REPORTS FOR SATELLITE SYMPOSIUM "APPLICATION OF GLOBAL AND REGIONAL INFORMATION FOR THE INNOVATION OF AGRICULTURAL AND ENVIRONMENTAL EDUCATION"

1. Information Technology and Rural Communication

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1. Introduction

It would not be an exaggeration to say that the information-environment system has already gone into the twenty-first century. In the past ten years in particular, this field has made tremendous advances in technology, of which the Internet is a good example. As a result, our lifestyles and social consciousness have come to be reformed. During the first twenty years of the new century, the information technologies, which have already begun to bud, will be bursting into full bloom. Eventually, in various ways, more affluence will be brought into the society out of this advancement, which will be a driving force. We are required to acknowledge that information transmission is in the process of a revolution, with which we are deeply concerned. Consequently, there is an urgent need to make a study about the utilization of technology in the information-environment system and in communications. In addition, favorable environments for global communication are also urgently need to be created.

Information technologies will be utilized effectively in various ways, such as in agriculture and in its society. Subsequently, this utilization will bring about the solutions of many existing problems. In order to transform farming from an old fashioned business to a lucrative business with intelligent systems, the consciousness of people in general has to change, as well as that of farmers. In addition, the technologies of the information -environment system should be put to use for the purpose of active communication. Consequently, positive study in developing networks and applications is needed badly. In the network society, the extent of the information-environment is of great significance. In short, through the information-environment, relationship-building, such as cooperation, sharing in ownership, and symbiosis, can be the outcome of communication. Furthermore, this relationship-building can be a means of problem-solving. Agricultural information technologies and communication technologies, about which we are knowledgeable, should be put to use in our country. In addition, the other Asian countries should share the technologies with us equally. Global communication will promote the development of agricultural industry in the world. Furthermore, this communication will be a driving force to solve various problems.

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2. The status of rural media

The appearance of various types of media and computers in the last 30 years was the driving force for the promotion of information systems, but the appearance of multimedia and high speed networks seems to be a major turning point.

Because of advances in telecommunications lines and the greater speeds and performance of computers, they are no longer limited to text based information. Multimedia refers to the use of audio, images and video information in computers. The development of multimedia personal computers and the Internet are promoting multimedia, so that information processing and information telecommunications handled in agriculture and by rural villages is becoming easier to use. The Internet is especially impressive. It is

referred to as a network of networks. It is a network which connects over 160 counties throughout the world and has over four million computers connected to it. It is said that there are 50-60 million users and that their numbers are increasing. The sudden focus on the Internet has made people realize that the multimedia age is upon us, and everybody is being affected in some way.

As the Internet has shown us, development of information technology in the next century is likely to center on the globalization of networks and multimedia, and this is also true for development of agricultural information technology. Multimedia communication requires high speed lines capable of sending several megabits of data per second to be of practical use, however, because of the vast quantities of information handled. As a result, creating high speed digital networks and other information infrastructure, including optical fiber networks and CATV networks, is indispensable. However, for the time being, the basic media for agriculture and rural villages will have to be centered on telematic media (personal computer communications, facsimiles, off-talk and the like) which uses public telephone lines.

3. The rural information media

Looking back at the media available to agriculture and rural villages, it seems that most types of media have appeared in the last ten years. Since the liberalization of the telecommunications industry in 1985, we have been overwhelmed by the progress made by different types of media : the appearance of personal computer and off-talk communications ; the more diversified and advanced functions made available for facsimiles ; the introduction and expansion of CATV etc. It is also true, however, that the various media have become fixtures in various regions and that varying features are being used, so that the race between different types of media is likely to continue. As Fig. 1 shows, from the viewpoint of market penetration, facsimiles seem to be the successor to cable broadcasts, which expanded rapidly after World War II (about 3.3 million installed units at their peak). The increase in facsimile networks created by agricultural cooperatives these past few years utilizes the features of facsimiles, and covers all of their members. In addition, facsimiles can be used even for members with low information. literacy. This is probably one of the main reasons that facsimiles are the preferred medium. It is likely that facsimile network and answer-facsimile systems shall continue to expand rapidly in the future, with new functions using IC cards and magnetic card readers. Tables 1 and 2 show the different media categories and comparisons of their features.

The development of agricultural information technology today is summarized and its features arc listed below.

1) The expansion of facsimile communication systems which use multiple function telephones.
2) The expansion of large scale member information systems at agricultural cooperatives.
3) New developments in local networks through the introduction of high performance CATV systems (MCAIC).
4) The implementation of multimedia in agricultural and rural village information systems through the use of personal computer communications and the Internet.
5) The extension of systems which incorporate both information systems and machine work systems, which include facilities monitoring selectors, etc.
6) The use of satellite communications in agriculture and in rural villages.
7) The expansion of precision farming (the use of GIS and GPS in agriculture), field management, and precision management.
8) The increase in personal computers being used in rural villages. (Resulting the lower prices of multimedia personal computers.)
9) The increase in the strategic use of information systems.
10) Delays in the creation of databases, and promotion of their use.

The three elements for the advance of information systems are :

1) The creation of databases and information sources, 2) the creation of networks and their improved speed, and 3) the extension of information terminals. In order to meet the current demand for more multimedia, there must be development of new and advanced functions.

One of the most important tasks is to connect agricultural and rural village networks to the Internet. Therefore, databases which are Internet compatible must be created and lines must be constructed. The Internet is a global scale network with many information resources. Because of this, mutual exchange of information is possible, and this is not limited to Japan alone. Internet connections will lead to effective use and exchange of information among the nations of the Asia-Pacific region. In order to create an international environment such as that described, the use of electronic media such as CALS indicated in Table 2, and the standardization of information, are tasks which cannot be avoided.

4. The situation concerning individual media

(1) CATV

In the spring of 1995 rural village type common access CATV and urban CATV were deregulated, so that both broadcasting and telecommunications were made possible. This has made the introduction of MCA/C (Multi-Channel Access on Cable) possible, so that CATV cables can be used for telephone services, personal computer communications, facsimile services, video on demand systems and other data communications. This has increased the value of CATV networks. In addition, although the cost is higher than other networks, CATV cables are capable of handling the high requirements of multimedia, so that they can play a major role as local information networks. This means that a new age is opening for rural village type CATV.

(2) Multiple function telephone and facsimile communication systems

In addition to telephone functions, multiple function telephones have such additional functions as facsimile functions, display functions, data communications, magnetic card reading functions, password access and the like. Data communications through personal computer communications and the CAPTAIN protocol can also be selected. In answer facsimile systems, data communication functions and display functions can be used so that information retrieval is made easier. Some models have terminal OCR functions, so that the terminals can read OCR sheets, code the data, then send it after confirmation. In Ibaraki and Fukushima prefectures, the JA is creating prefectural facsimile networks with over 10,000 facsimiles. In addition, there has been a significant increase in facsimile networks using answer facsimile services, such as the Vegetable and Flower On -line System. (table 3)

(3) Connections with other systems ; precision farming

A comprehensive improvement of information system functions is being implemented. They include ; systems which connect greenhouse environment monitoring systems and pocket pagers. systems which connect the feed tank quantity sensors at farm households with JA feed POS systems through telephone lines ; rice paddy water level control systems which use cellular telephone circuits ; systems which connect wheat drying facilities with work plan systems and facsimile networks ; systems which connect potato shipment facilities (quality selection information) and facsimile systems ; and the like.

Various innovations are being made to create these systems, such as ; connecting remote sensors with computer systems though telephone lines, and wide area information transmission by connecting computers with cellular telephone systems. Farm work management and farmland management using GPS (global positioning system) is also being implemented overseas. The new goal for farm-

ing is the creation of precision farming which uses various networks, information systems and sensors.

(4) Satellite media "Green Channel'

The Green Channel, which uses communications satellites and is being operated by the Horse Racing, Agriculture, Forestry and Fisheries Information Satellite Communications Organization, started operation in February 1995. Agriculture, forestry and fisheries information, JA information and other related information can be received directly through communications satellites, and these broadcasts are also being distributed to rural village and urban CATV systems. This system is using the satellite property of simultaneous transmission to a wide area to increase its effectiveness. Agricultural and forestry weather information is also being distributed nationally through this Green Channel. In addition to various IA information, the contents are gradually being improved to include such items as exchange between urban areas and rural villages. In addition to this JA information, horse racing information is being broadcast on weekday nights and on weekends. And between 7:30 a.m. to 8:00 p.m. on weekdays, agriculture, forestry and fisheries information is being distributed.

The Green Channel is attempting to become an information transmitting medium which transmits agricultural and rural village related information to urban residents. Further improvement in the Green Channel is hoped for because it is a means of directly appealing to consumers through images, and it allows direct transmission of information from rural villages to urban residents.

In regard to the introduction of receiving facilities, since 1994 the national government has been giving subsidies for receiving equipment expenses and construction expenses for one location in each prefecture or JA organization. The main parties which are implementing these enterprises are the JA Zenchu organizations, and the subsidies amount to one-third of all expenses. This program is being continued in 1995. Satellite communications differ from general broadcasting satellites in that an unspecified number of people cannot receive them under law.

Therefore, under the present conditions, Central Union of Agr. Coops. (Zenchu), Pref. Union of Agr. Coops., Pref. Feds. of Agr. Coops., and unit JA cooperatives can receive these signals ; but the farm households of unit JA members cannot. Telephone voting subscribers of the Japan Racing Association, however, can receive these signals. Subscription fees for agriculture, forestry and fisheries related information are free for the time being. At the end of January 1995, there were 149 urban CATV stations (with approximately 240,000 receiving households) and 39 rural village type CATV systems (with approximately 110,000 receiving households) which were receiving the Green Channel. Because of the wide range of satellite uses, it is hoped that the Green Channel will become similar to the DTN in the United States, so that weather and market information can be distributed digitally, thereby using the wide-area simultaneous distribution abilities of satellites.

(5) Cable broadcast telephones

Although there have been many complaints about cable broadcast telephones, such as "Connections can't be made," and "The sound quality is bad," there has been a transition to off-talk communications, disaster prevention administration radio, and facsimile systems with the upgrading of the systems. With the introduction of high performance broadcasting equipment, however, there have been new developments in cable broadcast telephone systems. This is because the introduction of digital switchboards and high performance broadcasting equipment has made possible services which were not possible before.

Twenty-four hours per day weather broadcasts (Kaminoyama. Yamagata Prefecture) : In this cable broadcast system, data is gathered from agricultural weather monitoring stations situated throughout the area, then this data is sent to subscribing farm households in real time through cable broadcasts.

Seven weather monitoring stations were built. The data from these stations is gathered at the municipal cable broadcasting headquarters located in N4isaki-cho every ten minutes and processed by computer. Subscribers to the system can access the latest data from any weather station by calling on the telephone.

A system which allows connections and access to information services 24 hours a day is also popular with users (Aoki-mura Cable Broadcast Telephone Association, Nagano Prefecture. 1.351 subscribing households. Subscription percentage of 95 percent.) In order to create a system which allows. "Access to necessary information, at the necessary time, in the necessary quantities 24 hours a day," the broadcast facilities were completely overhauled. This system allows connections 24 hours a day even during broadcasting, and telephone connections and broadcasts are possible even during power failures for up to three hours. In addition, there are the following functions ; Emergency telephone calls to 119 are not limited in area, but are directly connected to the command center of the Ueda Central Fire Department (NTT leased line used) ; for persons living alone, simply picking up the receiver will connect the telephone to the village office ; catch-phone functions ; conference calls for up to eight parties ; paging broadcasts are possible from all subscribing households, including paging throughout the entire system ; radio and background music broadcasts which can be enjoyed at home or in offices ; tourist site information ; local announcements ; village information ; and other 'talky" services over three channels. In addition, production council meetings are held by using the conference call function (for up to eight parties).

(6) Disaster prevention radio

Wireless systems, which are more resistant to disasters, are being installed mainly by local governments. This is a medium which has received much attention since the Hanshin Kobe earthquake.

Among the areas which are reviewing their disaster prevention plans and introducing wide area relief organizations, Tokushima Prefecture is unique in that it is constructing a disaster prevention administrative radio system which uses a communications satellite. It is changing its disaster prevention administrative radio from one which uses ground based relay stations to one which uses a communications satellite. In a related enterprise, Kochi Prefecture plans to improve its relay station network for disaster prevention administrative radio which is used by emergency personnel, so that the system covers the entire prefecture.

In general, technology is being improved. For example, reception performance is being improved and digital signal identification methods are being adopted, so that the possibility of getting signals mixed with those of other local governments is reduced. In Osaka Prefecture a reservoir disaster prevention system which uses the disaster prevention radio network has been constructed and is in operation. This system is called, 'The Reservoir Disaster Prevention Telemetering System.' It monitors the water levels of 50 reservoirs in the prefecture, and has unmanned rainfall monitoring stations which automatically monitor rainfall and send the data to the reservoir management office. This system allows quick response to disasters involving water. Water levels and rainfall are automatically monitored every ten minutes, twenty -four hours a day. Data is sent to local stations (four prefectural cultivated land offices) over telephone lines, then the data is sent to the central station (prefectural Cultivated Land Section, Agriculture and Fisheries Department) over the prefectural disaster prevention administrative radio systems multiplex radio circuits. Data is also sent to branches (three locations) and local government stations (the 18 local governments which have reservoirs in their areas). The system is designed so that in case of an emergency, the reservoir managers are contacted.

