Agrisoft Systems
NEWSLETTER
Twenty-fifth edition, Apr.— Jun. 2018

Message from the Management

OMP 9.3 coming up

Dear Customers and Friends,

We are in the final stages of preparing the next major release in the OMP development cycle, which will carry the version number 9.3. The main focus of this release is to add support for Spanish and Indonesian language in the OMP user interface. As described in the previous edition of this newsletter, providing multi-language support for the user interface of a program is highly non-trivial, as all labels and captions must be set dynamically at runtime without conflicting with the alignment and positioning of the buttons, textboxes and other components of the UI. Nevertheless, multi-language has become an ever more important requirement with OMP continuing to spread to the different oil palm growing regions of the world.

The new language versions are not the only change to the user interface in OMP 9.3. In fact, a new layout has been applied to all reports in the main OMP-DBMS application, and many reports have been redesigned to improve data presentation and clarity. One big change is that conditional formatting has been added to display zeros in grey in some situations. This makes the significant non-zero numbers stand out and can greatly improve readability in some situations, e.g. to see at-a-glance in which months there was non-zero fertilizer application in a given block.

Significant additions have also been implemented in the OMP Field Survey (OMP-FS) module. OMP-FS offers a flexible and integrated solution for surveying all kinds of field data using smartphones or tablets, and is described in more detail in the feature article in this newsletter. Starting with OMP 9.3, it will be possible to define “thresholds” for any question in OMP-FS. A threshold is a bound which describes what the

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normal or acceptable range for the given survey parameter is. A block in which the threshold is violated is referred to as an “offender”. Introducing the concept of thresholds and offenders formalizes the idea of exception reporting with OMP -FS. In particular, a pair of new reports have been added to the program which are designed explicitly to provide an overview of the survey results with a focus on blocks where parameter thresholds are violated. This makes it easy for managers to rapidly intervene at the right places when survey results indicate that action is needed. For example, a use case might be to carry out regular pest census surveys counting the number of leaf eater insects in a certain growth stage and to define a threshold that specifies the bound above which spraying is necessary. The new reports also make it easy to identify repeat offenders, i.e. blocks which have consistently violated the threshold over 2 or 3 successive surveys. Such repeat violations might be a signal for deeper underlying problems in the respective blocks, which may warrant further investigation. Another important addition to OMP-FS is a dedicated data analysis form and report to export raw survey point data in a format that is perfectly suited to easily create GIS point maps of any surveyed parameter.

Of course, the new OMP version also contains a multitude of smaller improvements and additions throughout the program, which will be described in detail in the upgrade guide document distributed with the update. While it is not possible to list all changes here, a lot of work was put in to streamline and improve the basic data analysis processes in preparation for the upcoming SQL Server migration.

In the main feature article of this newsletter we take a closer look at key strengths of the OMP-FS module and why we think it is a game-changer for field data collection. As usual, the newsletter concludes with a “What’s new” section, which gives an overview of the different things we are working on.

Yours sincerely,

Max Kerstan

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OMP Field Survey

Thomas Fairhurst[1] and Max Kerstan[2]

1. Introduction

All plantation managers recognize that reliable field data collection, analysis and interpretation is key to efficient plantation management. Plantations collect data on a wide range of often inter-related topics, from crop quantity and quality over plantation agronomy and field upkeep to pests and disease incidence. In the past, data was recorded on paper forms and data was then transferred to computer spreadsheets and databases that provide the means for data analysis and the basis for data interpretation. More recently, it became possible to use some high-end and costly GPS equipment with data dictionary capability for digital and georeferenced data collection, eliminating the requirement for data transcription. Drones can now be used to collect aerial imagery on plantations but, since drones are so far only able to capture data from above the oil palm leaf cano-py, there is still a requirement for data collection by field personnel during ground surveys.

Agrisoft Systems, in collaboration with Tropical Crop Consultants (TCCL), has developed OMP Field Survey (OMP-FS), an app for relatively low-cost Android devices that can be set up to collect verifiable georeferenced data based on field measurements or observations. In this article we will de-scribe how this app can be used with handheld devices to improve data collection efficiency and reliability, eliminate the need to transpose data from paper forms and provide the possibility to rapidly generate useful information in the form of tables and maps that can be used to guide plan-tation management interventions.

