Agrisoft Systems
NEWSLETTER
Forty-eighth edition, Jan.— Mar. 2024

Message from the Management

Unlocking Insights from Above: AI-Powered Analysis of Oil Palm Plantations

Dear Customers and Friends,

In the ever-evolving landscape of agricultural technology, the fusion of artificial intelligence and computer vision is revolutionizing the way we understand and manage our resources. A prime example lies in the extraction of invaluable insights from aerial imagery of oil palm plantations, thanks to advances in AI-based computer vision and object identification.

These breakthroughs make it possible to extract a wealth of information previously unimaginable from aerial imagery. Examples include the following:

- Precise palm point localization: AI algorithms can pinpoint individual palm points, providing detailed maps and counts.
- Thinning to reduce inter-palm competition: Voronoi diagrams can be used to easily identify regions in the plantation where palms are too close to each other in order to identify candidate palms for thinning.

- Height and canopy measurements: Accurate assessments of palm heights and canopy sizes provide a picture of vegetative growth, a key indicator of capacity to produce fruit.
- Categorization of palms: Palms can be categorized to provide an accurate palm census in the categories mature, immature, new/supply, abnormal or dead palms as well as vacant or unplantable points.
- Pest damage severity: Identifying the severity of leaf-eating pest damage aids in targeted interventions.
- Plant health and nutrient deficiencies: Utilizing multi-spectral imagery allows for the assessment of plant health scores and detecting signs of nutrient deficiencies.

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Whether sourced from drones or satellites, these images offer a cost-effective and rapid alternative to traditional ground-based surveys. The advantages are manifold: covering vast areas in record time, with the potential for high accuracy in key metrics such as palm counts and location.
Agrisoft is working in collaboration with our partners at TCCL on making this technology more accessible for our customers. We're exploring ways to support them from image collection in the field to leveraging trained AI models for object detection, seamlessly integrating the results into the Oilpalm Management Program (OMP).

While this is currently in the initial stage, we are very excited by the many possibilities and look forward to incorporating these technologies into our solutions for the oil palm industry. The upcoming TCCL Workshop on Yield Intensification to be held in Wye in May will be a great opportunity to discuss more about this topic with our collaborators and customers.

In the rest of this newsletter, we again pick up a topic from previous newsletters: the OMP Field Survey module. In particular we take look at an example of how the system can be used for exception reporting. The “What’s new” section at the end of this newsletter provides an overview of some of the topics we are working on.

Warm regards,

Max Kerstan

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Monitoring and reporting with OMP Field Survey

In a previous edition of this newsletter, we have discussed data collection with the OMP Field Survey (OMP FS) system. We would now like to discuss how the tool can be used for exception reporting by looking at a simple but realistic example.

Plantation managers have to constantly monitor many different parameters within the blocks they are responsible for, for example that harvesting and field upkeep standards are being maintained or whether there are any pest or disease outbreaks. In this context it can be very useful to establish a system of routine OMP FS surveys, in particular as an early warning system for issues that require quick intervention such as a pest outbreak or when production suffers due to harvesting problems. OMP Field Survey contains a number of features that are specifically designed to make this as easy as possible.

As an example, let us assume that our plantation has previously had problems with low oil extraction rates due to fruit being harvested at non-optimal ripeness. To address this, we set up a regular survey to grade the ripeness of harvested crop at random locations in the plantation. The primary aim is to identify instances of incorrect harvesting, so that we can follow up with the responsible harvesting team and supervisor. As a secondary benefit, we expect general compliance levels to improve as a simple consequence of all the harvesters knowing that these surveys take place and that they have a chance of being caught and having to face consequences for not reaching the target harvesting standards.

Our sample survey type is very simple, it contains just four simple questions where the surveyors can put in the number of unripe, underripe, ripe and overripe bunches they find at a fruit collection point (see Figure 1). The aim is to survey blocks in a random pattern so that harvesters cannot anticipate in advance when their area will

