Agrisoft Systems
NEWSLETTER
Fifteenth Edition, Jul. - Sep. 2015

## Message from the Management

# Tackling the problem of oil palm fertilizer recommendations

Dear Customers and Friends,

As already advertised in the previous edition of the Agrisoft Systems newsletter, the last quarter has brought the release of the new OMP Fertilizer Planner add-in program. From a software developer's perspective, the Fertilizer Planner has been one of the most interesting projects we have tackled at Agrisoft Systems over the past few years. On the face of it the problem of generating fertilizer recommendations seems to be perfectly suited to being automated with suitable computer algorithms, because at least in principle it is an empirical exercise which involves evaluating large quantities of agronomic data for all blocks in a plantation. However, at the same time it is crucially important to adjust fertilizer recommendation algorithms to the specific situation of each plantation site to derive effective recommendations, which is a fundamental problem for any fixed computer algorithm. From the first stages of the program design it was clear that finding a good compromise in light of these points would be the main challenge of the development project.

The OMP Fertilizer Planner tackles this problem by giving the user full flexibility in specifying and editing the rules and algorithms used to derive fertilizer recommendations at each site. While the easy to use interface makes it very simple for the user to tweak the algorithm to his liking, the powerful built-in optimization routine takes over the job of evaluating the rules against the OMP data for each individual block and at the same time minimizing the fertilizer cost. With the OMP Fertilizer Planner it is easy to create multiple

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different scenarios to investigate how more or less stringent conditions would impact the fertilizer budget, which requires major time and effort when done “manually” with spreadsheets. To the best of our knowledge there is no other general fertilizer recommendation tool which comes close to the power and flexibility of the OMP Fertilizer Planner. A more detailed look at the program features can be found in the later parts of this newsletter.

Besides the OMP Fertilizer Planner the main focus of the Agrisoft Systems development team over the past months has been on improving the harvest process control features of OMP HRR and on continuing the development of the Banana Management Program (BMP). With the growing use of handheld barcode or RFID scanners to record daily production in oil palm plantations, it is becoming ever easier to import this data into OMP on a daily basis. This opens up possibilities for many new features in OMP focusing on harvest process control, such as harvest round sheet reports, reports on blocks that are late for harvesting or that were only partially harvested, GIS maps showing days since last harvest per block, etc. The BMP project has also made significant steps forward in the past months and now offers a quite comprehensive coverage of the entire production process on banana plantations, from bunch bagging and tagging over production forecast to recording of bunch and box production as well as container shipping. Our next plans for the BMP project are to include coverage of nutrition and fertilizers as well as field upkeep, so there is no shortage of exciting developments to look forward to.

Yours sincerely,

Max Kerstan

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## What's New

# OMP Fertilizer Planner

Optimizing fertilizer inputs is one of the most important topics in oil palm plantations both from an agronomic and a financial perspective. This is because fertilizers on the one hand provide means to increase yields by more than 50% on the poor fertility soils predominant throughout most oil palm growing regions, while on the other hand typically accounting for more than half of the variable cost of production. Clearly, to derive the most effective fertilizer recommendations it is at least in principle necessary to separately evaluate the nutrient requirements of each block. Furthermore it may be possible to achieve significant savings on the fertilizer bill by reducing fertilizer doses in blocks where yield or fertilizer efficiency is limited by other agronomic factors such as poor drainage, severe erosion or incomplete harvester access.

As the OMP database stores data on a wide range of agronomic parameters from leaf and soil nutrient levels over production parameters to field upkeep scored, it is ideally suited to act as a data source for the generation of fertilizer recommendations. The OMP Fertilizer Planner uses this data set to generate fertilizer recommendations in two distinct steps. In the first step, the program uses the OMP data with the nutrient application rules entered by the user to evaluate nutrient targets for each block. In the second step the program derives the actual fertilizer recommendations by minimizing the overall cost while trying to meet the nutrient targets as closely as possible. In contrast with most fertilizer tools the optimization routine can handle both compound and straight fertilizers. A particular advantage of the OMP Fertilizer Planner is that it is very easy to create and compare multiple different scenarios with varying nutrient or fertilizer application rules.

