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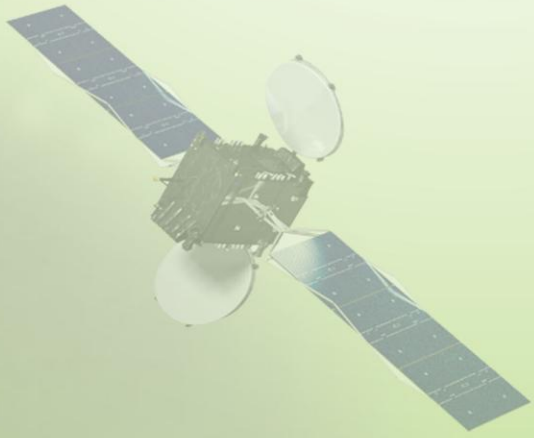
The Quality Information for Competitive Agricultural Based Production System and Commerce



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Forewords

The role of communication and information technology (ICT) is becoming more and more crucial for agriculture to enable the best managerial and operational scenarios. This conference is aimed to seek excellent or promising ICT-based solutions for improving agricultural-based production systems and commerce. For the purpose, as those written in the first announcements of the AFITA 2010 Conference, the committee invited contributing papers under several topics related to the applications of ICT in agriculture.

It is a great pleasure for me to announce that the committee has received plenty of papers under the topics offered. But, due to the unbalance number of papers within each topic, the grouping were rearranged, and finally ended up with the following topic groups: 1) Rural Economies and ICT Policies for Rural Development (5 papers) 2) Knowledge Repositories (4 papers), 3) Remote Sensing and GIS Applications For Agriculture and Precision Farming (7 papers), 4) E-Agricultural Services and Business (11 papers), 5) Decision Support Systems for Agriculture and Agribusiness (9 papers), 6) Computer Based Data Acquisition and Control in Agriculture (7 papers), and 7) Modeling and Simulation (9 papers).

Besides the technical papers above, this proceedings also compiles invited papers and workshop materials discussed in the conference. Several posters without papers are also displayed in the seminar venue making the conference becoming more eventful.

I would like to express my sincere gratitude and thanks to all parties that make this conference possible. May our efforts will give a valuable contribution to the development of agricultural sector and to the development science as well.

Bogor, October 2010
Conference Chair,

Prof. Kudang Boro Seminar

Contents

Development of Computer Program in Designing Transportation Packaging for Agricultural Products

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ABSTRACT

The biggest damage of agricultural products after harvesting occurs in the process of transportation or distribution. An effort to minimize the damage is to use appropriate packaging. Computers can be used to assist in the development of package design depending on the requirements of the distribution of agricultural products. Therefore, computer programs called Packaging Design System version 1 (PDS I) and version 2 (PDS II) have been developed to deal with these issues.

In the PDS I and II, the packaging was designed only derived from corrugated board material and had not been equipped by proper ventilation design. In fact, the use of wood as packing material for transport is still popular in Indonesia, therefore in PDS II , additional selection of wood materials was developed in designing packaging and complete with ventilation.

The result was a software, created by using Visual Basic programming language, called PDS III. Output generated from this program were dimension of packaging and packaging materials (corrugated board / wood). Especially on corrugated packaging, the type and wide of ventilation were informed. The output is generated from data entry such as geometry, dimensions and the individual weight of commodities, weight desired by package, the choice of packaging materials. This program also produced images of formation fruit in the package and formation of package in the container. It is intended to provide comfort in the preparation of fruits and packages.

Keyword: transportation, packaging, design, software

1. INTRODUCTION

Distribution, for agriculture commodity, has an important role. Through good distribution, the agriculture commodity will be able to reach widely customers. By the same meaning, the distribution can improve the selling value of the commodity. However the damage of agriculture products in the process of distribution is considered quite high, that is revolving between 32% - 47%. Many efforts to reduce the damages have been carried out. One of them is the use of the good and appropriate package, that is match to the requirement such as: form and dimension of the commodity, physiological characteristics of the commodity, transportation system etc. Those are important factors that simultaneously must be given attention in the planning of packaging.

