

The juice market is pumping!

Consumers, it seems, have come through the COVID-19 pandemic much more health-conscious. A general trend towards focusing more actively on health, and a growing demand for nutritional food, have seen the sales of fruit and vegetable juice shoot up.

The latest Report on the South African Juice Industry¹ indicates a 1.4% increase year-on-year, in total retail sales value, between 2019 and 2020. Market growth is expected to reach a compound annual growth rate (CAGR) of 1.2% for the period 2021 - 2025.

Consumers are looking beyond pumping iron at the gym, to eating and drinking more healthily. At the same time, however, consumers' intrinsic trust in brands has eroded and everyone – from consumers to regulators, investors and employees – is asking for more accountability and transparency regarding food safety from the farm to the table².

For every processor in this market, adhering to hygiene standards and high product quality in the production line is non-negotiable for their

business sustainability. Producing high-quality juice products every time requires machines that are 100% reliable and equipment that is safe.

At the heart of maintaining the highest hygiene standards lies the careful selection of equipment. The pump and piping solutions installed throughout the plant are the backbone of the production line, and what keeps the juice flowing through the entire processing operation to the final bottling stage. For good-quality equipment, fruit juice processors should look to a trusted and reputable brand that can offer a wide range of long-lasting, cost-effective and integratable pumping solutions that are certified and compliant with industry and international best standards, as well as being the best fit-for-purpose throughout the production line. Doing so means more plant uptime, efficiency and high-quality outputs, and better service delivery.

Fit-for-purpose hygienic pumping solutions that have been designed and built to eliminate any risk of contaminants during production

are necessary for producers who want to secure consumer trust in their juice. For example, throughout the production process, there are many areas where hygienic pumps with a modular design can be integrated, allowing for streamlined disassembly, cleanability and reassembly.

With nearly two decades of experience in South Africa and Africa, we at Verder Pumps South Africa provide a one-stop offering of advanced pumping solutions that are certified to the highest hygienic standards. We understand that the technical details and implications of selecting the right pumping solutions for specific use applications can be challenging. However, it is an important purchase decision – and continued and sustainable optimum production performance of the plant is dependent on it.



References:

1. Summary: 2021 Report on the South African Juice Industry -<https://www.businesswire.com/news/home/20220125005644/en/2021-Report-on-the-South-African-Juice-Industry---ResearchAndMarkets.com>
2. Building Trust: Lessons from field to fork, KPMG - <https://home.kpmg/xx/en/home/insights/2021/04/building-trust-lessons-from-field-to-fork.html>

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By Hannes Bester, MC Pretorius, Wayne Mommsen,
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Natasha Jackson and Jan Landman
(Citrus Research International)

Integrated pest management Citrus thrips (T.G. Grout)

Suppressing citrus thrips populations on the spring growth flush will assist in lowering populations experienced at petal fall.

On younger trees, a methamidophos or acephate (Spectra Stem) stem treatment is a useful option for this. An alternative may be an organophosphate that cannot be sprayed after petal fall, but sprays should be completed before flowers open to reduce any impact on honey bees. If mealybug requires control, the organophosphate could be sprayed at full cover. These treatments will also reduce developing populations of citrus psylla. Avoid using abamectin at this time, because it will be needed for citrus thrips control in summer, and only three applications are permitted per season.

Mealybug (S.D. Moore and T.G. Grout)

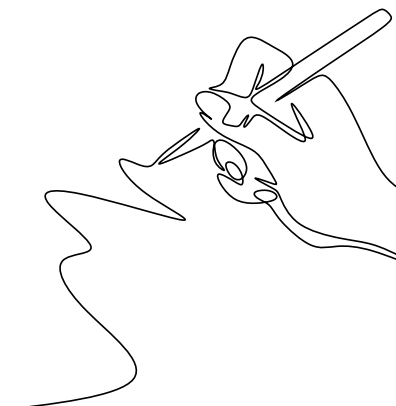
Mealybug infestation levels continue to be problematic, particularly under nets. This can be exacerbated by high thrips pressure, leading to disruptive applications of thripicides late in the season, and by the disappearance of buprofezin as a corrective treatment for mealybug. As preventative treatment of mealybug is almost twice as effective as corrective treatment, when in doubt, it is strongly advised that a preventative treatment for mealybug be applied. This can be done pre-blossom or closer to petal drop, using an organophosphate – as described for thrips or using buprofezin – or one of the newer options like Closer or Tivoli, if just for