2. Key features of the Field Survey app

2.1. Cost effective solution for data collection and aggregation

A key advantage of the OMP-FS app is that it can be used on any Android-based handheld device[3]. The app makes use of built-in georeferencing capability that features in almost all smartphones and tablets. Whilst the app can record the geo-coordinates of the survey point 'on the fly', for increased accuracy it may be advantageous to georeference accurately each designated data collec-tion location with a GPS device supporting differential correction. Subsequent surveys can be car-ried out with a handheld device that makes use of the pre-recorded georeference data for each data collection location. All data collected can be transformed into thematic or point maps using standard GIS software (Figure 1).

While raw data is typically collected at multiple locations or survey points within each block, this raw data still needs to be aggregated and processed to allow for meaningful analysis at the level of blocks, fields or divisions. Depending on

[1] Tropical Crop Consultants Limited, 26 Oxenturn Road, Wye, Kent, TN25 5BE www.tropcropconsult.com frond17@tropcropconsult.com +44 1233 811873
[2] Agrisoft Systems, Jl Prisma 66 A, Pojok, Yogyakarta 55283, Indonesia www.agrisoft-systems.com max.kerstan@agrisoft-systems.com +62 274 882606
[3] All other nutrients are applied in sufficient amounts.

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the parameter, the most meaningful aggregation method could be the simple or weighted average, sum or mode. Manually calculating a mode or a weighted average using spreadsheets can be an onerous task, but this is not necessary with OMP-FS as au-tomatic aggregation is a built-in feature.

OMP-FS is complementary to OMP in that survey data for OMP parameters which has been aggregated to block level can be imported into the main OMP database for further analysis and correla-tion with other factors. However, OMP-FS also includes powerful analysis features in its own right, which make it easy to identify problem areas quickly and enables field managers to pinpoint when and where interventions are required.

2.2. Data security

OMP FS provides robust security over data collection. The OMP operator defines a list of surveyors that have been issued with a device and are authorized to carry out surveys. Approved surveyors are only able to transmit the survey data that they have collected on the OMP-FS from the handheld device to the OMP operator by email (requires either GSM or WiFi connection) when the surveyor returns to the office.

2.3. Flexible and robust survey design

To ensure uniformity in data collection, the formulation of survey questions and the design of surveys is controlled by the OMP operator under the guidance of the field management team. Survey templates are then sent to each surveyor's handheld device by email and the surveyor imports these into the OMP-FS app to update the definitions on his handheld device. The surveyor is then able to conduct surveys as requested by the OMP operator under instruction from the field manager. Figure 1 provides a flow chart of the data collection and analysis process using OMP-FS.

Survey questions are grouped in two categories:

- The app can be used to collect data for **existing OMP fields** (e.g. petiole cross section, drainage status, leaf nutrient deficiency scores). For such survey questions, the app automatically uses the data format (e.g. numeric data or pickup list) that is defined in OMP and data is summarized appropriately (e.g. total, mean, mode) such that block-level results can be imported directly into OMP.

- The app can also be used to collect data for **user defined fields** (e.g. incidence of grass weeds, incidence of poor drainage), even if there is no matching field in the main OMP application. For such surveys, an appropriate data format (e.g. numeric data or pickup list) is selected and data can be summarized (e.g. total, mean, mode) as required at block and division level. This feature gives OMP-FS almost unlimited flexibility.

OMP-FS provides the means to allocate each survey question to different survey types, including the possibility of reusing questions in multiple survey types.

2.4. Setting up data collection locations in the field

A range of different data collection locations can be defined in the plantation:

- Most plantations identify and label a grid of sample datum points (SDPs)[4] at every tenth palm in

[4] In the past referred to, somewhat ambiguously, as leaf sampling units or LSUs.

