

# Black Box Testing of Palmviews Using BVA and EP: A Case Study at PTPN IV Regional 2

L Chairutama<sup>1</sup>, A Lase<sup>2</sup>, and N R K Batubara<sup>3</sup>

<sup>1,2,3</sup>Department of Computer and Informatics Engineering, Politeknik Negeri Medan, Medan, Indonesia

E-mail: \*srinovida@polmed.ac.id

**Abstract.** PT Perkebunan Nusantara IV Regional 2 developed the Palmviews application as a daily monitoring system for palm oil production. To ensure the reliability of the system in handling various user inputs, this study applied the Black Box Testing method with Boundary Value Analysis (BVA) and Equivalence Partitioning (EP) techniques. Testing was carried out on three main features, namely the login form, the date range filter on the dashboard, and the production data input form. BVA was used to test input value boundaries such as dates and numerical data, while EP was used to classify inputs into valid and invalid categories. The testing results recorded 18 test scenarios, with 17 valid and 1 invalid. Effectiveness calculations showed the system had a success rate of 94.44%, categorized as highly effective based on evaluation standards. This study concluded that the Palmviews application operates in accordance with expected functionality and is suitable for use as a decision-support tool in the company's operational environment.

**Keyword**— Black Box Testing, Boundary Value Analysis, Equivalence Partitioning, Input Validation, Palmviews Application

## 1. Introduction

PT Perkebunan Nusantara IV Regional 2 is one of the operational units engaged in the management of oil palm plantations. In order to support digital transformation within the company, the Palmviews application was developed to record and monitor daily oil palm fruit production from various plantations. The data recorded through this application serves as an important basis for quick and accurate managerial decision-making.

The Palmviews application features key functionalities such as daily production data input, a search filter system based on plantation, district, and regional criteria, and a data visualization dashboard that facilitates management in analyzing production trends. Given the critical role of this application in supporting daily operations and decision-making processes, comprehensive testing is necessary to ensure its quality, validity, and reliability, especially when handling critical input data.

To ensure the system can process various data variations effectively, this study employs a Black Box Testing approach using two primary techniques: Boundary Value Analysis (BVA) and Equivalence Partitioning (EP). The BVA technique is used to test the system against input values around the lower and upper bounds, such as production weight, number of bunches, and date ranges. This technique is highly relevant because the Palmviews application handles a large amount of numerical data with specific value limits.



Meanwhile, Equivalence Partitioning (EP) is used to group input data into valid and invalid classes, enabling the system to be tested more efficiently. EP is effective in verifying whether the system can recognize empty, malformed, or illogical inputs, such as cross-year dates or negative inputs. The combination of these two techniques is expected to identify potential weaknesses in data validation and enhance the system's resilience against various input scenarios.

## 2. Literature Review

### 2.1. Software Testing

Software testing is a systematic process for evaluating the quality of an application before it is used by users. Software testing aims to detect errors as early as possible to prevent adverse effects, such as data inaccuracy, poor system performance, and incompatibility with user needs [1]. One commonly used approach is black-box testing, which involves testing based on inputs and outputs without knowing the internal structure of the program code.

In its implementation, software testing is crucial for information systems handling critical data, such as evaluation systems or operational reporting systems. Proper testing not only demonstrates system functionality but also helps increase user confidence in the reliability of the application. The stages of this testing include planning test scenarios, conducting tests, recording results, and analyzing necessary improvements based on previous test results.

### 2.2. Boundary Value Analysis

Boundary Value Analysis (BVA) is a black-box testing technique that focuses on testing boundary values of input data, such as the lowest value, the highest value, and values right around the boundary. Errors in information systems often occur at extreme values of user input, so BVA is very effective for detecting input anomalies that are not covered by conventional testing methods [2]. This technique also helps in designing test scenarios relevant to system limitations.

BVA is widely used in data input systems such as registration forms, value entry, or performance evaluation forms. In both industrial and academic applications, this approach minimizes the risk of system failure due to invalid input. Examples of BVA implementation can be found in student assessment systems and reservation and service booking systems that require validation of numeric and text input with specific boundary conditions.