mealybug. If mealybug was problematic in the last season, two early sprays 4 - 6 weeks apart should be considered. Treatments must be applied as high-volume, full-cover film sprays, which can only be achieved if trees have been pruned and the spray machine has been properly calibrated. Where a parasitoid augmentation programme is being followed for mealybug, the earlier in the season releases are initiated, the more effective they are. This might be difficult where early thripicides are detrimental to the parasitoids. Good ant control will be required where parasitoids are being released, to prevent disruption of the natural enemies. River Bioscience is now selling an ant bait for both the pugnacious ant and the brown house ant, Saga.

False codling moth (S.D. Moore)

It may be very tempting to neglect orchard sanitation in winter, as false codling moth (FCM) levels are usually low and Valencias – which are harvested at this time – are generally less susceptible to FCM compared to some of the earlier season cultivars. However, this would be a big mistake. It has been shown that Valencias can fulfil an overbridging role for FCM from one season to the next. The most effective way to ensure the lowest FCM inoculum possible at the start of a season is to diligently continue sanitising orchards until the previous season is truly over. Most importantly, growers must ensure that no fruit whatsoever, remains on trees or on the orchard floor after harvesting is completed. In the warm northern areas of the country, FCM activity starts a lot earlier

Extension briefs for



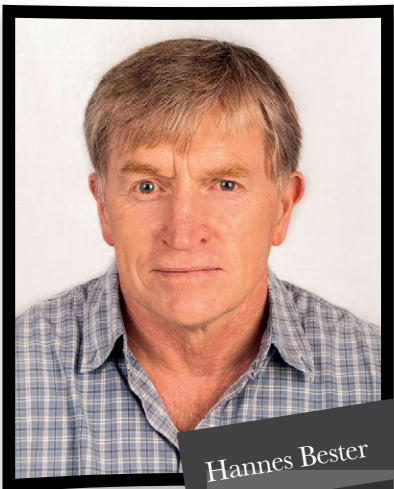
than in the Cape regions. Consequently, it may be beneficial to initiate mating disruption earlier in the season than usual. This will suppress the first FCM generation of the new season, as well as help to protect late Valencias before harvest. Check with your agrochemical supplier if the product registration permits you to do so.

Bollworm (S.D. Moore)

Depending on the region of the country, which influences temperature and blossom phenology, bollworm may begin invading orchards as early as September, or even in August. Therefore, growers should begin weekly blossom inspections for bollworm eggs and larvae no later than early September. Particularly if a biological product such as DiPel, Helicovir or Bolldex is going to be used, sprays should be applied as soon as eggs begin to hatch. This can only be determined through vigilant and regular scouting. Honey bee populations will benefit if sprays need to be applied during bloom, because these products are harmless to bees.

Citrus flower moth (S.D. Moore)

Moths of the citrus flower moth (also known as the lemon borer moth), *Prays citri*, are attracted to lemon blossoms. Growers should inspect these blossoms in spring to determine if they are infested with larvae or pupae. These can be identified by their colouration, which is usually greenish, as well as by the association of webbing with pupation. Even if the damage to – and loss of – blossom is not considered sufficiently severe to justify control measures, no intervention may allow the development of a second generation. It is the moths of this second generation that lay their eggs on the lemon fruitlets. Hatching larvae can potentially cause severe damage. Therefore, it is essential to control the first generation



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if one wants to prevent damage to the fruit. An experimental threshold for intervention based on pheromone delta trap catches, has been set at 150 moths per trap per week. However, there is no trapping system registered yet. This equates to an infestation level of 5% blossom clusters with larvae and pupae, which will lead to approximately 5% fruit damage. No plant protection products are registered for use against the lemon borer moth. However, there are a number of pesticides that are registered for other pests on citrus that are effective, including Bt (DiPel) and mevinphos.

Crop and fruit quality management (P. Cronjé)

General. It is important to keep managing and monitoring fruit pickers throughout the harvest

season, in order to reduce cull of export fruit caused by picking injuries. Pruning of early- and mid-season cultivars should commence as quickly as possible after harvest to allow ample time for flower induction.