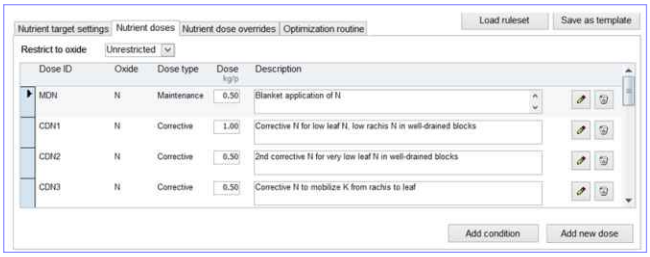


**Figure 1: Scenario with maintenance and corrective doses for nitrogen.**

When creating a new fertilizer scenario the first step is to define nutrient doses, together with rules which determine under which conditions each nutrient dose is to be applied. Conceptually it is useful to distinguish between 'maintenance doses' which are applied to almost all blocks and 'corrective doses' which are applied only to blocks exhibiting a nutrient deficiency or especially high nutrient demands e.g. due to high yields. Figure 1 shows a sample scenario with a maintenance dose and three corrective doses for nitrogen. Doses are cumulative in the sensethat a block which meets the conditions of multiple doses will receive the sum of the individual nutrient doses. The exception to this rule is given by the third type of dose which exists in OMP Fertilizer Planner, the so-called 'priority dose'. This type of dose should be defined with very stringent rules such as to apply only to blocks with severe deficiency of a certain nutrient. If a priority dose is applied to a block, all corrective doses belonging to other nutrients are cancelled in this block. This reflects the fact that little to no effect can be expected by applying other

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nutrients before the severe deficiency is corrected.

The key component of the OMP Fertilizer Planner application is the rule-builder form, shown in figure 2. Using the lists on the lower part of the screen, the user can select fields to use in the where condition. The lists contain more than 150 data fields ranging from leaf and soil analysis results over yield parameters and field upkeep statuses to climate and water deficit data. It is also

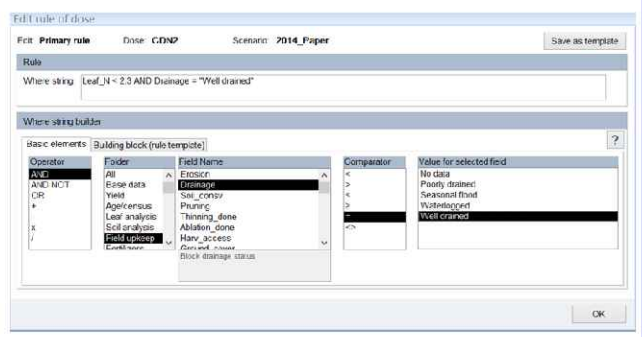


**Figure 2: The rule-builder form.**

possible to edit the where condition directly, allowing advanced users almost unlimited flexibility in designing rules. For example, it is straightforward to create a rule involving a yield response curve derived from a fertilizer trial.

In some cases it may be needed to cancel nutrient application in blocks meeting certain criteria. For example, it is useful to cancel nutrient application in blocks that are due for replanting in the coming year. This can be easily achieved in OMP Fertilizer Planner using so-called dose overrides. Although strictly speaking the same effect could be achieved by adding a suitable exclusion clause to the rules of all doses, it is of course much easier and quicker to simply define a single override rule.

