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Design of Potential Enchancement of Oil Palm Production Through BSFTBC Monitoring Program (Building Soil for The Better Crop)

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Abstrak

Palm oil crop productivity is significantly influenced by both endogenous and exogenous factors. The main endogenous factor is the planting material. Exogenous factors include climate, soil (fertility and nutrient balance), biotic environment, and the application of cultivation techniques (including fertilization activities). This research aims to develop a monitoring design for the potential increase in palm oil production through the BSFTBC (Building Soil for The Better Crop) supervision program within the Sub Holding PTPN IV. Data collection and progress monitoring of the Building Soil for The Better Crop program are carried out through the Palm Pro application, which contains information on fertilization activities, fertilizer dosage, implementation of fertilization activities etc. The result of this research is an application-based BSFTBC supervision system designed to facilitate the monitoring process, data storage, and evaluation of the use of organic materials block by block in the field. In conclusion, a consistent and sustainable implementation of the BSFTBC supervision program can provide periodic information and recommendations to management regarding the application of organic fertilizers (empty fruit bunches and solid) as well as inorganic fertilizers on oil palm crops within Sub Holding PTPN IV. This study is expected to improve soil health, fertility, and nutrient balance as a strategy for intensifying the palm oil recovery program and increasing palm oil crop productivity sustainably

Kata Kunci: Membangun Tanah untuk Peningkatan Hasil Panen; Produktivitas; Pemantauan; Pemupukan: Bahan Organik

Abstract

Produktivitas tanaman kelapa sawit sangat dipengaruhi oleh faktor endogenous dan exogenous. Faktor endogenous utama adalah bahan tanaman. Faktor exogenous antara lain iklim, tanah (kesuburan dan keseimbangan unsur hara), lingkungan biotik, dan penerapan teknik budidaya (termasuk didalamnya kegiatan pemupukan). Penelitian bertujuan untuk membuat rancangan monitoring potensi peningkatan produksi kelapa sawit melalui program pengawalan BSFTBC (Building Soil for The Better Crop) di lingkup Sub Holding PTPN IV. Pengumpulan data dan monitoring progress program Building Soil for Better Crop melalui aplikasi Palm Pro yang memuat informasi kegiatan pemupukan, dosis pupuk, pelaksanaan realisasi pemupukan¸dll. Hasil penelitian ini berupa sistem rancangan pengawalan BSFTBC berbasis aplikasi guna memudahkan proses monitoring, menyimpan data dan mengevaluasi penggunaan bahan organik pada blok per blok dilapangan. Kesimpulan program pengawalan BSTFTBC yang konsisten serta berkelanjutan dapat memberikan informasi dan rekomendasi secara berkala kepada manajemen terkait pengaplikasian pupuk organik (tankos dan solid) maupun anorganik pada tanaman kelapa sawit lingkup Sub Holding PTPN IV, sehingga diharapkan dapat meningkatkan kesehatan tanah, kesuburan dan keseimbangan hara di dalam tanah sebagai strategi intensifikasi program recovery tanaman kelapa sawit serta peningkatan produktivitas tanaman kelapa sawit secara berkelanjutan.

Keywords: Building Soil for Better Crop; Productivity; Monitoring; Fertilization; Organic Materials

1. Introduction

Productivity of oil palm plants is strongly influenced by endogenous and exogenous factors. The main endogenous factor is plant material. Exogenous factors include climate, soil (health, fertility and nutrient balance), biotic environment, and the application of cultivation techniques (including fertilization activities). Because oil palm is a perennial crop, there is a complexity among production factors that cause variations in yield or productivity (tons of FFB/ha).