Maturity indexing. Maturity indexing is done to predict the rate of change in fruit maturity, in order to harvest fruit at a maturity that would maintain optimal commercial shelf life. The aim is to define changes or rate of change in acids and sugars, and to build up a database over a number of years for comparisons. Random sampling of fruit every week from each of 10 representative trees should start 4 - 6 weeks before the expected harvest date. Titratable acidity is determined by titration with sodium hydroxide. Sugar content (Brix) is determined using a refractometer and the sugar to acid ratio calculated. Fruit colour should be read from a colour chart. The aforementioned data should be plotted on a graph in order to determine the optimal picking window. Growers should adhere to the time and temperature protocols for each citrus type to ensure optimal shelf life of the fruit (Cutting Edge No. 99). It is important to maintain good records of the maturity indicators over a number of years, in order to identify and possibly manipulate possible problems associated with internal and external quality parameters.

Degreening and postharvest rind disorders. The two publications *Common Defects Associated with Degreening of Citrus* by Andy Krajewski and Tim Pittaway, and *Postharvest Rind Disorders of Citrus Fruit* by Paul J.R. Cronjé are must-reads for any grower. Both are available from the CRI online shop at www.citrusres.com.

Pruning. Pruning of early and late cultivars should be done as soon as possible after harvest. All of the following should be removed during pruning: old, broken and dead shoots/twigs; weak and entangled shoots crossing each other; and rootstock regrowth (water shoots). Removal of all dead wood is important to

reduce fruit blemishes and to reduce the inoculum of latent pathogens, which cause postharvest decay. A light intensity level of at least 30% of full sunlight is necessary for optimal photosynthesis, and sufficient light intensity levels also improve fruit colour development. In dense and old trees, light intensity inside the tree canopy can drop to below 30% and adversely affect fruit set and size. At least one “window” cut should be made for adequate light distribution, and to improve bearing wood within the tree canopy. An increase in photosynthesis and light distribution will promote increased fruit size and internal fruit quality, better fruit colour, increased rind condition and less variation in fruit quality within the canopy. Pruning should be used as a thinning technique by pruning more heavily after a light crop (if a heavy crop is expected in the subsequent season) and if the orchard has a history of alternate bearing. A follow-up of regrowth management in the summer is critically important to maintain light management throughout the season. Proper pruning also improves spray penetration, leading to effective control of target pests and diseases. This is especially important for the effective control of phytosanitary pests and diseases. Pruning tools should be sanitised on a regular basis with a 10% Jik solution, to prevent spreading of viral diseases, and it should be done after each row – at least – and when moving from one orchard to another.

Flowering: One or two pre-bloom foliar urea applications (low biuret urea at 1%) should be applied for uniform flowering and fruit set, especially when leaf N levels are low and a light blossom is expected. If leaf N levels are sufficient, consider replacing the foliar urea application with a 1.5% KNO₃ application, only if leaf K levels are below optimum.

Fruit set. Treatments need to be applied according to cultivar requirements. A general guideline cannot be given as fruit set treatments differ by cultivar and,

in many cases by orchards, depending on the previous crop load. Specific treatments include the application of gibberellic acid (GA₃) and trunk or branch girdling, especially for weakly parthenocarpic cultivars that have a poor set. Girdling during full bloom improves set, as a cut through the bark temporarily restricts carbohydrate allocation to roots and allows for utilisation by flowers. Be careful not to girdle too deep into the trunk, or to remove a strip of bark. Moisture stress should be avoided at all costs during full bloom, fruit set and early fruit growth, as these periods are characterised by the cell division stage of fruit development, during which water supply is of critical importance.



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Geïntegreerde bemesting (P. Raath)

STIKSTOFBEMESTING VAN SITRUS

Aan die einde van die groeiseisoen

1. Blaar- en grondmonsters moes aan die einde van die groeiseisoen geneem gewees het (Februarie tot Mei).
2. Resultate van die blaar- en grondontledings tesame met boordinligting (ouderdom van bome, onderstam, kultivar, verwagte opbrengs, ens.) word gebruik vir bemestingsaanbevelings.

Waar mikro-spuite of enige ander stelsel behalwe druppers gebruik word:

1. Begin met stikstoftoedienings in Julie, met die uitsondering van die Wes-Kaap en Hartswater wat in Augustus begin.
2. Afhangende van die klei-inhoud van die grond, word die stikstof tussen 1 - 4 toedienings verdeel.

Waar druppers gebruik word.