While typically nutrient doses will be defined 'absolutely', it is also possible to switch to a mode

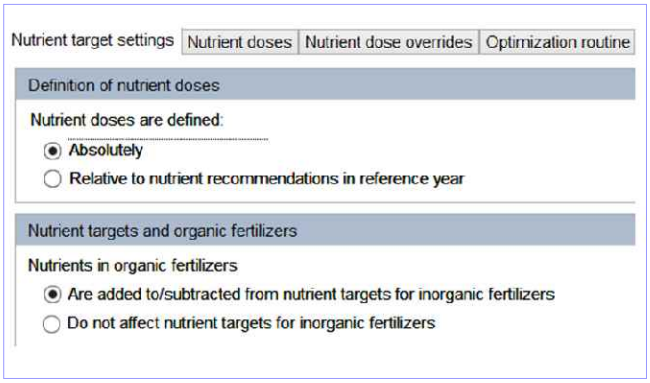


**Figure 3: General calculation settings for nutrient targets.**

where nutrient doses are defined relative to the nutrient recommendations of the previous year. In this way it is possible to 'refine' the fertilizer recommendations every year by adjusting the previous year's dose up or down depending on the observed reaction of the block. OMP Fertilizer Planner also supports nutrient substitution by application of organic crop residues such as empty fruit bunches or decanter cake. Users can enter the expected crop residue application based on the crop budget for the upcoming year and can then choose whether this nutrient contribution is to be subtracted from the raw nutrient targets when calculating the effective amount of nutrients that needs to be supplied in mineral fertilizer (figure 3).

Once nutrient doses and rules have been defined, the user can specify which mineral fertilizer sources are available together with the respective purchase, application and transport costs per ton, see figure 4. Furthermore, users can specify various side conditions including a maximum application bound, a minimum total application amount for each fertilizer and the minimal step to which fertilizer amounts should be rounded. Rounding is important as the application in the field is usually accomplished with measuring cups of a certain volume which defines the maximum

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accuracy to which applied fertilizers can be measured. Unrounded fertilizer recommendations to the nearest gram would give a spurious level of accuracy which can actually never be correctly achieved in the field. The 'minimum total application' bound can be used as a kind of 'minimum order' constraint, to ensure that a certain fertilizer type is only ordered if the total requirement exceeds a certain threshold. This is useful to avoid generating recommendations which would involve ordering small amounts of many different types of fertilizer. Finally, the user can specify the desired monthly spread in % of the annual total for each fertilizer and each block.

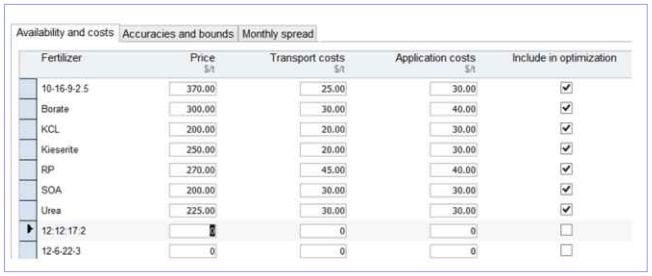
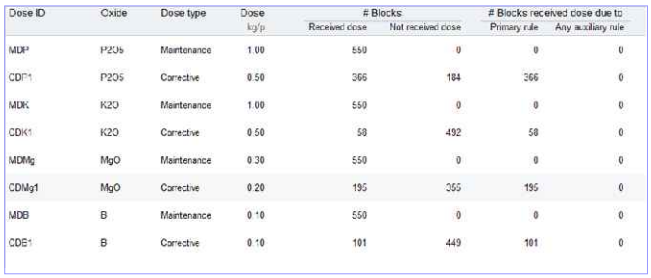



**Figure 4: Choosing fertilizer sources to include.**

Based on the settings described above, OMP Fertilizer Planner runs a specialized optimization routine to determine the nutrient targets for each block, subtract the organic matter contribution if necessary, and then work out the most cost-effective combination of fertilizers to achieve these nutrient targets within the chosen side constraints. The program contains various analysis tools to review the results, such as the screen shown in figure 5 which displays the number of blocks which receive each nutrient dose.A large selection of data analysis forms, reports and charts allow you to view fertilizer or nutrient recommendations as well as costs in different units (e.g. kg/p, bags, tons, $, $/ha,…) aggregated by different spatial levels from block to the whole estate. As usual in OMP a powerful global filter is available that allow you to select subsets of the data to focus on.