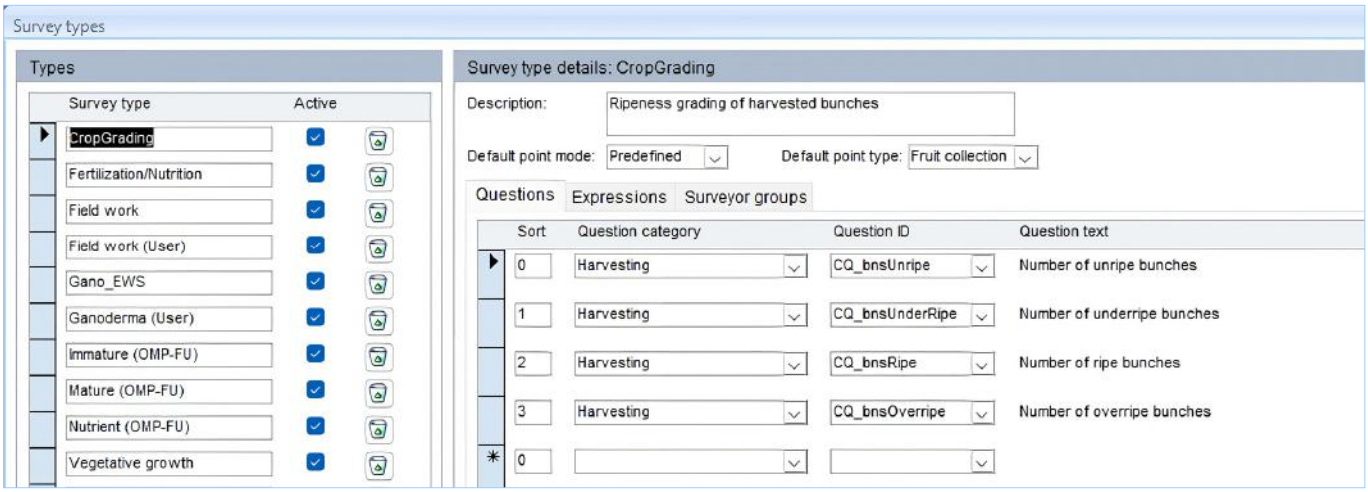

Figure 1: Sample crop grading survey type.

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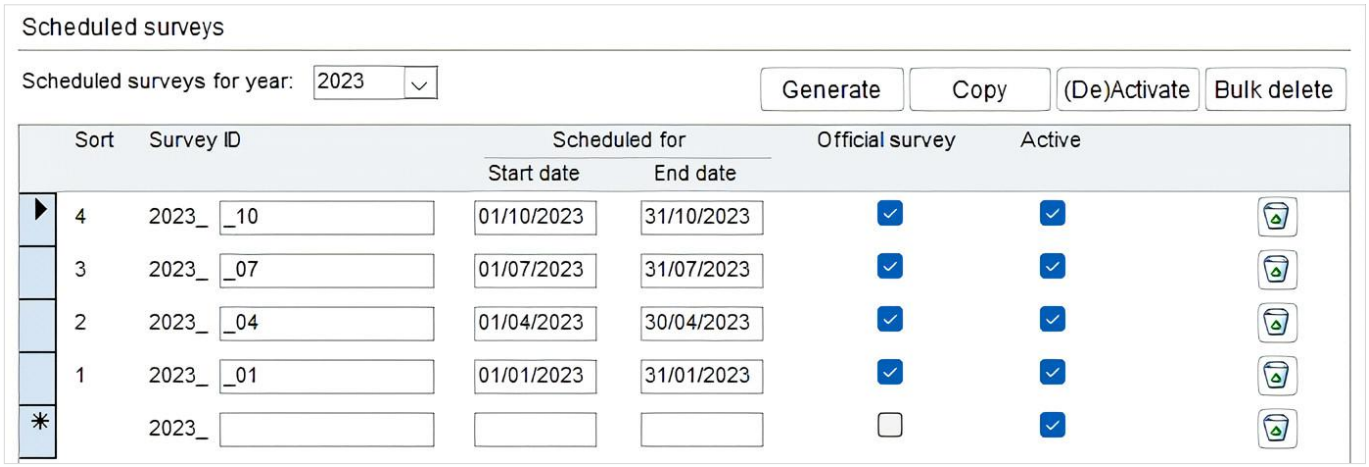

Figure 2: Quarterly scheduled surveys.

be surveyed, but covering every block roughly every 3 months. In order to be able to analyse how the harvesting performance develops over time, we define 4 quarterly scheduled surveys corresponding to the 4 annual rounds of surveying per block.

