# Fertilizer needs for Maluma - a case study

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## SUMMARY

Maluma is a young cultivar originating in South Africa. It has been cultivated for the past 8 years commercially and export volumes to the EU are increasing rapidly as more hectares are being planted. The cultivar expresses good yields with larger sizes than the standard Hass making this cultivar in certain areas in South Africa more profitable than Hass. As is the case with most new cultivars cultivation practises are initially based on closer relatives, but as the cultivar grows, more specific practises are need to be defined. This is certainly the case for Maluma as it is higher yielding than Hass with larger fruit and an earlier harvest slot than Hass. This created some interesting challenges recently.

In this study we tried to understand something about the fertilizer needs of Maluma in relation to yield parameters. Climatic considerations were currently not included. The study is a case study on three commercial farms with 10 – 11 year old trees. Leaf and soil analysis were compared to yield factors over the last 5 years. Some interesting observations were made in this study, but the authors had to conclude that more structured research is needed to understand the behaviour of this cultivar better.

Maluma es un cultivar joven que se originó en Sudáfrica. Fue cultivado durante los últimos 8 años comercialmente y los volúmenes de exportación a la UE crecen rápidamente a medida que se plantan más hectáreas. El cultivar rinde buenos beneficios con mayores tamaños que el Hass estándar haciendo de este cultivar en ciertas áreas en Sudáfrica más aprovechable que Hass. Como ocurre con la mayoría de los nuevos cultivares, las prácticas del cultivo se basan en los familiares más cercanos, pero a medida que crece el cultivar, es necesario definir prácticas más específicas. Ciertamente, este es el caso para Maluma ya que tiene un mayor rinde que Hass con una fruta más grande y una franja de cosecha más temprana que Hass. Esto creó recientemente ciertos desafíos interesantes.

En este estudio intentamos comprender algo sobre las necesidades del fertilizante de Maluma en relación con los parámetros de rendimiento. Actualmente no se incluyeron las consideraciones climáticas. El estudio es un estudio del caso en tres granjas comerciales con árboles de 10-11 años. Se comparó el análisis de la hoja y suelo con los factores de rendimiento durante los últimos 5 años. En este estudio se llevaron a cabo observaciones interesantes, pero los autores tuvieron que concluir que se necesita una investigación más estructurada para comprender mejor el comportamiento de este cultivar.

## INTRODUCTION

The Maluma cultivar of Persea americana Mill. was only established as an economic cultivar in South Africa since 2007. Before that a few semi-commercial plantings were done and limited export was done to the UK mainly. However since 2007 plantings have grown substantially worldwide and more and more fruit is being exported mostly from South Africa. However more and more trees worldwide are coming in production and year round production of Maluma should soon become a standard (Ernst personal communication, 2015). Currently the volumes exported from South Africa amounts to around 800 tonnes and growing fast (Ernst, 2014). Furthermore the cultivar is being planted at a rapid rate in more countries of the world and questions are being asked amongst others what the fertilizer requirements are in relation to Hass. In most cases with a young cultivar fertilizer needs are related to its closer cousins which in this case could have been Hass or even Pinkerton (as Maluma is also a high yielding, precocious black skinned cultivar). Maluma is, according to the literature, a Guatemalan x Mexican cross, while Pinkerton and Hass have both strong Guatemalan origins (Crane et.al. 2013) According to Lahav et.al. (2013) each cultivar normally has its own needs and therefore new cultivars need to be studied separately, and not as part of an extrapolation exercise. The study that was undertaken to establish some guidelines was undertaken to question the reliability of field observations as well as relation to other cultivars in terms of the establishment of fertilizer norms for Maluma.

## MATERIAL AND METHODS

The study was performed on Maluma orchards planted between 2001 and 2003 on Duke 7 clonal rootstocks. The soil type is mostly deep, red, clay-loam soils. All three orchards are situated in very similar climatic micro climates and fully irrigated using tensiometers to measure soil moisture to determine irrigation needs. Trees are planted at 408 trees to the hectare in a 7m x 3,5 m configuration and have only recently been selectively pruned to maintain tree size and shape. The trees at all three sites have filled the allocated space in the rows and are currently maintained in a hedgerow system.

Fertilizer application is done by hand using semi-organic fertilizer in two cases (sites D0295 & D6953), which is supplemented with some chemical fertilizer to balance the N:P:K ratios for normal fruiting trees. Commercial recommendations were done by the agronomist of the fertilizer company together with the agronomist of the exporting company using mostly Hass norms. The applications were split into three main applications as follows: fruit set period 38% of N:P:K, summer growth period 24% of N:P:K and 38% during Autumn when flower buds became visible but before or during harvesting. In the third case (site D0834) only chemical fertilizer is used with the N split in three even applications, while P was applied once and K applied in two applications of 50% each.

