AGRISYNC: AN INTEGRATED DIGITAL CROP MANAGEMENT SYSTEM

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Abstract

Crop management encompasses a variety of agricultural practices aimed at enhancing crop growth, development, and yield while promoting sustainability and efficient resource use. With the emergence of digital technology, modern tools such as precision agriculture and smart farming have significantly improved these practices. This study's objective is to develop and evaluate a user-friendly and reliable mobile application to help farmers manage their crops effectively. A prototype was developed to do this. Data were collected through literature reviews and consultations with local agriculturists for Department of Agriculture updates. The app was developed using Java programming language and Android Studio as the Integrated Development Environment with SQLite as the local database for data storage. Key features include planting and harvesting logs, local agricultural office updates, and crop information. Structured pre-test and post-test surveys were administered to five (5) home gardeners identified through purposive sampling. Results showed that there is no strong statistical evidence that the app is reliable with a critical value of 2.7764 and a p-value greater than the 0.05 significance level. On the contrary, there is a very high level of user satisfaction with the app. Furthermore, the result showed 100% that the app effectively disseminates updates from the Department of Agriculture. These findings indicate that there is a need to improve the app’s functionality. With future improvements that may focus on expanding the crop database and integrating weather-based alerts for further precision, practical features and ease of use suggest promising applications in agricultural productivity and digital farming education.

Keywords: crop management, agricultural technology, smart farming, mobile application, sustainable agriculture

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CHAPTER I
INTRODUCTION

1.1 Background of the Study

Adoption of best crop management practices improves crop productivity and can contribute to greater yields with improved quality. Crop management is the set of agricultural practices performed to improve the growth, development, and yield of crops. It begins with a seedbed preparation, sowing of seeds, and crop maintenance, and ends with crop harvest, storage, and marketing. The timing and sequence of agricultural practices depend upon several factors, such as winter or spring crops; harvested products such as grain, hay, and silage; sowing methods- broadcast and row-crops; and, plants age, soil, climate and weather conditions.

During the last two decades, there has been extensive research on advanced agriculture methods of farming agronomic crops, with an understanding that cropping system changes have very important implications for insect population dynamics and management. Crop production is still an important discipline of agriculture, needed to produce food and feed and enhance economic efficiency, and enhancing it has been an enduring aspiration in all agrarian history. New advances in fields such as artificial intelligence, automation, and connectivity have ushered the way for farmers into an era where processes can be tracked and targeted treatments applied with much more accuracy than before. The agricultural companies, very much capable of high production, have grown outputs ranging from production of crops that can supply several industries, such as pharmaceuticals and fuels, despite the problem of high production costs and poor rural appeal. These technologies have also successfully carried out various applications, including crop disease classification, yield predictions, and weed identification. As more agricultural companies are involved in crop production, the need for effective crop production systems is also continually growing. Hence, this research seeks to examine how deep learning can enhance crop management techniques and inform future research in agricultural production.

Modern crop management technologies have revolutionized agriculture using advanced equipment like precision agriculture, genetic engineering, and smart farming systems. Based on these principles, through technologies such as GPS, remote sensing, drones, and IoT sensors, precision agriculture provides real-time monitoring, data-driven decision making, and management optimization around resources to increase crops while reducing environmental impact (Shehzadi et al., 2023).

The primary purpose of this research is to develop a mobile application for crop management that is reliable and user-friendly. The mobile application includes crop management features such as a calendar with planting and harvesting dates, logs, information on crops and tips for growing, and local Department of Agriculture information updates. The mobile application facilitates easy, efficient, and dependable crop management through technology assistance that enables the farmers to enhance crop management practices.

1.2 Statement of the Problem

The dramatic increase in global populations leads to tremendous challenges in agricultural productivity, as the declining capacity of natural resources and climate change raise doubts about agricultural growth. Large-scale farming tends to be unable to satisfy increasing food demand while still being responsible for soil sustenance and minimizing adverse environmental impact situation crying for urgent establishment of effective crop management with an emphasis on greater productivity and sustainability. Household gardening in the municipality of Bacong plays an important role in local food production, but gardeners usually encounter barriers to timely and pragmatic information on the best crop management practices. This study aims to fill in the gap by performing a reliability and usability appraisal of a mobile application meant to be used for crop management. The study will also investigate how well the application disseminates information on behalf of the local Department of Agriculture. By directing its research at the contribution of this mobile application to agrarian development, this empowers household gardeners to derive higher yields and adopt sustainable agricultural practices.

Despite the growing recognition of the importance of effective crop management strategies, several gaps remain in the current literature and practice. This study aims to answer the following questions:

1. How many years of farming experience do the respondents have?
2. Do the respondents use any mobile applications for farming-related tasks?
3. How do the respondents typically plan their crop schedules?
4. Does the app improve respondents' awareness of reports from the local Department of Agriculture (DA)?
5. Does the app meet user expectations in terms of ease of use and overall satisfaction?

Null and Alternative Hypotheses:

In the context of this research, which assesses the reliability of a mobile application developed for crop management for home gardeners in Bacong, the following hypotheses can be stated:

Null Hypothesis (H_0)

The application of the mobile app for crop management is not reliable to the home gardeners in Bacong, Negros Oriental.

Alternative Hypothesis (H_1):

The application of the mobile app for crop management is reliable to the home gardeners in Bacong, Negros Oriental.

1.3 Objectives of the Study

This study aims to evaluate the reliability and user-friendliness of the crop management mobile application for home gardeners. It specifically aims:

1. In order to establish whether the information delivered by the mobile app is reliable.

2. To understand or learn the way the mobile app can promote the usage of sustainable gardening practices among home gardeners.

3. To assess how easy and accessible the mobile app is to use so that it serves the needs of home gardeners by allowing easy navigation and learning of the app's features.

4. To assess the extent to which the mobile app functions effectively in enhancing the level of communication and exchange of information between home gardeners and the local Department of Agriculture.

1.4 Scope and Limitations

This research is centered on the creation and integration of a mobile application that is tailored for crop cultivation and management. The app features a calendar for scheduling planting and harvesting dates, a log for the recording of sowing and harvesting operations, and a special section that gives crucial information on the crops. This data includes suggested sowing and harvesting seasons, best soil to grow on, and fertilization regulations, such as the kind of fertilizers to apply and how often. Significantly, the crop season data is specific to the Type III climate of Negros Oriental to make it relevant to farmers' practices there. Apart from that, the local Department of Agriculture updates will also be restricted to the Bacong municipality of Negros Oriental, with emphasis placed on this community's very own needs.

The data gathering for the research shall be conducted through five chosen home crop farmers who reside in Bacong, Negros Oriental. The participants will begin with a pre-test survey to set a baseline of their current knowledge on farming and how digital tools should be integrated into crop management. This shall be followed by one week of using the application, in which the reliability and usability of the application shall be tested. The post-test assessment will be done after this testing phase to gauge any improvement in knowledge and user experience.

However, this study has a number of shortcomings. It will not cover residential gardens with attractive plants because the research is primarily focused on agricultural production. Consequently, the findings will be applicable only to farmers in Bacong, Negros Oriental, and may not be generalizable to other regions or types of agricultural practices. Furthermore, the effectiveness of the application may be limited for farmers who rely heavily on real-time weather updates for cultivating a variety of crops in larger quantities, as the app does not provide such features. By acknowledging these limitations, the study aims to present a focused analysis of the mobile application's impact on crop management for household gardeners in Bacong.

1.5 Significance of the Study

This study significantly determines the reliability and user-friendliness of the crop management app. The integration of the crop management features such as the sowing and harvesting plants date logs, predetermined harvest season of recommended crops, information of recommended crops – sowing season, harvest season, soil type, fertilizing type and frequency, and common pests and diseases–, and information from the local department of agriculture promotes informed and efficient farm practices. In addition, this bridges the gap between traditional farming and modern technology. Furthermore, this significantly benefits the community especially the following:

- <u>Farmers</u>: Especially those who are involved in small, self-contained food production, will benefit from this app in terms of how they care for and tend to their crops. Through using the application, farmers can be more independent in their food and better secure their homes with reduced expenses at home. The app also offers farmers updates from the local Department of Agriculture on the availability of seeds, insurance, and other advantages that farmers are eligible for, thus improving farmers' access to important resources.
- <u>Researchers and developers</u>: This research forms the basis for future innovation in integrating agriculture with technology. By assessing the efficacy of the mobile app, researchers and developers can determine the potential for improvement and discover new ways to improve agricultural practices using digital tools.
- <u>The Department of Agriculture</u>: The findings of this study will be helpful to the Department of Agriculture since it seeks to aid accessible mobile applications that complement its mandate of enhancing agricultural practice through modernization. The findings are useful for informing future training programs, policy-making, and technology-based agricultural interventions, with a view to contributing to the development of the agricultural sector.

CHAPTER II
REVIEW OF RELATED LITERATURE

This chapter reviews the literature and empirical studies pertinent to the current study. It discusses basic concepts, advances in technology, and earlier findings on agricultural innovation and digital solutions. By addressing both theoretical perspectives and empirical studies, this chapter will provide clarity on the current landscape of knowledge, research gaps, and the context of the present study.

2.1 Related Literature

Agriculture today faces increasing demands for efficiency and sustainability, prompting greater reliance on technology. This review examines literature across five key themes: crop management, mobile technology in agriculture, farmers' access to government benefits, economic and productivity impacts, and barriers to technology adoption. These themes provide insight into how technological innovations shape farming practices, improve livelihoods, and influence the broader agricultural landscape.

Crop Management

Crop management encompasses the entire range of operations from seedbed preparation to planting, fertilizing, pest control, irrigation, harvesting, and lastly storage and marketing, suited to a particular crop, soil, climate, and other environmental conditions (University of Nevada, Reno, n.d.). It aims to enhance crop growth and yield while accommodating site-specific conditions. One important area is the promotion of diversified cropping systems, such as crop rotation and polyculture, which would increase agro-ecological complexity and foster sustainable field management (Gomiero, 2019). Cover crops have also been well researched for their n-fixation, weed suppressing, controlling pests, preventing the erosion of soils, and improving soil health and biodiversity (White et al., 2016).

With regard to crop production management, some of the challenges being faced include compliance with recommended technology and scientific principles of farming. This is largely attributed to (Mamai et al., 2020) limited availability of technical resources and managerial capacity in the agricultural enterprises concerned. Hence the amelioration of the organizational and management structures is paramount if improvements in production toward market orientation are to be achieved.

Precision agriculture is a paradigm shift in crop management that brings together sensors, satellite images, drones, and IoTs to monitor and manage soil parameters, irrigation, fertilization, and seeding operations with high spatial-temporal resolutions. The whole objective of this site-specific management is to enhance efficiency with the resources and crop production per se (Monteiro et al., 2021). Therefore, by utilizing technologies such as soil electrical conductivity sensors, moisture sensors, seed-metering devices, and smart irrigation systems, these inputs can be optimized and wastage minimized by real-time decision-making. In practice, agriculture crop planning and optimization are evident from literature, where much attention has been devoted to researching sustainability and irrigation management as key hotspots (Deo et al., 2025).

Limiting chemical input usage, such as pesticides and fertilizers, and bettering the use efficiency of other crop inputs will help lower greenhouse gas emissions and decrease environmental burden (Shah & Wu, 2019). Simply put, crop management blends traditional agronomic practices with modern technology to improve yield, quality, and sustainability.

Simply put, crop management blends traditional agronomic practices with modern technology to improve yield, quality, and sustainability. Effective management requires adapting practices to local conditions, leveraging precision agriculture tools, and enhancing organizational capacity in farming enterprises.

Mobile Technology in Agriculture

Mobile technology is a dynamic force that is transforming the field of agriculture-how farmers receive information, manage resources, and make decisions.

Osman et al. (2025) provide a systematic literature review that classifies agricultural mobile applications into three main types: Crop Operations, Farm Management, and Information Systems. Crop Operations assist users to manage decisions on crop protection, nutrition, irrigation, and harvesting. Farm Management tools deal with resources management, including field mapping, soil analysis, and machinery supervision, whereas Information Systems provide sources of agricultural knowledge, market information, and climate data via chatbots and alerts.

Moreover, mobile apps have been able to fill the information gap for smallholder farmers, providing real-time weather forecasts, crop prices, and best farming practices. They facilitate direct marketing, promote financial inclusion through mobile banking and access to credit, and support resource management by providing tools for monitoring proper input usage. In addition to that, the app also aids in the remote delivery of extension services for the adoption of sustainable operations and increased productivity. This becomes particularly important in areas where traditional extension services have not reached, thus democratizing information and helping rural economic development (Kamal & Bablu, 2023). According to industry analysis, mobile apps enhance the supply chain and logistics by enabling farmers to trace their products from the field to the market while managing inventory in such a way as to reduce losses. They also help ensure compliance with safety requirements and better farm efficiencies (Savonin, 2024).

Farmers' Access to Government Benefits

Government support is instrumental in enhancing agricultural productivity, food security, and rural welfare. Governments globally offer various forms of support, ranging from subsidies to technical assistance, to agricultural producers. Governments offer the support in a bid to reduce risk and enhance agricultural outcomes. An example is the experience of South Africa, where government support for agricultural development has been instrumental in reducing food insecurity and enhancing the welfare of farmers through the provision of access to crucial inputs and resources necessary for production (Mokgomo et al., 2022).

In the Philippines, programs like the Sikat-Saka insurance scheme offer subsidization for the premium price to smallholder farmers. It insures against losses arising from destruction by crops and livestock due to natural calamities and infestation by pests. Through the aid of advanced weather forecasting equipment, it enables quick disbursements and helps manage risk, thereby improving farmers' capacity to respond to climate-related concerns (Review of the Philippine Agricultural Insurance, 2023).

However, it is challenging to scale up these initiatives because of technical challenges and unavailability of data. This calls for appropriate infrastructure and capability. According to Amaglobeli et al. (2024), while prioritizing high-productivity farmers may guarantee maximum production and food security, it may leave behind low-income farmers who may not have access to markets or resources to benefit maximally from such initiatives.

The Abdul Latif Jameel Poverty Action Lab (J-PAL) and the Center for Effective Global Action (CEGA) (2024) highlight the connection between farmers' access to government schemes and their ability to engage in markets and adopt productive technologies. Studies by J-PAL and CEGA show that increasing farmers' access to markets by improving infrastructure development, contracting behavior, and digital platform use improves their ability to buy inputs and sell output at a profit. This enhanced market engagement allows farmers to utilize more of the government programs and subsidies, which ultimately results in greater productivity and income.

Digital platforms enhance the effectiveness of such programs by connecting farmers with essential market information, expert advice, and social networks. Lee et al. (2022) argue that not only do digital platforms make access to support services in agriculture easier for farmers but also increase overall information flow in the agricultural system. The integration of digital connection with data analysis enables the optimal utilization of inputs like fertilizers and pesticides, thereby reducing environmental impacts (Lee et al., 2022).

The literature suggests that government support programs enhance agricultural productivity and resilience, especially when complemented by information and communication technologies and market access. Scalability and inclusiveness problems, however, continue to be prevalent. Expanding infrastructure and leveraging digital platforms are key to propelling the highest impact and coverage of such programs.

Economic and Productivity Impacts

The application of digital technology in farming has revolutionized crop management, resulting in the creation of Digital Crop Management Systems (DCMS). DCMS incorporates data analytics, precision farming, and digital platforms to improve agricultural productivity and sustainability.

Empirical research has established the favourable role played by DCMS in improving agricultural productivity. For example, Kumar et al. (2021) established that farmers who implemented DCMS witnessed a 20% yield increase in crops compared to farmers engaged in conventional practices. In addition, using digital technologies in agriculture has transformed crop management.

A meta-analysis by Gouroubera et al. (2024) in which they reviewed eighteen empirical studies showed that precision agriculture enhanced by mobile devices with GPS can boost yields by 20% and at the same time lower input use by 10% to 20%. This precision allows for better allocation of resources and lower waste, thus enhancing farm profitability and fostering environmental sustainability.

Smith and Jones (2019) highlighted that this technology allows real-time monitoring and pinpoint interventions, eventually improving crop management practices and minimizing input loss. Brown (2021) also stressed the role of mobile apps in offering real-time monitoring services, enabling farmers to act promptly in addressing issues arising in the field.

Mobile application-enabled real-time monitoring greatly improves decision-making processes in agriculture. This technology allows farmers to react quickly to numerous challenges, thus enhancing the efficacy of operations. Implementing such innovations is necessary for maximizing agriculture efficiency as well as supporting environmentally friendly practices. As literature indicates, the use of mobile technology in agriculture not only supports greater responsiveness to short-term problems but also helps support long-term sustainability objectives by facilitating data-driven decision-making and resource allocation. Therefore, the integration of mobile apps is a turning point in the direction of a more flexible and responsible agricultural system.