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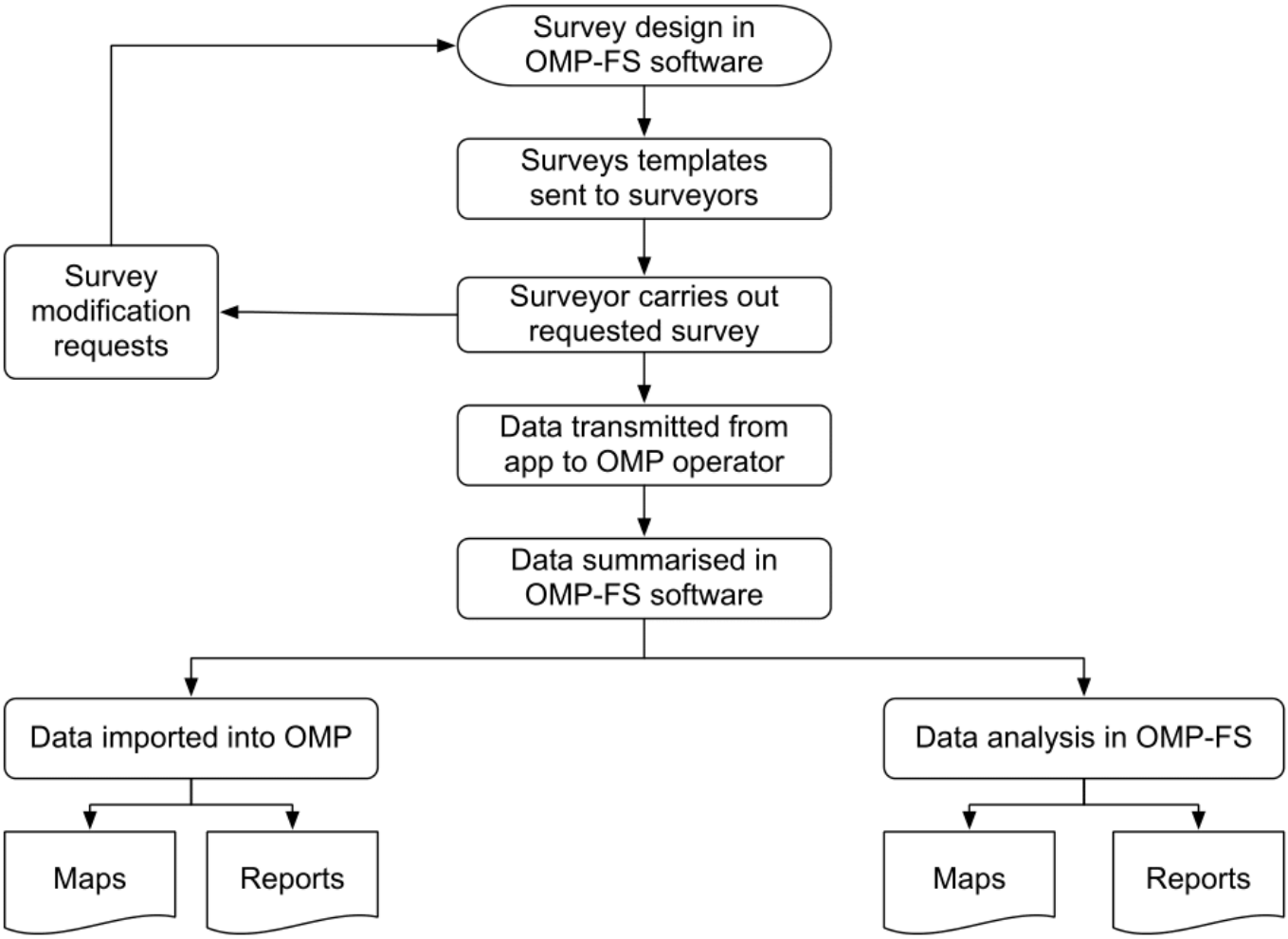

Figure 1. Flow diagram showing the steps for survey template design and distribution, data collection and reporting.

every tenth row (i.e. 1% sample). SDP palms are used primarily for leaf and soil sampling but they can also be used as sampling points for other field surveys as well as pest and dis-ease patrols. A 30 ha block planted at 143 palm/ha will contain about 40 SDPs. Typically, a sur-veyor can cover 20–40 ha/day or about 500–1,000 ha/month, depending on the amount of work involved in the survey. Since several different surveys must be carried out as part of routine management, 1–2 handheld devices may be required in each management unit of 1,000 ha. The SDPs are usually labelled with the row number and palm number but it is also possible to label SDPs with quick response (QR) barcode labels, which can be scanned by a handheld device to verify that the surveyor visited the sampling point.