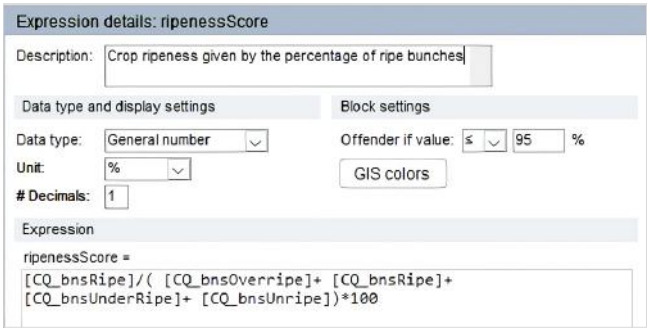

Figure 3: Expression for percentage of ripe fruit.

In order to more easily compare results from different blocks, we define an expression that calculates the percentage of ripe bunches from the raw survey data. After adding it to the survey type, it is displayed on all the data analysis forms and reports. Using this kind of expression makes it much easier to see at a glance whether the ripeness level achieved in a certain block is good or bad, rather than looking at the raw numbers of bunches in each ripeness category.

Note that the expression is also shown at higher aggregation levels and can for example be used as an easy indicator of harvesting performance at division level (see Figure 4). It is also integrated with OMP-GIS and you can easily output GIS maps showing the value of OMP FS expressions by block.

To make it even easier to identify problematic areas, OMP FS allows you to enter acceptable limits or targets for each individual question or expression. A block where the survey result violates this acceptable limit is called an “offender”. Note that in figure 3 we have defined an offend-

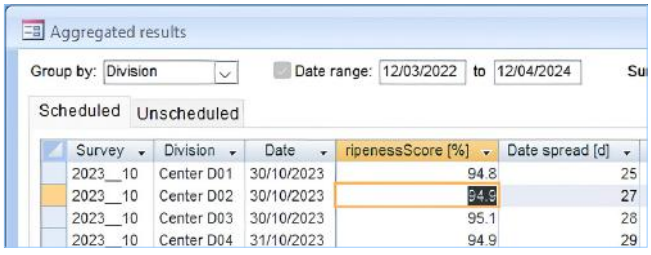

Figure 4: Ripeness score aggregated at division level

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er limit of a minimum ripeness level of 95%. The offender bound is used on the reports available in OMP FS. Figure 5 shows a part of the report "Results and offenders". This report allows us to select up to three scheduled surveys to compare (in the screenshot we have the 1st, 2nd and 3rd quarter of 2023 surveys). Charts and tables provide an overview of how the distribution of results and number of offenders changed between surveys, making it easy to get an overview of whether the situation is getting better or worse. We also get information on the number of repeat offenders (blocks which were offenders in more than one of the selected surveys) and im-

Survey type: CropGrading — **Agrisoft Demo Estate**

Survey 1: 2023__10
Survey 2: 2023__07
Survey 3: 2023__04

Expression: ripenessScore

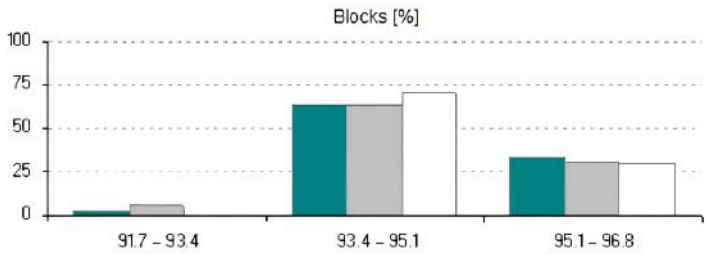
Division summary

Division: Center D01

Aggregated results

	Eff. date	Date spread d	Result %
Survey 1	30/10/2023	24	94.8
Survey 2	30/07/2023	26	94.7
Survey 3	29/04/2023	26	94.8

Spread of results

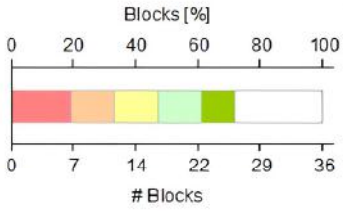


Progress/Offenders

	# Blocks			Area
	Total	Surveyed	Offenders	Offenders
Survey 1	58	36	23	681 ha
		62.1 %	63.9 %	65.1 %
Survey 2	58	36	21	607 ha
		62.1 %	58.3 %	57.6 %
Survey 3	58	31	19	598 ha
		53.4 %	61.3 %	66.0 %

