

## Fertilizer Information System for Banana Plantation

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**Abstract**— A banana is a nutritious fruit which contains good vitamins and nutrient for body. Banana tree requires suitable mean temperature and mean rainfall to grow up. Additionally, healthy soil improves crops growth due to sufficient nutrients. Farmers use fertilizer to improve soil nutrient and increase yield productions. Thus, a proper field management and fertilization is important to ensure banana plants to produce high quality of yield. Improper manage fertilizer will cause impact on the environment and affect the banana plantation. Therefore, fertilizer information system for banana plantation is developed to support farmers to manage information for banana farm in an effective way. Prototype model is employed to assist development of the system. PHP programming language is used to develop this system and MySQL as a system database. This system contains five modules which are registration and login module, manage banana plantation information module, fertilizer formulation management module, fertilizer information management module and report module. It is expected that the system will help farmers to manage and monitor the fertilizing task in the farm efficiently.

**Keywords**— Farming, Banana Plantation, Fertilizing, Information System.

### I. INTRODUCTION

Banana tree is a fast-growing plant which requires full supply of nutrients and water for increase productions [1]. Additionally, healthy soil improves crops growth due to sufficient nutrients. Fertilizer is required to replace essential nutrients that have been depleted by previous plant growth to achieve cropping system goal for increase quantity of crop yield [2]. So, farmers use fertilizer to improve soil nutrient which sometimes loss the nutrient when plants use them. Fertilizer restores this important element which supports plant growing in a good condition. Thus, a proper field management and fertilization is important to ensure banana plants to produce high quality of yield.

In the current process, some of the farmer fertilizes their banana plant based on their prior knowledge without using any expert consultation, lab testing or accurate measurement tool. Good farm practice on fertilizing requires elements such as to select right source, the right method, the right timing, and the right rate of application [3]. Thus, it is important for farmers to know the right amount that is sufficient to their plants. Also, the farmer does not record the fertilizer job in a manageable way that causing the fertilizing job sometimes do not complete well. Right timing of fertilizing schedule is important and must be completed within a right time to avoid excessive or insufficient nutrient. This situation can lead excessive of fertilizers that create adverse impacts on plant

growth. In addition, excessive amount of nitrogen and phosphorus cause to large quantity plant and algae growth in water which can reduce water quality for many usages. However, some of the farmer has difficulties to seek for any advice from respective officer regarding fertilizing problem. This may affect the banana plantation and maybe cause death of the banana plant.

Thus, this project proposes a fertilizer management information system to calculate the quantity of fertilizer to be sown on banana plant and fertilizing task management. The objectives of this project are to design and to develop fertilizer management information system for banana farm. Farmer can enter the amount of nutrient needed value then divide by percentage of nutrient in fertilizer to determine the quantity of fertilizer that include amount of urea, SSP (*Single Superphosphate*) and MOP (*Muriate of Potash*). Consequently, system will compute the amount of fertilizer, and generate new task report for workers job assign. The database of the system is developed to store the data of fertilizing banana farm. For example, the information of fertilizing, date and time of fertilizing, person in charge, and plant bed information are kept and manage in the database. The farmers need to follow the amount of fertilizer to sown around the tree. Therefore, this system is useful for the farmer and their workers to manage their farm specifically in fertilizing process.

This system is designed for farmers and their workers. The system is developed to determine the right amount of fertilizer

composition, and to assign the fertilizing job to the workers. System users are plantation owner (administrator) and worker of the plantation. There are five main modules which are the registration and login module, manage banana plantation information module, fertilizer formulation management module, fertilizer information management module, and report module.

This paper consists of five main parts. Part II explains related work for fertilizer management of banana plantation. Part III describes the methodology of system development. Part IV explains about findings on analysis and design of system. Meanwhile, Part V demonstrates the result and Part VI gives a conclusion.

## II. RELATED WORK

Good management of banana plantation not only can increase productivity but also can keep healthy growing of banana. Before start banana plantation process, a well-managed nutrition program should be planned which including what fertilizer and how much to apply. Moreover, bananas grow well in not compact soils where the pH value between 5.5 and 6.5 [4]. Irrigation process needed in banana plantation process in case the rain fall irregular as to maintain moisture of soil. In this project, banana plantation is studied as it contributing as one of main crop industry in Malaysia.