(7) Internet

In recent years, the communication infrastructure, including high-speed communication lines, has rapidly improved all over in Japan. This has provided most of the farming

areas with information utilization environments in which farmers have increasingly put the Internet to use. For the time being, it is mostly in use for information search or e-mail correspondence. However, some active ways of utilizing Internet communication in agricultural production or management can be seen in some areas such as remote-controlled farming on a web site, sales promotion on a homepage or promoting group farming on a mailing list.

In addition, there are good signs of more advanced utilization in this field. Japan Agricultural Cooperative Associations in some areas have built the Intranet in their own regions. In other words, the Internet has come to be a main information network system in those farming areas on a full-scale. The utilization is to :

1) correspond by e-mail.
2) convey or hold information in common amongst farmers on a mailing list.
3) search information on the Web.
4) forward farming information on a homepage.
5) offer farmers widespread information on a homepage.
6) publicize farming activities on a homepage.
7) maintain relations between farmers and consumers through a web site mall for agricultural products.
8) remote-control or watch farming with a web-camera.
9) carry out distance lectures using a stream camera.
10) hold a virtual meeting or forum.

The Internet, which can establish nationwide communication, has a strong impact on farming communities in many ways. More specifically, information can be exchanged nationwide among farmers, between farmers and consumers, and between researchers and farmers. In addition, updated agricultural information used in school education can be directly forwarded to classrooms from farms. This new information exchanging system, which was utterly impossible in the past, has come to be in use through the Internet.
Farmers can be motivated to build homepages :

1) for fun.
2) on which they can publicize their farming activities.
3) on which they can offer information to their contract farmers.
4) since they can enjoy the Internet in their spare time.
5) since they can offer better and updated farming information worldwide.
6) since they can hold information in common for the purpose of cooperative work.
7) since they can socialize with people who have no relations with farming.
8) since they can be justified in purchasing expensive computers.
9) on which they can be in touch with consumers.
10) on which they can develop a new sales channels.
11) since they can kill time on rainy days working on the homepage.

2), 3), 9) and 10) concern information transmission in particular and will be in need for farmers in the future. More specifically, deepened mutual understanding between farmers and consumers can be anticipated. Some farming education can be given to the consumers and, in return, consumer education to the farmers. Accordingly, various kinds of new farming systems can be created in this harmony.

5. Conclusions

The multipurpose communication system on the network has a good influence on farmers and can be a powerful tool to manage their farms or make decisions under increasingly complicated farming environments.

Communication technology has come to be indispensable to form Network-Marketing, Autonomously Dispersive Cooperative Farming or Individually Dispersive Group Farming that requires a Network system.

Consequently, a network infrastructure similar to that of urban areas or other industries should necessarily be provided in farming areas. This will make multipurpose, multi

-layered and wide-area communications possible. In consequence, some changes in the values of food production can be brought about nationwide, although it is a very difficult task. Moreover, the fascination of creative activities must be enhanced in the farming process. Network communication can be a powerful tool to actualize these ideas.

In addition digital or network technology will be put to good use on the farm. More specifically, farm management methods for different field conditions can be managed in anticipation. This includes automatic management systems, remote-controlled diagnosis and even more advanced data utilizing systems. Therefore, it is necessary to maintain information resources, set complete digital contents, average information-utilizing environments, assure convenient intellectual production activities on the network and equalize information literacy.

Case Studies

1. Share use of regional information resource

1) Lettuce Network System

The progress of information in agricultural cooperatives and production organizations is moving from direct office automation to the construction of a system of an integrated region that includes individual management units such as farming households. The aim of the system is to allow all to own the regional information resources in common. Each objective has been made clearly to operate a production area with a more strategic application of information.

In vegetable production areas, where there is severe competition between producers, the objectives of the information system are cost-reduction at production, improvement in quality, and advantageous sales to the market and consumers. These systems create a database of customers' data, sales data and field cultivation data as common resources. The aim of these systems is to establish themselves as superior in competition through strategic information processing. such as planning, prediction and analysis.

2) CATV and Joint Information System

Agricultural cooperative in Kawakami village, in Nagano prefecture, where 90% of turn over consist of vegetables, constructed the lettuce network with the objective of improving the cultivation technology of lettuce and achieving advantageous sales. This cooperative has already succeeded in coordinating farmer's shipments by providing them with market information through CATV over the past 6 years. Market information on lettuce and Chinese cabbage, transmitted through a public line, as well as text information such as weather information, is automatically added to CATV and supplied for farming households. Furthermore, a project to introduce a personal computer communication system in all farming households, and to provide information on various items such as market price, local weather, planting, and growth, as well as joint possession of the information resources, is in progress.

This system puts into the database the planting condition of each household to enhance advantageous sales. Different systems have been constructed.

1) Planting report information system
2) Shipment prediction system
3) Shipment plan information system
4) Sales and clearing information system
5) Purchase and supply information
6) Soil analysis information system
7) Local weather information system

These systems consist of plans and prediction systems using common information resources, and seek a strategy for superiority in competition between vegetable production areas, thus aiming at the establishment of conditions for superiority in cost, quality, price and discrimination.

The lettuce network has become a pioneer of agricultural information networks by using multimedia communication based on the combination of joint possession of regional information, CATV and personal computer communication.

2. Strategic use of networks (Yubari Agricultural Cooperative Strategic Facsimile System)

FAX communication can be operated by

everybody easily, so many cases of system introduction have been rapidly spread. In Japan now, FAX communication systems have been introduced in more than 200 cities and towns. Using such FAX systems with OCR or OMR systems, strategic marketing sales which is explained below are realized in Yubari City, Hokkaido. Yubari city has conquered the handicap of producing melons in a remote place. Moreover it has achieved advantageous marketing sales through the use of information.

1) The production of Yubari Melons

Yubari city is located almost in the center of Hokkaido, which lies 1200 km north of metropolitan Japan. It was developed as a coal town since 1888, but the coal industry was completely abolished in 1990. The population has now decreased from peak value of 110,000 to less than 20,000.

The main agricultural activity in the city has traditionally been vegetables, but because of the small agricultural area (3% of total city area), which is surrounded by mountains, The management scale is small. Also, because of volcanic ash, land productivity is low. Moreover, because temperature differences are extreme, the weather condition is not so good for general agricultural production. Therefore, for promoting agriculture which better fits to such land and weather conditions, melon production has been in progress since about 1955.

At present in Yubari city, there are 217 farmers houses, 372 ha of planting area and of about 400 million yen melon production, which is 93% of the total agricultural production in the city. Yubari melons get a high value as one of the highest quality melons because of the distinct control of seeds and quality. About 4% of the shipping quantity is for gifts, which are delivered to consumers directly; and the other 60% is for market shipping, including 20% of shipping to the metropolitan area of Tokyo and Osaka by air transport.

2) Introduction of Melon Shipping System

Yubari agricultural cooperative introduced computer systems in 1991 for improving the shipping process by the financial support of 40 million yen from agricultural ministry. Figure 2 shows the constitution of the introduced system. The system consists basically of 3 personal computers for summing up data with OMR (optical mark sheet reader), FAX mail system which receives FAX data from farmers and provides information to farmers, and terminal FAX in farmers houses.

The prescribed shipping number of cultivated melons are sent to the agricultural cooperative from farmers FAX in the form of a shipping sheet. The number of farmers and the shipping amount which are written on the sheet are read by OMR, and after summing up the result by computer, the total amount of daily shipping is calculated. Farmers must send the shipping sheet before 12 o'clock, and data processing finishes at 12:30. Then the summed up results are used for the collection of melons; the standard test of grade; the arrangement of containers, tracks and airplanes; and the delivering plan.

3) Effect of System Introduction

Figure 3 shows how shipping conditions change by the introduction of an information system. Formally, shipping procedure was estimated by the shipping result of the day before, so adjustment of marketing was uncertain and unbalanced. This was true especially in the case of melons, because the shipping amount can be influenced by weather condition and the daily shipping amount varied very much. Because of this unbalance, allocation to markets was difficult, and then in many case, rest melons was shipped to near market in Hokkaido. This shipping procedure had a bad influence on gift traders, transportation companies and consumers.

Since the system introduction, planting, growing and cultivating conditions can be obtained in a timely manner. Also, in the whole of shipping season, melons can be provided stably. Especially on the shipping day, by getting FAX shipping sheets, the shipping amount of the day can be found before sales. And then, gift shipping and market shipping can be allocated property, so melon producers can anticipate the needs of markets and consumers accurately. Stable

provision and price maintenance have been improved very much. The price of melons rose 30% by appropriate allocation planning.

Formally, the total amount of shipping from farmers was not known until 15:00. At that hour, containers and airplanes for transportation could not reserved. In marketing, a person who keeps containers can be a winner. After the introduction of the system, the total shipping amount can be known by 12:30, and airplanes and containers can be kept efficiently and speedily. And the collection of melons can be carried out intentionally because the quantity and shipment places are known. Moreover, by the introduction of the FAX system, highly technical information for melon production is provided to farmers. Information about production materials, growth data, market and life are provided, so good communication between farmers and the agricultural cooperative has been achieved.

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Discussion

Q: Rural communication systems explained are individual based. How do you check on whether the information and systems are used correctly?

A: We checked the forecasted data against the real field data every year in our prefecture's rice growth system. And if necessary, we amend the system.

Q: Trust is a factor in use of system and information as you indicate. With individual based information system, what is done to build the trust?

A: Public organizations that developed local information systems, have responsibility to their provided data and information. But, they do not have any responsibility about farmer's decision using these data or information.

2. Region-based Agricultural Information Network for Farm Advisory Services in Dairy Sector

— Experiences and Implications of Shihoro Agr. Coop., Hokkaido, Japan —

Masakazu NAGAKI

1. Introduction

This presentation introduces our experience in the development process of the Region -based Agricultural Information Network (RAIN) and evaluates the effectiveness of it as a decision support mean for farm managers. In this section, the emphasis is placed on the view that the RAIN must be incorporated to the traditional rural extension, farm guidance, and consultation activities in order to improve productivity and is not able to contribute solely. In other words, this presentation intends to show the importance of the human activities as the interface between computer technology and end-users, farm managers. As a typically effective instance, the RAIN constructed and being operated by Shihoro-agricultural cooperatives is introduced. Shihoro is a dairy farming region, located in Hokkaido. The regional computer information and communication network system in Shihoro is one of the well organized successful RAINs in which intellectual human activities are splendidly incorporated.

Nowadays, INTERNET has a great potential applicability in the agricultural sector. However, recent RAINs subsumes it as a part of important application. Moreover, RAIN has a common concept that the share of information by offering and receiving among member farms in the networked region.

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2. Exciting Concerns of Computer Technology Uses in Farm Management

New technology is increasingly necessary as agricultural operations continue to grow in size and complexity. The two decades of the 1980s and 1990s have shown drastic changes in the farm size and farming technology in Japan though the total number of farms has declined. The farms with larger size need more information that allows for the better decision making. The planning, directing, and controlling of farm businesses will become even more critical in the next decade because the global market mechanism will directly affect on farming business. The break through of computer technology of a past decade made the farm use it for better and timely managerial decisions.

Farm management can be defined as the series of decisions and successive operations of a farm to secure the greatest return and maximum ecological and financial sustainability on the farm under the given conditions. In other words, successful farming can be executed by the prior decisions are made properly under the given management goals and, in this context, the computer technology can be expected as the useful device to organize information. Probably computer plays a rule of the part of managerial skills of farm manager. Consequently, computer technology can contribute to secure and sustainable farming business.

However, the usefulness of the computer in improving managerial skills depends directly on the external farm supporting sys-

tem. Why? Reasons are as follows.

1) Some of the data comes from internal sources while much information must be acquired from external sources. The internally generated information such as tax statements, income statements, and balance sheets is the data which are processed through the kinds of routine tasks and farm manager may ask farm accountants instead of doing them by himself. On the contrary, extensive information may be obtained through the activities which are kinds of try and error type procedure and, then, are not able to ask a third person to do so. (Information acquisition system)

2) How to manipulate raw data and how to catch the meanings of processed information are essentially important. However, for dominant farm managers, these procedures may need assistance of a proper person outside because dominant farm managers do not have enough ability about information utilization literacy. 'Information utilization literacy' is an essential part of the information acquisition system. (External human supporting system)

The latter is one of the important functions of farm managers. Then, these out-sourced-information may be selected and accumulated. In the day-to-day coordination and administration procedures of a farm manager, indeed, much of information comes from external sources.

Essentially important functions of farm manager are ;

1) how he can obtain and accumulated information internally and externally,

2) with such information, how he can recognize problems involved on the farm and how he can make decisions for the new actions to solve the problems.

In other words, an external farm supporting system principally plays important rules for better managerial decisions. The external information acquisition system is, therefore, a subsystem of the farm management supporting system. Probably so-called the package composed by broad based external information acquisition environment and external human assistance environment, who assists farm managers in selecting information, analyzing, and using it for decisions, is a farm supporting social infrastructure of agricultural sector.

3. External farm support and information environments for dairy farming business

Any farm manager who adopts new or improved methods (or technology), better suited farming practices for the given farm conditions, passes through a number of stages. These stages include (1) awareness, (2) interest, (3) evaluation (include trials), and (4) decisions (whether accept or reject). The first two steps are mainly done by assembling information outside in various forms where concerned method is featured.

The evaluation stage is particularly important since evaluation is done by listing the advantages and disadvantages of the concerned method. During the evaluation stages, farm manager should carefully explore himself by the observations, inquisition, discussion, and so on. Extension office, local A-coop, or neighbor farms may offer the opportunity for such inquiries with wider experiences. After obtaining practical evidence on the concerned method, then, he can make confidential decisions finally.