At present time, computer could be used as a tool to carry out planning and designing of packaging of the horticultural commodities to achieve requirement in accordingly.

Suporting system for corrugated board packaging design has been developed with the name of the PDS (Packaging Design System). Instead of corrugated board, woods as a packaging material is still widely used in Indonesia. Teherefore, woods should be added to the program as an additional virtue as a choice of material of packaging that will be designed. In addition, ventilation has also important role in the packaging design of agricultural products. Therefore, the system should be completed by virtue of ventilation options to complet the outcomes of the design.

The purpose of this research is to develope a computer system assistance for planning, design and selection of packaging materials (cardboard and wood) which is equipped by ventilation for ellipsoidal and sphere form of fruit.

2. METHODOLOGY

Materials: corrugated cardboard, timber board of Miranti, tomatoes (as an example of ellipsoidal form of fruits), orange (as an example of spheroid form of fruits).

Equipment : computer programming language Visual Basic, vibrator table for transportation simulation, digital scales. The research was done in two stages. The first stage is development of the PDS with the addition of programs for virtue choice of packaging materials and ventilation. System algorithm was presented in Appendix 1. The second stage is validation of the output of PDS program. The validation is done by making the packaging as the output of the system, the arrangement of commodities in the containers as accordance with the recommended system, testing the strength of packaging by using vibrator table as a transportion simulation.

3. RESULT AND DISCUSSION

3.1. Design of Packaging Design System (PDS III version)

The Visual Basic is a programming language to build a PDS II. The user interface was built with two main forms, namely form for data enter and form of output as a results of the system (PDS).

Form input is a medium for data entry: data of commodities that involve of geometric shapes of fruit, individual fruit weight, dimensions, and bioyield fruit; data package consist of a choice of packaging material, type and area of ventilation; environmental data in the form of transport conditions expressed by class road and long distance of transportation, dimension of transportation device (such as truck or pallet).

Form output consists of three forms, namely : a) the form that displays the results of the design of packaging that contains information about inner dimension, design dimensions, outer dimensions; b) the form that shows formation how the arrangement of fruit in the package and c) the form that shows how the arrangement of packaging in the truck or pallet. The sample result of running the program using Gondol tomatoes is presented in Appendix 2.

3.1.1. References Used In Determining The Limits For Packaging Dimension

Rule 41. In determining the weight per package, PDS provides advantages and disadvantages of weight tolerance of ± 5% of the weight selected. This is intended to overcome the ununiformity of the individual weight of fruit. In addition to Rule 41, the determination of packaging dimension is limited by the standards of the OECD (The Organization for Economic Cooperation and Development). Aaccording to the OECD, standard dimensions of packaging is the length range of 40-60 cm and width range of 30-40 cm with a tolerance of ± 8%.

3.1.2. Dimension Of Individual Fruit

Fruit-dimensional data entered into the program (PDS) is determined by the geometry of fruit. For fruit with spheroid geometry, only need one data that is the diameter of fruit, while for fruit with ellipsoidal geometry requires two kinds of data that are the diameter of major and diameter of minor. The Major diameter is the diameter in length direction, while the minor diameter is the diameter in width direction (height). Fruit-dimensional data were entered into the PDS program in the form of individual data derived from the average value of individual dimensions. In this time, the PDS program was not be entered the value of the tolerance of fruit-dimensional data. This condition became one of the weaknesses of this system (PDS), because it will cause a difference between the output of the PDS with the experimental, caused by the arrangement of fruit in the packaging. Therefore, there would be differences in the distances between the arrangement of fruit in vertical direction (height) and horizontal direction (length and width). When the diameter range of fruits that used were not too wide, the difference can be minimized.