- Sample datum rows (SDRs) can also be defined, for example for black bunch surveys used for crop forecasting. In the black bunch survey example, the surveyor counts the total number of black bunches in the designated row and the

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number of palm points assessed. The OMP-FS then calculates the average black bunch count per palm.
- Data collection locations can also be defined for other purposes. For example, each crop collection point (CCP) can be identified and the OMP-FS app used to record the quantity (number of bunches) and quality (number of unripe, under ripe, ripe, over ripe and rotten bunches, number of bunches with long stalks, quantity of loose fruit) of crop delivered. Data for CCPs can then be plotted in maps and summarized for each block.

Data collection locations should be labelled and georeferenced:
- Each SDP can be labelled by painting the row and palm number on the palm trunk. Alternatively, each SDP can be labelled with a quick response (QR) card that contains the SDP's unique identification (e.g. Div1#Sec4#104D#R20#P15) and georeference.
- The first and last palms in an SDR can be labelled and georeferenced.
- CCPs used to monitor crop quantity and quality can also be labelled with the CCP's unique identification (e.g. Div1#Sec4#104D#CCP24) and georeference.

Data collection locations need only be georeferenced once (possibly with a GPS with differential correction) and each georeference recorded in the OMP-FS. The OMP-FS app is then only used to verify that the surveyor visited all data collection locations. In addition, the smartphone records a GPS 'digital trail' of the surveyor's movements.

2.5. Types of raw data collection

The app is designed to allow the collection of almost any kind of qualitative or quantitative data (Table 1).

2.6. Use of expressions to transform raw data into calculated parameters

In addition to spatial aggregation, the OMP-FS software can also perform more general calculations on raw data collected in the field with user-defined expressions or formulae. The OMP-FS is used to capture raw data so that the requirement to perform calculations in the field is eliminated. For ex-

Table 1. Examples of survey questions.

Entry mode	Example of question text	Response values
Picker	Condition of weeded circles	Clear, Weeds, Weeds + debris
Entry	Petiole width in mm	General number
Slider	Canopy leaf eater damage rating	0 to 5
Stepper	Abnormal palms per SDR	Integer
Button	Abnormal palms removed?	'Yes' or 'No'

Each survey parameter can be designated as a compulsory question where the surveyor is forced to enter data before moving to the next survey point.

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Table 2. Sample use cases for expressions in OMP-FS

Raw data	Unit	Calculated parameter	Unit	Formula
Petiole width	mm	Petiole cross section	cm^2	Petiole width x petiole depth ÷ 100
Petiole depth mm	mm			
Number of leaflets on one side of frond	-	Leaf area	m^2	0.55 x (number of leaflets x leaflet width x leaflet length x 2) ÷ 1,000,000
Leaflet width	mm			
Leaflet length mm	mm			
Leaf area	m^2	Leaf area index	-	Leaf area x number of green leaves x planting density ÷ 10,000
Number of green leaves	-			
Planting density	p/ha			
Circle weeding score (1 to 3)	-	Overall field upkeep score	-	(circle weeding score + pruning score + … + drainage score) ÷ (3 x (number of questions))
Pruning score (1 to 3)	-			
…	-			
Drainage score (1 to 3)	-			
Number of caterpillars per frond	-	Pest attack severity rating (0 to 3)	-	If # caterpillars < 3 then 0 Else if # caterpillars < 10 then 1 Else if # caterpillars < 30 then 2 Else 3

ample, during a survey of palm vegetative growth, the surveyor collects raw measurements and all calculations are performed by the software (Table 2). Besides this, expressions can be used to calculate more advanced data analysis quantities such as summary scores combining multiple parameters.

3. Practical application of the OMP-FS app and software

We will now describe some of the practical uses of the OMP-FS app and software.

3.1. Leaf and soil sampling

Most plantations carry out leaf sampling in all blocks each year. The normal practice is to collect leaf and rachis samples at each SDP. OMP-FS provides the means to collect additional data that can be used to improve the diagnosis of nutrient status:

- Nutrient deficiency scores can be recorded at each SDP and summary data imported into OMP.

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This provides the means to investigate the relationship between leaf nutrient concentrations and the appearance of deficiency symptoms in OMP.

- Vegetative measurements (e.g. petiole cross section, leaf area, leaf area index) can be recorded at all or selected SDPs and summary data imported into OMP.

Similarly, supplementary data (e.g. soil texture assessed using the finger test) can be collected at each soil sampling point and summary data imported into OMP.