Fertilizer management is one of the important parts in integrated plant nutrition process. Applying appropriate amount of fertilizer can ensure the banana plants obtain enough nutrients and replace nutrient that had been depleted. There are three important fertilizer elements needed for banana plants which are nitrogen, phosphorus and potassium [4]. Potassium is considered major nutrient element for banana as banana fruits and leaves contain a high potassium level. These three fertilizer elements are selected in this study in the case of banana plantation.

Computer application in farm management is not new. For instance, farm financial condition and market information uses Internet technology to release the information over the network [6]. Additionally, remote sensing and integrated network is applied in drip irrigation of integral control of water and fertilization. This is beneficial to improve water use efficiency under protected cultivation [7] – [8]. Farm management information system also requires computer application to handle manual work and daily routine to support farm management. The system has functions of information acquisition, expert decision and intelligent farm machinery management [9]-[13]. Farming and plantation sectors employs computer systems and information technology to improve its efficiency in managing the information and lead to better productivity.

## III. METHODOLOGY

The prototype model is selected to assist the development of fertilizer information system project. Prototype method encompasses of five phases, which are planning phase, analysis phase, design phase, prototype development phase, and the implementation phase as illustrated in Fig.1. Table 1 summarizes the main phase and activities carry out during each phase.

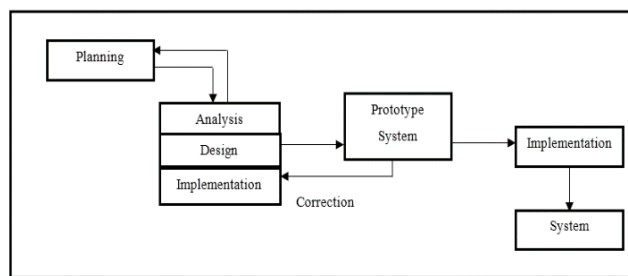


Fig 1. Prototype Model [5]

TABLE 1  
SYSTEM DEVELOPMENT ACTIVITIES

Phase	Activity	Deliverables
Planning	Task scheduling. Identify problem, scope and objectives	Gantt Chart Proposal
Analysis	Collect and analyse the collected information.	Project documentation
Design	Process system design, logical and physical design of database, user interface design	Data Flow Diagrams Entity Relationship Diagram Wireframe drawings for user interface
Implementation	Develop program code.	Program code Test plan
Prototype 1	Repeat task from planning phase until implementation phase.	Prototype system
Prototype 2	Detect errors again on the system and repair the existing system.	Prototype system

## IV. FERTILIZER INFORMATION SYSTEM

This section discusses an analysis and design of fertilizer information system for banana plantation. The design process follows structured approach.

Context diagram and data flow diagram are designed to identify the function and process details of the system. Hence, these diagrams can specify the structure and behaviour of system to make sure it meets the requirement of clients. The context diagram of this system is illustrated in Fig 2. The diagram shows the data flow between systems with the external entities which are administrator (farmer) and workers. The diagram shows the processes connected to external entities by data flows and resource flows. Data flow diagram level 0 contains the processes involved such as registration and login, manage banana plantation information, fertilizer formulation management, fertilizer information management, and generate report.

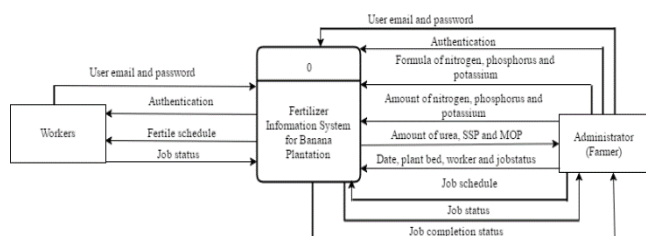


Fig 2. Context diagram

Entity relationship diagram in Fig 3 shows the graphical representation of entities and their relationship in data store of this system. The database of system includes five tables which are admin, worker, fixed\_formula, plant, bed\_cat and

fertilizer. The operational function of the data is including store, edit, update and delete. The database is managed in *phpMyAdmin* database software. Fig 4 indicate the schema table.

