits from an IDRC-supported Project: Tea Information Services (China)
CHEN Zongmao, WANG Zipei and LU Zhenhui 440
Practice and Enlightenment in Collection Development
CHEN Aifen 446

Appendix 1: Supporting Papers

Opening Address
WANG Xianfu 451
Welcoming Address
LIANG Keyong 452
Welcoming Addres
Clive David WING 454
Welcoming Address
WANG Tingjiong 455
Discussion 457
Summary Report of the International Symposium on New Horizons in Agricultural Information Management 459

Appendix 2: Symposium Participants

List of Symposium Participants 466

Appendix 3: Author Index

Author Index 472

Access Points to the Database of Bibliographies of Agricultural Documents in China and Their Retrieval Functions

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Abstract

The Database of Bibliographies of Agricultural Documents in China is an information retrieval system for storing the information concerning agricultural sciences in the Chinese language. It merges the creation of the database and editing and typesetting into an organic whole. Formation of the index entries uses nine function symbols to control the layout of access points and the logical relationships among the descriptors. There are 33 fields for each record, thirteen retrieval fields, eight indexes and 22 tail marks, 137 codes in the subject category index and 92 terms for retrieval concepts in the database. They can be combined with each other in retrieving and it is an effective information retrieval system that once "the headrope of a fishing net is pulled up, all its meshes open."

The Database of Bibliographies of Agricultural Documents in China is an information retrieval system for storing specific information concerning agricultural sciences in the Chinese language. It merges the creation of the database and editing and typesetting into an organic whole. Now we are using a computer system to edit and typeset hard copy of *Bibliographies of Literature in Agricultural Science and Technology in the Chinese Language* and benefit greatly from the system.

In order to raise the efficiency of information retrieval, the use of standard formats for the description and automatic formation of index entries is emphasized in designing the structure of the database and processing the data. The layout of access points is comprehensive, reasonable but not tedious, and simple but not omissive. Both the precision ratio and recall ratio are high.

There are 33 fields for each record in the database. These 33 fields are as follows: serial number of temporal records, entries of classification (for typesetting), classification number, numbers for controlling entry, retrieval concept, subject category code, titles, type of document, type of document code, languages, authors, other persons who take responsibilities (such as editors, translators or illustrators), institute in which author works, edition, titles of periodicals, place of publication, name of publisher, year of publication (volume, issue and page), size of books, series notes, standard number of documents, summary, call number, document source code, free terms, descriptors, entry of subject index, Latin name of organism, formula of chemical substance and

registry numbers of Chemical Abstracts, keywords out of context, abstract and so on. Each field has a defined field tag, field name and length, ability of repetition, and separation symbol. Models for each field have been tested and modified again and again and finally have been approved. Experience has proven that all selected fields are suitable. Among the 33 fields, there are thirteen fields for retrieval which are as follows: Classification number, retrieval concept, authors, other persons who are responsible, subject category code, titles of periodicals or book, sponsoring institute, publishing agency, year of publication, free terms, descriptors, Latin names of organisms, keywords out of context, and so on. Now I would like to analyze the access points to the database and its retrieval functions based on the index system.

I. THE AUTHOR INDEX

The data on authors stored in the database consist of personal author, corporate author and other persons who take responsibility including editors, translators and illustrators.

For each record, the maximum number of Chinese authors included is ten and two for foreign authors whose papers have been translated into Chinese. The sequence for name of author is that the surname is put before the given name and all names are sequenced alphabetically.

II. THE SUBJECT INDEX

The subject retrieval is conventional retrieval. But because of a different concept of design, the efficiency of retrieval is not the same. For subject indexing in the database, besides using controlled terms, we also increase the access points and try our best to display the correlations relating to the complete concept. In order to create conditions for nearly consistent retrieval by our microcomputer system, We use @ (commercial at sign) to control the words from the front and make descriptors and free words hierarchical. By so doing, loss retrieval is avoided, access points are increased and descriptors will play an effective role.