In Japan, especially in dairy farming sector, diversified sources of farm supporting organizations are available. They range from public extension services to private consultation services for individual farms. Dominant farm management supporting agencies in the dairy sector and their activities are as follows.

(1) District Extension Office, being financed together by the government and prefectural government, play a role as technical advisers and transmitters of new information received from national and prefectural experimental stations and directly from other sources.

(2) Veterinarians, employees of the farm insurance agricultural co-op, work not only for veterinary services but also work for technical advice concerning to the nutrition, reproduction, sanitation-related, and even man-

agement issues.

(3) Farm management advisers of the local agricultural co-op work for helping farm record keeping, farm financial diagnosis, and annual and long-term farm planning.

(4) A fourth group which deals with farm services includes :

a) Specialized data collection and analyzing service organizations (or companies) such as Japan Dairy Hard Improvement Association(JDHIA).

b) The Livestock Farm Management Association(LFMA), nation wide private organization composed by livestock farms and partly financed by the government. The LFMA is specializing in Data processing service for farm record keeping, accounting, farm diagnosis, financial management reports, and investment decision consultations. The LFMA also provides latest but practically applicable technical and economic information.

c) Voluntary farm manager organized membership associations (occasionally commercial firms) do farm services. Dairy Helper Co-op is the common type of custom services. Machinery work services for plowing, harvesting, and transporting with larger machinery are getting popular recently. Among members they have frequent opportunities to communicate the opinions and exchange practical experiences each other. It is said that these are good opportunities of OJT for young farm managers.

All these are traditional rural communication system and are still regarded as the important parts of the social infrastructure which are supporting dairy farms. The concern is how to incorporate the computer aided information network, RAIN, recently commonly become available in most rural areas, in that body.

The introduction of computer technology in the dairy sector was done earlier than other agricultural sectors in Japan. Increasing herd sizes brought about increasing demands for knowledge based herd management. This is particularly true in Hokkaido where a fairly large herd size dairying is dominant and the RAIN terminal becomes common type of a dairy farm management support device. Most RAINs are equipped and operated by the local A-coops or it's district associations. Many of member farms equipped on-line terminal and they are able to use computer technology for data retrieval and data processing as much as they want at any time.

4. How the RAIN can support farm the manager's decision?

As mentioned, farm manager is a decision maker and he has to bear all responsibility what he had decided. An introduction of computer technology as a part of farm management tool was highly expected that farm managers can make decisions more effectively and timely. The more effective individual based services to farmers in technical consultations and farm management advice was expected.

Certainly, the RAIN realized office automation and efficient Transaction procedures at local A-coops. Disappointedly, however, evident impact on member farms was rather modest than expected. Take for instance, monthly reported Dairy Hard Improvement records (DHI reports), processed and delivered by JHIA, a dominant obtainable information for the dairy farm through the RAIN, several monitoring surveys including my survey had shown disappointedly that dairy farms who use the DHI records with at certain frequencies were moderate. The ways of record uses were less improved than before the introduction of the RAIN, although the bundle of the DHI reports has a great potential use for the individual cow evaluations of performances. Meteorological data and weather forecast reports have become available through the RAIN. By referring this information, better nutritious hay and forage can be harvested. But again the cultivation and harvest period remained in traditional manners at most cases.

After while, we recognized that (1) less motivation to use was given in the information provided and (2) this was mostly because of the lack of information utilization literacy (do not mean computer operation literacy).

Delivering method had changed by the introduction of RAIN though, information contents had not changed much. Inter-causal relations, i.e., relations between causal technical factors and resulting economic performances were not explanatory analyzed and indicated. In both recognition of the problems involved in the farming activities and conceiving problem solutions, causal relations must be well explained and understood by the recipient farm managers in order to give them motivation.

From this point of view ;

1) In the data processing process, (a) the DHI records, (b) veterinary clinic records, (c) sample test records such as milk quality test, forage nutrition test, and soil fertility test, and (d) daily work chore records and various farm financial records must be combined properly and related. Then, a kind of causal relation manipulation must be made and the results must be presented in the reports.

2) The third person, specialist, assists farm managers for reading and understanding the information and suggest what improved actions have to undertake. In this connection, final reports must be presented in numerical expression as much as possible in order to avoid the subjective judgment of person. Such processes are actual information utilization literacy activities and characterized by the mutual communication of human being.

3) Consequently, these kinds of activities give a motivation and encourage farms to a positive use of them. So-called 'Human interface' must be incorporated at the outlet of the information delivering system. The third person who may in charge is a veterinarian, farm guidance staff of A-coop, and private consultant. They engage in these rules may be called the 'information mediators' and 'medial information recipients who interpret information and give suggestion of the direction of improved action plans concerning to farming practices and investments to final recipients, farm managers.

5. Outline of the Shihoro Dairy Farm Consultation & Information System(SDCIS)

Shihoro-cho located in almost the center of Hokkaido, Shihoro A-coop took the initiative to build an on-line computer communication network named the SDCIS in 1980 to offer individual based information processing services to the dairy farms in the town. The SDICS is a part of the whole system. The diagram of the SDICS is indicated in Fig.-1.

These services included the DHI cow report and milk analysis. The Forage and Soil Analyzing Center and Raw Milk Testing Laboratory were attached to the computer center. The automated meteorological data monitoring system was installed and collected to the center. The server computer is connected to every relating office and section and links on-line to the on-farm terminal computer of all dairy farms. Farm can choose one of the two types of terminals, (1) a one specially developed which is featured simple operation, low cost, and multi-purposes that is used not only as a network terminal but also be usable as a stand alone personal computer and a facsimile terminal, by simply pressing certain button, any information accumulated in the data storage, no matter text data and graphic data, can be retrieval, (2) usual on-farm computer terminal.

Principally, the SDICS works as follows : rural DHI supervisors visit the dairy farms every month to collect milk production data. The SDICS has greatly shortened the period of time needed to report the results and the evaluation of individual cow performances, which has taken almost one month in the past since records were sent and processed in the other place. Test samples for forage and soil analyses are transported to the lab. by milk collecting trucks. On the following morning the results of the analyses are conveyed by network-mail. The varieties of result reports are available to refer anytime custom farm managers want through the demand-on communication system. However, all reports are conveyed by hand since this is the routine task of the teams called 'visiting

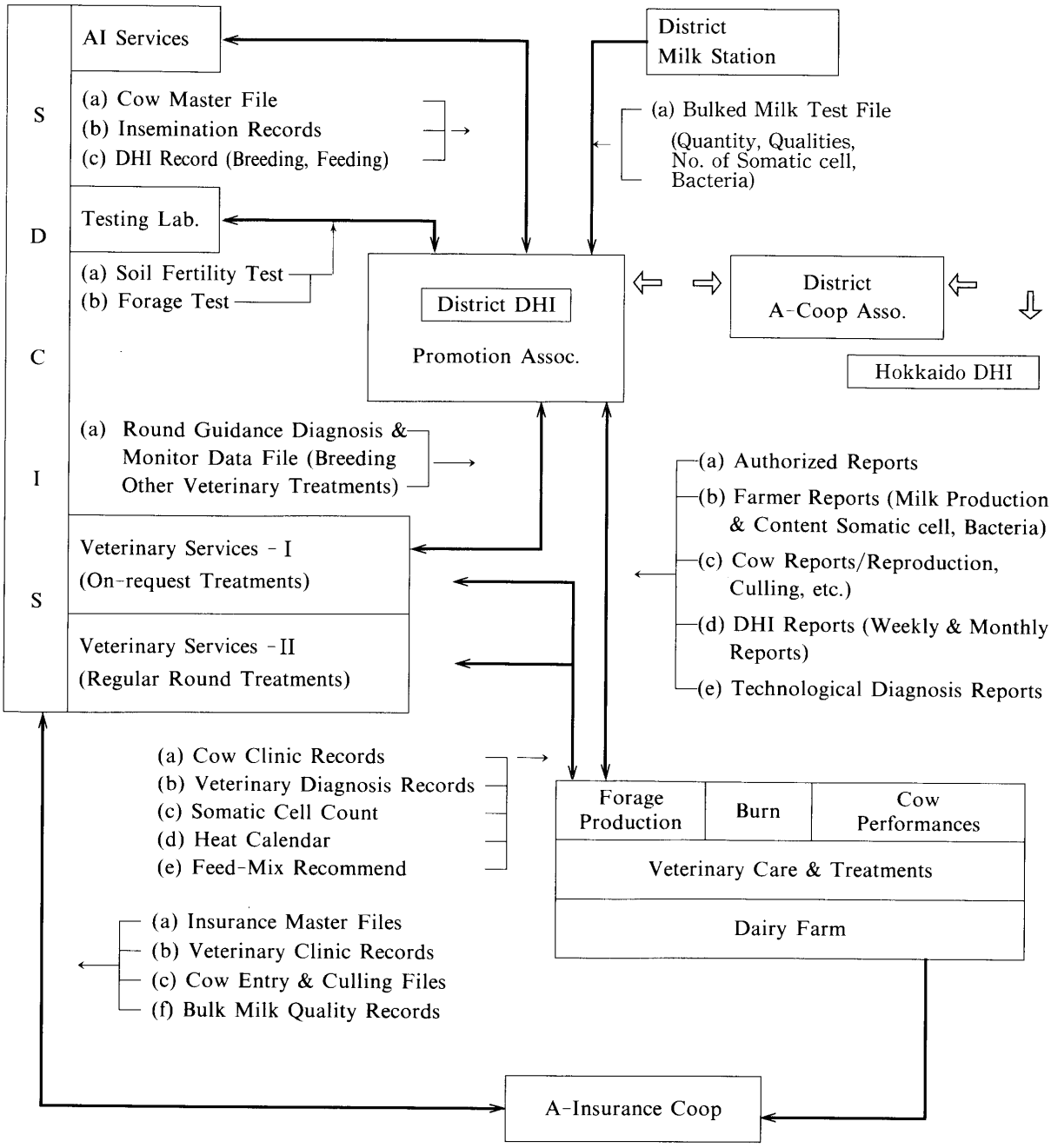

Fig. 1 Diagram of the SDCIS

farm guidance' which are composed by veterinarians and farm guidance staffs. They regularly visit barns and notify the reports, explain the cause-result relations hearing and discussion, then finally give necessary advice.

The information service of main six kinds are (1)raw milk analysis information (milk production, feed-production performance, tests of ingredients and somatic cells counts, and so on), (2) reproduction performances, (3) feed analysis, grassland soil analysis, and feed-mix recommendation, (4) veterinary test and diagnosis information, (5) genetics information and performance and sire selection information, (6) general productivity assessments, farm financial diagnosis information. This information includes analytical diagnosis, optimal planning under the constraints, suggestion for the improvement opportunities, and position of management performances both from a historical review of the farm and from comparative evaluation in

the regions.

The System SDICS has the noteworthy features:

1) Turnaround days of the formal DHI reports had shortened significantly.

2) Very clear improvement has been observed after the introduction of the SDICS, i.e. farm managers could do necessary actions immediately after receiving reports concerning to the milk quality in terms of constituents and hygiene and sanitary treatments. This improvement preferably effects not only in terms of efficiency but also in terms of decreasing unexpected managerial risks

3) The SDICS offers dairy managers comprehensive and well organized information of the farm addition to formal DHI reports so that they can use most of information is used immediately into consideration for their decision making on feed rationing, reproduction and health control and on forage production. This system thus enables dairy managers to obtain more scientifically analyzed and numerically arranged information timely and make decisions on the basis of this information. It is a kind of an exterior supporting system for dairy farms.

The dairy farms are benefiting from the SDICS in varieties of management aspects. It is quite evident that the large parts of recent improvements in the prospects of the productivity such as milk production per cow, reproduction, forage production qualities etc. in Shihoro. These improvement came from farm implementations based on analyzed information provided by the SDICS and from various types of adjacent extension and consultation activities. In this connection, the system is an indispensable tool for farm extension and consultation activities. Addition to this, it should be mention that productivity gaps between average farms and frontier farms became closer recently in Shihoro. This is the reflection that comparatively lower productivity farms improved as a result of using information the SDICS provided.

However, it should be emphasized that numerical and scientific management decisions resulting from the greater utilization of information are made possible both for farm managers and extension and consultation workers by the System. And the most important meaning the SDICS has that computer aided mass data processing and communication system is embodied in the existing rural extension and consultation infrastructure. In short, the SDICS is by no means a symbolic instrument of the latest information and communication equipment. Instead, it is a transformation of farm managers environment, from experience-based farming practices environment to scientific knowledge-and data -based decision environment as well as the extension and farm guidance & consultation staffs placed in the knowledge- and data -based environment on their practical inferring and judging.

The important feature which is deserved to mention is that veterinarians, employees of the agricultural insurance co-ops (AIC) which are independent organization, are working together with A-coop staffs. Commonly the local AIC locates separately from A-coop and no direct connection with local A-coop. However, in Shihoro, local ACI nominally exist separately from A-coop though, administrative staffs are positioned at the local administration office an Twenty-two points, plus triple-word-score, plus fifty points for using all my letters. Game's over. I'm outta here.d veterinarians are positioned at the Shihoro A-coop in order to work with farm guidance staffs of it. Conjunction to built effective RAIN, Shihoro's experience suggests to us that human resource allocation must be reconsidered in entire rural extension and farm guidance system.

6. Resulting implications

The evidence of the experiences in the Shihoro computer & communication network system suggests that computerized information services would be institutionalized almost everywhere in Japan as a rural infrastructure. It is our hope that dairy managers will evolve from a manager of the traditional family farm into a modern business enterprise in a sense that manager commonly uses information for his decision-aid, monitoring, and

control.