1. Begin met die stikstoftoedienings in Julie met die uitsondering van die Wes-Kaap en Hartswater wat in Augustus begin.
2. Verdeel die volumes wat per maand aanbeveel is in ten minste weeklikse toedienings.
3. Stikstoftoediening geskied volgens die fenologiese stadium van die boord. Gebruik gerus die breë riglyne hieronder.

Periode	Fenologie	N (% van totale toediening)
Julie	Seldifferensiasie en seldeling	25
Augustus	Knopbreek, blom en vrugset	25
September	Vrugset en selgroei	25
Oktober	Vruggroei	15
November/ Desember	Vruggroei	10

Blaarbespuitings:

- 1. Dien ureum as h blaarbespuiting in Julie toe om blom en vrugset te bevorder, of ná Oktober vir stikstof-aanvulling.
- 2. Die kritiese vereistes vir suksesvolle blaarvoeding is die kontaktyd waartydens die blare nat bly, druppelgrootte en die konsentrasie van die voedingselement in die spuit-oplossing.

Om die logging van stikstof te beperk kan die volgende gedoen word:

- 1. Dien stikstof in die middel, of aan die einde van die besproeiingssiklus toe.
- 2. Voorkom h oormaat van stikstof in die grondoplossing. Stikstofkonsentrasies wat hoër is as 150 - 200 mg/l het geen addisionele voordeel nie. h Oormaat stikstof lei tot moontlike logging van die stikstof en moontlike probleme met vrugkwaliteit.
- 3. Stikstoftoediening moet verkieslik aan die einde van die groeiseisoen gestaak word, sodat die stikstofinhoud in die grond gedurende die wintermaande kan afneem.
- 4. Die regte hoeveelheid water moet tydens besproeiing toegedien word. Dit is onvermydelik dat h sekere hoeveelheid stikstof geloog word tydens besproeiing, maar oorbesproeiing versnel die proses en h groot hoeveelheid stikstof kan verby die wortelsone geloog word. Reënval moet ook in ag geneem word tydens besproeiingskedulering.

NITROGEN (N) FERTILISATION OF CITRUS

At the end of the growing season:

- 1. Leaf and soil samples should have been taken between in February and May.
- 2. Results from the soil and leaf analyses with additional information such as tree age, tree vigour and expected yield rootstock are used to compile a fertiliser programme.

When micro-jets or any other system, except drippers, are used:

- 1. Start with nitrogen fertilisation in July with the exception of the Western Cape and Hartswater, which should start in August.
- 2. Split the nitrogen application into 1 - 4 portions, depending on the clay content of the soil.

When drip irrigation is used:

- 1. Start with nitrogen fertilisation in July with the exception of the Western Cape and Hartswater, which should start in August.
- 2. Split the recommended monthly volumes into weekly applications, at the least. Ensure that the water and fertilisers do not penetrate deeper than the upper root zone (30 - 40 cm).

Period	Phenology	N (% of total application)
July	Cell differentiation and start of cell division	25
August	Bud break, flowering and fruit set	25
September	Fruit set and cell growth	25
October	Fruit growth	15
November/December	Fruit growth	10

Foliar spray of nitrogen:

- 1. Spray the urea in July to improve flowering and fruit set, and after October to supplement nitrogen.
- 2. The critical requirements for successful foliar sprays are contact time, droplet size and concentration of the nutrient element in the spray solution.

Four measures can be used to prevent or minimise the downward movement of nitrate:

- 1. Inject nitrate in the middle of, or late in an irrigation event.

- 2. Avoid excessive concentrations of nitrate in the soil solution. Nitrate concentrations greater than 150 - 200 mg/l don't provide any additional benefit, and supplying more N fertiliser simply increases the risk of leaching by successive irrigation or rainfall events. Oversupplying N can also lead to fruit quality issues.
- 3. Complete the N supply programme by the end of the growing season to allow depletion of nitrate in the soil by winter.
- 4. Ensure that only the right amount of water is applied. Some movement of nitrate may be inevitable with each irrigation cycle, but overwatering is likely to speed up that process and move nitrate beyond the root zone. Allowing for expected rainfall when calculating the depth of water to apply will also help reduce the likelihood of leaching.