Barriers and Challenges in Adoption of Agricultural Technology

While such benefits, the implementation of DCMS also comes with a number of challenges. Skyrocketing initial capital expenses and farmers with a shortage of technical expertise are some of the significant barriers (Brown & Green, 2021).

Many agricultural technologies are perceived as complicated or difficult to apply, requiring specialized expertise or technical training that many rural farmers do not possess. In addition, lack of adequate rural infrastructure—particularly weak internet connectivity and limited digital equipment—impedes the accessibility and effective utilization of digital and precision agriculture technologies (Ruzzante et al., 2021; Bilali et al., 2021).

Compatibility problems with older farming machinery and the lack of easy-to-use interfaces lower adoption levels even further.

Social and behavioral factors also have a significant impact. Change resistance, doubts over novel technologies, and fears about privacy of data are reasons for farmers not wanting to adopt innovations. Social norms, cultural factors, and trust in extension services also play a vital role in influencing farmers' adoption of new approaches. In addition, knowledge and awareness gaps regarding the availability and benefits of these technologies hinder their adoption, especially where extension and education services are poor (Bilali et al., 2021; Loevinsohn et al., 2013).

The policy and institutional frameworks have great impacts on the uptake of technology. Poor linkages among research facilities, extension services, and farmers hamper the effective diffusion and applicability of technology to environments (Loevinsohn et al., 2013; Ruzzante et al., 2021). Lack of government support, non-existence of enablers, and no sustainable platforms for the diffusion of technology reduce technology scalability and sustainable impacts of agricultural innovations.

In summary, the literature emphasizes that surmounting the challenges to agricultural technology adoption requires holistic strategies that address financial limitations, increase technological usability and infrastructure, enhance education and extension services, and promote supportive institutional and policy frameworks. These multi-faceted approaches are critical in empowering farmers, particularly in developing nations, to take advantage of technological innovations for sustainable and productive farming practices.

2.2 Related Studies

In recent years, digital technology constitutes a milestone of sorts in agriculture, enhancing productivity and making farming more sustainable. A critical survey of the existing literature will shed light on the existing solutions, reveal some research gaps, and provide a basis for the present work. This section evaluates past works performed in mobile apps, machine learning models, and the government's support systems on agricultural development.

Various studies have shown the advantage of using mobile applications in modifying agricultural practices. In the paper "Development of an Android Application for Smart Farming in Crop Management," Athira et al. (2020) developed the mobile-based crop management application Padi2U, using the Master App Builder platform. The application is for the paddy cultivation sector and covers features including detailed information about the PadiU Putra paddy variety, resources from agricultural agencies, site-specific data, planting schedules, drone imagery, insights on paddy diseases and pest and weed management, weather forecasts, yield information, and reports from farmers. Particularly important is that all content in the application is delivered in the Malay language, which is the target user demographic's native tongue, rendering the app appropriate and accessible for local farmers. In another research, Karar et al. (2021) linked artificial intelligence and communication technology in a mobile application that automatically classifies pests with deep learning to support specialists as well as farmers. These applications help in better decision-making and reduction of crop losses.

Integration of AI, mobile computing, and smart systems into agricultural technology continues to fashion recent advances in rice production and disease management. Hasan et al. (2023) presented a lightweight convolutional neural network (CNN) model for the detection of rice leaf diseases with high accuracy, including brown spot, bacterial blight, and leaf smut. This model is designed for real-time applications in the field and is computationally efficient in such a way that it can run on mobile and embedded systems. In another study, Tyagi et al. (2023) utilized HSV and K-means clustering for image segmentation in combination with a lightweight CNN. Their proposed methodology, which requires fewer resources, achieved disease classification performances comparable to complex InceptionResNetV2 and MobileNet-based architectures. Whereas Karar (2021) built on these concepts, incorporating the Faster R-CNN framework for pest detection in rice fields and showcased how mobile cloud-accessible models for real-time diagnostics could be impeded by poor connectivity in rural areas.

The same kinds of advancement have occurred in the Philippines. Guiam et al. (2021) designed the Smarter Pest Identification Technology (SPIDTECH), an AI-powered smartphone system working fully on CNN-based image classification to detect pests of rice. Aribe et al. (2019) introduced another mobile technology called Ma-Ease for corn management, providing decision support to farmers in the Philippines by integrating weather information and other field inputs into an easy-to-use Android application. The studies underlined that mobile agri-tools are relevant for the specific location and could enhance productivity through intelligent systems if farmers have access to smartphones and digital infrastructure.

Investigating adoption, user behavior, and satisfaction is equally important in understanding mobile applications for farmers. Kerdsriserm (2024) found that in a study from Thailand farmers had acceptance and satisfaction of an app to compute rice production costs and returns, where perceived usefulness and satisfaction were found to significantly affect continued use. Comparable findings from India and Indonesia show that ease of use, social influence, and trust are major adoption factors in studies that used Technology Acceptance Models (TAM and UTAUT) (Mohsin et al., 2025; Diaz, 2021).

Additional research also explores the mobile application potentials through which IoT and smart farming systems can operate. A study in the Philippines by Mastul et al. (2023) reported that the use of mobile devices integrated with inexpensive sensors could monitor soil and water conditions in real-time, enabling efficient decision-making in farming activities. The extension of these tools was similarly reverberated in international research calling for hybrid AI-IoT systems that are user-centered and/or can be adapted to resource-constrained situations (Caliguiran & Guingab, 2023; Docejo & Kim, 2022).

Combining these studies provides a holistic picture showing how mobile applications and AI technologies are increasingly becoming integral in modern-day agricultural practices-from detection of diseases and pests to managing resources and production costs. Such promising technologies have to be usable, affordable, and relevant for the intended user. In the Philippines and in most developing countries, the aforementioned factors are accompanied by limitations on digital literacy, smartphone accessibility, and internet connectivity. Evidence can be found for a gap in longitudinal studies assessing continued use and performance-related impacts of the technologies on farm productivity and rural livelihoods.

To bridge these gaps, future research should focus on developing scalable, offline-capable apps, evaluating long-term adoption through field trials, and conducting participatory design with local farmers. By combining technical precision with socio-cultural awareness, mobile agricultural solutions can become powerful tools for sustainable farming in both local and global contexts.

CHAPTER III
RESEARCH METHODOLOGY

This chapter presents the research design and materials used in the study. Furthermore, the system functionality of the mobile application, its evaluation procedure, and data collection and analysis is also explained.

3.1 Research Design

This study employed a quantitative research design to assess the reliability and user-friendliness of the crop management app among the selected home gardeners. Pre-test and post-test questionnaires are administered to the respondents to assess the reliability and user-friendliness of the crop management app. The 5-point Likert scale is utilized for measurable analysis of the response from the respondents. This method is used to measure and compare respondents' experience before and after using the crop management app.

This study utilizes purposive sampling, a non-probability sampling method. These participants are selected based on their location, crops planted in their gardens, and availability during the evaluation period. There are a total (5) home gardeners as respondents who are residing in Bacong, Negros Oriental, plant crops in their residential area, and are willing to participate in the evaluation process.

3.2 Materials Used

This study only utilizes a software tool to develop a crop management mobile application.

- ***Android Studio***

Android Studio is the official Integrated Development Environment (IDE) for Android development created by Google. It is an open-source software tool that is used for code editing, user interface designer, emulator, and gradle build systems (*Google,* n.d.).

- ***Java Programming Language***

Java Programming language is an object-oriented programming language. C and c++ language syntax is similar to Java. It allows code to be reused and gives a clear structure to the program (*W3Schools.com*, n.d.)

- ***Extensible Markup Language***

Extensible markup language is used to design user interfaces and define app resources such as color, strings, and styles. It provides a precise and structured lay-out. It also supports drag-and-drop user interface design and live preview to visualize layouts and optimize app designs on various screen sizes. It also has an android emulator that simulates various virtual devices with customizable configurations (*App Resources Overview*, n.d.).

- **SQLite Database**

SQLite database is a lightweight built-in database that is used for local data storage. This database is utilized to store, retrieve, manage and update user data. This database organized user data into a structured table for efficient data access (*Save Data Using SQLite*, n.d.).

3.3 System Functionality

Crop Management app is a mobile application that focuses on assisting home gardeners in efficiently managing and cultivating crops through digital means. The development was carried out using Android Studio with SQLite as the local database for storage, update, deletion, and retrieval of data and the programming language used is Java. The tool used for the layout design, style, string, and color is Extensible Markup Language (XML). The app is installed as an apk file and shared with the respondents.

The app is composed of three main features:

- ***Crop Calendar***

  In the crop calendar, the user can schedule the sowing and harvesting dates of the crops. In addition, there are predefined crops that are already in the database. The user can choose either to select available crops in the app that have predefined harvest seasons or they can input a new crop that is not in the database and can select the sowing and harvest date. Furthermore, the user can view their scheduled activities and can delete their activity.

- ***Crops Information Display***

  The app provides important details about crops such as best sowing and harvest season of crops, fertilizing type and frequency, and common pests and diseases of each crop

- ***Local Department of Agriculture (DA) Updates***

  The app has integrated report from the local Department of Agriculture in Bacong, Negros Oriental. The report includes available seeds and fertilizers given to locals, insurance policies, other benefits farmers could enjoy from the office, and method of dissemination.

3.4 Evaluation Procedure

A pre-test questionnaire is administered before the app is introduced to measure the respondent's baseline knowledge about farming and crop management assistance using digital platforms and expectations. In pre-test questionnaires, respondents' socio-demographic profile is assessed, along with their background and farming practices, as well as their awareness of any updates from their local DA.

Following the pre-test evaluation, the respondents went through the instruction of the use of crop management app features like the crop calendar, crops information, and local DA updates. They were given access to the app for one week and were encouraged to use its various functionalities and integrate it into their farming practices.

After a week, post-test questionnaires were administered to the respondents to know about their experiences with the app. This questionnaire seeks to determine the reliability and user-friendliness of the app by measuring user satisfaction and determining whether this is a reliable app to integrate into the farming system by the respondents.

3.5 Data Collection and Analysis

Pre-test and post-test questionnaires were distributed to assess the app's reliability and usability. The questionnaires are divided according to the respondent's socio-demographic profile, farming background and practices, evaluation of the app's reliability, and respondents' user satisfaction of the app. A 5-point likert scale is employed to measure respondents' level of agreement in each item. This study employed purposive sampling to narrow down respondents that are home-gardeners residing in Bacong, Negros Oriental.

Microsoft Excel is utilized to process gathered data. Percentage distribution is used to summarize the results. Paired t-test was utilized to determine whether the crop management app is reliable to the home gardeners in Bacong, Negros Oriental.

CHAPTER IV
DESIGN AND IMPLEMENTATION

This chapter presents the design and the implementation of the prototype to the chosen respondents. The design specifically describes the system architecture of the mobile application.

4.1 System Architecture

The crop management app is an offline application. Android studio is utilized to develop crop management app. This app is programmed using Java Programming Language. Its key features are crop calendar, crops informations display, and updates from the Department pf Agriculture in the municipality of Bacong, Negros Oriental

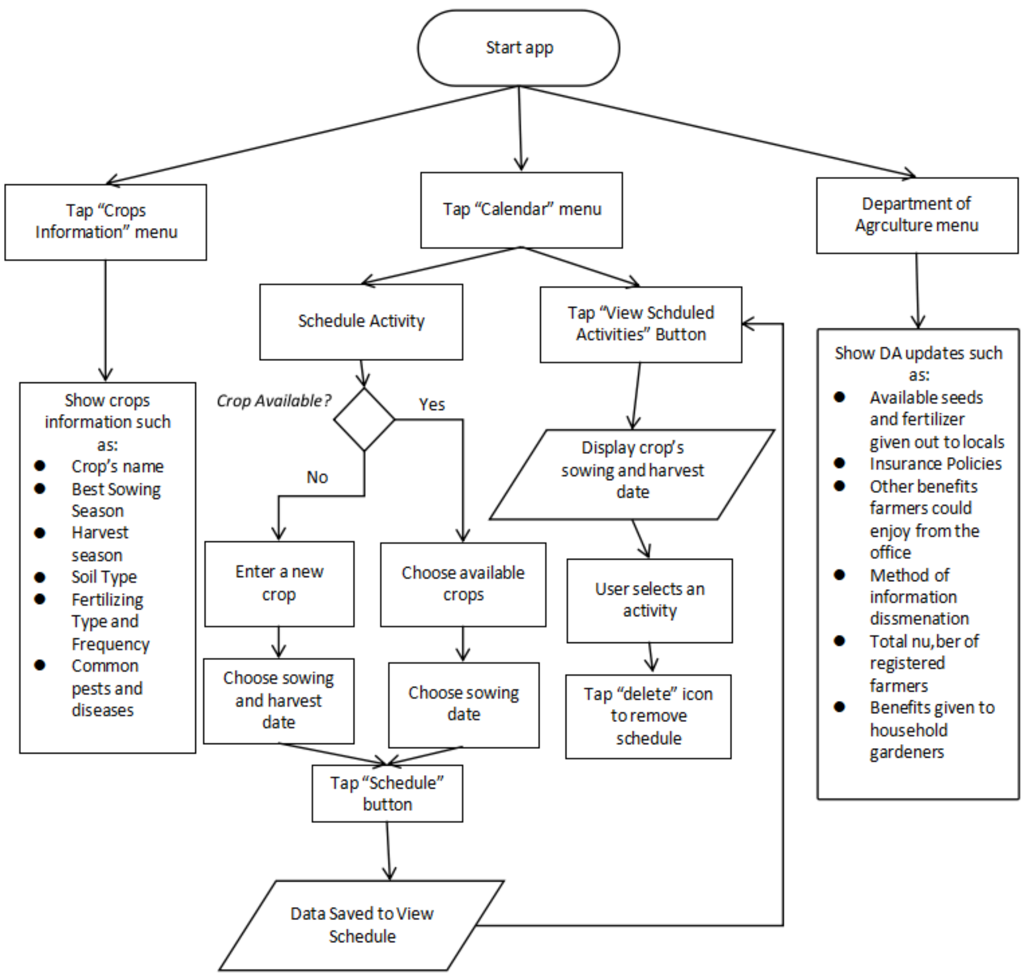

Figure 1. Crop Management App Flow Chart Diagram

The flow chart describes how the mobile application works. When the mobile application is opened, the "Calendar" menu is displayed by default. It is where the farmer could schedule an activity or tap the "View Scheduled Activities" button. When the farmer schedules an activity, the crop name is input in the text box, and the crop management system checks the database to see if the crop name already exists. If the crop name already exists, the system automatically chooses the matched crop name and allows the user to choose a sowing date. The "Schedule" button then saves the new entry to the database and displays the project or the crop to the "View Schedule" display. However, if the crop name does not exist yet, the new crop is recorded as a new crop name in the database. The farmer may choose a sowing date and a harvesting date after. The "Schedule" button saves the new entry and is sent to the "View Schedule" display. The second feature is the "Crops Information" menu, where a list of crop information, such as crop's name, best sowing season, expected harvesting season, best soil type for growth, fertilizer type and frequency, and common pests and diseases are displayed. The "Department of Agriculture" or DA menu is the third feature. The "Department of Agriculture" menu shows local agriculture office updates such as available seeds and fertilizers for farmers, insurance policies for farmlands and livestock, and other benefits farmers could enjoy from the office. The app features a third functionality, which is the "Calendar" menu.