Example: English (Chinese)

Pig @ (zhu)
Berkshire swine (zhu)
Fattening pig (zhu)
Lactating sow (zhu)
Lean type of swine (zhu)
Piglet (zhu)
Runt pig (zhu)
Sow (zhu)
Two piebald face pig (zhu)
Weaning piglet (zhu)

Land problems are very complicated. They involve politics, economy, law, soil, geology, geography, land reclamation, environment and ecology. A tree structure cannot be formed by using a subject classification for land data. Because their connotation crosses subjects, it is not suitable to design a new retrieval concept. They can not be recalled

by using subjects or subject categories. So using '@' is the only way to control the terms and avoid losses of retrieval.

Example: Land @ (tudi)

Cultivated land	Ownership
Landed estate	Real estate
Land price	Requisitioned land
Land registry	Rural land
Land rent	Urban land
Legacy land	

Reference books contain a subject index to help users. The function of a subject index depends on the indexing technology used and the format of the index entries.

1. Formation of the Index Entries

The index entries of book catalogues are the key in determining the retrieval efficiency of the subject index. In order to insure a high quality of index entries, the efficiency of indexing work must be raised, the formation of entries should be automatic and standard.

We use a special program to control index entries which uses nine function symbols to control the layout of access points and the logical relationship between the descriptors. The nine function symbols are as follows: semicolon ';', exclamation mark '!', question mark '?', equal-sign '=', commercial at sign '@', dash '-', reverse slant '\', right-half bracket ')', asterisk '*' and so on. If a semicolon ';' is put after a descriptor, it means the descriptor before the semicolon must be a guiding word in forming index entries for document records and we simply call it a semicolon descriptor. These guiding words must be the main heading or subheading of the entries. If an exclamation mark, question mark or commercial at sign are put after the descriptors, the descriptors before them can be combined with semicolon descriptors. Exclamation mark descriptors can be put before semicolon descriptors in combination to be main headings and they can also be put after semicolon descriptors to be subheadings. Question mark descriptors can only be put after semicolon descriptors to be subheadings or qualifiers in combination.

Commercial at sign descriptors can only be put before semicolon descriptors to be main headings. Equal-signs and dashes are put before descriptors or qualifiers and they can only be attached to semicolon descriptors, question mark descriptors and exclamation descriptors but are not to be rotated. After the entries have been formed the equal-sign descriptors will have been cleared up automatically and they are not stored in the database. A reverse slant is put after the descriptors which means that there is only one word in the entries. When multi-subject documents are handled, the right half bracket is used as a separating symbol to avoid pseudo combinations and conception confusion. When an asterisk is used and combined with ')', it signifies the end of the combination of multi-groups subject.

Example: Study of nutrition of anther cultured plant in hybrid rice

1. translocation and metabolism of phosphorous nutrition in the plant.

After the function symbols have been combined with descriptors, they display as follows:

hybrid rice; anther culture = plant! nutrition-study! rice @) phosphorous = nutrition element; metabolism = translocation! plant-in vitro?)*

After the index entries have been created, the above example will display as follows in the index entries:

anther culture plant
  hybrid rice
  metabolism translocation
hybrid rice
  anther culture plant
nutrition study
  metabolism translocation
  phosphorous nutrition element
nutrition study
  hybrid rice
phosphorous nutrition element
  metabolism translocation
plant in vitro
rice
  hybrid rice

2. Format of Arrangement for Index Entries

The index entries for the database are arranged mainly in line format. The subject headings and subheadings have been formed automatically by the computer system according to the indexing concepts and the notation of function symbols and there is no standard regulation for them. If there is only one subheading or one qualifier, it is put directly to the right of the subject heading leaving a space and putting them in line. If there are more than two second-level headings, the first second-level heading should be put after the subject heading, the other second-level headings are put below the subject heading. The second-level headings, the third-level headings, and the fourth-level headings or qualifiers for each entry should be put in one row leaving a space between the words. By doing so, it is very convenient to retain the real meaning of the descriptors, it is easy to read, a whole page of paper can be saved and the computer can handle it easily.