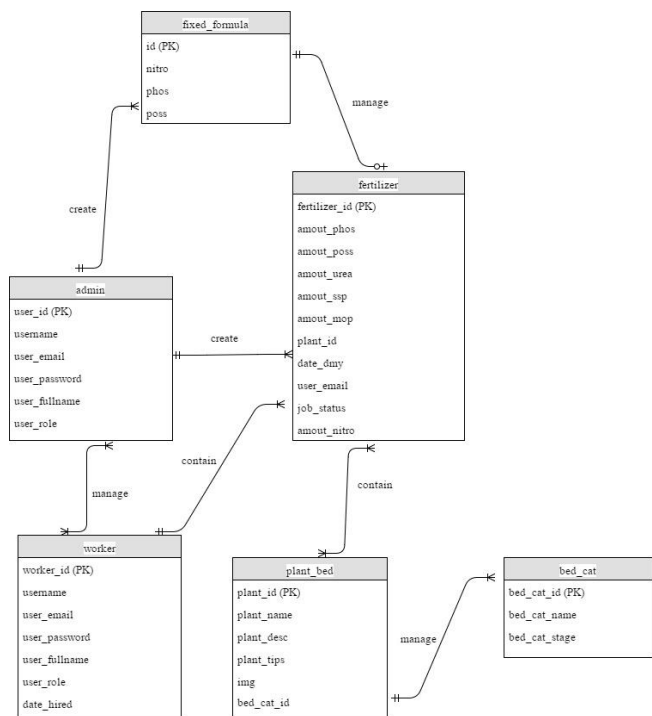


Fig 3 Entity Relationship Diagram

```

admin (user_id(PK), username, user_email, user_password,
user_fullname, user_role)

worker (worker_id(PK), username, user_email,
user_password, user_fullname, user_role, date_hired)

fixed_formula (id(PK), nitro, phos, poss)

plant (plant_id(PK), plant_name, plant_desc, plant_tips,
img, bed_cat_id)

bed_cat (bed_cat_id(PK), bed_cat_name, bed_cat_stage)

fertilizer (fertilizer_id(PK), amount_nitro, amount_phos,
amount_poss, amount_urea, amount_ssp, amount_mop,
plant_id, date_dmy, user_email, job_status)
    
```

Fig 4 Database schema

### V. RESULT AND DISCUSSION

At the end of this project, a fertilizer information system for banana plantation has been successfully developed. User authentication is necessary to use the system.

#### i. User Role: Administrator (Farmer)

Administrator (farmer) plays an important role in this system to manage the information stored in the database. Admistrator’s task in the system are such as data management (add, update and delete), manage plant information, manage formulation of fertilizer, calculate fertilizer mixture and amount, and manage workers. After user access is granted, administrator is able to view administrator dashboard. Three important main menus which are *banana plantation information*, *fertilizer information management*, and *worker*

*registration* section are as shown in Fig 5. In manage banana plantation information module, administrator can add and view banana plantation information. Additionally, Fertilizer Information Management module handles the formulation of fertilizer, database, fertilizer calculation and job assignment. Worker Registration section enable new worker registration and their profile details.

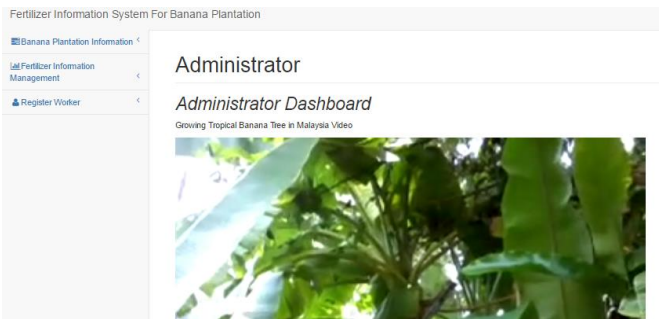


Fig 5 Administrator Dashboard

TABLE 2  
FERTILIZER FORMULATION TEST CASE

Component	Portion
Nitrogen	0.7
Phosphorus	0.11
Potassium	0.12

Table 2 tabulates the test case for fertilizer formulation management. The data embraces of formula of `nitrogen`, formula of `phosphorus` and formula of `potassium`. Information in Table 2 is entered to the system database using `manage formula` form as pictured in Fig 6. This formula was stored and manage in the system’s database. The official formula was showed on the system for a guide for user.