### 2.3. Equivalence Partitioning

Equivalence Partitioning (EP) is one of the techniques in Black Box Testing that divides the input set (input domain) into a number of equivalent classes, where each class is considered to represent a group of input values that are treated the same by the system. This technique is used to test the system based on the valid and invalid division of input data, so that testing can be more efficient because it is not necessary to test all possible values individually [3].

In the context of web-based systems such as the Palmviews dashboard, Equivalence Partitioning is very useful for testing various data input scenarios grouped by specific categories, such as farm type, district, date, and production data status. This technique helps identify logical errors or inconsistencies in input processing and ensures that the system responds correctly to each input class.

### 2.4. Palmviews (Monitoring Dashboard)

Palmviews is a web-based system developed to support the management of daily production data in the Plant Division, specifically for Region II. This system enables the collection, verification, and integration of production data from various plantations into a single centralized platform.

In addition to data management, the development of the Palmviews dashboard is also an important part of the system improvement process. The dashboard is designed to be responsive and can display production data visualizations based on plantations, districts, and regions. Using Laravel as the backend, Blade for the frontend, and Ajax for dynamic interactions, the dashboard is designed to be user-friendly for management. Experience in developing search features, data filtering, and system performance optimization provides a deep understanding of the importance of user experience in reporting systems within the plantation sector.



### 2.5. Laravel

Laravel is a modern PHP framework widely used in web application development because it offers clean syntax and advanced security features. Laravel automatically protects applications from various types of attacks such as SQL Injection, Cross-Site Scripting (XSS), and Cross-Site Request Forgery (CSRF) through its middleware system, input validation, and the use of parameter binding in database queries [4]. The framework also includes features for encrypting sensitive data and customizable user authentication tailored to project requirements.

In addition to security features, Laravel also offers ease of user interface development with the Blade templating engine and a structured routing system. Case studies of Laravel implementation in application development show that this framework can improve the efficiency and security of complex web application development. However, developers are still required to understand advanced configurations so that the integration of Laravel features can run optimally, especially in large-scale projects or systems with special requirements such as industrial production systems.

## 3. Methodology

This study uses the Black Box Testing approach with two main techniques, namely Boundary Value Analysis (BVA) and Equivalence Partitioning (EP). Testing was carried out on the form filter feature in the Palmviews dashboard, which displays production data based on user input, such as date, farm name, district, and region. The purpose of testing is to ensure that the system is able to handle input variations correctly and provide the expected output.

In the Boundary Value Analysis approach, testing focuses on values around the lower and upper bounds of numerical or character inputs, such as production quantities or date ranges. In the Equivalence Partitioning approach, inputs are grouped into valid and invalid classes.

This study applies the Black Box Testing approach to test the reliability and resilience of the system against various input variations, particularly in the main features of the application. The two main techniques used are Boundary Value Analysis (BVA) and Equivalence Partitioning (EP). Testing focuses on the following three critical features:

- Login form
- Filter date range on the main dashboard
- Production data input

### 3.1. Testing Techniques

#### 3.1.1. Boundary Value Analysis (BVA)

This technique is used to test input values that are at the minimum and maximum limits, as well as values just outside those limits. BVA is applied to numeric inputs such as weight and quantity, as well as date ranges.

#### 3.1.2. Equivalence Partitioning (EP)

This technique groups inputs into valid and invalid classes, then tests representative values from each class. EP is used to verify data format, mandatory fields, and system logic.

### 3.2. Test Design

The test design in this study was divided based on three main features in the application, namely the login form, the date range filter on the dashboard, and the production data input form. Each feature was tested using the Equivalence Partitioning (EP) and Boundary Value Analysis (BVA) techniques in accordance with the characteristics of the input received.



### 3.2.1. Login Form

Testing the login form aims to ensure that the system can verify user credentials correctly and deny access if the data is incomplete or incorrect. The Equivalence Partitioning (EP) technique is used to divide inputs into valid and invalid classes.