3. Punctuation Marks, Reading Method and Understanding of Index Entries

In order to easily control them with a computer system, punctuation marks are not used in the index entries and a space is left between subject headings, subheadings, qualifiers, controlled terms, headings in which the words are in normal order and headings in which its words are in reverse order and complicated subjects. Headings in which its words are in reverse order are usually put toward the rear of the descriptors. The format of arrangement for them is as follows:

A. Subject heading: heading in which the first word is in normal order, reading normally.

Example: Agricultural Economy Theory

B. Subject heading plus subheading: heading in which the first word has normal order, reading normally.

Example: Sweet potato germplasm resources
Livestock pathologic anatomy atlas

C. Subject heading plus phrase in reverse order or plus qualifier. When they are read in reverse order it refers to some special names and it is equivalent to "of".

Example: External type of agriculture China

D. Subject heading (or subheading, or heading in which its words are in reverse order) plus control word generally means the subject, the specialty, field, type and place they belong to. It is very necessary to understand them and most of them are read in reverse order.

Example: Agricultural product exchange China
High-frequency curree Method of insect control
Insecticide forestry protection
Insecticide pesticide industry
Insecticide plant protection
Qiminyaoshu China ancient agricultural book
Qiminyaoshu China agricultural history
Yellow stunt of wheat virosis

E. Complicated Subject: for more than two subjects, they should be understand, judged and analyzed.

Example: Resistant ability gene induction laser.

In order to provide more access points and give the words more opportunities to become hierarchical and display more concept relationships, many entry forms are used for the same concept and they are present repeatedly.

Example: White backed rice planthopper
Delphacid planthopper white backed rice planthopper
Egg type chicken
Chicken egg type chicken
Neck blast of rice
Rice blast disease neck blast of rice
Xiada 711
Rice variety Xiada 711

Each entry keeps its original meaning or intention. After entries have been formed they are easy to read and understand. There are thirteen Chinese characters for each entry and the total number of entries is controlled from ten to twenty. The total number, level and indexing depth of index entries for each specialty in the database are kept balanced in suitable proportions.

4. Tail marking

In order to retrieve information precisely and select documents quickly, 22 tail tags are designed after the control number of entries in subject index:

*A-new status	P-patent
*B-new subspecies	*P-hybrid parent
B-books	*R-new record
*C-new combination	R-review
*D-new breed; new cultivars	*S-new species
E-community name	*T-new serum type (bacterium)
*F-new form	U-cultivar(s) mentioned
*G-new genus	*V-variety
*H-new subgenus	*W-new strain; Line
*K-new section	X-sexual hybrid
*N-new name	+ -asexual hybrid

After users have retrieved the useful information through subject index, they can determine at once whether to select the records or give up on them based on the tail tags. If the users need some papers to review, they can find "R" at the end of control number, which means that the documents belong to the review the users want. Otherwise they will not select them.

III. THE SUBJECT CATEGORY INDEX

The subject category index differs from a conceptual index. The former uses codes instead of classification subdivisions and its classification number has been shortened in order to help in computer sorting. It organizes documents by subject category, coordinating the classification number to replace the subdivision. The subject category index can also be combined with the subject index and conceptual index to enhance the retrieval efficiency. For example, it is very difficult to retrieve from the literature by using the classification index, subject index or conceptual index. But if you use the subject category index, it is not only very easy to retrieve what you want, but also to search documents which are very concentrated. If you want to retrieve agricultural information from each district throughout the whole of China by using the classification index or subject index you may consolidate all of China by using only code W10 in the subject category index. If you combine code W10 with code L73 in retrieving, you will get all the literature concerning animal infectious diseases in every district throughout China and it is unnecessary to retrieve them through the name of each place, or kind of disease.