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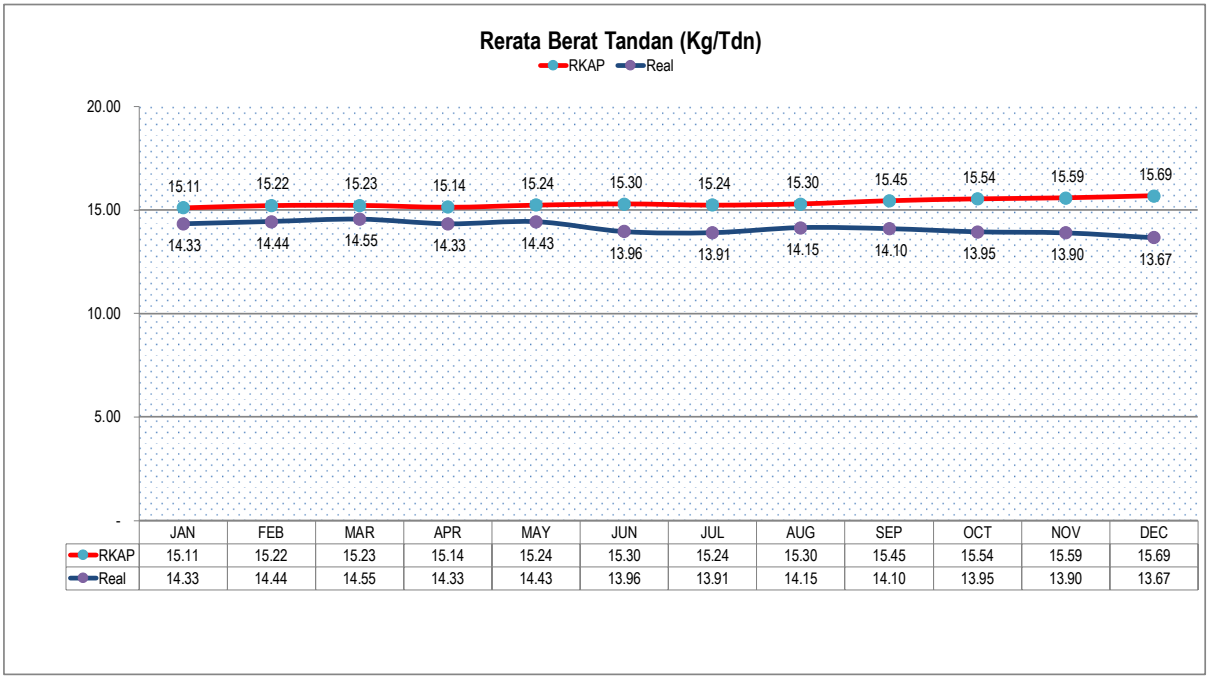
The productivity of oil palm plantations is expected to have an actual yield not significantly different compared to the potential yield, one of the components of oil palm productivity is the number of fresh fruit bunches per plant and the average bunch weight (RBT) both of which are greatly influenced by the level of fertility and nutrient balance in the soil.



	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
RKAP	15.11	15.22	15.23	15.14	15.24	15.30	15.24	15.30	15.45	15.54	15.59	15.69
Real	14.33	14.44	14.55	14.33	14.43	13.96	13.91	14.15	14.10	13.95	13.90	13.67

Figure 1. Prognosis VS Real the average bunch weight (RBT) achievement in PTPN IV scope in 2024

Based on the graph, it can be seen that in 2024 the average bunch weight (RBT) achievement is below the RKAP, so it can be concluded that there is still room for improvement to increase plant productivity through building soil activities, one of which is by overseeing balanced, effective and efficient fertilization activities.

According to Eko Noviandi Ginting (Warta PPKS, 2019), one of the causes of the low achievement of national palm oil productivity is the decline in soil health in oil palm plantation areas in Indonesia, one indication is the decline in soil organic matter content, where within a period of 5 years there has been a decrease of around 0.21% C-organic on average. Therefore, an understanding of how to maintain and improve soil health is needed for sustainable oil palm plantations.

According to Ray R. Weil & Nyle C. Brady (The Nature and Properties of Soils. 15th Edition, 2017) building soil means implementing management practices that improve soil structure, fertility, and biological activity, to support sustainable crop production. Healthy soil is the foundation of a productive crop. Building soil involves providing nutrients and protection to soil life networks (microorganisms), increasing organic matter, and reducing soil compaction.

PTPN IV as a company that manages state-owned oil palm plantations is certainly equipped with a palm oil processing plant that has an abundant source of organic matter as a by-product of processing oil palm fruit, this is an opportunity to optimize the use of organic matter for plant needs.

The effectiveness and efficiency of fertilization in oil palm can be achieved by regular, adequate, balanced fertilization, as well as optimal utilization of oil palm waste. Good fertilization must be the right type, the right dose, the right time, the right method of application, the frequency of fertilization (5T). (Pradiko, Warta PPKS 2015).