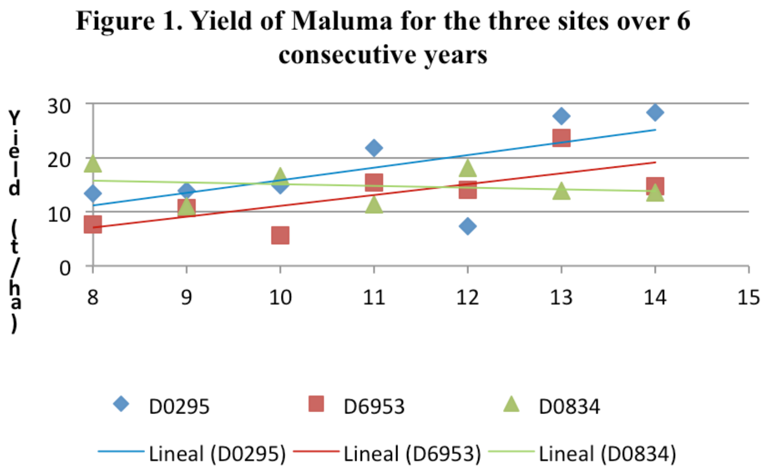
Standard orchard practices were applied in general, but the third orchard suffered from some severe Phytophthora infestation in 2012-2013. This had some impact on the yield in these orchards, but results are still shown as it gives an interesting picture of Maluma. In this study the yield data for the past six years was compared to the leaf Nitrogen levels, applied nitrogen per tonne of fruit harvested as well as the interaction between leaf Nitrogen and Applied nitrogen. Data of the other elements were also analysed annually but are not being discussed.

## RESULTS AND DISCUSSION

As the main purpose of the study was to establish guidelines no statistical analysis was done on the data as not enough replicates were used in this study. In future case studies more sites and more ages will be used to verify this data.

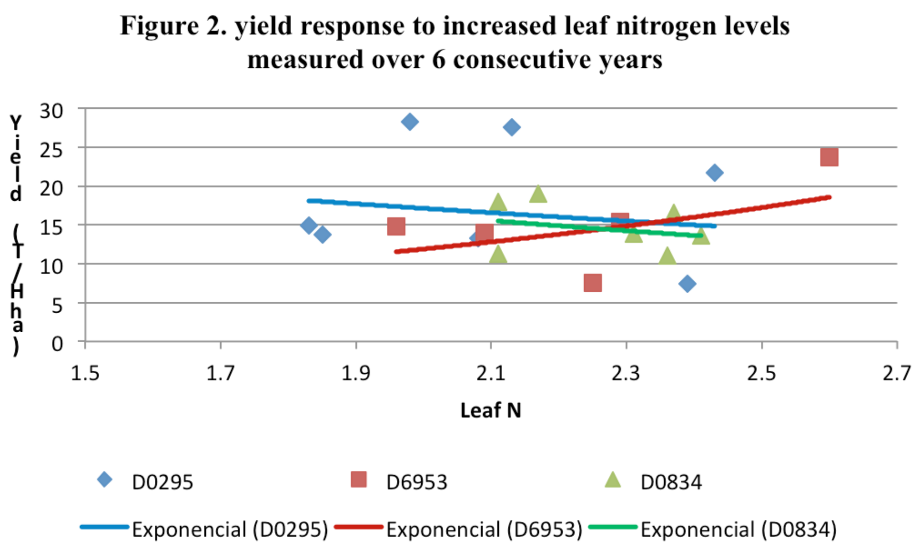
### Yield data

With regard to the yield of Maluma a positive trend could be found in two of the three sites, while the third one (D0834), despite the Phytophthora infestation, showed a sideways yield development. In Figure 1 this trend can be seen. It is clear from figure 1 that although the trees are reaching maturity and filling the row space, the yield is still increasing, indication that Maluma has the ability to increase yield over a longer lifespan than most other cultivars would normally do. In the case of site D0295, the yield decline in year 12 was attributed to some severe pruning done at the end of the 11th production year, where tree size was severely reduced. In the case of site D6953 the increase was much more uniform and even, although the setback in year 14 is also due to some severe pruning done in part of the orchard. This data will be monitored for the next 5 seasons to follow the trend and see when the yield reaches its plateau.