There are 137 valid codes for the database. The subject category codes refer to a subdivision list of systematic classification, but they have better retrieval functionality than that of the subdivision list and are particularly suited to information retrieval in animal science, botany, classification of general agricultural sciences and concerned specialties. The subject category codes and the *Classification of books and serials in China* supplement each other to create new access points. All the codes are flexible and not controlled by the rules of descriptor indexing and are easy to be learned. The codes can replace the function of a subdivision list, but are not controlled by the classification. In document retrieval, the codes can be used not only in combination with a classification number, but also in combination with the subject index. For example, physiology, which has a very close relationship with biochemistry, and also a very close relationship with sciences of plant and animals, outside conditions, agriculture technology, basic sciences and chemical substances, is cross searched with other subjects. If you retrieve them one by one, it is difficult not only to be comprehensive, but also to retrieve them correctly. If you use code F60 plus the name of any plant, or use L50 plus the name of any animal, you will have macro control to form a cross-retrieval series. You may save keying a whole page-long search strategy, help enhance the recall ratio, precision ratio and efficiency, and promote the retrieval process by using the codes.

IV. THE CONCEPTUAL INDEX

Retrieval concept is mainly used in macro-control. It is very difficult to retrieve literature on a specific subject by using the classification index, the subject index or the subject category index. In this case, the conceptual index works well. Let us take biocontrol as an example to describe it.

Most of biocontrol literature is decentralized among the concepts of pest, insect, biology and 'natural enemies' according to the indexing rules. According to the classification rule, the documents involving biocontrol of disease, insects and weed are classified based on control target and there are no specific codes for them in the conceptual index. Because they are often lost in retrieval, the biocontrol concept has been developed. For another example, the documents concerning the application of physical methods in agriculture, are decentralized throughout all aspects of agriculture, forestry, animal husbandry and aquaculture according to the rules of classification. From the angle of the physical method, it is very difficult to completely retrieve the documents concerned with the study method of lasers, ultrasonic waves, optics and electricity and it is common to lose them in retrieval. The shortcomings of other access points can be overcome by designing a retrieval concept for "physical method."

There are 92 terms of retrieval concepts for the database. These terms were determined and selected mainly based on the traditional habits and psychological state of Chinese users, the limitation of agricultural knowledge mastered by computer experts and other staff and the intersection of documents of agricultural sciences with documents of other subjects. All the retrieval terms which are not allowed in the classification index, the subject index or the subject category index are selected and can be combined with the

subject index. A new access point has been created by doing so. For example, a general concept has been designed for "flowering plants" in the systematic classification, only "plant" has been assigned to it in subject category indexing and no specific meaning is emphasized for it in subject indexing. Documents on flowering plants are decentralized under the names of various flowering plants. So it is very difficult to retrieve them. The disadvantages of other access points will be overcome by designing a flower retrieval concept. The access points of the conceptual index can help users save their money for retrieving, enhance indexing depth and are suitable for computer retrieval.

V. CA REGISTRY NUMBER AND MOLECULAR FORMULA INDEX OF CHEMICAL SUBSTANCES

This index is designed mainly for agricultural experts who study chemical substances. Information on application, analysis, characteristics of chemical substances in agriculture, its efficiency of application and development of new chemical substances retrieved only from the documents in the Chinese language is very limited. Therefore it is absolutely necessary to use reference tools and information resources from foreign countries. *Chemical Abstracts* (*CA*) is one of the most important reference tools for Chinese users. Therefore it is very important for Chinese users to combine the access points of "Chemical substances" with the access points of the database while accessing our database. There are more than ten access points for *CA*. If the user wants to use the key access point *Index of Chemical Substances* of *CA* to retrieve information quickly from a Chinese concept, the only short way is to combine the formula with the registry number of *CA*. Therefore the *CA* registry number has been attached to each Chinese name of a chemical substance in our database.

After you get the standard names of chemical substances from the registry numbers of *CA* and the formulas, you may retrieve precisely by using *Index of Chemical Substances*. The method used in compiling the *Index* is that it is sorted not by formula and *CA* registry number, but by the names of the chemical substance in Chinese, with the molecular formula and registry number of *CA* given at the rear of the Chinese names of the chemical substance. By so doing it may help Chinese users shorten the time span for retrieval. Therefore the formula, *CA* registry number and the names of chemicals have been put in the same index and the users can access *CA* with the same index and they can save time in retrieving.