Monitoring, reporting and evaluation of the results of activities using organic materials in the company are currently carried out manually by submitting reports on the results, documents, and other supporting data in hardcopy and the files must be transferred to the spreadsheet manually for further processing. This condition is not effective and efficient and can cause problems such as poorly organized application schedules based on indicators of organic matter application (percentage of organic matter in the area), uneven frequency of organic matter application, loss of data or files, so it is necessary to develop a Monitoring System for Potential Increases in Oil Palm Production Through the BSFTC (Building Soil For The Better Crop) Supervision Program which is expected to improve soil health, fertility and nutrient balance in the soil as a strategy for intensifying oil palm crop recovery programs and increasing application-based oil palm crop productivity.

Based on the background of the problems described above, the problem formulations to be discussed are:

a. How to recover and increase the productivity of oil palm plants?
b. What programs can be used to supervise the increase in productivity of oil palm plants?
c. What is an effective monitoring and evaluation report of the escort program?

This study aims to develop a monitoring system design for the BSFTBC (Building Soil for The Better Crop) program. Building Soil For The Better Crop is one of the strategic and operational excellence programs implemented within the working area of PTPN IV, which is expected to enhance soil fertility and nutrient balance. It serves as an intensification strategy for the recovery of oil palm plantations and aims to sustainably improve the productivity of oil palm crops in accordance with their genetic potential.

Based on the background described, the research problem statements to be addressed are as follows:

a. How can the recovery and productivity improvement of oil palm crops be carried out?
b. What programs can be implemented to support the productivity enhancement of oil palm crops?
c. What is the effective format for monitoring and evaluation reports of the productivity support program?

Problem Limitation and Research Assumptions

a. Problem Limitation

This research needs to be limited so that the focus and results can be clearly measured. The scope to be discussed includes:

1) Systems and Technology: only testing monitoring information systems based on digitalization applications (for example executive and admin dashboards).
2) Information Flow:
   - Focus on the monitoring of organic materials, inorganic fertilizers, and biofertilizers.
   - Observation of crop conditions, production data, soil (laboratory analysis results).
3) Applications of organic matter usage monitored in this study are tankos and solids.

b. Research Assumptions

To maintain consistency of analysis, this research is guided by the following assumptions:

1) Availability of basic data: Afdeling, block, block area, planting year, plant material, and number of plants. Data on organic matter application, productivity of each block of oil palm plantation for the last 5 years, and fertilization realization for the last 5 years within PTPN IV before system implementation are available in full and accessible to researchers.
2) User Commitment: Field operators and technical teams are willing to input data and test the design according to research instructions without significant resistance.

2. Literature Review

Research by Sapto Prayitno et al. (2008), entitled Productivity of Oil Palm (Elaeis guineensis Jacq.) fertilized with Empty Fruit Bunches and Palm Oil Mill Liquid Waste. This study aims to determine the effect of fertilizing empty palm bunches (TKKS) and palm oil mill liquid waste (LCPKS) on soil, vegetative plant growth, plant productivity and determine the best type of palm oil mill waste. Field research was conducted from October to December 2007. The research location was at PT Perkebunan Nusantara VII (Persero) Rejosari business unit, Natar, South Lampung.

This study used oil palm plantation (TM) 23 that has been treated: (1) Application of solid waste of empty bunches since 1998 which is given once a year at a dose of 20 tons/Ha. (2) Application of palm oil liquid waste since 1998 which is given every day at a dose of 4.25 m3/ha/day. (3) Inorganic fertilization only without the addition of palm oil processing waste at a dose of 2.75 kg/tree Urea, 2.25 kg/tree TSP, 2.25 kg/tree MOP, 3.75 kg/tree Dolomite per year of application (Fertilization Recommendations of PTPN VII Rejosari Business Unit in 2007). Each treatment was repeated eight times and there were 10 plants as sub samples in each replication, utilizing TM 23 oil palm plantation.

The results of this study can be concluded as follows: (1) The application of palm oil mill effluent (PKS) can improve the quality of physical, chemical and biological properties of soil and growth so that plant productivity also increases. (2) The use of palm oil liquid waste increases the number of bunches by 54.89%, the average weight of bunches by 8.9% and productivity by 70.62%. (3) Utilization of empty oil palm bunches increased the number of bunches by 18.6%, average bunch weight by 4.3% and productivity by 25.03%.