4.2 Crop Calendar

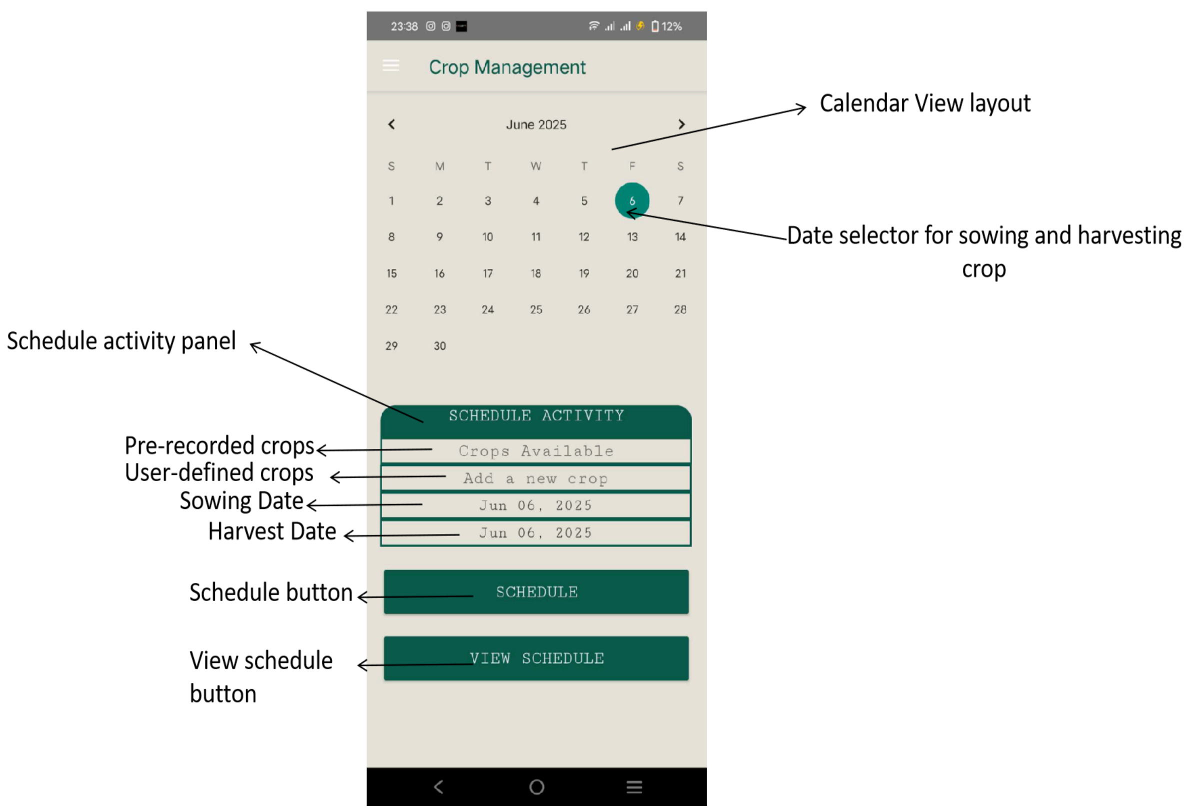

Figure 2. Crop Calendar User Interface

The crop calendar feature presents a calendar view and a schedule activity panel. In the schedule activity panel, users can input a new crop or select from available crops. Sowing and harvest dates can be chosen directly through the calendar view. Once the user clicks the schedule button, the data will be automatically saved and can be viewed in the "View Schedule" section.

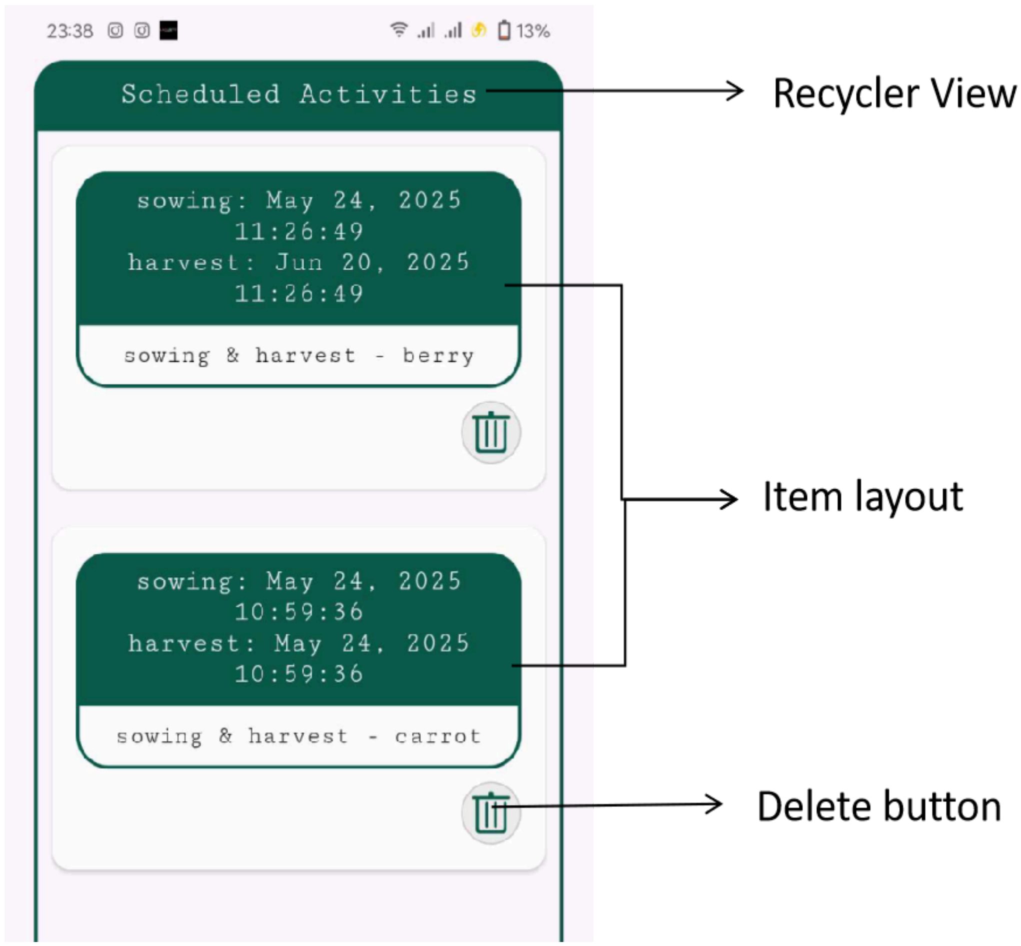

Figure 3. View Schedule User Interface

Once the View Schedule button is pressed, users are redirected to the View Schedule screen. The view schedule feature presents a list of projects' information in a form of list. All the data stored in the database, namely the name of the crop and the sowing and harvest date of the crop that the user has inputted, are retrieved and presented in a list. Furthermore, a delete button is attached below each item if the user wants to delete a certain scheduled activity.

4.3 Crop information

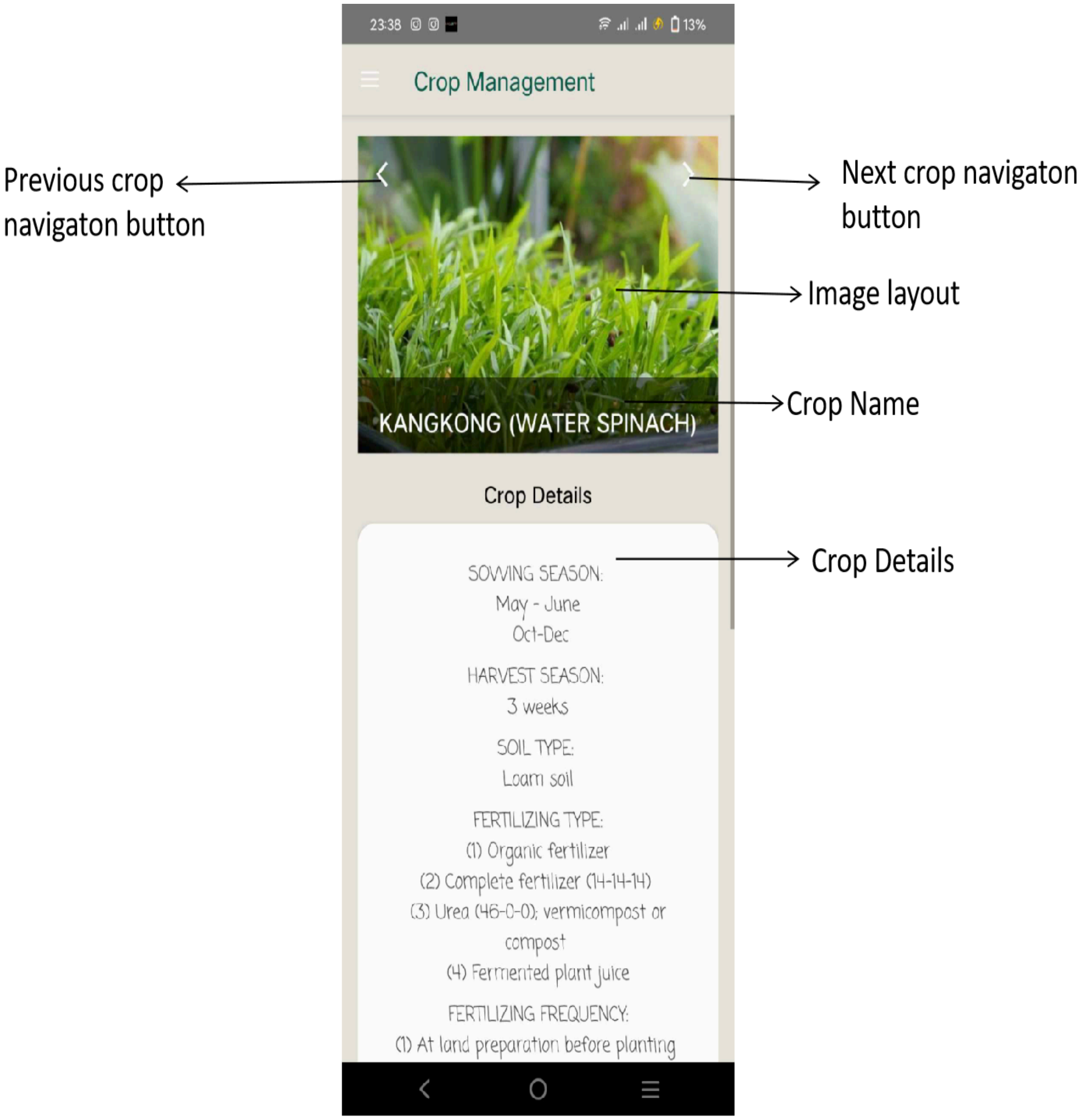

Figure 4. Crop Information User Interface

The crop information displays an image layout, a text layout, and two navigation buttons to switch between crop pages. There are 6 crops pre-recorded in the database, namely, Water Spinach (*Ipomoea aquatica*), Chinese cabbage (*Brassica rapa* subsp... *pekinensis)*, lettuce (*Lactuca sativa*), Mustard green (*Brassica juncea*), radish (*Raphanus sativus*), and green onions (*Allium fistulosum*). Each of the crops has information about the sowing and harvest season, soil type, fertilizing type and frequency, and common pests and diseases.

4.4 Department of Agriculture Update

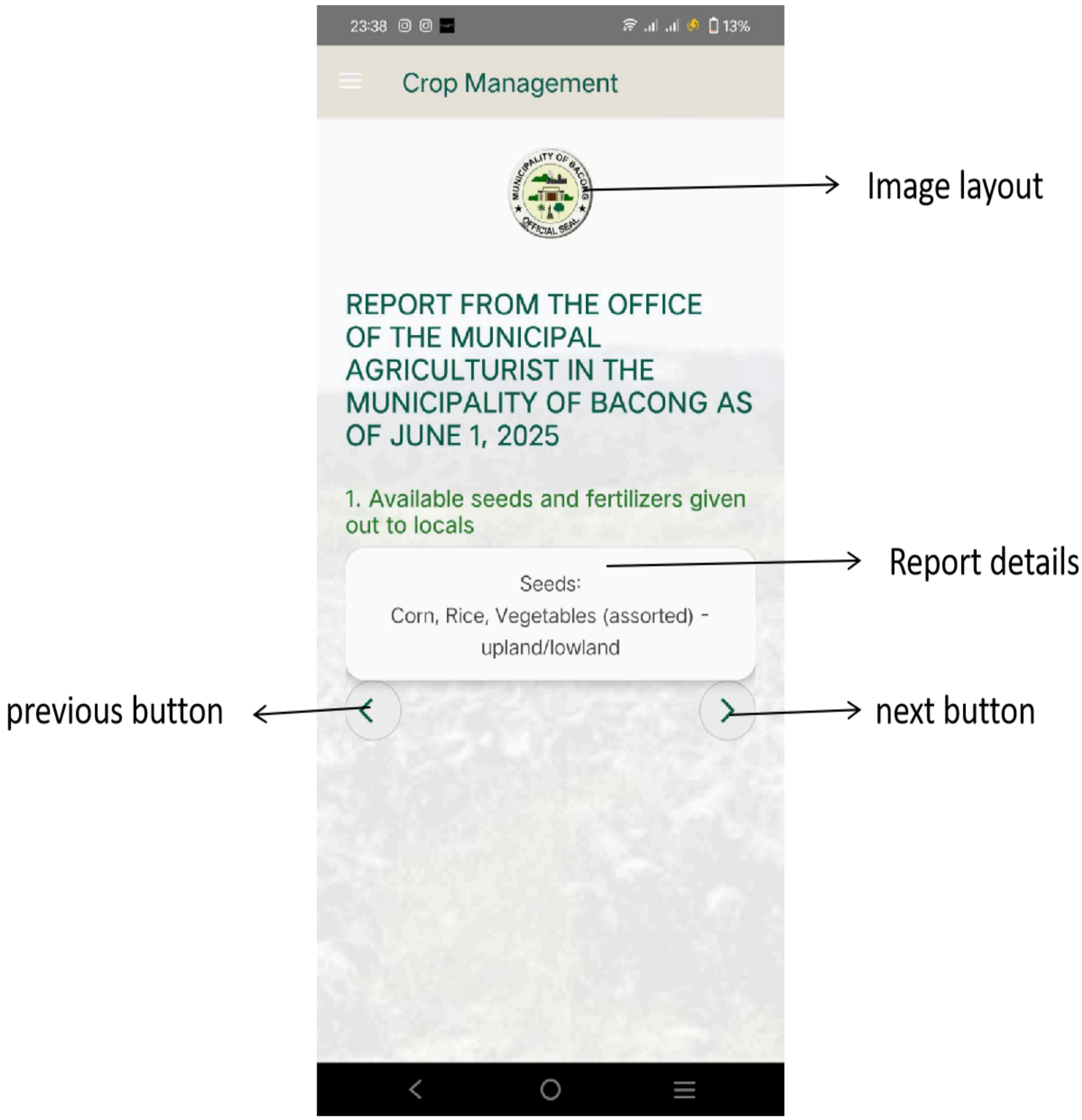

Figure 5. Department of Agriculture Office Update User Interface

The DA update feature consists of text and image layout. It is an offline update that is acquired from the office of the Department of Agriculture in the Municipality of Bacong, Negros Oriental. The report was acquired on June 1, 2025.

The report covers the available seeds and fertilizers given to locals, insurance policies, other benefits farmers could enjoy from the office, and the method of dissemination. This feature needs a specific technician for information to update regularly.

4.5 Implementation Process:

- Setup:

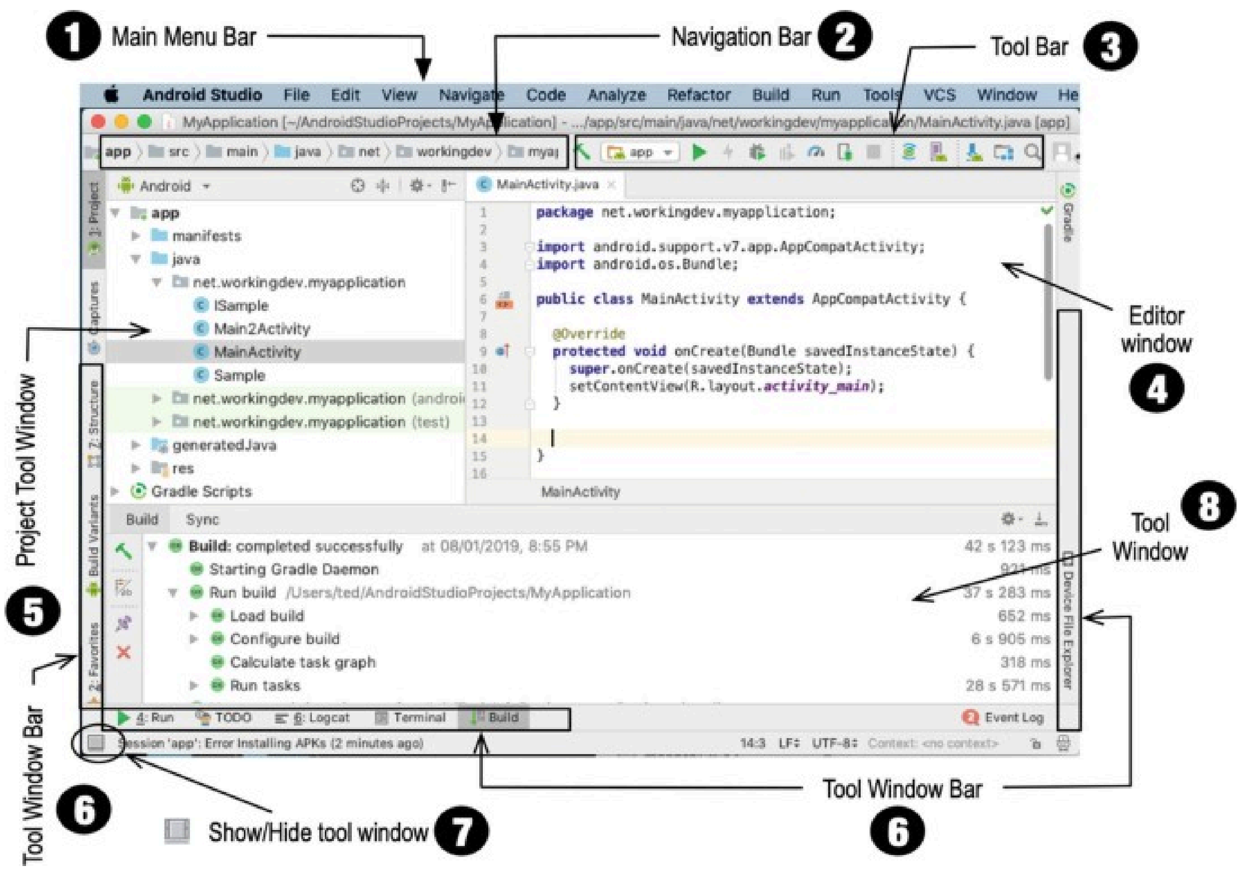

Figure 6. Android Studio (img source: Hagos (2020))

Android Studio, a software for developing applications, was utilized to carry out the creation of the crop management app. Activities performed in this app include coding, troubleshooting, and simulation on real devices.