Computer technology is characterized by as follows.

1) The technology which is applicable to any farm while machinery technology is applicable one that are effective to a larger scale sized farms.

2) Computer technology is intellectual device partly substitute to farm manager's managerial functions.

3) However, computer technology in the agricultural sector is become effective when it is constructed as a regionally hold infrastructure, or club-membered cooperative using instrument and sharing data and information among member farms.

4) Finally, most important issue is that computer technology can not be solely existed. Rather, it must be incorporated into rural extension, farm guidance, and mutual communication system. In other words, farm managers are final users (information recipients) though, intermediate users must be explicitly place as a man-machine-interface in the whole system.

Fortunately, computer technology may be applicable at various degrees of the scale depending upon financial constraint, human resources, and farm managers educational background. Farmers even in developing countries can be users, may be indirect information recipients, and they will step forward from traditional management practices to begin utilizing information more and control their production process based on scientific judgments received from computer-processed information services as Japanese dairy farmers do. Beforehand, effective computer technology use concepts must be clearly designed as the consensus among involved people. It is my convince that our experiences is suggestive and applicable.

Discussion :

Q : How easy is it for dairy farmers to adapt the type of record system, and adapt the "old" system to the new system. For example, is much of the information already in hard copies?

A : It is still not easy to adapt the farm record system in general. However, farmer and his wife have many opportunities to learn how to record and how to read since the district extension office and local A-coop offer training courses and workshop during off-farming season, especially when farm managers have to prepare the tax statements. Hard copy instruction materials are, of course, available though, these materials usually seem to be not very effective. Group training and undertaking seem to be more effective and successful. In addition to this, farm managers can easily start farm record keeping by using personal computer, as the farm records and farm financial statement software for beginner farmers are available. And most of these softwares are magnificently attached and carefully prepared with the help commands and instructions.

Q : Do Japanese Agricultural Science students study technology required for modern dairy management?

A : Yes, Japanese students majoring agricultural science can learn modern dairy management methods. However, the course specialized in dairy farming is rather limited in Japan since the dairy sector is not as large as rice and other crop sciences in terms of domestic production. Therefore, students who want to study dairy science and management have to choose the right course at the right institutions. Recently, it should be noted that many students who want to be dairymen go abroad, they go to the United States, Canada, Denmark, and New Zealand, for farm-stay-training for one or two years. Several types of private associations are sponsoring this program.

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3. An Asia Pacific Information Network For Agricultural Research and Educational Collaboration

Seishi NINOMIYA

Abstract

The Asia Pacific Advanced Network (APAN) and its activities especially in agricultural areas are introduced. APAN is an NGO consortium with two aims. One is the provision of high performance network links for research and education throughout the Asia-Pacific area. The other is to accelerate research and educational activities in the area, utilizing the APAN infrastructure. There are three activity areas under the APAN committee, the highest authority of the consortium. These are the Application Technology Area, the Network Technology Area and the User Community Area. The Agriculture Working Group of APAN (APAN/AG) is one of the most active working group in the User Community Area.

What is APAN?

APAN (http://apan.net) is an abbreviation for the Asia Pacific Advanced Network, which is an NGO non-profit international consortium established in June 1997. It has two main aims. One is the provision of high performance network links for research and education throughout the Asia-Pacific area. The other is to accelerate research and educational activities in the area, utilizing the APAN high performance network link infrastructure.

APAN members voluntarily offer the high performance network. In order to establish an APAN international link between two countries, a link point on each side and an international connection such as a seabed lease line or a communication satellite must be provided. Primary members provide both link points and international connections while regular members or associate members provide only link points. For example, the MAFFIN (Ministry of Agriculture, Forestry and Fishery Research Network, MAFF, Japan, http://www.affrc.go.jp/) voluntarily provides the Japan-Philippines link and the link point to it in Japan while PH-Net (Philippine Network Foundation Inc.) voluntarily provides the link point in Philippines.

Table 1 shows the members of APAN. The names of the countries in the table do not signify any national or governmental participation by those countries in APAN but do indicate that at least one link owner in each of those countries is offering at least one link point to the APAN international connection. A national institute, a university, a semi-governmental organization, a foundation or a private sector can be a link owner provided they can offer the above-mentioned facilities. In APAN member countries, there are usually APAN Project Institutes (API) where some research or educational project to utilize the high performance APAN international links is being undertaken.

APAN Topology and APAN Exchange Points

Figure 1 shows the status of APAN network topology and the exchange points as of March 1999. Since then, the Chinese and Malaysian links have also been established.

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Table 1 APAN Membership

Primary Members	Members	Associate Members	Liaison Members	Affiliated Member
Australia	Hong Kong	China	Canada	CGIAR
Japan	Indonesia	Malaysia	EU	
Korea	Thailand	(Vietnam)		
Singapore	Philippines			
USA				

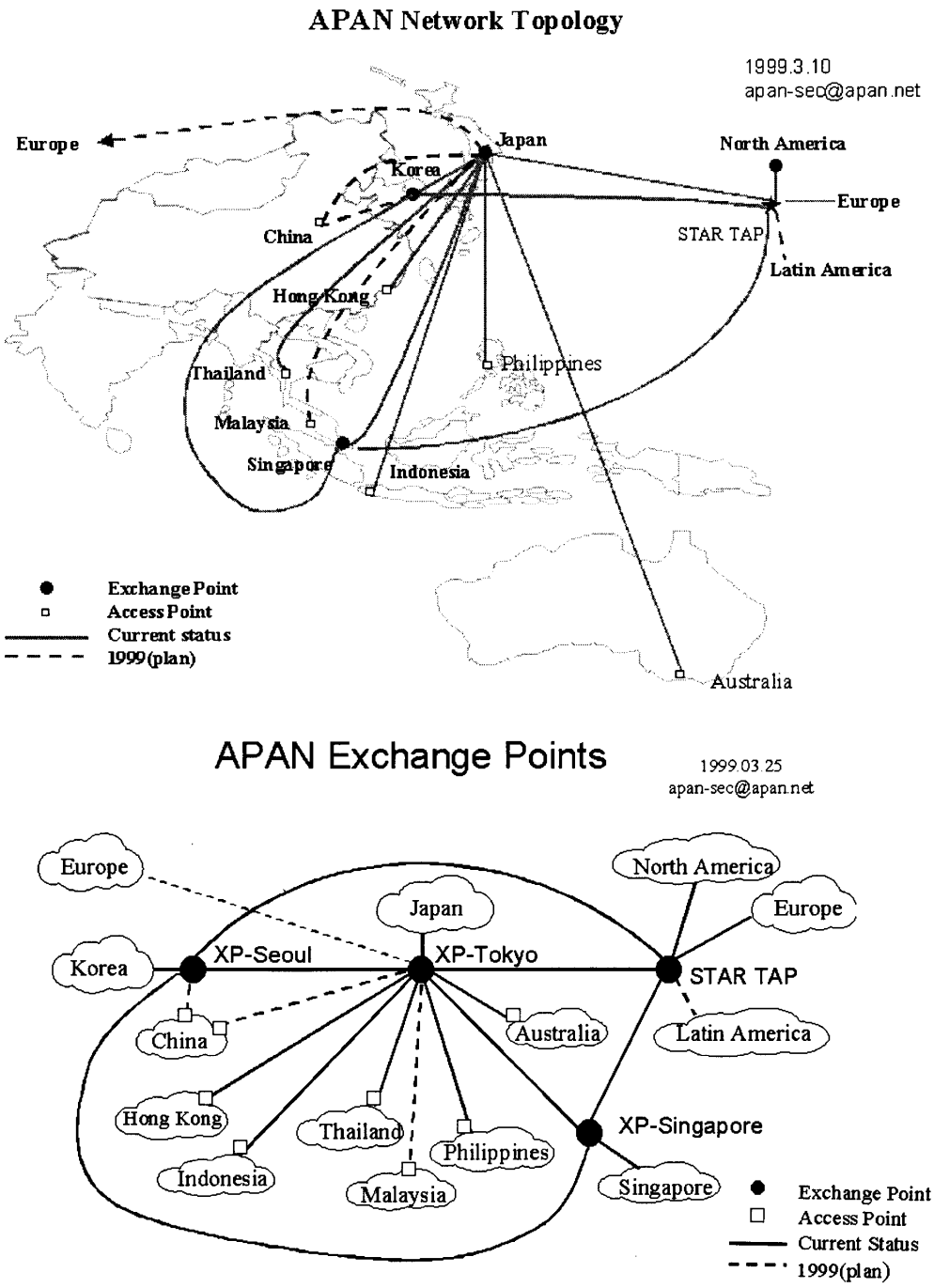

Fig. 1 APAN Topology and exchange points in March, 1999. The China and Malaysia links have been already established and the Vietnam link is now being planned.

The Vietnam link is expected to be finished by the end of 1999. The link performance varies from 0.75 (JP-PH) - 73 (JP-US) Mbps, depending on the connections.

APAN Organization and Its Activities

Figure 2 shows the APAN organization. In APAN, the APAN committee composed of the APAN link owners is the highest decision -maker. Under the committee, there are three activity areas. These are the Application Technology Area, the Network Technology Area and the User Community Area. Each area is composed of several working groups. The two former areas are mainly for network researcher and engineers who are involved in basic network technologies and basic applications of the network, while the third area is open to researchers, administrators, educators etc. from wide range of different research and educational fields. Their interest is in how to apply APAN's high performance international network to their own fields.

APAN meetings are held regularly twice a year, once in Japan and once in another country. When it is held in Japan, IWS (Internet Workshop, http://iws2000.jp.apan.net/) hosts the APAN meeting as a part of its international workshop, providing some special sessions for APAN as well as for the APAN committee meeting. Those special session are chaired by some of the working groups. The working groups usually cooperate closely with each other.

How to Join APAN

There are several steps required for an institute or organization to connect to APAN. First, there must be a link point to APAN in their country. Then, a network connection must be established from the institute to the link point. Because of the strict routing and allocation policy of APAN, this physical connection does not in itself secure the APAN connection. To achieve this, the institute has to be an APAN Project Institute (API). To become an API, one has to find start a research or educational project that utilizes the APAN connection, with some partner (s) in an API or APIs in other APAN countries.

APAN Agriculture Working Group

The APAN Agricultural Working Group (APAN/AG, http://agri-wg.jp.apan.net/) started at the APAN Tsukuba meeting held in March 1998. A sub-group of APAN/

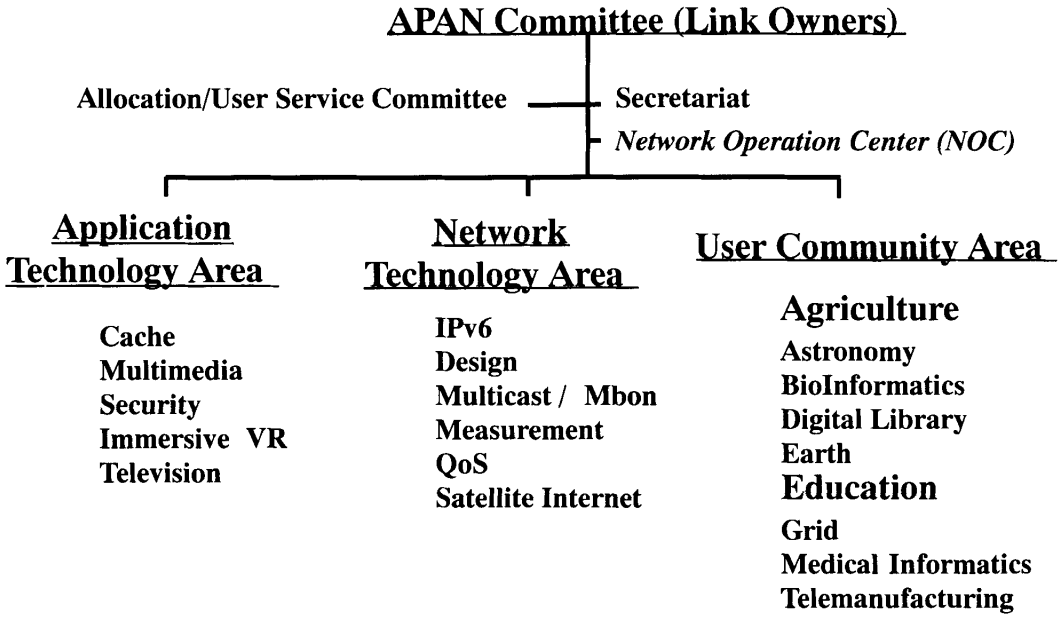

Fig. 2 The structure of APAN organization.

AG became an independent WG as the Earth Monitoring Group (http://ss.cc.affrc.go.jp/~emonitor/) at the Seoul APAN meeting in June 1998. The aim of APAN/AG is to accelerate agricultural information research, utilizing the APAN network. It promotes research or educational projects in agricultural fields and attempts to bridge institutes to start up new collaborations.

The Agriculture Working Group of APAN (APAN/AG) has been one of the most active working groups in the User Community Area since its establishment. It has been maintain close relationships with other working groups of APAN such as the Earth Monitoring WG, the Education WG, the Digital Library WG and BioInformatics, having overlapping membership with these groups.

In addition to the projects being either undertaken or planned under APAN/AG, some of which are introduced in the next section, APAN/AG has been trying to establish a local APAN/AG group in each APAN country. Missions to Korea, Thailand, Malaysia, Indonesia and Philippines were sent in the summer of 1999. In each country, a local meeting with the mission was held, gathering many people from fields related to agricultural information. A mission to China is also being planned.