VI. THE INDEX OF LATIN NAMES OF ORGANISMS

Organisms are some of the main targets of study in agriculture. A specific field for Latin names of organisms and its index has been designed for the database in order to help users have precise online retrieval.

VII. SOURCE INDEX

The sources of the data will be given periodically. Starting from 1989, a list of reference books or periodicals is given in each issue of the book bibliographies and an Index of Sources will be given each year in order to help users obtain original papers.

VIII. THE INDEX GUIDE

A book catalogue is one of the most important reference tools for getting agricultural documents. In order to reduce the ratio of refusing retrieval an Index Guide is given in each issue of our *Bibliography of Agricultural Sciences in China* and we tell users the relationship of "see references" between important key words and their synonyms. Doing so helps to facilitate the flow of thinking between editors and users, and enhances the recall and precision ratios.

IX. CASES OF RETRIEVAL

The access points to the database are complete, flexible and precise. Retrieval strategies can be written out at once according to the users' questions and the retrieval result is effective. Examples:

User's question:

1. The application of ELISA in quarantine.

Retrieval formula: Enzyme-linked immunosorbent assay *
infections diseases (F60 + L50)

The meaning of the retrieval formula:

(1) Enzyme-linked immunosorbent assay is a descriptor of ELISA
(2) infections diseases indicate infectious diseases of plants and animals
(3) F60 indicates physiology and biochemistry of plants
(4) L50 indicates physiology and biochemistry of animals
(5) + shows Boolean logical "union"
(6) * indicates Boolean logical "multiplication"

Access points: Descriptor is the access point for '(l)'; access point of '(2)' is concept; access points of '(3)' and '(4)' are codes of subject category.

User's question:

2. Dynamics of pesticide application in China and in foreign countries

Retrieval formula: (W$) * X10

The meaning of the retrieval formula:

(1) W$ indicates all places domestic and abroad

(2) X10 indicates pesticide and all kinds of pesticides

Access points: Access points of '(1)' and '(2)' are codes of subject category. S48 and TQ45 also indicate pesticide and all kinds of pesticides. They only show the pesticides which have been classified based on the rule of classification and they don't include the pesticides which have been classified based on the control target. Their indexing depth and ability of summary are not as good as those of X10. The data on pesticide retrieved by subject are only the general one, not all kinds of pesticides. Therefore X10 has been chosen in this example.

User's question:

3. The relationship between the physiological disease and application of herbicide in wheat crops but not wheat.

Retrieval formula: physiological disease * (herbicide + herbicide) *
(S435.121 ^ wheat)

The meaning of the retrieval formula:

(1) Physiological disease indicates the physiological disease of animals and plants
(2) Herbicide is formal descriptor
(3) Herbicide after "+" indicates the retrieval concept
(4) S435.121 indicates diseases of wheat crops
(5) wheat is a formal descriptor
(6) "*" indicates logical 'multiplication,' multiplication of concept
(7) "+" indicates logical 'union,' union of concept
(8) "^" indicates logical 'negation,' negation of concept

Access points: Access points of '(1)' and '(3)' are concepts. Access points of '(2)' and '(5)' are descriptors, being the subject retrieval. The subject in '(2)' is herbicide and herbicides in general which does not include all kinds of herbicides. Access point '(4)' is classification. S435.121 is the mark of classification and indicates disease of wheat crops. The examples of retrieval mentioned above show that when subject categories and retrieval concepts are combined with descriptors and marks of classification, the retrieval is simple and precise. Boolean retrieval and front consistent retrieval can be realized and rear consistent retrieval can also be realized on our HP3000/70 computer system.

The retrieval practice of eighty users in retrieving 30,000 records has proved that the inverted files of the database are effective and precise. The formation of entries controlled by the computer's functional symbols is logical, easy to read and understand and can keep the original meaning of words. All entries and indexes are typeset and printed out by Kehai software to meet the design requirements.

Thirteen retrieval fields, eight indexes and 22 tail marks can be combined with each other in retrieving and it is an effective information retrieval system such that once "the headrope of a fishing net is pulled up, all its meshes open."