Herry Prastowo Andrianto's research (2019), entitled Plant Garden Collection Monitoring System at the Technical Implementation Unit for Testing and Application of Technology (Case Study): Plantations of the Riau Province Food Crops, Horticulture and Plantations Service). This study aims to (1) Create a plant collection monitoring system at the Technical Implementation Unit for Testing and Application of Plantation Technology of the Riau Province Horticultural and Plantation Food Crops Office. (2) Creating a system that can make it easier for officers to see the development of each period of plant growth and development. (3) Creating a system that can facilitate farmers in making reports. (4) Creating a system that can make it easier for farmers to submit agricultural production materials. (5) Creating a system that can provide convenience in the process of question and answer about agricultural issues between farmers and officers.

The results of this study can be concluded as follows: (1) The monitoring system for plant collection gardens at the Technical Implementation Unit for Plantation Technology Testing of the Riau Province Food Crops and Horticulture and Plantation Office has successfully replaced the manual system that has been running so far. (2) This system makes it easier for officers to see the development of each period of plant growth and development. (3) This system makes it easier for farmers to make reports. (4)

This system makes it easier for farmers to submit agricultural production materials. (5) This system facilitates the process of question and answer about agricultural issues between farmers and officers. (6) From the questionnaires that have been distributed, it shows that the total percentage value of the aspects of using this system is 92.25% or interpreted as strongly agreeing.

Research by Redy Irvin Wiratama (2016), entitled Monitoring System for Garden Yields and Production Results of PT. Mitra Ogan Plantation Palembang Web Based. This study aims to (1) Design the process flow modeling of Monitoring Garden Results and Production Results based on existing business functions at PT. Mitra Ogan Palembang Plantation. (2) Build the application of Monitoring Garden Results and Production Results based on the rules that have been set in the design of the flow modeling of Monitoring Garden Results and Production Results.

The results of this study can be concluded as follows: (1) The system can monitor the activities of garden and production results, especially in handling the process of data collection more efficiently in the Plant Section, especially the Exploitation and Investment Division of PT Mitra Ogan Palembang Plantation without leaving company procedures so that it is easier for afdeling admin, garden staff, office staff, division heads and section heads. (2) The monitoring information system that is built can also record garden results and production results through a monitoring system that is implemented through a computer with the final result, namely a graph of production results to make it easier for the company, which is displayed in the monitoring information system for garden results and production results of PT. Mitra Ogan Palembang Plantation.

Journal of the National Seminar on Research and Technology Innovation, entitled Application of Fishbone Method for RT Hall Scheduling Application. This research creates an RT hall scheduling application that aims to make it easier for administrators to manage the schedule of activities to be held at the RT hall. This research can also be useful for administrators to manage the RT hall optimally, easily, and quickly so that all the needs of residents in using the RT hall can be optimally facilitated.

The method used in this research is the fishbone method where this method is used to analyze the problems experienced by RT hall administrators. While the system development method in this research uses waterfall. The results achieved from this study are that the administrators feel helped by this application because it can facilitate the administrators in managing and checking all scheduling data at the RT hall.

2.1 Conceptual Framework

The program to enhance soil fertility and nutrient balance as an effort to improve oil palm productivity according to its genetic potential requires a Design for the Potential Enhancement of Oil Palm Production through the BSFTBC (Building Soil for The Better Crop) Monitoring Program.

This design aims to ensure that all activities are properly recorded, monitored, and evaluated in a structured and real-time manner