- SQL Database Integration:

```java
package com.example.crops_final;

import android.content.ContentValues;
import android.content.Context;
import android.database.Cursor;
import android.database.sqlite.SQLiteDatabase;
import android.database.sqlite.SQLiteOpenHelper;

import java.text.SimpleDateFormat;
import java.util.ArrayList;
import java.util.Calendar;
import java.util.Locale;

11 usages
public class DatabaseHelper extends SQLiteOpenHelper {
    // Database Info
    1 usage
    private static final String DATABASE_NAME = "crop_scheduler.db";
    1 usage
    private static final int DATABASE_VERSION = 3;

    // Table Names
```

Figure 7: Code snippet for the database

SQLite database, a tool for data storage, was used to store pre-recorded crops and user-generated data locally, which includes the crop name and scheduled sowing and harvest dates. The database only utilizes 1 table to manage and store the scheduled activities. The database includes functions that handle data efficiently online, such as inserting, retrieving, and deleting data.

- Crop Selection:

In the crop calendar feature, users can choose to schedule crops from the prerecorded crop or input a new crop. The code verifies whether the crop name entry in the newly inputted crop name field exists in the database to prevent duplication.

- Calendar and Date Picker:

Calendar View layout is used to select the sowing and harvest dates of crops. For prerecorded crops, the harvest date is automatically calculated by adding the growth days from the day of sowing the plant. In addition, users can manually override the calculated harvest date.

- Schedule Saving and Viewing:

Once the schedule of crop activity is finalized, it is saved to the local SQL database. A RecyclerView or a scrollable layout is used to display all the stored scheduled crop activity data in a list. Every item has an attached delete button below it, allowing users to delete certain activities with a confirmation prompt to avoid accidental deletions

- Crop Information Feature:

In this feature, it presents the 6 pre-recorded crops in the database with their picture, and details such as sowing and harvest season, soil type, fertilizing type and frequency, and common pests and diseases

- DA Updates Feature:

The DA update feature presents the agricultural information relevant to the users. The information is shown with titles and content.

- Simulating on a Real Device:

The code was deployed on a real Android smartphone using USB debugging, a development tool, to verify the application layout and performance of the developed application.

CHAPTER V
RESULTS AND DISCUSSION

The result, analysis, and interpretation is presented in this chapter. The researchers selected five (5) respondents and gathered data through e-survey to determine the reliability and user-friendliness of the crop management app among the farmers in Bacong, Negros Oriental

Table 1

Demographic Profile of the Respondents

Parameter	Categories	Frequency (n = 5)	Percentage (%)
Gender	Female	3	60
	Male	2	40
	Prefer Not to Say	0	0
Age	21-30	2	40
	31-40	1	20
	41-50	0	0
	51-60	2	20

Table 1 illustrates the gender and age distribution of the five individuals who evaluated the AGRISYNC: Integrated Digital Crop Management System. The data shows that the majority of respondents were female (60%), while males accounted for 40%. This indicates a fairly balanced gender distribution, with a slightly higher representation of women. Such a trend may suggest a growing involvement of female farmers in the adoption of digital technologies in agriculture. Research has shown that women are increasingly participating in tech-based agricultural practices, recognizing the benefits of digital tools in enhancing productivity and efficiency (FAO, 2021). Regarding age, participants primarily fell into two categories: 21–30 years old (40%) and 51–60 years old (40%), with one respondent aged 31–40 years old (20%). The lack of respondents aged 41–50 might point to a demographic gap or simply reflect low participation from that age group. The presence of both younger and older respondents highlights the system's appeal across generations, emphasizing its potential to be accessible and user-friendly for diverse age groups—a key factor in the widespread adoption of agricultural innovations (World Bank, 2019).

Table 2

Years of Experience in Farming

Years of experience in farming	Frequency (n = 5)	Percentage (%)
Less than 1 year	3	60
1-5 years	2	40
6-10 years	0	0
More than 10 years	2	40

Table 2 displays the farming experience of the respondents, which shows a wide variety of agricultural backgrounds. Of particular note is that 40% of the respondents had farming experience of 1–5 years, which suggests that the majority of the users are newly experienced and are likely to take advantage of digital platforms providing advice and agricultural information. One respondent each (20%) reported less than 1 year, 6–10 years, and over 10 years of farming experience. This distribution mirrors a varied group of users, from beginners to experienced farmers, allowing for a balanced review of the functionality and pertinence of the app for various levels of proficiency. Having both novice and experienced farmers included emphasizes the app's capability to facilitate a broad range of users. For young farmers, new digital tools such as AGRISYNC can provide invaluable assistance by supplying inexpensive, real-time data, enabling them to make better decisions and learn best practices more rapidly. Klerkx et al. (2019) report that digital innovations within agriculture are particularly effective for less-experienced farmers by reducing knowledge gaps and enhancing decision-making skills.

Table 3

Current Use of Mobile Applications for Farming

Current use of mobile applications for farming	Frequency (n=5)	Percentage (%)
Yes	2	40
No	3	60

Table 3 shows that most of the respondents (60%) lacked experience with any farm mobile apps before using AGRISYNC for assessment, with only 40% already having some experience with the technologies. This means that there was relatively little exposure to digital farming technologies among the group, presenting the opportunity for the AGRISYNC app to be an introduction to digital farming for most users.

This low rate of previous contact with farming mobile apps highlights the value of accessible and easy-to-use digital technology in agriculture, especially for new users. According to Rose et al. (2021), enhancing accessibility and usefulness of farm apps is fundamental to promoting adoption, especially among smallholder and less tech-savvy farmers who might be slow to adopt new platforms without evident advantages or straightforward design.

Table 4

Frequency of Using Mobile Apps for Farming-related Tasks

How often do you use mobile apps for farming-related tasks?	Pre-Test		Post-Test	
	Frequency (n=5)	Percentage (%)	Frequency (n=5)	Percentage (%)
1-Never	1	20	0	0
2-Rarely	0	0	0	0
3-Sometimes	1	20	0	0
4- Often	1	20	2	40
5-Always	2	40	3	60

Table 4 highlights the change in frequency of mobile app usage for farming before and after the respondents engaged with the AGRISYNC application. Prior to the intervention, 60% of respondents reported using farming-related apps either frequently or always. Following the introduction of AGRISYNC, this figure rose to 100%, with 40% stating they "always" use such apps and 60% reporting they use them "often."

The two-tailed (see Appendix D.2) t-test used a significance level of 0.05, with a critical value of ±2.7764 based on 4 degrees of freedom. The computed t statistic was -1.414, and the p-value was 0.2301, indicating no statistically significant difference between the pre-test and post-test mean scores. Nevertheless, the observed increase in frequency post-intervention implies a growing comfort and openness among users toward integrating mobile technologies in their farming practices. According to Eastwood et al. (2017), repeated exposure to well-designed agricultural apps can enhance user confidence and adoption, particularly when the tools address practical farming needs.

Table 5

Level of Orderliness Experienced by Respondents in Their Farming Practices

How organized do respondents feel about farming practices?	Pre-Test		Post-Test	
	Frequency (n=5)	Percentage (%)	Frequency (n=5)	Percentage (%)
1-Very Disorganized	1	20	0	0
2-Disorganized	0	0	0	0
3-Neutral	1	20	0	0
4- Organized	2	40	2	40
5-Very Organized	1	20	3	60

Table 5 presents how organized the Pre-test and Post-test are in farming practices. The results from the Pre-test shows that the majority of the respondents are "Neutral" (20%), "Organized" (40%), and "Very organized" (20%), and only 1 respondent felt "Very Disorganized" (20%). After the Pre-test practices, the category "Very Disorganized" completely disappeared, indicating that all respondents felt at least somewhat organized afterward. The combined "Organized" and "Very Organized" responses increased from 60% to 100%, reflecting a strong improvement in farmers' confidence and structure in managing their practices.

The two-tailed t-test (see Appendix D.1) used a significance level of 0.05, with a critical value of ±2.7764 based on 4 degrees of freedom. The computed t statistic was -2.057, and the p-value was 0.1087, indicating no statistically significant difference between the pre-test and post-test mean scores. This shift suggests that AGRISYNC may have contributed to better planning, scheduling, and record-keeping among users—key components in effective crop management. Organizational improvements in agricultural operations are essential for enhancing productivity and resource efficiency. As emphasized by Zilberman et al. (2018), digital tools that assist with data management and planning can significantly impact farm decision-making and operational coordination, even in small-scale settings.

Table 6

Level of Confidence in Respondents' Knowledge of Cultivating Crops

How confident are you in your knowledge of cultivating crops?	Pre-Test		Post-Test	
	Frequency (n=5)	Percentage (%)	Frequency (n=5)	Percentage (%)
1-Not Confident at all	1	20	0	0
2-Slightly confident	0	0	0	0
3-Somewhat confident	0	0	0	0
4- Quite confident	2	20	2	40
5-Extremely confident	2	20	3	60

Table 6 reflects an increase in respondents' confidence in their crop cultivation knowledge following their use of the AGRISYNC application. After the intervention, 60% of participants rated themselves as "extremely confident," compared to only 40% prior to using the app. A significance level of 0.05 was used for the two-tailed t-test (see Appendix D.3) with a critical value of ±2.7764 on 4 degrees of freedom. The t statistic was -1.206, along with a p-value of 0.294, which indicates there was no statistically significant difference between the mean scores of the pre- and post-test. Qualitatively, however, data point at significant gains in perception by users about knowledge and confidence.

This trajectory means the application might have had a role to play in encouraging users to apply agricultural practices by availing timely and relevant information. As Kshetri (2020) points out, digital agriculture tools are expected to empower farmers through improved access to knowledge, thus making them more confident in making on-farm decisions and adopting best practice.

Table 7

Level of Respondents' Understanding of the App

The app was easy to understand and use	Frequency (n=5)	Percentage (%)
Strongly disagree	0	0
Disagree	0	0
Neutral	0	0
Agree	2	40
Strongly agree	3	60

Table 7 shows that all the respondents agreed that the AGRISYNC application was easy to use, with 60% strongly agreeing and 40% agreeing that it was simple to understand and utilize. This reflects the fact that the app is logically structured, making it easy even for those with minimal technological expertise to use.

This kind of usability is especially crucial in farming situations, where farmers themselves will be highly diverse in terms of digital competence. An effective interface can maximize user interest, minimize learning curves, and enhance the prospect of future use. As Venkatesh and Davis (2000) assert, perceived ease of use is a pivotal factor in affecting new technology adoption, particularly where users are at first resistant or unfamiliar with digital instruments.

Table 8

Respondents' Rating of Navigation Simplicity

I was able to navigate the app without confusion	Frequency (n=5)	Percentage (%)
Strongly disagree	0	0
Disagree	0	0
Neutral	0	0
Agree	3	60
Strongly agree	2	40

Table 8 specifies that all users agreed about the ease of the AGRISYNC application, with 60% agreeing and 40% strongly agreeing that they can use it easy and without confusion: suggesting an operation of the app around logical structuring making it easy for a person to use. Such an approach would be very important in making people with poor experience in the use of digital platforms adopt the application.

Significantly, an intuitive and accessible interface greatly favors positive user experience while removing barriers for technology use in agriculture. According to Beza et al. (2018), ease of navigation is a very strong factor in the acceptance of agricultural decision support tools, particularly with diverse user groups that include less digitally literate farmers.

Table 9

Readability of App Content

The text and content in the app were easy to understand and read.	Frequency (n=5)	Percentage (%)
Strongly disagree	0	0
Disagree	0	0
Neutral	0	0
Agree	2	40
Strongly agree	3	60

Table 9 indicates that everyone agreed the text and content of the AGRISYNC app was readable to them, with 60% strongly agreeing and 40% agreeing. That there was such a landslide response reveals that the app successfully makes use of clear language and visually readable content, leading to enhanced user understanding.

The clear presentation of text is critical, particularly for agricultural equipment meant for multiple groups of users, such as those with dissimilar literacy or educational levels. According to McLean et al. (2013), this emphasizes the importance of readability and simplicity of content in making digital tools accessible and facilitating user understanding, which in turn boosts learning and interaction.

Table 10

Completeness of App Features and Information

Does the app provide all the information and features you need to manage your crops in one place?	Frequency (n=5)	Percentage (%)
Yes	4	80
No	1	20
Maybe	0	0

From Table 10, it can be seen that a large majority, averaging from an 80% majority, are in agreement with the statement that the AGRISYNC app provides all necessary tools and information required for effective crop management on a single platform. On the contrary, only one respondent (20%) disagreed. This therefore means that, in general, the features offered by the app are in good correspondence with practical users' needs and expectations.

Bringing an entire set of features into a single platform is very important for digital agricultural tools, as this maximizes use and minimizes switching from application to application. According to Koutsouris (2019), integrated digital solutions with combined crop research management components including planning, monitoring, and decision support are preferred by farmers and will be used when they seek efficiency and simplicity directly in their farming practices.

Table 11

New Knowledge Gained from the DA through the App

Is there new information you got from the local Department of Agriculture through this app?	Frequency (n=5)	Percentage (%)
Yes	5	100
No	3	60

Table 11 indicates that all five (100%) respondents had received new and appropriate information from the local Department of Agriculture (DA) via the AGRISYNC app. This proves the efficacy of the app as a means of communication and dissemination of information, and farmers are able to attain up-to-date and localized agricultural information.

The capacity to provide farmers with up-to-date information from government institutions in real time is one of the main strengths of online platforms. In the view of Aker (2011), mobile-based agricultural services immensely enhance information flows between institutions and rural communities, facilitating better decision-making, transparency, and solidifying the connection between farmers and support services.

Table 12

Ease of Completing Tasks Independently

I was able to complete the tasks without help.	Frequency (n=5)	Percentage (%)
Strongly disagree	0	0
Disagree	0	0
Neutral	2	40
Agree	2	40
Strongly agree	1	20

Table 12 indicates that 60% of users agreed or strongly agreed that they could accomplish tasks within the AGRISYNC app on their own, but 40% remained neutral. While the outcome is not conclusive, it indicates that most users believed that the app was conducive to independent learning and could ensure independent task achievement.

This kind of independence is crucial in the case of digital agriculture, since it makes users capable of learning and behaving without needing external control all the time. According to Lwoga (2010), intuitive ICT tools are able to enhance farmers' decision-making ability and learn through doing—a key determinant for continuing digital involvement and knowledge retention.

Table 13

Rating on Overall Experience Using the App

Rate your overall experience using the app	Frequency (n=5)	Percentage (%)
Very poor	0	0
Poor	0	0
Good	1	20
Excellent	2	40
Very excellent	2	40

Table 13 indicates a high level of user satisfaction with the AGRISYNC app, with 80% of participants rating their overall experience as either "Excellent" or "Very Excellent." Only one respondent (20%) rated the experience as merely "Good," and there were no negative responses. This suggests that the app's overall design, functionality, and user engagement met or exceeded the expectations of most users.

A positive user experience is critical for the sustained adoption of digital agricultural tools. According to Davis (1989), user satisfaction strongly influences the perceived usefulness and ease of use—two key components in the continued use of technology. When users find an app both functional and enjoyable to use, they are more likely to integrate it into their regular farming practices.

Table 14

Overall Usefulness of the App

How useful was the app?	Frequency (n=5)	Percentage (%)
Not useful at all	0	0
Not so useful	0	0
Somewhat useful	0	0
Very useful	2	40
Very much useful	3	60

Table 14 reveals that all respondents appeared to agree unanimously regarding the usefulness of the AGRISYNC app. The majority of 60% rated it as "very much useful," while the other 40% termed it "very useful." Such consistent positive feedback indicates that the app is of great relevance and usefulness to users in assisting their agricultural work.