| Dose ID | Oxide | Dose type | Dose kg/p | # Blocks: Received dose | # Blocks: Not received dose | # Blocks received dose due to: Primary rule | # Blocks received dose due to: Any auxiliary rule |
|---|---|---|---|---|---|---|---|
| MDP | P2O5 | Maintenance | 1.00 | 550 | 0 | 0 | 0 |
| CDP1 | P2O5 | Corrective | 0.50 | 366 | 184 | 366 | 0 |
| MDK | K2O | Maintenance | 1.00 | 550 | 0 | 0 | 0 |
| CDK1 | K2O | Corrective | 0.50 | 58 | 492 | 58 | 0 |
| MDMg | MgO | Maintenance | 0.30 | 550 | 0 | 0 | 0 |
| CDMg1 | MgO | Corrective | 0.20 | 195 | 355 | 195 | 0 |
| MDB | B | Maintenance | 0.10 | 550 | 0 | 0 | 0 |
| CDB1 | B | Corrective | 0.10 | 101 | 449 | 101 | 0 |

**Figure 5: Review form for dose application.**

A typical process of generating fertilizer recommendations will go through several cycles of defining doses, rules and fertilizer settings, reviewing the results, and then tweaking the rules and settings as required. As mentioned before, all scenario settings can be easily saved and copied to a new scenario, making it extremely easy to

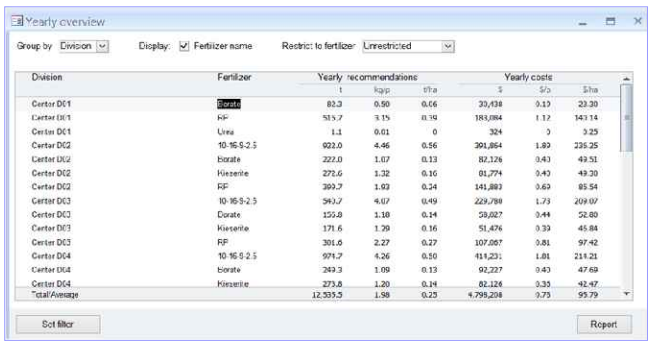



**Figure 6: Yearly overview of recommendations and costs.**

compare the effects of different assumptions or fertilizer restrictions. The settings used in the current scenario are clearly defined and can be printed out using a custom report. This makes it extremely easy to discuss the assumptions e.g. in board meetings or to obtain feedback and comments from other agronomists in a peer review process. This transparency of all

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assumptions, rules and settings throughout the entire process of generating fertilizer recommendations is one of the key advantages of using the OMP Fertilizer Planner. Of course, all fertilizer recommendations, cost data and other results can be easily exported in MS Excel format.

Even with a highly refined nutrient ruleset there will always be particular blocks in a large estate which fall out of the norm for some reason or another and which may require particular individual fertilizer recommendations. In OMP Fertilizer Planner the user can specify certain so-called 'flagging criteria' and the program will highlight blocks meeting these criteria as they may require further investigation directly in the field. The list of possible flagging criteria is very large and ranges from yield gaps over leaf or soil levels to field upkeep scores and fertilization. Blocks meeting one or more of the specified flagging criteria are highlighted on all data analysis with a little red flag symbol, see figure 7. Of course, fertilizer recommendations of individual blocks

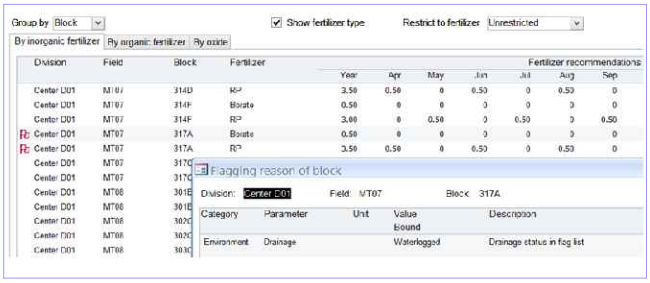


**Figure 7: Block flagged for attention due to water logging.**

and fertilizers can be edited manually if required. In this way the fertilizer agronomist has full flexibility to specify individual exceptions to the general nutrient rules.