3.1.3. The Dimention of Transport Equipment

Data needed by PDS are data relate to container dimention especially data of the high of the container. Those data will deternine the high of package stacking that will be applied during transportation process.. The high of stacking will affect to the degree pressure to the the botom of stacking, especialy to the lowest layer.

The pressure is expressed by how much compression force that will determine the selection of flute type, for package made from corrugated carton board, or the selection of the ticknes of woods for package made from wood. The basic of knowledge in selecting packaging materials is the strength of materials (compression strength) that able to withsatand to any force during transportation (compression force).

The length and high dat of container are needed to determine the choise of packaging pattern within container/pallet. The selected pattern is the pattern that has a high efficiency in using space within container / pallet. The eficiency in using container space will have significatnt impact on transportation costs.

3.1.4. Transportation Data

Transportation data in the form of type/level of road and distance of transportation are needed. There are three type/level of road can be selected. Those are inside city, outside city and village road which is normally bed. The choosen of type/level of road will deal with how much frequency and amplitudo that will occur to the packaging during transportation on those roads. Data of frequency, amplitudo and distance of transportation will affect to te degree of dynamic force occur to the packaging during the distribution. In the developed system based on computer asistance, the dynamic forrce is determined as a correction factor to the force apply to the packaging. This sistem also has not accomodated mode of transportation run using combination of two or three type/level of roads simultaniously, as well as for transportation using multi mode of transportation. This obstacles can be over come by further research to obtain data that can be expressed as correction factor in calculating force for any combination of type/level of roads or mode of transportation

3.2. Validation Of System Output

3.2.1. Package Design

The example of PDS program output is presented in apendix 3. Based on those output, experimental testing on packaging design was done by forming package with inner dimention of 275 x 246 x 207 made from corrugated carton board with type of flute B. There was difference in length, width and height between outside dimentionof package derived from PDS programe and dimention of package formed by using corrugated type of flute B obtained from the market. The difference of 2 mm at flap section is due to the thickness of flute type available which was 3 mm, whereas the PDS system used 3,5 thickness for flute type of B. The PDS programe has been equiped by data base of flute characterictic A,B,C,AB and BC. The formed package had 2 mm wider in flap dimention. Packaging that was made had a wider flap size of 2 mm, so as not to coincide at the time of packaging is closed but overlap of 2 mm. This condition will affect to the strength of package due to the cover part of package would easily scratch off. Based on theese observation, the system need to be fixed up by adding data base of variation of flute thickness in the same type of flute.

3.2.2. Arrangement Of Fruit In The Package

The arrangement of tomato ‘gondol’ fruit with mayor diameter range of 66 – 77 mm and minor diameter of 50 – 57 mm in package that formed with inside dimention of 275 x 246 x 207 lead to horizontal formation that was not sufficient condense. This meant that there was distance between packaging side and length side . Whereas, the height of fruit formation was higher than packaging height with the difference of 1-2 mm . This was caused by the use of single data derived from the average of fruit dimention to determine the formation of fruits in the system. This weakness could be overcome by informing the range of choosen fruit dimention to form fruit formation which was suitable with the formation produced by the system. The over height of fruit from packaging height would cause higher presure on the top layer of fruit at the time when package was closed. Meanwhile, the fruit formation which was not sufficient condence could lead to impect among the fruit or fruit against packaging wall when the fibration occur during transportation process. This condition would lead to increasing the damage of fruits.

3.2.3. The Testing Of Packaging Strength

The strength of packaging was tested by transportation simulation using vibrator desk. Three package contained 9 kg of tomato were formed in to three layer., then put on to vibrator desk with frequency of 2.13 – 2.91 Hz, amplitudo of 2-3 cm and time simulation of 1 hour. This simulation lead to produce compression force of 60.76 kgf. The package was still able to widtstand because the compression strength of the package was higher that was 205.05 kgf. The choosen packaging material that produce an extra compressioan strength was a result of packaging data in the syatem, with the lowest was flute B with the tickness of 3.5 mm. This weakness could be solved by adding type and thickness flute data available in the market in order to select packaging with sufficient and approriate compression strength. The use of package that sufficient to the

requirement wil have significant affect to the packaging cost.