Offenders in survey

Offenders/Improvers in survey 1



Block details (surveyed in survey 1)

Division: Center D01 **Field: MT04**

Block	Survey 1		Survey 2		Survey 3	
302E	11/10/2023	94.7	13/07/2023	93.5	18/04/2023	95.0
315B	21/10/2023	93.4	13/07/2023	94.1	03/04/2023	95.3
303A	14/10/2023	94.6	28/07/2023	95.8	16/04/2023	95.0
305A	25/10/2023	94.6	27/07/2023	95.9	12/04/2023	96.0

Figure 5: Part of report "Results and offenders".

Feature

provers (blocks which were previously offenders but no longer violate the offender bound in the latest survey). Finally, the block details section gives us a look at the scores of the individual blocks, with offender blocks highlighted in red and sorted to the front. Clearly, this report is ideal to monitor compliance with a specific metric or parameter (in this case crop ripeness) and to quickly identify offender blocks for potential follow up action.

The other main report in OMP FS is the report "Survey results overview" shown in Figure 6. This report provides information on all the questions and expressions of a survey type, again showing how the value and number of offenders developed between different surveys. It is clear that this report is particularly useful if our survey type contains various parameters that we are monitoring at the same time as we see everything at a glance.

The example given in this article shows how the reporting features built into OMP FS can help managers to set up a regular survey type to monitor performance of a particular metric. Of course, the crop ripeness example we have discussed is just one of many potential use cases. Other possible use cases include early warning pest or disease patrols, crop loss audits as well as monitoring of field upkeep standards or visual nutrient deficiencies.

Division summary

Division: Center D01 # Blocks (surveyed/total): 36 / 58

Question/Expression	Unit	Value		# Offenders [-]			Fraction of blocks [%]
		Survey 1	Survey 2	Survey 1	Survey 2	Both	0 20 40 60 80 100
CQ_bnsUnripe	b	250	239	0	0	0	
CQ_bnsUnderRipe	b	1,168	1,136	0	0	0	
CQ_bnsRipe	b	43,301	42,694	0	0	0	
CQ_bnsOverripe	b	964	1,016	0	0	0	
ripenessScore	%	94.8	94.7	23	21	12	

Block details (surveyed in survey 1)

Division: Center D01 Field: MT04

Question/Expression		302E		303A	
		Survey 1 11/10/2023	Survey 2 13/07/2023	Survey 1 14/10/2023	Survey 2 28/07/2023
CQ_bnsUnripe	b	7	13	15	10
CQ_bnsUnderRipe	b	51	37	55	36
CQ_bnsRipe	b	1,388	1,377	1,735	1,713
CQ_bnsOverripe	b	19	45	30	29
ripenessScore	%	94.7	93.5	94.6	95.8

Figure 6: Part of report "Survey results overview".

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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.

Interfacing with ERP systems

- Change log tables where the external systems can push a log of changes to reproduce in OMP (records added, deleted or updated)
- Triggers and stored procedures in the back-end to handle updating of all dependent tables
- Support for pushing daily production, fertilizer and application and pesticide application data
- Updating of key master data (block lists, block areas, fertilizer names,…)
- Automated handling of OMP data update with no regular human input
- Handling for OMP data locking, process to repeat when the OMP table is no longer locked

General improvements

- Additional spatial reporting level “plantation” between division and estate levels
- Option to exclude HCV areas in fertilizer calculations separately for organic and inorganic fertilizers
- Additional grouping options on fertilizer reports and data analysis forms
- Actual vs recommendation reports for nutrients
- New 3 year nutrient application report
- API for OMP-FS data transfer
- Automatic synchronization/recalc of daily and monthly production tables
- Possibility to save OMP-GIS background layers as part of OMP data file for easy re-using

Palm points table and mapping

- Tables to store ID and georeferenced positions of individual palms
- Columns to record palm status, e.g. mature, immature, abnormal and so on
- Support for mapping individual palm points in OMP-GIS
- Import palm points from the results of drone or satellite image analysis
- Voronoi diagrams and palm density heat maps to identify areas needing thinning
- Automatic assignment of palm points to blocks by intersecting with block boundary layer