Although of course we could not describe every program feature in this short outline, we hope that it is sufficient to provide an idea of the power and flexibility of the OMP Fertilizer Planner program. Please contact info@agrisoft-systems.com for more information or a trial or demo version of the program.

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## Visit Report

# BMP Implementation in Guatemala

In the past month an important milestone was reached in the development of our Banana Management Program (BMP) with the installation of the latest version of the program at the Bananera Nacional S.A. (Banasa) plantation in Guatemala. Due to their commitment to innovative solutions and production technologies, Banasa have supported the implementation of a comprehensive agronomy program for banana plantations in the mold of OMP and have been important partners in the development of BMP since the beginning of the project one and a half years ago. While several beta versions of the program were already trialed on site in the past, the newest version of the BMP program installed during our most recent site visit represents a significant step forward as it now covers the complete production process from bagging to export.

One of the most important components of BMP is the production forecasting module. Accurate forecasting plays a particularly crucial role for the production of fresh fruit such as bananas, as excess crop cannot easily be stored and sold at a later date and thus sales agreements must be made in advance. The newest version of the BMP forecasting module offers a mix of features to make it powerful and flexible yet easy to use. For example, the program calculates and displays

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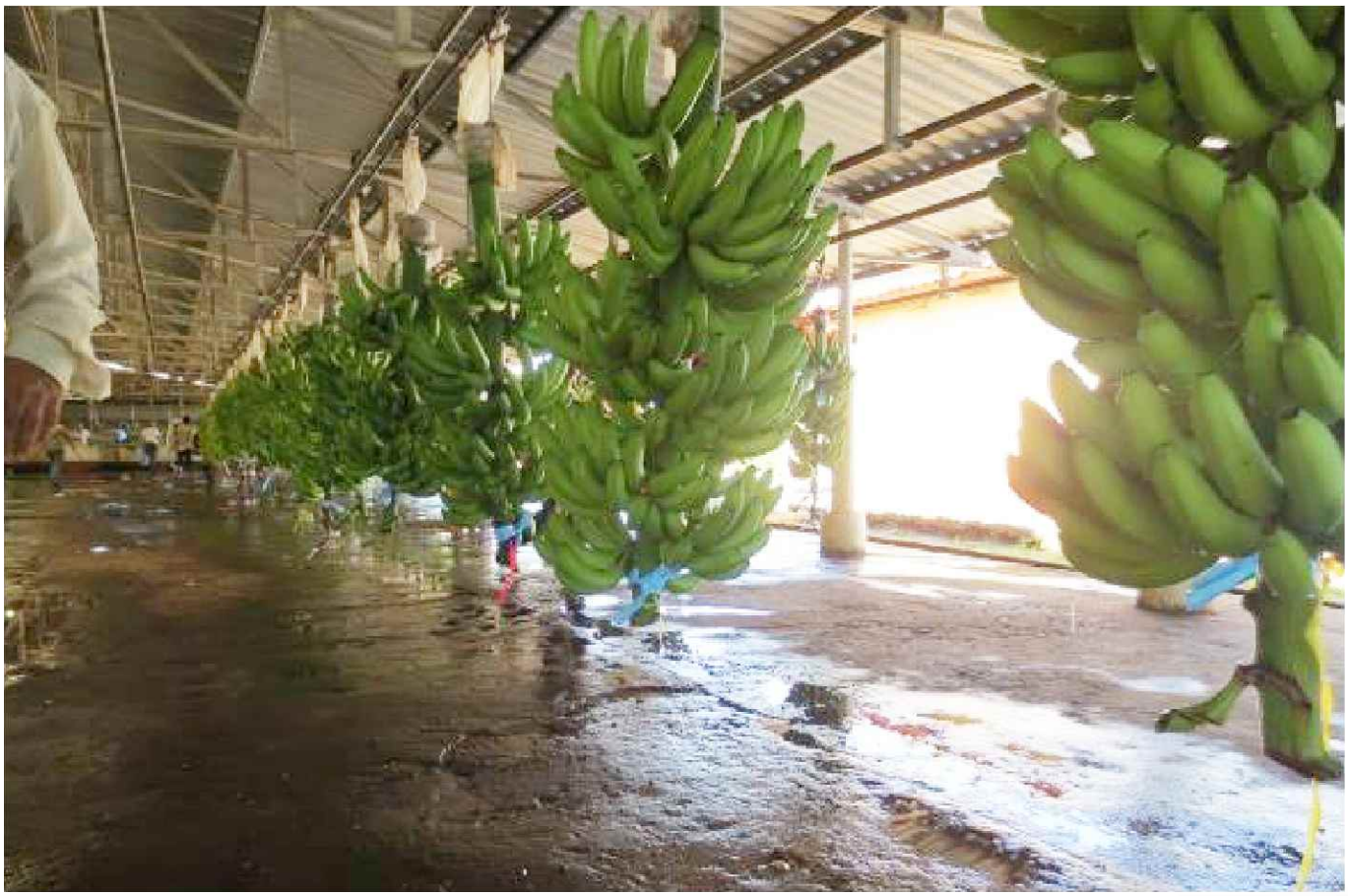
historical averages for all the forecast parameters as an entry guide for the user, who can easily choose which spatial and temporal range the averages are to be taken over. When harvesting of bunches tagged in a certain week commences, BMP can automatically adjust the forecast parameters for the coming weeks based on the latest actual data. The user can choose whether forecast prediction is to be based on a forecast of the box-to-bunch ratio or on the average bunch weight. Besides the forecast module, the new BMP version also includes powerful harvest process control tools