4. CONCLUTION AND RECOMMENDATION

4.1. Conclusion

1. Packaging Design System (PDS version III) is a computer aids base system for planning, designing and selecting transportation packaging made from corrugated carton and wood boards to be used for ellipsoidal and spheroidal fruit. The designed packaging has been equipped by the type and size of ventilation. PDS III version was built using Visual Basic programming language version 6.0 consists of the input form and output form.
2. The input forms were used for data entry of individual fruit, weight per packing unit, condition of transportation and description of transportation equipment.. The output forms were used to displays the results of dimensional packaging design and packaging design drawings, the pattern of fruit arrangement within the packaging, packaging arrangement pattern in the container, chosen type of flute (specifically for the corrugated carton packaging), and the estimation of compression force during the transport process.
3. The result of outcomes program validation for fruit arrangement in the package indicated the need of limitation range of individual fruit dimension that would be packaged. The effect of no limitation on individual fruit dimension range shown on the arrangement of fruit with were less fit or a bet full. This condition was not expected because would cause the high degree of damage due to vibrations and impact factor during the transportation process.

4.2. Recommendation

1. PDS version III need to be improve by addition of:
   a. Information of individual dimension range that permitted to be formed in the package
   b. The display of the output PDS program (especially for corrugated carton material) should not only for flute type, but need to be add the information of flute thickness. The flute thickness affected on the size of outer dimension of packaging and the size of flap, that lead to the package could not be closed properly
2. The system need to be improve to cover the deferent of type transportation system using different type of transportation mode