With apparent usefulness being considered a key determinant for the adoption of technology, it becomes imperative that the tools become practical in such farming communities facing real challenges. Most importantly, according to Holden, Lutz, and Irwin (2014), digital agricultural tools that provide practical answers to crop planning, pest management, and real-time information will be more readily embraced by farmers, thereby increasing productivity and information-based decision-making.

Table 15

Respondents' Intention to Continue Using the App for Farming Activities

Would you continue using this app for your farming tasks?	Frequency (n=5)	Percentage (%)
Yes	5	100
No	0	0
Maybe	0	0

Table 15 reveals that all five respondents (100%) expressed their intent to continue using the AGRISYNC app for future farming activities. This collective response indicates a high customer satisfaction level, a pointer to the possibility of the app remaining a long-term asset. Consistent engagement is very vital for ensuring the effectiveness of digital solutions in rural areas, where prolonged usage can improve productivity and decision-making.

Sustained use of agricultural technologies depends on a combination of perceived usefulness, ease of use, and relevance to the user's context. As highlighted by Rogers (2003) in the *Diffusion of Innovations* theory, long-term adoption is more likely when innovations demonstrate clear advantages and compatibility with users' needs and practices.

CHAPTER VI
CONCLUSION AND RECOMMENDATION

This chapter presents the conclusion drawn from the findings of the app evaluation. Furthermore, recommendations about further improvements for future researchers interested in the study are also discussed.

6. 1 Conclusion

The results reveal a need for the improvement of the app by adding to the crop database and weather alerts for better decisions in farming. While it can still be improved, the app has showcased simple usability and practical features in the areas of raising agricultural productivity and educating farmers in digital technology. In addition, updates on new developments have been efficiently provided to local users by the Department of Agriculture. With the ongoing revisions and updating, the app is set to become an available resource for the modern-day technology-based agricultural practices.

6.2 Recommendation

However, there are a number of strategies for the smooth adoption and ensuring the ecological sustainability of the Integrated Digital Crop Management System (IDCMS). Digital literacy skill training on technological crops, artificial intelligence, drones, and the Internet of Things should be carried out by farmers. Some supportive measures may include increasing investment in agricultural research, improving rural infrastructure, and having policy initiatives such as subsidies and incentives to ease farmers from adopting digital farming. While looking at the technology priorities, these would include soil health monitoring, pest detection system, user-focused improvements like multilingual support, offline access, and mobile financial tracking. Strengthen the collaboration among government agencies, technology providers, and academic institutions while linking farmers directly up to markets and essential services toward the formation of a scalable, user-friendly platform, which will bring significant contributions to food security and sustainable development of rural communities.

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APPENDICES

Appendix A: Data gathering from the Department of Agriculture

This appendix contains the documentation during the gathering of data needed for the mobile application development.

A.1 Inquiring updates from the Provincial Office of the Department of Agriculture

A.2 Letter received from the office of the municipal agriculturist

REPUBLIC OF THE PHILIPPINES
Province of Negros Oriental
MUNICIPALITY OF BACONG

OFFICE OF THE MUNICIPAL AGRICULTURIST

June 1, 2025

Dear Researchers,

Greetings!

Please refer below for the information requested in line with your letter request regarding the creation of a mobile application that could help farmers on crop management including local updates in our department.

1. **Available seeds and fertilizers given out to local farmers**

- Fertilizers from DA (National) – Complete Fertilizer (T14)

- Seeds:

Appendix B: Pre- Test and Post-Test Questionnaires

Appendix B presents the pre-test and post-test questionnaires given to the respondents before and after the farmers used the crop management application.

B.1 Pre- Test Questionnaires through Google Form

PRE-TEST QUESTIONNAIRE

Dear Ma'am/Sir:

Greetings of mirth and peace!
We, the researchers from the Department of Computer Engineering of the College of Engineering
and Architecture at Negros Oriental State University-Main Campus, would like to create a mobile
application that could help farmers on crop management. The app also features local Department
of Agriculture updates in the Municipality of Bacong, Negros Oriental.
In line with this, we would like to request for your consent on the collection of the needed data
through questionnaires. We would also like to request that you install and use our mobile
application and answer another follow-up questionnaire afterwards. Rest assured, we ensure that
our mobile application doesn't contain malicious software and bugs that could possibly harm your
devices.
We are hoping for your positive response regarding this matter. Thank you.

Sincerely,
Maghanoy, Maryne R.

Mendez, Jon Jerick U.

Paculba, Heriel Kaye U.

Villamil, Jasper Lloyd B.

Age *

Iyong sagot

Gender *

- Female
- Male
- Prefer no to say

Background in Farming

Main types of crops you grow: *

- Rice
- Vegetables
- Corn
- Fruits
- Iba pa:

Years of experience in farming: *

- ◯ Less than 1 year
- ◯ 1-5 years
- ◯ 6-10 years
- ◯ More than 10 years

Do you currently use any mobile applications for farming-related tasks? *

- ◯ Yes
- ◯ No

How often do you use mobile apps for farming-related tasks? *

	1	2	3	4	5	
Never	◯	◯	◯	◯	◯	Often

Current Practices in Farming

How do you typically plan your crop schedules?

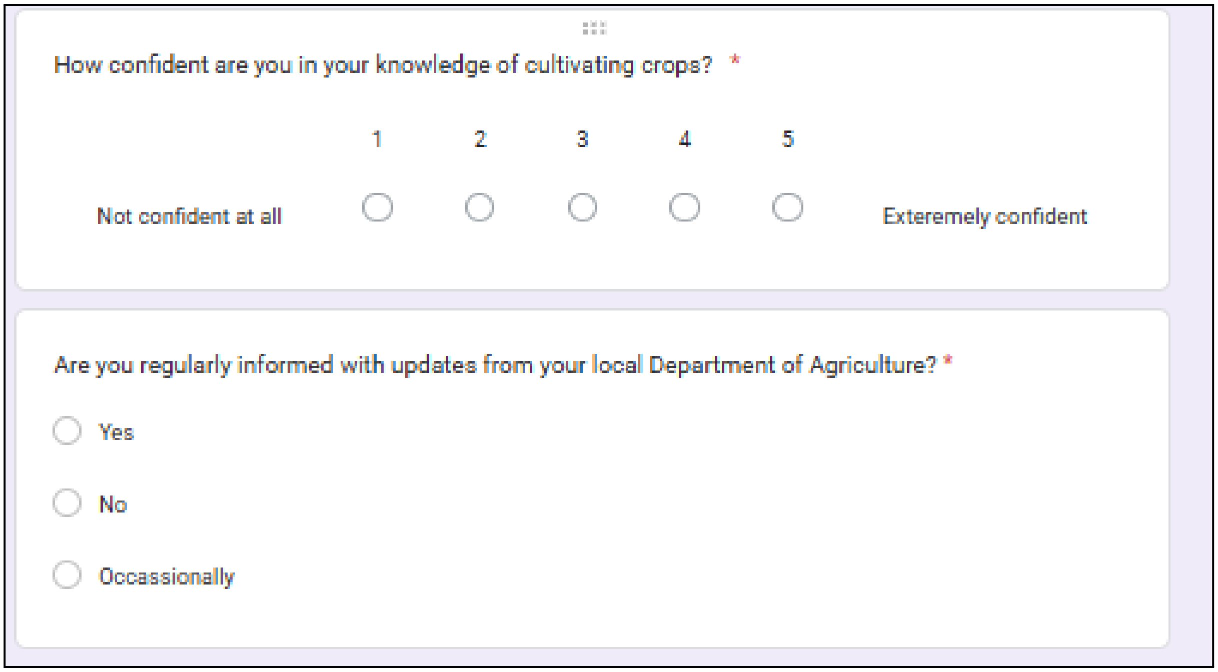
- [ ] Manually (notebook/calendar)
- [ ] Spreadsheet or computer
- [ ] Mobile app
- [ ] Iba pa: ____________________

How often do you record farming activities (sowing and harvesting)?

	1	2	3	4	5	
Never	○	○	○	○	○	Often

How organized do you feel your farming practices are?

	1	2	3	4	5	
Disorganized	○	○	○	○	○	Very Organized



How confident are you in your knowledge of cultivating crops? *

	1	2	3	4	5	
Not confident at all	◯	◯	◯	◯	◯	Exteremely confident

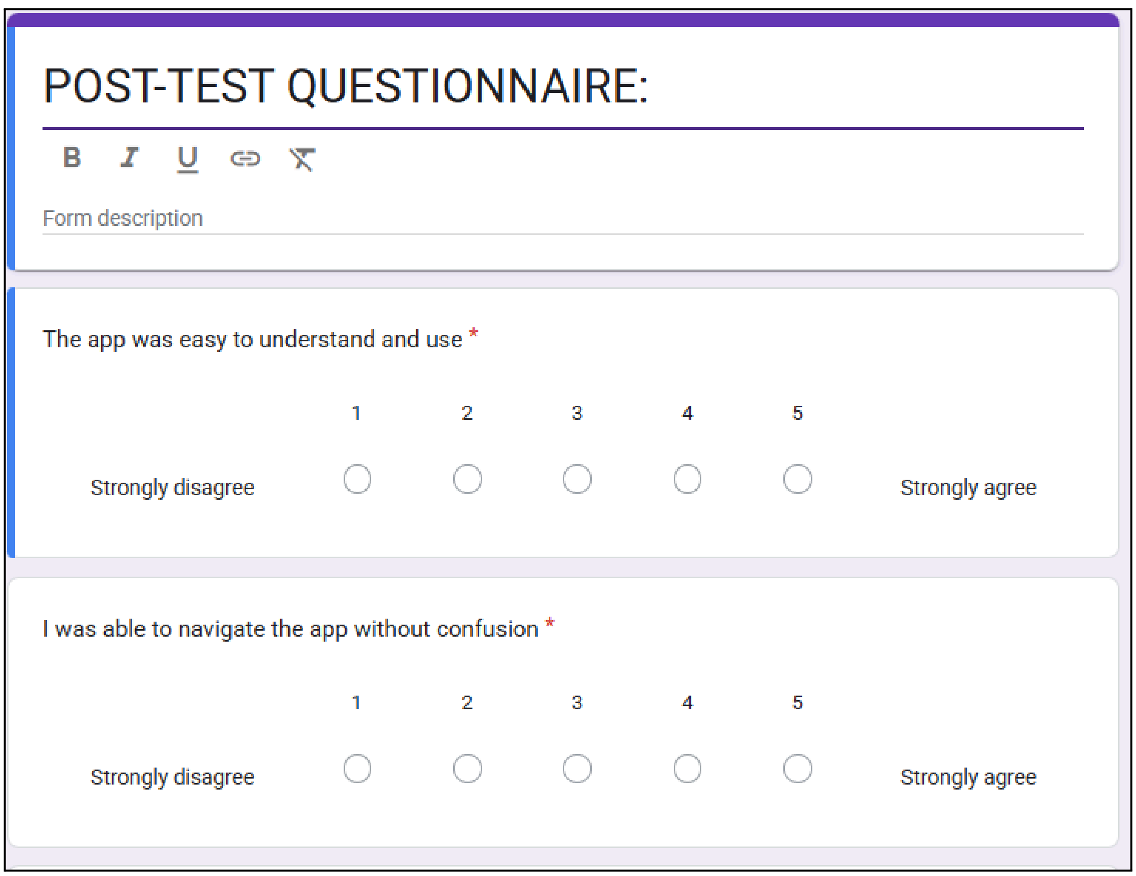
Are you regularly informed with updates from your local Department of Agriculture? *

◯ Yes

◯ No

◯ Occassionally

B.2 Post-test Questionnaires through Google form



POST-TEST QUESTIONNAIRE:

Form description

The app was easy to understand and use *

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

I was able to navigate the app without confusion *

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

The text and content in the app were easy to understand and read.

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

After using the app, How often do you record farming activities (sowing and harvesting)?

	1	2	3	4	5	
Never	○	○	○	○	○	Always

After using the app, how organized do you now feel your farming practices are?

	1	2	3	4	5	
Disprganized	○	○	○	○	○	Organized

After using the app, how confident are you in your knowledge of cultivating crops?

	1	2	3	4	5	
Not confident at all	○	○	○	○	○	Extremely confident

Does the app provide all the information and features you need to manage your crops in one place?

○ Yes

○ Maybe

○ No

Would you continue using this app for your farming tasks?

- ◯ Yes
- ◯ No
- ◯ Maybe

Is there new information you got from the local Department of Agriculture through this app?

- ◯ Yes
- ◯ No

I was able to complete the tasks without help. *

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

Rate your overall experience using the app: *

	1	2	3	4	5	
Very poor	◯	◯	◯	◯	◯	Very Excellent

How useful was the app? *

	1	2	3	4	5	
Not Useful at all	◯	◯	◯	◯	◯	Much more useful

Appendix C: Development of the crop management app

C.1 Java code for the DA updates feature

```
package com.example.crops_final; // This file belongs to the crops_final project folder

// Importing tools needed to build this screen
import android.annotation.SuppressLint;
import android.os.Bundle;
import androidx.fragment.app.Fragment;
import android.view.LayoutInflater;
import android.view.View;
import android.view.ViewGroup;
import android.widget.ImageButton;
import android.widget.TextView;

/**
 * This class shows DA (Department of Agriculture) updates in a swipe-style format.
 * Users can go forward or backward to view multiple report entries.
 */
public class DAupdatesFragment extends Fragment {

    // These are labels used to pass values into this screen from another part of the app
    private static final String ARG_PARAM1 = "param1";
    private static final String ARG_PARAM2 = "param2";

    // These variables hold the values passed into this screen (if any)
    private String mParam1;
    private String mParam2;

    // UI components — text areas and navigation buttons
    private TextView DA_title_report;
    private TextView DA_subreport1;
    private TextView DA_subdetail1;
    private ImageButton nextButton;
    private ImageButton prevButton;

    // These arrays store multiple sets of report titles and details
    private String[] subreport1, subdetail1;

    // Keeps track of which report is currently showing on screen
```

```
   private int currentPosition = 0;

   // Required empty constructor — needed by Android to set up the screen
   public DAupdatesFragment() {
   }

   /**
    * This method creates a new screen (fragment) and allows values to be passed into it
    */
   public static DAupdatesFragment newInstance(String param1, String param2) {
       DAupdatesFragment fragment = new DAupdatesFragment(); // Create a new screen
       Bundle args = new Bundle(); // A small box to store values
       args.putString(ARG_PARAM1, param1); // Put param1 inside the box
       args.putString(ARG_PARAM2, param2); // Put param2 inside the box
       fragment.setArguments(args); // Give the box to the screen
       return fragment;
   }

   @Override
   public void onCreate(Bundle savedInstanceState) {
       super.onCreate(savedInstanceState);
       // If there are any values passed into this screen, save them
       if (getArguments() != null) {
           mParam1 = getArguments().getString(ARG_PARAM1);
           mParam2 = getArguments().getString(ARG_PARAM2);
       }
   }

   @SuppressLint("MissingInflatedId") // Ignore ID warnings for older Android versions
   @Override
   public View onCreateView(LayoutInflater inflater, ViewGroup container,
                            Bundle savedInstanceState) {

       // Build the layout (UI) of this screen using the XML design file
           View view = inflater.inflate(R.layout.fragment_d_aupdates, container, false);

       // Connect the UI elements in the layout to this code
           DA_title_report = view.findViewById(R.id.DA_title_report); // Main title area
```

```
        DA_subreport1 = view.findViewById(R.id.DA_subreport1);       // Subtitle area
        DA_subdetail1 = view.findViewById(R.id.DA_subdetail1);    // Detail area
        nextButton = view.findViewById(R.id.next_button);           // Right arrow
        prevButton = view.findViewById(R.id.prev_button);        // Left arrow

        // Fill in the lists of reports and details
        initializeData();

        // Show the first report when screen loads
        displayCurrentReport();

        // When "Next" button is clicked, go forward
        nextButton.setOnClickListener(v -> {
            if (currentPosition < subreport1.length - 1) {
                currentPosition++; // Move to next report
                displayCurrentReport(); // Show it on screen
            }
        });

        // When "Previous" button is clicked, go backward
        prevButton.setOnClickListener(v -> {
            if (currentPosition > 0) {
                currentPosition--; // Move to previous report
                displayCurrentReport(); // Show it on screen
            }
        });

        // Return the fully built screen view
        return view;
    }

    /**
     * This method fills in the report titles and matching details
     */
    private void initializeData() {
        subreport1 = new String[]{
                "1. Available seeds and fertilizers given out to locals",
                "2. Insurance Policies",
                "3. Other benefits farmers could enjoy from the office",
                "4. Method of information dissemination",
                "5. Total Number of Registered Farmers",
                "6. Benefits given to household gardeners"
        };
```

```
        subdetail1 = new String[]{
              "Seeds:\nCorn, Rice, Vegetables (assorted) - upland/lowland",
                    "PCIC:\nCrops, Livestock, Farmers - (AP3 and Accidental insurance)",
                 "Capital Assistance:\nVegetables\nLivestock\nPost-Harvest (Oil Making)",
              "Leaflets\nFliers\nFarmers Meeting\nBarangay Outreach Program",
              "RSBSA - 2,600 farmers",
              "Seeds"
        };
    }

    /**
     * This method shows the current report based on what position we're in
     */
    private void displayCurrentReport() {
        // Set the fixed report title for all entries
            DA_title_report.setText("REPORT FROM THE OFFICE OF THE MUNICIPAL AGRICULTURIST IN THE MUNICIPALITY OF BACONG AS OF JUNE 1, 2025");

        // Show the matching subtitle and detail from the arrays
        DA_subreport1.setText(subreport1[currentPosition]);
        DA_subdetail1.setText(subdetail1[currentPosition]);
    }
}
```