Administrator

Manage Formula

Fixed Formula

amount of urea:  $urea=x/0.46$  Eq.(1)

amount of SSP:  $SSP=y/0.16$  Eq.(2)

amount of MOP:  $MOP=z/0.60$  Eq.(3)

Enter formula of nitrogen:

Enter formula of phosphorus:

Enter formula of potassium:

Save Reset

Fig 6 Manage Formula Module

Formula Table

Fertilizer id	Formula of nitrogen	Formula of phosphorus	Formula of potassium	Action
2	0.46	0.16	0.6	
3	0.3	0.7	0.9	
5	3	2	1.2	
7	1	1	1	

Fig 7 Fertilizer Formulation Database Table

Fig 7 realized the fertilizer formulation storing in database and displayed in the user interface of the system. System

calculates the proportion of urea, SSP and MOP based on the value of nitrogen, phosphorus and potassium. The calculation is performed by using SQL query ("SELECT \* FROM fixed\_formula ORDER BY id DESC LIMIT 1").

Fig 8 shows the interface where administrator select the plant id 28 and enter information as in Table 7.0 to obtain the appropriate fertilizer mixture of urea as 35.71, SSP as 300 and MOP as 158.33.

TABLE 3  
TEST CASE FOR FERTILIZING JOB ASSIGNMENT

Item	Data
Plant id	28
nitrogen	25
phosphorus	33
potassium	19
Fertilizing date	27 April 2017
Worker	Marc Yu

Plant ID  
28

Enter amount of nitrogen(g)  
25

Enter amount of phosphorus(g)  
33

Enter amount of potassium(g)  
19

Calculate

Amount of urea(g)  
35.714285714286

Amount of SSP(g)  
300

Amount of MOP(g)  
158.33333333333

Select Workers  
marc yu

No. of Job      user email  
2      ada@gmail.com  
1      keke@gmail.com  
3      lolo@hotmail.com  
1      mack@gmail.com  
1      marcyu@gmail.com  
3      milo@gmail.com

Date  
27/04/2017

Enter Job Status  
In Progress

SAVE RESET

Fig 8 Calculation Fertilizer and Job Assignment

After that, the administrator assigns work to the employee and the date to fertilize based on quantities previously calculated, such as information shown in Table 3. Meanwhile, Fig 9 lists all job schedules that had been assigned by administrator in the data table form.

## Administrator

### Job Schedule Data

Show 15 entries

Fertilizer ID	Amount of Urea	Amount of SSP	Amount of MOP	Plant ID	Date Fertilize	User Email	Job Status	Action
99	14.285714285714	12.5	11.111111111111	19	2017-04-06	keke@gmail.com	In Progress	<a href="#">✕</a> <a href="#">✓</a>
101	17.142857142857	18.25	14.444444444444	19	2017-04-11	mack@gmail.com	Complete	<a href="#">✕</a> <a href="#">✓</a>
111	19.8	19.8	19.8	19	2017-04-09	milo@gmail.com	In Progress	<a href="#">✕</a> <a href="#">✓</a>
112	6.6	6.6	7	3	2017-04-16	lolo@hotmail.com	In Progress	<a href="#">✕</a> <a href="#">✓</a>
113	30	45	15.555555555556	3	2017-04-10	lolo@hotmail.com	Complete	<a href="#">✕</a> <a href="#">✓</a>
114	0.91428571428571	0.9125	0.91111111111111	28	2017-04-17	lolo@hotmail.com	Complete	<a href="#">✕</a> <a href="#">✓</a>
115	28.571428571429	25	22.222222222222	26	2017-04-10	ada@gmail.com	In Progress	<a href="#">✕</a> <a href="#">✓</a>
116	57.142857142857	37.5	11.111111111111	26	2017-04-11	ada@gmail.com	In Progress	<a href="#">✕</a> <a href="#">✓</a>
117	57.142857142857	26.25	61.111111111111	2	2017-04-18	milo@gmail.com	In Progress	<a href="#">✕</a> <a href="#">✓</a>
118	15.714285714286	266.25	614.44444444444	2	2017-04-19	milo@gmail.com	Complete	<a href="#">✕</a> <a href="#">✓</a>
Fertilizer ID	Amount of Urea	Amount of SSP	Amount of MOP	Plant ID	Date Fertilize	User Email	Job Status	Action