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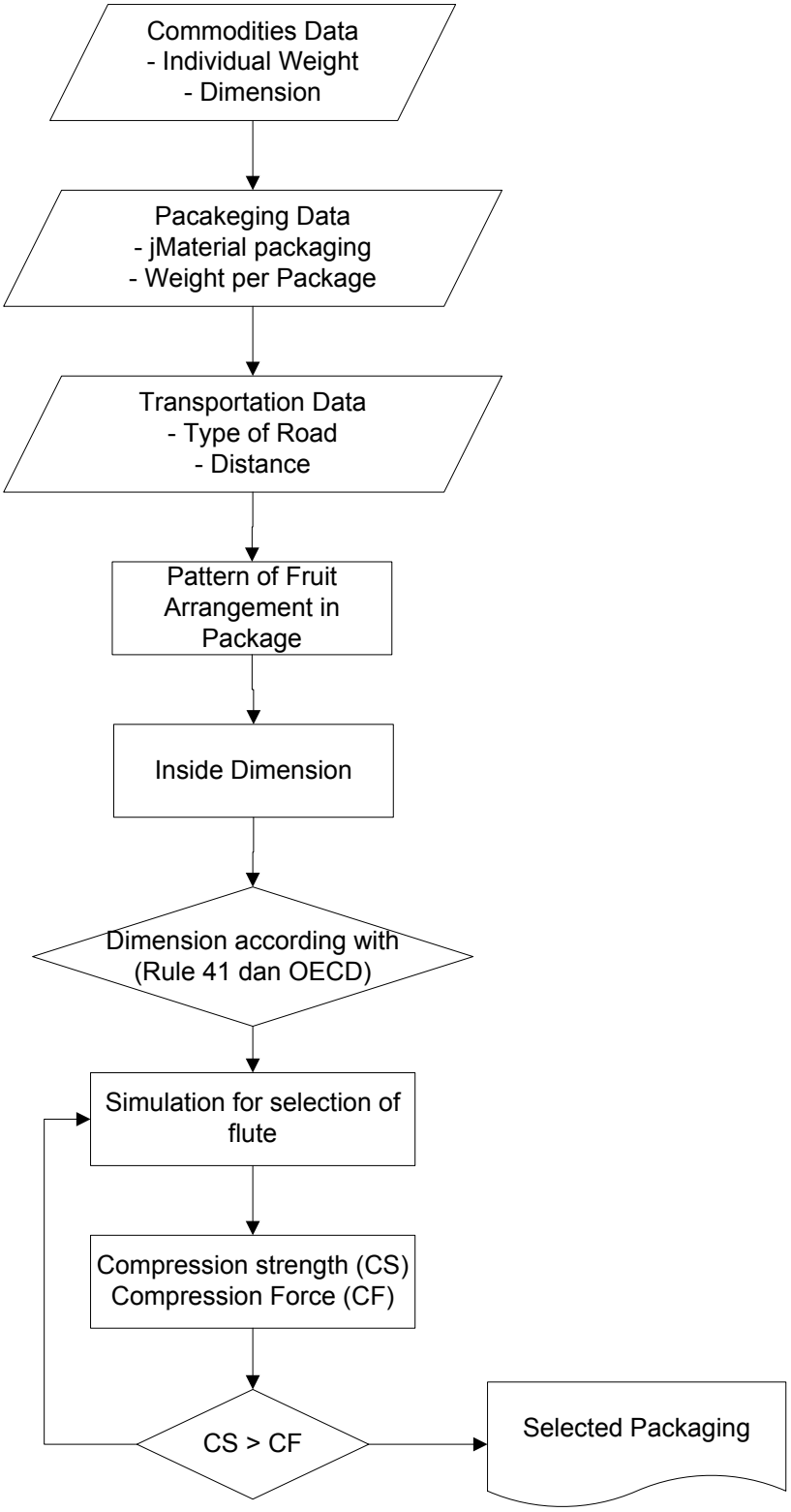
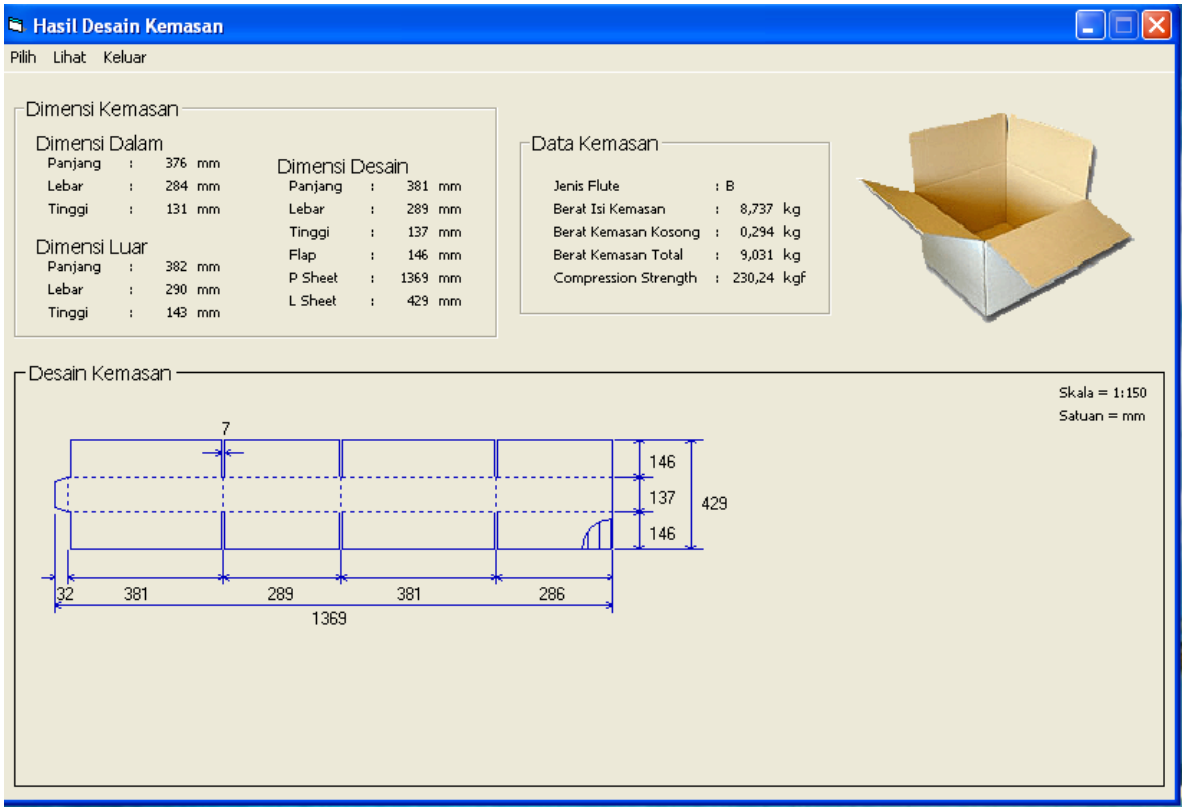
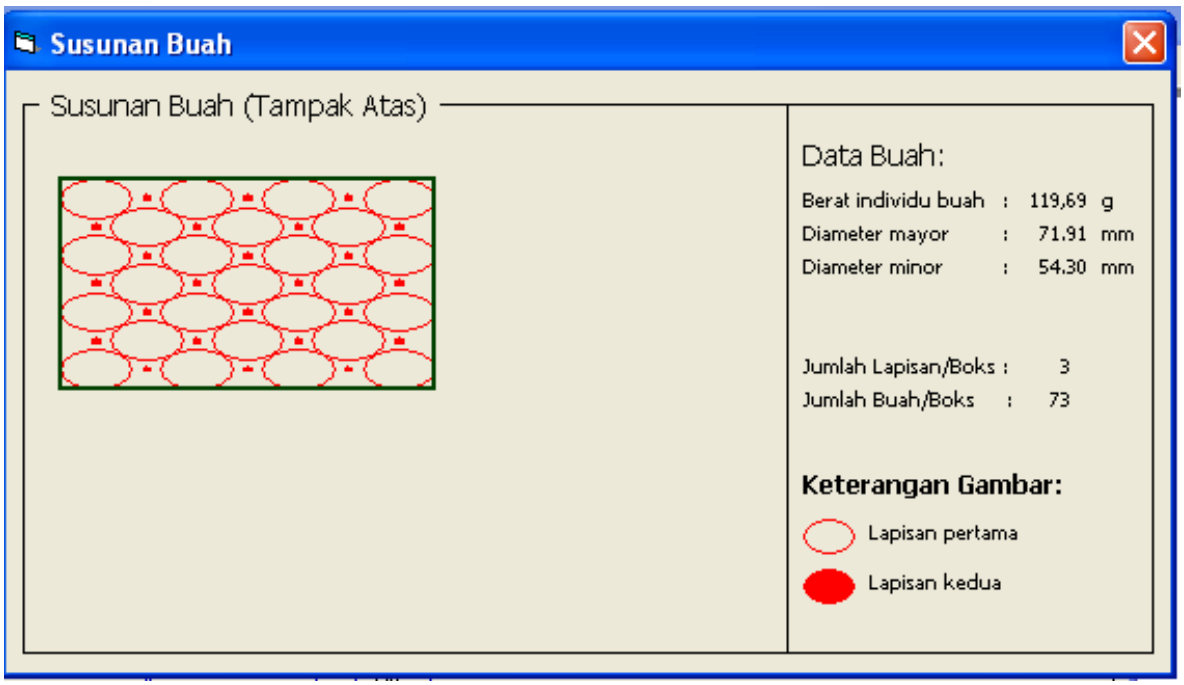
Apendix 1: Algoritm PDS Program



Appendix 2: The Example of Output of PDS Program



Packaging Design Selected (Regulated Slotted Container)



The Pattern of Fruit Arrangement in Packaging