APAN/AG Projects

In this section, some of the APAN-related projects are introduced.

Mirror Sites

Bio-mirror (http://bio-mirror.jp.apan.net/) is a project to promote the mirroring of DNA sequence databases, protein biosequence databases etc. It covers GenBank, EMBL, DDBJ, SWISS-PROT*, TrEMBL, PIR, BLOCKS, ENZYME, PROSITE*, REBASE. The total size of the databases mirrored was 18GB in November 1999 with monthly increment of about 1GB. The update frequency varies from one day to a month, depending on sites. Bio-mirror is now served in Australia, China, Japan, Korea, Singapore and USA (November 1999) and is planned to start in Indonesia and Malaysia.

A mirror of FAO's WEICENT is also being planned. WEICENT (http://www.fao.org/) is a popular database open to public, which provides world-wide information about agriculture. The database is currently located on a FAO server in Rome but connectivity to WAICENT from the Asia-Pacific countries is usually very slow because of the narrow bandwidth connection. In June 1999, FAO and MAFFIN agreed to mirror WEICENT at a MAFFIN site as an APAN project, and the mirror is expected to start in early 2000. Additional WEICENT mirrors at other APAN sites are also being planned.

The mirroring of the databases of IRRI (International Rice Research Institute, http://www.cgiar.org/irri/), one of the CGIAR institutes (Consultative Group on International Agricultural Research, http://www.cgiar.org/), is also being discussed between IRRI and MAFFIN for the higher utilization of these valuable databases. This discussion seems to be expanding to other CGIAR institutes. Mirrors for the databases of all the CGIAR institutes would be a valuable resource not only for the APAN countries but also for the world.

Distance Learning

Distance learning is one of the obvious applications of the APAN high performance network. Figure 3 and 4 show an example of a distance learning exercise conducted between IRRI and the Department of Agriculture in Thailand. The availability of APAN's fast network infrastructure made the video conference possible.

Wild Fire Detection

Figure 5 shows a wild fire detection project that utilizes the APAN network. Wild fire in tropical forests occurs unexpectedly and often it is quite difficult to detect from land. This project is to detect such wild fire, utilizing satellite images acquired by NASA and NOAA in USA. These images are sent to a super computer in MAFFIN via APAN so as to analyze them and to extract information regarding fires in tropical forest areas in the south-east Asian countries. The results of the analyses are sent through the

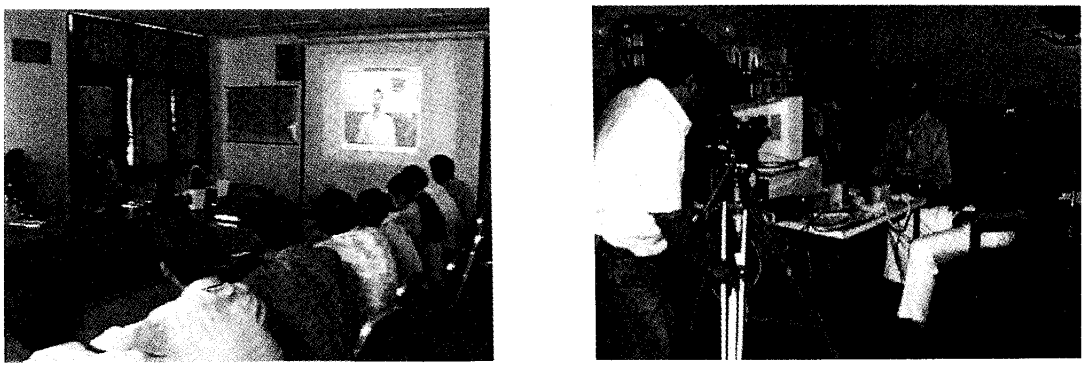

Fig.3 A distance learning practice between IRRI and the Thai Department of Agriculture, using APAN links (after Raab 1999).

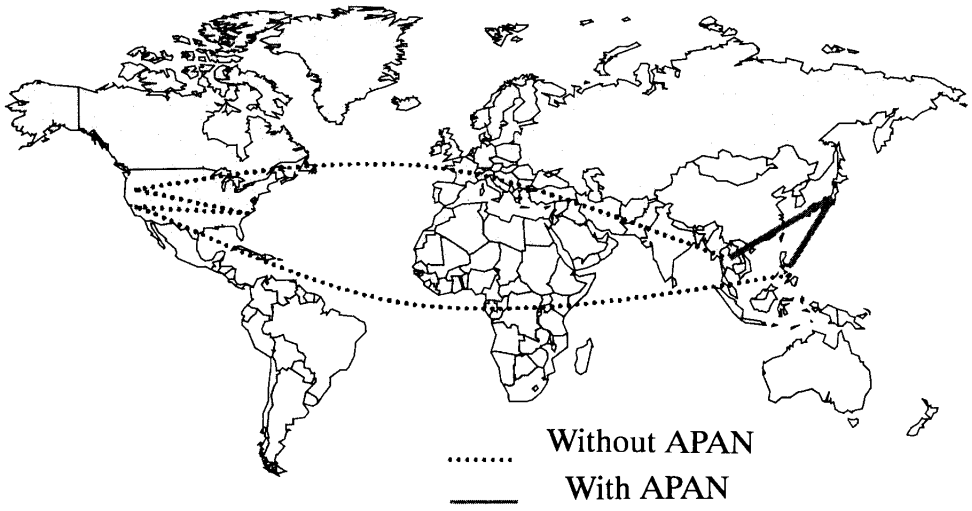

Fig. 4 The packet routes between IRRI and Thailand before APAN and after APAN. Not only the distance but also the network performance were hugely improved (after Raab 1999).

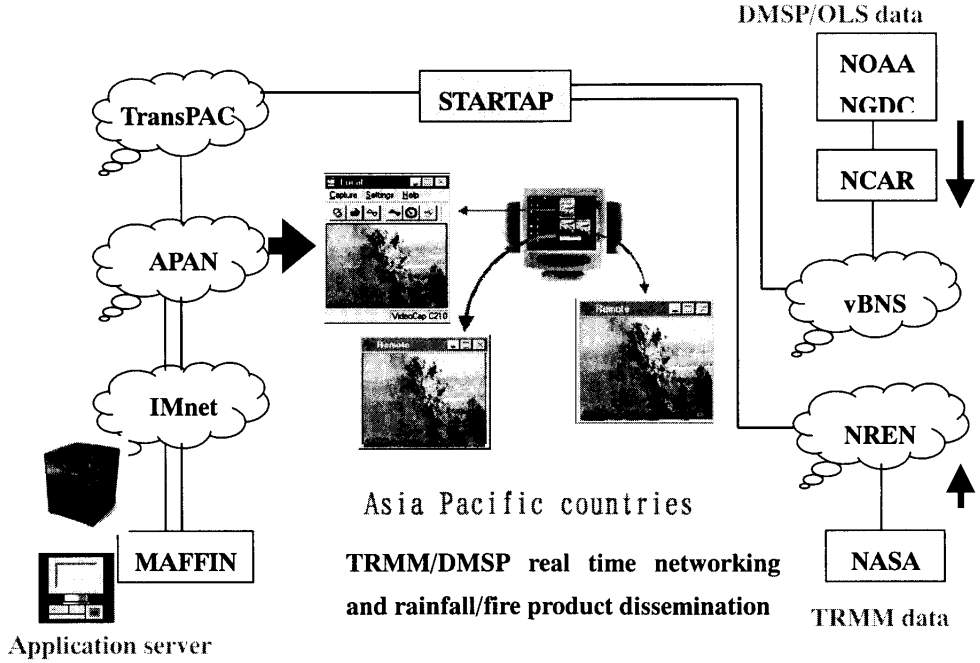

Fig. 5 An earth monitoring system over APAN (after Fujita 1999).

APAN network to places where fire is detected. This project is being undertaken by the APAN Earth Monitoring WG in cooperation with APAN/AG.

Digital Library

An agricultural digital library project is planned to commence in November 1999. This project aims to share digital libraries shared among people in the APAN countries. Almost all the countries in this region, use different languages and in order for these documents to be utilized they must be translated from their original languages. The first step of this project is to create a thesaurus for the different languages using English as a universal intermediary. The second step will be to create automated machine translators, which are becoming practical between certain languages, e.g. Japanese and Korean.

New Technologies Shared under APAN

In this section, new technologies and systems recently developed for agricultural information systems are introduced. The sharing of those will surely accelerate the usage of the APAN network and promote international projects.

Case Base

A case-base is a kind of database which preserves empirical cases and has a function to recommend relevant cases according to users' decision making queries. We have already developed a prototype case base system (Figure. 6, http://zoushoku.narc.affrc.go.jp/casebase.html, in Japanese) using a concept search engine which is based on latent semantic indexing (Deerwester 1990). As sample data, the system contains recommended cases of farming and rural activities collected by the staff of the rural branches of the Statistic and Information Department of MAFF. Using the system, one can retrieve cases without entering any keywords. The user can enter normal sentences as queries for the system and the system searches for cases corresponding to the queries based on the context or concept of the queries.

We also developed a search engine which leads to the information a user requires by asking the user to select queries automatically created by the system (Figure 7, http://riss.narc.affrc.go.jp/weed/, in Japanese). Even farmers who are not used to using a PC can easily access the information they need using this kind of search interface.

Model Base

In the past, we centralized data and programs at a single site to realize an information system. Such a system is generally huge and difficult to maintain. The function of it

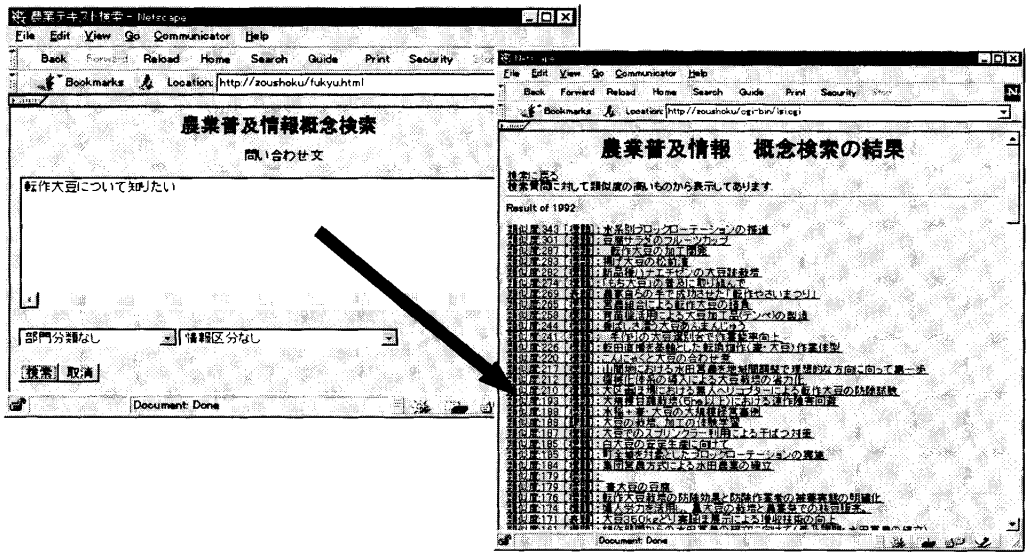

Fig. 6 An example of a casebase system with a conceptual search engine (after Otuka et al. 1998).

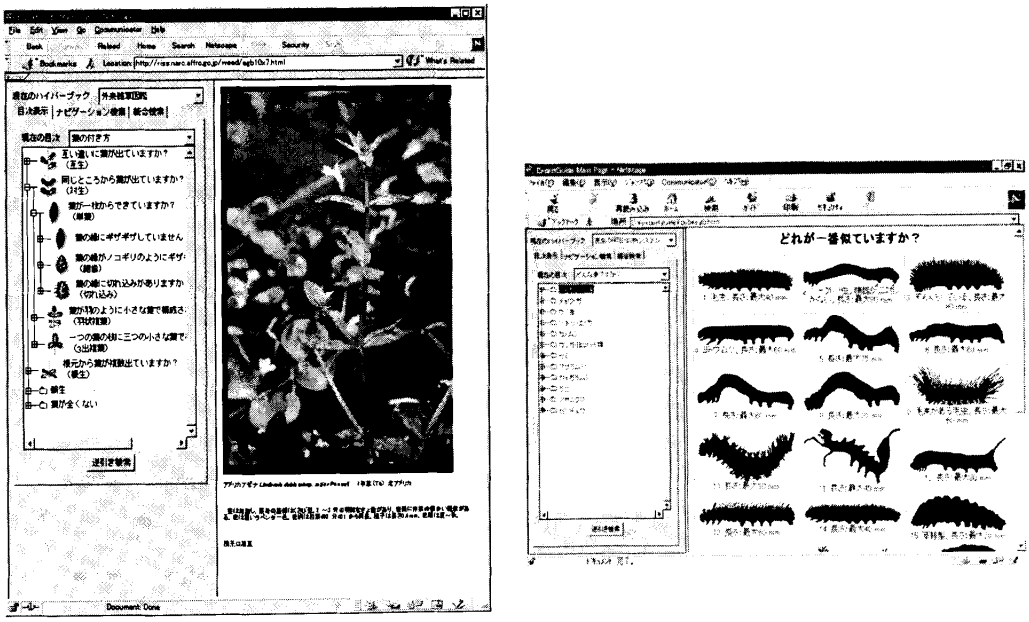

Fig. 7 Databases with a user-friendly interface for farmers unskilled in PC usage.

