Cultivation History Entry System for Agricultural Products

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Abstract: Pesticide legislation in Japan is very complex. It is a virtually impossible task that the farmer understands all of this law. To solve this problem, the authors have developed "Cultivation History Entry System for Agricultural Products". Even the farmer who does not completely understand pesticide legislation comes to be able to do farm works that uphold pesticide legislation by using this system. This system equips improved usability by adoption of AJAX (Asynchronous JavaScript+XML) technology. Because this technology enables a server access without screen transition, this system is superior to the past system for agricultural products in response performance and visibility.

1. Introduction

A hot topic is a problem of the pesticide residue in Japan now. News where high-density pesticide are detected from foreign-made dumpling sold in the supermarket is a fresh memory as one example of this problem. The consumer in Japan has come to have zest for very much in the safety of food by the problem of the pesticide residue. Especially, the number of consumers who feel insecurity about the safety of agricultural products obtained in the supermarket has increased because it is widely known to use pesticide in production process of agricultural products. The farmer recognizes this problem, and tries to uphold pesticide legislation (law that controls the pesticide use in the farm products cultivation in Japan) and to offer safe farm products.

2. Issues to safe farm products cultivation

However, some factors in which safe farm products cultivation is difficult exist in the agriculture of Japan.

The first is that the scheme of restriction on use of pesticide established by pesticide legislation is complex. Pesticide legislation provides for available pesticide of each cultivated crop based on the positive list method. For instance, pesticides that can be used are different though both Delaware and Muscat are grapes. The farmer who grows both Delaware and the Muscat should clearly understand the difference of pesticide that can be used for of each. Moreover, pesticide legislation restricts the interval of the spraying pesticide date and the harvest date at each combination of the cultivated crop and pesticide. It provides for the interval of the spraying pesticide date and the harvest date. When the limit interval of harvest date and spraying pesticide date is ten days, the act of harvesting after one week from the last spraying pesticide date is a violation of the pesticide legislation. If the cultivated crop changes even if the pesticides are the same, the farmer should pay close attention because the restricted interval may be different. In addition, pesticide legislation restricts also use-frequency of pesticide. Strictly speaking, this use-frequency is managed by the use-frequency of the constituent (compound) contained in pesticide. Therefore, if the same constituent as each pesticide is included, when two kinds of different pesticide are sprayed three times, the use-frequency of the constituent is six times. In pesticide legislation, besides this, restriction for the spraying density exists. If these all detailed restriction about use of pesticide is not understood, the observance of pesticide legislation is difficult. Moreover, these restrictions on use of pesticide are updated at any time. There is a possibility not to be able to buy today pesticide that could be bought yesterday according to the content of the update. The volume of data of updated information might be numerous though the latest information is open to the public in the Internet. It is a virtually impossible task that the farmer understands updated information every time accurately. Also, when it violates pesticide legislation, the penal servitude of three years or less or the penalty of one million yen or less is fined.

The second is that the majority of the farmers in Japan grow a lot of kinds of farm products in a narrow farmland. In Japan, a large-scale farmer who mass-produces a single kind like the United States in a vast farmland is extremely few. Especially in the city outskirts, a lot of farmers grow a lot of kinds of farm product at the same time in a narrow farmland because it meets to consumer's detailed demand. Holding a lot of cultivation kinds makes the approach to uphold above-mentioned pesticide legislation more complex.

The third is aging of the agricultural producer. Agriculture in Japan became unpopular industry in young generation compared with other industries because of the capability and the occupation image. Therefore, the problem of the lack of an heir in agriculture is serious. It is very difficult for the person who exceeds 70 years old to understand completely and to uphold the above-mentioned complex mechanism of pesticide legislation. But, even if farmer is a senior citizen, it is necessary to uphold pesticide legislation.

3. Development system

To solve the above-mentioned problem, the authors have developed "Cultivation History Entry System for Agricultural Products", which adopts AJAX technology, which equips improved usability. Even the farmer who does not completely understand pesticide legislation comes to be able to do farm works that uphold pesticide legislation by using this system.

The improvement of the usability of this system was achieved by the following four approaches.

The first is to be able to use it only by a browser. There are a lot of senior citizens not good at computers. However, there are a lot of senior citizens that it is possible to do if it is Internet browsing, too. It was thought that being possible to use it from the bookmark of a browser easily was a first prerequisite of the system spread to the farmer with a high ratio of senior citizens.

The second is not to do the screen transition at all. In a past information system of agriculture, the amount of the input per page was a little, and screen transition frequency was high. At first, screen transition frequency of this system was many too as this system had been supporting the input from the cellular phone, too. However, there were actually a lot of opinions that the system composed only of one page are easier to use than the system with a lot of screen transition, as shown in Figure 1. Especially, nearing to the image filled in on one screen is an easy-to-use way for the senior citizen. To achieve this demand, the AJAX technology was adopted. Details of entry screen without screen transition are described in the following chapter.