Showing 1 to 10 of 11 entries

Previous 1 Next

Fig 9. Job Schedule Data

index.php 1 / 2

Job Schedule

FERTILIZER_ID	AMOUNT_UREA	AMOUNT_SSP	AMOUNT_MOP	DATE_FERT	USER_EMAIL	JOB_STATUS
99	14.285714285714	12.5	11.111111111111	2017-04-06	keke@gmail.com	In Progress
101	17.142857142857	18.25	14.444444444444	2017-04-11	mack@gmail.com	Complete
111	19.8	19.8	19.8	2017-04-09	milo@gmail.com	In Progress
112	6.6	6.6	7	2017-04-16	lolo@hotmail.com	In Progress

Showing 1 to 5 of 11 entries

Show all

Fig 10. Job Schedule Report

Fig. 10 shows the interface of all the database such as fertilizer id, amount of urea, SSP and MOP, date of fertile, in charge worker email and job status already generate as a file can be save as PDF.

## ii. User Role: Worker

Workers can access the system after administrator register their user email and the password. The worker dashboard contains three main menus which are information management, view schedule and personal profile. Information management allows workers to view the banana plantation information. View schedule section allows workers to update job status of job schedule. Personal profile shows the worker personal details and enable worker to update their password for login system.

Fig. 11 shows the worker's job schedule data. This page contains information of worker's fertilizing job such as fertilizer mixture, the date to fertilizer, and plant\_id. Worker is required to update the job status when the fertilizing job is completed.

## Worker

### Job Schedule Data

Show 10 entries

Fertilizer ID	Amount of Urea	Amount of SSP	Amount of MOP	Plant ID	Date Fertilize	User Email	Job Status	Action
99	14.285714285714	12.5	11.111111111111	19	2017-04-06	keke@gmail.com	In Progress	<a href="#">✕</a>
Fertilizer ID	Amount of Urea	Amount of SSP	Amount of MOP	Plant ID	Date Fertilize	User Email	Job Status	Action

Showing 1 to 1 of 1 entries

Previous 1 Next

Fig 11 Worker's Job Schedule Data

## Worker

### Update Job Status

Enter Job Status

Complete

SAVE

Fig 12 Update Job Status as Complete

Fig 12 illustrates the function to update job status as complete. There are 2 options provided using drop down menu function for worker to select. Button save enable the selection option of job status to be recorded in the database, and updates all related information. Updated information in job schedule is as shown in Fig 13 for fertilizer id no. 99.

Worker

Job Schedule Data

Show 10 entries

Fertilizer ID	Amount of Urea	Amount of SSP	Amount of MCP	Plant ID	Date fertilizer	User Email	Job Status	Action
99	14.285714285714	12.5	11.111111111111	19	2017-04-06	leke@gmail.com	Complete	

Showing 1 to 1 of 1 entries

Previous 1 Next

Fig 13 Job Status Update

## VI. CONCLUSIONS

The project has achieved the objective and solves the problem statement. However, there still have some weakness of the system is the system only able calculate the amount of fertilizer needed for one banana plant as it can't calculate too much plant at a same time. Also, this system should contain more banana plantation information in detail such as watering information. This system can be expanded to include more banana plantation details. For instance, watering management, planting management, disease and pest management, and functions to support farm management. Also, this system should be improving to calculate the amount of fertilizer for 1-hectar farm at a same time. Moreover, task notification function should be included to notify the worker about the information for new job schedule.

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