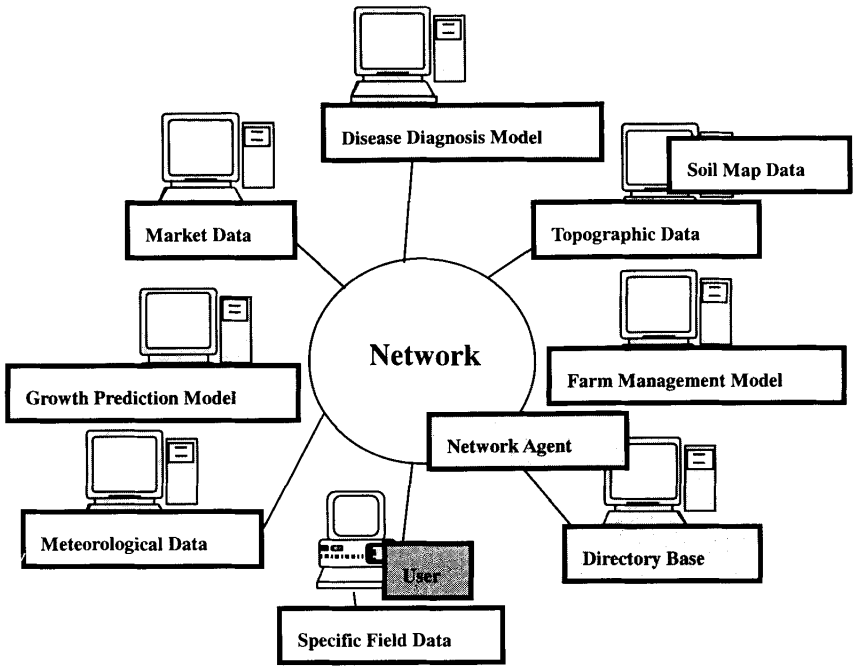

Fig. 8 The model base concept.

is relatively fixed and expansion of that function is usually difficult. Moreover, the same data and programs are often duplicated at different sites. What we are developing now is based on a completely different concept. Our idea is to keep the programs (models) and data at their original location without any centralization so that those can easily be updated. In such a system, the same data set is commonly used for different models located in different sites for different purposes. The different models, for example a rice growth model and a meteorological model, that are located in different sites, can be virtually combined automatically when both of the functions are required simultaneously. We

call such a distributed resource system 'a model base' (Figure 9).

The development of network and network technologies now make it possible to develop the model base. To realize the model base, we have been developing element models and databases (both defined as objects) as well as basic software such as the network agents that virtually combine the distributed objects to dynamically establish integrated systems upon users' requests. Figures 9-10 show some of examples of the prototype element models developed already. They are mainly developed using Java technology so that they can be easily published on the Internet without any platform dependency.

Remote Camera System

A Web based camera server system with remotely controllable pan-tilt-zoom func-

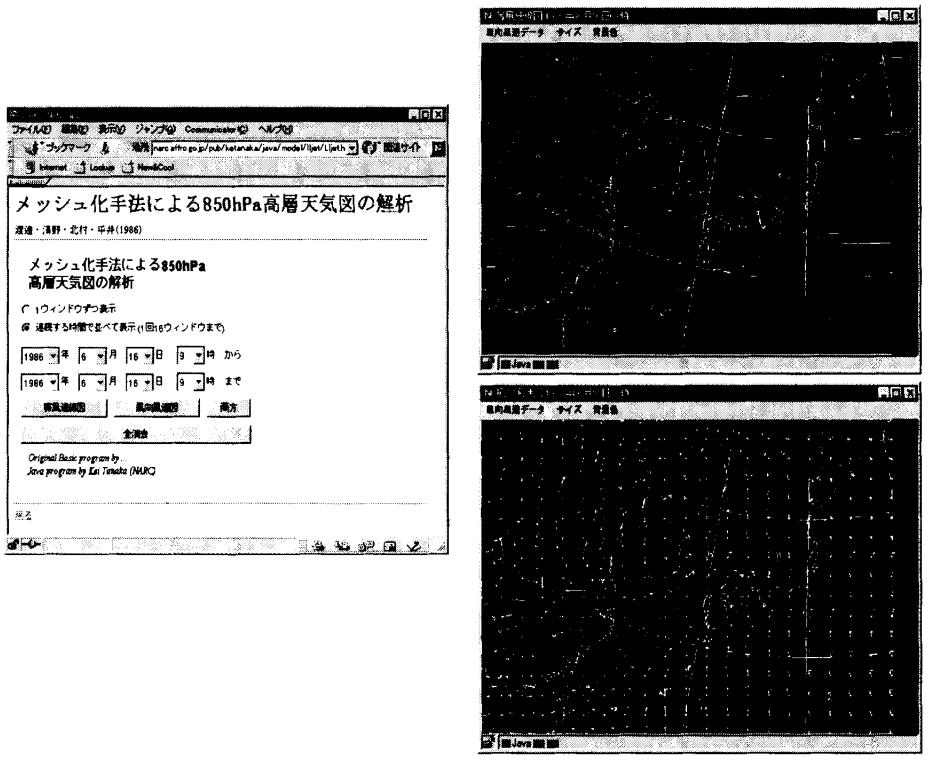

Fig. 9 An element of the model base. A wind-borne insect immigration prediction model, using upper air current data.

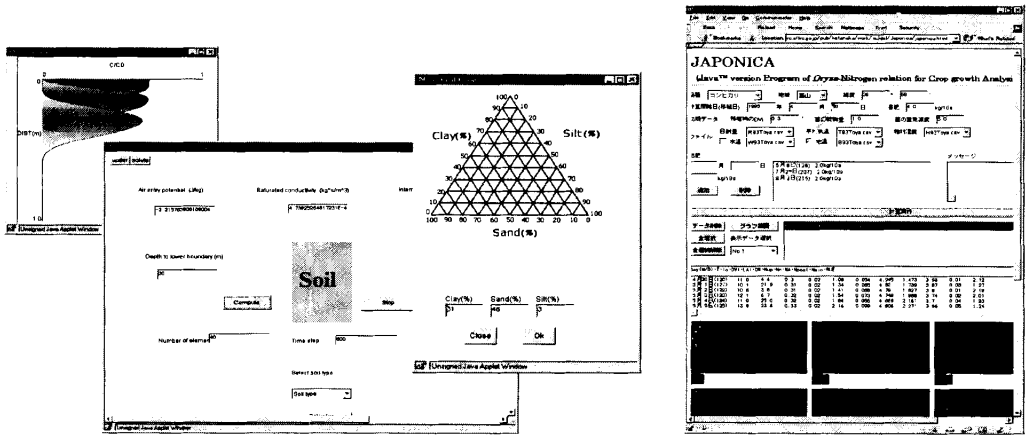

Fig. 10 Elements of a model base. A soil structure model (left. after Mizoguchi) and a rice growth model (right, after Tanaka et al. 1999).

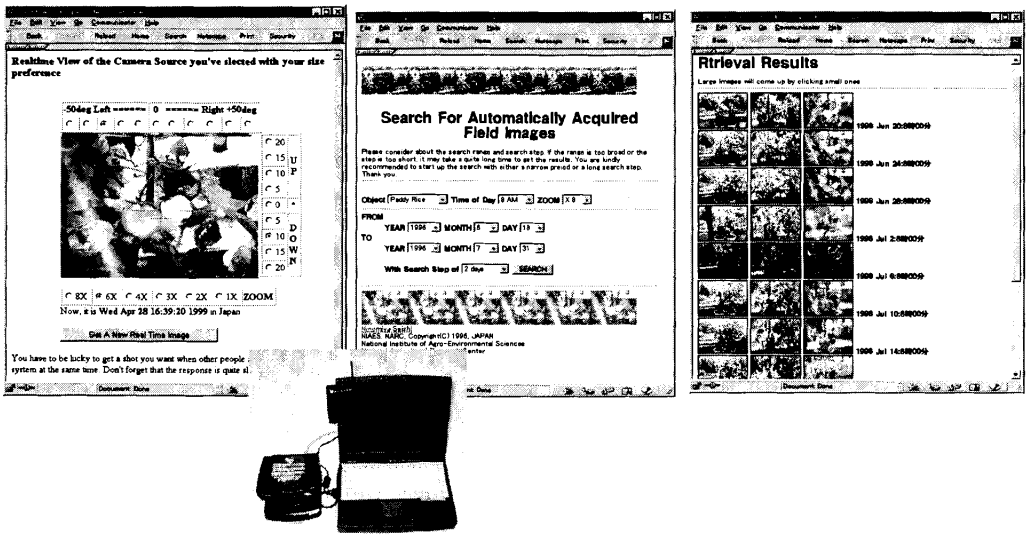

Fig. 11 An Internet remote camera system, Field Eye (Ninomiya et al. 1997).

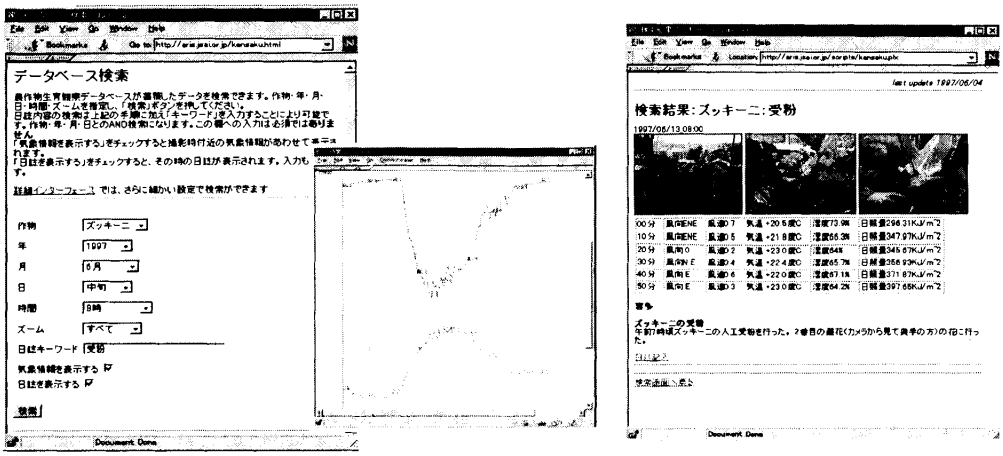

Fig. 12 A farm management record system combined with the FieldEye and a meteorological robot (after Kouno et al. 1998).

tions by WWW clients was developed (Ninomiya et al. 1997, http://fieldeye.narc.affrc.go.jp/defaulte.htm, Figure 11). With the camera server, a user with a web browser can obtain real-time still images of a remote site. The camera server also works as a remote image supplier to a Web-based image database system, acquiring images automatically based on pre-set timing, camera angle and zoom configurations. A mobile camera server with a wireless LAN or mobile phone was also developed.

The systems were combined with a meteorological robot and farm management diary system, aiming at an integrated Web-based farm management system. The combined system was set in a farmer's green house for practical evaluation (Kouno et al. 1998, Fig. 12, http://www.agic.ne.jp/~ muranet/farmweb/, site in Japanese). The farmer could review his cultivation by combining images and meteorological data as well as farm management records. In addition, he utilized the camera system for his sales promotion. He sold melon plantlets of melons to consumers and undertook the management of those until harvest. While the plants were growing, he let the consumers access his web-camera to observe their plants.

Product Identification

A new agricultural product identification system was added to the above-mentioned

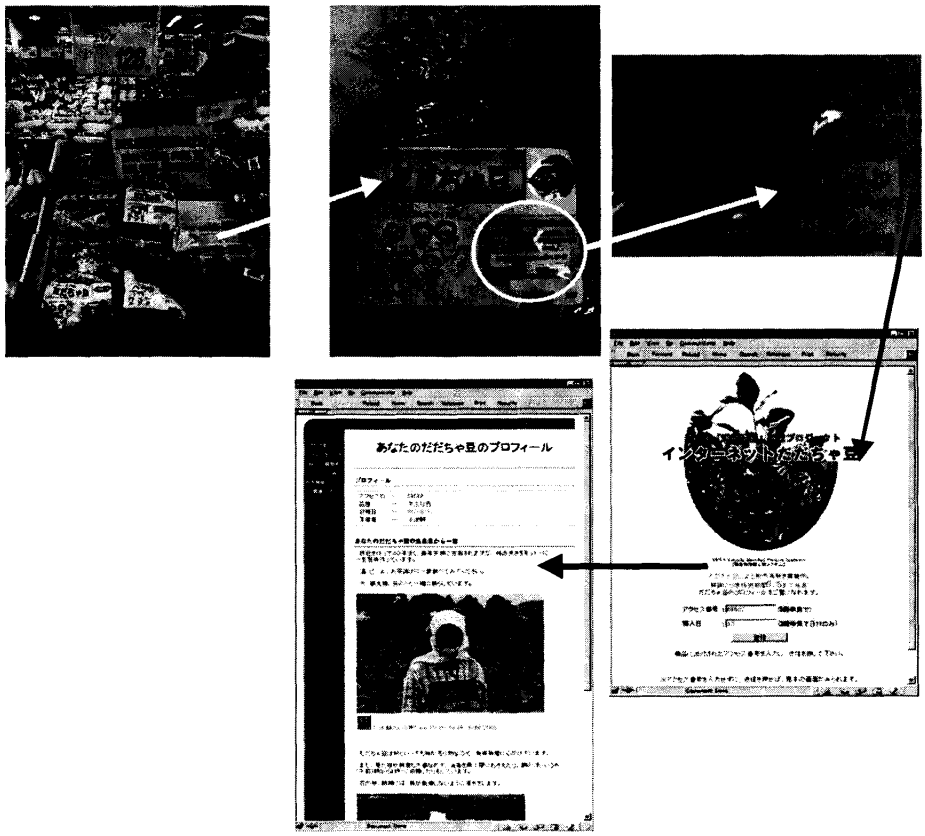

Fig. 13 A farm product identification system (after Sugiyama 1999).

farm management diary. The function lets consumers obtain the farming records of the agricultural product they purchase through the Internet, based on the code number and the URL printed on the product label (Fig. 13, http://vip2.nfri.affrc.go.jp/, site in Japanese). Using this function, consumers can know who produced the products and how, while farmers can obtain feedback from consumers.