### Leaf nitrogen

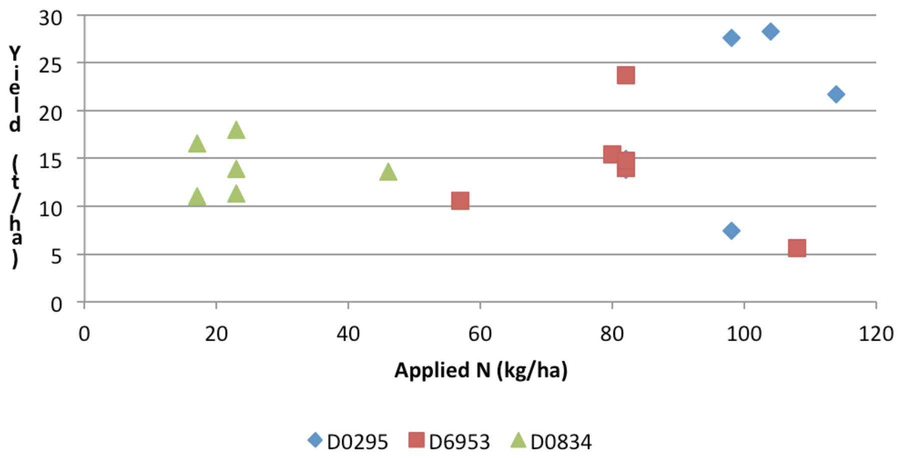
In Figure 2 the relationship between leaf nitrogen and yield can be seen. From this figure it is eminent that for site D6953 there is a positive trend towards yield with an increase in leaf nitrogen, while for sites D0295 and D0834 this trend is slightly negative. According to the literature this is a common phenomenon which makes the interpretation of fertilizer data more complex (Lovatt, 2001). From the studies previously conducted it was clear that the specific timing of applications according to the phenological stages of the tree played a significant role in increasing yield (Lahav et.al 2013; Lovatt, 2001). From Figure 2 it can be concluded that the leaf N norm for Maluma should be somewhere between 2.1% and 2.3% in the same range where the Hass leaf norm is used in South Africa. This could however be higher if more orchard could be properly sampled as site D6953 indicates that with higher leaf N levels, higher yields could be obtained.



**Nitrogen application rates**

In Figure 3 the relationship between applied nitrogen per hectare per annum and yield is shown. From this graph it becomes eminent that the yield response is not just a matter of applied nitrogen as especially the yield response for site D0834 to low nitrogen is quite out of line with sites D0295 and D6953. Some explanation for this can be the fact that the tree condition of site D0834 wasn't optimal and any addition of nitrogen would have a yield response, while the two healthy sites' responses wasn't merely to nitrogen only but to other mineral elements as well. However on both the two healthier sites much higher levels of nitrogen application did have a degree of increased yield response. Maybe in cases where more sites would be available a better relationship would be found. However the literature states that in the case of avocados there is quite often a very poor relationship between mineral elements applied and yield responses (Lahav et. al. 2013). Results from this basic observation one could deduct that an application rate of between 80 and 100 kg/ha N is needed to feed a crop of around 20 – 25 t/ha. Again these figures have to be verified with some better scientific research, where applications and the phenological stages are synchronised, or where mineral cycling studies as done by Stassen et.al. (1997) have been done to determine the relationship between the different plant parts and the yield factors to nutrient cycling. Another form of verifying this data could be the use of fruit analysis. Fruit analysis are regularly done (data not shown) in South Africa on avocado fruit including Maluma fruit as part of a quality assurance program (Kruger et.al. 2004) Data from these analysis reveal that a crop of 20t/ha removes 55.66kg of N/ha. With the data shown in figure 3 this means that the plant itself uses between 24 and 44 kg/ha N for plant development. This should however be verified in proper scientific research trials analysing all the different plan parts.

Figure 3. Applied Nitrogen (kg/ha) vs Yield (t/ha)




When all the data was converted to some useful information for fertilizer consultants to use, it was revealed that in most years a crop removal figure of 5,3 kg N/tonne of fruit should be applied to feed the tree as well as the crop. This figure is very similar to the preliminary figures obtained through research from Stassen et.al. (1997) for Hass trees. This figure takes the development of the tree into account as the yield increases as the trees age.

Similar correlations were drawn with the other elements but again very little correlations could be found through this study, which does seem to follow the literature with most cases.

## CONCLUSION

Although the study looked at three distinct sites, the results showed that varying results were obtained from each site. However some common ground could be found in the relationships between the applied nitrogen and yield increases, which could be used by fertilizer consultants. This data also shows that scientific research is needed to understand the cycling of nutrients in Maluma in relation to its phenology to ascertain the relevance of the data obtained from this study. Also this study was done in a single micro climate in South Africa and similar research studies should be undertaken in the different countries of production to verify the trends found in this study. Comparing this data with Hass would also shed some light on relationship or not between different cultivars on the same rootstocks, while different rootstock influences should also be researched.

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# ACTAS · PROCEEDINGS

## VIII CONGRESO MUNDIAL DE LA PALTA 2015

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