The third is to be able to use it only by the mouse operation and the numeric key input, because a lot of senior citizens are not good at the character input. For instance, neither the pesticide name nor the cultivated crop name, etc. are typed in the character. The method of selecting them from all items, which are extracted from the master data, through mouse operation is adopted.

The fourth is enforcement of the warning indication for the violation of pesticide legislation. For instance, in pesticide density input column, when an entry value of the column exceeds the upper bound of pesticide legislation, the color of the column immediately changes into red through AJAX technology. As a result, the user is made to notice the content of the entry is illegal. If this system is used before farm work is done, spraying pesticide violating pesticide legislation can be prevented beforehand.

4. Details of entry screen without screen transition

In order to create an entry screen without screen transition, it is seemingly easy to set the input of all necessary information into one page. However, it cannot be achieved simply by arranging all input fields into one

Figure 1. Screen image

page, because the content of each input item may be affected by the content of other input items and a server-side data. Figure 2 shows a dependence relationship of each input item in entry screen. It can be confirmed that each input item of "Harvesting date", "Cultivar selection", "Crop selection", "Pesticide selection", "Pesticide density", "Spraying pesticide date", and "Use-frequency of constituent" affects each other. The lower limit interval of "spraying pesticide date" and "harvest date" are decided depending on combination of the pesticide and the crop. Therefore, when "Splaying pesticide date" is entered, this system must alert a user if the above-mentioned interval falls below the lower limit.

It is not difficult for the web system with a lot of screen transitions of the past to complete the above-mentioned task. Because, using technologies generating a web page dynamically such as PHP, the content of the subsequent page can be optimized depending on the data which is submitted from input item of the previous page. However, it is too difficult to complete the task for the system without screen transition such as this system, because if screen transition is not allowed, these technologies can not access directly a server-side database.

To resolve this problem, the AJAX technology was adopted. In this technology, because JavaScript accesses directly the server without submitting of Form in the HTML language, the technology enables a server access without screen transition.

Figure 3 shows the flow of display for "Spraying Pesticide Date" input.

At first, in STEP1, click the input field of “Spraying Pesticide Date”. In the interest of saving input time, input field of "Spraying Density" is filled with the limit value set under the pesticide legislation from the beginning.

Next, in STEP2, select the date of spraying pesticide from among the window newly displayed.

In STEP3, the input field of “Spraying Pesticide Date” is filled with the selected date, and the background color

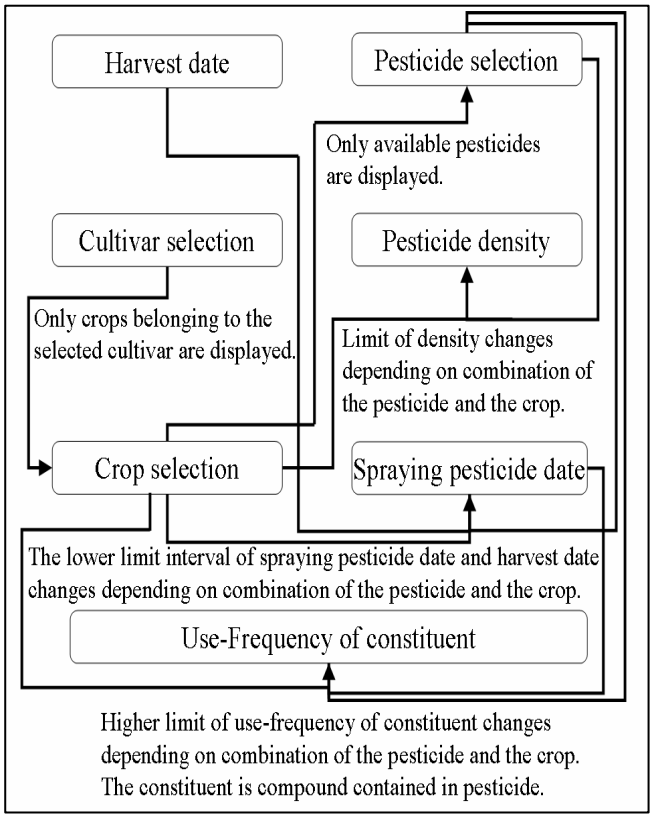

Figure 2. Dependency diagram for input item

of this field turns blue automatically. Interval of spraying pesticide date (5/24) and harvest date (6/7) is larger than the lower limit interval (7days), so the background color turns blue which means upholding pesticide legislation.

STEP3.2 is the case of entry for second pesticide spraying following STEP3. Interval of second spraying pesticide date (5/29) and harvest date (6/7) is larger than the lower limit interval (7days), so the background color turns blue as well as STEP3. On the other hand, because "current use-frequency of constituent" and "higher limit of use-frequency of constituent" has same value by increasing the frequency of spraying pesticide, so the table background color turns yellow which means current state is just barely within the bounds of the pesticide legislation.