Valid classes consist of username and password combinations that match the data stored in the system. Meanwhile, invalid classes include several possibilities, such as empty username or password fields, both fields being empty, or username and password combinations that do not match. This test ensures that the system can provide appropriate error messages and prevent unauthorized logins.

**Table 1.** Login form testing.

Components tested	Scenario	Conditions	Expectations
Username and password	Valid username and password	Valid	Successful login
Username and password	Blank username	Invalid	Failed to log in, error message appears
Username and password	Blank password	Invalid	Failed to log in, error message appears
Username and password	Username and password are empty	Invalid	Failed to log in, error message appears
Username and password	Incorrect username and password	Invalid	Failed to log in, error message appears

### 3.2.2. Date Range Filter on the Dashboard

The date range filter feature on the dashboard has a rule that the start date and end date must be in the same year. The Boundary Value Analysis (BVA) technique is applied to test cases at the minimum and maximum boundaries, such as when the start and end dates are the same (valid lower bound), and when the dates are in different years (invalid case).

Additionally, Equivalence Partitioning (EP) is used to group inputs into logical and illogical combinations. Logical combinations include the start date being earlier than the end date and within the same year, while illogical combinations include the end date being earlier than the start date or a year difference between the two dates. This testing aims to ensure that the system only processes valid date ranges according to the specified criteria.

**Table 2.** Date Filter Testing on the Dashboard.

Components tested	Scenario	Conditions	Expectations
Date Range	Start and end dates in same year	Valid	Successful Data Retrieved
Date Range	Start and end dates on different years	Invalid	Filter failure, appears error message
Date Range	Start date is greater than end date	Invalid	Filter failure, appears error message
Date Range	Start and end dates are the same (1 day)	Lower Limit	Successful Data Retrieved

### 3.2.3. Production Data Input Form

The production data input form consists of several important columns, namely production date, fresh fruit bunches (FFB) weight, loose fruit weight, and number of bunches. The test on the production date column uses the EP technique to verify that the system rejects empty inputs and only accepts data with a valid date format.

Meanwhile, numerical inputs such as FFB weight, loose fruit weight, and number of bunches are tested using a combination of EP and BVA. The test is conducted by providing values around the lower limit, such as zero (valid limit) and negative values (invalid). The system is expected to reject values less than zero and only process valid numbers with numeric data types.



**Table 3.** Production Data Input Form Testing.

Components tested	Scenario	Conditions	Expectations
Production Date	Date filled in correctly	Valid	Data saved
Production Date	Date not filled	Invalid	Failed to save, error message appears
Fresh Fruit Bunches Weight	Weight = 100	Valid	Data saved
Fresh Fruit Bunches Weight	Weight = 0	Lower Limit	Data saved
Fresh Fruit Bunches Weight	Weight < 0	Invalid	Login failed, error message appears
Weight of loose fruits	Loose fruits < 0	Invalid	Failed to save, error message appears
Number of Bunches	Total = 0	Lower Limit	Data saved
Number of Bunches	Total < 0	Invalid	Failed to save, error message appears
All Inputs are Blank	All columns are empty	Invalid	Failed to save, error message appears

### 3.3. Testing Results

After testing using the Black Box Testing approach with the Boundary Value Analysis (BVA) and Equivalence Partitioning (EP) techniques on critical features in the Palmviews application, the next step is to calculate the effectiveness value of the test results. This effectiveness value serves as an indicator of the extent to which the application can perform its functions appropriately in accordance with the test scenario.

To measure the effectiveness score, the following two main formulas are used:

$$\text{Valid Test Case} = \left(\frac{a}{b}\right) \times 100\% \quad (1)$$

$$\text{Invalid Test Case} = \left(\frac{c}{b}\right) \times 100\% \quad (2)$$

Description:

- a = number of valid test cases (succeeded as expected),
- b = total of all test cases performed,
- c = number of invalid test cases.

The value obtained from formula (1) is used as a measure of system effectiveness, namely the percentage of successful applications in responding to inputs according to validation requirements. Meanwhile, formula (2) provides information on how many inputs fail to be handled correctly, thus becoming material for evaluation for further development.