C.2 Java code for the Database

```
package com.example.crops_final; // Package declaration

// Import necessary Android and Java classes
import android.content.ContentValues;
import android.content.Context;
import android.database.Cursor;
import android.database.sqlite.SQLiteDatabase;
import android.database.sqlite.SQLiteOpenHelper;

import java.text.SimpleDateFormat;
import java.util.ArrayList;
import java.util.Calendar;
```

import java.util.Locale;

// This class helps create, update, and manage the app's local database
public class DatabaseHelper extends SQLiteOpenHelper {

// Database setup
private static final String DATABASE_NAME = "crop_scheduler.db"; // **Database name**
private static final int DATABASE_VERSION = 3; // **Change version if structure changes**

// Table names
public static final String TABLE_CROPS = "crops"; // **Stores crop names** and duration
public static final String TABLE_SCHEDULE = "crop_schedule"; // **Stores sowing/harvest events**

// Columns for crops table
public static final String KEY_CROP_NAME = "name"; // **Crop name (primary key)**
public static final String KEY_CROP_DURATION = "duration"; // **Days until harvest**
// The rest are placeholders, not used yet:
public static final String KEY_CROP_SOWING_SEASON = "SOWING_SEASON";
public static final String KEY_CROP_HARVEST_SEASON = "HARVEST_SEASON";
public static final String KEY_CROP_SOIL_TYPE = "SOIL_TYPE";
public static final String KEY_CROP_FERTILIZING_TYPE = "FERTILIZING_TYPE";
public static final String KEY_CROP_FERTILIZING_FREQUENCY = "FERTILIZING_FREQUENCY";
public static final String PESTS = "PESTS";
public static final String DISEASES = "DISEASES";

// Columns for schedule table
public static final String KEY_SCHEDULE_ID = "id"; // **Unique ID for each schedule**
public static final String KEY_SCHEDULE_CROP_NAME = "crop_name"; // **Link to crop name**
public static final String KEY_EVENT_TYPE = "event_type"; // **"sowing" or "harvest"**
public static final String KEY_MILLISECOND = "millisecond"; // **For sorting by time**
public static final String KEY_DATE = "date"; // **Human-readable date**
public static final String KEY_TIME = "time"; // **Time of day**

```
    public static final String KEY_NOTES = "notes"; // Optional user notes

    // Constructor — sets up the helper to use this database
    public DatabaseHelper(Context context) {
        super(context, DATABASE_NAME, null, DATABASE_VERSION);
    }

    // Called once when the database is created for the first time
    @Override
    public void onCreate(SQLiteDatabase db) {
        // SQL to create crops table
                String CREATE_CROPS_TABLE = "CREATE TABLE " +
TABLE_CROPS + "(" +
                KEY_CROP_NAME + " TEXT PRIMARY KEY," +
                 KEY_CROP_DURATION + " INTEGER NOT NULL DEFAULT
0)";

        // SQL to create schedule table with a foreign key linking to crops
            String CREATE_SCHEDULE_TABLE = "CREATE TABLE " +
TABLE_SCHEDULE + "(" +
                        KEY_SCHEDULE_ID + " INTEGER PRIMARY KEY
AUTOINCREMENT," +
                KEY_SCHEDULE_CROP_NAME + " TEXT NOT NULL," +
                KEY_EVENT_TYPE + " TEXT NOT NULL," +
                KEY_MILLISECOND + " INTEGER NOT NULL," +
                KEY_DATE + " TEXT NOT NULL," +
                KEY_TIME + " TEXT NOT NULL," +
                KEY_NOTES + " TEXT," +
                    "FOREIGN KEY(" + KEY_SCHEDULE_CROP_NAME + ")
REFERENCES " +
                TABLE_CROPS + "(" + KEY_CROP_NAME + "))";

        // Execute SQL commands
        db.execSQL(CREATE_CROPS_TABLE);
        db.execSQL(CREATE_SCHEDULE_TABLE);

        // Add sample crops
        insertDefaultCrops(db);
    }

        // Called when the database version is changed (e.g., structure
updated)
    @Override
        public void onUpgrade(SQLiteDatabase db, int oldVersion, int
newVersion) {
        // Remove old tables if they exist
```

```
        db.execSQL("DROP TABLE IF EXISTS " + TABLE_SCHEDULE);
        db.execSQL("DROP TABLE IF EXISTS " + TABLE_CROPS);

        // Create new ones
        onCreate(db);
    }

    // Adds default crop data to the crops table
    private void insertDefaultCrops(SQLiteDatabase db) {
        insertCrop(db, "Tomato", 90);
        insertCrop(db, "Corn", 120);
        insertCrop(db, "Carrot", 75);
    }

    // A helper method to insert a crop
    private void insertCrop(SQLiteDatabase db, String name, int duration) {
        ContentValues values = new ContentValues();
        values.put(KEY_CROP_NAME, name);
        values.put(KEY_CROP_DURATION, duration);
        db.insert(TABLE_CROPS, null, values);
    }

    // Add a schedule entry (sowing or harvest)
        public boolean addSchedule(String cropName, String eventType, long
milliseconds, String date, String time, String notes) {
        SQLiteDatabase db = this.getWritableDatabase();
        ContentValues values = new ContentValues();

        values.put(KEY_SCHEDULE_CROP_NAME, cropName);
        values.put(KEY_EVENT_TYPE, eventType);
        values.put(KEY_MILLISECOND, milliseconds);
        values.put(KEY_DATE, date);
        values.put(KEY_TIME, time);
        values.put(KEY_NOTES, notes);

        long result = db.insert(TABLE_SCHEDULE, null, values);
        return result != -1; // If insert was successful
    }

    // Get all crop names from crops table
    public ArrayList<String> getAllCrops() {
        ArrayList<String> crops = new ArrayList<>();
        SQLiteDatabase db = this.getReadableDatabase();
          Cursor cursor = db.rawQuery("SELECT " + KEY_CROP_NAME + "
FROM " + TABLE_CROPS, null);
```

```
        if (cursor.moveToFirst()) {
            do {
                crops.add(cursor.getString(0));
            } while (cursor.moveToNext());
        }

        cursor.close();
        return crops;
    }

    // Get duration of a specific crop
    public int getCropDuration(String cropName) {
        SQLiteDatabase db = this.getReadableDatabase();
          Cursor cursor = db.rawQuery("SELECT " + KEY_CROP_DURATION
+ " FROM " + TABLE_CROPS +
                            " WHERE " + KEY_CROP_NAME + "=?", new
String[]{cropName});
        if (cursor.moveToFirst()) {
            int duration = cursor.getInt(0);
            cursor.close();
            return duration;
        } else {
            cursor.close();
            return 0;
        }
    }

    // Get all schedule entries
    public Cursor getAllSchedules() {
        SQLiteDatabase db = this.getReadableDatabase();
          return db.rawQuery("SELECT * FROM " + TABLE_SCHEDULE + "
ORDER BY " + KEY_MILLISECOND + " ASC", null);
    }

    // Delete a specific schedule entry by ID
    public boolean deleteScheduleById(int id) {
        SQLiteDatabase db = this.getWritableDatabase();
          int result = db.delete(TABLE_SCHEDULE, KEY_SCHEDULE_ID +
"=?", new String[]{String.valueOf(id)});
        return result > 0;
    }

    // Generate a readable date string from milliseconds (optional helper)
    public static String convertMillisecondsToDate(long millis) {
        Calendar calendar = Calendar.getInstance();
        calendar.setTimeInMillis(millis);
```

```
        SimpleDateFormat dateFormat = new SimpleDateFormat("MMM dd, yyyy", Locale.getDefault());
        return dateFormat.format(calendar.getTime());
    }
}
```

C.3 Java code for the crops information feature

```
package com.example.crops_final; // This is part of the crops_final project

// Import necessary Android and Java libraries
import android.app.Activity;
import android.content.Intent;
import android.os.Bundle;
import android.view.LayoutInflater;
import android.view.View;
import android.view.ViewGroup;
import android.widget.ArrayAdapter;
import android.widget.AutoCompleteTextView;
import android.widget.Button;
import android.widget.CalendarView;
import android.widget.EditText;
import android.widget.TextView;
import android.widget.Toast;

import androidx.annotation.NonNull;
import androidx.annotation.Nullable;
import androidx.fragment.app.Fragment;

import java.text.SimpleDateFormat;
import java.util.Calendar;
import java.util.List;
import java.util.Locale;

// This fragment shows a calendar and lets users schedule crop planting and harvesting
public class calendarFragment extends Fragment {

    // UI components from XML layout
    private AutoCompleteTextView cropSearch; // Dropdown for selecting crop
    private EditText newCropInput, sowingDateInput, harvestDateInput; // Inputs for crop and dates
```

private CalendarView calendarView; // **Calendar widget for picking dates**
private TextView scheduleCountText; // **Displays number of schedules**

// **Calendar objects to hold sowing and harvest dates**
private Calendar sowingCalendar = Calendar.getInstance();
private Calendar harvestCalendar = Calendar.getInstance();
private boolean isSettingSowingDate = true; // **True if user is selecting sowing date**

private DatabaseHelper dbHelper; // **To connect and interact with the database**
private int currentCropDuration = -1; // **Number of days between sowing and harvest**

// **This function is called when the screen (fragment) is created**
@Nullable
@Override
public View onCreateView(@NonNull LayoutInflater inflater, @Nullable ViewGroup container,
@Nullable Bundle savedInstanceState) {

View view = inflater.inflate(R.layout.fragment_calendar, container, false); // **Load layout**
dbHelper = new DatabaseHelper(requireContext()); // **Initialize database helper**

// **Link UI elements with variables**
cropSearch = view.findViewById(R.id.cropSearch);
newCropInput = view.findViewById(R.id.editTextMain);
sowingDateInput = view.findViewById(R.id.sowing);
harvestDateInput = view.findViewById(R.id.harvest);
calendarView = view.findViewById(R.id.calendarView);
scheduleCountText = view.findViewById(R.id.txt_title_main);

// **Set up features**
setupCropAutocomplete();
setupCalendar();
setupDateInputs();
setupSaveButton(view);

// **Show current dates and number of saved schedules**
updateDateDisplays();
updateScheduleCount();

return view;

```
    }

    // Loads crop names from the database into the dropdown
    private void setupCropAutocomplete() {
        List<String> cropNames = dbHelper.getAllCropNames(); // Get crop names
        ArrayAdapter<String> adapter = new ArrayAdapter<>(
                requireContext(),
                android.R.layout.simple_dropdown_item_1line,
                cropNames
        );
        cropSearch.setAdapter(adapter); // Set adapter to dropdown

        cropSearch.setKeyListener(null); // Make dropdown non-editable
        cropSearch.setOnFocusChangeListener((v, hasFocus) -> {
            if (hasFocus) {
                cropSearch.showDropDown(); // Show dropdown list when focused
            }
        });

        cropSearch.setThreshold(1); // Show suggestions after 1 letter

        cropSearch.setOnItemClickListener((parent, view, position, id) -> {
            String selectedCrop = (String) parent.getItemAtPosition(position);
            currentCropDuration = dbHelper.getCropDuration(selectedCrop); // Load duration
            updateHarvestDate(); // Update harvest based on sowing + duration
        });
    }

    // Set how the calendar works when user picks dates
    private void setupCalendar() {
        calendarView.setOnDateChangeListener((view, year, month, dayOfMonth) -> {
            if (isSettingSowingDate) {
                sowingCalendar.set(year, month, dayOfMonth);
                updateHarvestDate(); // If we know duration, calculate harvest
            } else {
                harvestCalendar.set(year, month, dayOfMonth);
                long diff = harvestCalendar.getTimeInMillis() - sowingCalendar.getTimeInMillis();
                currentCropDuration = (int) (diff / (1000 * 60 * 60 * 24)); // in days
            }
            updateDateDisplays();
```

```
        });
    }

    // Changes what the calendar is selecting (sowing or harvest)
    private void setupDateInputs() {
        sowingDateInput.setOnFocusChangeListener((v, hasFocus) -> {
            if (hasFocus) {
                isSettingSowingDate = true;
                calendarView.setDate(sowingCalendar.getTimeInMillis());
            }
        });

        harvestDateInput.setOnFocusChangeListener((v, hasFocus) -> {
            if (hasFocus) {
                isSettingSowingDate = false;
                calendarView.setDate(harvestCalendar.getTimeInMillis());
            }
        });
    }

    // Automatically sets the harvest date based on sowing + duration
    private void updateHarvestDate() {
        if (currentCropDuration > 0) {
            harvestCalendar.setTimeInMillis(sowingCalendar.getTimeInMillis());
                                harvestCalendar.add(Calendar.DAY_OF_YEAR,
currentCropDuration);
            updateDateDisplays();
        }
    }

    // Updates the sowing and harvest date display
    private void updateDateDisplays() {
            SimpleDateFormat dateFormat = new SimpleDateFormat("MMM dd,
yyyy", Locale.getDefault());

sowingDateInput.setText(dateFormat.format(sowingCalendar.getTime()));

harvestDateInput.setText(dateFormat.format(harvestCalendar.getTime()));
    }

    // Setup Save and View Schedule button functionality
    private void setupSaveButton(View view) {
        Button btnSave = view.findViewById(R.id.btn_save);
        btnSave.setOnClickListener(v -> saveCropSchedule()); // Save data

        Button btnView = view.findViewById(R.id.btn_viewDatabase);
```

```
        btnView.setOnClickListener(v -> viewSchedule()); // Go to report screen
    }

    // Save a crop schedule to the database
    private void saveCropSchedule() {
        String cropName = cropSearch.getText().toString().trim();
        String newCropName = newCropInput.getText().toString().trim();

        // Avoid duplicates if user types a crop manually
        if (!newCropName.isEmpty()) {
            List<String> existingCrops = dbHelper.getAllCropNames();
            for (String existingCrop : existingCrops) {
                if (existingCrop.equalsIgnoreCase(newCropName)) {
                    newCropInput.setText("");
                    showToast("'" + newCropName + "' already exists. Please select it.");
                    return;
                }
            }
        }

        // Check if crop is selected or typed
        if (cropName.isEmpty() && newCropName.isEmpty()) {
            showToast("Please select or enter a crop name");
            return;
        }

        // Prevent entering both fields
        if (!cropName.isEmpty() && !newCropName.isEmpty()) {
            newCropInput.setText("");
            cropSearch.setText("");
            showToast("Please input one crop only");
            return;
        }

        // Make sure both dates are selected
        if (sowingCalendar.getTimeInMillis() == 0 || harvestCalendar.getTimeInMillis() == 0) {
            showToast("Please select both dates");
            return;
        }

        // Choose final crop name
        String finalCropName = cropName.isEmpty() ? newCropName : cropName;
```

```
        // If duration isn't set, calculate it from dates
        if (currentCropDuration <= 0) {
                        long diff = harvestCalendar.getTimeInMillis() -
sowingCalendar.getTimeInMillis();
            currentCropDuration = (int) (diff / (1000 * 60 * 60 * 24));
        }

        // If crop is new, add it to database
        if (dbHelper.getCropDuration(finalCropName) == -1) {
            dbHelper.addOrUpdateCrop(finalCropName, currentCropDuration);
        }

        // Get current time
                String timeStr = new SimpleDateFormat("HH:mm:ss",
Locale.getDefault())
                .format(Calendar.getInstance().getTime());

        // Save both sowing and harvest data
        boolean success = dbHelper.scheduleCompleteCrop(
                finalCropName,
                sowingCalendar.getTimeInMillis(),
                sowingDateInput.getText().toString(),
                timeStr,
                currentCropDuration,
                "Planted " + finalCropName
        );

        if (success) {
            showToast("Schedule saved successfully");
            resetForm(); // Clear everything after save
            updateScheduleCount(); // Refresh schedule counter
        } else {
            showToast("Failed to save schedule");
        }
    }

    // Go to the schedule list screen
    private void viewSchedule() {
        startActivity(new Intent(requireContext(), ReportActivity.class));
    }

    // Updates the top label showing how many schedules there are
    private void updateScheduleCount() {
        int count = dbHelper.getScheduleCount();
        scheduleCountText.setText("SCHEDULE ACTIVITY");
```

```
        }

    // Clears all input fields and resets calendars
    private void resetForm() {
        cropSearch.setText("");
        newCropInput.setText("");
        sowingCalendar = Calendar.getInstance();
        harvestCalendar = Calendar.getInstance();
        currentCropDuration = -1;
        updateDateDisplays();
    }

    // Show short popup message
    private void showToast(String message) {
                                    Toast.makeText(requireContext(),      message,
Toast.LENGTH_SHORT).show();
    }

    // Close database when fragment is destroyed
    @Override
    public void onDestroy() {
        dbHelper.close();
        super.onDestroy();
    }
}
```