3.2. Pest and disease surveys

All planters will be familiar with the tedious task of transforming pest and disease data collected on paper forms into digital format so that data analysis can be carried out. OMP-FS provides the means to set up pest and disease surveys so that data collected at each SDP can be rapidly transformed into maps and summary tables that form the basis for planning follow-up interventions in the field. For example:

- Pest and disease incidence can be mapped to show areas where control measures are required. Results from subsequent surveys can be used to verify whether control measures have been effective.
- The dominant stage in the life cycle of a pest can be identified from the results of regular pest and disease surveys so that the control measures can be timed to coincide with the most susceptible growth stage. This is particularly important in the case of leaf eating insect management.
- Present yields can be related to the extent of leaf canopy damage assessed and recorded in the past. In this way, a plantation can attempt to quantify the commercial losses due to leaf eaters or other pests.

3.3. Measurement of crop quantity and assessment of crop quality

In many plantations, workers are paid by the number of bunches harvested. OMP-FS app can be used to record the number of bunches at each CCP and the data used to calculate worker payments. An advantage of using the OMP-FS for this purpose is that it is possible to verify that the surveyor visited each CCP.

Crop quality can also be assessed at each CCP. In addition to recording the number of bunches, the surveyor records the number of unripe, under ripe, ripe, over ripe and rotten bunches as well as the number of bunches with long stalks and the amount of loose fruit.

Acceptable thresholds can be defined for calculated parameters such as the fraction of unripe or rotten bunches. Dedicated reports in OMP-FS make it easy to focus on ‘offender’ blocks where thresholds have been exceeded, and to pick out repeat offenders where there may be particular need for manager intervention.

Data on crop quality and quantity can be transformed into maps. For example, a map can be produced showing the percentage of ripe bunches (dot size) and whether stalks have been removed (dot colour).

3.4. Organization and supervision of cyclical and selective field work

Most field work in oil palm plantations is carried out in repeating cycles (e.g. harvesting, pruning,

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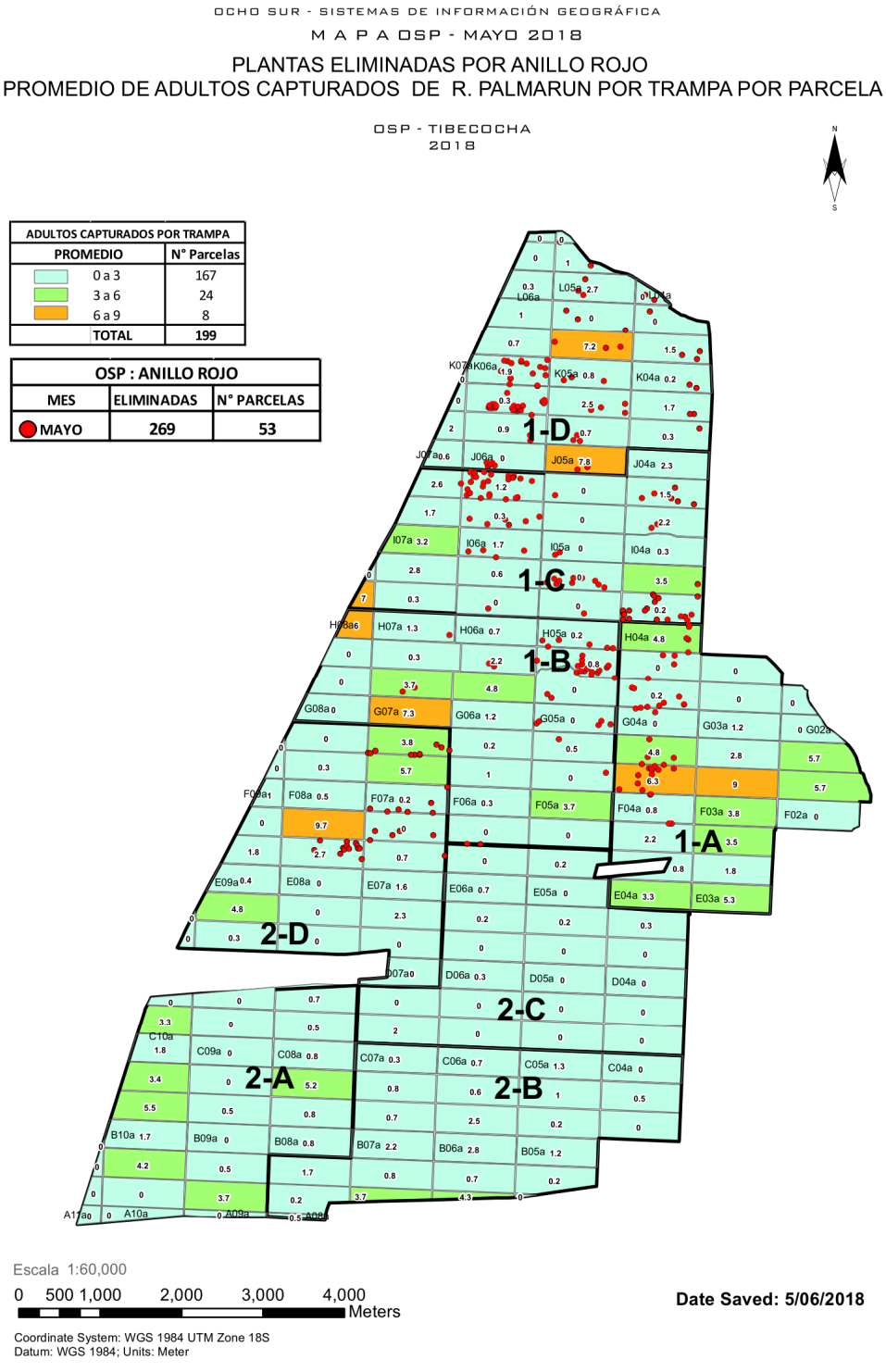