Grondgedraagde siektes (M.C. Pretorius en J. van Niekerk)
Aalwurms

Grond- en wortelmonsters kan in die lente getrek word en vir ontleding na die Diagnostiese Sentrum in Nelspruit gestuur word, sodat die aalwurmpopulasie in die wortels bepaal kan word. Die resultaat sal dien as h bestuurshulpmiddel om h kostedoeltreffende aalwurmbeheerstrategie daar te stel.

Die gebruik van chemiese aalwurmdoders vir die beheer van die sitrusaalwurm word nie aanbeveel voor ten minste 30 mm reën geval het nie. Elke aalwurmdodertoediening behoort met h behoorlike besproeiing opgevolg te word om te verseker dat die middels deeglik deur die grondprofiel gewas word. Toedienings behoort slegs volgens etiket-aanbevelings toegedien te word. Afwykings van die geregisteerde dosisse om kostes te bespaar, lei tot oneffektiwiteit. Dit is belangrik om 'n program te volg van twee of drie toedienings met twee maande intervalle (om toksiese vlakke hoog genoeg te hou in die grond vir 'n langer periode) – behalwe vir

Velum. Volg etiket-inligting van die betrokke produk. Afwyking van hierdie aanwysings kan tot oneffektiewe beheer lei, en dis 'n mors van geld.

Phytophthora
Phytophthora-wortelvrot – die gebruik van fosfonaatprodukte is 'n uiters effektiewe en bekostigbare beheermaatreël wat suksesvol deur produsente gebruik word. Dit is van uiterste belang dat die etiket deeglik bestudeer word asook die waarskuwings voordat die produk gebruik word, om effektiwiteit te verseker en fitotoksiteit te voorkom. Om effektiewe werking van die fosfonate te verseker behoort opvolgtoedienings, ten minste twee – maar verkieslik drie – toedienings, twee maande uit mekaar toegedien te word. Indien kraagvrotletsels voorkom, kan 'n stamverf of blaarbespuiting aangewend word (drie aanwendings per seisoen met agt weke intervalle). Vir wortelvrotbeheer word drie blaarbespuitings met agt weke intervalle aanbeveel. Die eerste bespuiting behoort direk na blomblaarval gedoen te word – nie tydens blom nie, aangesien dit die moontlikheid van blomblaarval kan verhoog. Dit word sterk aanbeveel om nuwe aanplantings en nie-draende bome op 'n fosfonaatprogram van drie aanwendings per jaar – twee maande uitmekaar – te hou om gesonde wortelontwikkeling te verseker. Produsente word gemaan om seker te maak dat bome nie oor- of onderbesproei word nie.

Fruit and foliar diseases (P. Moyo)
Alternaria core rot
Alternaria core rot (also known as navel-end rot or black rot) is caused by the fungus *Alternaria alternata*, and occurs in all areas of Southern Africa. The disease is most prevalent on citrus cultivars, such as navels and Clementines, which are characterised by the presence of a secondary fruitlet called the navel. The navel develops at the stylar end of the fruit and varies in size.

The formation of the navel-end opening and its size are influenced by climatic conditions during fruit set. Under cool weather conditions, the secondary fruit style successfully fuses with the style of the primary fruit such that both the secondary and primary style abscise during petal fall, resulting in a closed navel-end. However, under extreme weather conditions (e.g. warm, dry and windy conditions), the primary fruit style abscises prior to fusion with the secondary fruit style resulting in the formation of a cavity between the primary and the secondary fruit. Such cavities provide entry points for fungi, such as *A. alternata*, to penetrate and form infections, which remain quiescent until favourable conditions stimulate further growth of the fungus. *Alternaria* core rot is linked to fruits with large or malformed navel ends.

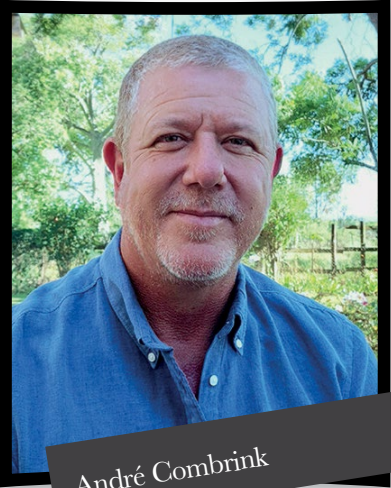
Score (50 ml/100 l water) and Folicur (80 ml/100 l water) are registered for control of the disease.