such as reports showing the number and fraction of bunches of each tagging color which are already harvested and which are still hanging in the field. Retrieval loss forms allow the BMP user to easily monitor which percentage of fruit is lost between bagging and tagging or between tagging and harvest. Furthermore the program of course includes various forms and reports showing production details including all the most important production indicators like bunches/ha, box-to-bunch ratio or waste percentage on various spatial and temporal aggregation levels.

With the features outlined above, we believe that BMP can now start to become a useful tool in the day-to-day operations at Banasa. We look forward to receiving feedback from the users at Banasa about the BMP production module over the coming months, and to continuing our cooperation on the next topics for BMP including fertilizers and field upkeep.



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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.

## This and that: general OMP plans

- Harvest round sheet reports
- Daily maps of number of days since last harvest per block
- Migration of OMP back-end to SQL Server
- Feature to export OMP reports in PDF format and attach the result to emails
- Data importing in OMP Field Upkeep
- Fiscal year handling for OMP Nursery, Seed Production and Tissue Culture
- Survey app for data collection in the field using smartphones or tablets

## OMP Mapper

- Standalone mapping application to display thematic GIS maps without requiring third-party host software like MapInfo or ArcGIS
- Capability to import base maps from .MIF or .SHP format
- Zooming, dragging and display of block information on mouse click
- Possibility to export maps in image or PDF format
- Customizable scale and legend

## Banana Management Program

- Improved features for copying forecast adjustments after harvest has commenced
- Print report for container details
- Print report of shipped containers by client and date range.
- Additional GIS maps including bunches/ha and boxes/ha
- Recording of nutrient recommendations per farm or cableway
- Recording and reporting of fertilizers applied manually or using fertigation
- Weekly field work reports on weeding, pruning and drainage maintenance
- GIS maps of cableways where field work was carried out
- Migration of BMP back-end to SQL Server