C.4: Java code for the crop calendar feature

```
package com.example.crops_final;
// Import necessary Android and Java classes
import android.app.Activity;
import android.content.Intent;
import android.os.Bundle;
import android.view.LayoutInflater;
import android.view.View;
import android.view.ViewGroup;
import android.widget.ArrayAdapter;
import android.widget.AutoCompleteTextView;
import android.widget.Button;
import android.widget.CalendarView;
import android.widget.EditText;
import android.widget.TextView;
import android.widget.Toast;

import androidx.annotation.NonNull;
import androidx.annotation.Nullable;
import androidx.fragment.app.Fragment;

import java.text.SimpleDateFormat;
import java.util.Calendar;
import java.util.List;
import java.util.Locale;

public class calendarFragment extends Fragment {

    // Declare UI components
    private AutoCompleteTextView cropSearch;
    private EditText newCropInput, sowingDateInput, harvestDateInput;
    private CalendarView calendarView;
    private TextView scheduleCountText;

    // Calendar objects to store sowing and harvest dates
    private Calendar sowingCalendar = Calendar.getInstance();
    private Calendar harvestCalendar = Calendar.getInstance();
    private boolean isSettingSowingDate = true; // Used to toggle between setting sowing or harvest date

    // Database helper instance
    private DatabaseHelper dbHelper;
    private int currentCropDuration = -1; // Stores crop duration in days
```

```
    // Called when fragment's UI is to be created
    @Nullable
    @Override
     public View onCreateView(@NonNull LayoutInflater inflater, @Nullable
ViewGroup container,
                        @Nullable Bundle savedInstanceState) {
            View view = inflater.inflate(R.layout.fragment_calendar, container,
false);

        // Initialize the database
        dbHelper = new DatabaseHelper(requireContext());

        // Connect layout components to variables
        cropSearch = view.findViewById(R.id.cropSearch);
        newCropInput = view.findViewById(R.id.editTextMain);
        sowingDateInput = view.findViewById(R.id.sowing);
        harvestDateInput = view.findViewById(R.id.harvest);
        calendarView = view.findViewById(R.id.calendarView);
        scheduleCountText = view.findViewById(R.id.txt_title_main);

        // Setup all features
        setupCropAutocomplete();
        setupCalendar();
        setupDateInputs();
        setupSaveButton(view);

        // Initialize default date display and schedule count
        updateDateDisplays();
        updateScheduleCount();

        return view;
    }

    // Load crop names from database and enable dropdown functionality
    private void setupCropAutocomplete() {
        List<String> cropNames = dbHelper.getAllCropNames();
        ArrayAdapter<String> adapter = new ArrayAdapter<>(
                requireContext(),
                android.R.layout.simple_dropdown_item_1line,
                cropNames
        );
        cropSearch.setAdapter(adapter);

        // Prevent user from manually typing
        cropSearch.setKeyListener(null);
```

```
        // Automatically open dropdown when focused
        cropSearch.setOnFocusChangeListener((v, hasFocus) -> {
            if (hasFocus) {
                cropSearch.showDropDown();
            }
        });

                cropSearch.setThreshold(1); // Start showing suggestions after 1
character

        // When a crop is selected, load its duration and update harvest date
        cropSearch.setOnItemClickListener((parent, view, position, id) -> {
            String selectedCrop = (String) parent.getItemAtPosition(position);
            currentCropDuration = dbHelper.getCropDuration(selectedCrop);
            updateHarvestDate();
        });
    }

    // Setup calendar view date selection logic
    private void setupCalendar() {
                calendarView.setOnDateChangeListener((view, year, month,
dayOfMonth) -> {
            if (isSettingSowingDate) {
                sowingCalendar.set(year, month, dayOfMonth);
                updateHarvestDate(); // Automatically compute harvest date if crop
duration is available
            } else {
                harvestCalendar.set(year, month, dayOfMonth);
                        long diff = harvestCalendar.getTimeInMillis() -
sowingCalendar.getTimeInMillis();
                currentCropDuration = (int) (diff / (1000 * 60 * 60 * 24)); //
Calculate duration in days
            }
            updateDateDisplays();
        });
    }

    // When a date field is focused, change calendar mode accordingly
    private void setupDateInputs() {
        sowingDateInput.setOnFocusChangeListener((v, hasFocus) -> {
            if (hasFocus) {
                isSettingSowingDate = true;
                calendarView.setDate(sowingCalendar.getTimeInMillis());
            }
        });
```

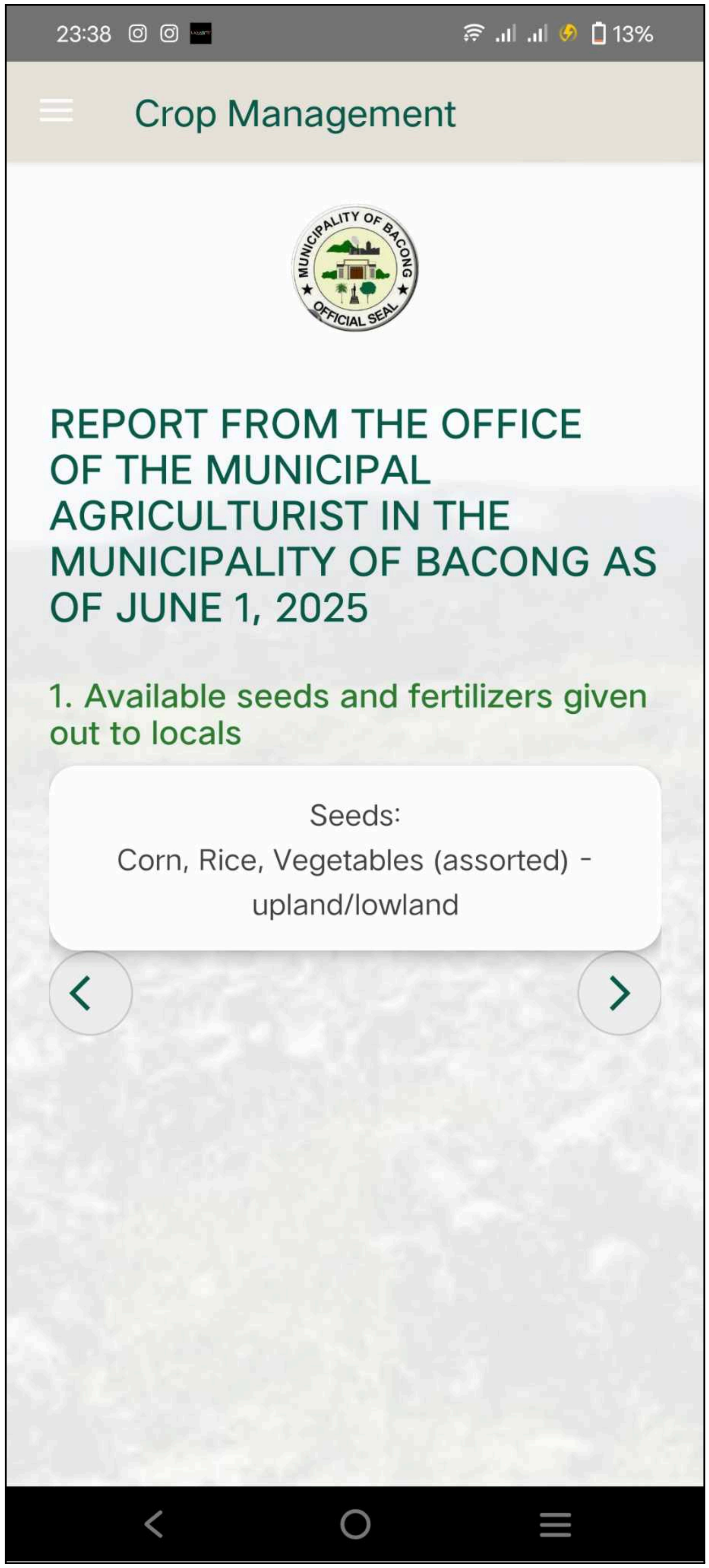
```
        harvestDateInput.setOnFocusChangeListener((v, hasFocus) -> {
            if (hasFocus) {
                isSettingSowingDate = false;
                calendarView.setDate(harvestCalendar.getTimeInMillis());
            }
        });
    }

    // Automatically compute harvest date from sowing + duration
    private void updateHarvestDate() {
        if (currentCropDuration > 0) {
            harvestCalendar.setTimeInMillis(sowingCalendar.getTimeInMillis());
                                    harvestCalendar.add(Calendar.DAY_OF_YEAR,
currentCropDuration);
            updateDateDisplays();
        }
    }

    // Display formatted dates on text fields
    private void updateDateDisplays() {
            SimpleDateFormat dateFormat = new SimpleDateFormat("MMM dd,
yyyy", Locale.getDefault());

sowingDateInput.setText(dateFormat.format(sowingCalendar.getTime()));

harvestDateInput.setText(dateFormat.format(harvestCalendar.getTime()));
    }

    // Setup Save and View Schedule buttons
    private void setupSaveButton(View view) {
        Button btnSave = view.findViewById(R.id.btn_save);
        btnSave.setOnClickListener(v -> saveCropSchedule());

        Button btnView = view.findViewById(R.id.btn_viewDatabase);
        btnView.setOnClickListener(v -> viewSchedule());
    }

    // Save crop schedule logic
    private void saveCropSchedule() {
        String cropName = cropSearch.getText().toString().trim();
        String newCropName = newCropInput.getText().toString().trim();

        // Prevent duplicate manual crop input
        if (!newCropName.isEmpty()) {
            List<String> existingCrops = dbHelper.getAllCropNames();
            for (String existingCrop : existingCrops) {
```

```
            if (existingCrop.equalsIgnoreCase(newCropName)) {
               newCropInput.setText("");
                  showToast("'" + newCropName + "' already exists in available
crops. Please select it from the list.");
               return;
            }
         }
      }

      // Check if crop is selected or entered
      if (cropName.isEmpty() && newCropName.isEmpty()) {
         showToast("Please select or enter a crop name");
         return;
      }

      // Prevent double entry
      if (!cropName.isEmpty() && !newCropName.isEmpty()) {
         newCropInput.setText("");
         cropSearch.setText("");
         showToast("Please input one crop only");
         return;
      }

      // Validate date selections
                  if    (sowingCalendar.getTimeInMillis()    ==    0    ||
harvestCalendar.getTimeInMillis() == 0) {
         showToast("Please select both dates");
         return;
      }

      // Determine which crop name to use
         String finalCropName = cropName.isEmpty() ? newCropName :
cropName;

      // If crop is new and duration isn't set, compute it from dates
      if (currentCropDuration <= 0) {
                  long   diff   =   harvestCalendar.getTimeInMillis()   -
sowingCalendar.getTimeInMillis();
         currentCropDuration = (int) (diff / (1000 * 60 * 60 * 24));
      }

      // Add new crop to database if not found
      if (dbHelper.getCropDuration(finalCropName) == -1) {
         dbHelper.addOrUpdateCrop(finalCropName, currentCropDuration);
      }
```

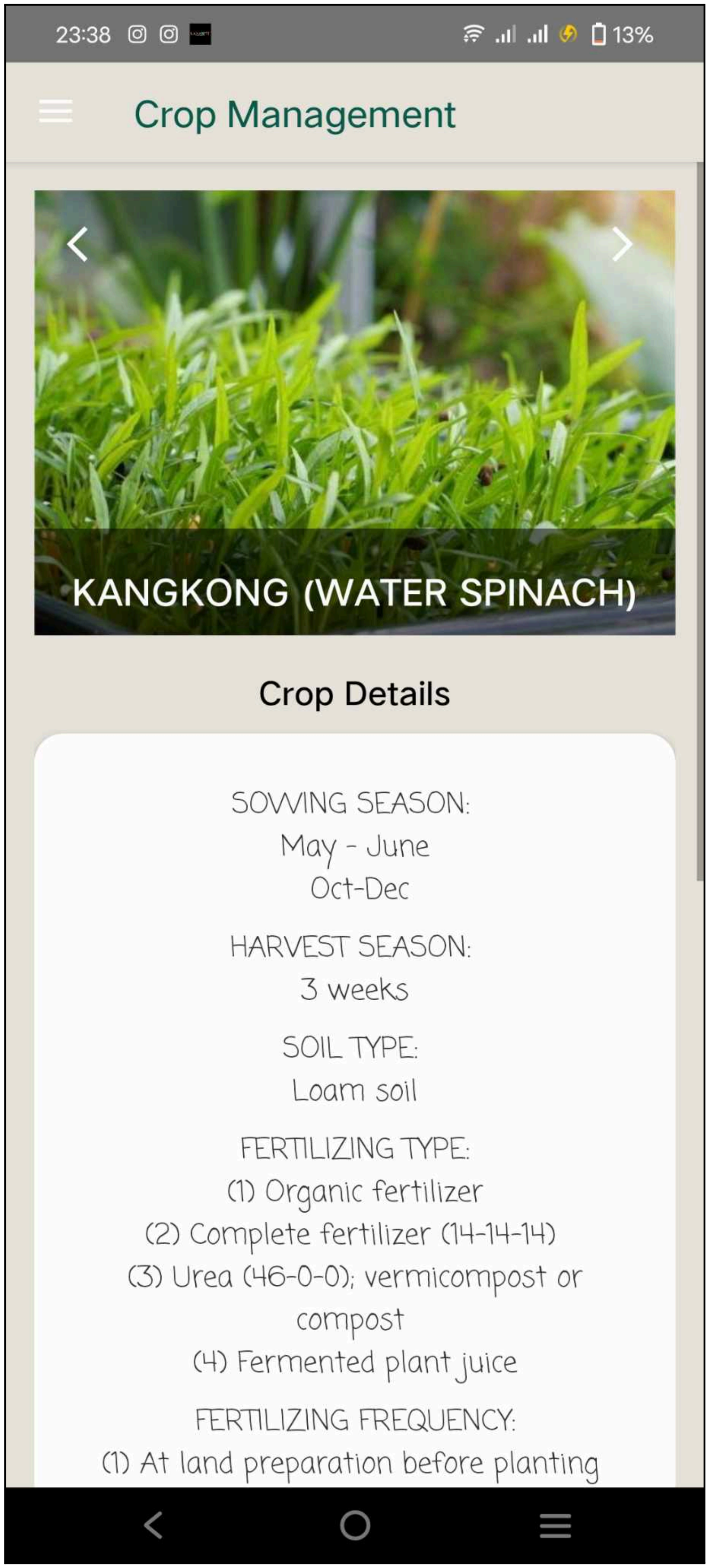
```
        // Get current time for schedule entry
                String timeStr = new SimpleDateFormat("HH:mm:ss",
Locale.getDefault())
                .format(Calendar.getInstance().getTime());

        // Save both sowing and harvest to DB
        boolean success = dbHelper.scheduleCompleteCrop(
                finalCropName,
                sowingCalendar.getTimeInMillis(),
                sowingDateInput.getText().toString(),
                timeStr,
                currentCropDuration,
                "Planted " + finalCropName
        );

        // Display result to user
        if (success) {
            showToast("Schedule saved successfully");
            resetForm(); // Clear form
            updateScheduleCount(); // Update count display
        } else {
            showToast("Failed to save schedule");
        }
    }

    // Open the schedule activity screen
    private void viewSchedule() {
        startActivity(new Intent(requireContext(), ReportActivity.class));
    }

    // Update text to reflect number of schedules
    private void updateScheduleCount() {
        int count = dbHelper.getScheduleCount();
        scheduleCountText.setText("SCHEDULE ACTIVITY");
        // You could append: + "\nTotal entries: " + count
    }

    // Reset all fields after saving
    private void resetForm() {
        cropSearch.setText("");
        newCropInput.setText("");
        sowingCalendar = Calendar.getInstance();
        harvestCalendar = Calendar.getInstance();
        currentCropDuration = -1;
        updateDateDisplays();
    }
```

```
    // Show a message using Toast
    private void showToast(String message) {
        Toast.makeText(requireContext(), message, Toast.LENGTH_SHORT).show();
    }

    // Clean up database when fragment is destroyed
    @Override
    public void onDestroy() {
        dbHelper.close();
        super.onDestroy();
    }
}
```