STEP3.3 is the case of entry for second pesticide spraying following STEP3 as well as STEP3.2. However, in this instance, interval of second spraying pesticide date (6/3) and harvest date (6/7) is smaller than the lower limit interval (7days), so the background color turns red means current state is offense against the pesticide legislation.

These processing utilizing an AJAX technology update the part of the screen properly without screen transition. The visibility of this system is better than that of the past system by which the screen disappears momentarily when the screen changes. In addition, because processing and unnecessary communication for screen transition are reduced, this system is superior to the past system in response performance.

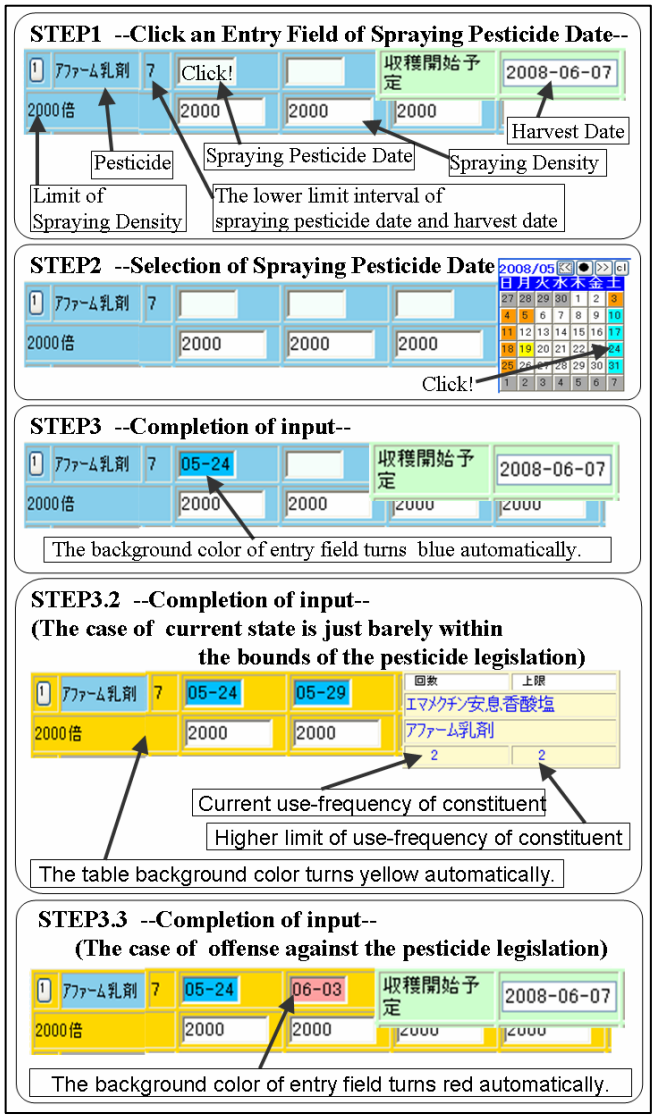

Figure 3. Flow of display for "Spraying Pesticide Date" input

5. Achievements, problems and future potentials

At first, this system was developed for the farm products certification run by an Osaka Prefectural Government. Currently, however, agricultural cooperatives in Osaka prefecture are trying this system on the premise of adoption, because they highly appreciate that the farmer can use easily and is able to do farm work that uphold pesticide legislation by using this system.

Moreover, another advantage by using this system is confirmed. Up to now, the person in charge manually had checked Cultivation History having been submitted by the farmer. This work requires a lot of manpower because the deliverables are large in quantity. In many cases, this system can automatically judge whether to uphold pesticide legislation. Therefore by using this system, the manpower for the check decreases, and, as a result,

agricultural cooperatives will obtain the advantage of management cost reduction.

However, a problem remains in the content of the database that stored information of restriction on use of pesticide. Display of unit is not unified for example "Ml/a" and "Milliliter/a" are used to signify the unit of amount of pesticide spraying per are. The causation of the problem is flaw in the data which is delivered from the independent administrative agency that manages pesticide legislation in Japan. From now, we will demand an improvement of the delivery data to resolve the problem. If the demand is not accepted, we will improve the problem by a proprietary program to unify the display of unit.

In the future, the technology obtained by this development may be utilized in not only agricultural sector but also the field of industry and commerce, especially, in the small and medium-sized enterprise. Generally, because the employee of the small and medium-sized enterprise is not good at computer, the penetration of the web system for the business management not used easily is very late. We will be able to contribute to the progress of IT in the small and medium-sized enterprises by developing an easy-to-use business system using the technology in the future.

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