APAN/AG Friends

APAN/AG has several friend organizations. International organizations such as FAO and CGIAR belong to the first group of its friends. CGIAR became an affiliated member of APAN after the APAN Osaka meeting held under IWS99 (http://www.itrc.net/workshop/IWS99/). APAN/AG has also close relationship with national associations for agricultural information such as Indonesian Society for Agroinformatics, Japanese Society for Agricultural Information and Korean Association for Agricultural Information Research.

In 1998, AFITA (the Asian Federation for Information Technology in Agriculture, http://www.jsai.or.jp/afita/) was founded, holding the first international conference in Wakayama City located closed to Osaka. just before APAN/AG was started in the APAN Tsukuba meeting in March, 1998. APAN/AG and AFITA have been mutually supporting each other since then and many are members of both APAN/AG and AFITA.

APAN/AG Contacts

The official contact persons for APAN/AG have not been decided in all the APAN countries yet, though we have some contacts anyway. The official contact persons are listed in Table 2.

Discussion

In this article, I have summarized the

Table 2 List of APAN/AG contact persons

Name	Country	Affiliation	e-mail
Markus Buchhorn*	Australia	ACSys, ANU	markus@acsys.anu.edu.au
Juncai Ma	China	IM, CAS	ma@micronet.im.ac.cn
Ronnie S. Natawidjaja	Indonesia	U. Padjadjaran	ronnien@pasca1.unpad.ac.id
Akira Mizushima	Japan	MAFFIN, MAFF	goddila@maffin.ad.jp
Seishi Ninomiya	Japan	NARC, MAFF	snino@narc.affrc.go.jp
Weon-Sik Hahn	Korea	RDA	hahnws@rda.go.kr
Byong-Lyol Lee	Korea	KMA	bllee@kma.go.kr
Suhaimi Napis	Malaysia	MSC-BIT	suhaimi@fsb.upm.edu.my
Felino P. Lansigan	Philippines	INSTAT, UPLB	fpl@imsp.uplb.edu.ph
Tan Tin Wee	Singapore	NSU, BIC	tinwee@pobox.org.sg
Somunk Keretho	Thailand	RDI, KU	sk@nontri.ku.sc.th
Chris Falcher	USA	CARES, U. Missouri	FulcherC@missouri.edu
Robert Raab	CGIAR	IRRI	R.RAAB@CGIAR.ORG
Paul O'Nolan	CGIAR	IRRI	P.O-NOLAN@CGIAR.ORG

* Temporary until a contact is established.

present status and the future plans of APAN and APAN/AG. At this moment, the APAN and APAN/AG activities seem to proceed and grow well. But, because APAN is an NGO volunteer-based consortium and it has no own funding or budget, we cannot be too optimistic. In fact, APAN has to be always hosted by someone when it needs to act, e.g. to hold a conference. That is, APAN's existence can not be taken for granted.

APAN basically considers only the international links between countries. But, when an organization intends to connect to APAN, a network connection to an existing APAN link point must be prepared by the organization. Often, this can be a high hurdle for organizations, because of comparatively high cost for domestic lease lines in many of the APAN countries. This kind of poor internal network infrastructure often limits APAN's activities at this moment.

In spite of some issues APAN is facing, the policy and philosophy of APAN are clear and sublime, and help us to achieve real international peaceful co-operation for human happiness through the acceleration of research and educational activities.

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Otuka, A. and S. Ninomiya (1998) Conceptual Retrieval of Agricultural Cases with Latent Semantic Indexing Approach, Proceeding of International Conference on Engineering of Decision Support Systems in Bio-Industries, Montpellier, France: 37-38.

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Ninomiya S., T. Kiura, K. Eto, T. Nanseki and M. Ueda (1997) Field Image acquisition system on WWW. J. SHITA 9: 12-19., in Japanese with an English summary.

Raab, R. T. (1999) Realizing APAN's potential to facilitate distance learning applications: A CG perspective on what needs to be done. APAN Osaka Meeting

Report. http://agri-wg.jp.apan.net/Osaka/index.htm.
Sugiyama, J. (1999) http://vip2.nfri.affrc.go.jp/.

Discussion :

Q : While the Philippines is growing rice, our staple food, we are a-rice importing country. What is now the level of forecasting technology or prediction method by which we can predict or estimate the amount of yield of a crop, such as rice? I hope that this can help our government leaders especially in the Department of Agriculture in determining the amount of importation necessary, thereby preventing shortage or cushioning effect on the economy like price increase (inflation).

A : There is a model to predict the productivity potential of rice in Japan. MAHH predicts this value and based on observation on actual paddies during July, August and September, so called a yield coefficient is figured up, combining with the predicted value. For the coefficient, many modifications on the value are made.

4. Collection and Utilization of Agricultural Information in Local Areas of Japan

Masami YAMADA

1. The present state of farmer's information acquisition

1) Farmers' main sources of information

There are many kinds of information available in a farmer's daily work (Table 1). Information from newspapers or magazines, and communication with extension advisers and with farmers groups are conventional sources. It goes without saying that these sources are still very important.

Recently, the circumstances surrounding agriculture is changing drastically such as the diversification of consumer's needs, liberalization of the rice price in the market, and so on. In these circumstances, farmers aim to get positive information to survive the competition.

Some farmers have purchased personal computers and they use it for bookkeeping, and getting information from information networks.

2) Acquisition of information from extension advisors

Extension advisers have a close relationship with farmers through technical consulting and guidance. They provide new technologies and new agricultural policies.

For this reason, extension advisers should be required to have knowledge on advanced agricultural technologies. They try to get the latest information from subject matter specialists and technical books, but there is a limit to how much information they can get from these sources.

To compensate for the weak points, there is a nationwide information network system, which covers all extension centers in Japan. Extension advisers can get information from a database in this network system and can communicate with other advisers who work anywhere in Japan.

Since the extension information network system is very important for extension advisers, it will be described more detail later.

Table 1 Main sources of getting information used by farmers

Means	Example	Main information
Printed matter	Newspaper Technical magazine	Agricultural trend Production technique
Person	Extension adviser* Other farmers	Advice for farm management and technique ditto
Computer	The internet	Weather and market prices

* Extension advisers also get information by many means that includes information networks

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918-8215 Japan

3) Utilization of personal computers by farmers

Progressive farmers can purchase a personal computer and use it in their farm management. From a questionnaire survey which was investigated by the national government in April 1999, 26% of farmers have a personal computer (MAFF, 1999). Among these farmers, 21% of them answered "Using for farm management," and 44% answered "Planning to use for farm management," so a total of 65 % of the computers were related to farm management in some way.

They use the computers for bookkeeping or tax matters (78%), cultivation of crops or rising of livestock (40%), a management of their customers and collection of market information (Fig. 1).

A big difference between the present use and future use of computers in farm management is shown in the item, "collection of market information." It is expected to doubles from the present level of use.

The same trend is shown in the farmers who want to purchase a computer in the near future.

Of the farmers who have personal computers 28% are connected to the internet, according to the result of the questionnaire.

2. Local information network system

1) The present situation of prefectural agricultural information system

There are 63 agricultural information systems, which are managed by prefectural organizations in Japan, as of November 1997. Since Japan has 47 prefectures, this means each prefecture has one or more network systems. Actually, Hokkaido prefecture, which is famous for agricultural production, has 4 agricultural information systems.

These local information systems are classified into two types of services. One of them aims to provide quick solutions and another aims to retrieve data from a large-scale database.

The first type of service which provides quick solutions for crop growth, includes a daily weather, weather disaster (typhoon, drought, heavy rain), growth diagnosis (mainly rice), growth forecast (mainly rice), forecasts for outbreaks of disease and pests. This information is very important and useful for daily farming and has made stable production possible.

The second type of service, which is used to retrieve data from a database, includes research result information, past weather data and market data. This information can be used when a farmer needs data.

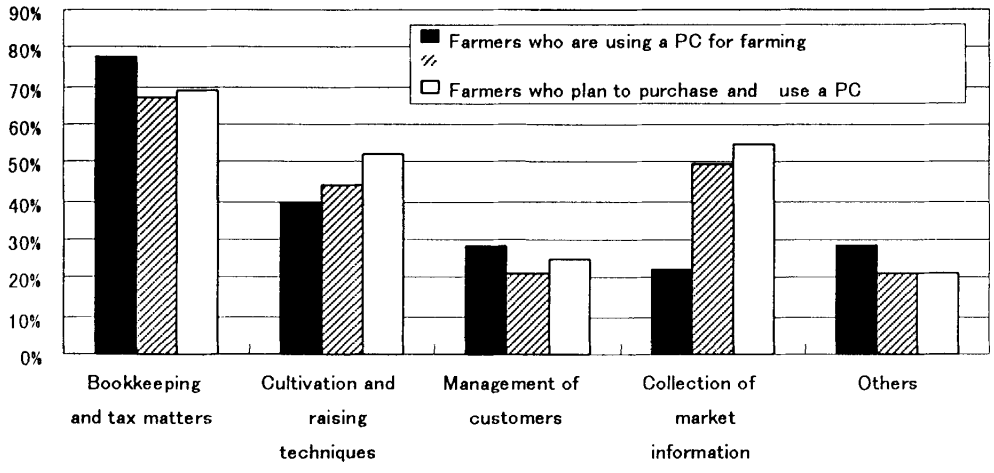

Fig 1. Purpose of personal computer use in farming

2) An example in Fukui prefecture

(1) An agricultural information system in Fukui Prefecture

An agricultural information network system, which is managed by the Fukui Prefectural Government, is a good example to understand the prefectural information network system for extension service and farmers.

The main agricultural product in Fukui Prefecture is rice, so the system is oriented toward rice growth and rice production. In Fukui Prefecture, the rice growth analysis and forecast system has been operating since 1991 (Fig. 2). The purposes of this system are to practice effective rice cultivation and to stabilize the production of superior quality rice by means of accurate analysis and forecasts.

Before we developed this system, analysis of rice growth and the forecasting of the main growth periods were conducted in each area. But in this system, the analysis and the forecasts are combined and function together effectively.

The entire system, except the investigation of rice plants on the farm, is done by the computer network system.

(2) The rice analysis and forecast system in Fukui Prefecture

The rice growth analysis and forecast system in Fukui prefecture is characterized as follows (Yamada, 1996).

a. Summary and analysis of the growth information is based on the investigated data from each field once a week. Growth data on 46 specified fields have been collected for ten years.
b. Forecast of the panicle formation stage and the heading stage is based on the theory of the development stage (DVS) system (Horie, 1990), which is calculated from the transplanting date, leaf age, daily air temperatures and day length.
c. A forecast of an outbreak of rice blast is based on the BLASTAM system, which is calculated from meteorological data such as temperature, precipitation, duration of sunshine and wind velocity.
d. On the basis of these results, subject matter specialists, agricultural experiment station researchers, agricultural cooperative staff, and prefectural government staff make applicable technical countermeasures. The countermeasures are formulated after discussions based on the growth information, weather information, growth forecast, plague and disease outbreak forecasts, etc. Finally the relevant guidance leaflets are prepared.
e. Each extension center or local cooperative office gets the countermeasures information from the network system on the day following the investigation.
f. Each local organization adds their own local countermeasures and they inform the farmers.

The rice growth analysis in this system has become more accurate based on the ten years of investigation data. For example, panicle formation stage varied more than 10

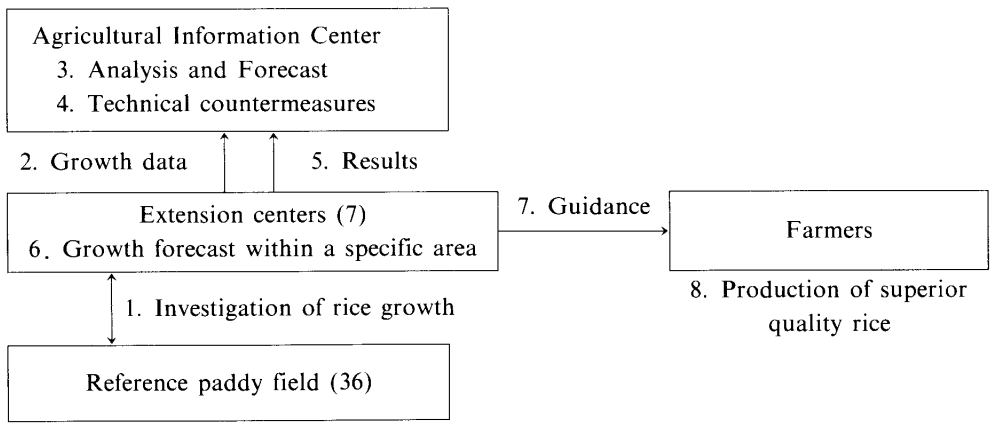

Fig. 2 Rice growth analysis and forecast system in Fukui Prefecture

days because of weather changes in past years. However, this system can estimate the panicle formation stage to within 2 days.