Botrytis on lemons
The role played by *Botrytis* and the damage that it can do to lemon fruit drop and the formation of ridging of the rind is still not clear. Damage can be caused during blossom on lemon petals when prolonged wetting and cool weather occur simultaneously. Producers in the Eastern Cape enlisted on the Adcon system can make use of their early warning forecasts for *Botrytis*. Benomyl is the most effective fungicide to control this fungus and should be sprayed at the balloon stage during blossom, which can also form part of the black spot control programme.

Postharvest pathology - waste prevention (W. du Plooy, L. Mamba, N. Jackson, J. Landman and C. Savage)
By this time of the citrus season, fruit volumes are quite high and the packhouses are straining under the demand for processing. This will be taking its toll on

management and may lead to insufficient diligence in the management of critical control points. Below are a few suggested critical control points that should be kept in mind.

- Critical control points for improved postharvest disease management**
- Communicate with the pre-harvest manager and ensure up-to-date exchange of information:
 - ✓ Monitor the incidence of insect activity in the orchards and institute appropriate measures to reduce their populations,



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especially fruit fly and FCM numbers that could increase with hotter weather

✓ Monitor orchard practices and sanitation:

o Advise the orchard managers and producers if sanitation is being improperly managed or neglected; and as this can also play an overbridging role for FCM from one season to the next, it is important to follow the FMS correctly.

o Removal of rotten and fallen fruit is crucial to keep spore loads down and to reduce the risk of postharvest decay.

o Monitor injuries to fruit during picking, handling and transport to the packhouse. Advise orchard managers and/or producers accordingly.

- Keep the time from harvest to the first fungicide treatment to a minimum; it is strongly recommended to treat within six hours from picking, and definitely within 24 hours after picking.
- Ensure that all fungicide applications are replaced frequently as per protocol and kept clean.
- Keep the fruit dumping site, where fruit will enter the packhouse as clean, as possible.
- Ensure proper removal of any rotten fruit before sanitising and treatment of the fruit.
- Have a sanitation action between fruit sorting and the first fungicide application.
- Ensure that fruit is dry before entering the fungicide treatment.
- Manage the concentration of imazalil in the fungicide treatment by doing regular titrations.
- Do not wax wet fruit – this could severely jeopardise fruit quality.
- Apply the correct amount of wax onto the fruit (i.e. 1.0 - 1.2 l per ton of fruit) and ensure even spread of the wax over the whole fruit.

- Reduce the time from harvest to cold chain storage.
- Packhouse sanitation should be a continuous process and not just a once-daily or -weekly activity.
- Store fruit destined for the juicing factory as far away from the packhouse as possible, and have them removed as soon as possible.

Below is a quick checklist for the critical measurements for the chemical applications:

Checklist for chemical application

- Chlorine application
 - o Solution pH: 6.5 - 7.5
 - o Chlorine concentration: 75 - 100 ppm (free active chlorine)
 - o ORP: 800 mV.



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Jan Landman

- Fungicide dip tank
 - o Imazalil concentration: 500 ppm
 - o Solution pH: not higher than six
 - o Exposure time: 1 - 3 minutes in a solution at pH3 or not longer than 45 seconds in a solution at pH6
 - o Maintain the concentration by following the advised imazalil top-up protocol, or according to regular titrations.
- Wax application
 - o Brushes must be kept clean and maintained to a very high standard to achieve the best results.
 - o Fruit should be dry when it reaches the wax applicator, as film formation on wet fruit is not successful and will suffer disintegration during transport.
 - o Wax load should be between 1.0 and 1.2 l per ton of fruit, depending on manufacturers' recommendations.
 - ◆ Over-application can lead to MRL exceedance.
 - ◆ Under-application will lead to poor fruit quality and poor disease control.
 - o When using impeller or venturi type of wax blending tanks, the wax solution should be agitated continuously (24 hours a day, seven days a week).
 - ◆ Thiabendazole tends to precipitate to the bottom of the wax drum and cannot be fully re-suspended in these types of tanks.
 - ◆ The funnel-shaped tanks, and horizontal tanks with a scraper paddle can be switched off during non-operational hours, but need to be switched back on an hour before the packline starts in the morning.
 - o Drying tunnels after the wax applicator should not be overheated.
 - ◆ Obtain the optimal temperature for the specific wax from the wax manufacturer.
 - ◆ The correct drying of the wax is crucial to ensure that the desired effect is gained.

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