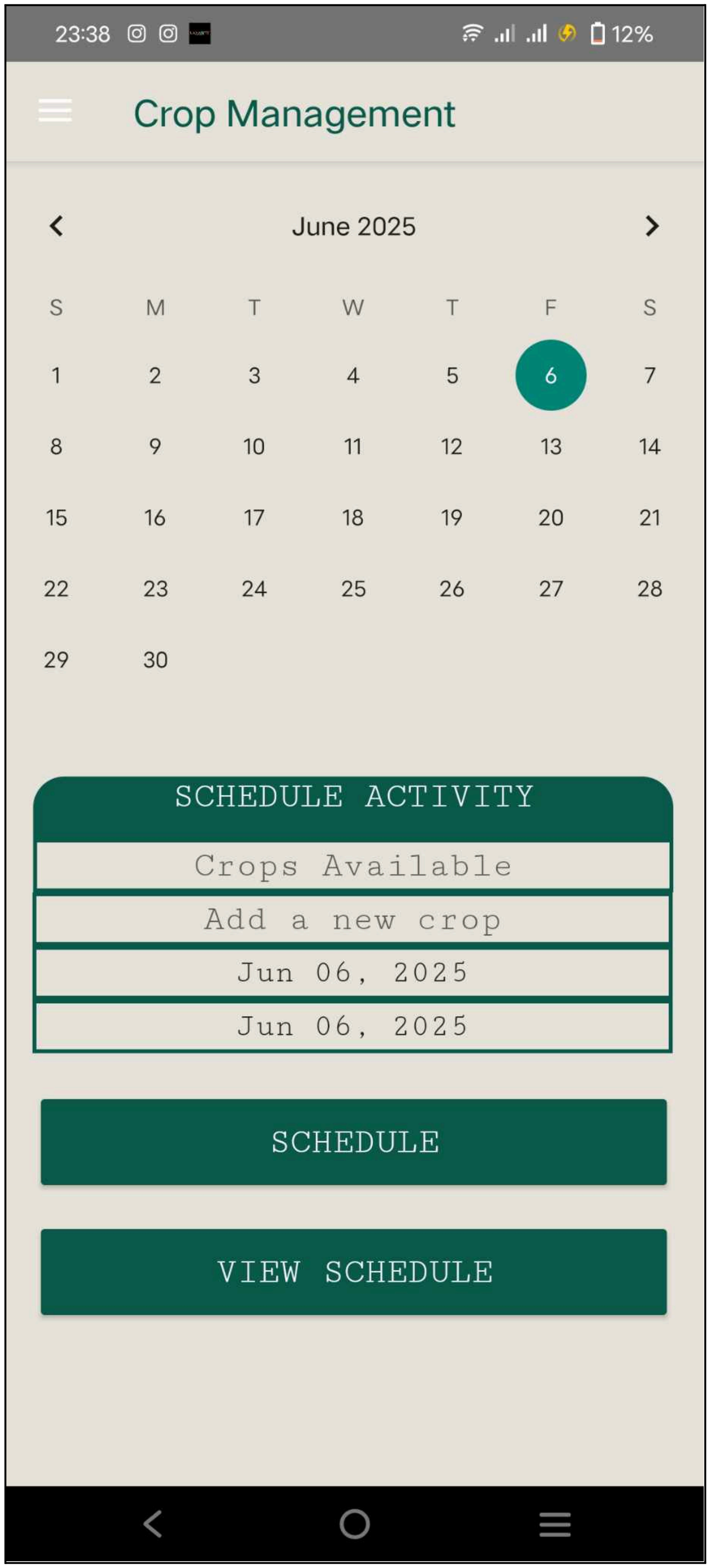
C.4 DA update user interface



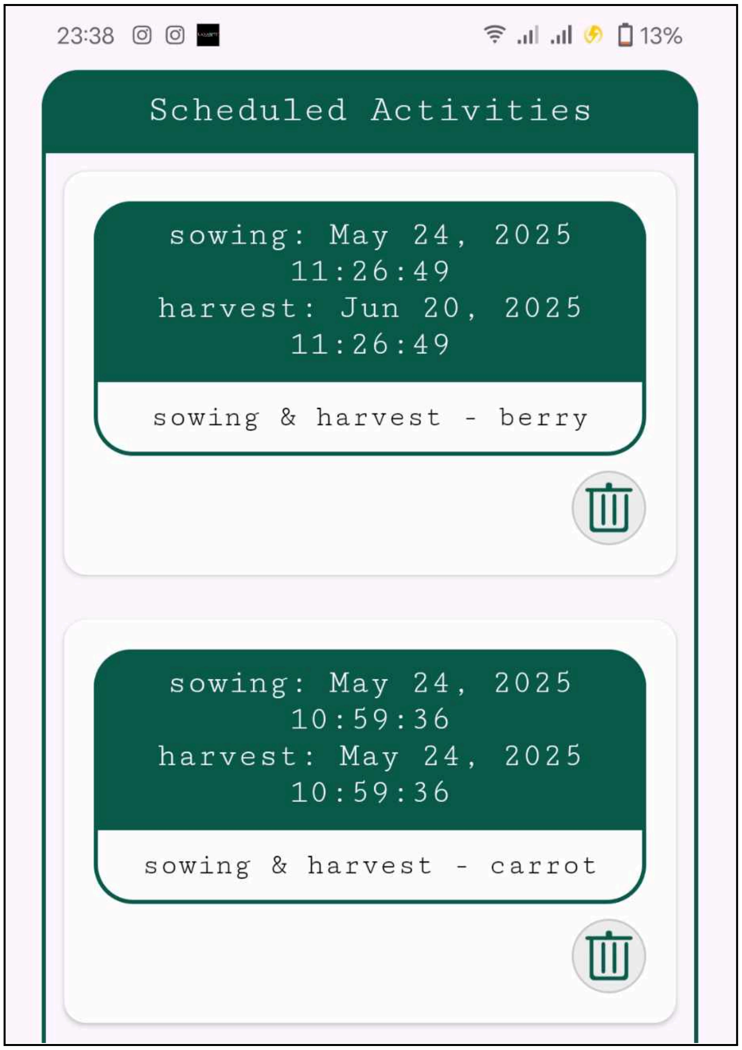
C.5 Crops information user interface



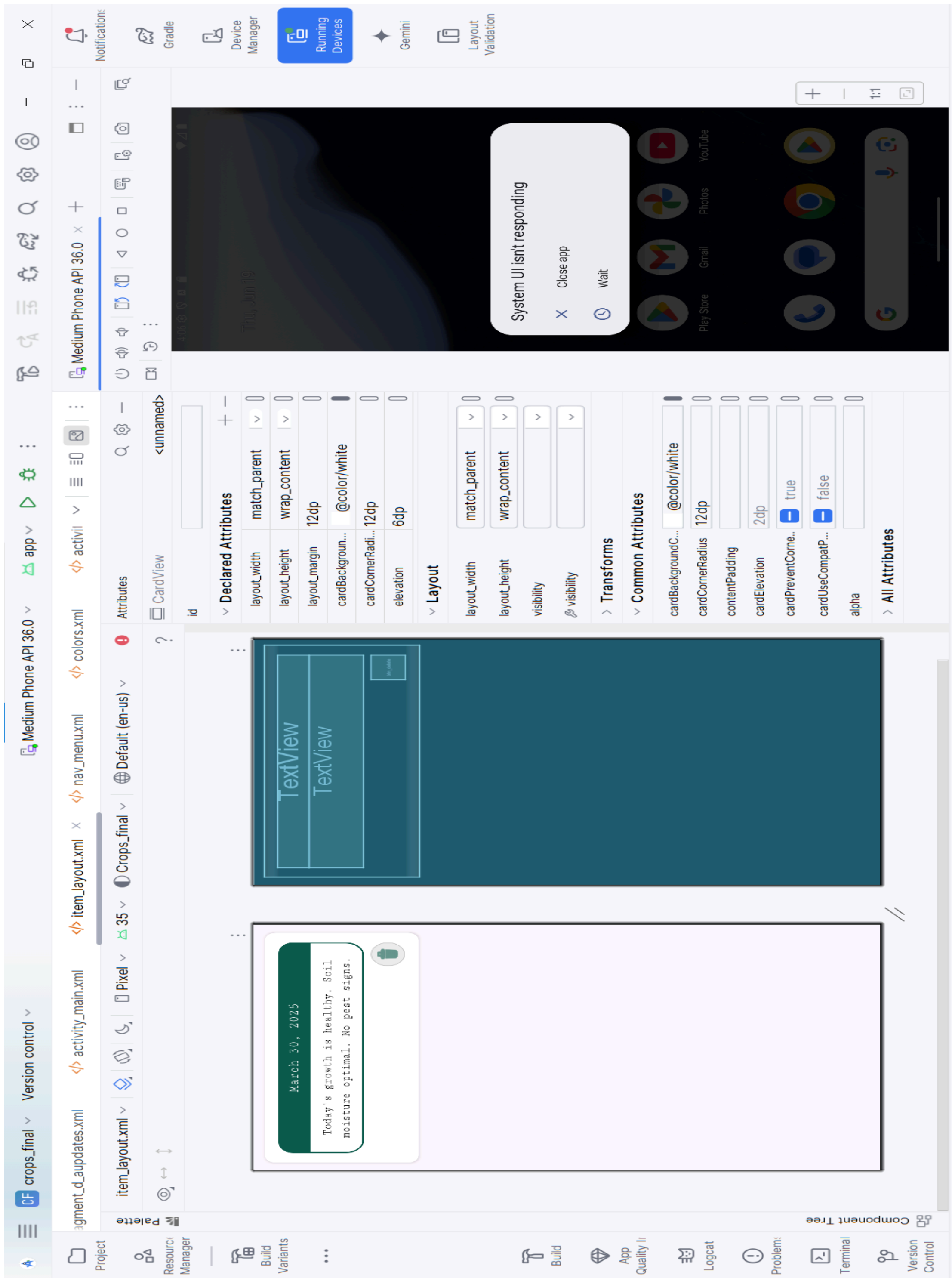
C.6 Crop calendar user interface



C.7 Scheduled activities list user interface



C.8 Simulating and debugging the code in the android studio



Appendix D: T-test Computations

This appendix shows the t-test calculations found in the results and discussions at Chapter 4.

D.1 T-test Computation for the Level of Orderliness Experienced by the Respondents in Their Farming Practices

HOW ORGANIZED DO YOU FEEL YOUR FARMING PRACTICES ARE?		
t-Test: Paired Two Sample for Means		
	f	*f*
Mean	3.4	4.[illegible]
Variance	2.3	0.[illegible]
Observations	5	[illegible]
Pearson Correlation	0.541736339	
Hypothesized Mean Difference	0	
df	4	
t Stat	-2.057983022	
P(T<=t) one-tail	0.054350476	
t Critical one-tail	2.131846786	
P(T<=t) two-tail	0.108700951	
t Critical two-tail	2.776445105	

D.2 T-test Computation for the Frequency of Using Mobile Apps for Farming-related Tasks

HOW OFTEN DO YOU USE MOBILE APPS FOR FARMING-RELATED TASKS?		
t-Test: Paired Two Sample for Means		
	f	*f*
Mean	3.6	4.6
Variance	2.8	0.3
Observations	5	5
Pearson Correlation	0.327326835	
Hypothesized Mean Difference	0	
df	4	
t Stat	-1.414213562	
P(T<=t) one-tail	0.115099821	
t Critical one-tail	2.131846786	
P(T<=t) two-tail	0.230199641	
t Critical two-tail	2.776445105	

D.3 T-test Computation for the Level of Confidence in Respondents' Knowledge of Cultivating Crops

HOW CONFIDENT ARE YOU IN YOUR KNOWLEDGE OF CULTIVATING CROPS?		
t-Test: Paired Two Sample for Means		
	f	*f*
Mean	3.8	4.6
Variance	2.7	0.3
Observations	5	5
Pearson Correlation	0.444444444	
Hypothesized Mean Difference	0	
df	4	
t Stat	-1.206045378	
P(T<=t) one-tail	0.147128184	
t Critical one-tail	2.131846786	
P(T<=t) two-tail	0.294256368	
t Critical two-tail	2.776445105	

CURRICULUM VITAE

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Birthdate: June 8, 2004

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Educational Background

- **Tertiary Education**
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  Bachelor of Science in Computer Engineering
  S.Y. 2022-2025
- **Secondary Education**
  Senior High School:
  Sisters of Mary School-Girlstown, Inc.
  J. P. Rizal St., City of Talisay 6045, Cebu
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  Junior High School:
  Sisters of Mary School-Girlstown, Inc.
  J. P. Rizal St., City of Talisay 6045, Cebu
  SY: 2016 – 2020
- **Primary Education**
  Lilo-an Elementary School
  Lilo-an, Maria, Siquijor
  SY: 2010 – 2016
- **Trainings Attended**
  Computer Systems Servicing NC II
  Electronic Products Assembly and Servicing NC II
- **Experiences**
  3rd Year Representative - Institute of Computer Engineers of the Philippines NORSU Student Chapter
  Teachers' Aide - Sisters of Mary School - Girlstown, Inc.
  Student Teacher - Sisters of Mary School - Girlstown, Inc.
- **Skills**
  Basic programming (C++, Java, Python), knowledge on Arduino, and EasyEDA

CURRICULUM VITAE

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- **Tertiary Education**
  Negros Oriental State University Main Campus 1 & II
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  Bachelor of Science in Computer Engineering
  S.Y. 2021-2025

- **Secondary Education**
  Senior High School:
  Asian College of Science and Technology (ACSAT)
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  SY: 2019 – 2021
  Junior High School:
  San Miguel National High School
  San Miguel, Bacong, Negros Oriental
  SY: 2015 – 2019

- **Primary Education**
  San Miguel Elementary School
  San Miguel, Bacong, Negros, Oriental
  SY: 2009 – 2015

- **Skills**
  Basic programming (C++, Java, Python), knowledge on Arduino, and EasyEDA

CURRICULUM VITAE

Villamil, Jasper Lloyd B.

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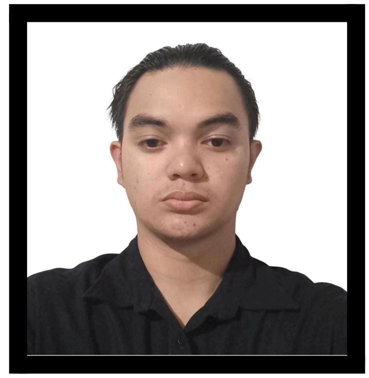
Birthdate: June 7, 2003

Age: 22 **Sex:** Male



Educational Background

- **Tertiary Education**
  Negros Oriental State University Main Campus 1 & II
  Dumaguete City, Negros Oriental, Philippines
  Bachelor of Science in Computer Engineering
  S.Y. 2021-2025

- **Secondary Education**
  Senior High School:
  Asian College of Science and Technology (ACSAT)
  8872+HRV, Kagawasan Avenue, Dumaguete City, Lalawigan ng Negros Oriental
  SY: 2019 – 2021
  Junior High School:
  Negros Oriental High School
  Dr. V Locsin St, Dumaguete City, Negros Oriental
  SY: 2015 – 2019

- **Primary Education**

  Presbyterian Theological College (PTC)
  6200 Cantil-e, Dumaguete City, Negros Oriental
  SY: 2009 – 2015

- **Experiences**
  3rd Year Representative - Institute of Computer Engineers of the Philippines NORSU Student Chapter

- **Skills**
  Basic programming (C++, Java, Python), knowledge on Arduino, EasyEDA, Excel, Autocad, and Microsoft Word

CURRICULUM VITAE

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Educational Background

- **Tertiary Education**
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- **Secondary Education**
  Senior High School:
  Siquijor Provincial Science High School
  Science, Technology, Engineering, and Mathematics (STEM)
  Capstone Project: "Smart Glove: Hand Talk Assistive Technology"
  SY: 2020 – 2022
  Junior High School:
  Siquijor Provincial Science High School
  SY: 2016 – 2020

- **Primary Education**
  Siquijor Central Elementary School
  Polangyuta, Siquijor, Siquijor
  SY: 2010 – 2016

- **Skills**
  Basic programming (C++, Java), knowledge on Arduino, and EasyEDA, AUTOCAD