As a reference for evaluating effectiveness, the researcher uses the standards set by the Ministry of Home Affairs' Research and Development Agency [5], which classifies the level of system effectiveness as follows:

**Table 4.** Effectiveness Reference Standards.

Effectiveness Ratio	Achievement Level
Below 40	Very Ineffective
40 - 59,99	Ineffective
60 - 79,99	Effective Enough
Above 80	Highly Effective



Based on the results of these calculations, application developers can develop recommendations for improvements to features that experience validation failures. These recommendations aim to improve the quality of the application to be able to handle more input variations correctly, as well as ensure the system runs optimally in supporting the company's operational activities. Thus, the results of this test also become an important basis in the process of iteration and application development in the next stage.

#### 4. Results and Discussion

Palmviews dashboard system testing is carried out to evaluate the reliability of the system in handling user input on several main features, namely the login form, date range filter on the dashboard, and production data input form.

Each feature was tested using scenarios designed based on a variety of valid and invalid inputs. The results of these tests were recorded and classified into two categories, namely:

- Valid, if the system provides output that matches expectations.
- Invalid, if the system fails to provide the appropriate output or a process error occurs.

Testing was conducted by comparing the actual output of the system with the expected results in each test scenario. If the results matched expectations, the test case was categorized as valid. Conversely, if the results differed or the system did not handle the input as it should, it was categorized as invalid. The following is a summary of the test results based on the number of test cases per feature:

**Table 5.** Test Case Results.

Features	Total Test Case	Valid	Invalid
Login Form	5	5	0
Date Range Filter	4	3	1
Production Data Input Form	9	9	0
Total	18	17	1

Based on the results of the tests that have been carried out, from a total of 18 test cases run, 17 test cases were declared valid and 1 test case was declared invalid. Referring to these results, researchers calculate the effectiveness of the application to assess the extent to which the system can function in accordance with predetermined specifications. The results of the calculation of the application effectiveness value are presented as follows:

$$\text{Valid Test Case} = \left(\frac{17}{18}\right) \times 100\% \quad (3)$$

$$\text{Invalid Test Case} = \left(\frac{1}{18}\right) \times 100\% \quad (4)$$

From the calculation results, an effectiveness rate of 94.44% was obtained, with an ineffectiveness rate of 5.56%. This value indicates that the majority of features on the Palmviews dashboard have worked well as expected.

Referring to the effectiveness standards in Table 4, this effectiveness rate falls into the "Very Effective" category, as it is above 80%. Therefore, the system can be deemed suitable for use and has generally met functional aspects. However, the finding of one invalid test case remains a concern that requires evaluation and improvement to ensure the system operates more optimally in the future.

#### 5. Conclusions and Suggestions

Testing results for the Palmviews application show that the system has performed well in handling various user input variations. By applying a Black Box Testing approach using Boundary Value Analysis (BVA) and Equivalence Partitioning (EP) techniques, the testing successfully evaluated three main features, namely the login form, date range filter on the dashboard, and production data input form. The BVA technique proved effective in testing inputs at the lower and upper boundaries, such as zero values in numerical inputs and extreme dates. Meanwhile, the EP technique helped verify the system's



ability to distinguish between valid and invalid inputs, such as empty data, incorrect formats, or inconsistent input logic. Out of the total 18 test scenarios conducted, 17 produced expected outputs, and only 1 was invalid. The achieved effectiveness rate of 94.44% indicates that the application falls under the “Very Effective” category according to the standards of the Research and Development Directorate of the Ministry of Home Affairs.

Although the test results show excellent system performance, there are still some notes that can be considered for future improvements. One important finding is the need for additional validation to prevent the selection of cross-year date ranges, so that the system truly limits inappropriate inputs. In addition, improvements to error messages are also needed so that users receive clearer and more informative feedback when input failures occur.

The Palmviews application is also recommended for further testing in large-scale data processing scenarios to ensure system stability and scalability in a real production environment. Regular evaluations and error logging will also greatly assist developers in monitoring and improving the quality of the application. With continuous improvements, this application is expected to become an increasingly reliable support system for daily production management in the PTPN IV Regional 2 environment.

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