Therefore farmers can get effective countermeasure information from extension advisers quickly. So, this system is very useful for the stable production of rice, especially under abnormal weather conditions.

(3) Weather information system in Fukui Prefecture

Fukui Prefecture has both the rice analysis and the forecast system, and a weather information system. The weather information system provides the following information.

a. Real-time meshed weather : one kilometer meshed present weather and forecast data for two days are displayed.
b. Weather data from the Automated Meteorological Data Acquisition System (AMeDAS) : weather data at the AMeDAS points are displayed on a prefectural map and on a spreadsheet.
c. Meteorological radar screen : live local radar screen is displayed.
d. Weather warning : weather warnings that were announced for Fukui Prefecture is displayed.
e. Typhoon information : the latest typhoon information is provided.
f. Weather forecast at AMeDAS points : weather forecast at the AMeDAS points for 48 hours are provided.
g. Weather forecast : today, tomorrow and one week weather forecasts are provided.

This weather information is very useful when farmers plan their farm work. It is especially useful when they fix a date for chemical spraying and harvesting. But farmers cannot use this system directly, so a direct offering of this weather information to farmers is being considered.

3. An information network in agricultural extension service in Japan

1) The role of agricultural extension services in Japan

The agricultural extension service of Japan has two purposes. One of them is to improve agricultural production and the other is to improve the standard of living in rural areas. In order to achieve these goals, nearly 10,000 extension advisers are allocated across Japan. The Ministry of Agriculture, Forestry and Fisheries (MAFF), and 47 prefectural governments shares the responsibility for this service (Fig. 3). The national government supports the prefectural extension service financially. The prefectural government executes the extension services to farmers through about 600 extension centers. Therefore any farmer who lives anywhere in Japan can access the extension service. This service started in 1948.

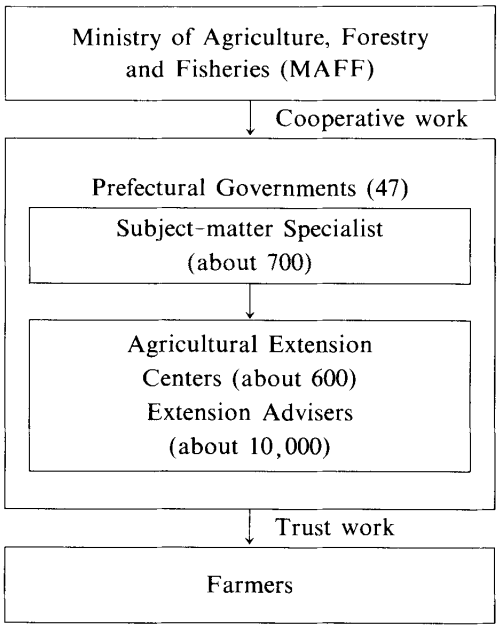

Fig. 3 System of the Cooperative Agricultural Extension Service in Japan

2) The nationwide extension information network

About 20 years ago, the extension information center was established from the need for information management within the agricultural extension service.

The extension information center started to collect information by paper and they provided this information in a book every year. However now, the main role of the information center is to manage a computer network system called the Extension Information Network (EI-net) (Yamada, 1998).

The information network system started as an experiment with 69 terminals in 1988. After 2 years, the system made a formal start with 284 terminals. This system consisted mainly of a bulletin board system and electronic mail system. Extension centers' participation in this system is increasing each year. With the increase of terminals, an user oriented database system is imperative. In 1994, a new system started with the addition of a database system and facsimile system. The new system is called EI-NET which is shortened from Extension Information Network System. Now, all of the extension centers have an EI-NET terminal.

From 1996, a part of the EI-net was

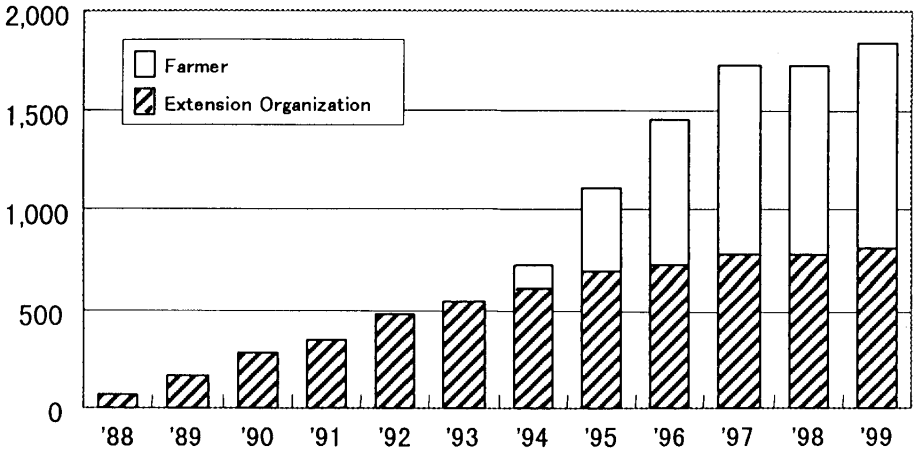

Fig. 4 Increasing number of EI-net terminals

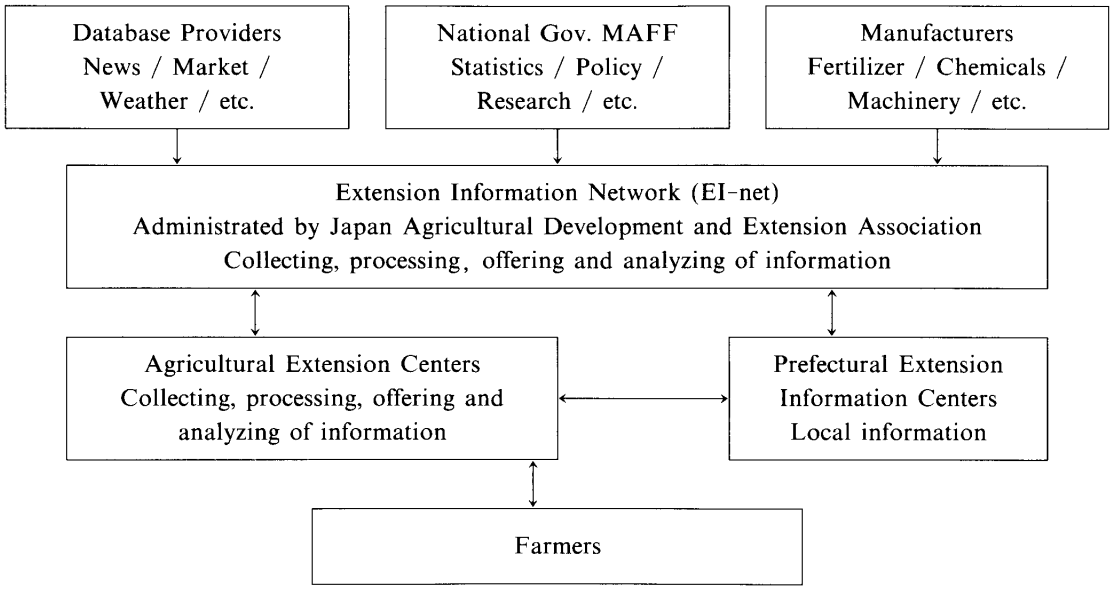

Fig. 5 Nationwide Extension Information Network (EI-net) System

opened to farmers. The number of participating farmers was about 1,000 in 1999 (Fig. 4).

The information flow of the EI-net is shown in Figure 5.

The EI-net is composed of many databases, bulletin boards, e-mail system and so on. The database companies provide news, market and weather databases. The national government provides statistical information, research results and so on. Private agricultural companies provide agricultural material information on such topics as chemicals, fertilizer, machinery and so on. Of course the extension information center provides their own database which is offered to extension advisers. These databases are used for on-line retrieval to get information which can help solve individual problems with data accumulated in the host computer.

In addition to the database, this system also includes bulletin boards, forums, e-mail, free software, fax sending systems and so on.

The bulletin boards allow all users to review messages left by other users, and leave user's own massages or opinions if they want. There are many boards concerned with agricultural administration and technical information which are related to crops, vegetables, fruit, livestock, home life, food processing, youth, farm management, computers, chemicals, machinery, fertilizer and so on.

The e-mail system is used for exchanging messages among members. The free software is usually developed by the extension adviser and is open to the public and used freely among members. Hundreds of software, spreadsheet data are available.

The fax system is used for sending or receiving fax documents from the EI-net. If we want to receive the results of the retrieved spot information database, the EI-net can fax the results to our office within a few minutes. It is very useful when the information includes image data such as photographs, charts and so on.

3) Advantages of the EI-net to extension advisers

These network systems give the following advantages to extension advisers.

a. Quick collection of information
b. Knowledge of current trends in agriculture
c. Communication with extension advisers located across Japan
d. Retrieval of necessary information from large-scale databases
e. Utilization of free software developed by extension advisers
f. Collection of up-to-date technical information
g. Collection of weather data
h. The ability to send information to many farmers simultaneously
i. Effective collection of local information.

4. Utilization of the internet for farming

Utilization of the internet has remarkably increased in the last few years. Therefore, farmers can get a lot of information directly from the internet. The main utilization is getting weather information and market information. Some progressive farmers introduce their own agricultural products in on internet home pages in order to sell it to consumers directly (JSAI, 1998).

The agricultural products on the internet are widely varied, such as crops (rice, azuki), livestock products (beef, saudages), dairy products (milk, goat's milk, special egg), fruit (pears, peaches, greenhouse oranges, persimmon, kiwi, apples, strawberries, loquats), flowers (orchids, lilies, carnations, potted flowers, etc.), potatoes, taro, sea food (clam, lobster), special plants (mushrooms, dried mushrooms, bamboo shoots, bracken, thunb, Chinese yam, ginger), processed products (tea, pickles, rice cakes, etc.). These products are different from the mass-produced ones and are not usually shipped to a market, but sold directly to consumers or retail shops. These are kind of value-added products. These web shops have been launched recently, so the sales value is not large and it seems to be part of the advertisement of their products.

5. Some problems and the future outlook

1) Computer literacy for extension advisers

One of the purposes of these systems is to provide useful information for farmers and extension advisers. The extension advisers are collecting information from the EI-net and their prefectural information system. They transformed the original information into useful information which supports a farmer's decision making. However, there are few extension advisers who can use the EI-net effectively in each extension center. This means the rest of the advisers are lacking the ability to use the information network systems. They should learn how to get information from these information network systems and how to transform it into useful information for farmers. It is necessary to train them to use the networks.

2) Improvement of the network system

Since the performance of the computer network system is improving year by year, these network systems provide not only documents, but also image data, sound data and even moving pictures. For example, images of plant growth, plant diseases and harmful insects are very useful for diagnosis by the user. These improvements in the network environment should renew the service of the networks. And the users of these networks will be able to get more useful information in the near future.

3) Information disclosure

There is a lot of information which has not been opened to the public yet. For example, each extension center makes many leaflets to advise farmers, however, most of these leaflets are usually not open to other extension centers. If some extension advisers want to make a leaflet about the same subject, he must collect information from the beginning. So it is important to strengthen the information collecting system from extension advisers or extension centers. There are 10,000 extension advisers and 600 extension offices in Japan, it would be a great resource for technical information.

6. Conclusion

Farmers have many means for getting information. Recently, gathering information by personal computer has been increasing year by year. There are also many characteristic agricultural information network systems which provide useful information to farmers and extension advisors in their local area.

On the other hand, there is a nationwide network called "EI-net," which is very useful to get expert knowledge for extension advisers, and these local and nationwide networks are compensated each other.

In local areas, utilization of the agricultural information network system is very convenient compared with conventional printed materials because the networks have no information difference and no time lag between the central area and the local areas. This advantage is very important for farmers who mainly work in local areas.

Requests for substantial of information offered to the farmers directly through these systems are increasing. When a farmer makes a decision about his farm management, this information from the systems will be more and more important.

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Discussion :

Q : (Comment from Australian delegate : I really enjoyed the presentation -it was well done. Hope that the presented paper will be published.) The question is related to the issue of rice protein check. Protein check is also regularly done in Australia, it is a requirement for growing a crop, and then information is supplied to the coop. Is information collected on this (rice protein) in Japan and does it happen? In Australia, our protein levels are slightly decreasing, which is forcing farmers to try other varieties such as Japanese short grain.

A : Protein content in rice is very important for understanding the eating quality even in Japan. Generally speaking, the contents of protein depends on a topdressing time and amount of fertilizer. If the topdressing time is delayed from the forecasted panicle formation stage, the protein contents will increase and the eating quality will be decreased. So the topdressing time is very important for rice growth management. The forecast of this topdressing is one very important task in our rice growth information system. Our prefecture collects data of rice eating quality of "Koshihikari" in each area and the data are being used to produce top quality rice with reasonable yield. The eating quality affects rice price in the market. So the farmers aim to produce high quality rice.

Q : Can you give me an example that can explain how the farmers are able to derive benefits from the information you provide/have.

A : Each year's panicle formation stage varies, the difference is about 10 days, depending on the different weathers. From the growth analysis and forecast system, we can forecast an accurate panicle formation stage within two days. This forecast is very important to determine a topdressing date and to keep a rice quality in a high level. And our prefecture's rice quality and rice price are higher than the other prefectures. It means that farmers in our prefecture are receiving economic benefit from the information system that we have.