Figure 2. Point map showing incidence of red ring disease and rhinoceros beetles in a plantation in Peru based on data collected with OMP-FS.

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circle and path weeding, fertilizer application). Some field work (e.g. selective manual weeding, selective chemical weeding, drain maintenance) is best carried out selectively. In such cases, workers sweep through all blocks, but the supervisor ensures that work is only carried out where it is required. For example, workers only slash or spray patches of grass weeds. In practice, this is difficult to achieve – either the field work is insufficiently 'selective' or areas requiring work are missed – and inefficient. This problem can be solved by carrying out a survey before work is carried out to identify areas requiring intervention. Data for each SDP can be presented in a point map where each point is coloured or sized to indicate field conditions (Figure 2). For example, if drainage is scored at each SDP, a map can be produced showing where drainage improvements are required. The field manager can then use the map as the basis for planning and organising implementation. A second survey could be carried out on the same set of blocks after the work has been completed to verify that work has been completed satisfactorily.

By defining meaningful thresholds and analysing (repeat) offender blocks, it is also possible to monitor and maintain high standards of regular cyclical field work such as pruning or harvesting.

4. Conclusions

We think the OMP-FS provides a breakthrough in data collection and management in oil palm plantations. Paper forms are eliminated from the process of data collection and it is possible to verify that the surveyor has visited all the designated data collection locations in the field. All data can be readily transformed into tables as well as thematic or point maps that provide management with the basis to plan and monitor the implementation of field practices. Automatic aggregation and powerful data analysis features such as custom expressions mean that data can be converted into usable information sufficiently quickly to allow for corrective measures in the field even before a problem gets out of hand. Over the past few years, the use of drones has attracted much attention in the plantation industry but most plantation managers recognize that the collection of reliable and verifiable data based on ground surveys will continue to be a vital feature of plantations for many years to come.

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From the developers desk

A selection of the on-going developments and plans which are part of our constant efforts to continue to improve Agrisoft products.

SQL Server migration goals

- Single unified backend for all OMP add-ins, automatic consistency of block lists and other key data
- Integration of add-in data into main OMP reports
- Script-based in-situ version updates, no need to import data from previous versions manually when updating OMP
- Improved speed when running OMP in client-server topologies
- Support for large data sets beyond limits of Access
- Support for automatic back-up procedures and cloud hosting
- Improved security and data locking
- Easier integration with other Business Intelligence (BI) tools

OMP Mapper

- Standalone application for OMP data mapping with no requirement of any host program like MapInfo or ArcGIS
- Import base maps from shapefiles
- Overlay maps on satellite images
- Support for thematic maps for block-based OMP quantities and point maps for georeferenced point data from OMP-FS