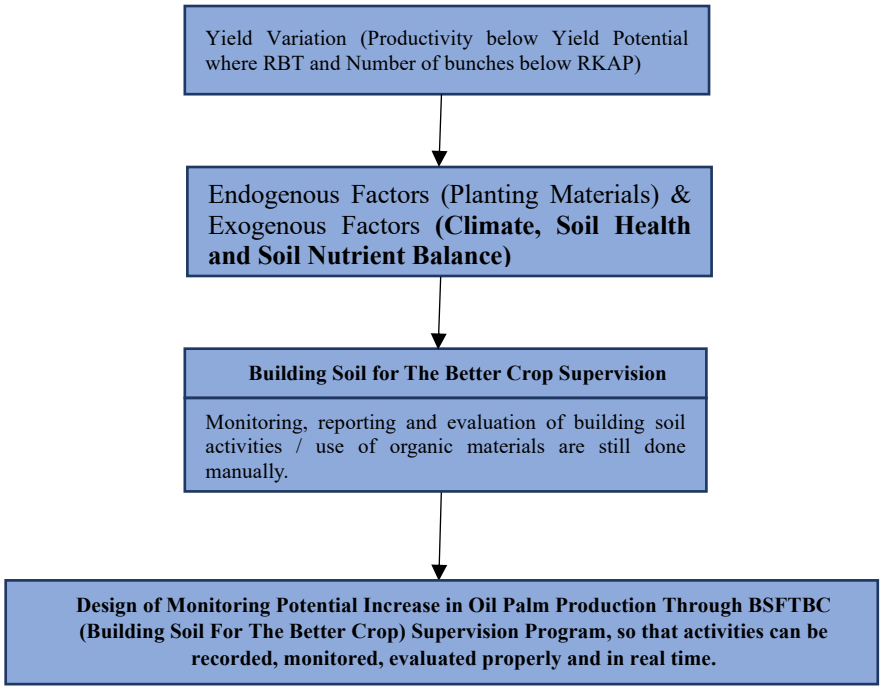


Figure 2. Conceptual Framework

3. Methods

3.1 Research Approach

This research uses a method, method or tactic as steps that must be taken by researchers in solving a problem to achieve certain goals. Thus the research method that the author uses is a qualitative descriptive method.

According to Sugiyono (2018: 48), the descriptive method is research conducted to determine the existence of variables) without making comparisons and looking for relationships between these variables and other variables.

3.2 Research Methodology

The stages of data collection and analysis in R&D research are as follows:

a. Potential and Problem Identification: identify the main problems, using the Fishbone Analysis method.
b. Conducting literature studies: literature searches to obtain in-depth information and understanding of the problems identified by reading journals from previous research, books so that they can be used as references in conducting research.
c. Data Collection
   - Field Observation: Conducting direct observations in the field obtained by the PIC of each region.
   - Initial data collection was carried out with the Focus Group Discussion (FGD) method to align the output of activities with strategic programs and operational excellence of PTPN IV as well as periodic coordination with experts from the Palm Oil Research Center and PTPN IV PIC both online and offline.
   - Secondary Data: Collecting areal statement data and maps of oil palm plantations in each region, data on the application of organic materials and soil conditioners, the productivity of each block of oil palm plantations, and the realization of the last fertilization within the scope of PTPN IV Sub Holding. These data are used for the preparation of tools and analysis in preparing recommendations in each plantation within the scope of Sub Holding PTPN IV.
d. Solution Design Rapid Application Development (RAD) Method
   - Using the RAD method to design system solutions that can be implemented quickly and effectively.
   - Create a system solution that can be implemented quickly and effectively.

3.3. Data sources and Data collection techniques

Data sources in this study were obtained from Primary Data (Field Observation and Focus group Discussion) and Secondary Data (Documentation and Literature Study).

Data Collection Techniques in this research are as follows.

a. Conducting direct observations in the field obtained by the PIC of each region.
b. Focus group discussions to align the output of activities with strategic programs and operational excellence PTPN IV conducted periodic coordination with experts Palm Oil Research Center and PIC PTPN IV both online and offline.
c. Documentation: Collecting areal statement data and maps of oil palm plantations in each region, data on the application of organic materials and soil conditioners, the productivity of each block of oil palm plantations, and the realization of the last fertilization within the scope of PTPN IV Sub Holding. These data are used for the preparation of tools and analysis in preparing recommendations in each plantation within the scope of Sub Holding PTPN IV.
d. Literature Study: Reviewing journals, books, and previous research reports relevant to the research topic to strengthen the theoretical basis and methodology.

3.4 Analysis technique data

The steps to analyze the data in this study are as follows:

a. Data Collection: Data collection is the recording of various types of data, study and collection of things that objectively follow the results of interviews and observations in the field.
b. Preprocessing The next stage is to prepare the results of the previous stage so that later it is ready to become data for the management stage.
c. Data Display At this stage the researcher has systematically presented the data that has been reduced systematically.
d. Drawing Conclusions in the analysis of skinative data, the initial conclusions drawn are still temporary and will change if there is no supporting evidence found in subsequent data collection. In accordance with the notion of drawing conclusions according to Miles and Huberman, namely, drawing conclusions and verifying. With this, conclusions in qualitative research can satisfy problems that have been formed at the beginning, but it may or may not be possible, because the formulation of problems and the calculation of qualitative research in the problem is temporary and will develop after research in the field.

4. Result and Discussions

4.1 Model

The model or framework used is an approach through the Fishbone method to determine the factors that affect oil palm productivity.

The productivity of oil palm plants is strongly influenced by natural conditions, namely climate, soil (health, fertility and nutrient balance), and the application of cultivation techniques (including building soil activities), as well as other factors such as the consistency of building soil activities, the monitoring and evaluation process carried out by officers related to building soil activities and the tools used.

Reports and evaluations of the results of activities using organic materials in the company are currently carried out manually by submitting results reports, documents, and other supporting data in hardcopy form and the files must be transferred to the spreadsheet manually for further processing. This condition is inefficient and can cause problems such as loss of data or files.

Based on the identification of problem factors that affect the productivity of oil palm above, it is necessary to design a System for Monitoring the Potential for Increasing Oil Palm Production Through the BSFTC (Building Soil For The Better Crop) Supervision Program which is expected to improve soil health, fertility and nutrient balance in the soil, and mitigate climate impacts (drought), as a strategy for intensifying oil palm recovery programs and increasing the productivity of application-based oil palm plants.

Another method used in problem solving is the Rapid Application Development (RAD) method. This method is the preparation of a system to replace the old system as a whole or improve the existing system. Rapid Application Development (RAD) is a software development method that focuses on the speed of development through iterations, prototypes, and rapid feedback from users. RAD aims to shorten the development cycle by involving users directly.

The stages in Rapid Application Development (RAD) are:

a. Business Modeling
   - Understand the flow of information within the organization and how the data is used by various business processes.
   - The development team works with stakeholders to define business objectives and key workflows.

b. Data Modeling
   - The data identified in the previous stage is modeled to support the business needs.
   - This includes creating data schemas, relationships between data, and how the data will be used.

c. Process Modeling
   - Processes involving data are designed to support business flows.
   - This stage includes defining the business processes, logic, and rules that must be applied in the application.

4.2 Plan Results

Tools Used for the Building Soil program in PTPN IV's operational areas, is the https://palmpro.app . Data entered through the mobile application will be stored on a server and analyzed automatically. The results of the analysis will be displayed on a dashboard, which can be accessed via the PalmPro web application.

Parameters for this activity will provide periodic information and recommendations to the management regarding the application of empty fruit bunches (EFB) and solid organic matter on oil palm plants within the Sub Holding PTPN IV area.

As a result, soil fertility can be improved, which is expected to enhance the productivity of the plants in a sustainable manner.

5. Conclusion

Based on the results of the analysis and design that have been carried out, and referring to the objectives of the study, the following conclusions can be drawn:

a. The Monitoring Design for the Potential for Increasing Palm Oil Production Through the BSFTBC Monitoring Program is a tool to evaluate and analyze the increase in fertility and balance in the soil in the long term which will have an impact on increasing productivity, RBT, and improving technical culture

b. The Monitoring Design for the Potential for Increasing Palm Oil Production Through the BSFTBC Monitoring Program is a strategy for increasing fertility and balance in the soil which includes:
   - Program for optimizing the provision of tankos routinely (OPEX).
   - Program for optimizing the provision of solids.
   - Management of 5T fertilizers.
   - Provision of biological fertilizers (extra).

c. The Monitoring Design for the Potential for Increasing Palm Oil Production Through the BSFTBC Monitoring Program can provide reporting monitoring and evaluation of the monitoring of Building Soil for Better Crop work that is up to date every month and can be exported which will become a formal progress report on the progress of the work

Based on the research results, in order for the design application to be implemented, the researcher suggests the following:

1) Training and modules are needed for HR who become PIC so that they have the competence and knowledge in the technical use of the application.
2) PIC officers at both the Plantation Unit and Regional levels must consistently update the BSFTBC program monitoring data periodically.

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